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Scientific Research
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Department



جمهورية العراق
وزارة التعليم العالي والبحث العلمي
دائرة البحث والتطوير

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كلية الاسراء الجامعة / السيد العميد المحترم

م/ مجلة كلية الاسراء الجامعة للعلوم والهندسة

السلام عليكم ورحمة الله وبركاته ...

أشارة الى كتابكم المرقم ع/٢٣٩٨ في ٣١ / ١٢ / ٢٠٢٠ بشأن اعتماد مجلتكم واعتمادها لأغراض النشر والترقيات العلمية وتسجيلها ضمن موقع المجلات الاكاديمية العلمية العراقية ، حصلت موافقة السيد وكيل الوزارة لشؤون البحث العلمي بتاريخ ٢٤/٨/٢٠٢١ على أتماد المجلة المذكورة في الترقيات العلمية والنشاطات العلمية المختلفة الأخرى ، واعتباراً من المجلد الثالث - العدد الثالث - لسنة ٢٠٢١ وتسجيل المجلة في موقع المجلات الاكاديمية العلمية العراقية.

للتفضل بالاطلاع وابلاغ مخول المجلة لمراجعة دائرتنا لتزويده باسم المستخدم وكلمة المرور ليتسنى له تسجيل المجلة ضمن موقع المجلات العلمية العراقية وفهرسة اعدادها ... مع التقدير.

أ.م.د يوسف خلف يوسف

ع/ المدير العام لدائرة البحث والتطوير

٢٠٢١/٩/٦

نسخة منه اليه:

- مكتب السيد وكيل الوزارة لشؤون البحث العلمي / اشارة الى موافقة سيادته المذكورة اعلاه والمثبتة على اصل منكرتنا المرقم ب ت م / ٤٥٧٦ في ٢٣/٨/٢٠٢١ / للتفضل بالاطلاع ... مع التقدير.
- قسم المشاريع الريادية / شعبة المشاريع الالكترونية / للتفضل بالعلم واتخاذ مايلزم ... مع التقدير
- قسم الشؤون العلمية / شعبة التأليف والنشر والترجمة / مع الاوليات .
- الصادرة .

مهند ابراهيم
٦ / ايلول

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المسؤول المالي

- م. م. بشار قاسم تعيب.....جامعة الإسرائ \ العراق.

تعليمات النشر

في مجلة كلية الاسراء الجامعة للعلوم الهندسية

- تصدر جامعة الاسراء (مجلة كلية الاسراء الجامعة للعلوم الهندسية) في مجلد سنوي يضم عددين.
- تقوم المجلة بنشر البحوث العلمية للباحثين في تخصصات العلوم الهندسية التالية:
 - هندسة العمارة
 - هندسة مدني
 - هندسة كيمياوية
 - هندسة الحاسوب
 - هندسة كهربائية
 - هندسة المواد
 - هندسة ميكانيكية

شروط النشر

- 1 - يطبع البحث بواسطة الحاسوب بمسافات مفردة بين الاسطر وبحجم خط 12 ونوع (Simplified Arabic)، اما العنوان باللغتين العربية والانكليزية فيكون بحجم خط 14 شريطة الا يزيد عدد صفحاته عن 15 صفحة بما في ذلك الجداول والاشكال والمراجع وعلى وجه واحد على ورق قياس A4 مع ترك هامش في حدود 2 سم من الاعلى والاسفل وهامش بحدود 3 سم من الجانبين الايمن واليسر.

- 2 - لا يفضل نشر البحوث من قبل رئيس واعضاء هيئة التحرير في المجلة سواء كان البحث منفرداً أو مشتركاً.
- 3 - يقدم البحث بثلاث نسخ ورقية ونسخة الكترونية بعد قبول البحث للنشر، يسلم البحث بشكله النهائي مطبوعاً بالنظام الاعتيادي بمسافة منتظمة لكافة الصفحات عدا الصفحة الاولى التي تتضمن عنوان البحث و اسماء الباحثين وعناوينهم باللغتين العربية والإنكليزية متبوعاً بالبريد الالكتروني للباحث الاول وعلى قرص مرن CD ببرنامج Microsoft Word / 2010.
- 4 - تقبل البحوث باللغتين العربية والانكليزية ويفضل كتابة البحث باللغة الانكليزية.

دليل المؤلف Author Guidelines

ادناه الشروط والمتطلبات الواجب مراعاتها من قبل الباحث للنشر في هذه المجلة بشرط أن لا يكون البحث قد نشر أو سينشر في أية مجلة هندسية أخرى ولم يمض على انجازه اكثر من أربع سنوات.

- 1 - يجب ان يكون عنوان البحث موجزاً قدر الامكان ومعبر عن البحث.
- 2 - اسماء الباحثين: تكتب اسماء الباحثين وعناوين عملهم بصورة واضحة مع البريد الالكتروني للباحث الاول.
- 3 - يجب ان يتضمن المستخلص موجزاً واضحاً عن البحث مكون من 250-300 كلمة متبوعاً بكلمات مفتاحية 4-6. إذا كان البحث باللغة العربية فيكون المستخلص متبوعاً بالكلمات المفتاحية اولاً ثم المستخلص متبوعاً بالكلمات المفتاحية باللغة الانكليزية ثانياً و العكس صحيح.
- 4 - المقدمة: تتضمن مراجعة المعلومات وثيقة الصلة بموضوع البحث الموجودة في المصادر العلمية وتنتهي المقدمة باهداف الدراسة وأساسها المنطقي.
- 5 - المواد وطرائق العمل: تذكر طرائق العمل بشكل مفصل ان كانت جديدة اما اذا كانت منشورة فتذكر بشكل مختصر مع الاشارة للمصدر وتستعمل وحدات النظام العالمي (S.I.U.s) System International of Units

- 6 - النتائج والمناقشة: تعرض بشكل موجز وهادف وبنظام متوالي وتعرض النتائج بأفضل صورة معبرة وتوضع الجداول والاشكال في أماكنها المخصصة بعد الاشارة إليها في النتائج.
- 7 - يستعمل نظام الارقام العربية وهكذا في البحوث المرسلة للنشر وتمثل مناقشة النتائج تعبيراً موجزاً عن النتائج وتفسيراتها.
- 8 - تكون كتابة المصدر في القائمة المصادر متضمنة الآتي: اسم او أسماء الباحثين، سنة النشر وعنوان البحث كاملاً واسم المجلة ورقم المجلد والعدد وعدد الصفحات، مثال:
الخفاجي، جاسم محمود و حميد، محمد حسوني و كريم، حيدر حاتم، (2018) " دراسة تجريبية على الخرسانة مع استبدال جزئي للركام الخشن بواسطة المطاط غير المرغوب فيه".
مجلة كلية الاسراء الجامعة، المجلد 1 العدد 1، 243-217. و ممكن ان تكتب كالاتي: مجلة كلية الاسراء الجامعة، 1(1)، 243-217.
- 9 - المستخلص الانكليزي يجب أن يكون وافياً ومعبراً عن البحث بصورة دقيقة وليس بالضرورة ان يكون ترجمة حرفية للمستخلص العربي و متبوعا بكلمات مفتاحية 4-6.

دليل المقيّم Reviewer Guidelines

- أدناه الشروط والمتطلبات الواجب مراعاتها من قبل المقيم للبحوث المرسلة للنشر في هذه المجلة
- 1 - ملأ استمارة التقييم المرسلة رفقة البحث المطلوب تقييمه بشكل دقيق وعدم ترك أي فقرة بدون اجابة.
 - 2 - على المقيّم التأكد من تطابق وتوافق عنوان البحث باللغتين العربية والانكليزية وفي حالة عدم تطابقهما اقتراح العنوان البديل.
 - 3 - أن يبين المقيّم هل ان الجداول والاشكال التخطيطية الموجودة في البحث وافية ومعبرة.

- 4 - أن يبين المقيّم هل ان الباحث اتبع الاسلوب الإحصائي الصحيح.
- 5 - أن يوضح المقيّم هل ان مناقشة النتائج كانت كافية ومنطقية.
- 6 - على المقيّم تحديد مدى استخدام الباحث للمراجع العلمية الرصينة وحدثها.
- 7 - أن يؤشر المقيّم بشكل واضح على واحد من ثلاث اختيارات وهي:
البحث صالح للنشر بدون تعديلات.
البحث صالح للنشر بعد اجراء التعديلات.
البحث غير صالح للنشر.
- 8 - يجب أن يوضح المقيّم بورقة منفصلة ما هي التعديلات الأساسية التي يقترحها لغرض قبول البحث.
- 9 - للمقيّم حق طلب إعادة البحث إليه بعد إجراء التعديلات المطلوبة للتأكد من التزام الباحث بها.
- 10 - على المقيّم تسجيل اسمه ودرجته العلمية وعنوانه وتاريخ اجراء التقييم مع التوقيع على استمارة التقييم المرسلة له رفقه البحث المرسل له للتقييم.

المصادر

- 1 - يشار الى المصادر في متن البحث كما يلي:
اللقب او الاسم الثالث للمؤلف والسنة اذا كان البحث بإسم باحث واحد، واذا كان مؤلفين فيذكران والسنة واذا كانوا ثلاثة فاكثر فيذكر اسم الاول واخرون والسنة.
- 2 - ترتب المصادر حسب الصيغة العالمية (APA) وكما بالامثلة المذكورة:
أ- بحث في مجلة.
اسم الباحث أو الباحثون، (السنة)، عنوان البحث، اسم المجلة، المجلد، العدد و صفحتي البدء والانتها للبحث.
ب- كتب.
اسم المؤلف أو المؤلفون، (السنة) عنوان الكتاب، الطبعة، دار النشر وعدد الصفحات.

- ج- الرسائل والاطاريح الجامعية.
اسم الباحث، (السنة)، عنوان الرسالة او الاطروحة، العنوان (الكلية
والجامعة) وعدد الصفحات.
د- بحث في وقائع مؤتمر او ندوة علمية.
اسم الباحث أو الباحثون، (السنة)، عنوان البحث، اسم المؤتمر او الندوة
العلمية، مكان الانعقاد، صفحتي البدء والانتهاه للبحث.

ترسل البحوث الى مجلة كلية الاسراء الجامعة للعلوم الهندسية على العنوان الاتي:

جامعة الاسراء- قسم التوثيق والنشر

بغداد / العراق

البريد الالكتروني:

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(تعهد الملكية الفكرية)

إنني الباحث..... صاحب البحث الموسوم (.....)

(.....)
أتعهد بأن البحث قد أنجز من قبلي ولم ينشر في مجلة أخرى في داخل وخارج العراق وأرغب بنشره في مجلة (مجلة كلية الإسراء الجامعة للعلوم الهندسية) التي تصدرها جامعة الإسراء.

التوقيع:

التاريخ:



(تعهد نقل حقوق الطبع والتوزيع)

إنني الباحث..... صاحب البحث الموسوم (.....)

(.....)
أتعهد بنقل حقوق الطبع والتوزيع والنشر إلى مجلة (مجلة كلية الإسراء الجامعة للعلوم الهندسية) التي تصدرها جامعة الإسراء.

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الخصائص الشكلية لفعل الأناقة

في النتاج المعماري

الباحثة هدير يحيى محمد و أ. د. عبد الله سعدون المعموري
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Formal Characteristics of the Act of Elegance in Architectural Production

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المستخلص

إنَّ تطورات وتغيرات الحياة المتسارعة والتقنيات المتجددة و بروز التراكيب المعمارية المعقدة ذات الجمال البصري المعقد ادت الى ظهرت الحاجة إلى تفعيل مفهوم يساهم في تعزيز و تطوير الخطاب المعماري وتهذيب وصقل عمليات انتاج الشكل من خلال الجمع بين استخدام النماذج الناشئة وتقنيات توليد الشكل والمنطق الفكري، فيعد مفهوم الأناقة إحدى المفاهيم العامة والعالمية التي تم التركيز عليها مؤخراً في عالم العمارة والتي تعتبر مهمة للغاية في الفن والعمارة ولها دور كبير في اضافة طبقة من التعقيد الجمالي و اظهار الحس الانساني والتماس الجودة العالية في عمليات تصميم و إنتاج الشكل المعماري يركز البحث على الخصائص الشكلية لفعل الأناقة حيث يسعى البحث لتحقيق الهدف العام وهو (استخلاص اهم خصائص الشكلية لفعل الأناقة في النتاج المعماري) و لتحقيق هذا الهدف اعتمد البحث منهج مؤلف من عدة مراحل مستندا الى الوصف والتحليل والتركييب تضمن بناء اطار مفاهيمي ومعرفي خاص بمفهوم الأناقة اضافة الى بناء اطار نظري شامل توصل اليه البحث الى مجموعة من الاستنتاجات والتوصيات تم تفصيلها وتقسيمها الى استنتاجات مرتبطة بالاطار النظري واستنتاجات مستخلصة من الجانب العملي التطبيقي ليخلص البحث حضور فعل الأناقة في عملية تشكيل النتاج المعماري هو غاية تتحمل اوجهاً شكلية مختلفة ومظاهر و مستويات متعدد وفقاً للمتغيرات المكانية والزمانية وهو الإحسان في تكوين هيئة الشكل لـ أبرز افضل خصائص المادة المكونة للنتاج المعماري.

الكلمات المفتاحية : الأناقة، خصائص الشكل، النتاج المعماري، النتاج المعماري

الأنيق.



Abstract

The rapid developments and changes in life, renewable technologies, and the emergence of complex architectural structures with complex visual beauty have led to the need to activate a concept that contributes to enhancing and developing architectural discourse and refining and polishing the processes of producing form by combining the use of emerging models, form generation techniques, and intellectual logic. The concept of elegance is one of the general and global concepts that have recently been focused on in the world of architecture, which is considered very important in art and architecture and has a major role in adding a layer of aesthetic complexity and showing human sense and seeking high quality in the processes of designing and producing architectural form. The research focuses on the formal characteristics of the act of elegance, as the research seeks to achieve the general goal, which is (extracting the most important formal characteristics of the act of elegance in architectural production). To achieve this goal, the research adopted a method consisting of several stages based on description, analysis, and synthesis that included building a conceptual and cognitive framework specific to the concept of elegance in addition to building a comprehensive theoretical framework. The research reached a set of conclusions and recommendations that were detailed and divided into conclusions related to the theoretical framework and conclusions extracted from the practical application side. To summarize the research, the presence of the act of elegance in the process of forming the architectural product is an aim that bears different formal aspects, manifestations and multiple levels according to the spatial and temporal variables, and it is the excellence in forming the form of the shape to highlight the best characteristics of the material that makes up the architectural product.

Keywords: Elegance, Characteristics of the shape, Architectural product, Elegant architectural product.

1 - المقدمة

تعد الأناقة مفهوماً شاملاً متعدد الأبعاد يدخل في العديد من المجالات والخطابات تعرف الأناقة بأنها شكل من اشكال التعبير وهي المزيج المتناغم بين الرقي والنعمة الذي يخلق هالة من الجمال الخالد، كما انها لا تقتصر على المظهر فحسب بل تتخلل الى جوهر السلوك والأفعال وحتى الأفكار، فتنقل إحساساً بالرقي و الوضوح، تتميز بالبساطة وضبط النفس والجمال الموزون. فتنجاوز بذلك مجرد الجماليات، لتجسد الجودة الخالدة التي تتحدث عن إحساس أعمق بالتجربة و الذوق والرقي الثقافي، كما تعرف الأناقة بأنها فعل الاحسان في الاختيار فهي احتواء المناسب للزمان والمكان فالأناقة فعل يمكن العثور عليه من خلال حركة الاشياء و تتسم بمجموعة خصائص تميز سلوكياتها و تركز الأناقة على ثلاثة ابعاد رئيسية وهي (ابعاد اخلاقية، ابعاد جمالية شكلية، ابعاد معيارية قياسية) مايميز الأناقة كونها تمتلك بعداً اخلاقياً انسانياً نبيلاً يشير الى الاحسان اي الأحسان في العمل والأحسان في التنظيم فهي تدخل في المنظومة الأخلاقية وتتشكل منها، من الناحية النظرية لم يتم تحليل مفهوم الأناقة و طبيعتها وجوانبها الوجودية بشكل واضح ودقيق ولا بد من التعرف على مكانة الأناقة وطبيعة حضورها في شكل النتاج المعماري ودراسة تطبيقها في تصميم الأعمال المعمارية فتحددت مشكلة البحث العامة من خلال تباين ابعاد المفهوم في الحقول المعرفية ومن خلال دراسة وتحليل الادبيات السابقة التي تناولت المفهوم توضحت مشكلة البحث ب " الغموض المعرفي حول الخصائص الشكلية لفعل الأناقة في النتاج المعماري" وقد تمثل الهدف الخاص بالبحث ب " بناء نموذج معرفي شامل حول الخصائص الشكلية لفعل الأناقة في النتاج المعماري"

1 - منهجية البحث

تم اعتماد المنهج التحليلي الوصفي بهدف دراسة الخصائص الشكلية لحضور الأناقة في شكل النتاج المعماري وتم ذلك من خلال اولاً: تم بناء تصور مفاهيمي و معرفي حول مفهوم الأناقة من خلال دراستها لغوياً واصطلاحاً ومن ثم طرح المفهوم وفي

الجوانب المعرفية المختلفة في الفلسفة والعلم وهندسة التصميم والرياضيات ثم الانتقال الى عرض المفهوم في العمارة من اجل التوصل الى اهم المفردات المعتمدة لقياس خصائص فعل الأناقة في شكل النتاج المعماري وتم تطبيق هذه المفردات على عينتين 1. البنك المركزي 2. متحف الفن الاسلامي، تم اختيار كل من العينتين لما يحملهما من علاقات شكلية تتسم بالنضج والتكامل مع السابق والمحيط.

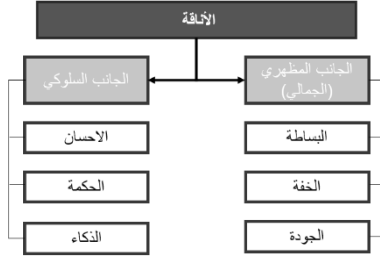
2 - مفهوم الأناقة لغوياً

إن مفردة الاناقة في معجم اللغة العربية المعاصرة تعد الاحسان في اختيار الالفاظ وطرق التعبير وجمال المظهر، وأنق الشيء اي احبه، وانق به اي اعجبه وفضله على سواه، وتأنق الشخص اي اعتنى بمظهره واسلوبه والتأنق في العمل اي اتقنه وجوده ان كان كاتباً تأنق في اختيار كلماته وعباراته واناقة الحسن في الترتيب والتنسيق او في المظهر والتعبير اي في المظهر او الاسلوب (عمر 2008، ص132) وهنالك ايضاً التأنق اللفظي / البديعي وهو اسلوب في الكتابة والكلام يتميز بالاسراف في استخدام انواع السجع والطبعات والتلميحات وغيرها (معجم اللغة العربية المعاصرة) الانق الاعجاب بالشيء انقت به اي معجب وانه لأنيق مونق لكل شيء اعجبك حسنه وهو حسن المظهر و اعجابه به (معجم لسان العرب) وفي القاموس المحيط شي انيق كأمر معجب وتأنق به اي عمله بالاتقان والحكمة والمكان احبه (الفيروزبادي، 2008، ص79). وعليه فإن الأناقة هو كل ما يرتبط بالتنظيم والتنسيق والترتيب وهي التنظيم المتقن ذو الجودة العالية المحكومة بالذكاء و الحكمة القادمة من الخبرة والتجربة والغرض منها هو الاحسان في العمل.

ثانياً: تعريف الاناقة في اللغة الانكليزية: ترجمة كلمة الاناقة في اللغة الانكليزية في قاموس المورد elegant وحسب قاموس ميريام ويبستر من مرادفاتها (،Classy elegant) وحسب موسوعة بريتانىكا فان مفردة elegance مشتقة من اللغة اللاتينية من الفعل eligo وهو يعني القدرة على الاختيار⁽¹⁾ (choose، select، appoint) وتعرف الأناقة وفق

1- <https://etymologeeek.com/eng/elegant>

قاموس كامبرج فتعني بالسحر والجاذبية والرشاقة في المظهر والاسلوب وحسب قاموس اكسفورد فهي تعني الرشاقة والكياسة.



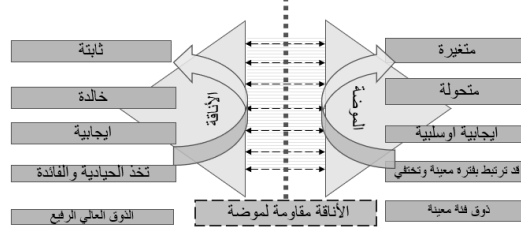
شكل (1) يوضح جوانب الأناقة

يتبين ان مفهوم الاناقة يرتبط بالمظهر والسلوك اذ تحمل جانبيين انساني اخلاقي تعني بالاحسان في العمل والاخلاص فيه وجانب شكلي جمالي يرتبط بكل ما هو جميل وجذاب يرتبط بالعواطف والمشاعر لذلك فهي الجميل المنظم بذكاء وحكمة واخلاص، والغرض منه الاحسان وكما هو موضح في الشكل (1).

3 - مفهوم الأناقة اصطلاحياً

فيتم تعريف الأناقة بأنها الجمال الذي يظهر فعالية وبساطة غير عادية (Merriam-Webster) وغالباً ما تستخدم الأناقة كمعيار للذوق، لا سيما في التصميم المرئي والفنون الزخرفية والأدب والعلوم وجماليات الرياضيات. وغالباً ما تُظهر الأشياء الأنيقة نعمة رفيعة وتقتصر النضج، وفي حالة الرياضيات، إتقان عميق للموضوع . ذكر الطيار والمغامر والمؤلف الفرنسي أنطوان دو سانت إكزوبيري⁽¹⁾،. ربما قدم لنا أفضل تعريف للأناقة الهندسية عندما قال: "المصمم يعرف أنه قد وصل إلى الكمال ليس عندما لا يتبقى شيء ليضيفه، ولكن عندما لا يتبقى شيء ليأخذه" (وقد دخلت كلمة "أنيقة" إلى اللغة الإنجليزية في القرن الرابع عشر الميلادي، وهي كلمة فرنسية (élégant) مشتقة من الكلمة اللاتينية الأنيقة "elegantia" (موسوعة بريتانیکا)، وفي السياق العلم تعبر الأناقة عن البساطة

والقوة التفسيرية (Casadevall & Ferric 2018)، وترى مصممة الأزياء وأيقونة الموضة الأبدية Coco Chanel الشهيرة، "الأناقة هي رفض"، مما يعني أنه من الأفضل تخطي المجوهرات الكبيرة والملابس البراقة لصالح الأنماط البسيطة المصنوعة من الأقمشة الفاخرة التي يمكن للمرء ارتداؤها إلى الأبد وتبدو رائعة في كل مرة اي ان الأناقة مرتبطة بالجودة العالية، كما ترى بان البساطة هي الفكرة الأساسية لمفهوم الأناقة الحقيقية وتصف الأناقة أيضاً بالبساطة الجميلة للحل، مثل البرهان الرياضي الأنيق كما تعرفها بانها الجمال الداخلي المماثل لـ الجمال الخارجي، كما تعرف موسوعة (Webster) الدولية لعام (1998) الأناقة الجمال المقيد بالاسلوب و ثراء حسن الذوق في التصميم أو الزخرفة، يطرح وليام هازلت بأن ويرى الأناقة شيء أكثر من سهولة؛ إنه أكثر من مجرد تحرر من الارتباك أو الانضباط. إنها تعني، أتصور، دقة، تلميع، تألق، مفعم بالحيوية ولكن حساس، فرناندو جيه كورباتو ان الأناقة هي تحقيق وظيفة معينة بحد أدنى من الآلية وأقصى قدر من الوضوح. كما يعرفها Jon Franklin بانها تلك البساطة التي تصل إلى أقصى الحدود، تصبح أناقة. ويرى Karl Lagerfeld بان الاناقة لاعلاقة لها بالموضة وهذا يدل على استمرارية و مرونة الأناقة. يتضح من ما سبق ان المفهوم الأنيق مقاوم كل ما هو مرتبط بالموضة العابرة فهو مرتبط بالصفات الخالدة المستمرة زمانياً كما تمتلك الأناقة تواصل بصوري فتبتعد عن الملل والتعب والثقل وغالبا ما تمتلك الأناقة مرحلة من النضج المعرفي والشكلي والذي يمكنها من التخلي عن كل ما هو غير ضروري فتستمد قوتها من بساطة ودقة تنظيمها وهذا النضج يظهر على كلا جانبي الأناقة فتكون الأناقة سلسلة واضحة تحرك الأفكار بدقة حيكها وقوة هيمنتها فتظهر في شكلها بساطة عالية وهذا ناتج عن وضوحها وفي باطنها تعقيد وهذا ما يعطيها القوة والتميز والتفرد.



شكل (2): يوضح موقف الأناقة مع الموضة والذوق، المصدر الباحثة.

يتضح من ما سبق أنَّ المفهوم الأنيق مقاوم لكل ما هو مرتبط بالموضة العابرة فهو مرتبط بالصفات الخالدة المستمرة زمانياً كما تمتلك الأناقة تواصل صوري فتبتعد عن الملل والتعب والثقيل وغالبا ما تمتلك الأناقة مرحلة من النضج المعرفي والشكلي والذي يمكنها من التخلي عن كل ما هو غير ضروري فتستمد قوتها من بساطة ودقة تنظيمها وهذا النضج يظهر على كلا جانبي الأناقة فتكون الأناقة سلسلة واضحة تحرك الأفكار بدقة حبكها وقوة هيمنتها فتظهر في شكلها بساطة عالية وهذا ناتج عن وضوحها وفي باطنها تعقيد وهذا ما يعطيها القوة والتميز والتفرد الاحسان وكما هو موضح في الشكل (2).

3 - مفهوم الأناقة في القرآن الكريم والسنة النبوية

يتضح من خلال ما سبق ان فعل الأناقة يتصف بالاحسان ويرتبط بالجودة العالية ويشير الله سبحانه وتعالى الى ضرورة ارتباط الفعل الانساني بالاحسان والاتقان في بعض الايات القرانية الكريمة، حيث يقول: (إِنَّ اللَّهَ يَأْمُرُ بِالْعَدْلِ وَالْإِحْسَانِ) (النحل 90) ففي قوله تعالى نجد ان الله تعالى يأمر بأصول الخير فهو يبين كميته الخير التي يردها الله ويأمر بها الانسان فهو يأمر بالعدل الذي يتصف بالأنصاف وعدم الجور اما الاحسان فهو يدل على الجودة والاتقان (وَأَحْسِنُوا إِنَّ اللَّهَ يُحِبُّ الْمُحْسِنِينَ) (الإحسان: مأمورٌ به في كُلِّ شَيْءٍ هَلْ جَزَاءُ الْإِحْسَانِ إِلَّا الْإِحْسَانُ) (النمل: 88) في الحديث الصحيح: " إِنَّ اللَّهَ كَتَبَ الْإِحْسَانَ عَلَى كُلِّ شَيْءٍ " نجد في هذه الايات الكريمة الحث والامر على الأحسان في العمل وفي كل شي اما الإتقان سمة أساسية مطلوبة عند المسلم يربيهها الإسلام فيه منذ ان يدخل فيه، ولها دور مهم في تغيير سلوكه ونشاطه وحياته، ويعرف الاتقان الإتقان معرفة الأدلة بعلمها، وضبط القواعد الكلية بجزئياتها؛ وقيل ان الإتقان معرفة الشيء بيقين (الجرجاني) فالمسلم مطالب بالإتقان في كل عمل تعبدي أو سلوكي أو معاشي؛ لأن كل عمل يقوم به المسلم بنية العبادة هو عمل مجزي به عند الله، وإن قُبِلَ منه هذا العمل يثاب عليه بالأجر والحسنات وأمر الرسول ﷺ أن يتقن الإنسان عمله، فقال: (إن الله يحب إذا عمل أحدكم عملاً أن يتقنه) قال الله -تعالى-: (صُنْعَ اللَّهِ الَّذِي أَتَقَنَ كُلُّ شَيْءٍ إِنَّهُ خَيْرٌ بِمَا تَفْعَلُونَ). قال الله تعالى (لَقَدْ خَلَقْنَا الْإِنْسَانَ فِي أَحْسَنِ تَقْوِيمٍ). قال تعالى: في سورة النمل) وَتَرَى الْجِبَالَ تَحْسَبُهَا جَامِدَةً وَهِيَ تَمُرُّ مَرَّ السَّحَابِ صُنْعَ اللَّهِ الَّذِي أَتَقَنَ كُلُّ شَيْءٍ إِنَّهُ خَيْرٌ بِمَا

تَفَعَّلُونَ (. من خلال هذه الآية الكريمة يتبين ان صفة الاتقان وصف الله نفسه بها لتنتقل الى عباة فالاتقان سمه خلقية سلوكية وقيمة انسانية والإسلام من أهم أخلاقه الأمانة، والأمانة تقتضي من العامل أن يقوم بعمله على أكمل وجه، وأفضل حال . نستنتج من ما سبق ان الاناقة ترتبط بالفعل انساني تنبت في السلوك لينتقل الى المظهر الخارجي مع ضرورة الاتصاف بالاحسان والاتقان والحكمة التي تأتي من التجربة والخبرة كما يجب المراعاة والتأني و التفكير في اي عنصر يتم اضافته اي الدعوة الى الأخلاص والأمانة وعدم الأسلاف في ماهو غير ضروري.

4 - حضور فعل الأناقة في الحقول المعرفية المختلفة

تدخل الأناقة في كثير من المجالات حيث تم تقديم مصطلح الجماليات لأول مرة في القرن الثامن عشر الميلادي من قبل بومغارتن، المعروف باسم أبو الجماليات الحديثة. عزّف الجماليات بأنها علم الحواس والمعرفة (Baumgarten 1750) ومن هنا بدأ المكفرون ينظرون بجدية الى الصفات التي تثير المشاعر والعواطف تم طرح ومناقشة كل من النعمة والاناقة جنباً الى جنب كالسمتين الرئيسيتين المتلازمتين للجمال حيث وصف Hogarth الأناقة elegance بالنعمة grace ويرى بأن الاشكال الانيقة مسلية للخيال كما انها ترضي العين وان الخيال هو لغة العقل (Hogarth2010) ويطرح Shiller فيرى ان النعمة grace هي تعبير عن الروح الجميلة وهي تمثل الجمال المتغير و جمال موضوعها الذي يمكن ان يتحقق وينتهي كذلك فهي تميز نفسها عن الجمال الثابت الموجود بالضرورة مع الذات الثابت وتكمن الاناقة في حرية الحركة وان النعمة هي خاصية مميزة للفرد (Shiller) كما تناولها كل من Spencer و Bergson حيث يرى Spencer بأن لذة النعمة اساس عقلي في الشعور بالعاطفة وان الاستمرارية عنصر بارز في الاناقة والنعمة (Spencer 1891) ويرى Bergson ان الأناقة هي إدراك سهولة معينة تقود الشخص إلى إدراك سهولة أكبر في الحركات التي يمكن التنبؤ بها ؛ لذلك، فإن الخطوط المنحنية أكثر نعومة من الخطوط المكسورة وان الرشاقة هي اللامادية التي تمر عبر المادة وتتغلب على صلابتها (Bergson 1917) وفقاً لهؤلاء المفكرين فقد أكدوا على ارتباط فعل الأناقة ببعض السمات الظاهرية مثل التنوع والحركة والحرية و السهولة والسيولة و الخطوط الحلزونية

والمحنية و الاستمرارية، ويعتبر الخط المنحني والخفة أهم مظهر مادي لها وان التنوع والحركة هو ما عطي الأناقة ذلك التميز والثراء الشكلي فهي تجمع بين العقل والقلب تحاول ان تقدم حلول ذكية باقصر الطرق لتصل الى القلب والمشاعر.

اما في مجال العلم فتعد الأناقة هي نوعية قيّمة ويمكن تحديد بعض السمات (مثل الوضوح والذكاء والبساطة) التي تساهم في توصيف عام للعلم الأنيق (Glynn 2010) ودائماً ما ترتبط بالبساطة والقدرة التفسيرية (Casadevall & Fang 2018) كما تشير الأناقة - الى الدقة والعمومية والقدرة على الاختبار و تشكل سمة جوهرية للممارسة العلمية الناجحة والملاحظة، وهي معيار يحدد الفرق بين التجارب الجيدة والسيئة (Nathan & Brancaccio 2013)، وبالتالي ان تعريفها يتضمن الوضوح، والذكاء، والصحة، والقوة الخارجية، والبخل، و الجمال. ان السعي وراء الأناقة يمكن أن يحسن من جودة العلم، لكن يجب السعي وراء الأناقة بحذر، لان الحقيقة العلمية في بعض الأحيان قد تكون غير أنيقة (Casadevall & Fang 2018)، يطرح Glynn بأن جوهر الأناقة العلمية هو البساطة وقوة التفسير بينما أشار في الوقت نفسه إلى أن تقديرها يتطلب سياقاً تاريخياً (Glynn 2010)، نستنج من خلال ماسبق ان الاناقة في فلسفة العلم تعد سمة جوهرية وهي تتمثل بالوضوح والبساطة مع التمثيل المناسب والقوة في التفسير مع اقتصاد في الوسائل فهي تعتبر معيار للنجاح وتسمى البساطة النحوية في العلم بالاناقة وهذه الصفات جميع لابد ان تقترن بالجودة والأنتقان واللذان يعدان من اهم الصفات في تمثيل الاناقة

في نهاية القرن العشرين، جذب مفهوم الأناقة "Elegance" انتباه المنظرين في مختلف مجالات علوم التصميم وهندسة النظم، وقد تم اقتراحه من وجهتي النظر الرسمية والوظيفية، مما أدى إلى تطور العلاقة بين الرياضيات والحاسوب وعلوم التصميم، يعتقد الباحثون في هذا المجال أن الأناقة في النظام تزيد من كفاءته وإنتاجيته قدم "Gelenter" الأناقة كميزة تجعل استخدام أسهل (استخدام أقل للذاكرة، وجهد أقل، و مكونات أقل، وما إلى ذلك) ووصفها بالاتحاد الفعال بين البساطة والقوة (بمعنى أن القدرة على تحديد مجموعة واسعة من المهام) قام Gelernter أيضاً بشرح الأوصاف الجديدة للأناقة حيث ان دورها كمخفف ومنظم للتعقيد وتم النظر في علاقتها بالإبداع (Gelenter 1998)،

وبحسب مدني، يرتبط التصميم الأنيق بمستويات عالية من الإبداع الوظيفي (Madni 2012) وهذا ما يوضح ارتباط الأناقة بالابداع. وقد تم تعريفها من قبل Griffin "الأناقة في التصميم الهندسي مفهوم لا مفر منه. يتضح على الفور عندما يكون موجوداً، ومع ذلك فمن الصعب تحديده، ومن المستحيل تحديده، ويبدو أنه غير قادر على تعليمه حتى الآن من المتعارف عليه هنا أن هندسة النظام، المفهومة بشكل صحيح، تهتم في جوهرها بتحقيق تصميمات أنيقة" (Griffin 2010) يتضح من خلال ما سبق كلمة "الأناقة" لها استخدامات واسعة جداً في مجال هندسة التصميم، غالباً ما يتم تحديدها على أنها هدف تصميم أو على الأقل سمة نظام مرغوب فيها، وعلى الرغم من غياب تعريف دقيق ومتفق عليه عالمياً في سياق التصميم الا انها تميل الى مفردات التوافقية و الكفاءة و الفعالية و الدمج و البساطة و الاقتصاد

كما دخلت علم الرياضيات و دائماً ما ترمز الى التناسق والتوازن من الجمال وهي الهدوء والنعمومة التي تثير البهجة وهي كل من الوثوقية والجاذبية يشير الكتبي الى ان كل ما يدعو الى الجمال في الرياضيات يدعو الى الأناقة لان الرياضيات يحكم بنظام متناسق وان الجمال المتناسق الأنيق هو الجمال في الرياضيات (سليم الكتبي ص75) حيث يجد العلماء الأناقة في الرياضيات في التناسق من الجمال فيقارنوها مع الفنون في العالم فيرى Weier strass ان الجمال في الرياضيات مستمد من الشعر فيقول " " اذا لم يكن الرياضي شيئاً من شاعر فلن يكون رياضياً فالرياضيات والشعر نفس ملكة التخيل الا ان احدهما موجهة الى العقل والثانية موجهة الى القلب " وقد ادخل احد العلماء النسبة في تعريف السعادة على انها نسبة الامكانات على الحاجات ان كل من التعريفين السابقين يمتازان بغزارة المعنى المقدم في اقل فترة من الزمن ليعتبا نوعاً م الجمال الهادي، يدفع الفرد للتمعن فيه والانجذاب نحوه انهما يمثلان تناولا انيقاً. (المصدر السابق) وكما هو موضح في الجدول (1) ادناه.

جدول (1) تحليل مفهوم الأناقة في الحقول المعرفية المختلفة		
المجال المعرفي	المؤشرات المستخلصة	الصفات
فلسفة الجمال والفن	الجمال المتقن والتفرد الغير المعتاد والذي يصل الى العاطفة والمشاعر	العاطفة، الجمال المتحرك، الأستمرارية، الكمال، التفرد، السمو، النعمة، الانحناء، الخطوط الحلزونية
فلسفة العلم	سمة جوهرية ومعيار للتقييم التجارب الجيدة والسيئة	الوضوح، القوة، البساطة، اقتصاد، جودة، أتقان
هندسة التصميم	هدف للتصميم والأناقة تزيد من كفاءة النظام وفعاليتة	الابداع، صحيح، فعال، كفوء، أستدامة، أقتصاد، بساطة، نكاء
الرياضيات	غزارة المعنى المقدم في اقل فترة من الزمن ليعتاً نوعاً من التناسق و الجمال الهادي، يدفع الفرد للتمعن فيه والانجذاب نحوه انه يمثل تناولا انيقاً	التناسق، التناغم انسجام، الدوائر، المنحنيات، النسبة الذهبية،

على وفق المعلومات التي تم طرحها فإن البحث يستخلص مايلي :

تم استخلاص مجموعة من المفردات التي توضح خصائص الأناقة وهي : الجمال، المرونة، التوافقية، التناسق، الانسجام، الأقتصاد، الأختزال، البساطة، الوضوح، النظام، التفرد، القوة، التوازن، الابداع، التفاعل، الجاذبية، الاحترام، الأخلاق، الاحسان، الهيبة، الابهار، الإنتقائية، الذكاء وتبين اهم السمات المظهرية للشكل المادي لـ الأناقة هي (الخفة والأنحاء).تم إستخلاص مجموعة من المفردات التي تبين لـ الأناقة خصائص قياسية ترتبط بالجودة العالية والكفاءة والكفاية والفعالية والاستدامة والاقتصاد والاتقان والخ .

وبدلالة هذه المؤشرات نستخلص تعريفاً إجرائياً لمفهوم الأناقة : يتبين من ماسبق ان الأناقة تتميز بخصائص تتمثل من خلالها الفعل الأنيق الاحسان والاخلاص والاتقان والجودة والتميز ليقدم اعظم تأثير مع اقتصاد الوسائل وهو يتسم بالوضوح والقوة والجمع بين التناقضات ومن خلاله يمكن التوصل الى تعريف أجراءي اولي لفعل الأناقة هو ذلك الأسلوب او النهج التنظمي المتفرد بوضوح علاقاته وتناسق مظهره وذكاء تجميعه فيبدو كأن جميع اجزائه متكاملة لايمكن اختزاله فهو يجمع بين المتناقضات البسيط والمعقد واللحظية والابدية والحركة والثبات فهو الابداع الذي يلامس المشاعر ويغذي الخيال وتدركه العواطف ليبقى في الذاكرة ويتسم بخصائص القوة والوضوح والأتقان والجودة .

