Queue Management for Lab Practical using IoT

Prof. Mr. Bhausaheb N. Rajole[1], Ms. Samiksha S. Salekar[2], Ms. Geeta S. Shinde[3], Ms. Garima R. Pachpute[4]

[1]Professor, Electronics and Telecommunication
MVP'S Karamveer Adv. Baburao Ganpatrao Thakare College of Engineering, Nashik
[2,3,4] Student, BE Electronics and Telecommunication
MVP'S Karamveer Adv. Baburao Ganpatrao Thakare College of Engineering, Nashik

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Abstract - *The "Queue Management System for College Labs" is an innovative solution designed to revolutionize the traditional approach to lab access and management in educational institutions. Leveraging the power of IoT (Internet of Things) and RFID (Radio Frequency Identification) technology, this system streamlines the process of accessing labs for students and faculty members. When users approach a lab, they authenticate themselves by scanning their RFID cards, triggering the capture of their images for verification and security. Simultaneously, crucial user details such as roll number and college year are displayed in real time on LCD screen outside the lab.The integration extends to the Student ERP system, ensuring that the captured data, including images and user details, is seamlessly transmitted and available in real time for teachers and administrators. This comprehensive system aims to optimize lab resource utilization, reduce waiting times, and enhance the overall efficiency and security of lab operations within educational institutions. Through a harmonious fusion of hardware and software components, this project envisions creating a more efficient, accountable, and user-friendly learning environment within college labs.*

Key Words: **RFID, IOT, WEB, Raspberry, LCD, ERP.**

1.INTRODUCTION

The educational landscape is evolving rapidly, driven by technological advancements that redefine traditional methodologies. In this dynamic environment, managing resources within educational institutions, especially lab facilities, has become critically important. The "Queue Management System for College Labs" addresses challenges inherent in traditional lab access and management. Educational institutions are hubs for knowledge creation, and efficient lab resource utilization is crucial for fostering conducive learning environments. Historically, lab access has been characterized by long queues and manual administrative tasks, resulting in frustration and underutilization of resources. The Queue Management System utilizes Internet of Things (IoT) and Radio-Frequency Identification (RFID) technology to streamline access procedures, enhance security, and provide real-time insights into lab occupancy. When students and faculty approach a lab, they scan their RFID

cards, triggering a cascade of processes. RFID authentication allows seamless access while capturing user images through Raspberry Pi based cameras for added security. User information is displayed on LCD screens outside the lab, ensuring transparency and real-time awareness for others nearby. Integration with the Student ERP system amplifies its transformative potential by transmitting captured data in real-time, providing administrators and educators with instantaneous access to crucial information, enhancing security, accountability, and automating administrative tasks. In the era of educational technology, the Queue Management System for College Labs signifies innovation, departing from conventional methods towards a streamlined, efficient, and user-friendly educational ecosystem. Its introduction represents a proactive step towards shaping the future of lab management within educational institutions.

2. LITERATURE SURVEY

1. An IOT Smart Queue Management System with Real-Time Queue Tracking : This paper proposes a smart queue management system for delivering real-time service request updates to clients' smartphones in the form of audio and visual feedback. The proposed system aims at reducing the dissatisfaction with services with medium to long waiting times. To this end, the system allows carriers of digital ticket to leave the waiting areas and return in time for their turn to receive service.

2. An IOT Smart Queue Management System with Real-Time Queue Tracking : A smart queue management system for delivering real-time service request updates to clients' smartphones in the form of audio and visual feedback aimed at reducing the dissatisfaction with services with medium to long waiting times is proposed.

3. Smart Queue Management System with Real Time Tracking Using
DNN: Queue management is a malady faced by the wide majority of burgeoning organizations as demand for service is increasing. However, this doesn't mean that backed up lines and grumbling customers is 'the norm' or a situation that can't be solved. Queue management technology can help you take the edge off both the actual

and apprehended waiting time for customers, improve customer satisfaction, and provide the data your managers need to further optimize the service experience

4. Internet of Things (IoT) enable Lcd smart queuing model to support massive safe crowd at Ka'aba : One of the important rituals that Muslims do on their pilgrimage to Makkah, which is called Tawaf in Arabic, is a walk around the Ka'aba seven times. The space around the Ka'aba is limited and it is usually crowded. Pilgrims arrive at unpredictable intervals to perform the Tawaf and quickly join the crowd, which increases the population. Congestion and high density are issues that arise during the Tawaf as a result of time and space constraints

3. NEED OF PROJECT

1) Efficient Resource Utilization: College labs are valuable resources, and efficient management is essential to maximize their utility.
2) Improved User Experience: Enhancing lab access and transparency benefits students and faculty, resulting in a better overall experience.
3) Real-time Monitoring: Providing real-time information about lab occupancy allows for better decision-making and resource allocation.
4) Simplified Administrative Tasks: Automating lab access and data integration with the ERP system streamlines administrative work.

