iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 14 **Issue:** III **Month of publication:** March 2026

DOI: https://doi.org/10.22214/ijraset.2026.78008

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue III Mar 2026- Available at www.ijraset.com

Design and Implementation of a Secure Web-Based Hostel and PG Management System Using Open-Source Technologies

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Abstract: ***The Hostel or PG Management System is a web-based application designed to automate and simplify hostel administration activities. The existing manual system is time-consuming and prone to errors, which can be reduced using this digital solution. The system is developed using Python with the Flask framework for backend processing and HTML, CSS, and JavaScript for the frontend. It allows the admin to manage student details, room information, and room allocation efficiently .The application also supports rent payment tracking and complaint management. All data is stored securely in a centralized database such as SQLite or MySQL. This system improves accuracy, reduces paperwork, and saves administrative time. It provides a scalable platform that can be enhanced with advanced features in the future.***

Keywords: Hostel Management System, PG Management System, Web Application, Python, Flask Framework, HTML, CSS, JavaScript, SQLite/MySQL Database, Student Management, Room Allocation, Rent Management, Complaint Management, Visitor Management, Admin Dashboard.

I. INTRODUCTION

The need for effective hostel and paying guest (PG) management systems has grown due to the quick expansion of educational institutions and urban migration. Manual paperwork and record keeping are major components of traditional hostel administration techniques. Data mistakes, duplication, and improper record management are frequently the results of such manual operations. Without automation, handling room assignments, student data, payments, and grievances becomes challenging. A centralized, digital infrastructure is needed to overcome these obstacles. A web-based program called the Hostel and PG Management System was created to automate lodging administration duties. The system offers an organized platform for effectively handling rooms, students, fees, and grievances.

Administrators have the ability to assign students, add rooms, keep an eye on financial records, and manage occupancy. Students can access accommodation details and payment history by securely logging in. They can also change their passwords and file complaints. Role-based authentication is used by the system for both administrative and student users. User credentials are protected through the use of secure password hashing algorithms. Open-source tools including Python, Flask, SQLite, HTML, and CSS are used in the project's development.

A. Background and Motivation

Manual record keeping is the foundation of traditional hostel and PG management systems, which frequently results in mistakes, data loss, and ineffective administration. As the number of residents rises, it becomes more challenging to manually manage room allocation, student data, fees, and complaints. These drawbacks emphasize the necessity of an automated and structured system.The goal of this project is to provide a safe, centralized web-based hostel and postgraduate management system that streamlines administrative work and increases accuracy. The system improves productivity, transparency, and data security by utilizing open-source technologies and putting in place safe authentication procedures. Through digital transformation, the initiative seeks to modernize hostel management and offer residential institutions a scalable solution.

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B. Problem Statement

A lot of data on rooms, students, payments, and complaints is handled by hostels and Paying Guest (PG) accommodations. These tasks are typically completed by hand using spreadsheets or registers, which is laborious and prone to mistakes. Data duplication, record loss, and trouble tracking room availability and payments are common outcomes of manual systems. Keeping up-to-date student information and effectively handling complaints are difficult tasks for administrators. Additionally, students are unable to see the progress of their complaints or the status of their payments. Manual data management becomes ineffective as the population grows. A centralized system for safe data retrieval and storage does not exist. Students and administration start to communicate more slowly. Monitoring and reporting become challenging. To get over these restrictions, an automated hostel/PG management system is needed.

C. Research Objectives

The following are the main goals of the suggested system:

1) Developing a centralized database system to store and manage student, room, payment, and complaint records.
2) Implementing role-based authentication mechanisms for administrators and students to ensure controlled system access.
3) Incorporating secure password hashing techniques to protect user credentials and enhance data security.
4) Automating room allocation and occupancy tracking to reduce manual errors and improve efficiency.
5) Offering an integrated payment tracking module to maintain accurate financial records.
6) Designing a complaint management system that enables students to submit and track issues digitally.

D. Contributions

To automate hostel administration, a web-based Hostel/PG Management System was created. implemented modules for recording fees, assigning rooms, managing students, and addressing complaints. created a safe login system with role-based access for administrators and students. To effectively store and handle hostel data, a centralized database was created using SQLite3.Digital automation decreased manual paperwork and increased management effectiveness.