5 - فعل الأناقة والنتاج المعماري وعلاقته بالمادة

تعتبر العمارة عن التفاعلات الاجتماعية والإقتصادية والسياسية في المجتمع العالمي المعاصر وهذا ما رفع من درجة الوعي بالتنوع والرقى وابرز الهوية الثقافية لكل مجتمع، مما ولد ضرورة في تحديد القيم الجمالية الاخلاقية في العمارة فالعمارة اكثر من مجرد بناء بل هي تجلب عاداتنا الجماعية من خلال فعل المعمار (Wasserman، others، 2000) ان ابراز الشكل وجعله وسيلة للتعبير واداة للحل وإن الشكل هو مجموع الخواص التي تجعل الشيء على ما هو عليه، اذ تتجمع الصفات الحسية وتعطينا كلها معاً شكل الشيء (سامي، 1966 ص 7) فهو التعبير المادي للمصمم عن فكرة او مفهوم لتحقيق هدف معين حيث يتعرض الى مجموعة من القراءات التي قد تتفق مع المفهوم او الفكرة المطروحة من قبل المصمم. (العقابي، الماجدي، الشكري 2020 ص 93) مع تزايد تعقيد الشكلية والمتطلبات الوظيفية للمشاريع المعمارية، هناك حاجة إلى أدوات أكثر تعقيداً للتقييم ان الأناقة كمفهوم لديها إمكانات هائلة للتأثير في جميع جوانب عملية التصميم، تكمن الأناقة في العالم الذاتي كأداة لتقييم عمل المصممين. تم تعريف الأناقة بمصطلحات اكثر موضوعية في كل من مجالات الفلسفة والرياضيات والهندسة حيث طورت هذه الحقول لغات متطورة يمكن من خلالها التواصل وتقييم العمل المنتج بشكل موضوعي، يمكن أن يوفر مفهوم الأناقة إطاراً لإنشاء تعريف جديد للهندسة المعمارية . على الرغم من أنه ليس المفهوم التقييمي الوحيد، إلا أنه يجمع بين الجوهر والوظائف المتعددة والاتساق لأناقة هي أداة قوية في يد المصمم لأنها تتيح الإدراك المتكرر للحلول المعمارية العملية والإبداعية من خلال توفير تقييم إطار لتبرير القرارات و أن جوهر العمارة لا يكمن فقط بتوفير حلول ناجحة للمشكلة المادية، بل في قيمها الروحية المسؤولة عن تشكيل الثقافة وتجاوز الوجود الفيزيائي الى اشكال جمالية وعاطفية ومعانٍ رمزية ترتقي بها الى رموز الحضارة (Wasserman، others 2000.14). الجوهر في الفلسفة هو السمة أو مجموعة السمات التي تجعل الشيء أو الجوهر ما هو عليه أساساً، والذي يمتلكه بالضرورة، والذي بدونه يفقد هويته. " بالتالي فالبحث يحاول دفع هذا المفهوم إلى مقدمة الخطاب المعماري

الحالي من خلال إعطائها القوة و الأساس النظري، امتلاك الاناقة للجاذبية العالية يسهم في دفعها ل الامام، وقد تبين من خلال ماسبق من عرض المفردة في الحقول المختلفة ان الاناقة فضيلة أخلاقية جمالية تحمل خصائص ظاهرية شكلية تتصف ب الخفة والشفافية والبساطة في التعقيد و خصائص جوهرية كالحكمة والقوة كذلك يرتبط بمفهوم المادة. من ناحية أخرى، هناك ميزة أخرى يتم التأكيد عليها كثيراً حول جودة الأنافة وهي الحركة والديناميكية. لذلك يمكن القول أن جودة الأنافة، نسبة الصورة الى الإحساس بالجوهراً أو القوة؛ وفي الوقت نفسه، لها علاقة مباشرة بالشعور بالحركة اي التباين الناعم والتدريجي (Wahdattalab & others) لقد صاغ المهندس المعماري الروماني فيتروفيوس (Vitruvius)، وهو ربما الكاتب الأكثر استشهاداً في هذا السياق وبالتأكيد واحداً من أوائل الذين كتبوا عن التصميم الإنشائي، المصطلحات firmitas و utilitas و venustas كأساسيات الهياكل الجيدة في وقت مبكر من 25 قبل الميلاد. أولاً، المبنى يجب ان يقف (القوة)؛ ثانياً، يجب أن تكون مفيدة من حيث المتانة والقوة (المنفعة)؛ وأخيراً، يجب أن يكون المبنى ممتع (الجمال) عرفَ Volkwin Marg⁽¹⁾ ثقافة البناء على أنها تجمع بين وجهين لعملة واحدة التكنولوجيا والفن والتي كما يقول لا يمكن تحقيقها إلا عندما يعمل المهندسون المعماريون والمهندسون بشكل خلاق معاً وهذا يعود إلى مثلث أفلاطون الحقيقة والخير و الجمال حيث ان الحقيقة هي الصدق الفكري عندما يتطابق الهيكل والشكل؛ ويكمن الخير بمعنى مساهمة مبانينا في المجتمع وأفراده؛ وأخيراً، الجمال بالمعنى الجمالي الذي يبدأ في التألق عندما يتم الجمع بين الخير والصدق بنجاح (marg 2008). وفي عام 1980 صاغ المهندس الأمريكي ديفيد بيلنجتون David Billington مصطلح "الفن الإنشائي" - فن الهندسة الإنشائية بالتوازي مع الفن المعماري. يعرف المثل العليا للفن الهيكل على أنها الكفاءة و الاقتصاد والأنافة. ويلاحظ أن المهندسين ليسوا علماء، لأنهم اخترعون و لا يكتشفون. إنهم اخترعون جسوراً أو أبراجاً وأسقفاً طويلة ومباني شاهقة من خلال الجمع الناجح بين استخدام أقل قدر ممكن من المواد بأقل تكلفة مع قرارات

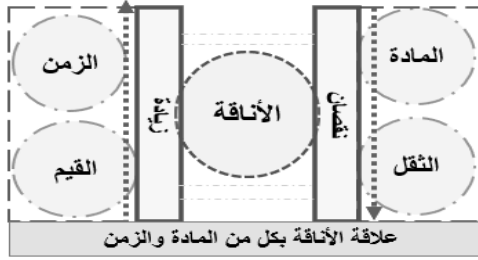
1- مارغ هو المؤسس المشارك لمؤسسة gmp وأكاديمية الثقافة المعمارية (aac) لتقدم المهندسين المعماريين الشباب، وحصل على العديد من الجوائز، مثل جائزة فريتز شوماخر، وميدالية أكاديمية الفنون الحرة في هامبورغ، والجائزة الكبرى لجمعية المهندسين المعماريين الألمان، وجائزة أفضل مهندس معماري في ألمانيا.

جمالية واعية (Billington 1995) يذكر المهندس المعماري الياباني Tadao Ando عندما يكتب عن الأناقة وجماليات البساطة كجزء من طريقة الحياة اليابانية. وفقاً لـ Ando فإن "Sabi-Wabi" المتواضع والمتضرر يلهم الأناقة في الهندسة المعمارية عن طريق التقليل والاختزال حتى يتم ترك المنفعة والجمال فقط. منزل Sabi-Wabi هو نتيجة "العيش المتواضع والتعلم والسعادة بحياة خالية من أي شيء لا لزوم له والعيش في الوقت الحالي" (Ando 2014) كما يوضح بريمو ليفي Primo Levi أن النظرة النوعية (الجمال) والكمية (البساطة) ان الكيمياء كالهندسة المعمارية فالصروح "الجميلة" المتناسقة والبسيطة هي الأكثر استمرار وثباتا اي يحدث الشيء نفسه مع قباب الكاتدرائيات أو أقواس الجسور ليفي (Levi 1988) ومن الممكن أيضاً أن يكون التفسير بعيداً ولا ميتافيزيقياً أن نقول "جميل" هو أن نقول "مرغوب فيه"، ومنذ أن قام الإنسان بالبناء أراد أن يبني بأقل تكلفة وبأكثر الطرق ديمومة و المتعة الجمالية . من خلال ماتقدم يمكن التوصل الى تعريف إجرائي لـ فعل الأناقة في العمارة هو الإحسان في تكوين هيئة الشكل لإبراز افضل خصائص المادة المكونة للنتاج المعماري و يمكن ان يتجسد شكلياً و يعكس جوهره و ما يحمله من خلال ثلاثة ابعاد : البعد الاول البعد الانساني الذي يتعلق بالخصائص والبنى الاخلاقية العميقة الثابتة وتتغير مظاهرها تبعاً لمعطيات العمرانية الاحترام والاتساق البعد الثاني : البعد الشكلي الذي تتعلق بالسّمات الظاهرية للشكل المادي للنتاج المعماري كالخفة والانحناء والتوازن والبعد الثالث : البعد القياسي الذي يتعلق بالاتقان والجودة والادائية والكفاءة . وهذا يعني ان ظهور الأناقة في النتاج هو غاية تحتمل اوجهاً شكلية مختلفة ومظاهر متعددة وفق المتغيرات المكانية .

6 - السمات الإدراكية و الفيزيائية للأناقة في العمارة

من الصفات المادية لـ الأناقة النحافة والضييق (De Botten2009) الوضوحية (goldblatt2007) الوضوح وسهولة القراءة (Schumacher2007) الشفافية والتألق (Mollasalehi2006) التنوع مع الاستمرارية والتكامل (Schumacher2007) وبعبارة أخرى هي ذلك التنوع الناعم الذي يمكن ربطه بخصائص الخفة والسهولة والثراء الإدراكي * فالأناقة سهلة الإدراك ويبدو ان الصفات المعاكسة للأناقة هي الثقل والصلابة والتعب والملل الإدراكي. لذلك الشكل الأنيق غالباً مايشجع المشاهد على مواصلة المشاهدة ومتابعته بصرياً. أي عائق أو انقطاع في مسار هذا السعي سيقلل من الأناقة. يمكن شرح هذه الميزة بناءً على قانون الجشطالت للاستمرارية أو الاستمرارية الجيدة. وفقاً لهذا القانون، يميل الناس إلى تلقي العناصر المستمرة في شكل مركب واحد (Lang 2014). يزيد التماسك والتكامل من المتعة الجمالية من خلال المساهمة في معالجة أكثر سلاسة وسهولة. لذا فإن المحفزات المتناظر والاستمرارية والانغلاق والتكرار تخلق شعوراً بالتماسك ولهذا السبب فهي موضع ترحيب أكبر (Arnheim1971) في حين إن التكامل المفرط للمدخلات الإدراكية يسبب الملل العقلي و تتعب الحواس (Berlyne Biederman & vessel 1971) على المستوى الإدراكي يتم الحصول على المتعة الجمالية من التحفيز الذي يلبي حاجتنا للتكامل و كما أنها تلبي احتياجات التنوع (Post Blijlevens & Hekkert 2016) يقدم الخط المنحني في نفس الوقت عامل التنوع والاستمرارية (الوحدة) ولهذا السبب له جاذبية بصرية ويعتبر أحد مكونات الأناقة في الشكل. أكدت تجارب مختلفة تفضيل المنبهات المنحنية على المنبهات الزاوية (Bertamini & Palumbo; 2009، Barona & Silvia، 2016).

نستنج من ما تقدم ان الأناقة تمتلك من التنوع والاستمرارية الذي يجعلها جاذبة بصرياً وان من الصفات الشكل المادي هي الخفة والحركة الناتجة الخط المنحني هو احد ابرز سماتها الشكلية للنتاج الأنيق وتأخذ الأناقة جاذبيتها وتماسكها من التحفيز الذي يلبي الحاجات الإدراكية فهو تلك الديناميكية التي تحفز على التواصل الصوري وتعطي المتعة الجمالية للمشاهدة بعيداً عن التشويش والغموض والملل فتكون الأناقة السهل الممتع ويوضح الشكل (3) علاقة فعل الأناقة بالمادة والزمن.



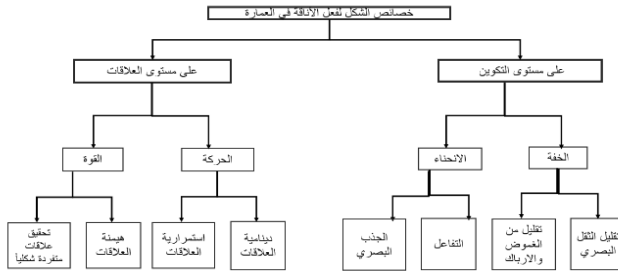
شكل (3): يوضح علاقة فعل الأناقة مع المادة والزمن، المصدر الباحثة.

7 - بناء الاطار النظري للدراسة

- الخفة: يقصد بالخفة هو نقليل الثقل البصري في شكل النتاج المعماري يرى goldbatt بأن وجود الأناقة ساعد على تفكيك الجوهر التقليدي للهندسة المعمارية المتمثل في الصلابة والقوة والوزن، ومع فقدان مظهر جاذبية الهندسة المعمارية يأتي التحرك نحو فكرة شعبية للأناقة تم تعريف الخفة بأنها اللامادية التي تخترق الكتلة وتجردها من ثقلها اللوان البيضاء والفاخرة تعطي المادة خفة بصرية اكبر فتبدوا العمارة وكأنها تنكر ثقلها (goldbatt2007).
- الأنحاء: يعمل الخط المنحني على زيادة التنوع والقدرة على تقديم التنوع والاستمرارية (التكامل) هي ما يصنع الخطوط المنحنية وتم تعريف الخط المتعرج بأنه عدد كبير من الخطوط المستقيمة ويمتلك مساحة معلومات اكبر في الصورة ترفع من درجة حرارة البنية وتزيد من تعقيدها لتعزيز الاستجابة تجاه المبنى (انوار مشعل ص15) فالاشياء الاكثر انحاءاً والتواءً تمتلك تأثيرات بصرية عالية (salingaros1997) وان العين تركز الاشكال الاكثر انحاءاً والتواءً لكونها تؤدي الى زيادة ايقاع الذي يقوم به عضلات العين فأننا نشعر بالشد تجاه تلك الاشكال (ابراهيم 1966) وان الخط المنحني يقطع من استمرارية الخطوط المستقيمة فنتنتج وحدات بزواوية تجعل الشكل اكثر

صعوبة وتقلل النظام لتعطي اجزاء بمراكز متعددة ومختلفة ينتج عنها الشد وتدفق الاشكال وتحتاج الى بذل جهد اكبر لتفسيرها (Metzger 2006).

- **الحركة** : تنشأ الحركة والدينامية من التنوع البصري واستمرارية والتكرار وبعبارة اخرى هي ذلك التنوع الناعم الذي يمكن ربطه بخصائص الخفة والسهولة والثراء الادراكي، و ان الصفات المعاكسة للأناقة هي الثقل والصلابة والتعب والملل الادراكي. لذلك يتمتع الشكل الأنيق مشهد بصوري متواصل و يشجع على متابعته بصرياً. وأي عائق أو انقطاع في مسار هذا السعي سيققل من الأناقة. يمكن شرح هذه الميزة بناءً على قانون الجشطالت للاستمرارية أو الاستمرارية الجيدة. وفقاً لهذا القانون، يميل الناس إلى تلقي العناصر المستمرة في شكل مركب واحد (Lang 2014). يزيد التماسك والتكامل من المتعة الجمالية من خلال المساهمة في معالجة أكثر سلاسة وسهولة، الأناقة تستمد جاذبيتها وتماسكها من التحفيز الذي يلبي الحاجات الإدراكية، مما يجعلها تجربة بصرية ممتعة بعيداً عن التشويش والغموض، وبذلك تكون الأناقة سهلة وممتعة.
- **القوة**: يقصد بقوة هيمنة الشكل وتماسكه فإن التوازن والتماسك يعززان المتعة الجمالية من خلال تسهيل معالجة المدخلات البصرية. المحفزات ذات السمات مثل التماثل، والاستمرارية، والتكرار، وما إلى ذلك، تخلق إحساساً بالتماسك والتوازن، مما يجعلها أكثر إمتاعاً (أرنهايم، 1971) (Arnheim, 1971)، ويوضح الشكل (4) اهم الخصائص الشكلية لفعل الأناقة في العمارة.



شكل (4): يوضح خصائص الشكل لفعل الأناقة في النتاج المعماري، المصدر الباحثة.

8 - فرضية البحث

سيتم في هذه الفقرة صياغة مجموعة من التصورات الافتراضية وفقاً لمفردات الإطار النظري الرئيسة وارتباطاً بتحقيق الأهداف الخاصة للبحث التي تحدد إطار عام يتم بموجبه تحليل المعلومات والبيانات وصياغتها في نتائج عملية وتم ذلك من خلال وضع فرضية رئيسية تشتمل على مجموعة من الفرضيات الثانوية المرتبطة بها

الفرضية الرئيسية للبحث: والتي نصت على " تميل النتاجات الأنيقة الى ابراز الخصائص الشكلية التي تعزز من استمرارها زمانياً " وتتفرع هذه الفرضية الرئيسية الى عدة فرضيات ثانوية وهي:

- ليعمل الانحناء على زيادة الخفة البصرية انما يعمل على تحفيز الادراك وزيادة الجاذبية البصرية لشكل النتاج المعماري الأنيق .
- ان كل من التفريغ الكتلي و الاستطالة والظل والضوء والالوان الفاتحة تسهم في تقليل الثقل البصري للمادة وبالتالي تعمل على زيادة خفة البصرية للتكوين الشكلي للنتاج المعماري.

9 - القياس والتطبيق العملي

يهدف التطبيق الى اختبار اعتمادية الاطار النظري ومعرفة قوة وفاعلية القيم الممكنة لتحقيق خصائص الشكل الأنيق في النتاج المعماري ولغرض التطبيق تم اختيار عينتين تم اعتماد الهيمنة البصرية والاندماج مع السياق كمعايير لتحديد العينات ومن اجل إجراء الدراسة العملية والتحقق من قيم المتغيرات والتأكد من صحة التصورات الافتراضية، أعتمه البحث أسلوبين للقياس استناداً إلى طبيعة مفردات الواردة في الإطار النظري، فالأسلوب الأول هو المقياس النوعي الذي يستند على القياس الوصفي التحليلي المقارن لمفردات الإطار النظري في حين الأسلوب الثاني هو أسلوب القياس الدلالي باعتماد الاستبيان مع اعتماد اسلوب المقارنة والتحليليين المقياسين بواسطة معامل

الارتباط عن طريق برنامج الاكسل لتحقيق هدف البحث وفرضيته وفيما يلي تعريف للعينات المنتخبة :

1 - العينة الاولى : البنك المركزي العراقي في بغداد - موضحة في الجدول (2)

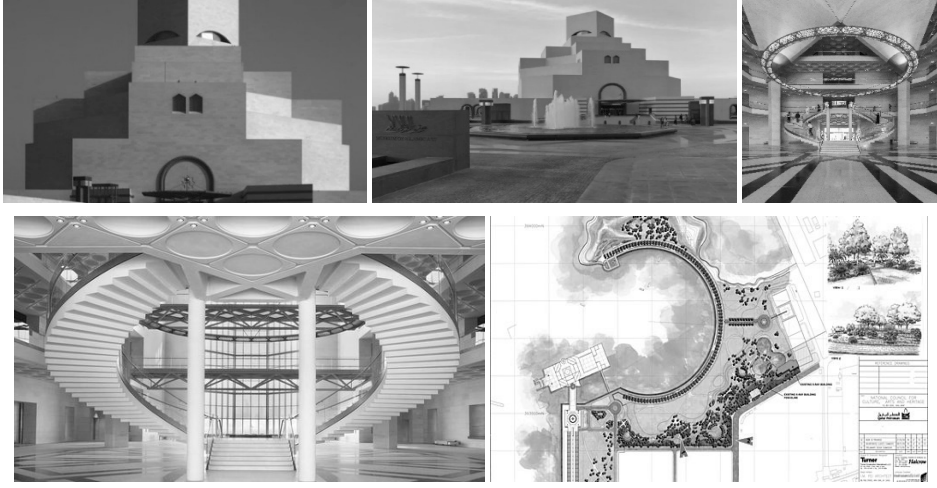
الجدول (2) : نموذج استمارة وصف وتحليل العينة (البنك المركزي العراقي (D) \ إعداد الباحثة									
	<table border="1"> <tr> <td>البنك المركزي العراقي</td> <td>أسم المبنى</td> </tr> <tr> <td>بغداد - العراق / 2011</td> <td>الموقع وسنة التنفيذ</td> </tr> <tr> <td>زها حديد</td> <td>المصمم</td> </tr> <tr> <td>2م90000</td> <td>مساحة المشروع</td> </tr> </table>	البنك المركزي العراقي	أسم المبنى	بغداد - العراق / 2011	الموقع وسنة التنفيذ	زها حديد	المصمم	2م90000	مساحة المشروع
	البنك المركزي العراقي	أسم المبنى							
	بغداد - العراق / 2011	الموقع وسنة التنفيذ							
	زها حديد	المصمم							
2م90000	مساحة المشروع								
<p>الوصف العام : هو نصب معماري خلف برج بابل بارتفاع 162.52 متر على مساحة بناء 93.552 متر مربع. صمم بهيكل محسن يحقق الاحتياجات المطلوبة، مثل مدخل كبار الشخصيات ومدخل الزائرين والردهة الرئيسية والمتاحف ومدخل الموظفين ومركز الطاقة والمنطقة العامة ومرفق الموظفين ومنطقة إدارة النقد ومركز البيانات ومركز الأمن ومناطق المناظر الطبيعية (www.daaxconstruction.com/projects/central-bank-of-iraq)، كما أثرت عدة عوامل على التصميم النهائي للبنك المركزي العراقي، فهو يتألف من شكل ضيق يصل إلى الطابق السابع ومن بعدها ينفتح لتوفير أرضيات أوسع في الطوابق العليا . تم أخذ أحمال الرياح في الاعتبار بالإضافة الى الأحمال الزلزالية، مع النظر الى العوامل السياسية والاجتماعية المحلية . مقاومة انفجار القنابل عامل إضافي مهم إنعكس على تصميم الهيكل وتحسنه لضمان تحمل مستويات عالية من التأثير . أما العامل الأخير فهو القرب من النهر والتأكيد على أنظمة مقاومة المياه بشكل كفوء (https://www.akt-uk.com/projects/central-bank-of-iraq) .</p>	وصف العينة								
<p>الوصف التحليلي : يعد مبنى البنك المركزي العراقي مثلاً على التصميم المعماري الذي يجمع بين القوة والحداثة و يعكس تصميم المبنى القوة والاستقرار للتعبير عن قوة وثبات المؤسسة المالية وتم ذلك من خلال متانة وصرامة التكوين وضخامة الحجم اعتدته هيمنة على المشهد الحضري بموقعه المركزي فيساهم موقعه الاستراتيجي في تأكيد دوره كرمز اقتصادي ومالي في العراق. رغم الطابع العصري للمبنى، هناك إشارات إلى التراث و الثقافة المحلية من خلال التفاصيل المعمارية أو الزخارف، قد يعكس هذا الربط احترام المبنى لتراثه الثقافي ويوفر نوعاً من التواصل والحركة بين الماضي والحاضر. يتعين على المبنى مواجهة التحديات المتعلقة بالتصميم الحضري في منطقة مكتظة، بما في ذلك إدارة حركة المرور والتكامل مع البيئة المحيطة. استتالة الشكل والتوحيد اللوني من خلال اعتماد اللون الابيض وانسيابية تدفق التفاصيل ساعد على تخفيف ثقل البصري للمبنى وان تكامل قاعدة المبنى مع السياق تمهيداً لصعوده نحو الاعلى ساعد على استيعاب الشكل من قبل المتلقي وتقبله بصرياً، وكما هو موضح في الشكل (5).</p>									



شكل (5): مناظر متنوعة لمبنى البنك المركزي العراقي في بغداد .

2 - العينة الثانية : متحف الفن الاسلامي في قطر - موضحة في الجدول (3)

الجدول (3) : نموذج استمارة وصف وتحليل العينة (متحف الفن الاسلامي E) / إعداد الباحثة		
	أسم المبنى	متحف الفن الاسلامي
	الموقع وسنة التنفيذ	الدوحة - قطر 2008
	المصمم	من تصميم المهندس المعماري (I.M.P (Ieoh Ming Pei
	مساحة المشروع	33.5 ألف متر
وصف العينة	<p>الوصف العام : يعد هذا المتحف كاحد النقاط الدالة في دولة قطر، وبإعتبره مشروعاً معبراً عن التنوع الثقافي وتعقيد الفن الاسلامي وهو من تصميم المهندس المعماري I.M.P (Ieoh Ming Pei) الذي سبق وصمم الهرم الزجاجي خارج متحف اللوفر الباريسي وصمم مبنى بنك شنغهاي الفريد في الصين، فضلاً عن قيامه بتصميم متحف ميهو في اليابان. ويتربع المتحف على واجهة كورنيش مدينة الدوحة، على جزيرة صناعية وتبلغ مساحته 33.5 ألف متر مربع، وهو مبنى مؤلف من خمسة طوابق. استلهم المتحف تصميمه من «نافورة الوضوء» التي أنشئت خلال القرن الثالث عشر في مسجد أحمد بن طولون في القاهرة، الذي يعود تاريخه إلى القرن التاسع الميلادي.</p> <p>الوصف التحليلي : يجمع المبنى بين التراث التقليدي واللمسات العصرية، يتميز المتحف بتصميمه الهندسي البسيط ولكن المهيّب، حيث يعتمد على تكوينات هندسية دقيقة تجسد التقاليد الإسلامية مثل الأشكال الزخرفية والأقواس. صفاء الكتل ونقاء الواجهات الخارجية للمبنى واعتماده الحجر الجيري الأبيض قلل من الثقل البصري والغموض ولكن تدرج الكتل وتداخلها أعطى نوعاً من الحركة تكسر ملل سكون الواجهات اضافة الى ان الحجر الابيض ساهم في إعطاء المبنى مظهراً لامعاً ونقياً، وعزز من انعكاس الضوء على بشكل جمالي . استخدام النقوش الإسلامية التقليدية والبلاطات المزخرفة في التصميم الداخلي يعزز من الهوية الثقافية للمتحف وان دمج هذه العناصر بشكل فني مع الأثاث العصري والمواد الحديثة ساعد على زيادة رقي وفخامة واناقة المبنى ، وكما هو موضح في الشكل (6).</p>	



شكل (6): يوضح صور ومخططات توضيحية لمبنى متحف الفن الاسلامي في قطر .

10 - تحليل النتائج

اظهرت نتائج القياس التركيبي والقياس الدلالي توافق نسبي وبأستخراج معامل الارتباط بين المقياسين في برنامج الاكسل يتضح صحة اعتمادية الاطار النظري والجدولان 4 و5 يوضحان نتائج القياس كل من المقياسين ودرجة معامل الارتباط بينهما . كما تم التوضيح في الملحق الجدول (6) يبين الاطار التطري لخصائص الشكلية لفعل الأناقة في النتاج المعماري.

المشاريع المنتخبة		متوسط فعل الأناقة
E	D	
57.50	65.00	القياس التحليلي (الاطار النظري)
55.25	78.00	القياس الدلالي (الاستبيان)
0.64		معامل الارتباط

الجدول (4): يوضح متوسط فعل الأناقة في المشاريع المنتخبة

معامل الارتباط	E	D	خصائص الشكل لفعل الأناقة في النتاج المعماري		
49.5	44	55	القياس التحليلي (الاطار النظري)	الخفة	على مستوى التكوين
71	57	85			
54.5	38	71	القياس التحليلي (الاطار النظري)	الانحناء	على مستوى العلاقات
65.5	45	86			
71	78	64	القياس التحليلي (الاطار النظري)	الحركة	على مستوى العلاقات
67.5	59	76			
70	70	70	القياس التحليلي (الاطار النظري)	القوة	على مستوى العلاقات
62.5	60	65			

الجدول (5): متوسط كل خاصية من خصائص فعل الأناقة لكل من المقياسين المعتمدين .

11 - الاستنتاجات

تتضمن هذه الفقرة طرح أهم الاستنتاجات الخاصة بالبحث والمتمثلة بالاستنتاجات التي تم التوصل إليها من خلال الجانب النظري ضمن الفصول السابقة للدراسة والاستنتاجات الجانب العملي التي بنيت وفقاً للدراسة العملية التي إجريت في هذا الفصل.

استنتاجات الجانب النظري :

- ارتباط الأناقة بخصائص مثل التنوع والحركة والحرية، السهولة والسهولة، والخطوط الحلزونية والمنحنية، والاستمرارية. ويعتبر الخط المنحني أهم مظهر مادي لها وهي ترتبط بكل ماهو جميل وسامي او قد تربط بين الاثنين فهي تجمع بين العقل والقلب تحاول ان تقدم حلول ذكية باقصر الطرق لتصل الى القلب والمشاعر وترتبط بكل ماهو غير معتاد ومتفرد وهذا ما يجعلها ترتبط بالابداع.
- تمتلك النتاجات الأنيقة خصائص للشكل المادي في العمارة تعزز من ادراكها البصري وهي الخفة والانحناء والحركة والاستمرارية والقوة ودائماً ماتحاول هذه النتاجات من خلال هذه الخصائص الى السعي للمحافظة على تحقيق ذلك التوازن البصري الأنيق .

- تأخذ الأناقة جاذبيتها وتماسكها من التحفيز الذي يلبي الحاجات الإدراكية فهي تلك الديناميكية التي تحفز على التواصل الصوري وتعطي المتعة الجمالية للمشاهدة من الصفات المعاكسة للأناقة هي الثقل والصلابة والتعب والملل الإدراكي، أن جودة الأناقة نسبة الشكل الى الإحساس بالجوده أو القوة مع اضافة الشعور بالحركة (التباين الناعم والتدرجي).
- ان الاناقة ذات سلوك انتقائية تميل الى الخصائص الخالدة في تكامل مستمر محاولة للوصول للمثالية، وهي غاية و يتحمل حضورها اوجهاً شكلية مختلفة ومظاهر متعدد وفق المتغيرات المكانية.
- الأناقة فضلية كل من الجمال والأخلاق فالغرض منها يكون على جانبيين الأول كل ماهو متعلق بالجمال والتكامل الشكلي الذي يرضي العين ويصل الى المشاعر ويحرك العواطف والغرض الثاني هو الأحسان وهو الأتقان او انجاز العمل على اتم وجهه وهو الجانب الأخلاقي المتمثل بالاخلاص بالعمل والقيام به على اتم وجهه وهو من مكارم الأخلاق التي يحث القران الكريم والسنة النبوية عليها (إن الله يحب إذا عمل أحدكم عملاً أن يتقنه) .

استنتاجات الجانب العملي:

- تؤكد نتائج التطبيق العملي نحو ميل النتائج الأنيقة الى ابراز خصائص الشكل التي تحقق الاستجابة الاكبر مع المحيط وهذا مايبقيها مستمرة خارج الزمن .
- اثبت نتائج التطبيق العملي ان تحقيق الاستطالة العمودية (الاتصال العمودي) في شكل النتاج المعماري بدلاً من الاستطاله الافقية يعمل هذا على زيادة الخفة البصرية بنسبة اكبر في شكل النتاج المعماري الأنيق .
- اثبت نتائج التطبيق العملي تتشارك اغلب النتاجات المعمارية الانيقة في تحقيقها لخصائص القوة في الحضور وتحقيق التفرد (قد يكون التفرد فكري او شكلي او ادائي) وتحقيقها ل الاستمرارية من خلال تكرار الشكلي وانعدام الفجوات والتواصل مع السياق البيئي المحيط.

- أكدت نتائج التطبيق العملي على ان تحقيق سمة الانحناء لايزيد من خفة البصرية انما يعمل علي تحفير الادراكات فهو ناتج لمجموعة من الخطوط المستقيمة فيعد الية لتحقيق التعقيد الشكلي وزيادة الجاذبية البصرية لذلك يلاحظ وجوده في العماثر التي تركز على ابراز مظاهر الهيمنة والسمو والابهار

12 - التوصيات

- 1 - يوصي البحث بأستثمار ماقدمه الاطار النظري من مفردات لاعتمادها ك معايير حكم على النتاجات المعمارية المعمارية الأنيقة و كيفية تجسيد هذا المفهوم في العمارة وعلى كلا الجانبين عملي ونظري.
- 2 - توجيه البحث العلمي لدراسة الأنماط والمراجع المرتبطة باتجاهات الأناقة وتحليلها لغرض توليد مداخل جديد للعملية التصميمية في انتاج نصوص معمارية تعطيها ميزات أنيقة خاصة بها.
- 3 - توصي الدراسة بضرورة تركيز المصممين المعماريين على مفهوم الأناقة بكافة مستوياتها ودراسة نظرياتها وارتباطاتها بالتكنولوجيا والابتكار لاستثمارها في عملية التصميم لما له من دور مهم في تعزيز أناقة العمارة وجمالياتها

13 - الآفاق المستقبلية للبحث

- اجراء بحوث تتعلق بمفهوم الأناقة عبر الحضارات والعصور المختلفة وماتحمله النتاجات المعمارية من انطباعات ورموز ومعاني تم تحييدها في هذه الدراسة (البحث).
- 1 - يمكن اعتماد ماجاء من مفردات في الاطار النظري للبحث في دراسة تطبيقية مقارنة بين نتاجات تابعة لفترات زمنية مختلفة، أو لحركات مختلفة، أو مصممين معماريين مختلفين؛ لدراسة مدى مقدار تحقق الأناقة فيها.

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الملحق :

الجدول (6) يبين الاطار النظري لخصائص الشكلية لفاعل الأناقة في النتاج المعماري

الترتيب	ربع		القيم الممكنة	المفردة الثانوية	
	E	D			
3.5	1	1	اعتماد الالوان البيضاء و الالوان الهادئة والفاحة	الخفة	
1	0.5	0.5	الشفافية		
3	0.5	0	التفريغ الكتلي		
2.5	0	1	الاستمالة (الاقفية او العمودية)		
2	0	0.5	تقليل الزخارف		
3.5	0.5	1	تقليل التفاصيل الغير الضرورية		
3.5	1	0.5	وحدة اللون		
2.5	0.5	0	وحدة الشكل		
2.5	0	0.5	وحدة التفاصيل المستترة	الوحدة	
2	0.5	1	جذب الانتباه		سلوك الأحناء
2.5	0	1	تفاعلي		اشكال الأحناء
3	1	0	تقوس		
1	0	0	تقعر		
2	0	1	الأحناء		
2	0	1	الانتقال الناعم		سمات الأحناء
2	0	1	مرونة ، سلاسة، سيولة بنعومة		
50%	2.5	1	اعتماد الضوء ضمن فكرة التكوين	الظل والضوء	
60%	3	1	التكرار في الكتل	التكرار	
50%	2.5	0	التفاصيل الصغيرة	التدرج في الكتل	
50%	2.5	1	على مستوى الشكل		
80%	4	1	على مستوى التفاصيل		
90%	4.5	0.5	تحقيق تواصل على مستوى الشكل		التواصل
80%	4	1	تجنب الأقطاعات	التفرد	
2.5	1	0	تفرد الفكرة		
			تفرد شكلي		
3	1	0	عدد وتنوع العلاقات داخل المجموعات	التعقيد	
2.5	0	0.5	كثافة وتنوع العناصر		
2.5	1	1	العلاقات بين العناصر		
4	1	1	العلاقات بين المجموعات		
4.5	0.5	1	العلاقات بين العلاقات	الأكثران	
4	1	1	يحافظ الشكل على اتزانه		

تأثير عنصر النبات على الفضاءات الخارجية التصالحية

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المستخلص

تناول البحث ان الفضاءات الخارجية تميل على ان تكون اكثر تصالحا وتجديدا من البيئات الحضرية المبنية، فالاشخاص في البيئات المبنية يكونون اكثر ارهاقا وتوترا واجهادا ولدى العديد منهم صعوبة في التركيز في شي محدد، ولكن هذا لايعني بالضرورة ان كل البيئات المبنية تعاني من عدم وجود خصائص تصالحية وتجديدية وان الفضاءات الخارجية هي غالبا تكون الاكثر تحفيزا وتجديدا من البيئات المبنية و تكون غنية بالخصائص التصالحية وتمتلك القابلية في اعطاء تاثير مشابه من الاسترخاء والراحة وتقليل مستوى الاجهاد والتوتر وتساعد على التركيز، ومن خلال مناقشة عدد من والدراسات السابقة المتعلقة بالفضاء الخارجي التصالحي، تحددت مشكلة البحث في عدم وجود اطار نظري المتعلق بخصائص العناصر الطبيعية التي تحقق فضاءات خارجية تصالحية وبهذا تمثل الهدف الرئيسي للبحث في اغناء المعرفة حول تأثير العناصر الطبيعية على الفضاءات الخارجية التصالحية برزت اهمية البحث في توفير اطار متكامل حول تاثير العناصر الطبيعية للفضاءات الخارجية التصالحية لاستعادة الصحة وقدرة الفرد على مواجهة متطلبات الحياة وطرق استثمار العناصر الطبيعية للفضاء الخارجي لتحقيق مفهوم التصالح، واعتمدت منهجية البحث بناء اطار مفاهيمي وتأسيس قاعدة معرفة لمفهوم الفضاء الخارجي التصالحي ومن خلال تناول عدد من الطروحات والدراسات تم التوصل الى تعريف للفضاء التصالحي وتحديد المفردات الرئيسية والمؤشرات الثانوية واختبارها ضمن التطبيق العملي خلال مقابلة أجريت مع عدد من الافراد وتوزيع استمبارات الاستبيان على عينة مقصودة من المستجيبين . تضمن هذا الاستبيان معلومات عامة عن العناصر الطبيعية والفضاء التصالحي، فرضية البحث أن وجود العناصر الطبيعية في الفضاء الخارجي تلعب دوراً في تحقيق الافتتان والامتداد الفضاء الخارجي التصالحي. وقد توصل البحث إلى مجموعة من الاستنتاجات أهمها: اشراك مفردة الفضاء الخارجي التصالحي وهي (الافتتان والامتداد) في تحقق الفضاء الخارجي التصالحي على وفق التسلسل الالهية ويتخذ فيها الافتتان والامتداد الاولوية وبنسب متقاربة، اضافة الى تاكيد دور العناصر الطبيعية في تحقيق الفضاء الخارجي التصالحي.

الكلمات المفتاحية: الانتباه، النظرية التصالحية، الفضاءات الخارجية الحضرية،

عناصر الفضاء الخارجي، مبادئ الفضاء الخارجي التصالحي.

المقدمة

تعد الفضاءات الخارجية التصالحية ذات اتجاه متزايد داخل بيئات الرعاية الصحية ومن الممكن ان يكون لها تأثير على الأشخاص إذا تم تطبيقها في أماكن أخرى . يجسد تصميم الفضاءات الخارجية التصالحية العديد من صفات الطبيعة التي يجذب إليها البشر تلقائياً (Heerwagen, 2011). ضمن الفضاءات الخارجية التصالحية، وجد تاريخياً أن الناس يعانون من تخفيف التوتر، وتحسين الروح المعنوية، وتحسين الرفاهية العامة (Barnes et al., 1999)، وتعتبر مبادئ ونظريات تصميم الفضاءات الخارجية الصحية والبحث النفسي التجريبي إطار عمل يسهل إنشاء فضاءات خارجية تصالحية..، وان تصميم الفضاءات الخارجية التصالحية هي استراتيجية ذات قيمة محتملة في تعزيز الأدوار المفيدة وفعالية مشهد الفضاء الخارجي، لقد وجدت العديد من الدراسات أن البيئات الطبيعية تفيد صحة الإنسان ورفاهيته، لكن القليل منها قام بقياس استعادة مكونات معينة للفضاءات الخارجي، ونتيجة التحديات المتزايدة لتعزيز الصحة العامة للمجتمعات وإدارة نمط الحياة اليومية المجهدة، كان من الضروري ايجاد طرق جديدة لتقليل التوتر. تتمثل مشكلة البحث في نقص البيانات الكافية التي تبحث في تأثير العناصر الطبيعية للفضاءات الخارجية من حيث تقليل الإجهاد وفوائد الاستعادة. لذلك، فإن الهدف من هذه الدراسة هو تحديد الآثار التصالحية للعناصر الطبيعية للفضاءات الخارجية . يبحث في المؤشرات الرئيسية لتطبيق التحضر الحيوي في الفضاءات الخارجية المختلفة وكيفية تعزيزه. تم عمل استبيان لدراسة وتحليل الحالة تاثير العناصر الطبيعية في تحقيق فضاء خارجي تصالحي .

المنهجية

تم بناء الإطار النظري من الأدبيات السابقة، وافترض البحث بناء على الدراسات السابقة أن العنصر النباتي له تأثير في إنشاء الفضاء الخارجي التصالحي. تم إنشاء استبيان حول المساحة الافتراضية بالاعتماد على عينة من الخبراء من داخل الحقل المعماري لمعرفة تأثير عناصر البيئة الطبيعية في الفضاءات الخارجية على تحقيق الفضاء التصالحي وعدد أفراد العينة (30) شخصاً. وتم تشكيل استبيان على عينة من المستجيبين. يشتمل الاستبيان على صور فوتوغرافية ومعلومات حول السمات البيئية، بالإضافة إلى أسئلة تتعلق بعلامات تطوير الفضاءات الخارجية التصالحية. تصورات الأفراد حول مقدار ما تم ترميمه من الفضاءات الخارجية. وتمت دراسة تأثيرات هذه المكونات ن خلال تقييم آثار الوساطة المرتبطة بإدراك خصائص الفضاءات الخارجية وتجربة الاستعادة التي يتم التحقيق فيها أيضاً.

