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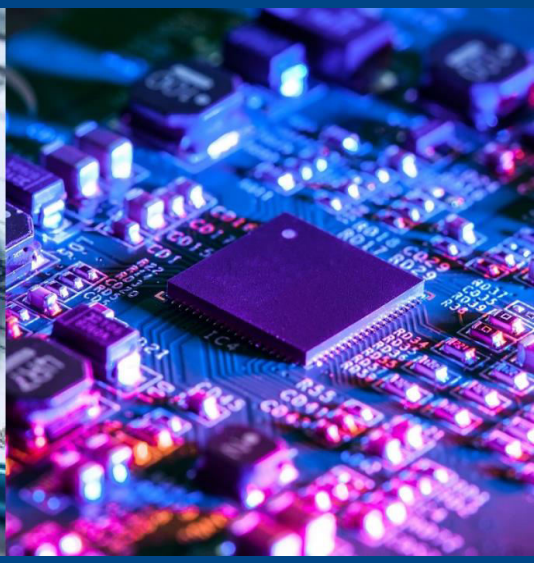

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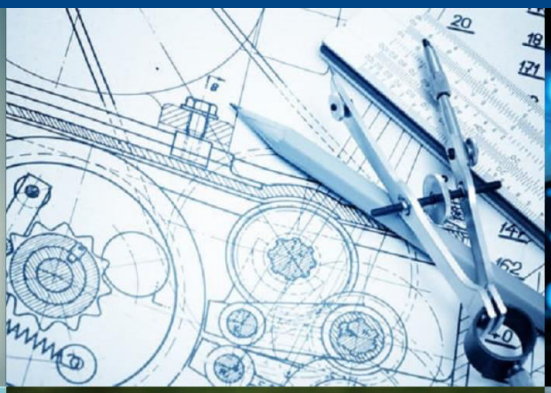

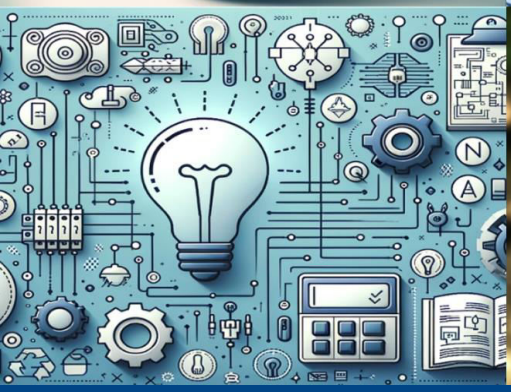

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Green Building Analysis - A Residential Case Study

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ABSTRACT: This paper presents a comprehensive analysis of a selected residential building, through the lens of green building principles. The study evaluates the project's performance across key sustainability metrics, including site planning, water efficiency, energy efficiency, material selection, and indoor environmental quality. Utilizing a framework aligned with established green building rating systems relevant to the Indian context, such as GRIHA (Green Rating for Integrated Habitat Assessment) and LEED (Leadership in Energy and Environmental Design), the analysis identifies the implemented sustainable features and assesses their effectiveness in reducing environmental impact and enhancing occupant well-being. Quantitative data, where available, including energy and water consumption figures, material specifications, and indoor air quality measurements, are examined to quantify the building's environmental performance. Qualitative assessments, based on design documentation and site observations, complement the quantitative findings. The abstract highlights the successes and challenges encountered in implementing green building strategies in a typical residential setting , providing valuable insights and lessons learned for future sustainable housing developments in the region and beyond. The findings contribute to a better understanding of the practical application and benefits of green building practices in the Indian residential sector, ultimately promoting a more sustainable built environment

KEYWORDS: Building Information Modelling (BIM), Autodesk Revit, Autodesk Green Building Studio, Energy analysis.

I. INTRODUCTION

Green building, also known as sustainable building, is the practice of designing. Constructing and operating buildings in a way that minimizes their negative impacts on the environment and maximizes occupant well-being. It encompasses a holistic approach that considers the entire lifecycle of a building, from material selection and energy efficiency to water conservation and indoor environmental quality.

In the residential sector, the adoption of green building principles offers numerous benefits, including reduced energy and water consumption, lower operating costs, improved indoor air quality, and enhanced comfort for occupants. This analysis will delve into a specific residential case study to examine the practical application and impact of green building strategies on a real-world setting. By focusing on a single dwelling, we can gain a detailed understanding of the specific technologies, design choices, and their resulting environmental and economic performance.

This case study examines the implementation and performance of green building principles in a residential dwelling Driven by the increasing need for sustainable housing solutions in the face of rapid urbanization and environmental concerns in the region, this analysis delves into the specific design strategies, material choices and technologies employed to minimize the building's ecological footprint while enhancing occupant comfort and well-being.