E. Organization of the Paper

This is how the rest of the paper is structured. The study's background and introduction are given in above. The Literature Survey is explained in Section II. The Proposed Methodology is explained in Section III. The Evaluation and Results are described in Section IV. The discussion are covered in Section V. In Section VI the paper concludes with conclusion and future work.

II. LITERATURE REVIEW

A. Manual Hostel Management System

In order to maintain student information, room assignments, fees, and grievances, traditional hostel administration systems mostly rely on registers, files, and paper documents. The hostel staff keeps all of the records by hand. Although this method is straightforward, it becomes ineffective as the student population grows. Updating and searching records in manual systems takes more time and effort. Data loss from misplaced or damaged documents is highly likely. Payment records frequently contain duplicate entries and computation errors. It becomes challenging to monitor the status of complaints and the availability of rooms. Manually creating reports is a slow procedure. There is little transparency between administration and students. Delays in communication are common. In general, manual systems are inefficient, inaccurate, and not scalable.

B. Semi-Automated Hostel Management Systems

Some hostels handle data using semi-automated techniques like Excel sheets or simple desktop programs. Although these solutions cut down on paperwork, they nevertheless have drawbacks. Data is frequently kept locally on a single system, which makes remote access challenging. The ease with which files can be altered or removed limits security. Access by multiple users is not effectively supported. Payment tracking and complaint processing are partially automated but do not provide real-time updates. Manual labor is still required to generate reports. Backup data is unreliable. When compared to manual methods, these solutions increase efficiency, but they do not completely address managerial issues.

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C. Existing Web-Based Hostel Management Systems

Administrators and students can access modern web-based hostel management systems online. Faster information access and centralized data storage are made possible by these systems. Payments, complaints, student data, and room assignments are all managed digitally. Nevertheless, a lot of current technologies are costly and complicated. They need expensive servers and licensing. Beginners may find it challenging to comprehend and manage certain systems. There aren't many choices for customization. Such systems are expensive for PGs and small hostels. Maintenance frequently requires technical assistance. As a result, even while web-based systems are effective, small businesses might not be able to pay or use them.

D. Review of Technologies Used

Numerous studies emphasize the development of management systems using Python, Flask, MySQL/SQLite, HTML, and CSS. Python's ease of use and readability make it popular. For tiny to medium-sized applications, Flask is a lightweight framework. Reliable and secure data storage is offered by MySQL and SQLite. User-friendly interfaces can be created with the aid of HTML and CSS. These technologies are affordable and open-source. They facilitate quick development and simple upkeep. These tools have been successfully used in several academic projects, demonstrating their dependability. They are therefore appropriate for creating the Hostel/PG Management System.

III. PROPOSED METHODOLOGY

A. System Architecture

The frontend, backend, and database are the three primary levels of the client-server architecture used by the Hostel/PG Management System. HTML, CSS, and JavaScript are used in the development of the frontend, which offers administrators and students an easy-to-use interface for interacting with the system. The Python Flask framework, which handles application logic, handles user requests, and links the system to the database, is used to construct the backend.Important data, including student identification, room information, payment records, and complaints, are managed and stored in the SQLite3 database. An effective and dependable hostel administration system is produced by this architecture, which guarantees seamless communication between the user interface, server, and database.

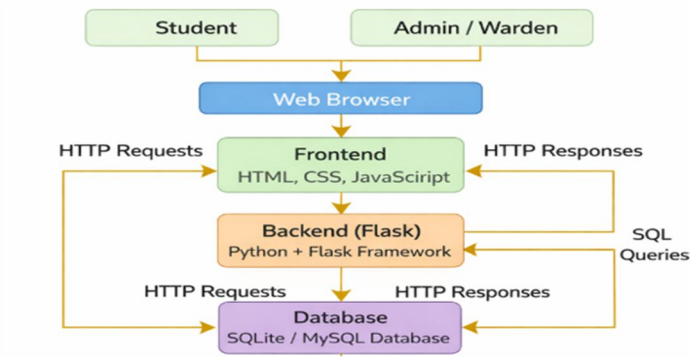


Fig. 1: System Architecture of Hostel or PG Management System

B. Overall System Workflow

The system has a client-server architecture, with the backend handling database operations and processing requests while the user interacts with the system via a web interface.