اعتمد البحث القياس النوعي في مرحلة جمع البيانات المسجلة من المشاركين في الاستبيان من خلال الإجابة (كثير، متوسط، قليل، لا يساهم). تم تحديد مجموعة من القيم لكل مؤشر، وتم استخدام مقياس ليكرت وهو أحد تقنيات تحليل البيانات الإحصائية التي توضح الارتباط بين أربعة متغيرات، حيث تمثل القيمة (4) المؤشر الذي تم تحقيقه، وتمثل القيمة (1) المؤشر الذي لم يتم تحقيقه.

الفضاء الخارجي التصالحي

هي إمكانية الفرد استعادة القدرة على التركيز عن طريق التعرض للبيئات وانها تركز على الفوائد التصالحية للطبيعة التي تتغلب على التعب الذهني الذي يؤثر سلباً على الناس وقدراتهم على الانتباه. قدم Kaplan هذه النظرية في عام (1989) [4] والتي تستند إلى نوعين من الانتباه الذي يحظى به الإنسان. الانتباه المباشر الأول المرتبط بالوظائف الإدراكية للدماغ. يتم استخدامه في الأنشطة اليومية في حياة الناس مثل القيادة في مكان غير مألوف أو الأعمال الورقية التي تعتمد على التركيز. والثاني الانتباه العفوي وهذا مرتبط بجزء من الذكريات في دماغ الإنسان المعروف علمياً بقدرته غير المحدودة [4] وان البيئة التصالحية مكان للراحة والتعافي وفي البيئات الإصلاحية، افترض (Kaplan, Kaplan, and Ryan, 1989) أن "الأماكن الطبيعية فعالة بشكل خاص في البحث والتطوير"، و أن العلاقة بين النشاط البدني والحد من التوتر هي طريق من الطبيعة إلى الرفاهية في وجود التفاعل العاطفي والانتباه [2]، وان الأنشطة الترفيهية والبدنية بطبيعتها يمكن أن تعيد الانتباه لأن المشاركين يميلون إلى الابتعاد عن عوامل إجهاد الانتباه من خلال هذه الأنشطة، مما يؤدي إلى تقليل التوتر والشعور بالحيوية هناك ثلاثة معايير للوصول الى فضاءات خارجية تصالحية: (Marcus & Barnes, Eds., 1999, p.3).

هناك ثلاثة معايير للوصول الى فضاءات خارجية تصالحية [6] :

- ان يساعد الفضاء الخارجي في تحقيق درجة من الراحة من الاعراض الجسدية.
- ان يحد الفضاء الخارجي من التوتر وزيادة مستويات الراحة للفرد الذي يتعامل مع تجارب النفسية والجسدية .
- ان الفضاء الخارجي يحسن من الاحساس بالرفاهية والاسترخاء الذي يختبره الفرد ويساعد في تحسنه.

فائدة الفضاءات الخارجية التصالحية هي: استعادة التوتر. تقليل إجهاد الانتباه

وتعزيز الوظائف المعرفية [8].

عوامل ادراك الفضاء الخارجي التصالحي [9]:

العوامل الإدراكية	التعريف
سهولة الوصول	من خلال تسهيل إمكانية الوصول إلى الفضاءات التصالحية
الرؤية	من خلال نطاق عناصر الفضاءات الخارجية التي يمكن رؤيتها، بما في ذلك المقياس المكاني والانفتاح.
الألفة	تكون العناصر البيئية مألوفاً ويمكن الوصول إليها.
الراحة	تتكون من خلال بيئة مريحة مع عناصر اثاث جيدة الفضاءات الخارجية، مثل الجلوس، والرصف، والإضاءة، إلخ.
المتعة	من خلال تصميم الفضاءات الخارجية أو الأنشطة التي حدثت هنا تعطي شعور السعادة
الشعور	بالانتماء من خلال وجود الخصوصية والامان
الهدوء شعور بالطمأنينة	وجود أصوات طبيعية أو ممتعة.
الاستكشاف	يكون من خلال فضاء جذاب ومثير للفضول
الإبداع	من خلال عناصر موجود في الفضاء الخارجي تعطي الشعور بالإبداع

مبادئ الفضاء الخارجي التصالحي [1]:

1 - الافتتان

هو الحافز الرائع هو الذي يستدعي الانتباه اللاإرادي. وبالتالي فإن الافتتان مهم للتجربة الإصلاحية ليس فقط لأنه يجذب الناس ويمنعهم من الملل ولكن أيضاً لأنه يسمح لهم بالعمل دون الحاجة إلى استخدام الانتباه المباشر. على الرغم من الأهمية الواضحة للمثيرات الرائعة (Hidi & Bard, 1986)، يدور الكثير من افتتان البشر حول قضايا العملية والمحتوى. ان البشر يفتتن بالقيام بأنشطة إعلامية مختلفة في ظل ظروف يسودها بعض عدم اليقين، ان الافتتان عند Kaplan الذي توفره البيئات الطبيعية قد يميل المرء إلى غروب الشمس وشلالات المياه والكهوف والنار والحيوانات، وان الافتتان والامتداد يدعمان بعضهما البعض خلال التواصل، الارتباط، أو وجود نمط أكبر مطلوب من أجل إشراك هذا الدافع البشري رفيع المستوى.

ان مفهوم الافتتان يستند إلى تمييز اقترحه لأول مرة (James, 1890). يتمحور هذا التمييز حول آليتين للانتباه: ارادي والارادي. الاهتمام الارادي هو فعل متعمد لتوجيه الجهد العقلي من أجل تلبية بعض الأهداف المحددة. في بعض المواقف، قد نجد أن أنماط التحفيز في بيئة ما ضرورية لتحقيق غرض معين، لكنها مع ذلك تفشل في جذب اهتمامنا. تسمح المعالجة الطوعية أو من أعلى للأسفل للشخص بتوظيف الجهد العقلي لتجاهل المعلومات غير ذات الصلة والتركيز فقط على العناصر الأكثر بروزًا. والانتباه اللاإرادي (الافتتان) هو إلى حد كبير وظيفة للاهتمام أو الجاذبية الموجودة في البيئة (Posner et al., 1980). في هذه الحالة، تكون الأنماط البيئية جذابة للغاية لدرجة أن تنشيط الانتباه أو اختياره يحدث بدون جهد تقريبًا. ونتيجة لذلك، فإن معالجة المعلومات تكون أكثر توجهاً نحو القاعدة

هنالك نوعين من الافتتان:

- 1 - الافتتان الشديد: تم وصفه في الأصل في ART على أنه محفزات بيئية تجذب الانتباه اللاإرادي ولكنها تمنع أو تثبط إمكانية الانعكاس. قد تشمل هذه المحفزات الإعلان والتكنولوجيا مثل الهواتف المحمولة، إلى جانب المنبهات الموجودة في البيئة الحضرية والتي تتطلب من المرء أن يوجه انتباهه بوعي نحوها. فيما يتعلق بالجري، تتضمن عمليات الافتتان الشديد وصفها الأصلي للمحفزات البيئية، ولكنها تتعلق أيضًا بالمنبهات الداخلية التي تجذب الانتباه اللاإرادي وتحجب أو تمنع إمكانية الانعكاس (أي الافتتان الترابطي).
- 2 - الافتتان الناعم: وفقًا لـ ART، فإن الافتتان الناعم هو منبهات بيئية، والتي بالمقارنة مع الافتتان الشديد، تجذب الانتباه اللاإرادي بلطف. تسمح المحفزات البيئية اللطيفة الموجودة في البيئات الإصلاحية بجذب انتباه الفرد اللاإرادي للمعلومات ولكن لا تحتاج إلى توجيه الانتباه نحوها بوعي. وفقًا للأدبيات، فإن الافتتان الناعم يشمل ميزات مثل الأشجار والبحيرات وغروب الشمس والغيوم. أثناء الجري، يشير السحر الناعم إلى المنبهات الداخلية أو الخارجية اللطيفة التي لا تتطلب الانتباه المباشر؛ وبالتالي فإن الانتباه اللاإرادي هو افتتان ناعم.

وحسب الدراسات توصل البحث الى وجود عدة مؤشرات للافتتان منها :

1 - الغموض

يشير الغموض إلى تلك الأماكن التي يتم فيها إعاقه جزء من المشهد البصري، مما يغري الشخص بالمضي قدماً (هاميت، 1980 ؛ كابلان وكابلان، 1982). الانحناء في الممر، المنظر الذي أخفته أوراق الشجر جزئياً، أو الدفق الذي يتعرج بعيداً عن الأنظار، جميعها تمتلك سمات تتعلق بالغموض (Gimblett et al., 1985). غالباً ما توفر المشاهد من هذا النوع إمكانية الحصول على معلومات إضافية. وهذا بدوره يمكن أن يجذب اهتمام الشخص ويعزز إحساسه بالمشاركة. على الرغم من وجود أدلة كثيرة توضح الفوائد التي تتمتع بها الطبيعة على البيئات الحضرية (Tennessee and Cimprich, 1995؛ Herzog et al., 1997؛ Hartig and Staats, 2006)، إلا أن القليل من الدراسات قد أوضحت التأثير الذي تحدثه الصفات الخلابة المحددة داخل الطبيعة على الاهتمام. الغموض في الطبيعة يقدم بعض الفوائد المرتبطة بالاهتمام، كانت الفائدة المباشرة لمشاهدة مشاهد الطبيعة التي تحتوي على لغز هو تنشيط شكل أقل تطلباً من الانتباه، والذي بدأ أنه يحدث من خلال تصورات الافتتان، إن السمات المادية التي تساهم بشكل متكرر في إدراك الشخص للغموض (أي التعريف المكاني، والفحص، وعمق المجال، وما إلى ذلك) قد تعزز أيضاً الدرجة التي ينظر بها الشخص إلى البيئة على أنها معقدة. يعتمد النمط الغامض إلى حد كبير على فكرة أن الناس لديهم حاجتان أساسيتان في البيئات: الفهم والاستكشاف (Kaplan & Kaplan, 1989) وأن هذه "الاحتياجات الأساسية" يجب أن تحدث "من موقع الفرد الحالي" من أجل توليد الشعور بالغموض [10].

الاعتبارات التصميمية التي تساهم في توليد حالة الغموض:

- 1 - تكون الحواف المنحنية التي تظهر ببطء أكثر فاعلية من الزوايا الحادة في جذب الأشخاص عبر الفضاء.
- 2 - يمكن للظلال والظلال الداكنة أن تعزز تجربة الغموض.
- 3 - يمكن للاستراتيجيات التي توفر الظلال الداكنة أو العمق للمجال أن تغرس مفاجأة أو خوفاً لا يُقدَّر.

- 4 - ستؤثر السرعة التي يمر بها المستخدمون عبر الفضاء على حجم الفتحة وحجم الهدف؛ أسرع يعني عادة أكبر.
- 5 - من المتوقع أن تغير الظروف الغامضة المتطورة الخصائص بمرور الوقت (على سبيل المثال، الحداثق منخفضة الصيانة ذات المسارات المتعرجة). يجب مراقبة هذه التغييرات لأنها قد تعزز حالة الغموض، أو تؤدي إلى تدهورها بطريقة أخرى لأنها تتطور إلى حالة مفاجئة (على سبيل المثال، يؤدي النمو المفرط للمزارع إلى حجب عمق الحقل).

2 - التعقيد

التعقيد البصري هو احد الاشارات التي تثير الافتتان الناعم بالطبيعة (Berlyne, 1971؛ Nadal, Munar, Marty, & Cela-Conde, 2010)، تتميز البيئات بمستويات وسيطة من التعقيد البصري والتي تكون مناسبة لجذب الانتباه بطريقة معتدلة وممتعة لذلك فان معظم البيئات التي من صنع الانسان تكون اما معقدة للغاية (تثير الافتتان الشديد) (Wohlwill, 1983) او انها تفتقر الى التعقيد البصري وغير قادرة على جذب الانتباه اطلاقا. أحد مبادئ التصميم المنظمة بشكل شائع يتعلق بالتعقيد البصري؛ تعمل القوانين واللوائح على تعزيز التنوع البصري أو الثراء أو التنوع ولتجنب الرتابة أو الفوضى (Stamps, 2000)، اعتبر Kaplan and Kaplan (1982; 1989) التعقيد كأحد محددات إعلامية رئيسية للتفضيل البيئي

في اشارة الى مفهوم (entropy) تناول (Stamps, 2004a) المصطلحات اللفظية التي تصف التعقيد، مثل "الغنى" و "التنوع" و "التباين"، والتي تشير جميعها إلى مقدار ما تحتويه إعدادات المعلومات، ذاتية وغامضة للغاية. واقترح أنه يمكن إنشاء مباني وكتل المباني ذات الكميات المعروفة من التنوع بطريقة موضوعية ومنهجية من خلال تطبيق صيغة رياضية لاضطراب المعلومات (informational disorder) (مثل Stamps, 2003, 2010a)

As entropy is based on frequencies of different characteristics or design features in the environment

- 1 - الاعتبارات التصميمية التي تساهم في توليد مفهوم التعقيد:
- 2 - إعطاء الأولوية للأعمال الفنية واختيار المواد، والتعبيرات المعمارية، والفضاءات الخارجية وخطط التخطيط الرئيسية التي تكشف عن الأشكال الهندسية والتسلسلات الهرمية.
- 3 - الهياكل التكرارية ذات التكرارات الثلاثة ستكون أكثر تأثيراً من التصميم الذي يقتصر على تكرارين.
- 4 - يمكن لتكنولوجيا الكمبيوتر التي تستخدم خوارزميات الوظائف الرياضية والهندسية أن تنتج تصميمات كسورية للتطبيقات المعمارية والتصميم والتخطيط بسهولة، إذا تم إنشاء تصميم كسوري، ففكر في استخدام الأشكال الهندسية مع نسبة أبعاد متوسطة المدى (بشكل عام، $D = 1.3-1.75$).
- 5 - الإفراط في استخدام و / أو التعرض المطول لأبعاد عالية الكسريات يمكن أن يفرس عدم الراحة أو حتى الخوف، مما يقاوم الاستجابة المقصودة: للتغذية وتقليل التوتر. يمكن أن يؤدي تجنب الكسريات أو قلة استخدامها في التصميم إلى إمكانية التنبؤ الكامل وعدم الاهتمام.
- 6 - يجب أن يأخذ تصميم الفضاءات الخارجية الجديدة في الحسبان تأثيره على الجودة الكسريات لأفق المدينة الحالي.

3 - التغيير او التحول

يشير مفهوم التحول الى الشعور بالجمال على وأنه الاتصال المفاجئ مع جانب من جوانب الواقع لم يعرفه المرء من قبل ؛ إنه نقيض الذوق المكتسب لبعض الفضاءات الخارجية أو الشعور بالدفء للأماكن التي يعرفها المرء جيداً. هناك أمثلة قليلة تجعل طبيعة هذه التجربة واضحة. (YI-FU TU AN،1990،p.93) وحسب (KENT BLOOMER) ان صفة التغيير متوفرة في كل النظم البيئية والبشرية والتي تعكس التطور والنمو والتحول لذلك يستجيب معظم الناس للبيئات المبينة التي تستحوذ على ديناميكية التطور والتحول. وتتمثل هذه في الابنية التي تتدفق المساحات والاشكال بتسلسل الى بعضها البعض وهذا التغيير المتدرج يعزز الشعور بالتحول ويشجع على الاكتشاف ما يؤدي لى زيادة العملية الادراك الايجابي ويقلل من الضغوطات النفسية (Kellert,2008,p.7-18).

واكد على دور المساحات الايجابية هي المفتاح لخلق مساحة خارجية ترحيبية، وفقاً لـ A Pattern Language. "تكون المساحة الخارجية إيجابية عندما يكون لها شكل مميز ومحدد، ومحددة مثل شكل الغرفة، وعندما يكون شكلها لا يقل أهمية عن أشكال المباني المحيطة بها." في المقابل، الفضاء السلبي لا شكل له، "غامض، غير متبلور، "لا شيء"، إذا كانت المساحة إيجابية، يشعر الناس بالراحة فيها وسيستخدمونها. إنهم لا يميلون إلى استخدام المساحات السلبية. لإنشاء مساحة إيجابية، امنحها بعض السياج، مثل الأشجار، أو السياجات، أو الأسوار، أو ممر متعرج، أو جناح مبنى. فيما يلي مثالان على المساحات الإيجابية من المناظر الطبيعية المصممة بتنسيق In Harmony، أحدهما يستخدم الأسوار والثاني يستخدم الجدران الحجرية والمزارع واكد ان حدوث عملية التغيير ممكنة إذا كان هناك مساحة انتقالية تسهل هذا التحول في المستخدم. المسار الذي يتحرك فيه الناس بين الشوارع والمبنى هو كل وسيلة مهمة لحدوث هذا التغيير، ويجب أن يمر هذا المسار عبر المنطقة الانتقالية، وأن يتم التأكيد عليه من خلال تغيير في الضوء والصوت والاتجاه وملمس السطح والمستوى، البوابات.

4 - الشعور بالمخاطرة

الخطر هو تهديد يمكن تحديده مقترن بضمانة موثوقة، المساحة التي بها حالة مجازفة / خطر جيدة تبدو مبهجة، ومع وجود تهديد ضمني، ربما يكون مؤذناً أو منحرفاً بعض الشيء. يشعر المرء أنه قد يكون خطيراً، ولكنه مثير للفضول، ويستحق الاستكشاف وربما لا يقاوم، وتتميز عملية الادراك الحسي في علم النفس بالديناميكية لوجود الفاعلية التلقائية في كل اجزاء الجهاز العصبي المركزي والتي يكون فيها التغيير المتواصل لحدوث التحفيز والاثارة كالشعور بالمفاجاة امر اساسي لحدوث الادراك الحسي الفعال (Cooper,1968,p.208) لهذا من اهم اليات الادراك الحسي تتميز باستجابتها الى المدخلات والمثيرات والاحداث المتغيرة والغير متوقعة احيانا بشكل افضل من استجابتها للاحداث والمدخلات البيئية الرتيبة والمتكررة بانماط ايقاعية جامدة والتي تخلق احساس بالملل ومن المحفز ومن ثم حدوث حالة النفور من المحفز الذي يدفع الشخص الى نبذ البيئة والبحث عن بيئة اخرى. الا ان الزيادة في التحفيز الادراكي الحسي وتجاوز محدودية

البشر في التكيف مع متغيرات البيئة قد يسبب الإرباك والتشويش البيئي نتيجة لى الكميات المكثفة من المتغيرات نتيجة المعلومات والمفاجات عن حدود استيعاب البشري والذي يؤدي الى توليد الضغوط البيئية على الشاغلين.

يمكن أن تتولد المخاطر من خلال استجابة مكتسبة أو معارضة للأحياء ناتجة عن خطر قريب وحاضر. ومع ذلك، فإن هذا الخطر حامل وغير قادر على التسبب في ضرر بسبب عنصر أمان موثوق به. الاختلاف المحدد بين المخاطرة / الخطر والخوف هو مستوى التهديد المتصور والسيطرة المتصورة (Rapee, 1997).

يمكن أن يؤدي الوعي بالمخاطر التي يمكن التحكم فيها إلى دعم التجارب الإيجابية التي تؤدي إلى استجابات قوية للدوبامين أو المتعة. تلعب هذه التجارب دورًا في تطوير تقييم المخاطر أثناء الطفولة. في البالغين، جرعات قصيرة من الدوبامين تدعم الدافع والذاكرة وحل المشكلات واستجابات القتال أو الهروب؛ في حين أن التعرض طويل الأمد لظروف شديدة من المخاطر / الخطر قد يؤدي إلى زيادة إنتاج الدوبامين، والذي يرتبط بالاكتئاب واضطرابات المزاج.

الهدف من نمط المخاطر / الخطر هو إثارة الانتباه والفضول وتحديث الذاكرة ومهارات حل المشكلات. هناك درجات مختلفة من المخاطر التي يمكن دمجها في التصميم اعتمادًا على المستخدم المقصود أو المساحة المتاحة؛ الممر الناتج فوق منحدر شديد هو حالة متطرفة؛ قد يوفر عرض حيوان مفترس في معرض حديقة الحيوان إحساسًا أكبر بالتحكم؛ في حين أن التنقل بين الصخور عبر ميزة مائية لطيفة يعرض المرء لخطر البلل. اعتبارات التصميم التي ستساعد في إنشاء حالة مخاطر / خطر جودة:

- 1 - عادة ما تكون تدخلات تصميم المخاطر / المخاطر متعددة تمامًا وبالتالي لن تكون مناسبة لجميع مجموعات المستخدمين أو الأماكن.
- 2 - ستكون استراتيجيات التصميم التي تعتمد على الظروف المكانية أسهل في التنفيذ عند دمجها في وقت مبكر مثل تصميم المفهوم والمراحل التخطيطية لعملية التصميم.

- 3 - يجب أن يحمي عنصر الأمان المستخدم من الأذى مع السماح بتجربة المخاطرة نستنتج مما سبق من دراسات وطروحات والخصائص الحسية والمادية للفضاء

الخارجي في تحقيق الافتتان عبر مجموعة من المفردات الرئيسية والمؤشرات من خلال اثاره المشاعر والاهتمام وعقد انتباه الشخص بهدف تشتيت انتباه بعيد عن القلق والتوتر والضغوط البيئية ومحاولة تحقيق الراحة والاسترخاء والهدوء.

2 - الامتداد

الامتداد في سياق السلوك التصالحي هو تجربة تحتوي على صفات تجذب الشخص إليها، تجربة لديها القدرة على الاحتفاظ بتلك الصفات الاهتمام لفترة طويلة من الوقت، وتجربة تشجع المرء على استكشافه بشكل أكبر (أي تشجيع المشاركة طويلة المدى في النشاط). اشار (Kaplan, 1955, p.173) انه يجب ان يكون للبيئة امتداد وان تكون غنية ومتماسكة بما يكفي لتساهم بشعور الفرد بالابتعاد والانفصال عن تجربة الحياة اليومية ان وجود الافتتان وحده لا يمكن ان يؤدي لى بيئة تصالحية عند نقصان وجود الامتداد لذلك يجب ان تكون البيئة التصالحية كافية لاشراك العقل من خلال توفير ما يكفي من الرؤية والتفكير بحيث تشغل جزءا كبيرا من ذهن الفرد، تحدد سميتي النطاق والترابط معا تجربة الامتداد على مستوى مفاهيمي اكثر الترابط من خلال الشعور بالوجود في عالم آخر بالكامل يعني المدى إما جسدياً أو إدراكياً. لتحقيق الشعور بالمدى، من الضروري أن يكون هناك ترابط بين العناصر المتصورة على الفور، بحيث تشكل جزءاً من جزء أكبر من الكل. وبالتالي يجب أن يكون هناك ترابط كافٍ لجعل من الممكن بناء خريطة ذهنية ونطاق كافٍ لجعل بناء الخريطة ذا قيمة (Kaplan, 1973, 1978)، اما النطاق من خلال تخطيط الحديقة أو تصميم الفضاءات الخارجية والأهم من الحجم هو الإحساس بأنه قد يكون هناك المزيد لاستكشافه أكثر مما هو واضح. ان الحدائق اليابانية فعالة بشكل خاص في النطاق. إن الإحساس بالمساحات الصغيرة، الذي يميز العديد من الحدائق وبعض الأفنية الخلفية، يحقق أيضاً نطاقاً.

يمكن تحقيق الامتداد في الفضاء الخارجي التصالحي من خلال :

- 1 - صفات الفضاءات الخارجية التي تجذب الشخص، وتعمل على تشجيع المزيد من الاستكشاف لهذا السلوك والاحتفاظ باهتمامه.
- 2 - في سياق السلوكيات التصالحية، لم يتأثر الامتداد بالبيئة ؛ بل تأثرت بالسلوك نفسه.

- 3 - تكشف التجارب الذاتية ان التنزه له قدرة على جذب شخص إلى النشاط. ترتبط الصفات التي تجذب الشخص ارتباطاً وثيقاً بالافتتان المترابط.
- 4 - ان انجذاب الشخص إلى السلوك وتحقيق الامتداد، له علاقة كبيرة بمراقبة الافتتان الترابطي. إن الافتتان الترابطي يساهم أيضاً في تحقيق فئة أخرى من الامتداد ؛ نظراً لأن الافتتانات الترابطية تتطلب الاهتمام، فإنها تمكنت من الاحتفاظ بمصالحها مثلاً " عليك التركيز على تنفسك و عليك التركيز على نوع من القيام بما تفعله حرفياً، ويمكنك نوعاً من التركيز على ذلك بدلاً من التفكير في ما يجهدك بالفعل أو ما يدور في ذهنك."

3 - الابتعاد

يمكن مقارنته بالانفصال النفسي عندما يمر الفرد "بتجربة نفسية للانفصال العقلي عن المطالب أثناء وقت الفراغ، وتنطوي على إلهاء عن الأفكار المتعلقة بالمهمة"، يرتبط التواجد بعيداً بفعل الهروب من خلال الانخراط المعرفي في أنشطة في بيئة تتناقض مع الإعدادات اليومية. لتحقيق الشعور بالابتعاد، لا يحتاج المرء إلى إبعاد نفسه عن البيئة جسدياً. اقترح Scopelliti and Giuliani (2004) أن الاستعادة يمكن تحقيقها من الناحية المفاهيمية وليس من خلال التغيير المادي، وانه لا يزال الفرد بحاجة إلى إبعاد نفسه عن البيئات المستنزفة للانتباه بالمعنى الجسدي أو العقلي، والنقطة الأساسية التي يجب إثباتها في أفكار الفرد هي أنه قد طالب بمسافة معينة من الضغوطات والالتزامات اليومية؛ وبالتالي تسهيل الاستعادة. ووفقاً لطروحات البايوفيليا لمفاهيم الهوية والاحساس بالمكان وكذلك القيم الرمزية والتاريخية والثقافية الموجودة في المكان التي بدورها تستحضر لدى الافراد مشاعر وعواطف خاصة تساهم في تعزيز ارتباطهم الروحي والعاطفي باماكن خاصة دون اخرى لذلك ركز Kevin Lynch على مفهوم الاحساس بالمكان (Sense of Place)، وعرف الهوية هي قدرة الشخص على التعرف على المكان وتمييزه عن بقية الاماكن من حيث الشكل او المعنى الذي يحمله المكان، وان تكون الاشكال الرمزية معبرة عنه بنفس الوقت. (Lynch,1960,p.138)

يمكن تحقيق الابتعاد من خلال:

- 1 - إعادة تركيز الانتباه على مهمة مختلفة توفر المسافة النفسية والانتقال إلى بيئة مختلفة توفر المسافة المادية.
 - 2 - تركيز انتباههم على الجري أو المشي يعني إعادة توجيه الانتباه بعيداً عن المحتوى الذي قد يكون مسؤولاً عن استنفاد الانتباه، بمجرد خروجك في الهواء الطلق، لن تضطر إلى التفكير في أي شيء خلال تلك الـ 10-15 دقيقة باستثناء التجول في الفضاء الخارجي."
 - 3 - إلى جانب توفير الراحة النفسية، ان المشي في الفضاء الخارجي يوفر فرصة لإبعادهم جسدياً عن البيئة التي تتطلب الانتباه. مثل إذا كنت أقوم بشيء مثل العمل طوال اليوم، أو شيء من هذا القبيل، فمن الجيد أن تأخذ استراحة من الروتين، وأن تخرج من المنزل. إنه نوع من تخفيف التوتر."
 - 4 - أنه من أهداف عند التنزه في الفضاء الخارجي تخفيف التوتر، فإن أخذ قسط من الراحة أو الجري في بيئة حضرية قد لا يحقق الهدف المنشود. يعتمد تحقيق الإحساس بالابتعاد عن البيئة التي يتم أخذ الاستراحة فيها، وهذا هو سبب انجذاب الاشخاص بشكل طبيعي إلى الفضاء الخارجي كمكان للتنزه والمشي أو الجري
- بينت الدراسات السابقة والاطاريح وجود مؤشرات للابتعاد وهي:

1 - الفضاء الروحي:

تأتي كلمة "روحانية" من الجذر اللاتيني Spiritus، والذي يعني "التنفس". وهذا يشير إلى نفس الحياة (Locktin, 2011). إنه ينطوي على فتح قلوبنا وتنمية قدرتنا على تجربة الرهبة والاحترام والامتنان. إنها القدرة على رؤية ما هو مقدس في المألوف، والشعور بآلام الحياة، ومعرفة شغف الوجود، وتسليم أنفسنا لما هو أعظم منا. هدفها: تحقيق الرحمة. تأثيره: صحة جسدية وعقلية جيدة (Locktin, 2011). وان روحية الفضاء اعتقد العديد من الفلاسفة ارتباط الطبيعة بالجانب الروحي للأفراد اذا يظهر التوصل الروحي مع الطبيعة نوعا من التبجل والتقديس للاشياء الكبرى من الافراد او تلك العناصر

التي تمتلك طاقة واتصال خاص مع الارض مثل (الاشجار، الجبال وغروب الشمس) والتي تمثل وسيلة يمكن يقدرها الانسان ويقيم من خلالها علاقة مع الطبيعة، ان الانسان القديم كان غير محمي وفهمه قليل عن العالم الطبيعي والقوى الطبيعية التي يواجهها في حياته اليومية نتيجة لذلك شكل العبادة الخرافية للبشر مثل البرق والرعد والرياح والقمر والنجوم ومن خلاله تطور تقديس الطبيعة والتي من الممكن القول اصبحت جزءا من تركيبة البشر (Cerwinske,1998,p.11)، ناقش (Kellert,1994) ان التصميم البيئي المجدد والاصلاحي يثري الجسم، عقل وروح الانسان من خلال التجارب الايجابية للطبيعة ضمن البيئة المبنية (Pedram Sogol,2015,p.2) حيث وضحت دراسة (Pedram Sogol) ان الفرد يشعر بالروحانية في فضاء المنزل من خلال ارتباطه مع عناصر طبيعية مثل عنصر المياه والالوان المستمدة من الطبيعة، ان السمات الحسية كالملمس يمكن ان تجعلنا اكثر توافرا مع العالم الطبيعي

2 - الملاذ:

الملاذ هو مكان للانسحاب، من الظروف البيئية أو التدفق الرئيسي للنشاط، حيث يكون الفرد محمياً من الخلف ومن فوق. المكان الذي يتمتع بحالة جيدة من اللجوء يشعر بالأمان، ويوفر إحساساً بالتراجع والانسحاب - للعمل أو الحماية أو الراحة أو الشفاء - سواء بمفرده أو في مجموعات صغيرة. تشعر مساحة الملاذ الجيدة بأنها منفصلة أو فريدة من نوعها عن البيئة المحيطة بها ؛ يمكن أن تشعر خصائصه المكانية بالتأمل والاحتضان والحماية. في المتنزهات الحضرية الصغيرة، يكون حجم المتنزه أقل أهمية من القدرة على الانغماس في الفضاء مع ظروف السياج المؤدية إلى الترميم (على سبيل المثال، Nordh, Hartig, Hägerhäll & Fry, 2009). في المتنزهات الأكبر حجماً، تعتبر مساحات الملاذ تحت الأشجار وفي الغطاء النباتي المتاخم لمساحة مفتوحة أو مرج هي المواقع المفضلة (على سبيل المثال، Ruddell & Hammitt, 1987). على الرغم من أن العلم لم يؤسس بعد مقاييس لتكرار أو مدة الوصول إلى ظروف اللجوء، يُقترح أن يكون التوازن بين Prospect و Refuge أكثر أهمية من حجم أو تكرار التجربة (Appleton, 1996).

جدول (1) يوضح المفردات الرئيسية والثانوية والقيم الممكنة للإطار النظري / المصدر: الباحثة

المفردة الرئيسية	القيم الممكنة	المتغيرات الثانوية	
المفردة الأولى: الافتتان	تشجع اكتشاف الفضاء من خلال (السرعة التي يمر بها المستخدمون وإثارة الاهتمام)	الغموض	
	الدلالة الفنية من خلال المنحوتات أو التماثيل		
	المتعة والترقب من خلال (إثارة الاحساس من مصدر سمعي، شمي أو غرس الشعور بالإنهيار، الحركة خلال مسارات متعرجة)		
	التدرج من خلال تسلسل الفضاء واستخدام الظلال		
	تشويش حدود الفضاء من خلال الحواف المنحنية والمشاهد المحبوبة جزئياً		
التعقيد	بالحركة والمسارات: المسارات الغير منتظمة وأشكال الفضاءات الواسعة. التقاطعات من خلال عناصر الفضاء الخارجي (النباتات، الأشجار، اثاث، القواطع... الخ). مخطط الفضاءات الخارجية وأفق المبني.	مفهوم Entropy الذي يتمثل ب:	
	الغنى والتنوع في الصفات والخصائص والعناصر ضمن الفضاء الخارجي.		
	التباين الذي يحدد الاختلافات ما بين سمات عناصر الفضاء الخارجي.		
	التعقيد البصري من خلال تعدد مراكز التركيز البصري. التعقيد البصري	الهندسة الكسورية (Fractal geometric)	
	على مستوى الهيكل من خلال المسقفات والمظلات		
	على مستوى الإنهاءات والتفاصيل للارصفة وسطوح الفضاء الخارجي والواجهات التي تحيط بالفضاء الخارجي		
	على مستوى الاثاث (اثاث الشارع، الانارة، المسقفات، المصاطب، والخ...)		
	التغيير أو التحول	عنصر المفاجأة والشعور بالجمال من خلال (الاتصال باحد الجوانب البيئية غير معروفة سابقا، الإثارة من خلال الحركة ضمن الفضاء)	التغيير أو التحول
		ديناميكية التطور والتحول من خلال (التدفق في المساحات والأشكال الى بعضها البعض بالتسلسل، المداخل، الطرق والجسور)	
		A Pattern Language يتحدد من خلال شكل الفضاء الخارجي المميز والمحدد	
1- الانتقال بين الممرات لتوفير امكانية الوصول. 2- الممرات والمعابر. 3- الاتصال العاطفي بين الفرد والفضاء. 4- التكيف مع روح البيئة. 5- الوصلية من خلال التحول مع قلة المفاجأة.		الفضاء الخارجي الانتقالي من خلال	

المفردة الرئيسية	المتغيرات الثانوية	القيم الممكنة
المفردة الأولى: الافتتان	المخاطرة	الإثارة من خلال (إثارة الانتباه والفضول، تحديد المشكلة ومهارات حل المشكلة)
		السقوط، التبلل، الإصابة، فقدان السيطرة والتحكم.
		المخاطرة المتصورة كالسقوط، الخوف من التبلل، الإصابة أو فقدان السيطرة والتحكم.
المفردة الثانية: الامتداد ضمن الفضاء الخارجي	الارتباط النطاق	مميزات مشتركة (وجود عنصر بارز، حواف لانهاية لها، المرور من تحت الماء أو فوقها أو التجارب التي ينظر انها تتحدى الجاذبية)
		الغنى (مستوى مفاهيمي) كالسطوح الشفافة
		التماسك (مستوى مفاهيمي) مثل المنصات مرتفعه (المسرح، المدرج، الخ).
خصائص الفضاء الخارجي الممتد	الافتتان الترابطي	مخططات التصميم الفضاء الخارجي تكون مفتوحة وممتدة.
		1 - واجهات تحيط بالفضاء الخارجي مرتفعه.
		2 - المسطحات المائية.
		3 - الفضاءات الخارجية تكون مفتوحة.
		4 - اسيجة ذات ارتفاعات منخفضة.
		5 - الطرق والمسارات تكون منحنية ومقوسة.
		6 - المشاهد تكون محجوبة جزئياً ضمن المسارات.
أنماط الفضاء الممتد	داخلي - خارجي، داخلي - داخلي .	

تأثير العناصر الطبيعية على الفضاء الخارجي التصالحي:

تتناول الطبيعة في الفضاء الخارجي التصالحي الاتصال المباشر والمادي وعابر للطبيعة في المكان أو الفضاء. وهذا يشمل الحياة النباتية والمياه والحيوانات وكذلك النسمات والأصوات والروائح والعناصر الطبيعية الأخرى. تشمل الأمثلة الشائعة النباتات المحفوظة بوعاء، وأحواض الزهور، ومغذيات الطيور، وحدائق الفراشات، والمعالم المائية، والنافورات، وأحواض الأسماك، وحدائق الفناء، والجدران الخضراء أو الأسطح المزروعة. تتحقق أقوى تجارب الطبيعة في الفضاء من خلال إنشاء روابط هادفة ومباشرة مع هذه العناصر الطبيعية، لا سيما من خلال التنوع والحركة والتفاعلات متعددة الحواس تشمل الطبيعة في الفضاء الخارجي التصالحي سبعة أنماط تصميمية:

1 - الاتصال المرئي بالطبيعة. نظرة إلى عناصر الطبيعة والأنظمة الحية والعمليات الطبيعية.

- 2 - الاتصال غير المرئي بالطبيعة. المحفزات السمعية أو اللمسية أو الشمية أو الذوقية التي تولد إشارة متممة وإيجابية إلى الطبيعة أو الأنظمة الحية أو العمليات الطبيعية.
- 3 - المنبهات الحسية غير الإيقاعية. روابط عشوائية وعابرة مع الطبيعة يمكن تحليلها إحصائياً ولكن قد لا يتم التنبؤ بها بدقة.
- 4 - التقلب الحراري وتدفق الهواء. تغيرات طفيفة في درجة حرارة الهواء، والرطوبة النسبية، وتدفق الهواء عبر الجلد، ودرجات حرارة السطح التي تحاكي البيئات الطبيعية.
- 5 - وجود الماء. حالة تعزز تجربة المكان من خلال رؤية الماء أو سماعه أو لمسه.
- 6 - الضوء الديناميكي والمنتشر. يرفع شدة الضوء والظل المتفاوتة التي تتغير بمرور الوقت لتهيئة الظروف التي تحدث في الطبيعة.
- 7 - الاتصال بالأنظمة الطبيعية. الوعي بالعمليات الطبيعية، وخاصة التغيرات الموسمية والزمنية المميزة للنظام البيئي الصحي.

1 - العنصر النباتي

تم ذكر الفوائد التصالحية للبيئات الطبيعية ومناظر الغطاء النباتي في العديد من الأبحاث والتجارب. من خلال النظر إلى الطبيعة فقط، يمكن تقليل مشاعر الخوف واكتساب تأثيرات إيجابية مثل العاطفة والغبطة. إن التعرض للمشاهد الطبيعية حيث تهيمن الأشجار والنباتات على الطبيعة له تأثير إيجابي على الحالة العاطفية للشخص أكثر من التعرض للمناطق الحضرية الخالية من الأشجار أو النباتات (Ulrich & Parsons 1990 ؛ Ulrich 1979).