II. LITERATURE REVIEW

The concept of green building has evolved from a focus on energy efficiency to a holistic approach encompassing environmental, economic, and social considerations throughout a building's lifecycle. Sustainable housing, a subset of green building, specifically addresses the environmental impact of residential dwellings, recognizing their significant contribution to overall energy consumption and resource depletion. Principles of sustainable housing include minimizing energy and water use, utilizing environmentally friendly materials, reducing Waste and creating healthy and comfortable indoor spaces.

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India, with its rapidly growing urban population and increasing energy demands, faces unique challenges and opportunities in the adoption of green building practices (TERI,2012). Studies have highlighted the potential for significant energy savings in the building sector through the implementation of appropriate design and technological interventions (Bureau of Energy Efficiency). Government initiatives and the efforts of organizations like the Indian Green Building Council (IGBC) and the Green Rating for Integrated Habitat Assessment (GRIHA).

The residential sector presents unique considerations for green building implementation due to the diverse needs and preferences of individual homeowners. Research in this area various strategies, utilizing building orientation, natural ventilation, daylighting, and thermal mass to minimize the need for mechanical heating and cooling. Studies in tropical climates, emphasize the importance of shading devices, cross-ventilation, and appropriate building orientation to reduce solar heat gain.

Investigating the effectiveness of high-performance insulation, energy-efficient windows and doors, efficient lighting (LEDs), and energy-star rated appliances in reducing energy consumption in residential buildings (IEA. 2021). The integration of smart home technologies for energy management is also an emerging area of research. Examining the implementation and impact of water efficient fixtures, rainwater harvesting systems, and greywater recycling in reducing water demand in residential settings.

Evaluating the environmental and performance characteristics of various building materials, including those with recycled content, low embodied energy, and locally sourced options (Monahan & Powell, 2011). Research in India also explores the use of traditional and natural building materials like bamboo and earth in sustainable construction (Reddy,2008). Material choices on air quality, thermal comfort, lighting, and well-being (Fisk,2017). The use of low-VOC materials and effective ventilation systems are key areas of focus.

Investigating effective passive cooling techniques, such as evaporative cooling and natural ventilation strategies, suitable for the climate and analyzing the potential of rainwater harvesting and groundwater recharge in addressing water scarcity in residential areas. Exploring the availability and suitability of local materials like granite, laterite, and specific timber species for sustainable construction.

III. METHODOLOGY

This study employs a mixed-methods approach to analyze a selected residential building, that has incorporated green building principles. The methodology involves a combination of qualitative and quantitative data collection and analysis to provide a comprehensive understanding of the project's design, implementation, and performance.

The case study selection:

BULIDING TYPE: - Residential
LOCATION: the climate in Guntur is tropical with dry winter
SIZE: 3,500 SFT

The Willingness of the homeowner/developer to provide access for observation and data collection. And access to architectural plans, material specifications, energy and water bills, and any green building certifications pursued.

Site Selection: Analyze the site selection process, considering factors like proximity to amenities, public transportation,
brownfield redevelopment, and preservation of open spaces.

Site Development: Evaluate strategies for minimizing site disruption during construction, erosion and sedimentation
control, stormwater management, heat island reduction (e.g., reflective surfaces, vegetation), and light pollution reduction.

Water Use Reduction: Analyze the implementation of water-efficient fixtures (low-flow toilets, showers, faucets),

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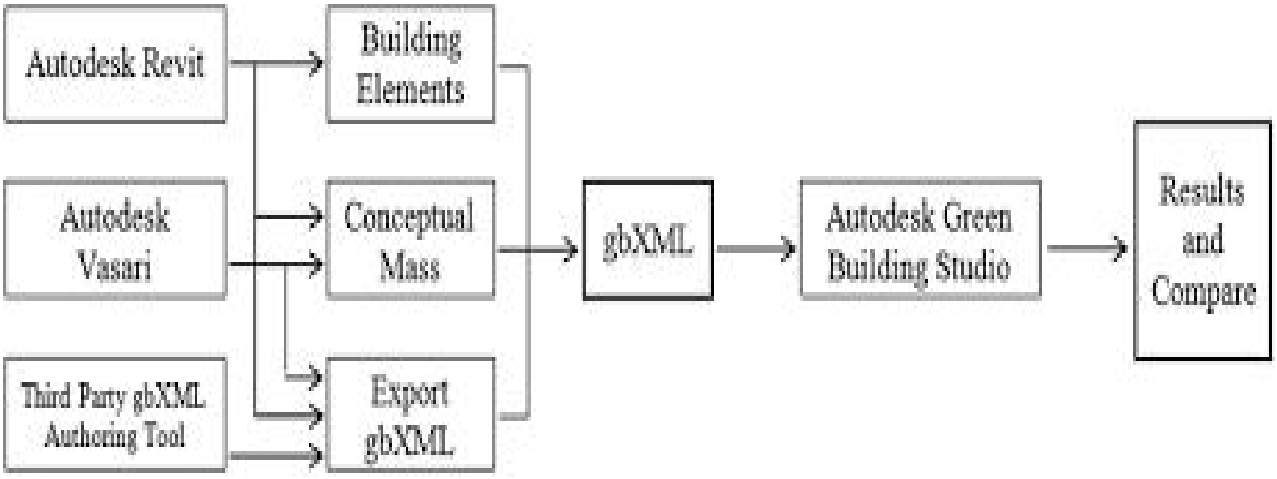
rainwater harvesting systems, greywater recycling, and water-wise landscaping.