The system's workflow can be summed up as follows:

1) User Login Authentication
2) Admin Dashboard Access
3) Student Registration and Data Management
4) Room Creation and Allocation
5) Fee Payment Management
6) Complaint Submission and Monitoring
7) Data Storage and Retrieval
8) Report Generation and System Monitoring

This organized process guarantees seamless coordination between the various application modules and increases system efficiency.

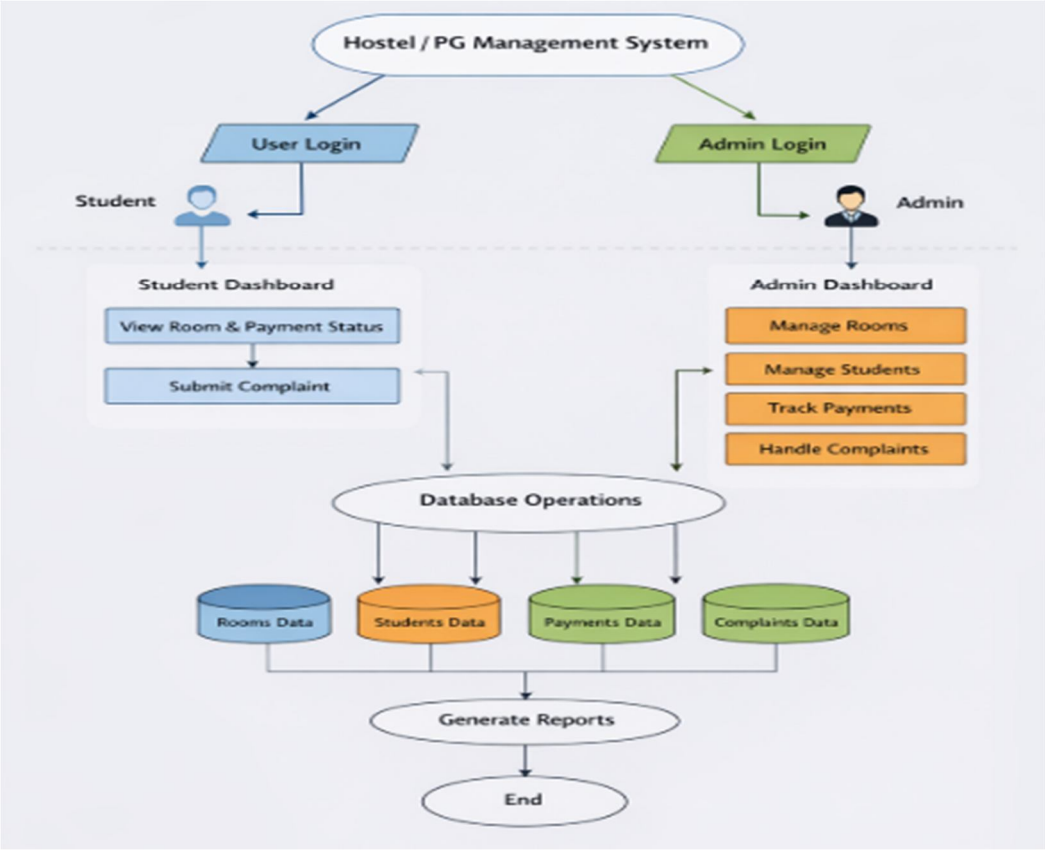


Fig. 2: Overall Workflow of Hostel and PG

a) User Authentication and Access Control

The system uses a login authentication method for administrators and students to provide secure access. Before gaining access to the system, each user must supply legitimate login credentials.

The following tasks are carried out by the authentication module:

- Verification of the admin login
- Using hashing to store passwords securely
- User activity session management
- The ability to log out for safe session termination

This module makes sure that only authorized users may carry out system administration tasks and stops unwanted access.

b) Student Information Management

Administrators are able to keep precise records on dormitory inhabitants thanks to the student management module. It offers features for accessing, updating, adding, and removing student data.

