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Safe Hostel-A Smart Security System for Girls Hostel

Rugvedi Deshmukh
Dept. of E&TC
JSPM Narhe Technical Campus
Pune, India

Suhani Ghadge
Dept. of E&TC
JSPM Narhe Technical Campus
Pune, India

Tanushree Sangade
Dept. of E&TC
JSPM Narhe Technical Campus
Pune, India

Priyanka Tambe
Dept. of E&TC
JSPM Narhe Technical Campus
Pune, India

Neeta R. Kadam
Dept. of E&TC
JSPM Narhe Technical Campus
Pune, India

Abstract-Ensuring safety in girls' hostels has become increasingly important, creating a need for advanced and automated security systems**.** This project presents Safe Hostel: A Smart Security System for Girls' Hostel, which uses an ESP32-based embedded system to provide secure and efficient access control. The system is developed using Arduino IDE and integrates a camera module for face detection and a fingerprint sensor for dual authentication.
When a user approaches the entrance, the system verifies identity using both facial and fingerprint data. Upon successful authentication, the gate opens automatically using a servo motor, and attendance is recorded in real time. In case of unauthorized access or failed verification, the system denies entry and sends an instant notification to the hostel warden via Telegram.
This system significantly decreases dependency on manual monitoring, improves accuracy, and strengthens overall safety management. It is cost-effective, scalable, and suitable for real-time hostel monitoring, making it a practical solution for modern security applications.

Keywords: Hostel Security, Facial Recognition, Artificial Intelligence, IoT, Smart Attendance, Real-Time Alerts.

Introduction-Safety within girls' hostels has become a major issue, especially with the limitations of traditional monitoring approaches. To address this, the project Safe Hostel: A Smart Security System for Girls' Hostel proposes an automated solution using the ESP32 microcontroller. The system is developed using Arduino IDE and uses face detection and fingerprint authentication for secure access. If the user is verified, the gate opens automatically and attendance is recorded. In case of unauthorized access, a notification is sent to the warden via Telegram.

Problem Statement-Existing hostel security methods rely heavily on manual processes, which are slow, unreliable, and unable to provide real-time monitoring or strict access control. Therefore, an intelligent system is required that can continuously track activities and ensure secure access control without human intervention. The problem is to create a database for face recognition so that when a student is recognized, the gate opens automatically, otherwise it remains closed and an alert is sent to the warden, while also marking attendance accurately.

Proposed Solution-The proposed Safe Hostel Smart Security System is designed to provide secure and automated access control for a girls' hostel. The system uses a ESP32 and Fingerprint as the main controller to manage the entire process. When a student arrives at the entrance, the system verifies whether she is an authorized resident. If the identity is valid, the system automatically opens the gate, allowing entry. If the person is unknown, access is denied to ensure safety. The system also maintains a record of entry and exit for monitoring purposes. This reduces manual checking and minimizes human errors. Overall, the system provides a reliable and efficient solution for hostel security.

Key Contribution-
Safe Hostel system provides an automated and intelligent security solution for girls' hostels by replacing manual checking with a reliable digital system. It ensures secure access by allowing only authorized residents to enter while preventing unauthorized entry. The system also provides automatic attendance tracking through entry and exit logs. Additionally, it enables real-time monitoring and quick alerts to hostel authorities, improving overall safety and management efficiency.

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Literature Review-The paper title Facial Recognition Based Attendance Management system. The paper "Facial Recognition Based Attendance Management System" explains how facial recognition technology can make attendance systems smarter and more secure compared to traditional methods like registers or fingerprints. The system identifies students by capturing facial images and comparing them with stored data using recognition algorithms to automatically record attendance. Face detection is achieved using machine learning techniques such as the Haar Cascade method, which improves recognition accuracy through trained datasets. The data is stored in databases like MySQL or CSV. Key technologies used include OpenCV for image capture and processing, machine learning for training, and database systems for record storage. Overall, the system ensures faster, automatic attendance marking, prevents proxy attendance, saves time for teachers and students, and enhances security by allowing only authorized faces, the paper Conclusion is Face recognition makes attendance marking fast, automatic It helps to avoid fake or proxy attendance. The system saves time and effort for teachers & students. It provides better security because only authorized faces are accepted.[1]

