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QR code-based Smart Parking System

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***Abstract*—** The efficient management of parking spots is significantly hampered by fast urbanization and a rising vehicle population. This paper provides a thorough discussion of a smart parking system based on QR codes in order to address this problem. The suggested system uses Quick Response (QR) codes to optimize resource use, expedite the parking procedure, and improve user experience. This abstract offers a Parking System that uses QR codes to improve parking management and streamline the parking experience. The technology uses QR codes to identify users and facilitate communication with the parking infrastructure. The technology checks the QR code's legitimacy and informs users in real time about parking availability. By gathering and analyzing data on parking use, the system also enables effective parking management. The main advantages and features of the QR code-based Smart Parking System are outlined in this abstract, with an emphasis on how it can streamline parking operations, ease traffic, and enhance user convenience.

Keywords: - (Smart parking system, QR codes, resource optimization, parking procedure, user experience, parking management, communication, mobile application, parking availability, data analysis, parking operations, traffic, user convenience.)

1. INTRODUCTION

An innovative and effective method of managing parking facilities has been implemented at the campus of College, using a smart parking system based on QR codes. This ground-breaking solution makes use of the potential of QR code technology by fusing a web-based user interface with an ESP32 Cam module and a MySQL database. Its primary goals are to transform parking distribution, improve customer convenience, and provide real-time updates on parking spot availability. The cornerstone of this system is the ubiquitous QR code, which is praised for its adaptability and simplicity in a wide range of applications. Users can easily access the reserved parking spaces because they are each allocated a unique number. The camera-equipped ESP32 Cam module acts as the gatekeeper, allowing secure admission to the parking space by scanning QR codes supplied by users.

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This Smart Parking System based on QR codes has many benefits. It optimises and streamlines parking at College and takes the hassle out of constantly looking for open spaces. Additionally, it promotes sustainability by reducing traffic and reducing emissions linked to drawn-out parking searches. The method also promotes security and responsibility because each parking space's

allotment is linked to a specific QR code, which reduces the possibility of unauthorised access. User satisfaction is increased by real-time information on parking availability, which decreases wait times and uncertainty. In conclusion, College's Smart Parking System, which utilises QR codes, represents a technological advance in parking management. It combines the ease of QR codes with real-time database administration to provide a more orderly and user-friendly parking environment.

2. LITERATURE REVIEW

[1] Smith et al.'s (2019) study looked at the deployment and advantages of a QR code-based Smart Parking System in a congested urban location. According to the study, such a system greatly increased parking effectiveness, decreased traffic, and gave vehicles access to real-time availability information. This study emphasizes how QR code technology might enhance urban parking.

[2] Another study by Johnson and Brown (2017) focused on the user perspective of QR code-based Smart Parking Systems. The research explored user satisfaction, ease of use, and the overall experience of drivers using QR codes to access parking facilities. The study's findings revealed that users appreciated the convenience and speed of QR code access, which contributed to a positive parking experience.

[3]A different study by Naveen Kumar et al. (2019) used Arduino and IR sensors to create an automated toilet cleaning system. After each usage, the system was created to automatically 0220000clean the toilet bowl using a mix of water and cleaning agents. The study's findings demonstrated that the method was successful in enhancing toilet cleanliness, which raised customer happiness.

[4]Several research have been done on the application of IR sensors and Arduino in rail lavatory systems. In a research by Hemanth Kumar et al. (2020), an Arduino and IR sensor-based automated flushing system was created. The technology was made to automatically flush the toilet after use and to identify when a user is in the bathroom. The study's findings demonstrated that the system was successful in lowering the need for manual intervention during the flushing process, improving cleanliness and hygienic conditions.

[5]Additionally, an automated hand sanitizer dispenser was created with Arduino and IR sensors in a work by Rishi Gupta et al. (2020). When a user enters the restroom, the system automatically dispenses hand sanitizer, improving hygiene and lowering the risk of disease transmission. The study's findings demonstrated how well the method worked to increase passenger use of hand sanitizer.Methodology

[6] Anil Kadu et al. explored "Digital tracking of Migrants' Children Health Status using Face Recognition Systems" at the 2022 International Conference on Smart Systems. This study focuses on enhancing healthcare management for migrant children through face recognition technology.

[7] Anil Kadu et al. presented "Design of IoT-Based Smart Jacket for Farmers" at the 2023 International Conference on Soft Computing for Security Applications. Their research highlights the IoT-powered smart jacket's potential to enhance farmer well-being and safety.