أثناء تصميم هذه البيئات، يحتاج مهندسو الفضاءات الخارجية إلى الانتباه إلى جوانب مثل مواد الغطاء النباتي والمظهر البصري والحجم وكيف يمكن لكل هذه الأشياء أن تحفز معظم الحواس في المستوى الصحيح دون التحفيز المفرط أو الكثافة المنخفضة جداً لمنع الناس من إرهاق النظام الإدراكي البشري ومستويات عالية من الإثارة (نفسية وفسولوجية) (Baum، Singe & Valins see Cohen 1978). يمكن استكشاف لون النبات ورائحته ولمسه من خلال قنوات متعددة الحواس، ويمكن أن يغري جميع الحواس

(Wagenfeld 2009)، كما يمكن استخدام النباتات كحاجز للرياح يقلل من الرياح الباردة (تغير درجة الحرارة) وكذلك أصوات الرياح أو أصوات أخرى مزعجة. يمكن أن يؤدي وجود الأشجار والنباتات الكبيرة الأخرى إلى تعزيز التفضيل الجمالي (Ulrich 1990). من خلال توفير هذا النوع من البيئة الطبيعية تمكن مستخدميها من الاستمتاع بوقتهم والاسترخاء. تثير المساحة ذات الاتصال الجيد بالأنظمة الطبيعية علاقة مع كل أكبر، مما يجعل المرء يدرك الموسمية ودورات الحياة. غالبًا ما تكون التجربة مريحة، وحينئذٍ إلى الماضي، وعميقة أو مفيدة، ومتوقعة كثيرًا. هناك توثيق علمي محدود للتأثيرات الصحية المرتبطة بالوصول إلى النظم الطبيعية؛ ومع ذلك، يشبه إلى حد كبير وجود الماء، يُشتبه في أن هذا النمط يعزز الاستجابات الصحية الإيجابية. في Biophilic Design (Kellert et al., 2008)، يؤطر Kellert هذا على أنه "الأنماط والعمليات الطبيعية"، حيث يمكن أن تؤدي رؤية وفهم عمليات الطبيعة إلى إحداث تحول في الإدراك فيما يتم رؤيته وتجربته. يحتوي هذا النمط على عنصر زمني قوي، يمكن التعبير عنه ثقافيًا، كما هو الحال في الحب الياباني للزوال الزائل لأزهار الكرز. الهدف من نموذج الاتصال بالأنظمة الطبيعية هو زيادة الوعي بالخصائص الطبيعية ونأمل أن تكون الإشراف البيئي على النظم البيئية التي تسود فيها تلك الخصائص. قد تكون إستراتيجية العمل مع النمط بسيطة مثل تحديد المحتوى الرئيسي من منظور الطبيعة (على سبيل المثال، الأشجار المتساقطة في الفناء الخلفي أو أزهار الأوركيد على عتبة النافذة)، أو قد يكون تكاملًا أكثر تعقيدًا للأنظمة، مثل من خلال توضيح العلاقة بين سلوك شاغلي المبنى والبنية التحتية لمياه الأمطار (على سبيل المثال، bioswales، raingardens، مجاري العواصف)، من خلال تنظيم الأنشطة المنزلية (مثل الاستحمام والغسيل) أثناء أحداث المطر. في كلتا الحالتين، عادة ما يكون المكون الزمني هو العامل الرئيسي في التعرف على الأنماط وإثارة وعي أعمق لنظام بيئي فعال.

الاعتبارات التصميمية للعناصر النباتية في الفضاء الخارجي التصالحي:

1 - دمج جمع مياه الأمطار ومعالجتها في تصميم الفضاءات الخارجية التي تستجيب لأحداث الأمطار.

2 - في بعض الحالات، سيكون توفير الوصول المرئي للأنظمة الطبيعية الحالية هو النهج الأسهل والأكثر فعالية من حيث التكلفة. في حالات أخرى، دمج

أساليب التصميم سريع الاستجابة (على سبيل المثال، استخدام المواد التي تغير الشكل أو توسع الوظيفة مع التعرض لاكتساب الحرارة الشمسية أو الرياح أو المطر / الرطوبة أو التظليل)، والهياكل (مثل الآبار المتدرجة)، والتكوينات الأرضية (على سبيل المثال، arroyos، bioswales، الكثبان الرملية) سيكون ضرورياً لتحقيق المستوى المطلوب من الوعي.

3 - صمم فرصاً تفاعلية، خاصة للأطفال والمرضى وكبار السن (على سبيل المثال، المناهج التعليمية التكاملية؛ برامج البستنة، الحدائق المجتمعية؛ الطبخ / النظام الغذائي الموسمي).

دراسة الحالة

ولمعرفة ما يفضله المستجيبين، تم إنشاء استبيان باستخدام المفردات الأساسية والثانوية الموجودة في الجدول رقم (2) (المتوفر في الملف المرفق)، مع بعض الأسئلة والصور المصاحبة المتعلقة بتفضيلاتهم في تنسيق الفضاءات الخارجية وتأثير وجود العنصر النباتي الطبيعي في الفضاءات الخارجية، الهدف الرئيسي من الاستبيان هو إثبات أن "المكونات الطبيعية تساعد على تحقيق الجذب والتوجيه في الفضاءات الخارجية التصالحية"، وفقاً لفرضية البحث، وتم استخدام مقياس ليكرت الإحصائي لتجميع وتقييم النتائج.

النتائج

بعد تقديم الاستبيان واستخراج الإجابات وتبويبها ضمن الجدول أعلاه نستنتج ما يلي:

- تبين أن تأثير مساهمة النبات في تحقيق الافتتان في الفضاءات الخارجية التصالحية يتأرجح بين أربع قيم: (مساهمة كثيرة - مساهمة متوسطة - مساهمة قليلة - عدم مساهمة)، وتباينت النسب بين هذه القيم الأربع، حيث أن وكانت النسبة الأكبر للمساهمة هي المساهمة الكبيرة والتي بلغت (60.35%) من المجموع، في حين بلغت نسبة المساهمة المتوسطة (31.3%) من المجموع، في حين بلغت نسبة المساهمة الصغيرة (7%) من المجموع. الإجمالي، وبلغت نسبة عدم المساهمة (1.35%) من الإجمالي
- تبين أن تأثير مساهمة النبات في تحقيق امتداد في الفضاءات الخارجية يتأرجح بين أربع قيم: (مساهمة كبيرة - مساهمة متوسطة - مساهمة قليلة - عدم مساهمة)، وقد اختلفت النسب بين هذه القيم الأربع، كما وكانت النسبة الأكبر من المساهمة هي المساهمة الكبيرة حيث بلغت (60.3%) من المجموع، في حين بلغت نسبة المساهمة المتوسطة (28.5%) من المجموع، في حين بلغت نسبة المساهمة الصغيرة (7.95%). من المجموع الكلي. المجموع، في حين بلغت نسبة عدم المساهمة (3.15%) من المجموع.

مساهمة عنصر النبات في تحقيق الافتتان في الفضاء التصالحي الخارجي

مساهمة عنصر النبات في تحقيق الغموض للفضاء التصالحي الخارجي					
المجموع الكلي	قيم قياس المساهمة				معايير الغموض
	لا يساهم	قليل المساهمة	متوسط المساهمة	كثير المساهمة	
100%	0	0	22.7%	77.3%	اثارة الاهتمام
100%	0	9.1%	40.9%	50%	عنصر دلالي خارجي
100%	0	0	13.6%	86.4%	المتعة
100%	0	13.6%	22.7%	63.6%	تدرج فضائي
100%	4.5%	9.1%	27.3%	59.1%	تشويش حدود الفضاء
	0.9%	6.36%	25.44%	67.30%	النسبة الكلية للغموض

مساهمة عنصر النبات في تحقيق التعقيد للفضاء التصالحي الخارجي					
المجموع الكلي	قيم قياس المساهمة				معايير التعقيد
	لا يساهم	قليل المساهمة	متوسط المساهمة	كثير المساهمة	
100%	0	5%	40%	55%	مسارات غير منتظمة
100%	0	9.1%	31.8%	59.1%	التقاطعات مع عناصر الفضاء الخارجي
100%	0	9.1%	36.4%	54.5%	الغنى و التنوع و التباين
100%	0	0	14.3%	85.7%	تعدد المراكز في الفضاءات
100%	0%	5.8%	30.6%	63.6%	النسبة الكلية للتعقيد

مساهمة عنصر النبات في تحقيق التغيير للفضاء التصالحي الخارجي					
المجموع الكلي	قيم قياس المساهمة				معايير التغيير
	لا يساهم	قليل المساهمة	متوسط المساهمة	كثير المساهمة	
100%	4.5%	4.5%	45.5%	45.5%	السماح بالتدفق في المساحات
100%	4.6%	9.1%	13.6%	72.7%	تحديد الممرات للوصول للفضاء الخارجي
100%	4.5%	6.8%	29.5%	59.1%	النسبة الكلية للتغيير

مساهمة عنصر النبات في تحقيق الافتتان للفضاء التصالحي الخارجي					
المجموع الكلي	قيم قياس المساهمة				معايير للافتتان
	لا يساهم	قليل المساهمة	متوسط المساهمة	كثير المساهمة	
100%	0	9.1%	40.9%	50%	المخاطرة
100%	0.9%	6.36%	25.44%	67.30%	النسبة الكلية لمساهمة النبات في تحقيق الغموض
100%	0%	5.8%	30.6%	63.6%	النسبة الكلية لمساهمة النبات في تحقيق العقيد
100%	4.5%	6.8%	29.5%	59.1%	النسبة الكلية لمساهمة النبات في تحقيق التغيير
100%	1.35%	7%	31.3%	60.35%	النسبة الكلية لمساهمة النبات في تحقيق الافتتان

ساهمة عنصر النبات في تحقيق الامتداد للفضاء التصالحي الخارجي					
المجموع الكلي	قيم قياس المساهمة				معايير الامتداد
	لا يساهم	قليل المساهمة	متوسط المساهمة	كثير المساهمة	
100%	4.75%	4.75%	14.3%	76.2%	وجود النبات كسياج
100%	4.7%	14.3%	38.1%	42.9%	مشاهد محجوبة
100%	0	4.8%	33.3%	61.9%	وجود مسارات منحنية
100%	3.15%	7.95%	28.5%	60.3%	النسبة الكلية لمساهمة النبات في تحقيق الافتتان

الملخص

- طبقت هذه الدراسة استبياناً لاستكشاف تأثير العناصر النباتية في تحقيق فضاء خارجي تصالحي يساعد الفرد على استعادة التركيز، كان للعناصر النباتية آثار نفسية تصالحية على الأفراد من خلال قضاء الوقت في الفضاء الخارجي مما أدى إلى التعافي العقلي، ومع ذلك، فإن قضاء وقت أطول لا يرتبط بالضرورة بتجربة تعافي أفضل، ولكن مزيج الوقت وأنواع البيئات المختلفة يؤثر على التعافي النفسي، وخلص البحث إلى هذه النتائج الرئيسية:
 - طريقة التصالح هي بالفعل القدرة على إدراك فائدة الطبيعة، بالإضافة إلى ذلك، هناك احتمالات بأن القدرة على التعافي من التوتر والإرهاق العقلي تعتمد على الطريقة التي نشعر بها وكذلك الطريقة التي نتعامل بها مع الطبيعة، اعتماداً على خلفيتنا الثقافية والبيولوجية.

- لدى العديد من الأفراد، وخاصة المراهقين، نظرة بيئية محددة للعالم، وهو أمر ضروري لتحفيزهم مبكراً حول فوائد النباتات لأنهم في المرحلة التي يتعلمون فيها فهم بيئتهم بشكل أعمق من خلال المشاركة النشطة.
- فيما يتعلق بنتائج البحث، سيكون من المفيد إجراء المزيد من الأبحاث المتعمقة التي تلبي احتياجات مختلف قدرات الفضاءات الخارجية التصالحية، وخاصة تجارب الناس مع العنصر النباتي في الفضاءات الخارجية.

- التعرض للفضاءات الخارجية المحيطة بالأشجار والنباتات له تأثير ترميمي إيجابي أكثر أهمية من الوصول إلى المناطق الحضرية بدون نباتات ويجب أن يأخذ مهندسو الفضاءات الخارجية في الاعتبار عوامل الفضاءات الخارجية مثل المواد والمظهر البصري والحجم... إلخ، وكذلك كيف يمكن لكل هذه العوامل أن تحفز الكثير من الحواس على المستوى المناسب دون المبالغة في التحفيز، لمنع الناس من إرهاق أنظمتهم الإدراكية ومنحهم مستوى أعلى من الاهتمام (النفسي والفسولوجي).
- دور الفضاءات الخارجية في الحفاظ على صحة نفسية جيدة، فضلاً عن دورها الواضح في الابتعاد عن العلاج الطبي والتركيز على الصحة من خلال طرق الوقاية.
- وبالتالي، يجب على المماريين أن يكونوا أكثر وعياً واهتماماً بهذه التصورات التجريبية والقضايا المتعلقة بالفضاءات الخارجية.



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9. Conclusion

In conclusion, this paper highlights the need to embrace cryptography as a primary solution in the cloud computing security space. First, the results of the work put emphasis on the multi-faceted significance of cryptographic procedures in support of data secrecy and the given integrity, as well as applicable rules compliance. CISOs and other information technology professionals should employ layered security measures, become alert to new attacks like quantum computing, and invest in security awareness training for cloud environments to enhance protection.

The role of cryptography in providing security standards remains significant even as cloud computing presents the future of technology. This study also demonstrates that rather than being a component, cryptography is rather a powerful force that defines and drives the reliability and dependability of cloud computing technology. It is crucial to be constantly on the lookout for trends and threats, to adjust strategies and behaviors as necessary, and to employ sound cryptographic policies to confidently protect a cloud from various threats and preserve the sanctity of its information.



technologies like artificial intelligence and ailing blockchain. Assess how these technologies can be used to supplement eventual cryptographic approaches for improved security.

- **Resilience Against Advanced Persistent Threats (APTs):** Consider such advanced concepts and issues of cryptology and develop cryptographic methods for counteracting APT. Enhance the resilience of cryptographic systems at a time where threats classes are diverse, and resilience and creativity are rife with new cunning threats.
- **Standardization of Cryptographic Protocols:** As all the protocols entail that some of them need to be designed or are still under design, involve the industry partners to assist in designing standard cryptographical protocols. Standardization contributes to the achievement of these objectives: Integrated systems: Through standardization, various cloud environments are more easily compatible since everyone must follow certain laws.



Future Research Directions [20]

- **Quantum-Safe Cryptography:** Organizations should commit resources towards research and deployment of post-Quantum cryptographic algorithms to protect their networks and structures. Find out measures that can be taken to avoid susceptibility to potential threats brought about by future advancements in quantum computers.
- **Advancements in Homomorphic Encryption:** Information derived from homomorphic encryption is an enabler that will reverse the process of putting encrypted data into usable form in other algorithms. There are two aspects that need to be addressed as part of the current and future development of the app that will effectively add to this capacity; The capacity of the app must be enhanced to justify the growth in the number of users.
- **Dynamic Key Management Solutions:** Further analysis of predesigned and selected Dynamic KM technologies that can be utilized in dynamic cloud environments. Some of these are, namely: specifying cryptographic algorithms, self-updating protocols, and key management methods.
- **User-Friendly Cryptography Interfaces:** The cryptographic software itself also was presented with new interfaces that are comfortable for the user. Through reminding consumers of criminal and security issues and guiding them to make correct and safe decisions, adaptive interfaces assist in promoting safe and correct behaviors.
- **Integration with Emerging Technologies:** Simplify the cryptographic products and discuss them with reference to contemporary



- **User Education Programs:** Continued awareness of users via seminars and other training methods is also instrumental in improving security standards. Teach users how to identify phishing scams, when to use and when not to use strong authentication measures and what are the meaning and importance of encryption.
- **Post-Quantum Readiness:** Closely monitor activities in the post-quantum cryptography arena and plan for a migration toward quantum-soup algorithms. To address this issue, cryptographic protocol designers should monitor the threats and periodically design and adjust cryptographic protocols based on these threats.
- **Hardware Security Modules (HSMs):** Discuss the following use cases for the improvement of cryptographic storage: Hardware Security Modules (HSMs). HSMs offer security by dedicating fixed and secure hardware processing elements for cryptographic key management.
- **Compliance Adherence:** Reliability of cryptographic implementations in terms of regulations and standards: Adopt proper standard conformities of cryptographic implementations for the appropriate industry standards. Cryptography: Conduct the literature review for cryptographic measures based on the growing compliance needs and update it periodically.
- **Multi-Layered Security:** Secure it with multiple layers of security measures including encryption, firewall, DDoS protection, intrusion detection and access control mechanisms among others. It also increases resistance in various ways against the different security threats.



In these case studies, early identification, and aggressive execution of security measures for cloud computing is illustrated. Cryptography successes help protect data, meet laws and standards, and build and sustain customer trust, while security failures drive home key lessons about the necessity for strong authentication, encryption, and of promoting awareness in cloud-based settings.

8. Recommendations

Best practices for implementing Cryptography in Cloud Computing [19]

- **Holistic Encryption Strategy:** It is recommended when implementing encryption to take a more comprehensive strategy to data protection, which also involves protecting data during transfer and while stored. For the channel we must employ the recommended encryption protocols, which in this case are SSL/TLS while for the storage, one must employ good algorithms like AES among others.
- **Key Management Excellence:** Implement secure key management procedures and ensure proper management of symmetric keys such as creation, distribution, updating and decommissioning of keys. These procedures can be made more efficient with key control automation systems.
- **Regular Security Audits:** For checked cryptographic 's realization, carry out periodical security auditing. This ranges from basic checks on the type of encryption used in a network, the management of keys and other measures put in place as checked against standard code of practice.



· Background:

- Overview: Negative example: Company Y had recently undergone a security risk where its cloud computing setting was violated, and confidential information leaked.
- Root Cause Analysis:
- Weak Authentication: The break in was made easy since the attackers exploited poor user authentication measures such that many of the users had their accounts and passwords stolen.
- Lack of Encryption: Cloud data retrieved by the outfitter was not well encrypted, thus it was easy for unauthorized personnel to access sensitive information.
- Insufficient User Education: One is users become the prey of phishing attack because of poor or lack of security consciousness.

· Lessons Learned:

- Multi-Factor Authentication (MFA): MFA could have also been adopted to add another layer of security that would have minimized the effect if the credentials were compromised.
- Encryption Best Practices: It is therefore very desirable to adopt encryption best practices for data at rest by using formats that make it virtually impossible to accessible by anyone other than the rightful owner even in cases where the system has been compromised.
- Continuous User Education: A notable point for raising the bar in perspective is the growing need for regular and comprehensive user education programs to mitigate the risks of social engineering attacks.



- Used appropriate AES-256 algorithm to encrypt data that are stored in cloud.
 - Ensured sound key management strategies, and even key management techniques such as key cycling were followed.
- Results:
- Enhanced Data Security: The application of cryptographic functions contributes greatly to increasing the security of customer data through protection during transfer and storage.
 - Compliance Assurance: The cryptographic solutions enabled its adherence to industry regulation and standards, making customers assured on protection of their data.
- Lessons Learned:
- Holistic Approach: It could be inferred that the implementation success was due to the adoption of a comprehensive strategy that favored the protection of data in transit and at rest. Proofs revealed that encryption coupled with key management policies were successes.
 - Regular Audits: The continuing review of the cryptographic implementations also helped in the steady monitoring and non-deviation in compliance to the set standards with attention being focused on the areas that needed constant enhancement.

Lessons Learned from Security Breaches in Cloud Computing [18]

Case Study: Here follows some major types of Security Breach Incident Y that individuals can face in their daily lives.



- Regular Security Awareness Campaigns/ Solution: Another security recommendation would be to constantly remind users through seminars, articles, and other forms of advertisement about the positivity of security concerns, potential threats that linger in the environment of cyberspace, and the significance of adhering to secure practices in the use of Cloud Computing technology.
- Transparent Security Policies/ Solution: Certainly, the developers must transparently convey the security policies to the users and define the paradigm around data protection in the cloud.

Enhancing user awareness and education, along with addressing emerging technological challenges, is essential for building a resilient and secure cloud computing environment. A holistic approach that combines technological solutions with user empowerment contributes to a more robust defense against potential threats. (Schneier, 1996).

7. CASE STUDIES

Successful Implementations of Cryptography in Cloud Environments [18]

Case Study: Analysis of Cloud Service Provider X

· Background:

- Overview: The case of Cloud Service Provider X has established cryptographic solutions as security measures to its cloud services.
- Cryptography Applications:
- Ensured data in-transit is encrypted by building an encrypted end-to-end mechanism based on TLS protocols.



- Quantum Key Distribution (QKD)/ Solution: Introduce and integrate Quantum Key Distribution (QKD), which allows to develop secure communication channels according to the theory of quantum mechanics to minimize the risks of a quantum attack.

User Awareness and Education Increase [20]

· Challenges

- User Negligence/ Challenge: This implies that occasional user may be naïve in security related practices and may unknowingly act in a manner that poses a threat to the security of its data that is stored in cloud.
- Phishing and Social Engineering/ Challenge: Phishing attacks and use of social engineering exploits vulnerabilities that users have. This is because apart from not recognizing these types of tactics, the users may be easily duped always.

· Solutions

- User Training Programs/ Solution: To enhance the security of consumers, initiate extensive user awareness programs to teach the consumers about the right behavior and precautions they should take when they are using the cloud services; for instance, proper password management, detecting and avoiding of phishing scams, and the need for data encryption.
- Multi-Factor Authentication (MFA)/ Solution: Promote and ensure compliance with multi-factor authentication (MFA) process so that password is not the only access that is granted meaning reducing instances of unauthorized access.



tool of hardware acceleration to reduce some amount of processing of cryptographic computations.

- Caching and Pre-Computation/ Solution: It is important to utilize cache memory and pre-calculation methods to decrease the amount of effort for commonly executed cryptographic functions, which will enhance efficiency of operations in cloud environments.

Addressing quantum Computing Threats [12]

· Challenges

- Quantum Computing Vulnerabilities/ Challenge: The emerging new technology in the computing environment, the quantum computing, is seen to be a real threat to the traditional cryptographic algorithms, notably the public-key cryptography since they can be vulnerable to quantum cryptanalysis attacks.
- Post-Quantum Transition/ Challenge: Issues that surround post-quantum cryptography particularly when preparing to migrate from the current state involve choice and implementation of cryptographic algorithms that will not be affected by quantum computers as well as maintaining compatibility with already established systems.

· Solutions

- Post-Quantum Cryptography Adoption/ Solution: The next step is to maintain awareness of the progress of post-quantum cryptography and start implementing the quantum-resistant algorithms. Quantum development means cloud systems have been prepped in anticipation of quantum threats.



best practices most recommended by the industries. Hence, strong key management practices of key associated issues can help cloud environments to strengthen the cryptographic systems' security and reduce risks inherent to key-related issues.

Overcoming Performance Challenges [6]

· Challenges

- Computational Overhead/ Challenge: The security solutions that use strong encryption are likely to affect processing in the cloud either at the framework level or for the services to the clients.
- Latency in Secure Communications/ Challenge: The adoption of such safe communication measures like SSL/TLS may entail a certain level of latency, thus causing problems when it comes to the interactivity of applications and services in the cloud models.
- Resource Consumption/ Challenge: Cryptographic processes are computationally demanding, especially in cases of large amounts of data to be encrypted; and they often collaterally translate into considerable resource utilization and performance drawbacks.

· Solutions

- Algorithmic Optimization/ Solution: It is imperative to make sure that mathematical algorithms are refined, and the size of the computer required greatly reduced but the security of the data remains unaltered. This entails choosing friendly and appropriate algorithms and refreshing the cryptographic protocols.
- Hardware Acceleration/ Solution: Utilize hardware related advancements like dedicated cryptographic hardware or GPUs as a



- Robust Lifecycle Management Policies/ Solution: Creating effective frameworks and procedures for critical key lifecycle, when it is necessary to describe key creation, distribution, updating, and deletion. The proper checklist that can be recommended from time to time can make sure that the company complies with the set down policies.
- Hardware Security Modules (HSMs)/ Solution: HSMs for storage of keys Implementation of HSMs has been adopted by many organizations as a way for storing keys securely. HSMs offer specific hardware designed to securely manage cryptographic keys, improving key-level security.
- Continuous Monitoring and Auditing/ Solution: Stringent measures of monitoring and auditing, the key areas of access control which are tailored for revealing unauthorized access or any malicious events related to key management. This is because it helps the business to achieve and remain in compliance with legal and regulatory standards.
- Key Revocation and Rotation Strategies/ Solution: Key revocation and rotation are efficient techniques that must be employed appropriately without causing inconveniences that may negatively affect the quality of the services delivered. This may entail providing a framework for convoluted key transition that may require key rotations with little interruption.

To tackle key management challenges in cloud cryptography we need to consider the technological solutions, the policies which need to be equipped and set up for the key management and of course following the



- **Secure Key Storage/ Challenge:** Of particular concern is storing and protecting cryptographic keys when deploying applications in a cloud computing model. Some of the potential risks associated with the access of key storage include exposure of the keys so that the data might be leaked.
- **Compliance and Legal Issues/ Challenge:** The main issue arising with the integration of meeting regulatory requirements associated with key management in different regions. Cloud service providers that want to protect implementation implementations of cryptographic keys are legally bound to adhere to various legal systems.
- **Key Revocation and Rotation/ Challenge:** The security of systems requires that key sharing should be done in a timely manner and keys be updated or replaced periodically. Revocation and rotation of keys is also complex in cloud environments as any disruption of services may severely affect services in many organizations.

· Solutions

- **Automated Key Management Systems/ Solution:** Designed for key management within a large and complex cloud environment, the automated systems used must be also capable of handling the scale and tasks required. Automation enables the most vital copy key generation and its distribution and timely rotation.
- **Tenant-Specific Key Management/ Solution:** Businesses that lease computing resources should follow specific control measures to meet the multiple tenancy challenge. It means that to ensure different requirements are met, proper divisions of the key management procedures and accesses controls are done.



6. Challenges and Solutions

Key Management Issues in Cloud Cryptography [2]

Cryptographic keys are some of the valuable assets needed for the operational security and efficiency of cryptographic systems in cloud computing. However, key management in the cloud introduces specific challenges that need to be addressed:

. Challenges

- **Scale and Complexity/ Challenge:** Cloud deployment commonly results in a big number of users, services, and connected devices. These kinds of operations can be challenging at this scale to manage cryptographic keys, and issues can arise with the distribution, rotation or revoking of keys.
- **Multi-Tenancy/ Challenge:** Multitenancy is normally common with cloud services so they may be more shared in nature. Key management becomes an issue of concern as one tenant may require frequent access and issuance of keys while another will not require them frequently and the keys need to be isolated and properly managed to avoid cross –contamination.
- **Lifecycle Management/ Challenge:** The management of cryptographic keys used for encryption, distribution, and security purposes has proven daunting during the cloud computing lifecycle, especially in terms of generation, distribution, rotation, or destruction. Failure at any of the four stages results in the generation of security threats.

Altogether, the use of cryptographic measures is essential in cloud computing to ensure its compliance with existing regulations. In this regard, cryptography provides important inputs that help in the development of the secure and compliant cloud model which touches on the areas of data confidentiality, storage security, and access controls and auditability. This is especially important for industries that are dealing with sensitive data or are within confined regulations. The following figure 4 elaborates on the Cryptography model for secure data sharing over cloud [18].

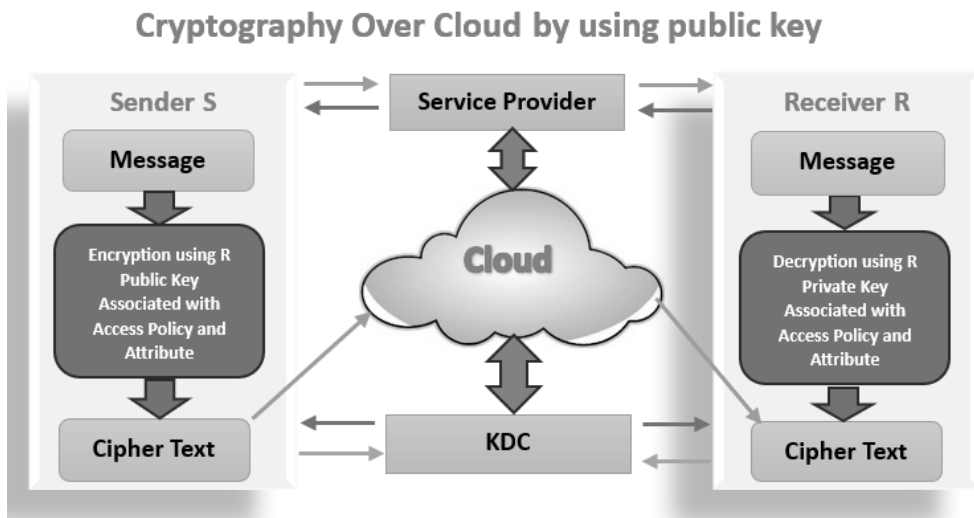


Figure 4 Cryptography model for secure data sharing over cloud



- **Secure Communication Protocols:** The safe transfer of data is highlighted in many regulatory frameworks used in organizations today. Policies such as SSL/TLS, which secure the flow of line, also help in meeting the compliance as they safeguard data from being intercepted by unauthorized parties [17].
- **Protection Against Data Breaches:** It is important to have secured applications to avoid leakage of sensitive information and especially when such instances attract stringent penalties. It is for these performances that utilization of encryption to data in status simplification secures cloud environments' invulnerability against undue access and conceivable invasions in consonance with requirements stipulated by regulations on safety of data [18].
- **Cross-Border Data Transfer:** It helps in protecting the data while moving from one country to another, thus helping to meet the ideals of some regulatory authorities on data transfer across borders. Inasmuch as data security is concerned, encryption protocols help to ensure that information remains secure as it passes through various networks of organization in different international boundaries to ensure they meet the set legal requirements on transfer of data between nations [18].
- **Adherence to Industry Standards:** Use of cryptography makes it possible for cloud service providers and their users to observe industry specific cryptographic standards set down by regulatory authorities. Adhering to standard cryptographical methods makes the security feature robust and puts into consideration the regulator's requirement [19].



encryption fulfilling the privacy requirements for cloud service providers and users [4].

- **Secure Data Handling and Storage:** The law sometimes provides legal standards in the care and storage of data. Cryptography, in part through storing data at rest, guarantees that, even if an unauthorized entity breaches the physical perimeter, the information remains protected. The rules of using personal data are set by the General Data Protection Regulation (GDPR), Health Insurance Portability and Accountability Act (HIPAA), etc., and can be fulfilled with the help of cryptographic security measures [16].
- **Identity and Access Management:** Cryptography helps SOPs for identity and access management to be secure and aligns the organization to requirements set by various authorities concerning user Authentication and authorization. With the help of cryptographic methods in protected login, access control, and multi-factor authorization, cloud environments can meet the requirements of regulation and protect users' identities adequately [16].
- **Audit Trails and Accountability:** This is useful for things like digital signatures and cryptographic time stamping to assure the audit trail and accountability. The specificity of the compliance requirements means that the programs need to allow tracking and auditing of activities done on the sensitive data. Audit trail is a method used for tracking activities, and it ensures that records are protected with the help of cryptographic measures to conform to the regulatory auditing standards [17].



Compliance and Privacy Assurance [17]:

The protection of data that is in motion or stored temporarily in a system is equally important especially as it seeks to meet industry standards or regulatory requirement as well as personal preferences. These aspects are served by cryptographic measures to ensure users and organizations that their information is protected using the highest standards of confidentiality and security. All in all, the application of cryptographic techniques to protect data in motion and data stored in cloud computing significantly enhances the level of cloud security. Through such measures as encryption, secure communication protocols, and state-of-the-art cryptographic approaches, CSPs and consumers can effectively unleash the complexities of securing data across its evolutionary life cycle in the context of a cloud system.

Compliance with Regulatory Requirements

Thus, cryptography is a paramount means for safeguarding cloud computing environments against non-compliance with legal statutes and regional or domain-specific standards. The significance of cryptographic measures in achieving regulatory compliance is particularly pronounced in the following aspects [4]:

- **Data Confidentiality and Privacy:** By using relevant strong encryptions, cryptography meets regulatory requirements covering the secrecy and privacy of organizational information. There are many regulated sectors where the protection of personal and financial data is a crucial issue, for instance, the healthcare or finance industry. Some measures are as follows: encryption of the data transmitted and stored on the cloud as well as in-transit



received data has not been altered in transit. This is good because it assures the data has not been interfered with while in transit across different networks.

Data at Rest [5]:

- File and Disk Encryption: Cryptographic solutions to data intended to be stored in Cloud repositories or physical devices involve encryption of these data. Other technologies such as AES (Advanced Encryption Standard) are utilized by safeguarding data that is stored, which means even if unauthorized personnel gain access, data stored would be on encryption and so cannot be accessed.
- Secure Key Management: Cryptographic systems help adopt secure key management policies for data that is archived. Data that is stored needs to be encrypted, and the keys used for decryption of stored data need to be created, distributed, and protected so that improper access to data that is stored cannot be gained.
- Homomorphic Encryption: Modern encryption algorithms such as homomorphic encryption enable arithmetic operations to be conducted directly without use of decryption. This is especially useful when data stored in the cloud needs to be retained secure and intact in storage while still requiring computations.

Unified Approach [5]:

The field of cryptography is a fundamental one that deals with securing the data in the instances of its transmission and storage, thus providing an integrated line of protection during data flow and storage. It also makes security more thorough as it covers possible security threats regardless of whether data is sent from one point to another or stored and waiting for a signal to be active.



In summary, there is a general value of cryptography and cloud computing, worth of data integrity in general cryptographic applications. By applying the mentioned techniques, CSPs and consumers could build a sound framework for proving and sustaining data genuineness, accessibility, and availability through the entire cloud data life cycle. It also makes cloud-based systems more reliable and trustworthy in comparison to traditional systems.

Protection of Data in Motion and Storage

Cryptography has a critical role in ensuring solution security in their networks and Cloud's data transmission and storage (Data In-Transit & Data At-Rest). The significance of cryptographic measures in protecting data in these two states is critical for maintaining overall security and confidentiality:

Data in Transit [5]:

Encryption of Communication Channels: Those protocols that may include SSL/TLS encrypt data during its transit between the users and cloud services. This makes that information that is transferred over the networks to be retained secure and private, thereby eliminating indirect listening and other unlawful invasions of privacy.

- Secure Sockets Layer (SSL) and Transport Layer Security (TLS): These cryptographic protocols thus afford secure encryption between clients' and servers' stations. They employ mathematical formulas to ensure that data that is transmitted through the cloud is safe by being encrypted, this adds in on the security of the data transmitted on the cloud.
- Message Authentication Codes (MACs): These include MACs that are applied to data in transit, with the purpose of ensuring the



techniques are of more importance when transporting large volumes of data and storing it in cloud storage [6].

- **Blockchain Technology:** IT security is also one area that is addressed by blockchain as certain cloud applications, for instance by enabling distributed ledgers or decentralized systems utilize cryptographic hash function to ensure data authenticity. Thus, each block records a hash of a previous block within blocks, making the system's sequence tamper-evident and secure [1].
- **Cryptographic Time Stamping:** Identifying time sequences with cryptographic technology enables the creation of protected timestamps for data, thus proving the data's authenticity at a certain time. This is important for auditing and any previous records stored in the cloud should be intact without modifications [1].
- **Preventing Unauthorized Modifications:** Cryptography also plays a crucial role in maintaining checkpoint access to the altered data by employing access control measures and checking the data integrity through necessary cryptographic measures. This is important when it comes to ensuring that the information contained has a set level of consistency and accuracy, especially in multi-user cloud platforms [4].
- **Secure Multi-Party Computation:** It is done using cryptographic techniques like secure multi-party computation, where the symbols are inputted by two or more parties and the output is a function of the input data without exposing the data. This helps to maintain data integrity in that even at a time when computations involve collaboration client data is kept safe [4].



- **Cryptographic Hash Functions:** Cryptographic hash is a modern technique for creating virtual fingerprints or digital identification numbers usually of a small size from data. These hash values serve as unique identifiers for the original data. They contain signatures or descriptors. It has been proposed that hash values can be compared before and after transmission or storage of data in the cloud where changes can be quickly and easily identified, thus maintaining data integrity [1].
- **Digital Signatures:** Digital signatures offer a sound way of authenticating digital messages in the manner that guarantees their authenticity with automatic checks on their integrity. In cloud computing, information is tagged, and the tag ensures the sender that the information being received has not been tampered with in the process. Cloud users can check the validity of the data and confirm that the data has not been modified by anyone since it was generated by encrypting the message with the public key of the recipient [3].
- **Secure Communication Protocols:** Different cryptographic protocols used in secure communication like SSL/TLS, do not only encrypt it but also check whether the content is intact or not. The protocols employ necessary measures such as message authentication codes (MACs) to identify alterations in the data as it is passed through the network [3].
- **Checksums and Error Detection:** Data integrity employs cryptographic checksums and error-detection codes with an aim of identifying and possibly correcting errors that are likely to affect data integrity. These



- **Compliance with Privacy Regulations:** There is an increased demand for privacy regulations and the protection of information and data in many industries. Cryptography enables cloud service providers as well as clients to stick to these regulations by enabling them to implement effective techniques for the protection and proving the confidentiality of such data [18].
- **Data Segmentation and Isolation:** This makes it easier to segment and isolate data to make sure that one string of information does not directly have access to the other string of information since there is always separate keys encrypting each string of data. This also enhances data security as opposed to data masking, which, besides hiding specific values within a dataset, does not protect data from unauthorized access even if the intruder gets access to a particular segment of the data [18].

In summary, we have established that cryptography occupies a central role in the protection of data within the cloud computing environment. Its many uses in preserving security in data in transit, and security in data and information at rest, are helps in making the cloud secure and reliable. It is therefore important for organizations and users of cloud services, where the information can be processed and/or stored, to grasp the importance of cryptography as the chief tool in ensuring data confidentiality.

Securing Data Integrity

One of the key necessities of trustworthy and dependable operating model for cloud computing is data integrity. Cryptography plays a pivotal role in preserving the accuracy, consistency, and reliability of data, addressing several key dimensions of securing data integrity within the cloud [1]:



- **User Authentication and Access Control:** Cryptography is also used to aid in providing methods for user authentication in the process and make sure only worthy dignitaries can access certain information. Some of the broad range measures that can be employed by cloud service providers to promote security include the use of cryptographic protocols for the purpose of user authentication, restricting the access to information within cloud by employing cryptographic key and credential [16].
- **Secure Key Management:** The use of key means protection of the key plays the most-significant role in the confidentiality of data and therefore requires proper management. According to cryptographic solutions it can be possible to investigate proper formation, data transmission, and storage of encryption key. Robust key management practices provide protection to those assets and permit only the intended recipients to carry with them the keys to permit them deciphering of the information [15].
- **Homomorphic Encryption for Secure Computation:** This created additional security whereby computation can be made on encrypted data without necessarily exposing the raw data. This increases data privacy during the processing phase to enable computations to be processed in the cloud safely without the crucial details being revealed [17].
- **Protecting Against Insider Threats:** Another important aspect of cryptography is that restriction of insider by cryptographic permissions. The use of cryptography access mechanisms allows individual tenants or users of the same Cloud environment the ability to access and decrypt only data contained in their own tenancy domain [17].



5. Significance of cryptography in cloud computing

Ensuring Data Confidentiality

The usefulness of cloud computing to accrue maximum returns on investment in cloud technology through sturdiness and flexibility can only be complemented by the relevance of cryptography as a paramount tool in defense of data privacy. Several key aspects highlight the crucial role that cryptographic measures play in safeguarding sensitive information within cloud environments: The following factors explain the light at which cryptographic measures can be used to enhance security of data that is stored in the cloud:

- **Encryption for Data in Transit:** Integrity of data during transfer is another aspect protected with the help of protocols, in particular Secure Socket Layer/Transport Layer Security. Encryption procedures work some type of data manipulation that makes the data non-readable by anyone who is not particularly allowed to understand it. This ensures that even if the information, which was transmitted reached the unauthorized recipient, its confidentiality cannot be violated [16].
- **Protection of Data at Rest:** Regarding distributed data repositories, decryption methods are used for encoding the data. This can essentially be attributed to the fact that encryption such as AES has the function and capacity of a warrant to safeguard data at rest in a way that makes it nearly impossible to violate the access of the information in question. This is particularly relevant where the application is deployed on a multi-tenant public cloud [15].



- Analyzing the trade-offs of cryptographic techniques, focused requirements of different industries, and the development of cloud solutions.

Case Study Synthesis:

- Summarizing the general lessons, success stories, and possible lessons learnt and the strengths and weaknesses on the application of cryptography in cloud security, based on the case studies observed.
- Making a comparison of what has been discerned in the literature with regards to the theoretical frames and what has been observed in the case studies.

Narrative Synthesis [15]:

- In the process of work carried out, it is necessary to create a logical and unified story that would include information obtained during the literature review and case study analysis.
- The importance of realizing an emancipatory/phenomenology understanding of contemporary security approaches and cryptography, focusing on its role in cloud systems with an emphasis on confidentiality and integrity.

Choice of qualitative data analysis approach will help in achieving the study objective as follows; Thus, the study aims at providing meaningful insights on the topics and trends that were identified using a broad spectrum of sources and show the real-life applicability of using cryptographic solutions.



as the goal of the study was to consider the role and significance of cryptography in protection of data in cloud computing systems and approaches from various sources.

Data Analysis

While trying to establish the research results for this study, the analysis will entail a qualitative method. The analysis will encompass the following key steps [2]:

Thematic Coding:

- Using a more practical thematic coding approach to sort the information found during literature review and analysis of white papers and case studies.
- Detecting the cyclical motifs, patterns, and ideas concerning the application of cryptography to provide confidentiality and data integrity in the context of the cloud computing business.