4. METHODOLOGY AND DISCUSSION

The methodology for implementing the "Queue Management System for College Labs" is a comprehensive and meticulously planned process that spans hardware integration, software development, testing, and user training. The initiation phase involves a thorough analysis of the existing lab infrastructure, understanding user flows, and determining the technical requirements for seamless integration. This is followed by the hardware setup, where RFID scanners, Raspberry Pi-based camera modules, and LCD display. The RFID scanner serves as the entry point, authenticating users and triggering the Raspberry Pi cameras to capture images for enhanced security. Simultaneously, essential user details are displayed on LCD screens outside the lab, providing real-time information to others in the vicinity. The software development phase focuses on creating a sophisticated system that manages RFID authentication, image capture, and data transmission to the Student ERP system. Python-based scripts are employed, utilizing libraries like OpenCV for image processing to ensure secure and efficient data transfer between the Raspberry Pi and ERP system. User interfaces are designed to be intuitive, facilitating user interaction and ensuring a seamless experience. Special attention is given to the integration with the Student ERP system, where APIs and protocols are implemented to

ensure compatibility and efficient data exchange. User acceptance testing becomes a crucial aspect of the methodology, where the system undergoes rigorous testing to identify potential glitches and ensure seamless operation.
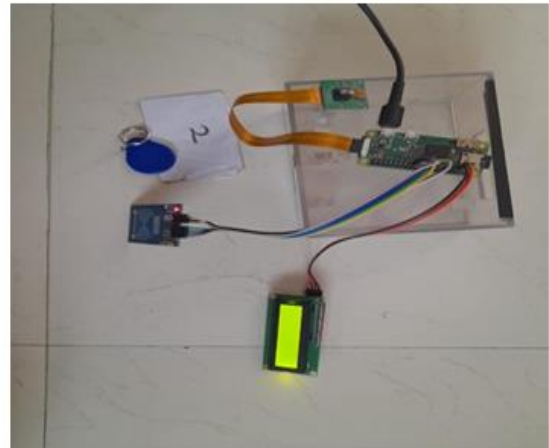

Fig -1

Continuous monitoring and maintenance procedures are implemented to address any technical issues that may arise during the testing phase User acceptance testing becomes a crucial aspect of the methodology, where the system undergoes rigorous testing to identify potential glitches and ensure seamless operation. Continuous monitoring and maintenance procedures are implemented to address any technical issues that may arise during the testing phase. User training and documentation are prioritized to ensure that both students and faculty can easily adapt to the new system, fostering a smooth transition.
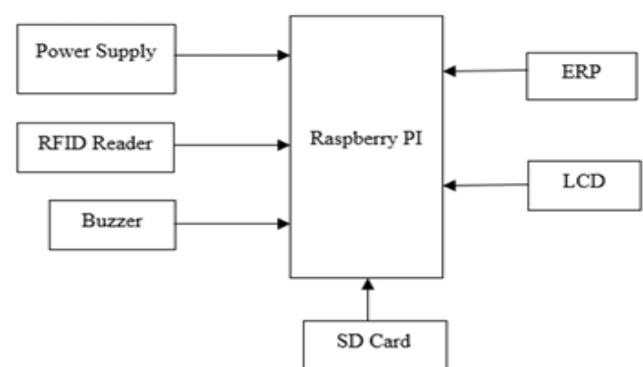