Important student information is stored by the system, including:

- Name of the student
- Email Address
- Contact Details
- The assigned room number
- Status of Payment

The unified storing of student data enhances accessibility and facilitates the effective management of hostel inhabitants by administrators.

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c) Room Allocation and Management

Administrators can establish, maintain, and assign hostel rooms to students according to availability using the room management module.

Important features include of:

- Including additional rooms in the system
- updating the availability and capacity of rooms
- assigning rooms to students who have registered
- Keeping an eye on both occupied and empty rooms

This module guarantees efficient use of hostel resources and avoids disputes over room assignments.

d) Fee Management and Payment Tracking

The system includes a fee management module to track hostel fee payments and maintain financial records.

The module performs the following tasks:

- Recording monthly hostel payments
- Monitoring pending and completed payments
- Updating payment status
- Maintaining payment history for each student

This functionality reduces manual record keeping and allows administrators to manage financial transactions efficiently..

e) Complaint Management System

The system has a complaint management tool to enhance communication between students and administrators. Students can file complaints about maintenance problems, hostel amenities, or other issues.

The procedure for resolving complaints consists of:

- Submission of student complaints
- Storage of complaints in the database
- Administrative evaluation of complaints filed
- Resolution of complaints and status reports

This module enhances overall hostel management and guarantees prompt issue resolution.

f) Database Integration

The system stores and manages all application data in an organized fashion using a SQLite3 database. The database is made up of several tables that are intended to handle various kinds of data.

The primary database tables consist of:

- Admin Table
- Students Table
- Rooms Table
- Payments Table
- Complaints Table

The database guarantees dependable system performance, safe storage, and effective data retrieval.

g) System Advantages

The suggested approach has a number of benefits:

- Automation of hostel administration tasks
- A decrease in errors and manual paperwork
- Easy access and centralized data storage
- Safe user administration and authentication
- Effective room distribution and payment monitoring
- Better communication via the handling of complaints

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IV. EVALUATION AND RESULTS

In order to assess the performance, usefulness, and efficacy of the created application in overseeing hostel operations, the Hostel/PG Management System was evaluated. To make sure all features work properly, the system was tested using a variety of modules, such as student administration, room assignment, payment tracking, and complaint handling.

A. System Implementation Outcomes

A simulated hostel management scenario was used to successfully test and implement the created system. Administrators may add student information, manage rooms, keep track of fee payments, and keep an eye on complaints with this application. Students can examine their room details, check the status of their payments, and file complaints by logging into the site.The solution successfully lowers manual labor and increases operational efficiency, as the deployment results show. Accurate data storage and retrieval are ensured by the seamless interaction between all modules and the database.

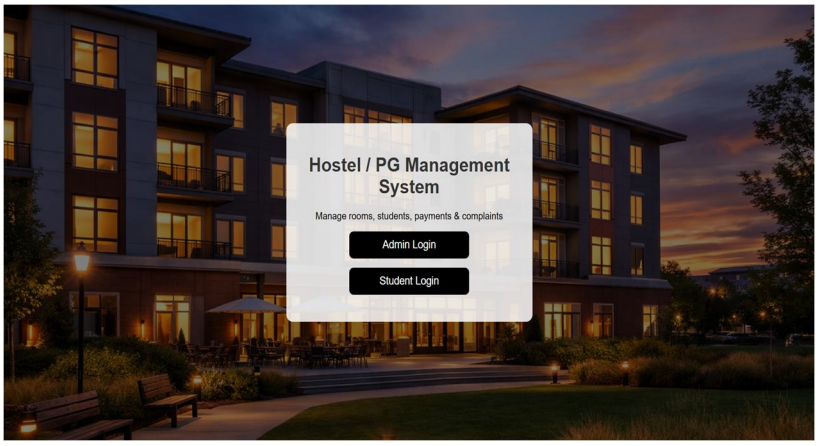


Fig. 3: Admin and User Homepage Interface

B. Functional Evaluation

To make sure that every system module operates as intended, functional testing was done. A variety of test scenarios were carried out, such as student registration, room assignment, payment updates, complaint reporting, and login authentication.The findings show that every system feature functions well and without significant problems. While the database integration enables effective data management and retrieval, the login authentication module guarantees secure access.