Pattern Recognition:

- In this step, the collected data is analyzed to identify patterns of the application of cryptographic algorithms and protocols under different cloud computing contexts.
- To establish the prospects and challenges within the several industries as well as different CSPs, in their execution of cryptographic solutions.

Contextual Understanding:

- Building up a situation-aware conception of the real-life applications as well as the threats linked with cryptology in cloud security.



White Papers Review:

- By gathering white papers from reliable cloud service offering firms, security firms, together with other stakeholders that are operating in the cloud computing technology fields to gain their vivid opinions on the application of cryptographic approaches in cloud settings.
- Looking at various reviews of the white papers and generally understanding the kind of information that is presented in the papers; specifically focusing on the technicality part of the papers that contains specifications, recommended approaches, and practical implementation of cryptography to secure data in the cloud.

Case Studies:

- To achieve a wider variety of case studies, I chose cases from several different industries, different cloud service models, and different cryptographic solutions used.
- Analyzing the case studies of the given organizations in order get the details of the exact cryptographic algorithms, protocols, and strategies used for securing data while in transit and when stored in the cloud.
- Upon identifying key areas and tasks of interest within the selected case studies, the next step is to note patterns, difficulties, and triumphs that occurred in the implementation across the different cases.

Such approaches are defined to chart the process of data collection, with special emphasis placed on using quality sources to obtain accurate and reliable information. Thus, while conducting the study, the author sought to use both journal materials, white papers and their practical case,



This research design can be regarded because of joining detailed literature review which will identify existing approaches and key ideas with the case study analysis which will highlight how these ideas can be applied in the practical environment. The use of both theoretical and empirical strategies is expected to offer insights and comprehensive coverage of the part played and effect brought by cryptography in safeguarding information in the cloud environment. The triangulation of theoretical and practical data provides for the credibility and validity of the practical findings drawn from the various cases under study.

Data Collection

The data collection process for this study involves [15]:

Literature Analysis:

- Conducting a literature review in professional periodicals, scientific journals, conferences papers, and other books that are aimed at investigating the effectiveness of cryptography in maintaining the confidentiality and integrity of data in cloud environment.
- In this phase, the author should systematically analyze the available literature to come up with unique research concepts, theoretical concepts, and practical applications of cryptographic solutions in cloud context.
- Filtering out the important facts which ones can be considered as the main key points for understanding the research objectives in terms of data, trends, possible and existing challenges, and developments.



4. Methodology

Research Design

The chosen research design for this study involves a two-fold approach [14]:

Literature Review:

- Carry out a literature review of previous work on cryptographic techniques used in maintaining security in cloud computing with regards to data privacy and protection.
- Conducting a literature review of the published research articles, books, conference papers and other documents that serves to understand the theoretical background and practical implications of cryptographic techniques for implementing availability in cloud computing models.
- Outlining major trends, issues, and innovations in the context of cryptography as an IT field while providing cloud computing services.

Case Study Analysis:

- Case studies to analyze the practical applications of cryptographic tools and technologies in LoA-based cloud computing deployments.
- Considering appropriate industry types and CSPs in the choice of cases to gather a wider base for cryptographic use.
- Herein, methodical understanding of the concrete cryptographic algorithms, protocols, and strategies utilized in these cases to provide data confidentiality and integrity.
- Applying the lessons learned and the best practices tested in the case studies to assemble tips and guidelines for action.



the assurance level of the integrity of information within the developed systems. As to the specific objectives of the assessment made within the framework of the study, it is expected to contribute to a better understanding of the importance of cryptographic algorithms in maintaining data integrity within the context of cloud computing [12].

Discussion on the topicality of cryptographic methods in terms of securing the data both in transit and at rest in the cloud.

The key concern of this research study is understanding the importance of cryptography for information protection in contexts of cloud computing when data is in transit as well as while stored. The objectives of the research include analyzing cryptographic systems and protocols due to the increase in data transmission security over networks and storing of data in cloud storage systems. Therefore, in exploring the application of cryptographic techniques to both these areas of contemporary information technology usage, the present study aims to present a more comprehensive understanding of how cryptographic return and associated security features and protocols support the process of shielding sensitive information across the complex and interconnected framework of cloud computing infrastructures. Thus, this research seeks to provide deeper insights into the multiple roles that cryptography plays in raising the level of security in data transmission and in storage within the cloud [13].



3- Objectives

To evaluate the extent of Cryptography in supporting data security and confidentiality in Cloud computing

The main aim of this work is to Map out the extent to which cryptography can be useful to ensure data security with emphasis on cloud computing. This entails an articulate discussion on how cryptographic tools, for instance, encryption and its associated protocols, offer mechanisms of protecting volatile and critical data at different angles of data processing, storing, and communication within clouds. The specific focus is to analyze how cryptography functions as one the key building blocks in maintaining the data confidentiality and to discuss threats related to cloud computing that has emerged as a major concern in the contemporary information technology setting. This way the research hopes to shed light on the applicability and effectiveness of cryptographic schemes to ensure the privacy and security of data in cloud-based environments.

To evaluate the effectiveness of cryptographic algorithms in preserving data integrity of data hosted in cloud environments.

This research project focuses on assessing and explaining the impact of cryptographic algorithms on data reliability in the context of cloud computing. The objective includes the definition of the role of cryptography which covers such elements as hash functions and digital signatures, in achieving the goal of accuracy, consistency, and reliability of cloud data storage, processing, and transfer. In evaluating the outcomes of the different cryptographic algorithms being employed, the study aims at determining the level of success these algorithms may have in ensuring that changes, interference, or data corruption within the cloud system, are effectively addressed to improve



- **Multi-Party Computation:** Multi-party computation (MPC) is a cryptographic approach that enables multiple parties to jointly compute a function over their inputs while keeping those inputs private. This technique is valuable in scenarios where collaborative computations are required without revealing individual data sets [9].
- **Quantum Cryptography:** With the advent of quantum computing, researchers are exploring quantum cryptographic solutions to address potential threats posed by quantum algorithms that could break classical cryptographic schemes. Quantum key distribution (QKD) is one such approach that leverages the principles of quantum mechanics for secure key exchange [11].
- **Secure Cloud Storage Protocols:** Cryptographic protocols designed for secure cloud storage focus on ensuring the confidentiality and integrity of data stored in the cloud. Techniques like convergent encryption and proxy re-encryption enhance the security of cloud-based storage solutions.

These existing cryptographic solutions demonstrate a concerted effort to address the specific security concerns in cloud computing. As the field continues to advance, ongoing research and innovation in cryptography will be essential for staying ahead of emerging threats and ensuring the sustained security of data in cloud environments [11].



- **Data Encryption:** Encryption remains a fundamental cryptographic solution for protecting data in cloud environments. Both data in transit and at rest can be encrypted, providing an additional layer of security. The algorithms of Advanced encryption, such as AES (Advanced Encryption Standard), are widely employed to safeguard sensitive information [8].
- **Homomorphic Encryption:** It is an innovative cryptographic technique that allows to perform computations on the data that is encrypted only without decryption process. This enables secure data processing in the cloud while preserving the confidentiality of sensitive information [8].
- **Secure Key Management:** Effective key management is critical for maintaining the security of encrypted data. Cryptographic solutions for secure key generation, distribution, and storage help prevent unauthorized access to encryption keys, ensuring the overall integrity of the encryption process [10].
- **Digital Signatures and Authentication Protocols:** Digital signatures play a crucial role in authenticating the origin and integrity of data in cloud environments. Authentication protocols, such as OAuth and OpenID Connect, leverage cryptographic mechanisms to verify the identity of users and entities accessing cloud services [10].
- **Tokenization:** Tokenization involves replacing sensitive data with unique tokens, reducing the risk associated with the exposure of actual data. Cryptographic tokenization solutions are employed to protect sensible data, such as credit card numbers or personally identifiable information (PII), stored in the cloud [9].

- **Shared Resources:** Multi-tenancy, a key feature of cloud computing, means that resources are shared among multiple users. This introduces the risk of one tenant impacting the security or performance of another, intentionally or unintentionally.

Understanding these security challenges is essential for developing effective strategies and implementing robust security measures in cloud computing environments. Cryptography, as a foundational element of cloud security, plays a critical role in addressing many of these challenges, providing encryption, authentication, and other mechanisms to ensure the integrity of cloud-based systems and protect data [11]. Figure 3 below clarifies Cloud security module.

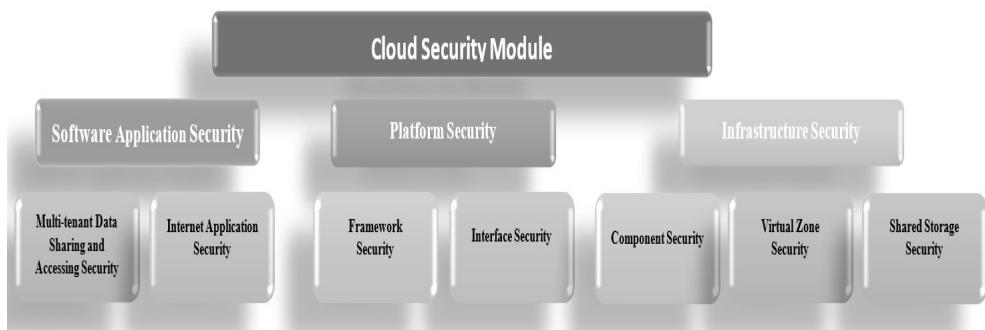


Figure 3 Cloud security module

Existing Cryptographic Solutions in Cloud Environments

As the security challenges in cloud computing continue to evolve, researchers and practitioners have proposed and implemented various cryptographic solutions to mitigate risks and ensure the confidentiality and integrity of data in cloud environments. The literature highlights several key cryptographic solutions tailored for the specific challenges posed by cloud computing [6].



- **Compliance and Legal Issues:** Different industries and regions have specific regulatory requirements governing the storage and processing of certain types of data. Ensuring compliance with these regulations in a cloud environment can be challenging, especially when data is stored across geographic locations [9].
- **Insecure Interfaces and APIs:** Cloud services often rely on interfaces and APIs (Application Programming Interfaces) for interactions between different components. Insecure interfaces or APIs can become potential points of vulnerability, allowing attackers to exploit weaknesses in the system [9].
- **Lack of Transparency:** Cloud users may have limited visibility into the security measures implemented by the service provider. The lack of transparency regarding security practices, incident response procedures, and data handling processes can lead to uncertainty and concerns about the overall security posture [10].
- **Data Loss and Recovery:** Cloud users entrust service providers with their data, but the possibility of data loss due to various factors, such as hardware failures or accidental deletion, is a significant concern. Ensuring robust data backup and recovery mechanisms is critical to mitigating the impact of such incidents [10].
- **Identity and Access Management:** Managing user identities and access controls is complex in cloud environments, especially when dealing with many users and diverse services. Issues such as weak authentication, improper access controls, or inadequate identity management can compromise the overall security of the cloud infrastructure [11].



- **Authentication Mechanisms:** Cryptography plays a pivotal role in user authentication systems. Secure authentication protocols, often based on cryptographic principles to ensure that the authorized systems gain access to sensible resources.

In the context of Information Technology, cryptography provides the tools and techniques necessary to address security challenges and protect data from various threats. As technology continues to advance, the role of cryptography in IT remains indispensable for maintaining the confidentiality, integrity, and authenticity of digital information [9].

Security Challenges in Cloud Computing

The rapid adoption of cloud computing has ushered in transformative benefits for organizations, but it has also given rise to a unique set of security challenges. Understanding and addressing these challenges are crucial for maintaining the integrity and confidentiality of data in cloud environments. The literature highlights several key security challenges associated with cloud computing [10].

- **Data Breaches:** Cloud environments store vast amounts of sensitive data, making them attractive targets for malicious actors. Incidents of data breaches or unauthorized access can have extreme sequels, including the exposure of sensitive information and potential legal ramifications [10].
- **Insider Threats:** The shared multi-tenant nature of cloud services introduces the risk of insider threats. Unauthorized access by individuals within the cloud provider's organization or by co-tenants poses a significant challenge, emphasizing the need for robust access monitoring and controls mechanisms [10].



- **Data Encryption:** cryptography is used to describe the secure encoding of information in preventing it from being accessed by entities that are unauthorized to do so. Essentially, cryptographic ciphers can be employed in converting the concerned information into a form that is quite comprehensible to humans and computers, which helps in offering a degree of security to both the data in motion and the data in storage [8].
- **Digital Signatures:** Digital signatures are also known as digital signatures, which is the cryptographic techniques that are employed in the identification and identification of the communication or message of digital communication. This assures the recipient the authenticity of the sender and that the content has not been interfered with in the middle [8].
- **Hash Functions:** It's used to easily convert a large message or any input of any size to a fixed-size output referred to as the hash or message digest. In IT hash functions are employed in checking and ensuring the integrity of data, password security and even in investigation and solving of cyber-crimes. A small modification in the input leads to the fluctuation of the hash value output, which is very helpful for detecting changes [7].
- **Key Management:** Effective key management is essential for the secure implementation of cryptographic systems. Cryptographic keys are used for encryption and decryption processes, and proper key management practices are crucial for maintaining the security of encrypted data [9].

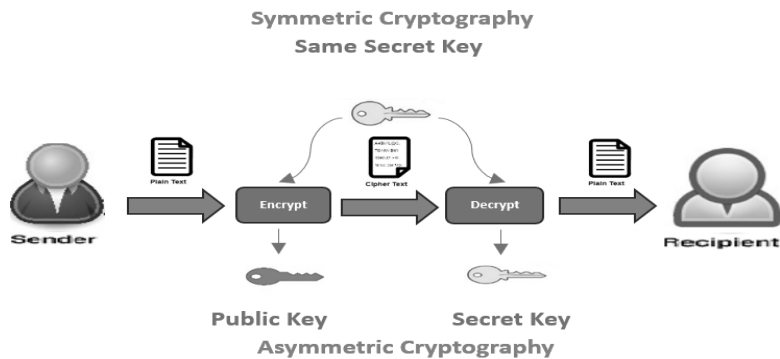


Figure 2 Cryptography block diagram

Cryptography in Information Technology

Cryptography plays a critical function in Information Technology as IT has become mankind's lifeline in contemporary society as regards the provision of information using the internet and other related media. Cryptography plays crucial roles in the information technology domain as a key component of protecting information confidentiality and secure transmission in numerous applications. Scholars have identified several elements to specifically illustrate that cryptography is central in Information Technology [8].

- **Secure Communication Protocols:** Cryptographic protocols set the foundation of secure communication that is Major in Information Technology. There are several protocols that are currently employed to set up secured tunnels whereby information exchange is consequential; SSL/TLS is one of the most famed protocols used in creating encrypted connections between clients and servers to facilitate secure network communication and prevent leakage of information [8].



is the key enabling process of this shift, while the work of Whitfield Diffie and Martin Hellman in the 1970s paved the way for the advancement by making possible to exchange cryptographic keys over insecure channels. To continue with the new evolution in generation, the RSA algorithm, which was developed by Ron Rivest, Adi Shamir, and Leonard Adleman, offered the much-needed practical approach to implementing public key cryptography [6].

The practice of cryptographic standards emerged during the last 20 years of the twentieth century, and institutions such as NIST were actively defining preferable algorithms. The advanced encryption standard (AES) Symmetric Key Cryptography Algorithm became a global standard in the year 2001 which eventually initiated the development of other cryptographic practices. In total then, the past developmental history of cryptography shows that this discipline has been dynamic in its capacity to address the problems of protecting information in various timelines. From the earliest modes of protecting the sending and receiving messages from unauthorized third parties to the evolution of contemporary cryptographic techniques, this journey makes us rich in understanding as to how the science of cryptography has evolved over the time and how much it continues to be important in the world of information security. This is something that is very important to understand to grasp the extent of the cryptographic techniques that are employed even in the current generation technologies and especially when it comes to personal data security within cloud-computing architectures [7]. The following is the Cryptography block diagram as depicted in Figure 2 below.

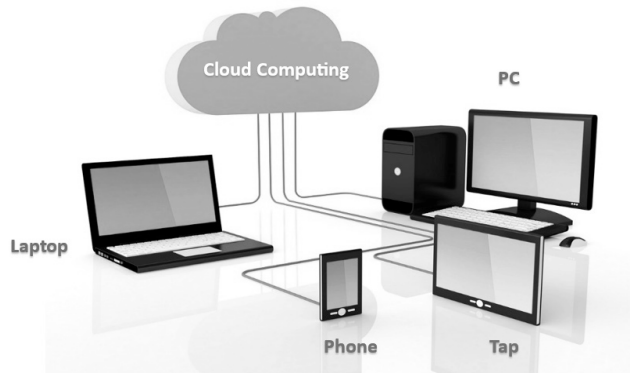


Figure 1 Cloud computing application diagram

2- Literature Review

Historical Evolution of Cryptography

Effective communication requires that data transmitted through communications channels remain secure meaning cryptology is the science of secure communication since its early beginnings to present times illustrates this struggle. Due to this, encryption in early civilizations was viewed as a technique that would facilitate the passing of messages while at the same time ensuring that none of the civilians had any clue as to what was going on. With time, the idea of cryptography developed, and there were several inventions at some specific periods of time; especially during a war; for instance, the Enigma machine in the Second World War [5]. The new starter came with changes by moving from symmetric key systems to a new public key cryptography system. The Italian communication protocol that was established based on this theory



Concerning this exploration, it is intended to explain the necessity of cryptography in terms of risk management and maintaining the latter in compliance with the prescribed rules to build credibility and have a more secure cloud computing platform [2].

With the increase in the growth of using various organizations' assets in cloud infrastructures, the matter of protecting it has become an issue of increasing concern. The importance of cloud computing is that most companies and people are storing their information on cloud environments, and this opens new risks such as hacking others' information, data theft, and more. According to these challenges the following is deemed necessary because the information that is being sought to be stored on a cloud may be personal information or even sensitive business information [3].

Consequently, this work intends to highlight the importance of cryptography as an essential approach toward the protection of information in cloud computing. With cloud adoption at an all-time high, it is crucial to outline the use of cryptographic methods to manage the threats arising from improper use of these services which may compromise the privacy and data integrity. This study aims at contributing as to how cryptographic elements are used in cloud computing as a system, while emphasizing the fact that data security is achieved at different sub-phases throughout transfer, storage, and processing. In this way, the research aims not only to contribute to the existing knowledge of the precautions required for the formation of a stable cloud computing climate [4], but also to provide the foundation for forming a secure one. The cloud computing application diagram is highlighted in the figure below, Figure 1.



1. Introduction

As a relatively new development in the IT disparate and complex area, cloud computing has revolutionized the way information and data is hosted and managed by organizations and consumers. This is an innovative method that enhances capability, versatility, and economic utility by allowing computing resources to be hosted remotely by a third party. Nevertheless, like any other solution, clouds have certain risks and concerns that are largely related to security issues and, therefore, require the application of appropriate security measures [1].

It's for this reason that cryptographic techniques remain fundamental approaches for curbing the threat of data corruption and unauthorized access of data in cloud computing. These techniques work effectively ensuring confidentiality of the data transfers and data stored regardless of their location and are thus crucial in developing guarded paths between the users and cloud services. This paper approaches the role played by cryptography in the field of cloud computing, and its ability to tackle numerous security issues, as a multifunctional tool. Starting from creating secure methods for data encryption to handle both keys and users, elementary aspects of cryptography lay a solid foundation for cloud computing. When arguing about the use of cryptographic applications in the cloud, their advantages and disadvantages, and the potential risks in this sphere, it is possible to conclude about the significance of indicating the fact that, in order to provide the effective usage of cloud computing services, as well as to avoid certain threats, it is crucial to gain detailed knowledge of these techniques for both providers and consumers of cloud services.



Abstract

Cloud computing has grown as a widely accepted concept simultaneously, as the alarms for the security of data and information. This paper seeks to establish the comprehensive roles of cryptography in tackling these issues in the Cloud environment. The study begins with the historical background of cryptography and then moves on to analyze trends in information technology before discussing on the challenges to security in cloud computing. The goal of its publication is to highlight the importance of using cryptographic technologies for the protection of information confidentiality, its integrity and compliance. The combination of literature review and the case study method was applied, pulling knowledge from examples of good cryptographic use and the lessons learned from breaches in security. They reveal how cryptology is crucial in the furthering of cloud security and in maintaining customers' faith. Key information technology practitioners are encouraged not to relax their guard and adopt an integrated security strategy to ward off future attacks. Conclusion of the study is in synthesis of the subsequent analysis, highlighting the continued applicability of cryptography for Cloud Information System security.

Keywords: Cryptography, Cloud Computing, Data Security, Encryption, Information.

المستخلص

نمت الحوسبة السحابية كمفهوم مقبول على نطاق واسع في وقت واحد، مثل أجهزة الإنذار لأمن البيانات والمعلومات. تسعى هذه الورقة إلى تحديد الأدوار الشاملة للتشفير في معالجة هذه المشكلات في البيئة السحابية. تبدأ الدراسة بالخلفية التاريخية للتشفير ثم تنتقل لتحليل الاتجاهات في تكنولوجيا المعلومات قبل مناقشة التحديات التي تواجه الأمن في الحوسبة السحابية. والهدف من نشره هو تسليط الضوء على أهمية استخدام تقنيات التشفير لحماية سرية المعلومات وسلامتها والامتثال لها. تم تطبيق الجمع بين مراجعة الأدبيات وطريقة دراسة الحالة، واستخلاص المعرفة من أمثلة الاستخدام الجيد للتشفير والدروس المستفادة من الانتهاكات الأمنية. وهي تكشف مدى أهمية علم التشفير في تعزيز الأمن والحفاظ على ثقة العملاء. يتم تشجيع ممارسي تكنولوجيا المعلومات الرئيسيين على عدم التخفيف من حذرهم واعتماد استراتيجية أمنية متكاملة لدرء الهجمات المستقبلية. اختتام الدراسة هو تجميع للتحليل اللاحق، مما يسلط الضوء على استمرار تطبيق التشفير لأمن نظام المعلومات السحابية.

الكلمات المفتاحية: التشفير، الحوسبة السحابية، أمن البيانات، التشفير،

المعلومات.

The Importance of Cryptography in Cloud Computing

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10 -Conclusions

- **Balance in Architectural Design is Essential:** Modern buildings should strike a balance between innovation and maintaining the cultural and historical identity of urban areas, which enhances the city's sustainability.
- **Visual and Material Harmony is Key:** Buildings that incorporate local materials and achieve visual harmony with the traditional environment help foster integration into the urban fabric and reinforce the city's visual identity.
- **Spatial Integration Improves Functionality:** High-quality spatial integration in buildings enhances the flow of movement and social interaction, contributing to increased urban cohesion and improved connectivity between different areas.
- **Environmental Sustainability Remains a Challenge:** While some modern buildings adopt sustainable techniques, achieving full environmental sustainability continues to be a challenge, requiring ongoing improvements.
- **Coexistence Between Modern and Traditional Architecture is Possible:** Modern architecture can successfully integrate into traditional urban landscapes if designed thoughtfully, with consideration of the historical and cultural elements of the area.
- **Preservation of Cultural Heritage is Vital:** Architects should aim to preserve cultural heritage through designs that strengthen local identity and connect the present with the past in an integrated manner.
- **Enhancing Urban Design Discussions:** This research provides a deeper understanding of how to balance innovation with respect for urban heritage, contributing to better urban planning.



4. **Weak Relationship Between Accessibility and Environmental Impact:** The correlation (0.408) suggests that while buildings may be easy to access, this doesn't necessarily correlate with a high degree of environmental sustainability.
5. **Visual Integration Plays a Significant Role in Overall Design Success:** The relationship between visual integration and other indicators, like material harmony and spatial integration, shows that aesthetics play a crucial role in determining the success of architectural designs.
6. **Challenges in Balancing Urban Scale and Material Harmony:** While spatial integration and urban scale have a positive relationship, some buildings that achieve this balance may not fully harmonize with materials in their environment, indicating a challenge in this area.
7. **Environmental Impact is Partially Related to Spatial Integration:** The correlation (0.612) between environmental impact and spatial integration suggests that buildings with good spatial integration may also adopt some sustainability practices, but this isn't always the case.
8. **Most Buildings in the Study Exhibit Excellent Accessibility:** Results indicate that 80% of the buildings have excellent accessibility, demonstrating the importance of location and design in ensuring easy access.
9. **Need for Improvement in Spatial Integration:** Since 40% of the buildings only achieved partial spatial integration, there is a need for some buildings to improve their design to enhance movement flow and interaction with the surrounding urban environment.
10. **Challenges in Achieving Full Environmental Sustainability:** Although 40% of the buildings excel in environmental sustainability, 60% still rely on less sustainable techniques, suggesting a need for further improvements in this area.



3. **Spatial Integration and Material Harmony:** The correlation between spatial integration and material harmony is 0.645, suggesting a moderate relationship. This implies that while spatially integrated buildings often harmonize with materials used in the environment, the relationship isn't extremely strong.
4. **Accessibility and Environmental Impact:** The correlation between accessibility and environmental impact is 0.408, indicating a weak relationship. This suggests that ease of access to a building doesn't necessarily correlate with its level of environmental sustainability.

9- Summary of Practical Study Findings

1. **Visual Integration and Material Harmony are Strongly Related:** There is a significant connection between visual integration and material harmony. Designs that blend well visually with the surrounding traditional environment also tend to use materials that complement the local context. This strong correlation (1.000) suggests that improving visual integration will directly enhance material harmony.
2. **Spatial Integration and Urban Scale are Positively Related:** The strong correlation (0.919) between these two indicators shows that buildings that are well integrated spatially are also proportionate in size and height within their surroundings, indicating a harmonious relationship between movement flow and scale.
3. **Moderate Relationship Between Spatial Integration and Material Harmony:** The correlation (0.645) indicates a medium-strength connection. Some spatially well-integrated buildings may not necessarily achieve full material harmony with their surroundings.

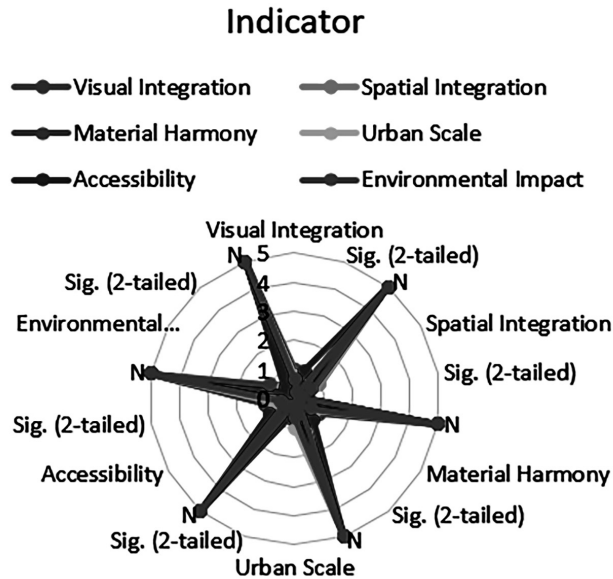


Figure. 12 "Radar Chart illustrating correlation relationships between architectural indicators: visual integration, spatial integration, material harmony, urban scale, accessibility, and environmental impact." as prepared by the researchers

8- Key Relationships Between Indicators

1. Visual Integration and Material Harmony: The table shows that the correlation coefficient between visual integration and material harmony is 1.000, indicating a perfect and very strong relationship between the two indicators. This means that any change in visual integration will directly affect material harmony, and vice versa.
2. Spatial Integration and Urban Scale: There is a strong correlation between spatial integration and urban scale (0.919 with Sig = 0.028), indicating a positive relationship. This suggests that buildings with strong spatial integration tend to be proportionate within the urban context.



7- Correlation Analysis

The Pearson Correlation analysis presented in Table (4) and Figure (12), provides insights into the relationships between the architectural indicators used in the study, including visual integration, spatial integration, material harmony, urban scale, accessibility, and environmental impact. These correlations allow for an understanding of how each of these indicators interacts and influences the others.

Table (4): Correlation Coefficients Among Architectural Indicators in Modern Buildings within Traditional Urban Environments, as prepared by the researchers.

Indicator	Visual Integration	Spatial Integration	Material Harmony	Urban Scale	Accessibility	Environmental Impact
Visual Integration	1.000	0.645	1.000**	0.791	0.000	0.645
Sig. (2-tailed)		0.239	0.000	0.111	1.000	0.239
N	5	5	5	5	5	5
Spatial Integration	0.645	1.000	0.645	0.919*	0.612	0.667
Sig. (2-tailed)	0.239		0.239	0.028	0.272	0.219
N	5	5	5	5	5	5
Material Harmony	1.000**	0.645	1.000	0.791	0.000	0.645
Sig. (2-tailed)	0.000	0.239		0.111	1.000	0.239
N	5	5	5	5	5	5
Urban Scale	0.791	0.919*	0.791	1.000	0.250	0.612
Sig. (2-tailed)	0.111	0.028	0.111		0.685	0.272
N	5	5	5	5	5	5
Accessibility	0.000	0.612	0.000	0.250	1.000	0.408
Sig. (2-tailed)	1.000	0.272	1.000	0.685		0.495
N	5	5	5	5	5	5
Environmental Impact	0.645	0.667	0.645	0.612	0.408	1.000
Sig. (2-tailed)	0.239	0.219	0.239	0.272	0.495	
N	5	5	5	5	5	5

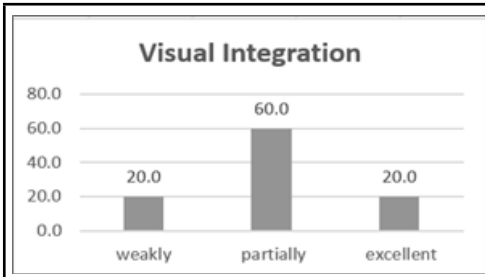


Figure. 6 illustrates the results of the visual integration index for the samples. as prepared by the researchers.

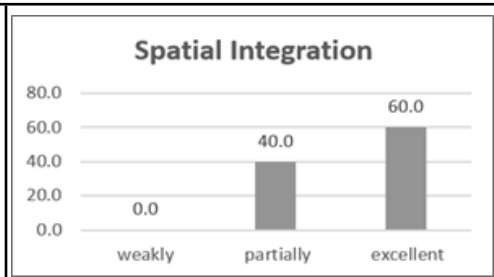


Figure. 7 displays the results of the spatial integration index for the samples. as prepared by the researchers.

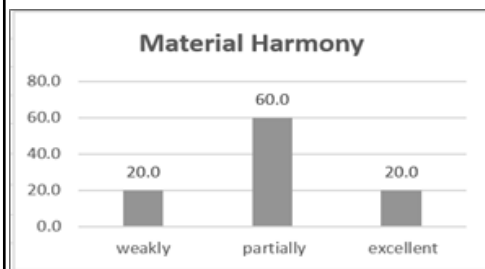


Figure. 8 shows the results of the material harmony index for the samples. as prepared by the researchers.

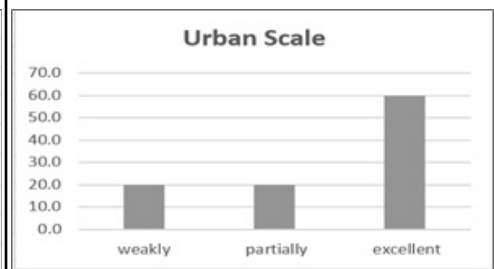


Figure. 9 demonstrates the results of the urban scale index for the samples. as prepared by the researchers.

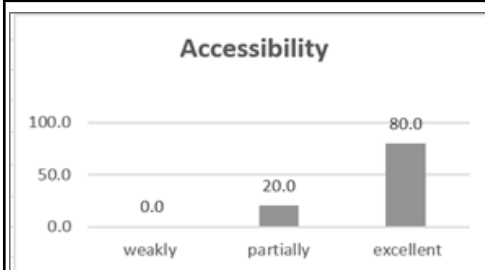


Figure. 10 highlights the results of the accessibility index for the samples. as prepared by the researchers.

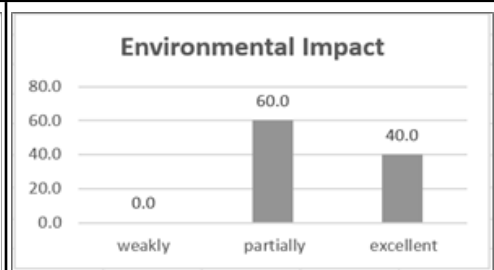


Figure. 11 reveals the results of the environmental impact index for the samples. as prepared by the researchers.



limitations. No building scored "poor" for accessibility, meaning all buildings provide reasonable levels of access.

This distribution suggests that while most modern buildings are designed for easy access, some areas still need improvements, particularly in regions with limited infrastructure.

6.6 - Environmental Impact (Figure. 11)

The environmental impact index assesses the sustainability of modern buildings based on the materials and technologies used. The data shows that 60% of buildings achieved "partial" environmental impact, adopting some sustainable practices but not achieving full sustainability. On the other hand, 40% received an "excellent" rating, using sustainable technologies and materials like renewable energy systems and environmentally friendly building materials. None of the buildings in the study were rated as "poor," suggesting that all the buildings exhibit a reasonable level of environmental consciousness.

These results indicate that while most modern buildings incorporate sustainable practices, there is still room for improvement to achieve complete environmental sustainability. Environmental sustainability is an essential consideration in modern architecture, but more efforts are needed to enhance the performance of some buildings in this regard.



predominantly on modern materials that do not blend well with their traditional environment.

These results show that while many modern buildings attempt to balance modern and traditional materials, achieving full harmony with the surrounding traditional context remains a challenge in some cases.

6.4 - Urban Scale (Figure. 9)

The urban scale index examines the compatibility of modern buildings with the surrounding urban context in terms of size, height, and proportions. The findings revealed that 60% of the buildings achieved "excellent" urban scale integration, fully aligning with the traditional urban environment. Meanwhile, 20% achieved "partial" integration, blending in some aspects but facing challenges in proportion. Another 20% scored "poor" for not matching the surrounding urban scale, leading to visual imbalances.

This highlights that while most modern buildings are carefully designed to fit within their urban context, some buildings struggle to match the size and height of the surrounding area, posing challenges for designers to balance innovation with traditional urban scales.

6.5 - Accessibility (Figure. 10)

The accessibility index reflects how easy it is for visitors and residents to access the modern buildings within the urban environment. According to the analysis, 80% of the buildings scored "excellent" for accessibility, demonstrating effective design and locations that make them easily accessible through public transport and pathways. In contrast, 20% scored "partial," indicating some challenges in accessibility due to infrastructure



20% demonstrated "poor" integration, where modern styles clashed with the traditional surroundings.

These findings indicate a wide variation in how modern buildings interact with their urban settings, with the challenge of balancing innovation and maintaining harmony with the traditional architectural context remaining significant in many cases.

6.2 - Spatial Integration (Figure. 7)

Spatial integration measures how well modern buildings fit into existing movement flows and public spaces. The results showed that 60% of modern buildings achieved "excellent" spatial integration, significantly enhancing the movement of people and their interaction with the surrounding public spaces. However, 40% achieved "partial" integration, improving movement but not fully interacting with the urban environment.

This indicates that while most modern buildings in this study consider their interaction with the surrounding public and urban spaces, there are still cases where improvements are needed for better spatial integration.

6.3 - Material Harmony (Figure. 8)

The material harmony index assesses how well the materials used in modern buildings align with those in the surrounding traditional architecture. According to the findings, 60% of the buildings achieved "partial" material harmony, using a mix of modern and traditional materials, though not entirely aligning. An additional 20% achieved "excellent" harmony, using materials that perfectly match the surrounding context. However, 20% of the buildings displayed "poor" harmony, relying



Table 3 Descriptive Statistics for architectural integration indicators in modern buildings within traditional urban environments. as prepared by the researchers.

Indicator	N	Minimum	Maximum	Sum	Mean	Std. Deviation
Visual Integration	5	1.00	3.00	10.00	2.0000	0.70711
Spatial Integration	5	2.00	3.00	13.00	2.6000	0.54772
Material Harmony	5	1.00	3.00	10.00	2.0000	0.70711
Urban Scale	5	1.00	3.00	12.00	2.4000	0.89443
Accessibility	5	2.00	3.00	14.00	2.8000	0.44721
Environmental Impact	5	2.00	3.00	12.00	2.4000	0.54772

This data provides insights into how well these modern structures align with traditional urban settings. For example, accessibility scores the highest mean (2.80), indicating that these buildings are generally accessible to the public, while both visual integration and material harmony score lower averages (2.00), suggesting challenges in aligning modern designs with traditional aesthetics and materials.

6- Discussion of the Results

6.1 - Visual Integration (Figure. 6)

The visual integration index reflects how well modern buildings align aesthetically with their traditional surroundings. The study found that 60% of the buildings achieved "partial" visual integration, combining contemporary elements like glass and steel with the surrounding traditional style but without fully matching the local aesthetic. Conversely, 20% of the buildings achieved "excellent" visual integration by using materials and designs that completely harmonize with their traditional environment. However, another



5- Results of the Practical Study

The architectural indicators (visual integration, spatial integration, material harmony, urban scale, accessibility, and environmental impact) for modern buildings integrated into traditional urban environments were analyzed in Table 3 using the three-point scale. To statistically analyze the results, the data will be entered into SPSS. Means and standard deviations will be calculated for each indicator, providing an overview of how these buildings perform across each criterion.

Additionally, correlation analysis will be conducted to measure the relationship between the different indicators. This analysis aims to determine how each indicator influences the others and understand the interplay between these factors. The analysis will offer valuable insights into how modern architectural design affects the traditional urban context, helping to assess the extent to which these buildings integrate with their surroundings. These results will deepen the understanding of how modern architecture impacts the cultural and environmental identity of cities.

The same Table summarizes the performance of five modern buildings based on six architectural indicators. Each indicator's minimum, maximum, sum, mean, and standard deviation are provided to assess the extent to which these buildings achieve the desired integration with their traditional urban settings.



4- Measurement Indicators

This practical study aims to evaluate the success of modern buildings integrated into traditional urban environments by applying six main architectural indicators: visual integration, spatial integration, material harmony, urban scale, accessibility, and environmental impact. The study selects five diverse global architectural examples and assesses their performance using a three-point scale (1-3), where:

- 3 represents "fully achieved,"
- 2 indicates "partially achieved,"
- 1 means "weakly achieved" or not achieved at all.

The goal is to analyze these buildings based on these architectural indicators to determine how modern architecture influences the cultural and urban identity of surrounding areas and provide insights on whether these buildings enhance or disrupt the traditional character of the cities. Table 2 illustrated the above three-point scale for the above five examples.

Table 2 Analysis of the five examples according to architectural indicators, using the three-point scale. as prepared by the researchers.

Example	Visual Integration	Spatial Integration	Material Harmony	Urban Scale	Accessibility	Environmental Impact
Louvre Pyramid (Paris, France)	2	3	2	3	3	2
The Shard (London, UK)	1	2	1	1	3	2
Islamic Art Museum (Doha, Qatar)	3	3	3	3	3	3
MAXXI Museum (Rome, Italy)	2	2	2	2	2	2
Apple Store (Milan, Italy)	2	3	2	3	3	3



- **Material Harmony:** The use of glass in the store's design contrasts with the traditional stone used in surrounding buildings, resulting in a "partially integrated" rating for material harmony. The difference between materials creates a dynamic visual effect but also highlights a divide between modern and historic elements (Lipman, 2020).
- **Urban Scale:** The store's size and height are perfectly aligned with the traditional scale of the square, making it fully integrated into the urban context (Norman Foster Foundation, 2019).
- **Accessibility:** Centrally located in Milan, the store offers excellent accessibility to both locals and tourists, with multiple transportation options available, giving it a rating of "excellent" for accessibility (Lipman, 2020).
- **Environmental Impact:** The Apple Store incorporates sustainable technologies, such as double-glazed glass and natural lighting, earning it a "high" rating for environmental impact due to its energy-efficient design (Norman Foster Foundation, 2019).

5



Figure. 5. Apple Store (Milan, Italy)

<https://www.aureliotomasso.com/en/apple-store-milan/>



- **Environmental Impact:** MAXXI employs modern technologies aimed at reducing energy consumption and promoting sustainability. Therefore, its environmental impact is evaluated as "partially sustainable" (Schumacher, 2011). Figure 4



Figure. 4. MAXXI Museum (Rome, Italy)
<https://en.wikipedia.org/wiki/MAXXI>

3-5 Apple Store (Milan, Italy)

- **Visual Integration:** The Apple Store, designed by Norman Foster in 2018, sits in Milan's Piazza Liberty. Its sleek glass design creates a visual balance between modernity and the historical buildings surrounding the square, earning it a rating of "partially integrated" in terms of visual harmony. The store's minimalist aesthetic blends with, but does not fully match, the surrounding architecture (Lipman, 2020).
- **Spatial Integration:** The store's design enhances the flow of movement smoothly within the historic square, guiding visitors seamlessly toward open spaces and entrances. Its spatial integration is rated "excellent" due to its ability to maximize the available space and improve navigation for the public (Norman Foster Foundation, 2019).



