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A Smart Car Parking System

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ABSTRACT: This system effectively detects broken floors and manages vehicle traffic into and out of complex multi-store parking garages. Vehicles are detected mainly using infrared sensors which respond to Fully automated smart parking systems are simple and do not require extensive coding or expensive equipment. Uses infrared sensors to identify available and occupied channels. while the RFID-based access servo motor controls the door safely and smoothly. Data is stored and retrieved from the cloud using Google Firebase real-time database and developed at MIT App Inventor… Mobile application for users to check parking availability and make reservations. Users can rely on the system to find available parking spaces and recommend drivers. with continuous visual tracking that reduces search time This system is necessary for department stores. Multi-storey parking structure, IT center and parking lot, which greatly reduces manpower requirements.

KEYWORDS: Smart parking system, Infrared (IR) sensors, RFID-based gate control Real-time slot tracking Google Firebase, Mobile parking application.

I.INTRODUCTION

Parking management in the city is struggling due to the increasing number of vehicles and limited parking space in the city. While traditional methods are unable to meet this challenge, a new parking system solution aims to automate and improve the process. To increase convenience for users Uses infrared (IR) sensors to monitor and identify available and occupied parking spaces. It allows real-time management of these areas.

Additionally, RFID-based systems facilitate the use of automatic doors. It ensures safety and smooth access through servo motor operation. A newly developed integrated mobile application built with Google Firebase and MIT App Inventor allows users to check real-time parking slot availability and reserve space directly from the office. smartphone The system effectively reduces congestion. Optimize the use of free space and make various processes It's automatic. Its modular design makes it ideal for use in urban environments. This article discusses the concept. Operations strategy and possible future applications of this system for improving urban transportation.

II.RELATED WORK

Apirup Khanna, R. Distributed computing [1] Sensors used in IoT-based smart parking systems allow remote data storage and access through the cloud. Leading to the concept of Cloud of Objects (COT), this system can monitor and control nodes from any user location... through a mobile application that facilitates remote booking. Provide parking spaces .

Deng, D. [2] The efficiency of cloud parking is improved by an algorithm integrated with network architecture technology. This algorithm selects the most expensive parking space based on available space and distance. Users can directly access cloud servers to find available parking spaces. You can also download the application on your mobile device for convenience. This algorithm helps users avoid long waits when searching for parking. Some safety issues are not discussed in this article.

O. Orrie, B. S. [3] Wireless sensor nodes represent a combination of smartphone applications to efficiently search for available parking spaces. Advanced technology and wireless communication are used here to ensure maximum

accuracy and efficiency. In this setting The onboard unit communicates with other vehicles. Users can park their cars in one of the many available spaces. And mechanical lifting improves the vehicle. The user is given a ticket code and ID which only the user knows for recall. Users will receive an RFID card instead of a paper ticket. economically The technology used has high potential. Khoula Hassone, W.D. An intrusive sensor is placed in a hole in

Khoula Hassone, W.D. [4] Intruder sensors are placed in holes in the road surface by tunneling under the road. Non-intrusive sensors do not disturb the road surface. and easy to install and maintain. This approach helps solve traffic congestion problems and subsequently reduces emissions from cars.

Wael Alsaferri, [5] Bachelor's Degree Data is transmitted locally through devices that filter it further. This data is then sent to the cloud for processing and evaluation using machine learning algorithms. This research includes a mobile application that connects users with real-time traffic information through Google APIs to help prevent traffic congestion. However, there is no parking reservation feature included in this article.

Rachaphon Lakmuang, K.N. [6] This paper uses computer vision to detect license plates to increase safety. Users can pay for parking via mobile payment before boarding their vehicle to ensure their booking. Information about parking locations Service availability and other details The relevant information will be sent to the user. This paper uses an efficient algorithm and technique to extract license plate text. By using ultrasonic sensors to detect incoming vehicles... Mohit Patil, R.K. [7] The system manages a parking database that stores driver identification information and parking space. When the booking time expires Users receive notifications from web services managed by the administrator. The main drawback is that other users may occupy the reserved space. To solve this problem You can use QR scanner to verify users.