"Unsupervised Blink Detection Using Eye Aspect Ratio values" The paper "Unsupervised Blink Detection Using Eye Aspect Ratio (EAR) Values" explains how blinks can be detected automatically using the EAR formula, which mathematically represents how open or closed the eye is. The Eye Aspect Ratio (EAR) technique determines eye movement by analyzing specific facial points, where variations indicate blinking activity. Two main methods are used: the baseline thresholding method, where a fixed EAR threshold (e.g., 0.2) detects blinks when values drop below it for continuous frames, and the SVM (Support Vector Machine) method, which applies machine learning for higher accuracy by analyzing multiple frames. The study concludes that EAR-based blink detection is effective, with static thresholds being simple but less reliable, while machine learning techniques significantly improve accuracy.[2]

A study on IOT based Girl's Hostel management System, This project focuses on managing a girls' hostel by improving security and saving electricity through automation. It uses eye detection for attendance and motion sensors to control lights and fans, ensuring energy is used efficiently. Emergency buttons are provided for safety, and the system works automatically without requiring GSM for messaging. It helps hostel authorities and parents track when students enter or leave, ensuring their safety. The system saves power by turning off unused appliances and enhances security using advanced eye recognition, providing accurate attendance without physical cards or fingerprints. Future improvements that include adding facial recognition or health monitoring, integrating IoT- based smart systems for better energy management, and creating a fully automated, safe, and efficient hostel environment it aims to enhance women's safety.[3]

The research paper on "Hostel Girl's Security System "The project focuses on enhancing the safety of hostel girls by using technologies like fingerprint authentication and eye detection. Since hostel girls live away from their families and need extra security, The model focuses on improving safety by providing immediate alerts and secure identification during emergency situations. Eye detection technology uses cameras and recognition software to identify each girl based on her unique eye pattern, ensuring accurate identification and preventing fake entries. In case of danger, a girl can trigger an alert through a mobile app, which immediately notifies the warden and parents. The system provides real- time identification without location tracking, helps in emergencies, and creates a secure environment for hostel girls.[4]

"Hostel In\out management and monitoring system. using RFID, Face Recognition" The document describes a proposed Hostel In/Out Management and Monitoring System designed to address persistent security concerns in a hostel environment. The core of the system is based on RFID (Radio- Frequency Identification) and Face Recognition technology, utilizing a Raspberry Pi as the central processing unit. This system tracks student movement automatically by combining RFID and facial recognition to enhance security and maintain accurate records.

Each student is required to store their unique photograph and mobile number in the system's database. The Conclusion of this paper is we have implemented an hostel in out management and monitoring using raspberry pi. In proposed method, the system that which sense RFID Reader, photo of Student & Compare them with stored data base. They have to impress their RFID Card Reader, photo in system which are placed in hostel main gate.[5]

"Girls hostel security system Using Raspberry Pi" this paper outlines a Girls hostel security system, security in girl's hostel is one of most persistent problem that hostel needs to address Nowadays security. persistent is a prime concern in every human being life. The system having student name,

branch, year, photo and parents mobile number stored in hostel database. The human body has the privilege of having Features that are unique and exclusive to each individual This exclusively and unique characteristic has led to field of biometrics & its application The system automatically takes information of student present in hostel which is helpful for hostel management. The Raspberry pi is heart of this project. In this proposed system in/out monitoring of student is done by using raspberry pi and send alert warden via message using IoT about authentication if match Found with database then door will automatically open and person will in and out from hostel. The Conclusion is that the main aim to provide security measurement in hostel. As we have seen from last few years there is gradual increase in student migrant and mostly of them are girls due to which need of hostel increases. This system does not allow any other person to enter in hostel.[6]

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"IOT based well organized hostel power consumption and attendance administration system" The IoT-based hostel power consumption and attendance administration system integrates smart meters, sensors, and cloud technology to efficiently monitor electricity usage and student attendance. The system reduces energy wastage, ensures transparency in billing, and automates attendance tracking through RFID/biometric methods. Real- time data is stored on a server or cloud and can be accessed by hostel authorities for analysis. This enhances energy management, improves accountability, and ensures security in hostels. The conclusion of this paper is IoT based hostel system significantly enhance power efficiency and student administration making hostel management smarter, secure, and sustainable.[7]