Fig- 2. Block Diagram

5. Data Flow of the System

The dataflow of the "Queue Management System for College Labs" is a complex yet orchestrated process that seamlessly integrates hardware, software, and data exchange protocols. The process initiates when a user approaches a lab and scans their RFID card at the RFID

scanner. This action triggers the authentication process, where the RFID card information is validated against the system's database. Upon successful authentication, the system activates the Raspberry Pi-based camera module, capturing the user's image for verification purposes. Simultaneously, user details such as roll number and college year are sent to the LCD display outside the lab in real-time, providing immediate visibility to others.
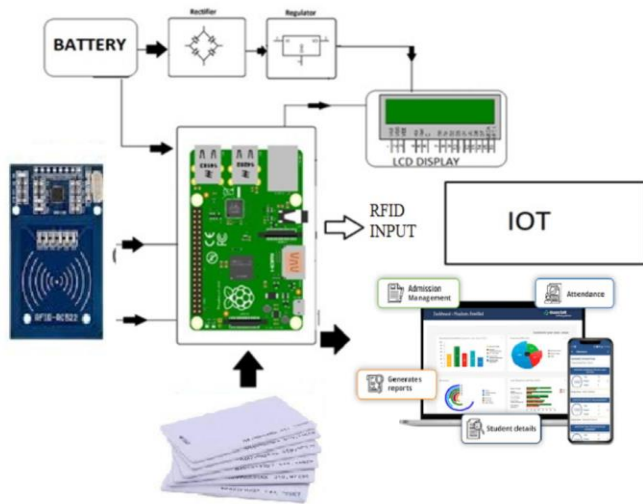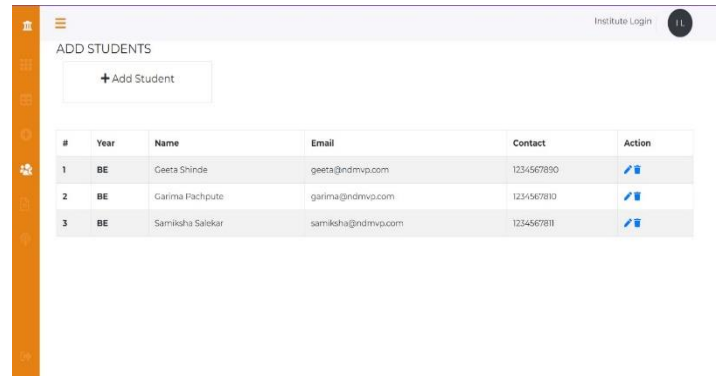

Fig- 3. Data Flow Diagram

Concurrently, the captured image, along with user details, is transmitted through the integrated software module to the Student ERP system. This data transfer is facilitated by robust APIs and protocols, ensuring secure and efficient communication between the Raspberry Pi and the ERP system. Within the ERP system, the received data is processed, and a real-time record of lab access, including user identity and timestamp, is stored. The ERP system then becomes a central repository for this information, allowing administrators and teachers to access and monitor lab occupancy in real-time. This bi-directional data exchange between the Queue Management System and the ERP system ensures a synchronized and updated database, providing accurate insights into lab usage patterns, occupancy trends, and individual user activities. Furthermore, the system facilitates feedback loops where user actions, such as scanning an RFID card, trigger corresponding responses across multiple components. For instance, successful authentication initiates image capture, LCD display updates, and ERP system data storage simultaneously. This intricate dance of data ensures that information is seamlessly propagated across the system, creating a dynamic and responsive ecosystem.

6. APPLICATIONS

College and University Labs: Optimizes access to subject specific labs, enhancing resource utilization and efficiency for students and faculty.

Research Centers: Streamlines access to research labs, providing real time occupancy data and fostering efficient usage of research resources.

Computer Labs: Facilitates streamlined access to computers and technical resources, improving the overall efficiency of computer labs.

Library Services: Manages study space occupancy, aiding in the efficient utilization of library resources and creating a conducive learning environment.

Innovation Hubs and Makerspaces: Ensures efficient utilization of tools and equipment in innovation spaces, promoting collaborative projects and creativity.

Office Spaces: Extends the system to manage access and occupancy in administrative and faculty office areas, improving workspace allocation and utilization.

7. CONCLUSION

In conclusion, the "Queue Management System for College Labs" offers a transformative solution to lab access challenges. Seamlessly integrating RFID, Raspberry Pi cameras, and LCD displays, it enhances security and automates tasks. This holistic approach optimizes resource utilization and fosters transparency. Real-time data exchange empowers informed decision-making. The user-friendly interface enhances the experience for all stakeholders. Successfully implemented, it promises to revolutionize lab management in educational institutions. This innovation reflects a future where technology enhances educational experiences.

8. REFERENCES

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