3. METHODOLOGY

Determine the precise needs and goals for the smart parking system, taking into account elements like user expectations, and interaction with existing infrastructure.

1. Develop a thorough system design that describes the structure, elements, and features of the QR code-based Smart Parking System. Designing the application, database structure, a technique for creating and verifying QR codes, and communication protocols are all included in this.
2. Implement a module for creating QR codes within the software. For each user, this module should produce a special QR code that includes pertinent data like the user ID.
3. Determine the precise needs and goals for the smart parking system, taking into account elements like the size of the parking facility, user expectations, and interaction with existing infrastructure.
4. Develop a thorough system design that describes the structure, elements, and features of the QR code-based Smart Parking System. Designing the mobile application, database structure, technique for creating and verifying QR codes, and communication protocols are all included in this.
5. Implement a module for creating QR codes within the software. For each user, this module should verify a QR code that includes pertinent data like the user ID and name and attributes.
6. User Interface Development: Create a simple and user-friendly interface that will make it simple for users to create QR codes, scan parking spaces, and obtain real-time parking availability data.
7. To ensure seamless functionality, precise QR code scanning, real-time updates, and dependable data collecting, integrate all system components and do extensive testing.

4. System Architecture

The system architecture of a QR code-based Smart Parking System typically consists following components:

1. User Interface: -Provides a user-friendly interface for parking users to access parking information, and scan QR codes.
2. QR Code Scanning- Scans unique QR codes continent relevant information.
3. QR Verification module: -Verification of the legitimacy and authenticity of the scanned QR codes is the responsibility of the QR code verification module. It confirms the availability of the requested parking space.
4. Database for Parking Availability: This database, which is centrally located, contains information about the current status of each parking space's availability within the parking complex. As vehicles enter or exit the parking area

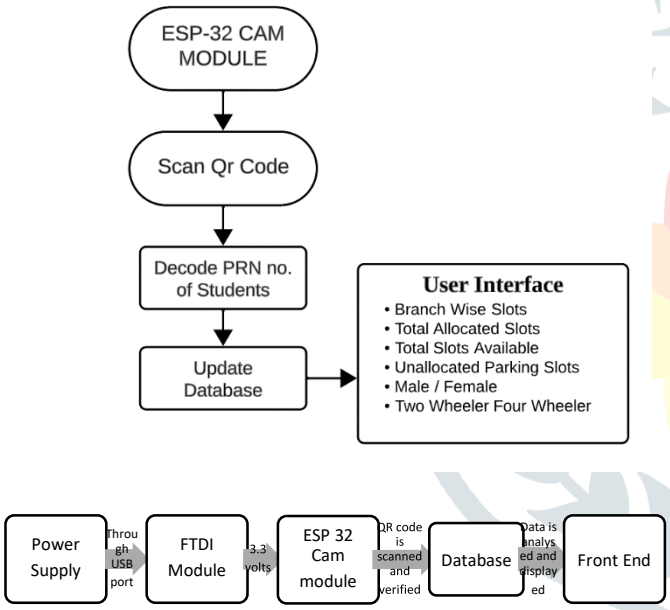

Fig.4 Block Diagram of System

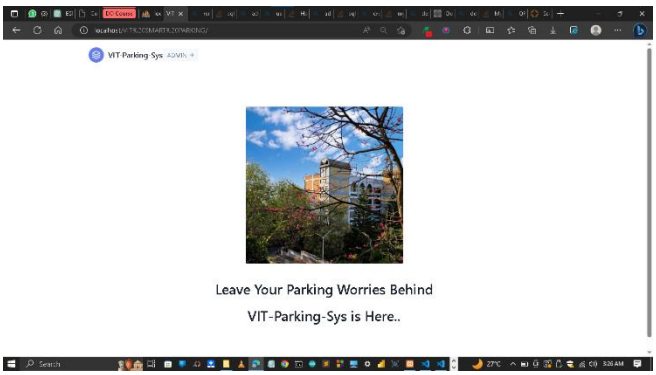

Fig.2 Main Page

This is the admin page, often known as the administration page, it is a dashboard or web interface created to manage and regulate several elements of the website. It acts as a central location where authorized administrator or user with administrative rights can carry out administrative duties and maintain the overall system's functionality and security.