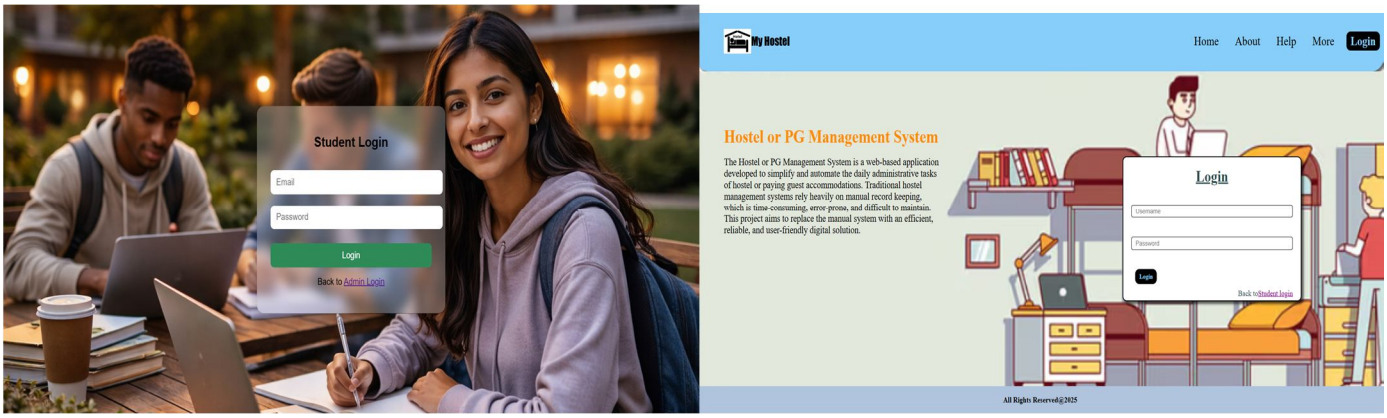


Fig. 4: Admin and Student login page

C. Performance Analysis

Response time, data processing effectiveness, and system dependability were used to assess the system's performance. The findings demonstrate that because the Flask framework and SQLite database are lightweight, the system handles user requests swiftly and effectively.Throughout a variety of tasks, including data entry, record modifications, and report preparation, the program showed consistent speed. Additionally, the system ensures dependable performance by maintaining data consistency across several components.

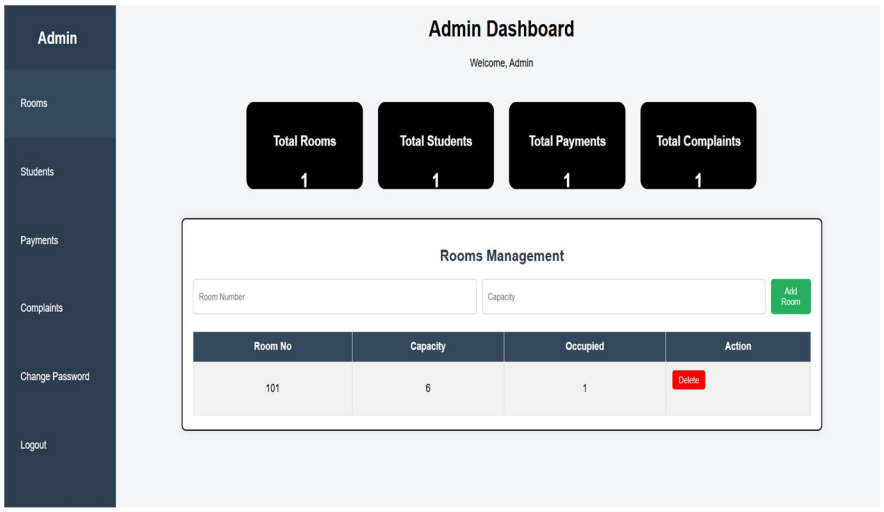


Fig. 5: Admin Dashboard

D. User Interface Evaluation

The system's user interface was made to be straightforward and simple to use. The system's well-organized dashboards and menu options allow both administrators and students to interact with it.The evaluation's findings demonstrate that users don't need sophisticated technological knowledge to carry out tasks like managing hostel information, examining records, and filing complaints. This enhances the system's usability and overall user experience.