3-4 MAXXI Museum (Rome, Italy)

- **Visual Integration:** Designed by Zaha Hadid in 2010, the MAXXI Museum features bold curves and a daring design that stands in contrast to the traditional Roman fabric. In terms of visual integration, it is rated "partially integrated," as it introduces a modern artistic element that enhances contemporary design without heavily clashing with the traditional surroundings (Betsky, 2013).
- **Spatial Integration:** The building's design supports the flow of movement around the museum, with wide corridors and interactive spaces. Its spatial integration is rated as "good," as its architectural layout effectively guides visitors through both the indoor and outdoor cultural areas (Schumacher, 2011).
- **Material Harmony:** The use of glass and concrete contrasts sharply with the traditional Roman materials of stone and brick, resulting in a "partially integrated" rating for material harmony. While the modern materials create a striking difference, they offer a unique juxtaposition to the historic environment (Betsky, 2013).
- **Urban Scale:** The building remains proportionate to its urban surroundings in terms of height and size, but its external shape stands out, earning it a "partially in scale" rating with the urban context (Schumacher, 2011).
- **Accessibility:** The museum benefits from excellent accessibility due to its proximity to various forms of public transportation in Rome, giving it a "good" rating for accessibility (Betsky, 2013).



- **Spatial Integration:** The museum's central location on the Doha Corniche enhances the flow of movement, as it is carefully designed to direct visitors effortlessly towards the museum. Its prime location makes it "excellent" in terms of spatial integration (Craig, 2012).
- **Material Harmony:** The use of materials like limestone aligns perfectly with the surrounding traditional environment, giving the museum an "excellent" rating for material harmony with the local context (Holod, 1995).
- **Urban Scale:** The museum's size and scale are perfectly proportioned to fit with the surrounding buildings and natural landscapes, making it "fully in scale" with the urban context (Craig, 2012).
- **Accessibility:** With its ideal location and thoughtful design, the museum offers high accessibility for tourists and local visitors alike, contributing to its "excellent" rating for accessibility (Holod, 1995).
- **Environmental Impact:** The museum incorporates sustainable techniques, such as maximizing natural light and using environmentally friendly building materials, leading to a rating of "fully sustainable" in terms of environmental impact (Craig, 2012). Figure 3



Figure. 3. Museum of Islamic Art (Doha, Qatar) https://en.wikipedia.org/wiki/Museum_of_Islamic_Art,_Doha.



- **Urban Scale:** Due to its significant height, The Shard dwarfs the surrounding traditional buildings, making it "inconsistent" with the local urban scale (McNeill, 2009).
- **Accessibility:** Despite its visual disconnect, The Shard benefits from excellent accessibility thanks to its prime location near London Bridge Station, earning it a high rating for ease of access (Sudjic, 2006).
- **Environmental Impact:** The Shard incorporates modern energy-efficient technologies such as double glazing to enhance natural lighting and reduce energy consumption, giving it a "partial sustainability" rating (McNeill, 2009) Figure 2.



Figure. 2. The Shard (London, United Kingdom)

https://en.wikipedia.org/wiki/The_Shard

3-3 Museum of Islamic Art (Doha, Qatar)

- **Visual Integration:** The Museum of Islamic Art achieves an ideal balance between modern architecture and traditional Islamic elements, earning it a "fully integrated" rating for visual harmony. The design successfully blends Islamic motifs and modern geometric simplicity, making it harmonize beautifully with its surrounding environment (Holod, 1995).

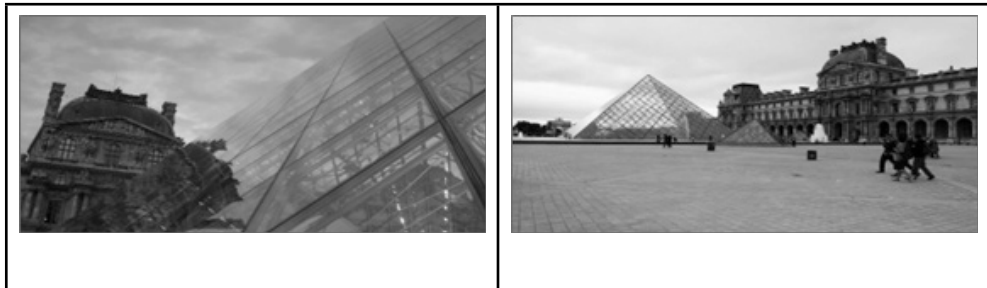


Figure. 1. The Louvre Pyramid (Paris, France)

<https://www.archdaily.com/88705/ad-classics-le-grande-louvre-i-m-pei>

3-2 The Shard (London, United Kingdom)

- **Visual Integration:** The Shard's towering glass façade and contemporary design starkly contrast with the historical buildings that surround it. This significant difference makes it visually "disconnected" from its traditional surroundings. The modern architecture of The Shard dominates the skyline rather than blending with the surrounding structures (Sudjic, 2006).
- **Spatial Integration:** The Shard's location near London Bridge station enhances the flow of people in and out of the area, making it an important part of the city's transport network. However, it doesn't fully integrate with the traditional spatial network around it, thus being spatially "partially integrated" (McNeill, 2009).
- **Material Harmony:** The use of glass and steel in The Shard's construction stands in stark contrast to the brick and stone used in neighboring historical buildings, creating a "weak" material harmony (Sudjic, 2006).



integration. The pyramid stands as an independent modern element, while enhancing the overall visibility of the Louvre museum (Frampton, 1985).

- **Spatial Integration:** The pyramid serves as a central, underground entrance, facilitating the flow of visitors into the museum and achieving "good" spatial integration. Its low-profile structure doesn't obstruct movement in the courtyard but enhances it, making it a flexible point of interaction within the urban space (Buchanan, 2010).
- **Material Compatibility:** The pyramid's use of glass and steel results in "partial" material harmony. While these modern materials differ from the limestone of the surrounding historical buildings, they create a distinct yet aesthetically intriguing juxtaposition (Buchanan, 2010).
- **Urban Scale:** In terms of height and mass, the pyramid does not dominate its surroundings, making it perfectly aligned with the urban scale of the historic area. Its low design allows the older structures to remain the visual focal points (Frampton, 1985).
- **Accessibility:** The Louvre Pyramid was designed as a new primary entrance, significantly enhancing ease of access to the museum. The accessibility is rated as "excellent," as the design promotes smooth circulation and interaction with both the museum and its outdoor spaces (Frampton, 1985).
- **Environmental Impact:** The pyramid's design incorporates natural lighting for the interior spaces, reducing energy consumption. However, it is rated as "partially sustainable" due to the use of non-eco-friendly materials like glass and steel (Buchanan, 2010). Figure 1



3- Case Study

This practical study aims to analyze selected examples of modern buildings integrated into traditional urban environments. The focus will be on specific architectural indicators such as **visual integration, spatial integration, material compatibility, urban scale, accessibility**, and environmental impact. These indicators will help assess how these modern structures affect their historical surroundings, measuring their harmony or contrast with the cultural and spatial identity of the cities they inhabit.

The study analyzes five key examples, such as **the Louvre Pyramid** in Paris and **The Shard** skyscraper in London. For each, the indicators will be applied to measure aspects of design and interaction with the surrounding environment. Additionally, correlation analysis will be used to understand the relationships between these indicators and how they influence each other. The ultimate goal is to arrive at precise conclusions about the impact of modern architecture on traditional cities and whether these structures enhance or clash with the identity of the space.

The results will offer fresh insights into how modern design can succeed or fail in traditional urban contexts, contributing to a balanced dialogue between modernization and cultural preservation.

3-1 The Louvre Pyramid (Paris, France)

- **Visual Integration:** The Louvre Pyramid presents a striking contrast with the traditional stone buildings that surround it, featuring a sleek, glass design. Despite this stark difference, the pyramid adds a contemporary aesthetic that does not overshadow the historical significance of the area, achieving a "partial" visual



2-6 Table of Indicators

Table 1 Provides a summary of the key architectural indicators derived from the theoretical framework, as prepared by the researchers.

Indicator	Description
Visual Integration	This indicator measures how well a modern building aligns with the surrounding traditional urban environment in terms of form and materials. It focuses on the aesthetic harmony between the new design and the historical buildings around it.
Spatial Integration	This evaluates the impact of the modern building on the flow of movement and transportation in the surrounding area. It examines how the building design influences paths, movement, and transitions within the urban context.
Material Compatibility	Refers to the extent to which the materials used in the modern construction match those used in nearby traditional structures. It considers the harmony between the old and new materials, such as stone or glass.
Urban Scale	Focuses on the proportion of the modern building in relation to the surrounding traditional structures. It analyzes whether the new design fits the urban scale without overshadowing existing views and buildings.
Accessibility	Indicates how easy it is for visitors and residents to access the modern building. This includes analyzing transportation methods, available routes, and the convenience of reaching the site from main city areas.
Environmental Impact	This indicator assesses the building's effect on the surrounding environment in terms of sustainable materials used and energy efficiency. It examines how well the design minimizes the consumption of natural resources and energy.



2-4 Environmental Sustainability and the Impact of Modern Buildings

With increasing awareness of environmental sustainability, it has become essential for modern buildings to adopt sustainable construction techniques and environmentally friendly materials. Environmental preservation is a core part of modern architectural design, especially in traditional environments that rely on natural building materials with lower energy consumption (Green, 2018). Research advocates for the use of techniques like solar energy, natural ventilation, and lighting systems, which help reduce environmental impact and achieve long-term sustainability (Miller, 2019). Cities that adopt such techniques in their modern buildings contribute to creating sustainable urban environments, enhancing their appeal while minimizing negative environmental effects on the surrounding areas (White, 2020).

2-5 Social Analysis and Interaction with the Traditional Environment

Modern architectural design has a direct influence on social behavior and interaction within public spaces, particularly in traditional environments. Researchers emphasize that buildings that consider the social context contribute to enhancing social interaction and the effective use of public spaces (Brown, 2021). Buildings that fail to achieve this alignment lead to feelings of isolation and a loss of belonging among local residents (Davis, 2020). On the other hand, buildings that incorporate open, flexible public spaces encourage community gatherings and interaction, thereby strengthening social relationships within the city (Roberts, 2019). Social interaction is one of the key factors that ensure the continued vitality of traditional environments.



2-2 Visual Integration in Modern Buildings

Visual integration is a key element for the success of modern buildings in harmonizing with traditional environments. This concept focuses on how the modern building interacts with its urban surroundings in terms of form, color, and materials. Studies emphasize that a lack of visual coherence between modern and traditional buildings can deteriorate the overall visual identity of the city (Smith, 2018). Modern buildings need to use materials and colors that are consistent with the city's traditional character, ensuring successful visual integration (Jones, 2020). Buildings that achieve this integration help enhance the city's visual identity without negatively affecting its architectural heritage (Anderson, 2019). Therefore, visual integration becomes a powerful tool in maintaining balance between modern designs and historical architectural identity.

2-3 Spatial Integration and Interaction with the Urban Scale

Spatial integration refers to how well modern buildings blend with the natural flow of movement within public spaces and their surrounding environment. Buildings that achieve good spatial integration improve pedestrian experiences and facilitate movement between different city spaces (Roberts, 2021). Studies show that modern buildings that fail to achieve this integration create isolation or disrupt the flow of movement, which negatively affects social interaction and the use of public spaces (Hall, 2020). Conversely, buildings that respect urban flows contribute to improving accessibility and achieving spatial harmony that complements the traditional urban fabric, leading to effective spatial integration (Smith, 2019). This axis is crucial in determining how well a modern building integrates with a traditional environment without disrupting urban cohesion.



the building; and environmental impact, assessing the building's sustainability in terms of materials used and energy-efficient technologies. The study uses correlation analysis to understand the relationships between these indicators using the SPSS statistical program. By doing so, it aims to provide clear insights into how successful or unsuccessful modern buildings are in integrating with the traditional urban context. The findings of this study will contribute to a deeper understanding of how modern architecture affects urban identity in traditional environments, paving the way for developing design strategies that balance innovation with respect for urban heritage.

2-Theoretical Framework: Key Axes of the Study

2-1 Modern Architecture and its Impact on Urban Identity

Modern architecture plays a crucial role in shaping the urban identity of contemporary cities, especially in areas with a strong traditional architectural heritage. Modern buildings often feature materials and designs like glass and steel, which raise questions about how these contemporary structures affect the traditional urban identity. Achieving a balance between innovation and respecting architectural heritage requires special attention from architects and urban planners (Frampton, 2015). Research shows that innovations that consider traditional elements, such as using local materials, significantly contribute to enhancing local identity, while neglecting these aspects creates a visual and cultural disconnect between residents and their surroundings (Curtis, 2017). Blending modernity and heritage is essential to ensure the continuation of cultural identity in traditional areas while simultaneously promoting urban development that aligns with current needs (Jones, 2020).



1 - Introduction

The relationship between modern buildings and traditional urban environments is one of the most critical issues facing contemporary cities. With rapid urban expansion and the continuous rise of modern architecture, it has become essential to study how these buildings affect the traditional urban context and urban identity. Architecture plays a crucial role in shaping the cultural identity of communities, and therefore, the interaction between modern structures and traditional environments raises important questions about how these buildings can be integrated without distorting the original urban character. The main challenge in this context is achieving a balance between architectural innovation and respect for urban heritage. Modern buildings often aim to present bold, technologically advanced designs, but these can sometimes clash with the surrounding traditional context. Therefore, there is a growing need to use scientific criteria to measure the impact of these buildings on the surrounding environment in terms of aesthetics, spatial relationships, materials, and environmental factors. This study is based on an analysis of global examples of modern buildings integrated into traditional urban environments, using a set of architectural indicators developed to measure the various impacts of these buildings. These indicators include visual integration, which measures how well the modern building fits aesthetically with the traditional environment; spatial integration, which considers the building's effect on the flow of movement and use of public spaces; material harmony, assessing the compatibility of the materials used in the modern building with those in the surrounding traditional architecture; urban scale, examining how well the size and height of the modern building align with neighboring structures; accessibility, measuring how easily people can access

المستخلص

تواجه المدن المعاصرة تحدياً كبيراً في دمج المباني الحديثة ضمن البيئات العمرانية التقليدية مع الحفاظ على الهوية الحضرية. تشكل هذه العلاقة بين العمارة الحديثة والتراث العمراني محور الاهتمام في هذا البحث. تتمحور مشكلة البحث حول كيفية تأثير الأبنية الحديثة على الهوية الحضرية في المناطق التقليدية، وما إذا كانت قادرة على التفاعل بشكل إيجابي مع السياق الحضري دون تشويه طابعه التقليدي.

تهدف الدراسة إلى تحليل هذا التأثير من خلال دراسة مجموعة من الأمثلة العالمية باستخدام مجموعة من المؤشرات المعمارية مثل التكامل البصري، التكامل المكاني، الانسجام المادي، النطاق الحضري، الوصلية، والتأثير البيئي. تم تطبيق المقياس الثلاثي (ضعيف، جزئي، ممتاز) لتقييم كل مؤشر، مع استخدام معامل الارتباط لتحليل العلاقات المتبادلة بين المؤشرات المختلفة.

أظهرت النتائج أن هناك ارتباطاً قوياً بين التكامل البصري والانسجام المادي، مما يعني أن المباني التي تتمتع بتكامل بصري أفضل مع البيئة التقليدية غالباً ما تستخدم مواد تتناسب مع السياق التقليدي. كما تبين وجود علاقة قوية بين التكامل المكاني والنطاق الحضري، حيث كانت المباني التي تتميز بتكامل مكاني جيد متوافقة حجمياً وارتفاعياً مع المباني التقليدية المجاورة. ومع ذلك، كشفت الدراسة عن علاقة ضعيفة بين الوصلية والتأثير البيئي، مما يعني أن كفاءة الوصول إلى المباني لا ترتبط بمستوى الاستدامة البيئية. خلص البحث إلى أن المباني الحديثة تواجه تحديات كبيرة في تحقيق توازن بين الابتكار واحترام الهوية الحضرية التقليدية، مع الحاجة إلى تعزيز الاستدامة البيئية لتحقيق تأثير إيجابي طويل الأمد.

الكلمات المفتاحية: المباني الحديثة، البيئات الحضرية التقليدية، الهوية الحضرية، التكامل البصري، التكامل المكاني، التناغم المادي و التأثير البيئي



Abstract

Contemporary cities face significant challenges in integrating modern buildings into traditional urban environments while preserving urban identity. This study focuses on the relationship between modern architecture and urban heritage. The research problem revolves around how modern buildings affect urban identity in traditional areas, and whether they can interact positively with the urban context without distorting its traditional character.

The study aims to analyze this impact by examining a range of global examples using architectural indicators such as visual integration, spatial integration, material harmony, urban scale, accessibility, and environmental impact. A three-point scale (weak, partial, excellent) was applied to assess each indicator, and correlation analysis was used to examine the relationships between these various indicators.

The results revealed a strong correlation between visual integration and material harmony, indicating that buildings with better visual integration with the traditional environment often use materials that align with the traditional context. Additionally, there was a strong relationship between spatial integration and urban scale, meaning that buildings with good spatial integration are generally compatible in terms of volume and height with neighboring traditional structures. However, the study found a weak relationship between accessibility and environmental impact, suggesting that the ease of access to buildings does not necessarily correlate with their environmental sustainability.

The study concludes that modern buildings face significant challenges in balancing innovation and respecting traditional urban identity, with a need to enhance environmental sustainability for a more positive long-term impact.

Keywords: Modern buildings, Traditional urban environments, Urban identity, Visual integration, Spatial integration, Material harmony, Environmental impact.

The Impact of Modern Buildings on Traditional Urban Environments and Urban Identity

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تأثير المباني الحديثة
على البيئات العمرانية التقليدية والهوية الحضرية

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- Accurately recognize the presence of efflorescence.
- Ascertain whether the efflorescence is a result of a new building bloom.
- Utilize the provided troubleshooting list to identify the underlying factors contributing to efflorescence, and address these reasons prior to attempting its removal.
- Take into account materials with lower levels of soluble salts.
- Coatings should not be relied upon as the only method to manage efflorescence.

Design

- Separate the outer layer of bricks from the rest of the structure by creating a gap filled with air.
- Apply a waterproofing treatment to the outer surface of walls that extend below ground level.
- To address walls that lack an air space, it is advisable to use a damp proof coating to create a separation between the brick and the backing.



6. Conclusions

Brick is one of the most used masonry units in wall construction. One of the primary challenges associated with using brick in wall construction is the efflorescence phenomenon. This article concludes with a strategic approach aimed at reducing the impact of factors that cause this phenomenon and mitigating their impact on the wall. The review yielded the following findings:

1. The main source of the problem in clay brick production is the availability of salt in the raw material; treating the soil before its use in the production industry could potentially solve part of the issue.
2. At the same time, more than one solution may be required for using the produced brick in external load-bearing walls.
3. When fine cementitious materials like silica fume are used in place of some clay, the efflorescence effect is reduced accurately and satisfactorily.
4. If the masonry wall is located on the external surfaces of the building, it may be more practical to use a coating material for these surfaces.

7. Summary of Recommendations

General

- Develop and build brickwork with the aim of optimizing its ability to withstand water infiltration.



way for a precise, efficient, and cost-effective technique to measure efflorescence. This has been accomplished by the development of an innovative, cost-effective, and high-performing electrical apparatus that delivers precise measurements of the salinity ratio. This technology has greatly decreased the typical duration for assessing efflorescence from 7-10 days to around one to three hours [36].

5.5 Using Additional Materials

Using new materials from available solid waste in the land is considered one of the methods for reducing waste in the environment [37–41]. For effect on the efflorescence phenomenon, much research has been done to use new materials in the clay brick composition to find their effect on the efflorescence [27]. Nhabih *et al.* [42] investigate the usage of silica fume. When adding silica fume by 15% of soil weight to the sample, it reduces the efflorescence by 92.3%. Riaz *et al.* [43] used brick kiln dust as a partial replacement for clay, which obtained that decrease in unit weight with a reduction of mechanical properties while increasing the resistance to the efflorescence. Zanelli *et al.* [44] investigate the usage of construction and demolition residual in the brick production. The obtained results indicate a decrease in the mechanical properties and increase the porosity in the brick with a reduction in the efflorescence. Argha and Bari [7] used fly ash in the mortar to react with some kind of available salt in the bricks moisture, which caused the reduction in the efflorescence.



5.3 Use of Nano coatings

Many researchers have tried to use the coating method of the brick wall surface to prevent the evaporation effect on the surface of bricks [19, 31]. The rapid evolution of nanotechnologies in construction emerged soon after their discovery, giving rise to an innovative generation of specialized building materials capable of addressing emerging market demands [32]. Nanotechnology integration facilitated the combination of these nanosized particles with organic components. This utilization aimed to create surface roughness while concurrently lowering surface free energy, leading to the development of materials with super hydrophobic properties [33]. Ginchitskaia *et al.* [34] used carbon nanotubes in the coating cover, which increased the mechanical properties by 30–35%. Another study coated the brick surface with ZnO nanoparticles through chemical deposition and modified it with silver nanoparticles to impart hydrophobic, photocatalytic, and antibacterial properties. The modified brick nanocomposites demonstrated increased flexural strength. The efflorescence test revealed that the flexural strength of the brick modified by ZnO/Ag was almost 1.8 times greater than that of the non-coated brick, and the modified brick exhibited reduced efflorescence on the surface [35]. The findings indicated a significant improvement in the efflorescence properties of the brick, leading to an increased interest in the utilization of nanomaterials.

5.4 Using new Technique

Efflorescence poses a major challenge for clay bricks due to its adverse environmental effects. This issue has a significant impact on the quality of the bricks and therefore is a challenge to address. This research presents a



5. Solutions of Efflorescence

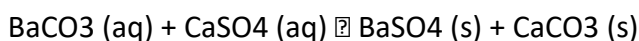
5.1 Fuel Change

Most fuel types available in the burning process, with the exception of wood, anthracite coal, and coke, produce sulfur. Therefore, using these materials during the burning process will be more efficient [19].

5.2 Adding Salt

This technique involves adding types of salt, such as barium carbonate, to react with soluble salts found in clay, such as calcium sulfate, resulting in the creation of insoluble salts, including barium sulfate and calcium carbonate [29].

This approach is designed to reduce the amount of soluble salts, ultimately minimizing efflorescence on the surface of bricks or construction materials. This process's chemical reactions can be represented as follows:



This reaction results in the formation of barium sulfate (BaSO_4) and calcium carbonate (CaCO_3), both of which are relatively insoluble in water. As a result, the brick's efflorescence is reduced. It's crucial to emphasize that while this method has been contemplated for managing efflorescence, its practical implementation and efficacy can be influenced by diverse factors. These factors include the clay's exact composition, current environmental conditions, and the concentration of soluble salts. Furthermore, the use of barium compounds necessitates careful consideration due to potential environmental and health-related concerns about barium [30].



should be noted that even if appropriate materials and good workmanship are employed, a structure will not necessarily be successful and enduring if the design is flawed. Efflorescence occurs when there is water in the masonry is the main source of moisture responsible for the occurrence of efflorescence. shown in Figure 4.

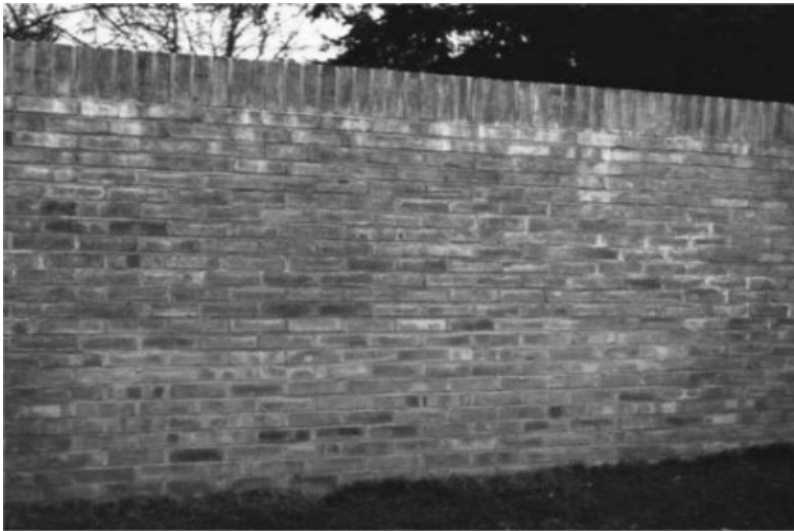


Figure. 4 Efflorescence from Water Penetrating Wall Top

Precipitation will infiltrate all masonry walls to varying extents, particularly if they are inadequately built or constructed. Restricting the presence of moisture effectively inhibits the formation of efflorescence. Consequently, the success of the project relies heavily on the careful design and meticulous consideration of specific crucial elements, especially those related to the prevention of moisture infiltration into the brickwork and the proper drainage of water from the tops of walls and horizontal surfaces [28].

affected by many factors, which are the ability to dissolve in water, size of the salt particle, temperature of the subjected weather to the wall face, and capillary of the walls [19, 24, 25].

4.3 Under Ground Salty Water

As shown in Figure 3, when the wall is in contact with the ground and the underground water contains soluble salt, the water will rise in the wall due to the capillary action, and due to the different weather conditions on both surfaces of the wall, the soluble salt will dry on the heated surface of the wall [26].

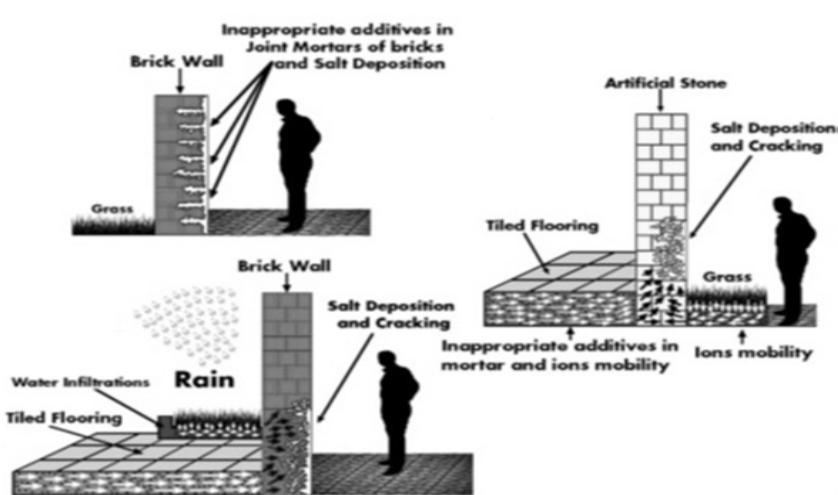


Figure. 3 Capillary effects on the efflorescence [27]

4.4 Design and Detailing

Poor wall that dissolves soluble salts. Rainwater that infiltrates or makes contact with masonry is the main source of moisture responsible for the occurrence of efflorescence material selection or craftsmanship can undermine even the most exquisite design and detailing. Conversely, it



on the fact that the soluble compounds are more easily seen on the brick's darker surface. This is because brick has a porous structure that allows water to be transported through it, which is necessary for the bond between brick and mortar to form [18].

4.1 Used Fuel In Burning Process

During the burning process of the bricks, an amount of gas is released into the air, containing a high amount of sulfate. This gas reacts with the available moisture or water on the brick surface, producing an effective acid. This acid then reacts with the available lime or magic in the brick, resulting in the formation of efflorescence [19–21].

4.2 Available Salt in Raw Material

All types of clay contain different types and amounts of salt since the clay is formed from the decomposition of different types of rock. Available salts in the clay may be sulfate of iron, hydrated silica, or aluminum salt, which vary in amount and particle size [19, 22]. Abilities of available salts for solution in the water vary, which show their effect on creating efflorescence, which means the high soluble salt in moisture is a higher maker of efflorescence [19]. One of the available salts that is little soluble in the water is iron pyrites, which are available in most types of clay and react with air when exposed to weather that causes the formation of iron sulfate. By the solution of iron sulfate in the water or available moisture in the brick, the yellow efflorescence will be produced. If the bricks are subjected to heat, the iron sulfate will dissolve, and the obtained sulfate will attach to available limestone or magnesia [19, 23]. The activity of these salts in the clay is



4. Causes of Efflorescence

Efflorescence can occur through various intricate methods. Efflorescence is the result of water with dissolved salts rising to the surface of brickwork, where the water evaporates and leaves behind the salts. The salt solutions can move across the surfaces of masonry units, between the mortar and brick units, or via the pores of the mortar or brick units.

Efflorescence can only occur if specific circumstances are present simultaneously:

- The brickwork must contain or be in touch with soluble salts. These salts can be found in various components such as mortar ingredients, backing materials, trim, neighboring soil, brick, and so on.

- The user did not provide any text. The salts need to be in touch with a water source for a sufficient duration to dissolve.

- The user did not provide any text. The brickwork must have a pore structure that enables the movement of salt solutions to the surface or other areas where water can evaporate. A driving force, such as difference in temperature or humidity, guides the movement of moisture through the pore structure. People who are unfamiliar with efflorescence often mistakenly believe that it is caused by the substance on which it is found, typically the brick. The primary source of soluble chemicals that cause efflorescence on brick surfaces is typically the materials that come into contact with the brick, such as mortar, grout, concrete masonry, concrete, soil, or other substances. Nevertheless, soluble chemicals can also arise from within brick units. Efflorescence, being predominantly white in hue, tends to be more noticeable when contrasted with darker shades. According to John Sanders and Denis Brosnan, the misconception that brick causes efflorescence is often based

brick building, including the use of sealants, surface treatments, or alterations to the materials

2. .Evaluating the Efficacy of Efflorescence Prevention Methods: Assessing the effectiveness of various techniques to prevent efflorescence in real-world scenarios by conducting tests and analyzing the results.
3. Creating Innovative Solutions: Suggesting new approaches or adjustments in the use of materials and manufacturing methods to tackle the issue of efflorescence.

3. Methodology

After reviewing previous experimental work and discussing efflorescence, we have discussed the factors that cause the appearance of efflorescence. We have also discussed the solutions for each factor, as shown in the following Figures:

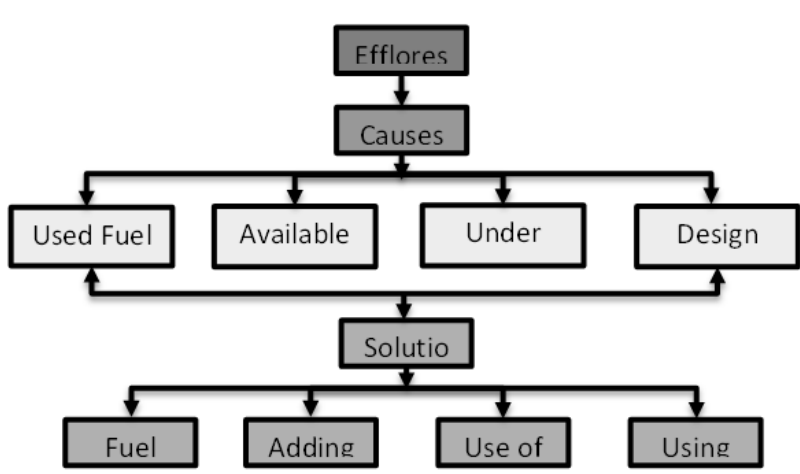


Figure.2 Methodology steps



masonry walls were placed, whereas the efflorescence caused by gypsum took longer, possibly even more than a year, to appear on the face of the walls [2, 12, 14], a phenomenon primarily observed in older buildings [11]. Due to the high usage of natural raw materials, many trials have been conducted to modify brick compositions [15–17]. Khan *et al.* [4] used marble waste as a partial replacement of clay in bricks, varying the ratios from zero to thirty percent by 5%. They observed an increase in porosity as the replacement rate increased, leading to increased water absorption, decreased strength, and increased efflorescence. Argha and Bari [7] conducted an investigation into efflorescence on the partition walls in garages. They found that the lower part of the walls had a higher chloride content, and they recommended using a low alkaline cement in the mortar to reduce the reaction between the available soluble salt in the brick and the external weather that causes efflorescence. Shahidi, [10], used a computer program simulation to predict the efflorescence in bricks based on their chemical composition. Khitab *et al.* [5] conducted an investigation into the use of waste brick and ceramic powder as a substitute for clay in bricks. They found that 12% of ceramic powder, combined with 15% of clay powder, or 27% of waste, can serve as a partial replacement for clay without significantly impacting the main brick requirements. This article discusses the factors that lead to efflorescence in masonry brick walls, as well as the strategic measures to minimize its occurrence and impact.

2. Research Significant

This article discusses the following topic

1. Study on Efflorescence Mitigation Techniques: Examining and assessing existing methods employed to reduce efflorescence in



its behavior; carbonate elements increase the brick's porosity after burning, while alkaline elements like potassium and sodium cause an increase in efflorescence due to chemical reactions after placement, and quartz acts as a filler [5, 8, 9]. The chemical composition of clay generally determines the color of the produced brick; a high content of organic material results in a dark color, a high content of iron oxide results in a red color, and a high content of limestone results in an orange color [2]. Masonry is important, especially for the building's decoration and architectural purpose [7], which is many times affected by the efflorescence phenomenon [10, 11]. As depicted in Figure 1 below, the efflorescence phenomenon involves the movement of soluble salts and gypsum from the brick to the surface, where they absorb heat from the evaporation of the moisture that contains these salts and gypsums [7, 12, 13].



Figure.1 Brick Masonry wall subjected to efflorescence [10]

Most of these salts are composed of alkaline sulfate or sodium chloride [1, 7, 12].The efflorescence caused by the salt appeared shortly after the



1. Introduction:

Brick is one of the most performable used masonry units in the world because it has many desirable properties, such as light weight, easy availability, thermal insulation, and sound insulation [1–3]. For the first time, bricks were discovered in Mesopotamia, which was used nine thousand years before chrisms. From that time until today, many changes have been made in its shape, composition, texture, and properties [2]. Today, the world produces approximately one thousand five hundred billion bricks annually [4, 5], resulting in the use of approximately three hundred fifty million tons of clay in this industrial process [5]. The properties of produced bricks are determined by three factors: the raw materials, the production process, and the location of use [2]. Two properties determine the durability and life time of clay bricks: compressive strength, which is responsible for withstanding external stress, and porosity, which is the most important property. An increase in porosity in bricks increases water absorption, moisture content, and efflorescence, which in turn decreases compressive strength and shortens the brick's lifespan [2, 6]. In Uganda, over 80% of living place walls are constructed from bricks [1]. Similarly, in Pakistan, masonry units are the most commonly used for construction [5]. Clay, which is obtained from the ground through the deterioration of various types of rocks, is one of the main compositions of clay bricks, containing a variety of chemical elements and salt amounts [2]. The main chemical compositions of clay bricks are silicon oxide, aluminum oxide, iron oxide, ferrous oxide, potassium oxide, titanium oxide, sodium oxide, calcium oxide, and magnesium oxide [2, 7]. Aluminum oxide and silicon oxide are two main compositions of clay in the range of 40–95% [2, 7, 8]. Each element in the brick composition influences

المستخلص

إن بناء المباني، وخاصة المساكن السكنية للمجتمعات، هو صناعة مهمة على نطاق عالمي. وكثيراً ما يتم استخدام وحدات البناء مثل الطوب والكتل والأحجار كمواد. ويحظى الطوب بتقدير كبير بسبب توفره على نطاق واسع وفعاليتيه من حيث التكلفة وقدراته العازلة الممتازة. ومع ذلك، فإن وجود الترسبات يشكل صعوبة في بناء الجدران المصنوعة من الطوب. يشير الترسبات إلى العملية التي تنتقل بها الأملاح إلى الطبقة الخارجية من الطوب، مما يؤدي إلى تكوين رواسب بيضاء والتأثير سلباً على جاذبيته البصرية. ويحدث الترسبات بسبب ظروف مختلفة، مثل وجود الأملاح في الطوب، واستخدام الوقود الأحفوري أثناء عملية الحرق، والبناء في مناطق تحتوي التربة على أملاح قابلة للذوبان. إن وجود الأملاح في المواد الخام المستخدمة في تصنيع الطوب هو عامل بارز يساهم في هذه المشكلة. ومع ذلك، فإن اتخاذ تدابير لإصلاح التربة قبل عملية التصنيع يمكن أن يخفف بشكل فعال من هذه المشكلة. بالإضافة إلى ذلك، هناك تدابير أخرى يمكن استخدامها للحد من حدوث التزهير، بما في ذلك استخدام الطوب المقاوم للتزهير وتطبيق المواد المانعة للتسرب للحد من ظهور الملح.

الكلمات المفتاحية : طابوق, التزهير, محلول ملحي, التركيب الكيميائي



Abstract

The construction of buildings, especially residential housing for communities, is a significant industry on a global scale. Masonry units such as bricks, blocks, and stones are often utilized materials. Bricks are highly regarded because to their widespread availability, cost-effectiveness, and excellent insulating capabilities. Nevertheless, the presence of efflorescence presents a difficulty in the construction of brick walls. Efflorescence refers to the process in which salts move to the outer layer of the brick, resulting in the formation of white deposits and negatively impacting its visual appeal. Efflorescence is caused by various circumstances, such as the existence of salts in bricks, the utilization of fossil fuels during the burning process, and constructing in regions with soluble salts in the soil. The presence of salts in the raw materials utilized in brick manufacture is a notable factor contributing to this problem. However, taking measures to remediate the soil before to the manufacturing process can effectively mitigate this issue. In addition, there are other measures that can be employed to reduce the occurrence of efflorescence, including the use of efflorescence-resistant bricks and the application of sealants to limit the migration of salt.

Keywords: Bricks, Efflorescence, Salt Solutions, Chemical Compositions

استراتيجيات للتخفيف من ظاهرة الترسيب في الجدران المبنية باستخدام الطوب الطيني: دراسة مرجعية

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Strategies to Mitigate Efflorescence in Walls Constructed Using Clays Bricks; A Review Article

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The concrete advantages are contingent upon both the proven performance enhancements identified in the assessment and the long-term sustainability of the implemented solutions. While this research offers a quantification of certain financial advantages, such as annual energy consumption, it is important to acknowledge that the actual benefits are contingent upon the accuracy of predictions, verification of installed devices and systems meeting design specifications, and the sustained performance during procedure.

The expense disparities between environmentally-friendly designs and conventional projects are predominantly dependent on the precise assessment criteria (credits) that are achieved. The impact on this particular component is anticipated to arise from both client preferences and existing cost constraints. The constraints mentioned are dependent on various aspects, including the scale of the project, the characteristics of the location, and the design approaches utilized.

The potential cost escalation could be significant in the event that a customer indicates a preference for particular ecologically sustainable features, and/or if the circumstances surrounding their integration lead to a substantial supplementary expenditure.



tight restrictions on the use of construction materials that do not meet basic sustainability criteria. They also advocate for the importance of transparency and accountability. Furthermore, these policies explicitly acknowledge the significance of sustainability. Another advantage of these laws is that they effectively discourage the utilization of construction materials that fail to meet the necessary criteria. Every building expert must adhere to these criteria, which encompass comprehensive procedures and meticulous overviews of those procedures.

Manzoor *et al.*, (2021) state that a key driver behind the construction of sustainable buildings is to promote the acquisition of knowledge in emerging building technologies among building experts. This factor was identified as a significant catalyst for the development of sustainable structures. One of the primary driving forces behind the creation of eco-friendly buildings is the desire to protect the environment. The government's policies may facilitate a larger number of folks to enhance their proficiency in contemporary technologies.

5 - Conclusion

The tangibly beneficial outcomes that result from the economic investment in green buildings, the availability of relevant resources, and an awareness of sustainable building practices, such as cost reductions brought about by increases in energy performance as well as decreased water consumption, material consumption, and waste.

Conceptual benefits encompass several advantages such as enhanced workplace productivity, improved health and satisfaction in residential environments, and alleviated strains on infrastructure, among others.



Something can transition from being perceived as a hindrance to being a catalyst if the factors that classify it as a hindrance are reinterpreted as factors that provide answers to a problem. Thus, obstacles to implementing sustainable construction practices, such as limited access to education and information, perceived higher initial expenses, conflicting incentives, absence of government regulations, and neglecting building operations, have the potential to become catalysts for promoting sustainable building practices if they are reversed.