The research paper on "Smart Security System for Girl's Hostels using surveillance and Authentication Technologies" Safety and security are major concerns in girl's hostel, especially in urban areas where Students and Working women reside away from their families. Traditional manual Security measures Such as Watchmen and registers are often inadequate in preventing unauthorized access, instructions, or emergencies with the advancement of modern technologies like IOT, biometric authentication, and real-time Surveillance, Smart Security Solutions have emerged as are liable way to

Strengthen hostel Safety. The proposed Girls hostel Smart Security System integrates Smart Surveillance Cameras, biometric or RFID based Entry authentication, and emergency alert mechanisms. The System ensures that only organized residents and Stall can access the premises, while real-time monitoring provides administrators with the ability to detect suspicious activities. The Girls hostel Smart Security System is an efficient and modern Solution to address the growing concern of hostel safety. By combining Surveillance biometric and IOT based monitoring, the system minimizes human error and ensures round-the-Clock -protection.[8]

Methodology-

The proposed system is implemented using an ESP32 controller that coordinates all hardware components and processes authentication tasks efficiently. All components, including the camera module, fingerprint sensor, and servo motor, are interconnected using GPIO pins. When a user approaches the entrance, the system captures the face and scans the fingerprint. The ESP32 verifies these inputs with stored data. If authenticated, the gate opens using a servo motor and attendance is recorded. If authentication fails, access is denied and a notification is sent to the warden via Telegram. The entire process works in real time, ensuring a secure and automated hostel entry system.

System Overview-

Safe Hostel system overview describes how the complete system works as an integrated security solution for girls' hostel management. At the entry point, the system collects user data through sensors and verifies identity by matching it with stored records before granting access. If the person is authorized, access is granted and the gate opens automatically, otherwise entry is denied. The system continuously records entry and exit data for attendance and monitoring purposes. All information is updated in real time, allowing hostel authorities to track movements and ensure safety. It also helps in maintaining proper discipline by monitoring entry and exit timings. The system reduces dependency on manual supervision and increases overall security efficiency.

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Table 1
Comparison Of Safe Hostel-A Smart Security System For Girls Hostel

Title	Technology Used	Performance Metrics	Advantages	Limitations
Facial Recognition Based Attendance Management System	Face Recognition, Machine Learning, OpenCV, Haar Cascade Algorithm, Barcode Scanner	Accuracy =90–95%, Detection Speed=85–90%, Reliability= 88–92%	Reduces proxy attendance, improves security, automated system, efficient data handling	Affected by lighting conditions, facial expressions, pose variations
Unsupervised Blink Detection Using Eye Aspect Ratio Values	Eye Tracking System (Tobii Pro Glasses 2), Machine Learning, Eye Aspect Ratio (EAR), Isolation Forest	Accuracy=95–98%, F1 Score=96%	No need for labeled data, high accuracy, robust to noise, automatic detection	Sensitive to parameter (contamination), depends on eye-tracking data quality
Hostel Girls' Security System	Fingerprint Authentication, GPS Module, Microcontroller, Mobile Application	Accuracy = 90–95%, Response Time Efficiency =85–90%, Reliability =88–92%	Provides safety to girls, real-time location tracking, emergency alert to warden & parents, avoids proxy entry using fingerprint	Depends on GPS accuracy, requires mobile/internet, hardware cost, system failure risk
IoT Based Girl's Hostel Management System	IoT, ATmega328 Microcontroller, Fingerprint Sensor, PIR Sensor, GSM Module, Buzzer, Relay	Accuracy: 80–88% |Efficiency: 90–92% |Reliability: 80–85%	Energy saving, Improved security, Low cost, Easy to use, Emergency alert system	Limited scalability, Depends on sensors, GSM dependency, Basic security level, Maintenance required
Intelligent Monitoring and Alert System for Girls' Hostels	Fingerprint Authentication, GSM (SMS), Web App (HTML, CSS, JS, PHP), MySQL, Client-Server	Accuracy: 85–90% |Efficiency: ~80% |Reliability: 80–85%	Improved security, Auto tracking, Parental alerts, Easy management, User-friendly	Hardware dependent, Needs network, Limited users, Setup cost, Maintenance required
IoT Based Well-organized Hostel Power Consumption and Attendance Administration System	IoT, Raspberry Pi, RFID, Fingerprint Sensor, PIR Sensor, GSM (SMS), Web Interface	Accuracy: 80–85% |Efficiency: ~90% Reliability: ~85%	Energy saving, Improved security, Automatic attendance, Parental notification, Smart monitoring system	Depends on sensors accuracy, Network dependency, Hardware cost, Complexity in setup, Maintenance required
Girls Hostel Security System Using IoT and Raspberry Pi	IoT, Raspberry Pi, Fingerprint Sensor, Camera (Webcam), LCD Display, Biometric System	Accuracy: 90–95% |Efficiency: ~85% |Reliability: ~90%	Strong security, Prevents unauthorized access, Automatic door control, Attendance tracking, Alert to warden	Depends on biometric accuracy, Hardware cost, Limited scalability, Requires maintenance, Possible system failure
Hostel In-Out Management and Monitoring System Using RFID, Face and Thumb Recognition.	RFID, Fingerprint Scanner, Face Recognition (Camera), GSM Module, ARM11 Microcontroller (Raspberry Pi), LCD	Accuracy=92–97% |Efficiency=88% |Reliability= 92–95%	High security (multi-level), Fully automated system, Reduces manual work, Parent notification, Time saving	High system complexity, Cost of multiple devices, Network dependency (GSM), Maintenance required, Possible matching errors