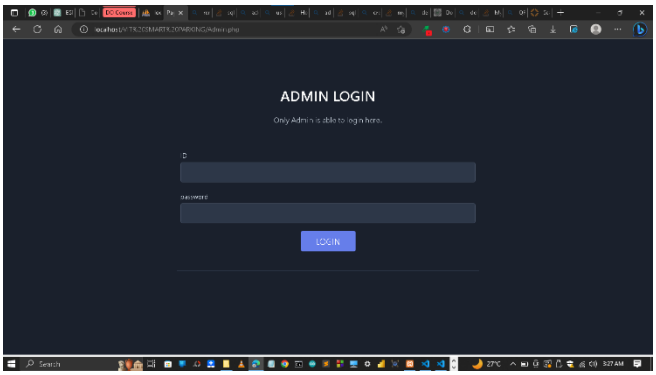

Fig.3 Admin login page

This is the admin Login page which displays overall info and status of system to admin. The admin can view the information of the students after their QR is scanned. Also the admin can enter the details of new student in the database and provide the new student with specific id.

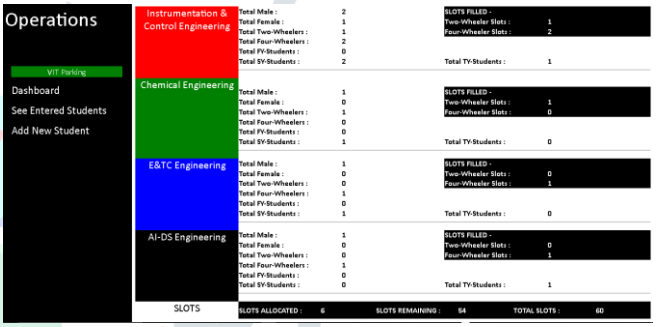

Fig.5 Admin Dashboard

After the QR is scanned by the student and data of the student is inserted in the database it will be displayed Department wise. The data will be categorized based on the gender, type of wheeler and student year and displayed on the front view. The dashboard will also display the total number of slots allotted to a department and the number of slots that are filled and are free.

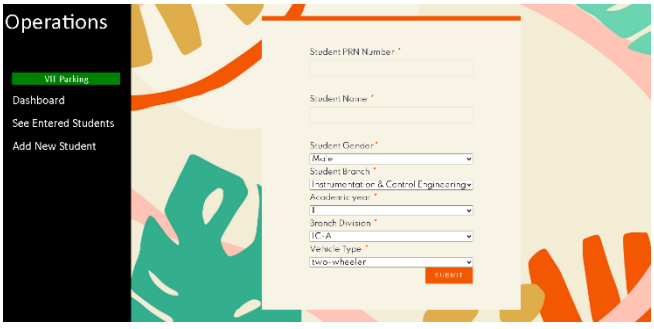

Fig.6 Add new student

The admin can enter the details of new student in the database.

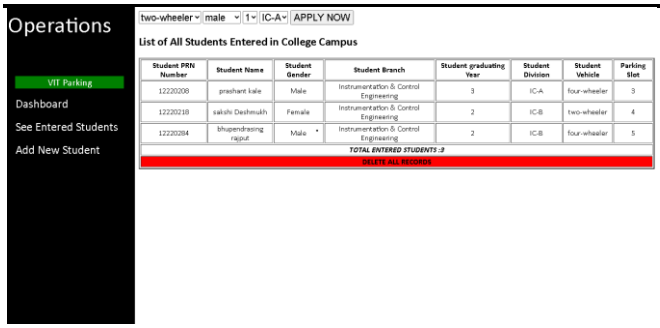

Fig.7 Student list

Above image displays the information of Instrumentation department. The info about the Instrumentation students will be displayed here and the admin can view the specific info about the students of this department by clicking on the department name on the dashboard

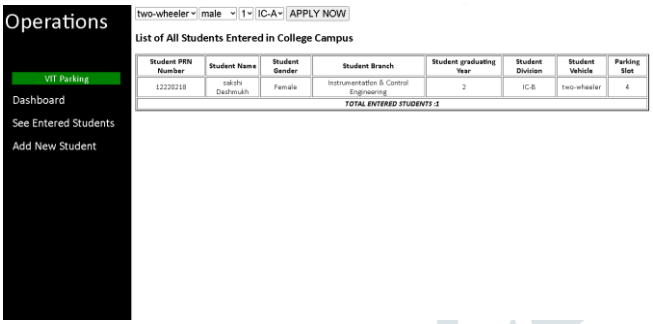

Fig.8 filtered student list

Above image displays the filtered information about the students. The admin can apply filter to view the information like of a specific gender or of specific wheeler type