The government must take steps to fulfill the objectives mentioned above, which include designing and implementing appropriate policies. Internationally, sustainable construction is commonly understood to be primarily influenced by government policy.

Manzoor *et al.*, (2021), states that the government of the United Kingdom has implemented numerous legislative efforts and legislation to promote environmentally friendly practices in the real estate industry.

Tabassi *et al.*, (2016) assert that policies serve as how the government guides the construction sector toward sustainability. They argue that policies are instrumental in steering the construction sector towards sustainable practices. This is supported in the UK as the government provides and promotes initiatives that incentivize the construction industry to use sustainable techniques.

Furthermore, Erdogan *et al.*, (2019) highlight the importance of government engagement in environmentally sustainable construction methods and the establishment of legislation to effectively govern and regulate these procedures. They assert that undertaking this action is imperative to safeguard the ecology in its entirety. Government rules impose



Wardhana and Sari, (2023) further validate the notion that a deficiency in suitable training for construction professionals is a significant barrier to the development of sustainable buildings. In recent years, professional organizations have been striving to incorporate sustainable alternatives into their professional qualification frameworks.

4.2 - Project Management Practice Implications for Sustainable Construction

To tackle the aforementioned difficulties, it is necessary to have a facilities manager who can actively promote and support sustainable methods. Increasing their utilization of green solutions is believed to enable facility managers to make a more substantial contribution to sustainable buildings.

Kang *et al.*, (2016) reported an increase in the recognition among facility managers of the importance of their role in promoting sustainability. This insight stems from the heightened emphasis on the significance of sustainability. They contend that the development of the facility management sector has been influenced by climate change and the drive to reduce carbon emissions, despite the perception that FM is typically associated with conservatism. The reason for this is that climate change is leading to an increase in the frequency and intensity of extreme weather phenomena.

Gunduz and Almuajebh (2020) identified several factors that drive sustainable project management, these include legislation, corporate image, organizational ethos, leadership from senior management or directors, customer pressure, cost reduction throughout the project's life cycle, and pressure from employees and shareholders to adopt sustainable practices. Constructing environmentally friendly buildings can be much simplified by considering these variables during the building process.



Gunduz and Almuajebh (2020) discovered that multiple variables hinder the adoption of ecologically sustainable construction practices. Several factors contribute to this predicament, including inconsistent financial incentives, inadequate government legislation that fails to promote the development of sustainable structures, and an approach to construction operations that regards sustainability as a secondary concern.

While the construction sector has been progressively advancing towards the development of more ecologically conscious buildings, other businesses have also been integrating sustainable practices into their daily operations and educational curricula for more than ten years (Kang *et al.*, 2016).

Fields such as architecture have been using sustainable building methods for a somewhat longer duration compared to the construction industry. The building sector lacks sufficient knowledge on ecologically sustainable techniques, falling short of the level of advancement it should have reached.

Ogunde *et al.* (2017) identified a major hindrance to the use of sustainable construction technologies: a dearth of appropriate knowledge, they argue that the dearth of knowledge and the absence of consensus among professionals in the construction industry are hindering the implementation of environmentally sustainable plans.

Zhang *et al.*, (2014) found that building specialists, who are typically confident in their ability to gain and utilize knowledge, saw a decrease in optimism when faced with problems related to sustainable construction. This remains true even though building specialists have exhibited confidence in their ability to provide understanding.



These concepts have been examined in the context of comparing and contrasting conventional and modern houses, to create energy-efficient structures in a hot and arid region of Iraq (Abbas and Razaij, 2021).

The design criteria encompass various aspects such as the selection of location, distance between buildings, arrangement, building enclosure, and shape. Based on the study's findings, historic dwellings had a significantly lower average temperature than modern homes throughout the hot summer months.

4.1 - Impediments to Sustainable Construction Project Management

The conceptual framework that has been developed has the potential to guide facilities managers in designing sustainable buildings. However, there are various factors related to sustainable buildings that may hinder the implementation of the facilities manager's role in achieving sustainability. Insufficient expertise and comprehension of smart buildings, which can drive technological innovation by facilities managers, along with a lack of awareness, education, and tools, can all be classified as obstacles to project management in the attainment of sustainable facility structures (Aslam *et al.*, 2021).

Tokbolat *et al.*, (2020) concur that the absence of specialized and scientific training for facilities managers limits our current understanding of project management issues and will inevitably affect sustainable management as buildings adjust to new technology.

Tabassi *et al.* (2016) contend that the absence of training hampers our current understanding of project management challenges and will undoubtedly impact sustainable management. According to them, the absence of training is problematic as it hinders our ability to comprehend the most efficient methods for managing tasks.



the adaptability of green building certification schemes and the highly building-specific nature of individual investments.

Zhang *et al.*, (2014) argue that the cost of constructing green buildings is not always higher than that of traditional constructions. Despite the apparent clarity, it is evident that engaging in activities necessary for certification or attaining higher levels of certification will result in higher building costs.

Manzoor *et al.* (2021) found that acquiring a certification for a green building involves extra expenses, along with different "soft costs" related to the design of the construction and the assessment of its environmental impact. These costs may encompass both explicit and implicit expenditures.

Nevertheless, when considering the overall expenses of a certified green building, which encompass the costs of research and design in addition to the basic planning and construction costs, lower-tier green structures may only incur a slightly higher expenditure compared to conventional construction (Zhang *et al.*, 2014).

4 - Sustainable Buildings Projects in Iraq

It is indisputable that the sustainable construction movement is rapidly gaining momentum worldwide. Indeed, the concepts of "sustainable building" or "sustainable methods" have a lengthy lineage, emerging as a response to both environmental conservation efforts and an energy crisis. Consequently, Iraq is experiencing a swift transformation in its built environment, with a significant surge in the desire to construct eco-friendly buildings.

The term "sustainable building" encompasses various concepts that have been previously explored and implemented in construction projects.



Mohd-Rahim *et al.* (2017) found that buildings in the UK that undergo assessment using the BRE Environmental Evaluation Method have longer operating durations and require an annual premium that is 28 percent higher than the usual rate. Additionally, they find that rental residences with green certification command a greater price compared to those that are being sold.

This emphasizes the importance of certification in reducing disparities in information and creating an inexpensive method for potential renters to evaluate the overall quality of an investment. It is important to mention that the financial value of green buildings extends beyond the savings gained on operational expenses.

Goel *et al.*, (2020) discovered that consumers are not only interested in energy consumption certificates, but they are also prepared to pay extra for sustainability certifications.

Similarly, Oke *et al.*, (2023) finds that the price of LEED buildings exceeds the value of their reduced running costs. This indicates that there is an additional value placed on "sustainability" or commercial advantages that go beyond simply reducing operating expenses.

It is crucial to note that Mohd-Rahim *et al.*, (2017) found that the economic worth of green building certification diminishes as the number of certified buildings in the vicinity increases. This implies that consumers who make their purchase later will receive a lower premium for certification.

3.3.5 - Expenses and Efficiency of Investments

There is a lack of strong scientific evidence about the expenses and advantages of expenditures needed to acquire green building accreditation. The limited generalizability of cost projections is attributed to two factors:



Constructing buildings incurs intangible social costs that are difficult to measure or value due to the utilization of energy, which subsequently impacts the quality of air and water, as well as the discharge of rainwater, which affects the quality of water. The progression of municipal growth is impacted by the selection of a location and the restoration of the site, which in turn indirectly influences issues such as congestion, air pollution, and other challenges faced by the municipality.

Wang *et al.*, (2014) found that sustainable certified buildings in the UK had a positive impact on neighboring property values, even for houses that are not certified, a phenomenon known as the "gentrification effect." This discovery implies that certification is linked to beneficial outcomes.

The presence of these externalities indicates a state of balance in which economies construct fewer environmentally friendly structures than is optimal. This is likely to occur even if the imbalances in knowledge are totally resolved. Despite the potential for profit organizations to aggressively respond to a signaling approach that addresses hidden information about the environmental quality of buildings, these corporations currently lack the motivation to solve their own inefficiencies internally.

3.3.4 - Cost of Obtaining Sustainable Certification

Shi *et al.*, (2014) discovered that Green Mark–certified residences in Singapore command a 9.9 percent higher price in the selling market, despite the fact that initial transactions only require a 4.4 percent premium. This implies that green certification could reduce information imbalances in the economy when it comes to reselling.



Building qualities, such as efficacy and interior air quality, pose challenges in terms of pre-purchase or pre-lease detection and confirmation. This resemblance to a consequential encounter, wherein the discernment of the worth of a product is only possible post-consumption, implies that the value of a structure remains unknown until it is acquired or rented.

In addition, Oke *et al.* (2023) propose that the presence of professional investors, who possess a stronger conviction in the profitability of energy efficiency enhancements, may result in planners allocating greater financial resources to energy performance initiatives. This can be due to the increased trust of institutional investors in the profitability of energy performance improvements.

The difficulty in ascertaining information about building quality may result in the construction of unsustainable buildings. This scenario involves the displacement of high-quality structures (sustainable buildings) by low-quality buildings (conventional buildings), which in turn hinders the encouragement of more investments in sustainable development. The major policy tool used to promote green buildings is certification systems such as LEED (Wardhana and Sari, 2023), this challenge serves as the driving force behind the implementation of these systems.

3.3.3 - External Factors

Buildings provide a substantial contribution to air pollution, and regulations for sustainable construction should encompass a broader spectrum of concerns beyond only information-related ones. Building construction, operation, and demolition throughout the life cycle of a structure are accompanied by a multitude of externalities that have not been assigned a monetary value. The construction process, including the proper disposal of construction waste, can impact the quality of both water and air (Dang *et al.*, 2021).



In this study, Shi *et al.* (2014) provide evidence that investments in Singapore's Green Mark accreditation for ecologically responsible buildings yielded positive results when more stringent environmental regulations were introduced. Engaging in beyond-compliance activities can be utilized to cultivate favor with authorities, as well as with environmentally aware consumers or other stakeholders.

3.3.1 - Lack of Economic Capability

Notwithstanding the various potential benefits that may be obtained from building in a sustainable manner, the market is continually under producing sustainable constructions due to a number of significant market faults. These flaws are the reason why the market consistently under produces sustainable constructions. Inequalities in information and the existence of externalities are two examples of the issues that are associated with the market. According to Pham *et al.* (2014), the present trend toward "Sustainable Building" might be seen as an attempt to bring the "private expenses" of structures more in line with the "Social Expenses" that are hidden beneath the surface.

3.3.2 - Asymmetry of Information

Regarding sustainable buildings, there are sometimes variations in the information provided, which can lead to a poor representation of architectural features that are difficult to assess. Builders possess a greater understanding of the construction business compared to building owners, whereas building owners or inhabitants have a superior awareness of the design and performance characteristics of the structure compared to potential buyers or tenants.



Improved efficiency may arise from more effective use of energy and water, as well as from more productive employees (thanks to retention and advancement efforts) (Sekerin *et al.*, 2018).

Additional benefits may accrue to building owners from sustainable design, such as protection from the effects of climate change, new regulations, and other environmental threats. Furthermore, as per Gunduz and Almuajebh (2020), one way for a business to reduce its risk exposure is to use fewer inputs like water and energy, whose prices might fluctuate wildly.

As an illustration, Erdogan *et al.*, (2019) demonstrate that climate-related disturbances increase the premium that is paid for green-certified dwellings in the state of California, where modern and higher-quality industrial structures may have a higher overall energy consumption compared to old buildings; however, these buildings are fewer susceptible to damage caused by extreme climate.

According to Shi *et al.*, (2014), expenditures made in “Singapore's Green Mark” designation for environmentally friendly buildings paid off when stricter environmental rules were implemented. Beyond-compliance activity can also be employed to curry popularity with authorities, in addition to connecting with green customers or other interested parties of positive externalities. This can be accomplished by taking advantage of sustainable marketing advantages or by appealing to other participants who are environmentally conscious.

Pham *et al.* (2014) found that contemporary and higher-quality commercial structures may consume more energy overall compared to older buildings. However, these buildings are also more resistant to the impacts of weather disturbances.

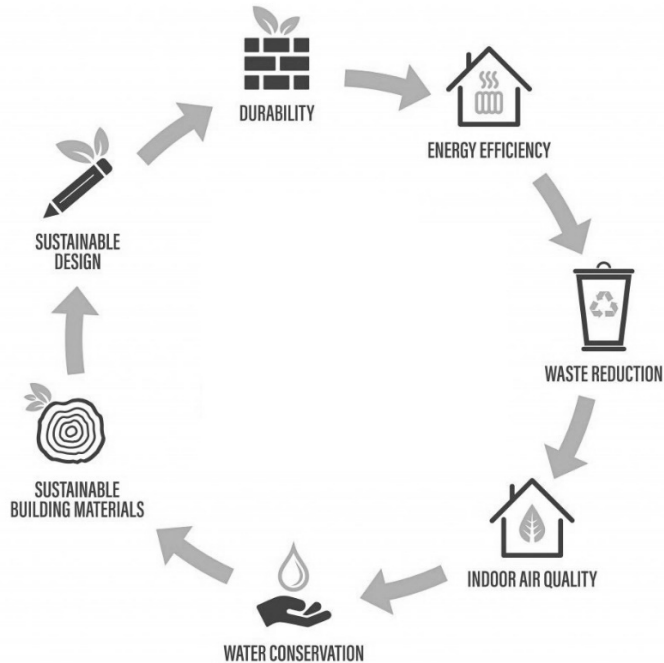


Figure (4): Economic Advantages of Sustainable Construction
(Source: Erdogan *et al.*, 2019)

3.3 - Market Advantages of Sustainable Construction

The decrease in operational costs and the rise in productivity can both contribute to an augmentation in the asset valuation of the structure, which is advantageous whether it is being sold or rented. If the operator of a sustainable structure can exploit sustainable marketing opportunities or appeal to environmentally conscious participants, they may gain economic benefits from the provision of beneficial externalities. This, in turn, can provide additional direct advantages to the operator of sustainable construction.



markets in the residential real estate sector. This study examined the residential real estate sector.

Arif *et al.* (2009) conducted a separate study to examine the influence of environmental certification on the pricing of commercial real estate buildings. A study revealed that Energy Star-Certified buildings and "LEED" Certified structures in the same metropolitan location have price premiums of 10% and 31% respectively, compared to non-certified buildings. It was also shown that this price premium is applicable to both LEED and Energy Star certifications. Unlike the other buildings in the region, which lack the necessary environmental accreditation, this skyscraper stands out.

3.2 - The Economic Justification for Policies Concerning Sustainable Construction

This section will explore the theoretical rationale for designing eco-friendly buildings and implementing environmentally conscious building policies. The reasons for constructing buildings sustainably include improved building efficiency and greater opportunities for marketing. Market shortcomings such as asymmetric information and negative externalities can be addressed by establishing green building policies and methods, where Figure (4) showing the main principle to achieve success marking of sustainable construction.

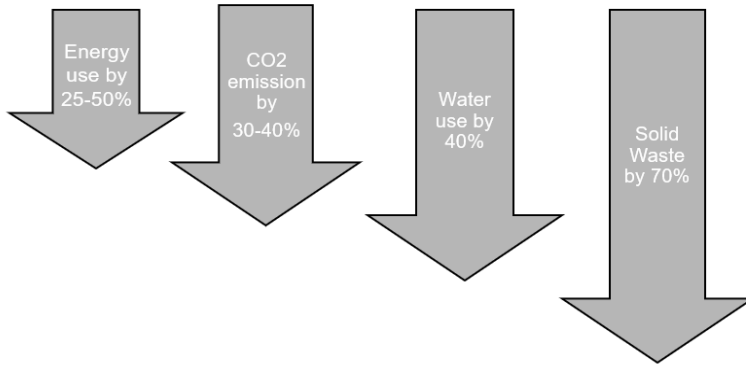


Figure (3): Visual Representation of Green Building Benefits
(Source: Sang *et al.*, 2018)

In a recent study, Luo *et al.*, (2022) have presented findings that demonstrate a positive impact of sustainable features in buildings on rental and sales prices per net square meter. Specifically, the research indicates an increase of around 21 percent and 26 percent in rental and sales transaction prices, respectively. This was discovered in their research area.

Another study examining the correlation between energy-efficient design and the leasing and revenue markets for commercial property revealed that rents for such properties are approximately 7% to 17% percent higher. Additionally, the selling subscription for Energy-Star labelled properties is found to be thirty dollars per square foot, while for LEED certified properties it is 130\$ per square foot.

The study conducted by Luo *et al.* (2022) examined the correlation between energy-efficient building practices and the rental and revenue



reduced operational costs along with enhanced energy efficiency (Hwang *et al.*, 2019).

In October 2004, the cost assessment firm "Davis Langdon" conducted a study comparing the construction expenses of 138 facilities, including libraries and laboratories, across the United States. Out of the total of 138 buildings, 93 were not constructed according to LEED standards, while 45 were in the process of seeking LEED certification. The study's findings indicate that there was no substantial difference in the total expenses between sustainable and conventional structures from an economic standpoint.

A reassessment of the research conducted in 2006 confirms the consistent findings on the process of making inferences. A separate study aimed to measure the advantages of sustainable buildings discovered that the new facility, which was designed with environmentally friendly principles, experienced a 25% boost in manufacturing efficiency and a nearly 30% reduction in electricity consumption per square foot (Rawai *et al.*, 2013).

The aforementioned findings were discovered within the recently established facility, designed in an environmentally sustainable manner.

Environmentally friendly buildings have a beneficial impact on the capital value of the building due to an enhanced working environment, lower building running expenses, and reduced infrastructure maintenance costs. One advantage of this is an augmentation in the overall value of the building (Sang *et al.*, 2018).

Figure (3) provides a visual depiction of these advantages. The subsequent paragraphs will provide an elucidation of several studies that have substantiated the augmented value of eco-friendly structures.



3.1 - Economic Benefits

Environmentally efficient structures offer substantial financial advantages. The advantages encompass reduced initial investment costs, decreased ongoing expenses, and diminished overall expenditures during the building's lifespan. Furthermore, building participants see an enhancement in labor productivity and an increase in property values. The subsequent text provides a concise overview of select published research that pertains to the current topic and has endeavored to measure the monetary advantages of utilizing eco-friendly construction materials.

Luo *et al.*, (2022) conducted the first extensive study on the costs and financial advantages of green buildings. The research found that allocating an extra two percent of the budget for estimating results in life cycle returns that are ten times higher than the initial outlay.

The reduced use of electricity, water, and garbage, along with the decreased costs associated with management and maintenance, and the improved tenant productivity and health, all contribute to financial benefits for the business.

For example, if \$100,000 is invested initially to incorporate environmentally friendly construction technologies into a \$5 million project, it would result in savings of \$1 million over the estimated 20-year lifespan of the structure (Luo *et al.*, 2022).

In 2004, the General Services Administration (GSA) conducted a study comparing and contrasting 12 buildings that were certified under the Leadership in Energy and Environmental Design (LEED) program. These buildings were situated in various regions around the United States. Based on the statistics, environmentally friendly buildings have considerably



instruments are utilized to assess the quality of the building on a numerical scale ranging from one to ten, with ten representing the highest rating.

The grading methods are consistently improved over time in response to advancements in technology, professional knowledge, and market trends.

The acronym "BREEAM," derived from the "Building Research Establishment's Environmental Assessment Method," was initially used in the United Kingdom in 1990. Another instance of grading systems is "CASBEE," an acronym for "Comprehensive Assessment System for Building Environmental Efficiency," which originated in Japan in 2001. The acronym "LEED," which stands for Leadership in Energy and Environmental Design, originated in the United States in 1998. Both of these rating systems are examples of rating systems. The utilization of these individual grading techniques enables the exchange and acquisition of knowledge from different industry experiences, hence expediting the progress towards environmentally conscious construction practices.

3 - Benefits of Sustainable Buildings

Hwang and Ng (2013) argue that the construction industry is seeing a significant change due to the "sustainable building revolution," resulting in a growth in the market share of this specific sector.

Tam *et al.*, (2004) highlighted that while the tactics and ideas are already present, the challenge is in moving beyond the familiar and conventional approach of "business as usual" and taking the risk to be innovative. This is in spite of the existence of preexisting techniques and ideas. To examine the present status of research on the challenges and potential advantages of projects involving environmentally friendly building, a thorough search of the pertinent published literature was conducted.

per the findings of Zhao *et al.* in 2020, the conventional method provides limited opportunities for optimization, often resulting in issues during the latter stages of the process. In contrast, integrative design offers a diverse range of optimization possibilities right from the start of the design process, as depicted in Figure (2).

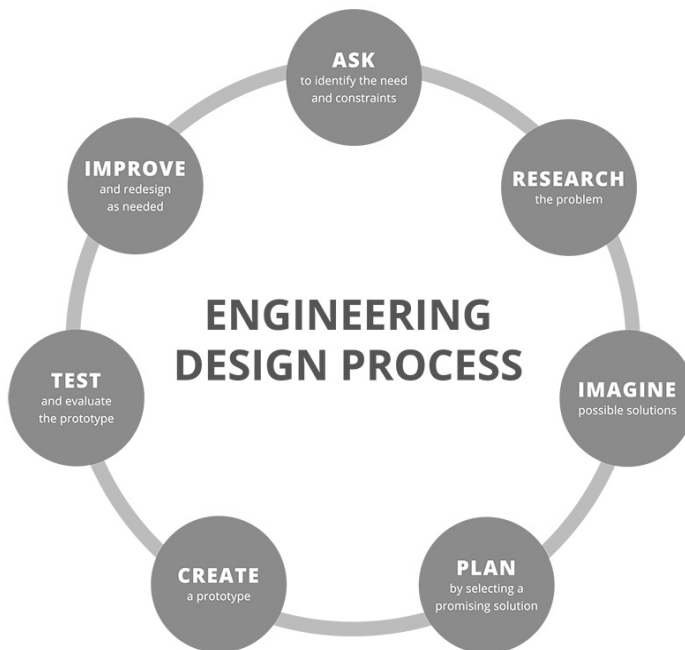


Figure (2): Integrative Design for Optimization of the Design Process
(Source: Zhao *et al.* 2020)

The reason for this is because integrative design employs an iterative method instead of a top-down approach in the design process.

Certification programmers or grading tools are crucial elements of green buildings as they assess the performance of the building and encourage the adoption of sustainable building practices and technology. These



Integrated design, however, encompasses more than simply gathering all members of the design team in one location at the beginning of a project to establish consensus on performance objectives.

Kubba (2010) emphasised the need of establishing a shared vision for the tasks at hand and improving the quality of connectivity and data used for communication. Integrated design encompasses more than simply gathering all members of the design team together in one location at the beginning of a project.

Hawang and Tan (2012) identified the following as the most prominent characteristics of the integrated design methodology:

1. Recruiting design team members who are eager to participate in the development and construction of structures utilizing an innovative approach.
2. Establishing ambitious objectives for the entire group and assessing their advancement in relation to those goals.
3. Achieving a state when the team has completely eliminated all expenses.

Before commencing the design process, allocate time for cognitive tasks such as charrettes, research, and other comparable endeavors.

4. Ensuring sufficient time for input and revisions prior to finalizing the design concept.

Maximize the involvement of as many individuals as possible in various elements of the project.

In order to fully comprehend the integrated design process, it is important to possess prior knowledge of the conventional design process. As



clear definition of the "integrated design process."

In order to achieve a sustainable building in terms of the environment, economy, and society, it is crucial to use all of the sustainable construction strategies listed in the table above (Kats, 2003).

These techniques should be handled in a synchronized and cohesive manner. The Integrated Development Process is a methodology employed throughout the design phase to identify and resolve any significant concerns that could greatly impact the long-term sustainability and effectiveness of the project (Feng and Hewage, 2018).

This approach is employed to detect and resolve any concerns that could significantly impact the project's long-term viability.

2 - The Efficacy of Sustainable Building

Implementing an integrated design approach that fosters synergy across many academic disciplines and technology is a method to attain significant levels of building efficiency. This method is commonly observed in numerous contemporary construction processes. By implementing a high efficiency building envelope, which includes reinforced windows and improved insulation, one possible strategy to save costs in the mechanical construction of a building is to minimize its size (Hwang and Ng, 2013).

Throughout every phase of the design process, it is imperative for mechanical engineers, construction engineers, architects, and other pertinent specialists to collaborate in order to create synergies and explore alternative possibilities.

Kubba (2010) asserts that every design decision should be made after a meticulous evaluation of the costs and benefits connected with it.

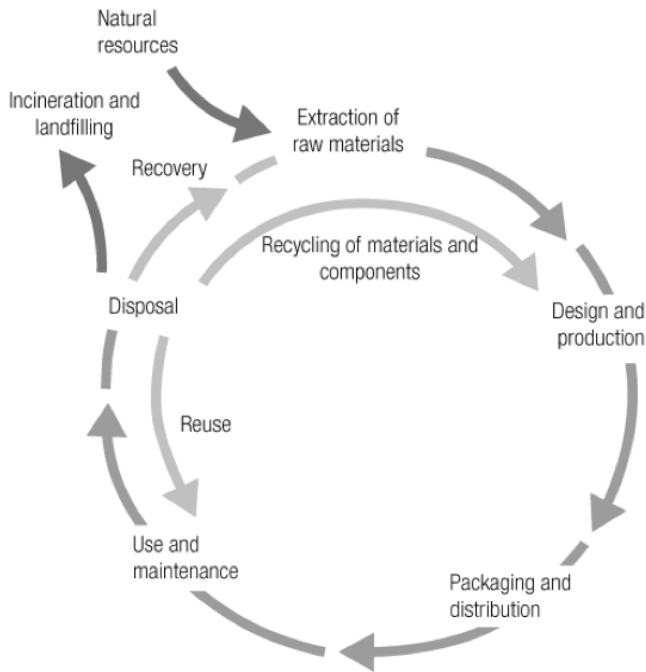


Figure (1): The Life Cycle of Sustainable Construction
(Source: Waidyasekara and Fernando ,2012)

According to Waidyasekara and Fernando (2012), it is recommended to evaluate the construction processes at each of the three phases. This will help gain a better understanding of how the design, construction, operation, and disposal of a structure can impact the environment as a whole.

Each sustainable idea is tailored to its unique set of requirements, including climatic conditions, geographic factors, environmental and social needs, and the utilization of diverse construction materials. As a result, every project yields distinctive environmentally friendly solutions. Before delving into the description of "sustainable building," it is imperative to establish a



A comprehensive literature analysis was conducted to analyse the increasing momentum of the sustainable building industry worldwide. To commence, the concepts of sustainability and green construction are deconstructed into their constituent elements, which encompass an integrated design process, evaluation criteria, and strategies for implementing sustainable practices. Following that, a concise account of the sustainable architecture movement in Iraq is provided to the reader.

The thesis examined the concept of sustainable development in the context of constructing eco-friendly structures. A structure will undergo four essential stages throughout its lifetime: the design phase, the construction phase, the operating and service period, and ultimately the destruction phase.

As depicted in Figure (1), sustainable building involves moving away from practices that cause pollution and use up non-renewable resources. Instead, it focuses on using resource-efficient materials and processes that benefit the environment and society in the pre-building, building, and post-building phases of construction.

This holds true throughout the entire construction process. Sustainable building involves transitioning away from practices that lead to pollution and the depletion of non-renewable resources.



1 - Introduction

In the past decade, there has been a growing focus from environmental economists and policymakers on sustainable building. While there is no universally agreed-upon definition of "sustainable buildings" or the corresponding policy, scholars, and organizations typically prioritize resource efficiency in construction and aim to minimize the adverse impacts of buildings on people and the environment.

Consequently, there has been a growing implementation of regulations in Iraq and other nations regarding the construction business. These policies aim to enhance energy efficiency and mitigate the environmental impact of the construction or site.

This article presents a concise overview of the economic and policy aspects of sustainable buildings by analyzing empirical and scientific data. Our focus is on making investments in entire buildings in order to narrow down the scope of our evaluation and emphasize the importance of considering the life cycle and energy efficiency aspects of environmentally friendly constructions (Ries *et al.*, 2006).

Sustainable buildings are promoted through a range of policies, some of which are optional while others are mandatory, that impact the whole lifespan of the building, starting from its design and construction and extending to its operation and final dismantling. Therefore, we distinguish sustainable building regulations from initiatives at the component level that aim to enhance energy efficiency, such as appliance standards, building codes, and other regulations unique to technology.

المستخلص

لقد أدى الوعي العالمي المتزايد بحالة الأرض المتدهورة والآثار غير المتوقعة لتغير المناخ إلى ظهور ظواهر عالمية تؤثر على العديد من العناصر مثل الاقتصاد والأمن الزراعي وتوافر المياه وإمدادات الطاقة. تساهم المباني بشكل كبير في توليد الغازات المسببة للاحتراس الحراري العالمي، فضلاً عن التخلص من الملوثات واستهلاك الطاقة. لذلك، تلعب دوراً حاسماً في معالجة القضايا البيئية.

على الرغم من الاعتراف على نطاق واسع بالمباني المستدامة باعتبارها تقدماً محتملاً، إلا أن المتخصصين في سوق العقارات ما زالوا يعتقدون أن التكاليف الأولية لإنشاء المباني المستدامة أعلى بكثير من تكاليف المباني التقليدية. تعمل هذه النظرة كعائق يعيق الاستخدام الواسع النطاق لمبادئ البناء المستدام. الهدف من هذا البحث هو التحقيق في الفوائد والعقبات الاقتصادية المحتملة التي تأتي مع بناء المباني الصديقة للبيئة. والهدف هو تحديد ما إذا كانت هذه المزايا يمكن أن تلعب دوراً حاسماً في عملية صنع القرار عندما يتعلق الأمر بالمشاركة في المباني المستدامة. يؤكد هذا البيان على فكرة أنه من أجل تقييم التكاليف الإجمالية لبناء المباني المستدامة مقارنة بالمباني التقليدية، من الضروري مراعاة العمر الافتراضي للمشروع بالكامل.

الكلمات المفتاحية: صناعة البناء، المباني المستدامة، الفائدة الاقتصادية، مبادئ

البناء، البناء المستدام، إدارة المشاريع.



Abstract

The increasing global awareness of the Earth's deteriorating condition and the unpredictable effects of climate change has given rise to worldwide phenomena that impact several elements like the economy, agricultural security, water availability, and energy supplies. Buildings contribute significantly to the generation of greenhouse gases, as well as the disposal of pollutants and energy consumption. Therefore, they play a crucial role in addressing environmental issues.

Although sustainable buildings are widely acknowledged as a potential advancement, professionals in the property market still believe that the upfront costs of creating sustainable buildings are significantly higher than those of conventional buildings. This view serves as a hindrance, obstructing the widespread use of sustainable building principles. The objective of this research is to investigate the possible economic benefits and obstacles that come with the construction of ecologically friendly buildings. The aim is to determine whether these advantages can play a crucial role in the decision-making process when it comes to participating in sustainable buildings. This statement affirms the idea that in order to fully assess the total costs of constructing sustainable buildings compared to conventional ones, it is necessary to take into account the entire lifespan of the project.

Keywords: Building Industry, Sustainable Buildings, Economic Benefit, Building Principles, Sustainable Construction, Project Management.

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optimization, three-dimensional and projective geometry, variational methods, and continuous mathematics like signal processing. It also looked at computer science and discrete mathematics subjects like graph algorithms, combinatorial optimization, and database retrieval methods. Concurrently, the study focused on how incorporating a robot's state awareness can improve how well it interprets visual information, especially for non-egocentric activities. Three complimentary robotic use cases were demonstrated, each tackling unique obstacles in the estimate of three-dimensional shapes. The results showed that consistent increases in spatial perception ability across different settings can be achieved by adding the state of the robot into visual deep learning models. Similar to the difficult subject of automotive engineering, computer vision is wide and multifaceted, which emphasizes the need for a multidisciplinary approach. Through the incorporation of many methodologies and theoretical frameworks, The purpose of this research is to improve our knowledge of visual perception and support the creation of increasingly sophisticated robotic systems. Even though computer vision is still a very difficult field to grasp, research is still being driven by the wide range of interesting issues it poses. The goal is to improve the field and offer significant insights through this work.



Critical Discussion: The study's conclusions provide a substantial contribution to the current discussion concerning the applicability of reconstruction theories in visual perception. The findings suggest that while reconstruction-based methods provide a well-organized framework for visual representation, they might not be entirely sufficient for tasks requiring scene recognition and classification. This is especially true for increasingly complicated visual tasks, because Marr's sequential and hierarchical approach conflicts with the simultaneous and integrative processes seen in human vision. From the standpoint of computer vision the study supports the case for alternative theories of visual representation by highlighting the inherent difficulties in reconstructing scene representations from source photographs. The study highlights the significance of choosing appropriate representations customized for particular computational tasks instead than following a generic, one-size-fits-all strategy.

Conclusion

This Within the field of computer vision, research has covered a wide range of subjects, from fundamental concepts like picture generation and preprocessing to more sophisticated methods like semantic analysis and three-dimensional reconstruction. The research examined diverse techniques for augmenting, dividing, and evaluating images in order to derive significant data, encompassing motion evaluation, object observation, and image creation. Even with substantial advancements in these areas, humans and computers still perceive visual information quite differently, and this disparity is expected to increase in the near future. The study also looked into a wide range of mathematical techniques, such as linear algebra, least squares



dependability. 10% of the data was used for validation and 90% of the data was utilized for training in each iteration. 100,000 rounds of this method were done to make sure the model was accurate and stable. The performance of the model was evaluated using precision and recall measures, which are widely used in machine learning and information retrieval. The results showed that it was highly effective in properly predicting which elements users will interact with. The average precision was 90.2% (SD: 0.3%), and the average recall was 87.0% (SD: 1.6%). would perceive as trappable.

Results Analysis: A thorough analysis was carried out to compare the model's predictions with the "Click ability" attribute—a prevalent element in mobile interface design—found in the view hierarchy in order to obtain a deeper understanding of the model's efficacy. A confusion matrix was used in the evaluation process to give a thorough understanding of the model's accuracy across several classes. The model greatly increased recall, demonstrating an improvement of over 7%, and improved precision marginally when compared to the clickable property, according to the data. This implies that even in cases when items aren't clearly labeled as trappable in the display hierarchy, the model is better at detecting elements that consumers consider to be trappable. Additionally, the minority class was up sampled in order to establish a balanced dataset, which addressed the imbalance in the dataset—where trappable components were more frequent than non-trappable ones. The model's precision and recall rates were 82% and 84% for trappable elements and 81% and 86% for non-trappable elements in tests conducted with this balanced dataset. These results show that even in complicated and variable data settings, the model can reliably detect trappable parts.



in terms of elucidating the entirety of human visual perception in terms of distinguishing and categorizing complex visual scenes.

Classification of Image Engineering Literature: This study conducted a systematic review to categorize the vast and diverse literature on image engineering (which combines image processing, image analysis, and image understanding) and its useful applications across a range of technological fields. The literature was categorized into four main areas: copy dispensation, copy examination, image understanding, and technical requests to address broad problems in the discipline. Within these categories, subcategories were created to better represent the specific focus of each research. For example, research in image processing was categorized into categories such as segmentation, enhancement, and filtering, and image analysis was categorized into categories such as feature extraction, object recognition, and pattern recognition. This systematic review included more than 25,970 research publications from the past 18 years, providing a comprehensive overview of research trends and priorities in imaging technology. This categorization emphasizes the broad range of research and the connections between multiple subfields within the discipline.

Model Design and Evaluation: Based on theoretical understandings, a strong model was created to assess the efficiency of different visual processing methods. A crowd sourced dataset that was selected for its diversity and fit with the study's goals was used to train this model. Many photographs in the collection had been annotated to detect qualities like tappability, or components of a user interface that users believe to be trappable. The dataset was divided into ten sections and a tenfold cross-validation procedure was applied to guarantee the model's resilience and



start of an extensive review series devoted to the statistical classification of image engineering literature. Every pertinent study that was published in 15 different publications was methodically reviewed for this review. The literature review divided the research into four main sections: image processing, image analysis, and image understanding. This is because image engineering is a smooth combination of these three interrelated but distinct fields, as well as their practical engineering applications. comprehending images and using technology. Based on the substance and emphasis of the research, each of these categories was further subdivided into more focused groups. This classification, which comprises 25,970 research articles published over the previous 18 years and highlights important trends and research areas in the field of image engineering, is condensed in. The data emphasizes the most popular fields of study and how they are used.

Review of Reconstruction Theory in Visual Perception: The first step in this research is to evaluate David Marr's seminal theory of visual perception. Marr claims that the main job of the visual system is to create an internal, coherent representation of the external scene by reconstructing it from the visual stimuli it receives. According to his idea, this reconstruction process happens in a sequential manner, allowing the visual system to recognize crucial aspects of the image such surface reflectance, the direction and speed of moving objects, as well as surface patterns. Marr's hypothesis has been under increasing examination despite its enormous effect, as current research in neuropsychology and psychophysics suggests that visual processing is not strictly linear. Rather, it makes use of intricate parallel processing systems that combine several data sources at once. This study reevaluates Marr's reconstruction theory and points out its flaws, particularly



Hingorani, Rao, and others (1996), Bobick and Intille (1999), and Birchfield and Tomasi (1999) are instances of this. These methods operate by calculating the least-cost path via a horizontal slice of the DSI, or through the matrix of all pairwise matching costs between two related scanlines. Utilizing plane-based approaches, partial occlusionIt is feasible to directly estimate homographies between distinct planes in situations rich in planar structures, such as those containing architecture and specific manufactured goods like furniture, by applying either feature-based or intensity-based techniques. Essentially, this data may be utilized to concurrently deduce the camera positions and the plane equations, meaning that plane-based structure can be calculated from motion. Luong and Faugeras (1996) provided concrete evidence of recovering a fundamental matrix from two or more homographies. by the use of least squares and algebraic manipulation. Regretfully, this method is frequently not particularly reliable because meaningful re-projection mistakes are not directly correlated with the generated algebraic errors (Szeliski and Torr 1998). The homo-graphics' sites are, hallucinated in order to guarantee that a few virtual point correspondences are displayed and incorporated into a typical structure from motion algorithm. Using full bundle adjustment, which includes explicit plane equations and extra constraints to make reconstructed co-planar features lie precisely on their respective planes, may be an even more effective method. (A logical approach to this would be to utilize 2D in-plane parameterizations for the remaining points and to define a coordinate frame for each plane, for example, at one of the feature points.) The mechanism that Han Shum created."

Methodology Research and Application of Image Engineering:

28 years ago saw the launch of image engineering (IE), which sparked the



Methodologies of 3D Computer Vision. page16.17 algorithms that work together. Cooperative algorithms were among the first techniques for disparity calculation, and they were influenced by computer models of human stereo vision. (e.g., Dev, 1974; Marr and Poggio, 1976; Marroquin, 1983; Szeliski and Hinton, 1985; Zitnick and Kanade, 2000). These algorithms, which generally behave similarly to global optimization algorithms, update disparity estimates step-by-step through nonlinear operations. Actually, a global function that is being minimized for some of these algorithms can be stated explicitly [Scharstein and Szeliski 1998]. Gradual, coarse-to-fine warping. The majority of the most advanced algorithms available today initially count all potential matches at all potential discrepancies before choosing, by some method, the best set of matches. Sometimes, techniques derived from classical (infinitesimal) optical flow computation yield faster results. Here, disparity estimations are updated incrementally as each image is successively warped, until a decent registration is achieved. The most typical implementation of these techniques is inside a hierarchical coarse-to-fine refining framework (Quam, 1984; Bergen, Anandan, Hanna, Hingorani, 1992; Barron, Fleet, Beauchemin, 1994; Szeliski, Coughlan, 1997).