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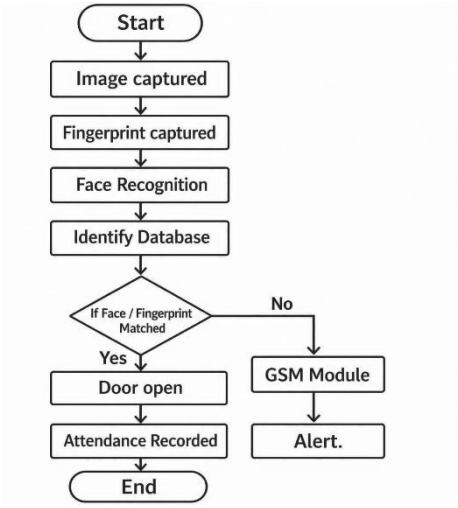
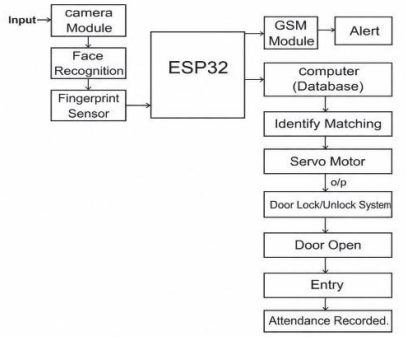
Flow Chart-



Block Diagram-



HARDWARE COMPONENTS-

1. ESP32 and Fingerprint -Main controller for facial recognition and hardware interaction.

2. Camera Module–Captures real-time facial images.

3. Servo Motor – Controls the electronic door lock, GSM Module (SIM800L) / Wi-Fi Module (ESP8266) – Sends SMS or cloud notifications.

4. Power Supply Adapter–Supplies power to all components.

Software Architecture-

1. Arduino IDE – Used as the main development environment to program the ESP32 microcontroller. It is used to write, compile, and upload code that controls all hardware components and system operations**.**

2. Embedded C/C++ – The system logic is implemented using Embedded C/C++ in Arduino IDE. It handles sensor integration, decision- making, and communication between modules.

3. Face Recognition Module – The ESP32 camera module captures images and performs basic face detection to identify authorized users in real time.

4. Fingerprint Processing – The fingerprint sensor is programmed to enroll and verify fingerprints, providing secure and reliable user authentication.

5. Telegram Bot Integration – A Telegram bot is integrated with the system using internet connectivity. It sends real-time notifications to the hostel warden whenever a student enters, exits, or when unauthorized access is detected.

Wi-Fi Communication (ESP32) – The inbuilt Wi- Fi module of ESP32 is used for network connectivity, enabling communication with the Telegram platform and remote monitoring.

