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Smart Hostel Issue Reporter: A Web-Based Complaint Management System with an ESP8266-Based Physical Reporting Interface

Ramesh S. Yevale[1], Prachi Subhash Jadhav[2], Snehal Shashikant Nalawade[3], Sanskruti Sandip RedePatil[4], Shivani Subhash Salunkhe[5]

Department of Computer Science and Engineering, SKN Sinhgad College of Engineering, Korti, Pandharpur, India[1-5]

Abstract: Hostel residents frequently face maintenance-related problems such as electrical faults, water leakage, plumbing issues, and cleaning requirements. Traditional complaint reporting methods often depend on verbal communication or manual registers, which can make complaint tracking, prioritization, and status monitoring difficult. This paper presents the Smart Hostel Issue Reporter, a web-based complaint management system designed to provide a structured and centralized platform for reporting and managing hostel complaints. The proposed system provides a student interface for submitting complaints and monitoring their progress, along with an administrator interface for reviewing, assigning, and updating complaints. The application uses React.js for the frontend, Node.js and Express.js for backend services, and MongoDB for data storage. Authentication and role-based access are used to separate student and administrator operations. In addition to web-based reporting, an ESP8266-based physical reporting interface is considered as a supplementary reporting mechanism using an OLED display, push button, buzzer, and indicator LEDs. The system aims to improve complaint visibility, record maintenance, and communication between hostel residents and administrators. The hardware interface is treated as a prototype, and complete hardware-to-backend integration remains a part of further development.

Keywords: Hostel Management, Complaint Management System, Web Application, React.js, Node.js, MongoDB, ESP8266, Internet of Things (IoT).

I. INTRODUCTION

Hostel facilities require regular maintenance to provide students with a safe and comfortable living environment. Problems such as damaged electrical equipment, water leakage, plumbing failures, and unclean surroundings require timely attention from hostel management.

In many hostels, students report these issues through verbal communication, phone calls, or written registers. These approaches may not provide a centralized record of complaints. Students may also face difficulty knowing whether their complaints have been received, assigned, or resolved.

The Smart Hostel Issue Reporter is designed to address these limitations through a centralized web-based platform. Students can submit complaints by selecting a category and providing the required details. Administrators can access submitted complaints, review their information, and update their status.

The project also considers a physical reporting interface based on the ESP8266 microcontroller. This interface is intended to provide an additional way to initiate complaint reporting within the hostel environment. The main objective is to make complaint submission and tracking more organized, accessible, and transparent.

II. PROBLEM STATEMENT AND OBJECTIVES

A. Problem Statement

Traditional hostel complaint reporting methods often lack centralized storage, systematic tracking, and transparent status updates. Manual complaint registers can make it difficult for administrators to maintain records and for students to monitor the progress of reported issues. Therefore, a centralized complaint management system is required to simplify complaint registration, maintain complaint records, and support effective communication between students and hostel administrators.

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B. Objectives

The main objectives of the proposed system are:

- To provide students with a digital platform for submitting hostel complaints.
- To organize complaints according to categories such as electrical, plumbing, cleaning, and water leakage.
- To allow students to monitor the status of their submitted complaints.
- To provide administrators with a centralized dashboard for complaint management.
- To maintain complaint records in a database.
- To implement authentication and role-based access for system users.
- To explore an ESP8266-based physical interface as an additional complaint reporting method.

III. RELATED WORK

Several studies have explored web-based and IoT-based solutions for hostel management and complaint handling. William et al. presented a Smart Hostel Management System that focuses on improving hostel-related administrative activities through digital technologies [1]. discussed the development of a web-based hostel management system to improve hostel application and management processes [2]. Tharu et al. proposed an integrated hostel management system with role-based access for students and wardens, highlighting the importance of access control in hostel applications [3]. Sheeba et al. explored an IoT-based hostel tracking approach, demonstrating the potential use of connected devices in hostel-environments [4]. Developed a web-based student complaint management system for tertiary institutions, emphasizing the need for structured complaint submission and management [5]. Wong and Mahdin discussed an online hostel management system intended to improve application and management processes [6]. Presented a web-based campus complaint management system for handling complaints in an academic environment [7].

These studies provide a foundation for developing digital systems for hostel administration and complaint management.