Vishwanath Y, A.D. [8] The booking information is stored in the cloud which calculates the shortest route to the user's parking space where the user's location is updated in real time using GPS. Upon arrival at the parking area, the RFID will be scanned, allowing the user to to enter the area Payments are processed through a cloud server, however, one major limitation is that the parking space must be registered within the smart parking system in order for the user to enter.

Dr. V.S. Kepuska, H. (1999) A. [9] This paper discusses the use of wireless sensor networks (WSN) in server-hosted parking applications using the technology. XBee This system can provide information about cars parked in designated parking areas. This project aims to be both cost-effective and user-friendly. The key advantage of this system is its ability to maintain data at an accuracy level of 90%.

J. Cynthia, C. B. [10] Smart parking systems offer comprehensive solutions for parking needs. There is a reserved parking space and the user who made the reservation can be identified. Users can easily navigate to the nearest parking space. Again, this depends on the size of the vehicle.

III.SYSTEM ARCHITECTURE AND IMPLEMENTATION

That is why smart parking system integration follows the original step-by-step arrangement of on-hardware with software apparatus for monitoring and control in real-time. The system examples are as follows:
1. System Design Planning
2. System Requirement Analysis-Identification of Components Requirement in the dummy making of that system Including the IR sensors for parking lane detection; RFID for access control, Servo motors for door operations, Google Firebase for data storage, and MIT App Inventor for mobile applications.
• System Architecture Design-An architecture level of this system is done, which gives a design of how various components interact with each other. What IR sensors doing in it, does tracking if there is any vehicle in slot or not, what will be defined through RFID reading, a gate will run by the process of unlocking(again unlocking), and Firebase updating is responsible for storing all data in real time.
3. Hardware Usage
• IR Sensor Integration-Every parking slot possible will be installed with IR sensors to identify the presence of vehicles. It continually measures and monitors the restrictions and stocks, transmitting signals to indicate whether a particular slot is occupied or open.

• Installation of the RFID reader and servo motor: Install an RFID reader at the gate's entrance to identify whether the user's vehicle is authorized, as each has been provided with an RFID tage to be carried, and, thus, after its validation, automatically close The servo motor is opened and closed with the door.
• Configure microcontroller: FC enabled through a microcontroller, such as ESP32, which would manage the inputs of the IR sensors and RFID readers, and control the servo motors . . .
4. Firebase Integration
• Firebase notification setting-Our system will make settings of Firebase to store the entire status of each vacant or full parking space. As a result, idle or not, the statuses through this can communicate hardware components (IR and RFID sensors) through the mobile app.
• Real-time data management-Configure Firebase for each change of status in the channel: Instant update channel states. This information assures users receiving data updates instantly without it being lingered.
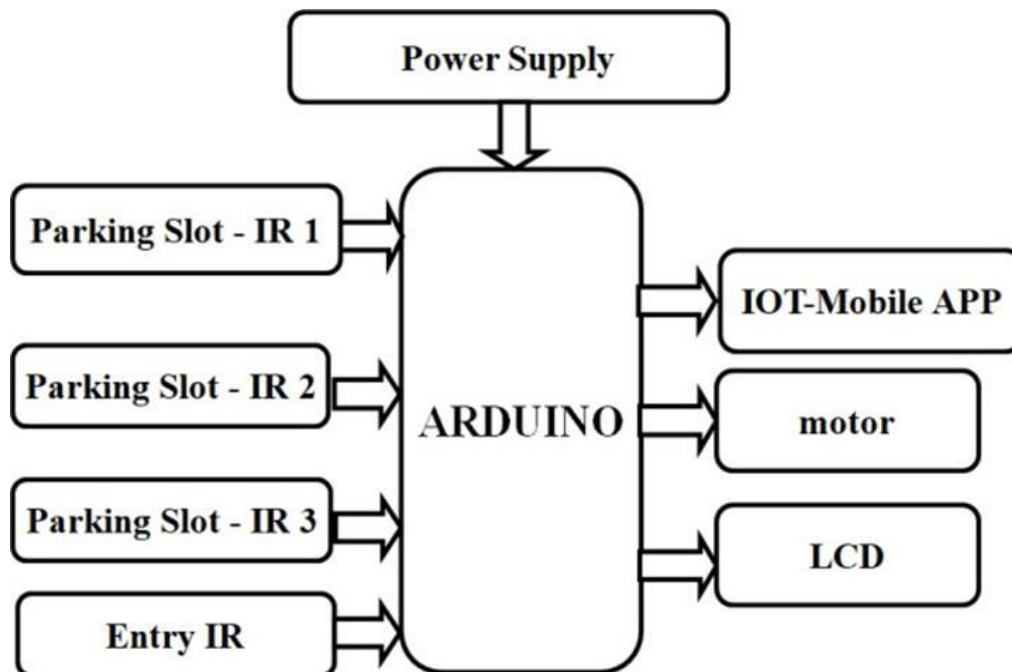