Attendance Management Logic – The system automatically records entry and exit data after successful authentication, ensuring accurate and real-time attendance tracking.

IMPLEMENTATION AND TESTING-

The system implementation involved extensive hardware integration, software development, and comprehensive testing phases. This section details the implementation process and experimental validation.

Hardware Implementation-

The Safe Hostel system hardware implementation involves integrating multiple components to create a secure and automated entry system for a girls' hostel. The ESP32 microcontroller acts as the main controller, responsible for processing data and controlling all connected hardware components.

An ESP32-compatible camera module is used to capture real-time images of the person at the entrance for face detection and identification. A fingerprint sensor is also integrated into the system to provide an additional layer of authentication by verifying the user's fingerprint with stored data.

A micro servo motor (SG90) is interfaced with the GPIO pins of the ESP32 and is used to control the opening and closing of the hostel gate by rotating at specific angles. The gate mechanism is connected to the servo motor to enable automatic operation.

All components are connected using jumper wires through the GPIO interface, ensuring proper power supply, ground connections, and signal transmission. The system is powered using a stable power source to ensure continuous and reliable operation.

When a person approaches the entrance, the camera captures the image and the fingerprint sensor scans the fingerprint. The ESP32 processes these inputs and, if the identity is verified, sends a control signal to the servo motor to open the gate. Otherwise, access is denied and the gate remains closed.

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SOFTWARE IMPLEMENTATION-

The Safe Hostel system software is developed using the Arduino IDE, which is used to program the ESP32 microcontroller for efficient system control and real-time operation. The ESP32 handles communication between different modules, including face recognition, fingerprint authentication, and gate control mechanisms.

Face detection is performed using an ESP32- compatible camera module, which captures images and processes them to identify authorized students. Along with this, a fingerprint sensor is integrated to provide an additional layer of security by verifying the user's identity through stored fingerprint data.

When a student arrives at the entrance, the system captures the face and scans the fingerprint. If both credentials match the stored data, access is granted, and the gate opens automatically. The attendance of the student is recorded instantly.

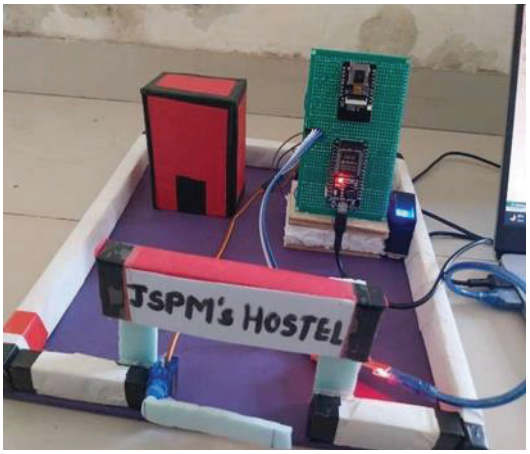
For communication and monitoring, the system is integrated with the Telegram platform using a bot. Whenever a student enters or exits, or if an unauthorized access attempt is detected, a notification is sent to the hostel warden via Telegram in real time. This ensures immediate awareness and enhances security.

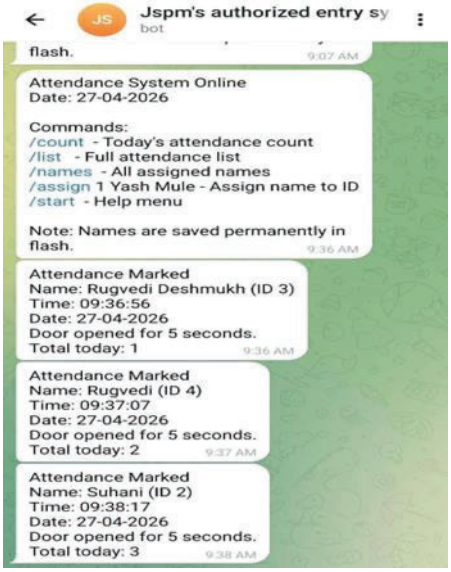
All modules work together seamlessly to provide a reliable, fast, and secure system. The use of Arduino IDE and ESP32 makes the system cost- effective, scalable, and suitable for real-time hostel security applications.