IV. IDENTIFIED GAP

Existing hostel management and complaint management solutions demonstrate the usefulness of digital platforms. However, a complaint reporting system designed specifically around the reporting and tracking needs of hostel residents can provide a more focused approach.

The proposed system concentrates on the complaint life cycle, including submission, review, status updates, and resolution. It also considers a physical reporting interface as a supplementary method for initiating complaints. The system is intended to combine centralized complaint records with role-based access and a simple user interface.

V. SYSTEM OVERVIEW AND ARCHITECTURE

The Smart Hostel Issue Reporter follows a client-server architecture. Students and administrators interact with the application through their respective interfaces. The backend processes requests and communicates with the MongoDB database.

The main components are:

- Student Interface: Allows students to register, log in, submit complaints, and monitor complaint status.
- Administrator Interface: Allows authorized administrators to view complaints and update their status.
- Frontend: Provides the user interface using React.js.
- Backend: Processes application requests using Node.js and Express.js.
- Database: Stores user and complaint information using MongoDB.
- Physical Reporting Interface: Uses an ESP8266-based prototype with an OLED display, push button, buzzer, and indicator LEDs.

A. System Architecture

The web application communicates with the backend through application requests. The backend performs the required operations and stores complaint information in MongoDB. The physical reporting interface is considered an additional input mechanism; its complete integration with the backend is part of future development.

VI. STUDENT MODULE

The student module provides the primary interface for hostel residents.

A. Student Registration and Login

Students can create an account and log in using their registered credentials. Authentication helps ensure that only authorized users can access protected application features.

B. Complaint Submission

Students can submit complaints by providing the required information. The complaint form includes relevant details such as complaint category, room or location information, description of the issue, and priority level, where supported. The system supports complaint categories such as electrical issues, plumbing, cleaning, and water leakage.

C. Complaint Tracking

Students can view their submitted complaints and check their current status. This provides visibility into the progress of reported issues.

VII. ADMINISTRATOR MODULE

The administrator module provides access to complaint management functions.

A. Complaint Monitoring

Administrators can view the complaints submitted by students and review the associated details.

B. Complaint Status Management

Administrators can update complaint statuses according to the progress of the work. The proposed complaint lifecycle includes Pending, In Progress, and Resolved.

C. Centralized Records

The administrator can access complaint information from a centralized interface. This helps maintain records and supports complaint monitoring.

VIII. BACKEND AND DATABASE

The backend is developed using Node.js and Express.js. It receives requests from the frontend, processes the application logic, and interacts with MongoDB. MongoDB is used to store application data, including user information and complaint records. The database supports the storage and retrieval of complaint details, user records, and complaint status information. This centralized storage helps maintain a consistent record of reported issues.

A. Authentication and Authorization

Authentication is used to verify the identity of users. Role-based authorization separates student and administrator operations so that users can access only the features permitted by their roles. Password hashing is used to avoid storing passwords as plain text. Protected backend routes are used for operations that require authentication.

IX. METHODOLOGY AND DESIGN

The system is developed through an incremental approach. The main application features are implemented and tested in stages. The development process includes:

- Requirement analysis and identification of hostel complaint categories.
- Design of student and administrator interfaces.
- Development of frontend components.
- Development of backend routes and application logic.
- Database design and integration with MongoDB.
- Implementation of authentication and role-based access.
- Testing of complaint submission and status management.
- Development of the physical reporting prototype.

This approach allows individual modules to be developed and tested before they are combined into the complete application.

X. FUNCTIONAL REQUIREMENTS

The major functional requirements of the proposed system are:

- User registration and login.
- Student complaint submission.
- Selection of complaint categories.
- Viewing submitted complaints.
- Monitoring complaint status.
- Administrator access to complaint records.
- Updating complaint status.
- Storing user and complaint information in the database.

XI. NON-FUNCTIONAL REQUIREMENTS

The system considers the following non-functional requirements:

- Usability: The interface should be simple and understandable for students and administrators.
- Security: Authentication and role-based access should protect application functions.
- Maintainability: The application should support modification and extension of individual modules.
- Reliability: Complaint records should be stored and retrieved consistently.
- Scalability: The application architecture should allow additional features to be introduced.
- Accessibility: Students should be able to access the web application through supported devices and browsers.