A. Energy and Water Consumption Data:

Utility bills for a period before and after the full occupancy of the green building features were collected to analyze actual energy and water consumption patterns and potential savings.

B. Indoor Environmental Quality:

While extensive quantitative IEQ monitoring might be beyond the scope of were madeBased of observations and homeowner feedback regarding natural light, ventilation, thermal comfort, and perceived air quality



MODELING IN REVIT:

REVIT PROCEDURE:

1) Create the REVIT Project Model File
2) Assign the Project Information
3) Create Grids for the REVIT Model
4) Create Levels for the REVIT Model
5) Locate the Project Base Point in the REVIT Model
6) Create Standard Plan Views with the Desired Underlay Properties

- Choose the walls as per the requirements from properties. In this we have selected 9-inch thickness for outer walls and 4-inch thickness for inner walls.
- Adding Doors, Windows, and other Components.
- For placing the doors and windows we must select form the load families.
- Click on doors and windows and select and place the doors and windows as per size requirements from properties.
- Click on stairs and place the stairs in required position.

IV. RESULTS AND DISCUSSION

This analysis of a residential green building in demonstrates the successful implementation and potential benefits of various sustainable design and construction strategies. While acknowledging the limitations of a single case study, the findings suggest that green building practices can lead to reduced resource consumption, improved occupant comfort, and potential cost savings in the local context. Further research and wider adoption of these principles are crucial for promoting a more sustainable built environment.

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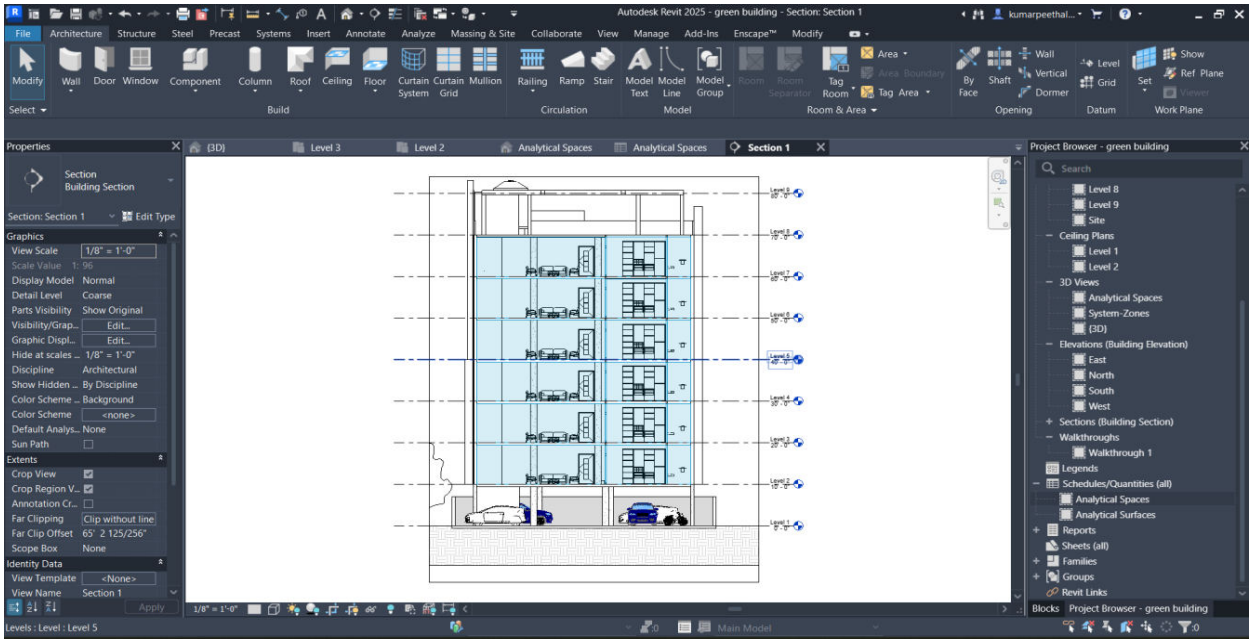