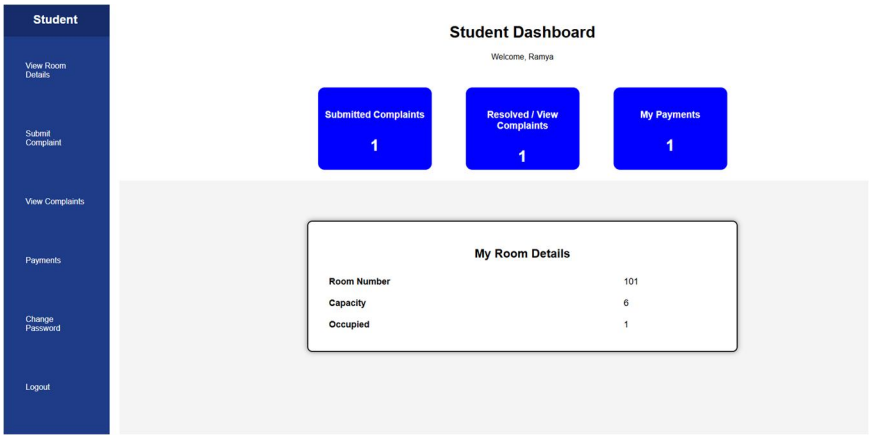


Fig. 6: Student Dashboard

V. DISCUSSION AND LIMITATIONS

A. System Performance and Observation

The overall effectiveness of the created Hostel and PG Management System is covered in this section. Core features such student registration, room administration, room allocation, payment tracking, and complaint handling were all successfully completed by the system during testing. The Flask-based backend communicated with the database quickly and effectively, processing user requests. The solution ensured correct management of hostel records by demonstrating dependable data storage and retrieval. Both administrators and students could readily interact with the system thanks to its responsive and straightforward user interface.

B. Limitations of the System

Despite all of the system's benefits, there are some drawbacks. Performance in big hostel environments may be impacted by the current implementation's limited capacity to accommodate multiple users at once. Furthermore, for web access, the system requires internet connectivity. The present version lacks advanced features including real-time notification services, mobile application support, and automated payment gateways. Future stages of development may address these constraints.

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C. Comparison with Existing Systems

The suggested web-based Hostel and PG Management System offers increased accuracy and efficiency over conventional manual approaches. Paper-based records, which are prone to errors and data loss, are the foundation of manual systems. Spreadsheet-based administration is one example of a semi-automated solution that provides certain advances but lacks centralized access and security. The suggested solution, on the other hand, provides automated procedures for room assignment, payment tracking, and complaint handling, as well as secure authentication and centralized database management. This increases the system's dependability and suitability for contemporary hostel management.

VI. CONCLUSION AND FUTURE WORK

A. Conclusion

The Hostel/PG Management System provides an automated, dependable, and efficient alternative to the conventional manual method of managing hostel operations. The system reduces errors and saves management time by streamlining important procedures like room assignment, student management, payment tracking, and complaint handling. It provides a safe and user-friendly interface for both administrators and students, boosting transparency and collaboration. Developed using Python Flask and MySQL, the system guarantees secure data processing and easy scalability for future expansions. Overall, this approach increases productivity, accuracy, and convenience, making hostel management more astute and well-organized while offering students greater amenities and services.

B. Future Work

An automated, reliable, and effective substitute for the traditional manual approach to hostel operations management is the Hostel/PG Management System. By simplifying crucial processes including room assignment, student management, payment monitoring, and complaint handling, the system lowers errors and saves management time. It increases openness and cooperation by giving administrators and students a secure and easy-to-use interface. The system, which was created with MySQL and Python Flask, ensures safe data processing and simple scalability for future growth. All things considered, this strategy boosts efficiency, precision, and ease of use, making hostel administration more clever and well-run while providing students with more facilities and services.