XII. COMPLAINT LIFECYCLE

The complaint lifecycle describes the sequence of activities from complaint submission to resolution. Initially, a student submits a complaint through the application. The complaint is stored with a Pending status. After reviewing the complaint, the administrator can update its status to In Progress. Once the issue has been addressed, the administrator can mark it as Resolved.

XIII. HARDWARE PROTOTYPE

In addition to web-based complaint submission, the project considers a physical reporting interface using the ESP8266 microcontroller. The prototype is intended to provide a simple physical interaction point for hostel residents. The ESP8266 provides Wi-Fi connectivity and can serve as the controller for the connected components.

A. Hardware Components

The proposed prototype uses the following components:

- ESP8266: Main microcontroller with Wi-Fi connectivity.
- OLED Display: Displays instructions and system messages.
- Push Button: Provides physical user input.
- Buzzer: Provides an audio indication.
- Red LED: Indicates an error or warning condition.
- Green LED: Indicates a successful operation.
- Breadboard and jumper wires: Used for prototype circuit connections.
- USB cable: Provides power and supports programming.

B. Prototype Operation

The OLED display is intended to show instructions and feedback to the user. The push button provides physical input, while the buzzer and LEDs can provide confirmation or warning indications. The ESP8266 can use its Wi-Fi capability to communicate with a backend service. However, the complete communication between the physical prototype and the complaint management backend is not claimed as a completed implementation in this paper.

XIV. SOFTWARE IMPLEMENTATION

The software application is developed using a client-server architecture.

A. Frontend

React.js is used to develop the frontend interface. The interface provides separate views for students and administrators. Students can submit and track complaints, while administrators can review and manage complaint records.

B. Backend

Node.js and Express.js are used to implement backend services. The backend handles user authentication, complaint submission, complaint retrieval, and status update requests.

C. Database

MongoDB is used as the database for storing user and complaint information. The backend communicates with MongoDB to perform the required data operations.

D. Security

Authentication and role-based authorization are used to control access to protected features. Password hashing is used to protect stored user credentials.

XV. TESTING AND RESULTS

The application is tested by checking its major functional operations. Testing focuses on the student and administrator workflows. The main test areas include student registration and login, submission of complaints, storage of complaint details, retrieval and display of complaints, administrator access to complaint records, updating complaint statuses, and access control for protected operations.

The software modules are developed to support the complaint submission and management workflow. The physical reporting interface is treated as a prototype, and complete hardware-to-backend integration requires further testing. No quantitative performance improvement is claimed because a controlled performance evaluation has not been completed.

XVI. DISCUSSION

The proposed system provides a centralized approach to hostel complaint reporting and management. Students can submit complaints through a web interface and monitor their status. Administrators can access complaint records and update their progress.

The use of a separate student and administrator interface supports role-based access. MongoDB provides centralized storage for complaint information, while the backend manages application operations. The ESP8266-based physical reporting prototype provides a possible additional input mechanism. Its integration with the backend can extend the system beyond conventional web-based reporting.

XVII. LIMITATIONS AND FUTURE WORK

The current system has certain limitations that can be addressed in future development:

- Complete integration of the ESP8266 hardware interface with the backend is still required.
- The physical interface can be extended to support more detailed complaint input.
- Notification services can be added to inform students about complaint status changes.
- Complaint assignment to maintenance staff can be introduced.
- A detailed analytics dashboard can be developed to identify frequently reported issues.
- Automated complaint prioritization can be explored after collecting sufficient complaint data.
- The system can be extended to support additional hostel services.

These improvements can increase the functionality and usefulness of the system.

XVIII. CONCLUSION

The Smart Hostel Issue Reporter presents a web-based approach to managing hostel maintenance complaints. The system provides facilities for students to submit complaints and monitor their status, while administrators can review and update complaint records through a centralized interface.

The use of React.js, Node.js, Express.js, and MongoDB provides the software foundation for complaint management. Authentication and role-based access support-controlled access to application features.

The project also considers an ESP8266-based physical reporting prototype as an additional complaint input mechanism. Although complete hardware-to-backend integration requires further development, the prototype provides a foundation for extending the system with a physical reporting interface. Overall, the proposed system aims to make hostel complaint reporting more organized, accessible, and transparent.

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