Programming that changes with time Dynamic programming gives rise to a variant of the global optimization algorithm. For typical classes of smoothness functions, 2D optimization of Equation is known to be NP-hard [59], but for independent scanlines, dynamic programming can find the global minimum in polynomial time. The first use of dynamic programming was in sparse, edge-based stereo vision techniques. The problem of dense (intensity-based) scanline matching has been the focus of more recent methods. Belhumeur (1996), Geiger, Ladendorf, and Yuille (1992), Cox,



that can enable diversity of recovery if the vision system is to recover the scene's features, including the object's surface reflectance, movement direction and speed, surface structure, and so on. The strong theory states that various occupations are built on the same data structure, share a same conceptual core, and go through the same understanding process. Marr provided evidence in support of his theory that the representations that comprise the visual People can deduce the inside world from a multitude of hints. If the creation of such a unified representation is taken to be the ultimate goal of all visual input processing and decision-making, then vision may be thought of as a reconstructive process that begins with scene interpretation of information. Since reconstruction does not directly contribute to interpretation, the reconstruction-based approach can have the widest circle. Obtaining the representation solely through reconstruction from the source image is another challenge. Recovering good scene representations from original photos in computer vision is tremendously computationally expensive.. In fact, a growing body of research in biological vision tends to corroborate alternative representation ideas. Lastly, there are conceptual issues with the reconstruction theory. The theoretical assumption that reconstruction is possible for every representation task is the root of the issue. Setting aside the issue of whether reconstruction is technically feasible, one may first wonder if it is worthwhile to search for a representation that is universally consistent. Given that the most effective representation will be whichever performs the task the best; a representation with universal homogeneity is not always required. Information processing theory actually states that choosing the appropriate representation for a given computer issue is crucial. Marr also mentioned this in Foundations and Advanced

within the window independently. The direction of the point of interest is given by the longest vector in all windows. The size of the sliding window is critical. It is a parameter that must be chosen carefully. Large sizes usually result in insignificant vector maxima, while small sizes usually reflect dominant gradients. Descriptors created from the sum of Haar wavelet responses. We will first compute the descriptor by tiling a square region centered on our point of interest in the direction specified in the previous section (so that we are also rotationally invariant). We will use a window size of 20σ . These squares are regularly divided into $4 \times 4 = 16$ sub-squares, showing important local and spatial information. Please compute the hair wavelet for each sub-region. Responses are made in a fixed 5×5 grid. To simplify notation, we denote the horizontal Haar wavelet response as d_x and the vertical Haar wavelet response as d_y . Note that “vertical” and “horizontal” mention to the designated opinion of attention. (Fig 1.6).

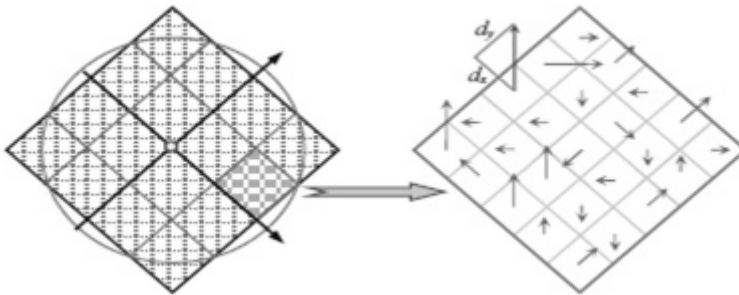


Fig 1.6 : Four-sided area around opinion of attention

Review of Reconstruction Theory in Visual Perception Glitches with Rebuilding Philosophy Rendering to Marr’s philosophy, "The fundamental purpose of processing is to recover the scene from visual stimuli and incorporate it into the representation. Representation is the core idea shared by all visual activities or professions. There needs to be a representation



benefit. Characteristic derived from the total of the Haar wavelet responses. A square window of that orientation is centered at a certain point of interest, depending on the orientation that has been selected there.. Every orientation and position within the image is handled in this way. The diameter of the window is 20σ . The window is then divided into smaller $4 \times 4 = 16$ blocks at regular intervals using the spatial knowledge of the features. The wavelet reply is calculated in a standard 5×5 grid in each sub-region. For simplicity, we use the notation dx and dy to denote the flat and perpendicular Haar wavelet responses, respectively. The terms “horizontal” and “vertical” in this paper refer to the designated opinion of attention, as described below. Determining the direction A direction is chosen at the point of interest to achieve invariance to image rotation. First, the Haar wavelet response is computed along the X and Y directions within a 6σ circle radius around the point of interest (where σ is the scale at which the point of interest is detected). The sampling step is equal to σ and is scale-dependent. Its size is fixed to 4σ side length and, like other wavelets, is scale-dependent. It enables a fast filtering process by reusing computations using integral maps. Lone six processes are obligatory to compute the reply at each scale on the X and Y axes, as it belongs to the Haar wavelet template group. The wavelet responses are computed and Gaussian filtered using a weighting function and can be represented as coordinate points in space. The abscissa represents the strength of the response in the horizontal direction and the ordinate represents the strength of the response in the vertical direction. The way container be got by summing the replies inside a descending subdivision window of stage scope $\pi/18$ and radian $\pi/3$, as shown in Figure 1.5. The local direction vector is created by adding the horizontal and vertical responses

The sampling step size relative to the scale is defined by the value of σ . To ensure compatibility with other components, the size of the wavelet is scale-dependent and is determined by the side length of 4σ . Therefore, the integral image is reused for fast filtering. Based on the properties of the Haar wavelet template, the responses in the X and Y guidelines at any scale container be calculated with only six operations. Then, after weighting the wavelet response with a Gaussian delivery placed at the opinion of attention, the reply is got as a opinion in a establish interplanetary anywhere the flat coordinate agrees to the flat response concentration and the perpendicular manage corresponds to the perpendicular response concentration. As shown in Character 1.5, the course is determined by summing all responses in a descendent fan-shaped gap of size $\pi/3$ radians (stage scope $\pi/18$).

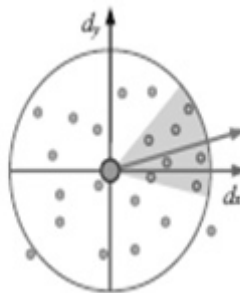


Fig. 1.5: Schematic diagram of determining orientation

A local orientation vector is created by adding the individual sums of all of the replies—both vertical and horizontal—in the window. The point of interest's orientation is determined by the biggest vector across all windows. The moving window's dimension is an input that needs to be carefully set because high dimensions often result in nonsensical maxims in the vector, whereas small dimensions are more likely to reflect the gradient of a single



a multi-scale description.. Thus, we present the concept of scale-space. The representation of the image consists of a set of smoothed copies of the image, which are determined by the smoothing kernel's size. Together with the two spatial variables, (u, v) , the parameter sigma, often known as scale, locates a point (u, v, σ) in scale-space. We'll make use of the linear scale-space, which a Gaussian kernel yields. This decision is not capricious; rather, it comes about as an inevitable outcome when the of because when formalizing the transition from a fine to a coarser scale, filtering shouldn't produce additional bogus structures. For more information, the reader is directed to Lindeberg (2012). Computer Vision: Techniques for Three-dimensional Reconstruction page156""

Description and Matching of Points of Interest: Similar to the gradient data produced by SIFT, the SURF descriptor characterizes the brightness distribution near the key point. The difference is that SURF container brand full use of the essential copy to haste up the cunning because it is based on the response of the first-order Haar wavelet in the X and Y directions instead of the gradient. In addition, its descriptor length is only 64, which saves time and improves flexibility in the feature matching and calculation process. The matching process of the SURF descriptor includes three steps: creating a square rectangle and finding the direction at the interest point based on the previously selected direction, obtaining the SURF descriptor at this location, and (3) comparing the properties of the descriptors in the two regions. Direction determination: To ensure the invariance of image rotation, the direction is specified. First, the X and Y hair wavelet responses are calculated in a 6σ circular neighborhood around the detected interest point, where σ is the scale at which the interest point is detected.



association, prediction. The method usually employs a Kalman filter, which makes use of a motion model to forecast a point's location based on its past positions at a given time instant. Additionally, it preserves an estimate of the prediction's uncertainty, enabling the definition of a search window. Within the search window, features are identified; one of these is linked to the tracked point; the filter then uses the found point's position and uncertainty to update the position estimate. There could be uncertainties in the association operation. More complex filters, such as the Joint Probabilistic Data Association Filter, are required when many points are identified in the search window. Bar-Shalom and Fortmann (1988) provide an in-depth analysis of the issue. Computer Vision: Techniques for Three-Dimensional Reconstruction page155" **Scale Invariant Feature Transform** "Blob-like feature locations with high contrast are identified by the Scale Invariant Feature Transform (SIFT) operator, which was introduced by Lowe (2004). It does this by approximating the LoG filter (Laplacian of Gaussian) and applying it to a scale-space representation of the picture. Scale-Space Recall that at a given scale, feature points of differing types are detected by both the HS operator and the LoG. Although it is not given much thought at first, the choice of scale is not a secondary one and has to be addressed soon. In reality, real scenes are composed of numerous structures, each with its own inherent scales. frequently distinct from one another. In addition, the distance from the camera affects how big these different parts are projected into an image. This implies further that the perception of a genuine thing will vary based on other situational conditions. One technique to deal with the fact that it is impossible to determine beforehand which size is best to explain each of the intriguing structures in the photographs is to include them all in



calibrating parameter. Two-Step Calibration Process A classic example of a traditional calibration method is the two-level method. The reason for its name is that the calibration is split. divided into two parts: determining the camera's exterior parameters (without accounting for translation along the optical axis) and determining additional parameters. Because it makes use of radial alignment constraints (RAC), this technique gets its name. The technique involves a large number of linear equations, making parameter solving reasonably simple. This technique is used in industrial vision systems; the depth direction accuracy can approach 1/8000 and the average 3D measurement accuracy can reach 1/4000. The calibrating procedure might be separated into two scenarios:. Since k is the lens's radial distortion coefficient, it is not possible to take k into account when calculating R using the methods described above. If f and μ is known, then only one image comprising a collection of coplanar datum points needs to be utilized for calibration. Right now, R , T_x , and T_y are calculated in the first step, and λ , k , and T_z are calculated in the second. Similarly, k is not taken into consideration when calculating T_x and T_y , but it is when calculating T_z (the impact of a change T_z on the picture is comparable to k), therefore it moves on to the second phase. Foundations and Advanced Methodologies for 3D Computer Vision, page 40.

Predictive Tracking: The KLT approach, as was previously mentioned, operates under the premise that there are slight displacements between images captured at subsequent instants. When these are large, using spatiotemporal coherence to forecast the locations of the points in the subsequent frame can be a way to offset the motion. The following three steps are repeated in a conventional scheme: First, extraction; then,



partly solve the problematic of data scarcity. Starting from Pix2Pix, which prepares data in pairs, to Cycle-GAN, which processes unpaired data, to StarGAN, which can handle multiple domains, this research direction is steadily approaching reality. Consider an AI anchor. 3D Computer Vision Fundamentals and Advanced Methods, pp. 37-38"

Traditional Calibration Methods: "In order to establish the corresponding relationship between the calibration target points and the corresponding points on the captured image for determining the internal and external parameters of the camera, the traditional method of camera calibration requires a known calibration target. This can determine the size and shape of the calibration target. These offer good calibration accuracy for the calibration target, a straightforward solution, and theoretical clarity. The drawback is that the

The precision of the calibration target is relatively high, despite the somewhat complex calibration method. Fundamental Steps and Conditions: With reference to the full space imaging model presented in Sect. 2.2.4 and the nonlinear camera model presented in Sect. 2.3.2, the camera can be calibrated in the direction of transformation from 3D world coordinates to computer image coordinates. illustrates the four processes involved in converting the world coordinate system to the computer picture coordinate system, each of which requires some parameter calibration. The parameters that need to be calibrated are the translation matrix T and the rotation matrix R . First step: Step 2: The lens's focal length, or λ , serves as the calibrating parameter. Step 3: The lens's radial distortion coefficient (k), eccentric distortion coefficient (l), and thin prism distortion coefficient (m) are the calibrating parameters. Step 4: The uncertainty image scale factor, μ , is the



strategy that uses the classifier's training to separate the target from the back-ground. Due to its more reliable performance, object tracking research has gradually focused on this method. In recent years, some tracking techniques based on Siamese networks semantic segmentation have attracted attention: semantic segmentation requires labeling the semantic class of each pixel in the double. A common method to bottomless education is to custom a fully convolutional network (FCN). FCN implements end-to-end semantic image segmentation by inputting an image and immediately obtaining the group of apiece pixel as output. U-Net, advanced convolution, Deep Lab series, PSP-Net and many other advances are examples of further progress. Monocular depth estimation: Image data is usually used as input to predict the depth value consistent to each pixel in the image. This is the basis of deep learning for monocular complexity guesstimate. The characteristic elementary construction of CNN uses unfathomable erudition for monocular deepness estimation methods. It is believed that this solitary view stereophonic corresponding (SVSM) model can be trained based on a minimum amount of depth annotated images, because monocular depth estimation is usually data-intensive for a big quantity of depth footnote data, and data collection is expensive. Another is the creation of images and videos, which is more in line with computer graphics technology. The intellectual traits of the double are the participation, and the related image circulation is the output. The automatic creation of photos and movies, the growth of databases, and the improvement of image information have received more consideration in the development of deep learning. VAE and GAN are two popular deep generative models. GAN is an unsupervised deep learning technique that learns through a game amid two neural nets and can



tracking, picture and video classification, and more since 2012. Deep learning has steadily supplanted classical statistical learning to become the de facto standard for computer vision frameworks and techniques. Image classification is an attempt to place a picture in a specific category. Classical image classification models, such as Alex-Net, VGG, Google-Net, Res-Net, and Dense-Net, have worked as the foundational net for various errands such as discovery and division. Neural net models are made up of layers upon layers, ranging in depth from a few to thousands. Classification of videos: Two-stream convolution network is another effective deep learning method that was used earlier to combine motion and apparent data. A 2D convolution kernel serves as the foundation for this two-stream convolution network. Many academics have suggested using 3D CNNs in recent years to achieve video categorization by either merging 2D and 3D or expanding the 2D convolution kernel to 3D. I3D, C3D, P3D, and other ones are some of these. These suggestions for video motion detection include the generalized compact nonlocal network, boundary sensitive network, and attention clustering network, among others.

Object tracking: Object tracking is the act of figuring out how one or more objects move within a certain scene. In multi-object tracking, a video image is captured with numerous trajectories of interest, and temporal correlation is used to derive information about the moving trajectory. Object tracking can be broadly classified into two groups: Both discriminative and generative approaches are used. In order to reduce the reconstruction error, generative approaches primarily employ a reproductive perfect to describe the object's seeming topographies and then look for other potential items. Tracking via detection refers to the second category, which is a discriminative



etc.); recently, direct and efficient data augmentation techniques (such as safety device, mixing, sample pairing, chance pruning, etc.); and automatic data increase methods (such as reinforcement learning-based methods).

4. Hyper- parameter **optimization Deep learning model design requires data**: Model design, model training, feature selection, preprocessing, and hyper-parameter tuning. Hyper-parameters are crucial for deep knowledge. Manual parameter tuning requires expertise and machine learning knowledge. Automated hyper--parameter optimization based on bottomless knowledge can efficiently replace physical parameter change. The main idea here is to control the relationship amid the loss drive of the authentication set and the hyper-parameters, then compute the function originated on the hyper-parameters and smear the incline descent method to enhance the hyper-:parameters. Though, hyperparameter derivation involves tremendously complex calculations.

5. **Network Project Network design**: It is an essential skill for deep learning. Extended Short-Term Reminiscence Networks, Multilayer Perceptron Networks, Perceptron Networks, Auto-Coupled Systems, Bidirectional Regular Neural Systems, Convolutional Neural Systems, Profound Convolutional Neural Grids, Copiously Coupled Networks, Reproductive Combative Webs, Graph Convolutional Neural Networks, Self-Learning Network Coding Networks, Recurrent Neural Networks, and Recurrent Neural Networks. The list includes many more. 3D Computer Vision Fundamentals and Advanced Techniques Page 35.36

Deep Learning in Computer Vision: Subterranean erudition procedures have demonstrated remarkable performance in several tasks such as semantic segmentation, depth estimation, object detection, object



Fine-Tuning: The pre-trained model is further trained on the dataset of the target task during the fine-tuning phase. Through this procedure, the model's parameters are incrementally modified to better match the unique properties of the target data. By fine-tuning, the model is able to match the more specialized features required for the target task to the broader traits it learnt from the source task. Although transfer learning has many advantages, there are drawbacks as well. Making sure the source and target tasks are appropriately related is one of the main challenges.; In the absence of these, the knowledge transfer may be ineffective or even detrimental to the model's performance (a phenomena referred to as negative transfer). Furthermore, especially in cases when the target dataset is limited, fine-tuning needs to be carefully controlled to prevent over-fitting. A major development in machine learning is transfer learning, which offers a framework to support models' effective and efficient learning even in the face of sparse data. Through the purposeful utilization of pre-existing knowledge, transfer learning not only expedites the creation of intelligent systems but also expands the range of sectors in which AI may be applied.

3. Data Augmentation Deep learning: A large quantity of labeled exercise information is required. Though, there are few general exercise datasets for practical situations. Moderate amounts of data can be processed efficiently through data augmentation. Through processes such as transformation and synthesis, data augmentation creates a new dataset that is comparable to the training dataset. Adding noisy data can also enhance the resilience of the model. Common data augmentation can be divided into three main categories: traditional data augmentation techniques (such as copying, rotation, ascending, translation, random thinning, adding clamor,



of convolutional networks can be designed microscopically. There are numerous brain structures in the search space. many networks. Deep neural networks can be used to integrate insight, decision-making, or perceptual decision-making finished end-to-end knowledge by marrying reinforcement information and executive skills.

2. Transfer learning Assignment learning: Transfer learning is a method to maximize one's own objective by using related support work. This task optimization method works well when there is little labeled data for the target job. In order to optimize the model for the target task or accelerate learning, transfer learning techniques are usually applied after training the source model using the source task with a large number of training examples.

Training the Source Model: Training a model on a source task with a sizable amount of labeled training data is the first step in the process. The target task and this source task usually include similar kinds of data. As an illustration, a model may be taught to identify a wide range of common things in photos (source task), which may subsequently be helpful for identifying particular objects, such as different species of plants or animals (target job).

Knowledge Transfer: The knowledge (features, patterns, etc.) acquired from the source task is transferred to the target task once the model has been trained on it. This is accomplished by fine-tuning the trained model—or portions of it—using the dataset of the target task. The theory behind this is that general properties like edges, textures, and forms are captured by the neural network's early layers, which can be used again. It is only necessary to modify or retrain the later layers—which are more task-specific—using the target data.



This noise can be generated by the environment, actuators, sensors, and other sources. Machine learning models can be trained using noise-free data generated by synthetic data. Third, collecting real data is often costly. This is especially true for the data required for model training in machine learning. We can generate data that can be collected more cost-effectively by using synthetic data. Fourth, real data is often biased. There are many possible reasons for this distortion, including the environment, actuators, and sensors. To help train machine learning models, unbiased data can be generated using synthetic data. Real data is often unrepresentative, which is the fifth reason why synthetic data is needed in robotics. This is especially true for the information required to train machine learning models. Because synthetic data is used, machine learning models can be trained using data that more accurately represents the real world. (Basic methods of deep learning: One of the straightforward methods of deep learning is reinforcement learning, transition learning, data amplification, hyper-parameter optimization, and network design.

1.Reinforcement Learning Model project based on reinforcement knowledge has two components: One for creating models and the other for verifying them. Initially, a collection of sub-networks is generated by the model generation unit using a random starting technique. The income feedback generation unit is the proper rate of validation after training using the sub-networks on the indicator dataset. The generating unit conducts fresh trials and modifies the design strategy in light of the model effects. The design action that happens automatically Space encompasses functions like pooling, group convolution, residuals, and convolution. Global network topologies can be constructed macroscopically, while repeated substructures



and identify the scene. This feature is related to 2D computer vision, which is a reasonably developed field with a wide range of current uses. As theory and technology have advanced, an increasing amount of study has concentrated on fully utilizing 3D spatial information (typically in conjunction with temporal information). derived from objective landscapes to automatically assess, comprehend, and make decisions about the objective world. This involves deriving extra depth information from 2D projection images in order to have a thorough grasp of the 3D environment. Computer vision is currently focused on artificial intelligence, however this subject requires the introduction of other technologies. research that is currently being conducted. This book focuses on recent related research, which falls under the category of 3D computer vision. Basics of 3D Computer Vision and Advanced Techniques. Automation Robots are machines that have the ability to be programmed to carry out certain activities. These chores can be as easy as transferring a piece of paper from one place to another. These can also be more difficult assignments, such traveling the globe or completing activities that are doable by humans, like figuring out a Rubik's cube. Constructing a robot that can handle difficult jobs, however it can be difficult because a lot of training data is needed for the robot to behave human-like. One way to generate this data is through simulation, which is a technique for modeling a robot's behavior. Robotics requires synthetic data for a number of reasons. **First**, there's typically a lack of real-world data. This is particularly valid for the data required for model training in machine learning. This is particularly valid for the data required for machine learning model Training, an important part of robotics. In some cases, real data can be completely replaced or supplemented by synthetic data. Second, noisy real-world data is common.



that is akin to the human visual system should be developed. The second study objective is to use this work as a means of investigating the systems of the human brain involved in visual tasks and to gain knowledge and comprehension of these mechanisms (e.g., computational neurology). Here, research on biological mechanisms is the main focus. Long-term study of the human brain's visual system from the perspectives of physiology, psychology, neurology, and cognition has yielded a wealth of knowledge, but it has not yet fully unraveled all the mysteries surrounding visual processes, particularly with regard to the study and comprehension of visual mechanisms. When it comes to the research and proficiency of visual information processing, we are still far behind. A thorough study of computer vision would be made possible with a full grasp of how the humanoid intelligence processes visual. We mainly address the first research goal in this text. As previously said, computer vision research is heavily inspired by human visual functions and is a computerized embodiment of those functions. From the view of humans. Typical examples include motion detection through filtering techniques, the application of the concept of local orientation, the efficient data structure of pyramids, and more recently, artificial neural networks. The creation of novel computer vision algorithms may also result from an understanding of an investigation into the operation of the human visual system. Applications and research in computer vision have a long history. In general, 2D projected images of 3D objective scenes were the main source of information for early computer vision systems. The primary objective of computer vision research was to enhance the quality of the image and enable the user to obtain information more easily and clearly, or on automatically gathering several types of characteristic information from the picture so that the user may examine



models. However, modeling the complexity of the visual world is far more demanding than simulating the vocal tract that produces spoken language. Forward models used in computer vision are usually created in computer graphics or physics (optics, radiometry, sensor design). Both areas model how objects move, how light is scattered by the atmosphere, how it reflects off surfaces, and how it is refracted by camera lenses. (or the human eye), and lastly projected onto an image plane that is flat or curved. Even if entirely computer-animated movies including human characters haven't been able to overcome the uncanny valley², which divides actual people from android robots and computer-animated humans, computer visuals are still improving every day.

The illusion of reality works perfectly in certain contexts, such as depictions of static scenes made up of objects or animations of extinct animals like dinosaurs, that is, using one or more photographs to describe the world we live in and reconstructing its features, such as shape, lighting, and color distribution. It's interesting to note that computer vision algorithms frequently make mistakes, whereas humans and animals can perform this task without any issues. Individuals without prior experience in this sector sometimes underestimate the complexity of this issue. (My coworkers frequently ask me for software that can identify and identify every person in a picture.) This is ...Algorithms and Applications in Computer Vision by Richard (Szeliski, 2022, p. 3).

Computer Vision's Objectives: The digital implementation of human visual functions, such as detecting, recognizing, processing, and interpreting three-dimensional scenes in real-world scenarios, is known as computer vision. Eventually, to accomplish typical visual tasks, a more universal system



Computer vision: What is it? People can easily see and understand the three-dimensional structure of their surroundings. Imagine how clearly we perceive three dimensions when we look at a vase of flowers on a table. Imagine how clearly we perceive three dimensions when we look at a vase of flowers on a table. The flowers can be easily distinguished from the background due to the delicate surface patterns of light and shadow on the petals (Fig. 1.1a). It is easy to count (or say) the names of all the people in a group photo and to infer their emotions from their facial expressions. Although perceptual psychologists have successfully created illusions¹ to illuminate some of the principles of the visual system, they have spent decades trying to understand how the visual system works. (Fig. 1.3) They have not yet completely solved this puzzle (Marr 1982; Palmer 1999; Livingstone 2008). Accurate methods are currently being developed to compute partial 3D models of the environment from hundreds of partially overlapping photos (Fig. 1.2). When enough images of a particular object or facade are available, stereo matching can generate dense and accurate 3D surface models.

Additionally, it may follow a moving subject against a complicated backdrop. Additionally, by fusing face, clothes, With facial hair identification, it is able to identify and identify each individual in a picture . The goal of making a computer comprehend visuals at a level comparable to that of a two-year-old—for example, counting every animal in a picture—has not yet been accomplished, despite recent advancements. Why is eyesight so challenging? One reason is the inverse nature of vision. When there is not enough data to be completely certain of an answer, we seek to discover the unknown. Therefore, we are forced to use physics-based probabilistic



Method	Description
<code>p = cam.project(P)</code>	Project the world point P to the image plane p
<code>cam.plot(P)</code>	Plot the world points defined by the columns of P
<code>cam.mesh (X, Y, Z)</code>	Plot the mesh defined by X, Y, and Z
<code>cam.showpose (T)</code>	Show the camera at specified pose
<code>cam.clf</code>	Clear the current camera view
<code>cam.hold</code>	Hold the current camera view, future calls to plot add to the camera view
<code>cam.rpy(r, p, y)</code>	Set the camera transform to specified roll-pitch-yaw angles
<code>cam.name</code>	Property: name of camera
<code>cam.Tcam</code>	Property: default camera transform (read and write)

Specific camera classes: Table (2) lists the option parameters that the constructor of each camera type accepts. possess special choices that are explained in the web documentation. The standard central camera specifications when building cameras are 1024×1024, 8mm focal length, 10 square pixels. Unless explicitly specified, the principal point is assumed to be at the center of the image. "Robotics, Vision, and Control: Basic Algorithms in MATLAB" by Peter Corke.

Option	Description
<code>'name', name</code>	The name of the camera which is displayed in the window's title bar
<code>('resolution', npix)</code>	The dimensions of the image. npix is a scalar for a square image or a 2-vector
<code>'centre', pp</code>	The coordinate of the principal point
<code>'pixel', rho</code>	The dimensions of the pixel. rho is a scalar for a square pixel or a 2-vector
<code>'noise', sigma</code>	The standard-deviation of Gaussian noise added to the image-plane coordinates
<code>'pose', T</code>	The default pose of the camera. Default is as shown in Fig. 11.2
<code>'image', im</code>	Set camera image-plane dimensions according to the image dimensions and display the image



authority to keep the car in its lane and avoid collisions, while the human operator is only responsible for steering. "Robotics, Vision, and Control: Fundamental Algorithms in MATLAB" by Peter Corke The location of the camera's center of mass is a problem caused by external factors, namely the position of the camera.

Determining the intrinsic and extrinsic properties of a camera with respect to a world coordinate system is called camera calibration. The set of world points on which calibration techniques rely has known relative coordinates and associated image plane coordinates. Advanced methods such as Bouguet's Calibration Toolbox for MATLAB® (Bouguet 2010) require only many images of a planar chessboard target. From this, the intrinsic parameters (including distortion parameters) and the relative positions of the chessboard in each image can be computed, as explained in Section 11.2.4. Although they can estimate the distortion model, classical calibration methods can only be applied to views of the calibration target in three dimensions. Nevertheless, these methods are easy to understand and serve as the basis for our discussion in the following sections. "Robotics, Vision, and Control: Fundamental Algorithms in MATLAB" by Peter Corke Camera Class: The abstract superclass Camera is the predecessor of the toolbox camera classes Central Camera, Fisheye Camera, and Spherical Camera. The public methods of all classes are shown in

Table (1) The behavior of camera views is related to MATLAB® figures behave similarly. By default, plots and grids redraw the camera's view. If a camera view does not already exist, it is created. The MATLAB commands `clf` and `hold` correspond to the procedures `clf` and `hold`.



they co-founded Unimation, the first robotics company, in Danbury, Connecticut. Consolidated acquired the company in 1970. Diesel Corp. (CDC) developed it into the Condec division. Their first robot was used in a General Motors die casting plant in New Jersey. In 1968, they licensed their technology to Kawasaki Heavy Industries, allowing it to produce the country's first industrial robot. Engelberger ran the company until Westinghouse Electric acquired it in 1982.

Employees in the company's engineering department volunteered to help operate the cars. Peter Corke's book *Robotics, Vision, and Control: Basic Algorithms in MATLAB* Mobility: We have already mentioned the types of mobile robots and how they move. This section is about mobility, which is determined by how far the vehicle moves in space. It can be characterized by a scalar parameter, called the generalized coordinates of the train. In addition, the train has a position in configuration space, or C space, specified by this space CC . For each state in C , the robot can achieve a certain amount of free motion, which means that it can move in any direction along this space. It is worth noting that the people on the surface also had a certain advantage in creating a chart that can be used to travel around Mars, although they only provided the most general information. In other words, the robot chooses its own path to the destination after the human tells it where to go. Considering that the communication is delayed by several minutes, the time difference in communication is clearly visible. Camera Calibration Some robots are hybrid controllers, where the control system is shared or exchanged with the human operator. In tracked hybrids, the control system is shared by the human operator and the robot. For example, the aircraft pilot can act like an autopilot and regain control. With shared control, the human operator has the



crowds and constantly moving parked carts and carts. A Mars rover must navigate small craters and boulders because it does not have an accurate local map before setting off. Robotic cars must obey traffic rules, traffic signals, and road regulations.

The DARPA Grand Challenge showcases examples of these vehicles (Buehler, Iagnemma, and Singh, 2007). The second challenge requires these robots to work safely in human environments. Hospital delivery robots operate inside the human body, robotic surgical instruments operate inside the human body, and robotic cars operate inside the human body. " **How do you define a robot?** Not all of the definitions are very useful, yet there are plenty. This book will use the following definition to guide us: a goal-oriented machine with sense, plan, and action capabilities. A robot senses its surroundings and plans its actions based on that information and a predetermined purpose. The task could involve manipulating an object with an arm-robot's tool or guiding a mobile robot to a specific spot. For robots, sensing is essential. Proprioceptive sensors detect the actual condition of the robot, such as the current drawn by an electric motor or the angle of the joints on a mobile robot with wheels. Outside-in sensors Calculate the current status of the world in relation to the robot. For instance, to detect collisions, it might make use of a robot vacuum cleaner. It could be a compass that determines the direction of the Earth's magnetic field in relation to the robot's heading, or it could be a GPS receiver that calculates the distance to a constellation of satellites. An active sensor could possibly be the source.1956–1982, Unimation Inc. Devol first met with Joseph Engelberger in order to secure funding for the development of his animation technology. He received financial support from Moore, Lanning, and Maxwell. In 1956,

The use of robots has increased productivity and improved product quality. Rather than eliminating jobs, it has helped manufacturers in countries with high labor costs to remain profitable. Many of the products we buy today are made or operated by robots. Today, these early robots fall under the category of manufacturing robots, a branch of robotics. Other types include field robots for outdoor work, humanoid robots that resemble real people (Figure 1.4), and service robots that perform tasks such as household chores, personal assistance, or medical rehabilitation.

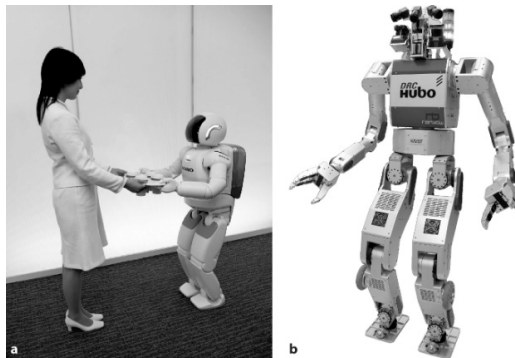


Fig. (1.4 a & b): Non-terrestrial mobile robots. a) SeaBed Autonomous Underwater Vehicle (AUV) operated by the Australian Centre for Field Robotics (Photo: Roger T. Hanlon), b) Global Hawk Unmanned Aerial Vehicle (UAV) - (Photo courtesy of NASA)

A factory robot is typically a small work cell manipulator in the form of a fixed arm that performs repetitive tasks. Parts are systematically fed to the robot so it can maximize its superior speed and precision. Robotic work environments should be avoided because their high pace can be dangerous. Field and service area robots face huge obstacles requiring robots to work and navigate in complex, crowded, and dynamic environments, a requirement that is required of delivery robots in hospitals that must move between

first robot patent was filed by George C. Devol in 1954 and granted in 1961. The device was a robotic arm with a gripper attached to a track and its movements recorded by a camera. It was designed as a magnet stored on a rotating drum. The first robotics company, Unimation, was founded in 1956 by Devol and Joseph Engelberger. Their first industrial robot, the Unimate (Figure 1.2), was put into operation in 1961.

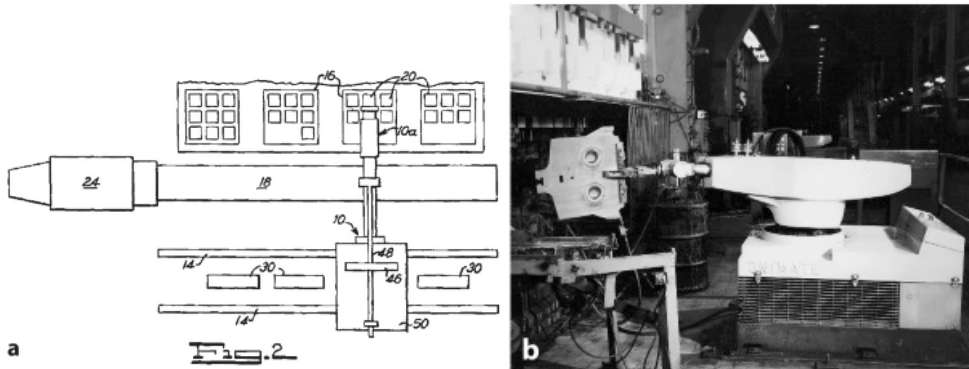


Fig. (1.2a & b): Universal automation plan view of the machine from Devol's patent

Devol and Engelberger's original idea of robotic automation has been realized, and millions of arm robots, such as the one in (Figure 1.3), have been built and are currently used for a range of tasks, such as: B, welding, painting, loaders, electronic palletizing, and packaging assembly.

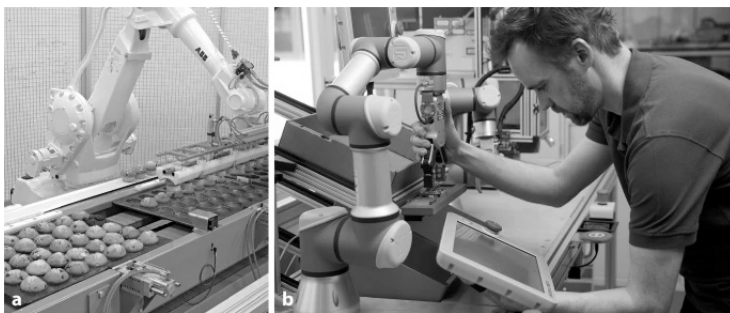


Fig (1.3) Arm robots

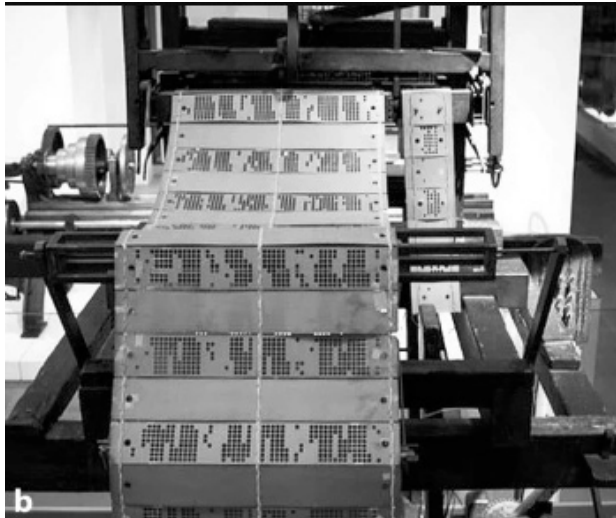


Fig 1.1 b: Programmed mechanism system

The coded pattern to be woven was represented by a series of holes on a punch card. The device had several features of a modern robot: it could perform physical tasks and was programmed. The word "robot" first appeared in the Czech science fiction play "Rossum's Universal Robot" by Karel Čapek in 1921. The word "robot" alludes to an artificial person or robot and comes from the Czech word for "slave." As in many subsequent robot stories, the robot uprising in the play ends tragically for humans. Isaac Asimov's Robot Trilogy deals with ethics and human-machine relations. He was involved in several novels and short stories published between 1950 and 1985. The "positronic brain" possessed by these robots is where the "Three Laws of Robotics" are kept. These stories influenced public perception of robots and also later novels and films. Also in the mid-20th century, the field of cybernetics emerged, a name rarely heard today but once an exciting science at the forefront of understanding life and creating intelligent machines. The

Introduction

The word “robot” can mean different things to different people. Many people’s expectations of robots and their capabilities are largely influenced by science fiction literature and movies. Unfortunately, this common perception does not reflect the state of robotics practice. But one thing is certain: robotics will play a major role in the technological landscape of this century. Items such as vacuum cleaners will soon be among the many smart devices that will appear in our homes and offices, and the first will be cleaning robots. Automata like the duck depicted in Vaucanson (Figure 1.1a) fascinated 17th-century Europeans.

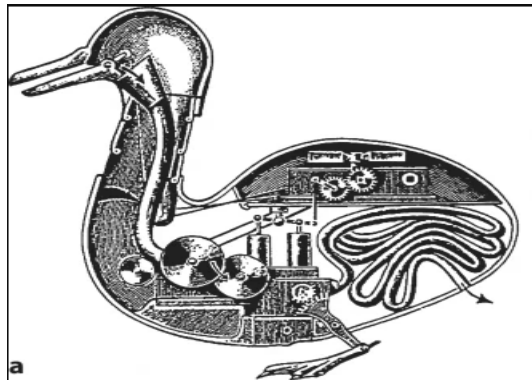


Fig 1.1a: Early programmable machines a Vaucanson’s duck (1739) .

These robots exhibited behavior that seemed lifelike at the time, despite their sophistication for the period. Vaucanson then went on to study the automation of silk weaving, and the duck uses a cam mechanism to synchronize its movements. Jacquard further developed these ideas and built a loom that looks like a programmed loom (Fig. 1.1b).

المستخلص

يمكن أن تصبح معالجة الصور أكثر دقة وكفاءة باستخدام تقنيات المعالجة البصرية. من أجل إصدار أحكام تصميمية أفضل في وقت مبكر من عملية تصميم ، تهدف محاكاة فن التغليف المرئي إلى تطوير تأثيرات تغليف واقعية بسرعة. غالبًا ما تسفر تقنيات المحاكاة التقليدية عن نتائج ليست واقعية أو مفصلة، كما أنها تستغرق الكثير من الوقت والموارد البشرية. يمكن لتقنية الرؤية الآلية القائمة على المعالجة البصرية الاستفادة الكاملة من تقنيات الرؤية الحاسوبية ومعالجة الصور لمحاكاة تصميمات العبوات بدقة وكفاءة. يقترح هذا البحث أساسًا لتقنيات الرؤية الآلية القائمة على المعالجة البصرية للصور. يتم التقاط صور العبوات الحقيقية باستخدام كاميرات عالية الدقة أثناء مرحلة جمع الصور، وأثناء خطوة المعالجة البصرية، يتم استخدام الخوارزميات لتعزيز وتقليل الضوضاء وتحليل التفاصيل الدقيقة في الصور. بعد ذلك، يتم استخدام تقنيات معالجة الصور المتقدمة لاستخراج وتحليل السمات الرئيسية للتصميم بدقة.

الكلمات المفتاحية: الرؤية الحاسوبية، الخصائص الهندسية، الوضعية، الحركة، الوظائف البصرية البشرية، تصميم فن التغليف البصري، خوارزميات التعلم الآلي.



Abstract

Image processing may be made more accurate and efficient with the use of optical processing technologies. In order to make better design judgments early in the package design process, visual packaging art simulation aims to swiftly develop realistic packaging effects. Conventional simulation techniques frequently yield findings that are neither realistic or detailed, and they also take a lot of time and human resources. Optical processing-based machine vision technology can fully utilize computer vision and image processing techniques to simulate package designs accurately and efficiently. This research proposes a foundation for machine vision technologies based on image optical processing. Real package pictures are captured using high-resolution cameras during the image collection stage, and during the optical processing step, algorithms are employed to enhance and reduce noise and analyze fine details in the images. After that, advanced image processing techniques are used to accurately extract and analyze the main features of the design.

Keywords: Computer Vision, Geometric properties, Posture, Motion, Human visual functions, Visual packaging art design, Machine learning algorithms.

Designing A Visual Control Framework Based on Feature Point Analysis to Guide Robots in Uncharted Areas

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تصميم إطار تحكم بصري يعتمد على تحليل نقاط الميزة
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