Implementation and Recommendations:

The positive outcomes observed in this case study highlight the potential of green building practices to create more sustainable and comfortable residential spaces. Incorporating climate-responsive design principles from the initial stages of building design.Encouraging the adoption of rainwater harvesting and water-efficient fixtures and supporting the use of environmentally friendly building materials. And builders about the benefits of green buildings. Incentives to encourage the adoption of green building practices in the residential sector.

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V. CONCLUSION AND FUTURE WORK

A. Conclusion:

- This case study has provided a valuable insight into the practical application and potential benefits of green building principles within a residential dwelling. The analysis of the implemented strategies, including climate-responsive passive design, energy and water-efficient technologies, and the use of sustainable materials, suggests a positive impact on resource consumption and occupant comfort.

- While quantitative performance data was limited, qualitative assessments and homeowner feedback indicate a reduction in energy and water usage and an enhanced living environment. The findings underscore the relevance and effectiveness of green building practices in addressing the environmental challenges and improving the sustainability of the residential sector specific climate and socio-economic context. This case study serves as a positive example, demonstrating the feasibility of creating more environmentally responsible and comfortable homes in the region.

- A comprehensive green building analysis of a residential case study reveals the tangible benefits and challenges associated with sustainable housing. The findings often demonstrate significant reductions in energy and water consumption, leading to lower operational costs and a decreased environmental footprint. Improved indoor environmental quality contributes to enhanced occupant health and well-being. Furthermore, the analysis can highlight the effectiveness of specific green building strategies and technologies implemented in the project.

- However, the analysis may also reveal challenges such as higher initial construction costs, the complexity of integrating various sustainable systems, and the importance of occupant behavior in achieving optimal performance. It underscores the need for a holistic approach that considers the interplay of design, technology, and human factors in creating truly sustainable residential buildings. Ultimately, the case study serves as a valuable learning tool, providing practical insights and benchmarks for future green residential developments.

- the conclusions drawn from a well-executed green building analysis contribute to a better understanding of sustainable design and construction practices, promoting the adoption of environmentally responsible and resource-efficient buildings for a more sustainable future. The specific findings of the case study will highlight the successes and challenges of the particular project, offering specific recommendations tailored to its context and potentially informing broader industry best practices.

B. Future Work:

Building upon the analysis of residential green building case studies, several avenues for future work can be explored:

- **Long-term Performance Monitoring:** Conduct longitudinal studies to assess the actual performance of green residential buildings over their lifecycle. This includes continuous monitoring of energy and water usage, indoor air quality, and occupant satisfaction to validate initial projections and identify areas for improvement over time. For example, researchers could install smart home technologies to gather real-time data on energy consumption patterns in households with different green building features.

- **Cost-Benefit Analysis and Financial Modeling:** Develop more sophisticated economic models that account for the long-term benefits of green building, including reduced utility bills, increased property value, and potential health benefits. This could involve analyzing the payback period for various green technologies and identifying financial incentives that can promote wider adoption. For instance, studies could compare the lifecycle costs of conventional homes versus green-certified homes in specific regions, considering factors like energy prices and maintenance expenses.

- **Occupant Behavior and Education**: Investigate the role of occupant behavior in the performance of green homes. Research could explore how residents interact with green building systems and identify effective strategies for educating and engaging occupants to maximize the benefits of sustainable features.

- **Integration of Smart Technologies:** Explore the potential of integrating smart home technologies with green

building design to optimize energy efficiency, water management, and indoor environmental quality.

- **Impact of Policy and Regulations:** Analyze the effectiveness of existing green building policies and regulations in driving the adoption of sustainable residential construction. This could involve comparative studies of different policy approaches and the identification of best practices for promoting green building at local, regional, and national levels.
- **Life Cycle Assessment (LCA):** Conducting a comprehensive LCA of residential green buildings in the region to quantify their overall environmental impact from material extraction and manufacturing to construction, operation, and eventual demolition.

By pursuing these future research directions, a more comprehensive understanding of the benefits, challenges, and optimal strategies and similar regions can be developed, ultimately contributing to a more sustainable and resilient built environment.

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