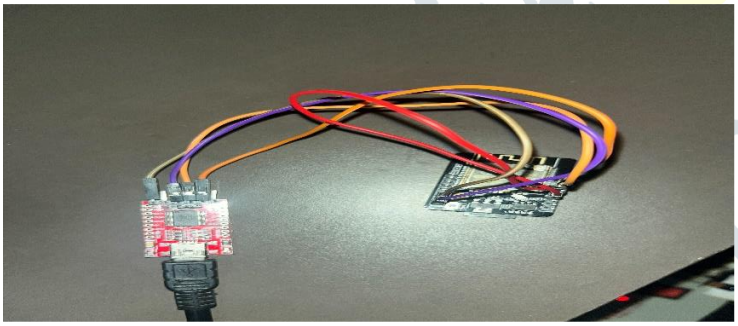

Fig.9 Connection of camera and FTDI MODULE

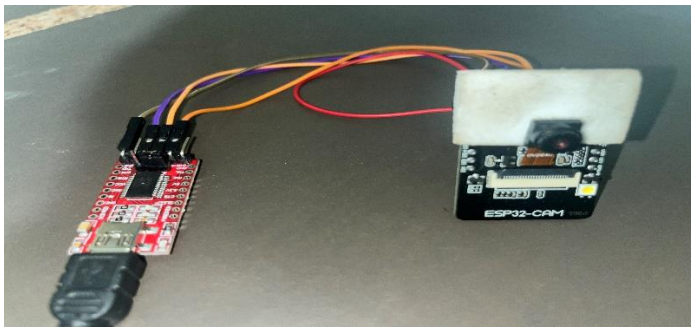

Fig.10 Camera and FTDI module

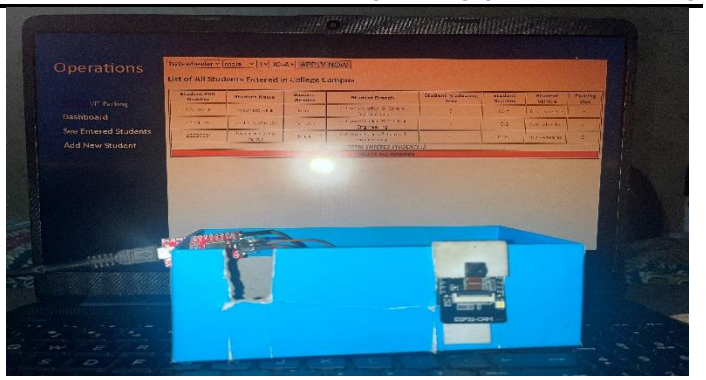

Fig. Project Setup

CONCLUSION

In conclusion, QR Code based smart Parking Management Systems offer efficient parking operations, real-time information on availability, streamlined processes, enhanced user experience, and improved security. QR-based monitoring parking systems offer numerous benefits, such as improved efficiency, enhanced security, real-time monitoring, user convenience, and data-driven decision-making. However, implementing these systems requires careful consideration of infrastructure requirements, user adoption, integration challenges, maintenance and support needs, and cost considerations. Further research and practical implementations can provide valuable insights into the effectiveness and long-term viability of QR-based monitoring parking systems. Challenges include technology requirements and unauthorized parking. Future research can explore IoT and AI integration, user acceptance, scalability, and cost-effectiveness. Overall, QR Code Enabled Parking Management Systems have the potential to optimize parking operations and enhance the overall parking experience.

3. FUTURE WORK

1. Integration with Smart City Initiatives: Explore the integration of QR-based monitoring parking systems with broader smart city initiatives, such as intelligent transportation systems, to create a more connected and efficient urban environment.
2. Enhanced Data Analytics: Investigate advanced data analytics techniques to extract deeper insights from the collected parking data, such as predicting parking demand, optimizing pricing strategies, and improving traffic flow within parking areas.
3. IoT Integration: Explore the integration of Internet of Things (IoT) devices and sensors within the parking infrastructure to enable real-time data collection, remote monitoring, and automated decision-making processes.

4. User Experience and Mobile Applications: Focus on enhancing the user experience by developing intuitive and user-friendly mobile applications for scanning QR codes, making parking reservations, and providing real-time information on parking availability, pricing, and navigation.
5. Security and Privacy: Address security concerns related to QR-based monitoring parking systems, including data encryption, secure communication protocols, and protection against hacking or unauthorized access. Additionally, investigate privacy protection measures to ensure the responsible handling of user data.

4. REFERENCE

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