RESULTS AND DISCUSSION-

Safe Hostel system was successfully implemented and tested as an automated security solution for girls' hostel management. The system was able to accurately recognize authorized users and allow entry while restricting unauthorized access, and the gate mechanism operated properly based on recognition results. It also recorded entry and exit data efficiently, enabling proper attendance tracking and monitoring. The system showed fast response time and performed well in real-time conditions, demonstrating reliability and efficiency.

In discussion, the system reduces the drawbacks of manual security methods by providing automated and accurate identification, improving overall safety and control. It ensures that only authorized students can access the hostel and helps authorities monitor activities effectively. However, the performance of face recognition may vary depending on lighting conditions and image quality. Despite this limitation, the system proves to be practical, scalable, and suitable for real-world hostel security applications.





SYSTEM PERFORMANCE EVALUATION-

The proposed Safe Hostel Smart Security System was evaluated under real-time conditions to analyze recognition accuracy, gate response time, and alert performance. For authorized users, the system achieved recognition accuracies of 95% and 93%, with gate response times of 1.5 seconds and 1.7 seconds respectively, and no alert was generated. In the case of unauthorized users, the system denied access and generated alerts with response times of
3.8 seconds and 4.1 seconds. These results indicate that the system performs efficiently in identifying valid users, restricting unauthorized entry, and providing timely alerts, ensuring reliable and secure hostel management.

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CONCLUSION

The proposed system, Safe Hostel: A Smart Security System for Girls' Hostel, provides an effective and modern solution to improve hostel security using embedded systems and IoT technology. The system is implemented using the ESP32 microcontroller programmed through Arduino IDE, ensuring efficient control and real-time operation.

Unlike traditional manual registers and RFID-based systems, the proposed system uses face detection and fingerprint authentication to verify the identity of students, thereby enhancing security and reducing the chances of unauthorized access. The integration of dual authentication improves reliability and ensures that only registered students are granted entry.

The system also includes an automated attendance management feature, where entry and exit records are maintained in real time. Notifications are sent to the hostel warden through Telegram, enabling instant alerts in case of student movement or unauthorized access attempts.

Overall, The proposed solution is economical, adaptable, and practical for real-world deployment in hostel environments. It automates security operations, improves accuracy, and enhances overall management efficiency.

The project demonstrates how ESP32-based smart systems can be effectively used for real-world security applications.

FUTURE WORK

1. Buzzer Alert System: A buzzer can be installed at the gate so that when an unknown person tries to enter, an immediate alarm is triggered.

2. Parent Access System: Parents can be given access through a mobile app or portal to check their daughter's entry and exit records.

3. Hostel Mobile Application: A dedicated mobile app can be developed where students can apply for leave, check attendance, and receive hostel notices.

4. Visitor Management System: Visitors can be registered digitally, and their entry and exit can be monitored by the system.

REFERENCES

[1]. V.Karthick,V.P.Kumar,R.Divyaprasath,K.Kesari nath,R.Hariraj. "Facial Recognition Based Attendance Management System" (2020)
[2]. Bharana Fernando, Arjun Sridhar, Shawhin Talebi, John Waczak, and David J. Lary. "Unsupervised Blink Detection Using Eye Aspect Ra o Values" (2022)
[3]. Prof. N. R. Janavekar, Dr. P. N. Shinde, Mayuri Jadhav, Komal Kumbhar, Akanksha Dond "IoT Based Girl's Hostel Management System" (2024)
[4]. Anushree Bobhate, Dnyaneshwari Chutke, Mayuri Udan, Kajal Pal, Pranjali Hulke. "Hostel Girls' Security System" (2018)
[5]. Rohini S. Morey, Roshani K. Ghanmode, Dipali
[6]. R. Hedau, Prof. Anuprita Linge. "Girls Hostel Security System Using IOT and Raspberry Pi" (2018)
[7]. Sneha Sonar, Rajendra Pal. "Hostel In Out Management and Monitoring System Using RFID, Face and Thumb Recognition" (2016)
[8]. M.A. Soomro, A.R.Nangraj, Javed. "Intelligence Monitoring and Alert System For Girls Hostel" (2023)
[9]. Geetha, Anbumani. "IOT Based Well-Organized Hostel Power Consumptions Attendance Administration System" (2020)