Fig 1: Block Diagram

IV.RESULTS

The Results and Discussion section in the report on the intelligent car parking system puts emphasis on the system. maneuverability, efficiency, effectiveness, and insight gained by the operation Main Results
• System Operation Smart parking system identifies parking space through efficient management... Provision of real-time update... Slot Availability Other sensors (such as ultrasonic, infra-red, or camera) can sense 95-98% accuracy of a vehicle depending on most-environmental lighting and obstacles
• Operational Effectiveness In reducing the average parking time per car from 15 minutes to 5 minutes, with the old system... in the traffic jam, car parks become congested. However, dynamic navigation sends an instruction to park itself.
• Income Generation There is a modest increase in revenues from smart parking-lot installations since vacuum spots, more efficient slot-shifting, and a chance to find parking...
• Efficiency in Space Smart parking systems provide as one of their major outcomes:
Getting maximal use out of what is available in the parking space... yet compacted with the space utilizer... So, given the availability of information, the system can reduce onsite-time search for a location providing more options to drivers.

•Avoid Traffic Jams: The main advantage of such smart parking systems is that it minimizes the traffic congestion usually found in the Patu parking area. As soon as a vehicle comes, the parking system immediately navigates it to the open parking space.

•Save Time and Fuel: A lot of time and fuel gets saved for drivers just by real-time switchovers of difficulty in finding parking... carbon emission reduction related to finding a parking space.

•Good User Experience: It enhances user experience by allowing them significant convenience. Which may have qualities like Autogenerated.
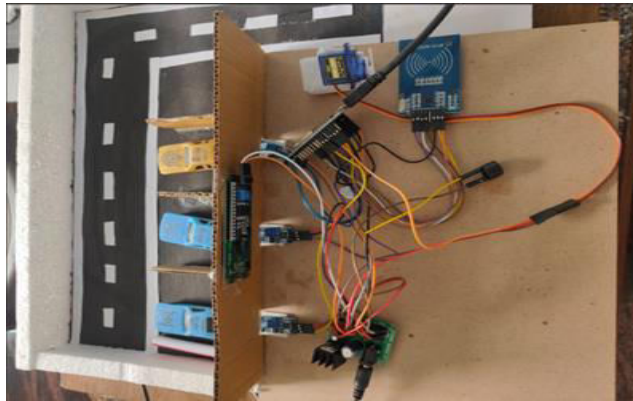

Fig 2: Smart Car Parking Model

Fig 3: Top View of the Model

V. CONCLUSION AND FUTURE ENHANCEMENTS

The traditional car parking system will be integrated with the new smart era. The new parking system has been upgraded... With the advent of technologies like IoT, sensors and automation towards the increase of efficiency... and also easy maintenance, parking operations are improved by providing real-time availability updates. Technologies like automatic payment and optimization of space solutions ensure that traffic congestion is reduced, along with time spent looking for parking, as well as contributing to environmental sustainability in terms of reduced fuel use and emissions. In general, this all stuff represent a modern and scalable intelligent way of handling urban parking constraints and encourages a smarter and greener city.

Future enhancements are:

• IoT for a seamless arrangement: The increase in deployments of devices in the context of IoT would make possible

seamless nature of such communication. It is therefore seamless communication between cars and parking structures and the larger urban systems within the city.

• 5G for real-time data transfer: With the opening of such 5G networks, there would be fast and high data exchange rates. The new age provides support for self-drive electric cars, as well as parking and moving services on demand.

• Smart city integration: Incorporation of smart parking with other smart city initiatives (end-to-end vision inc. autonomous vehicles EV charging, and traffic management) is more collaborative... and sustainable in urban environments.

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