VII. ACKNOWLEDGMENT

The authors would like to express their sincere gratitude to Bonam Venkata Chalamayya Engineering College for providing the academic environment and support necessary to complete this research work. The authors also extend their appreciation to the faculty mentors for their valuable guidance, technical suggestions, and continuous encouragement throughout the development of this project. Their support greatly contributed to the successful design and implementation of the proposed hostel and pg management system.

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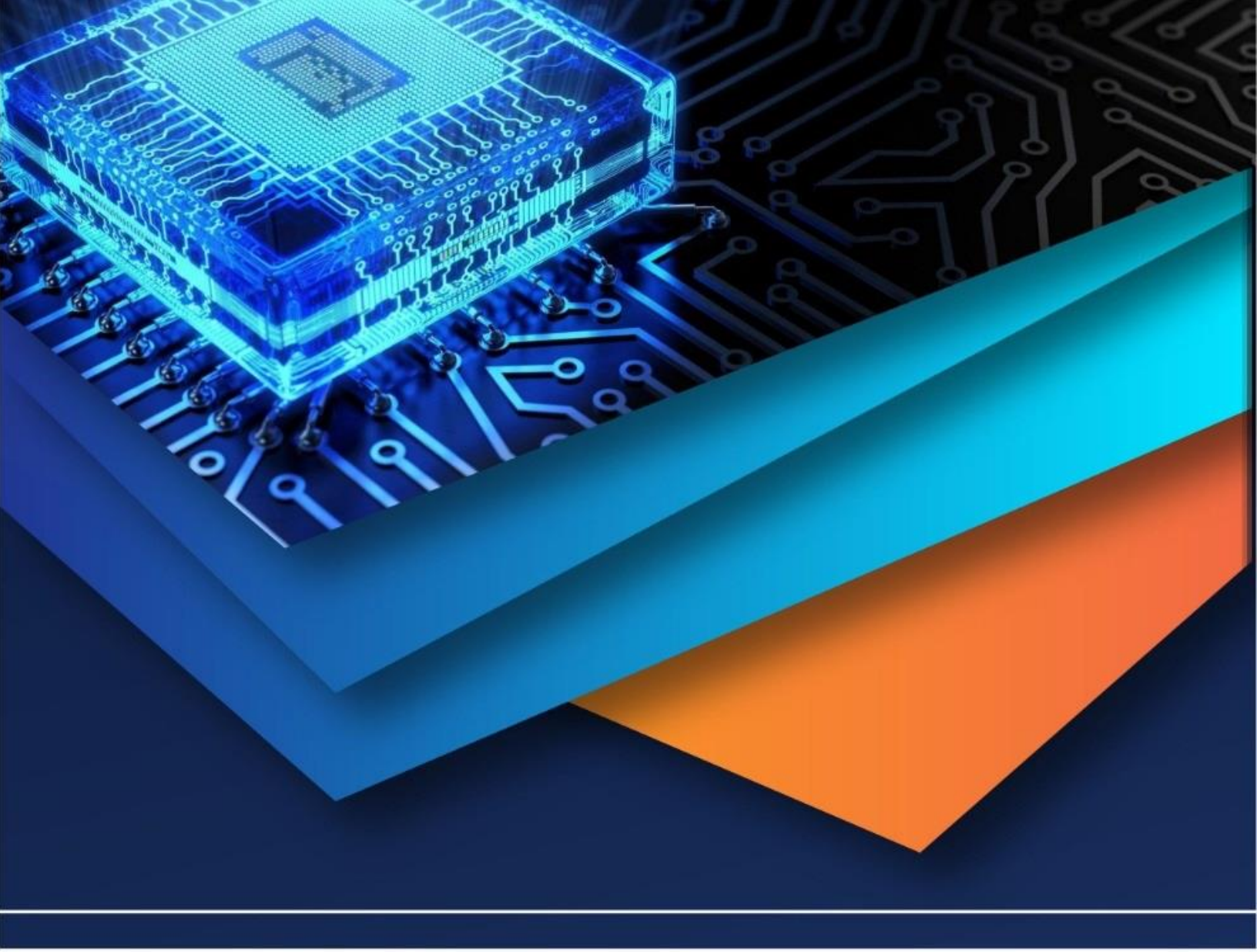


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