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Smart Parking System

[1]Ms Sonali Wadekar, [2]Mrs V.D. Jadhay, [3] Dr. Swati Pawar

[1]M Tech Student, [2]Assistant Professor, [3]Assistant Professor,
[1]Computer Science and Engineering, SVERI'S Collage Of Engineering Pandharpur Solapur, INDIA
[2]Computer Science and Engineering SVERI'S Collage Of Engineering Pandharpur Solapur, INDIA
[3]Computer Science and Engineering, SVERI'S Collage Of Engineering Pandharpur Solapur, INDIA

Abstract: With the rapid growth of urbanization, the number of vehicles on the road has significantly increased, leading to a growing demand for efficient parking solutions. One of the major challenges faced by drivers in urban areas is the unavailability of parking spaces, especially during peak hours. This often results in excessive time spent searching for parking, fuel wastage, traffic congestion, and environmental pollution.This project proposes the design and implementation of a Smart Parking System using Arduino and Infrared (IR) sensors to detect the occupancy status of parking slots in real time. Each parking lane is equipped with IR sensors that monitor the availability of slots and relay this information to a microcontroller (Arduino). The data is then displayed on a user interface device, such as an LCD or mobile application, helping drivers to quickly identify and navigate to available parking spots. The system aims to minimize the time and effort required to find parking, reduce fuel consumption, and lower environmental pollution. It is a low-cost, scalable, and efficient solution suitable for public and private parking facilities. The proposed smart parking system enhances urban mobility and contributes to the development of smarter and more sustainable cities

Index Terms - Smart Parking System, Arduino, IR Sensors, Parking Slot Detection, Urban Transportation, Real-time Monitoring, Environmental Pollution, Fuel Wastage, Traffic Management, loT-based Parking, Cost-effective Solution, Sustainable Mobility.

I. BACKGROUND

Living in one of India's bustling metropolitan cities, people frequently encounter a variety of challenges related to urban transportation, with parking being one of the most significant issues. Parking a vehicle not only demands substantial human effort and time but also occurs at a scale that is often difficult to manage efficiently. With the rising number of vehicles on the road, the demand for parking spaces continues to grow, resulting in increased congestion and inconvenience for drivers. Traditionally, drivers search for parking spots manually—either by relying on prior experience or chance. In high-density urban areas, this method is time-consuming and inefficient, often leading to unnecessary fuel consumption and increased traffic. An alternative approach is to utilize largecapacity parking lots; however, even these can be challenging to navigate without a proper system in place. To address these challenges, smart parking systems have been introduced as part of modern traffic management strategies. These systems aim to reduce operational costs and improve the efficiency of parking space utilization for both drivers and facility owners. Our proposed system leverages Arduino and infrared (IR) sensors to detect the availability of parking slots. The sensors communicate with the Arduino, which processes the information and displays it on a user interface. This enables drivers to check the status of parking availability before entering the lot, thereby reducing the time and effort typically required to find a space. According to a case study conducted at one of India's largest parking facilities—serving a major

cinema, shopping mall, and office complex—the system accommodates over 30,000 vehicles daily. Such high volumes highlight the complexity of managing parking manually. The objective of this study is to evaluate current parking usage and address the issues encountered by drivers. While some modern parking systems use video surveillance for monitoring, these solutions are often expensive. Our goal is to develop a cost-effective, reliable, and high-performance smart parking system that can be widely implemented. By minimizing search time and reducing traffic congestion, the proposed system promises to transform urban parking experiences and contribute to a smarter, more sustainable city infrastructure.

For this study secondary data has been collected. From the website of KSE the monthly stock prices for the sample firms are obtained from Jan 2010 to Dec 2014. And from the website of SBP the data for the macroeconomic variables are collected for the period of five years. The time series monthly data is collected on stock prices for sample firmsand relative macroeconomic variables for the period of 5 years. The data collection period is ranging from January 2010 to Dec 2014. Monthly prices of KSE -100 Index is taken from yahoo finance.

II. LITERATURE REVIEW

This paper presents an IoT-enabled smart parking system to reduce traffic congestion. Ultrasonic sensors are used to detect vehicle presence in parking slots. Arduino collects and transmits data to a cloud platform. A mobile application provides real-time availability of parking slots. The system is cost-effective and suitable for urban areas(1). This study describes a parking model using Arduino and IR sensors. The setup detects whether a slot is occupied or free. Results are shown on an LCD screen at the parking entrance.public areas. It aims to reduce traffic congestion during peak hours [4] . The system integrates IoT with Android for user convenience. Users can reserve parking slots in advance using the app. Ultrasonic sensors detect slot occupancy in real time. Data is transmitted to a server and reflected on the app. This enhances parking management efficiency significantly [5]. This design focuses on minimizing manual efforts in parking. The system uses Wi-Fi modules to connect with cloud servers. IR sensors are used to detect vehicle presence. Results are visible through a user-friendly dashboard. It helps to avoid unnecessary roaming in search of space [6].This research proposes a reservation-based smart parking solution. Drivers can pre-book slots through a web interface. RFID is used for vehicle identification and access control. The system avoids unauthorized parking and improves space utilization. It is ideal for corporate and institutional setups [7].This lIoTbased model focuses on real-time slot monitoring. Ultrasonic sensors gather data sent to a web server. Arduino controls input and output operations. Users can access slot status using a mobile app. It reduces traffic, pollution, and enhances convenience [8].

This paper explores implementation in metro cities. Vehicle detection is handled using ultrasonic sensors.A web interface provides real-time slot monitoring.The system can scale to multi-level parking zones.It improves security, transparency, and efficiency[9]. This design uses IR sensors and GSM for notifications. Drivers receive parking information via SMS alerts. Arduino manages data collection and slot updates. It is useful for areas without internet connectivity. Cost-effectiveness is one of its main strengths[10]. This paper emphasizes scalability in smart cities. It integrates cloud computing with Arduino-based sensing. The dashboard provides real-time updates to drivers. IR sensors ensure accurate slot monitoring. It can be extended with Albased prediction features[11].Arduino Uno is used to control the parking model. IR sensors detect the entry and exit of cars. An LCD display shows the total number of available slots. It supports a multi-level parking mechanism. The system is ideal for commercial and office complexes [12]. A cloudintegrated system helps manage space remotely. ESP8266 module connects sensors to the internet.Drivers access slot data via a mobile app. The solution is low-cost and easy to deploy. It reduces pollution and enhances user experience[13].The Android app helps users locate nearby parking spots. Sensor data is sent through Wi-Fi modules to the cloud. Arduino controls relay mechanisms and slot updates. The app provides a map-based interface for convenience. This system is suitable for malls and public areas[14]. This paper presents a sensorbased model with vehicle count logic. The system displays occupancy and vacancy on an LED screen. Arduino acts as the central controller for slot updates. It is energy-efficient and easy to maintain. Real-time tracking helps avoid unnecessary waiting and traffic[15).

III. PROPOSED SYSTEM

The proposed smart parking system is designed to address the common challenges faced in urban areas related to parking space unavailability, especially during peak hours. It utilizes Arduino microcontrollers and infrared (IR) sensors to detect the presence or absence of vehicles in each parking slot. These sensors are installed in every lane or parking bay and continuously monitor the slot status. The collected data is then processed by the Arduino, which updates a user interface (such as an LCD or mobile display) in real-time, showing the availability of vacant and occupied slots. This allows drivers to conveniently identify free parking spaces before entering the parking area, thereby reducing the time spent in searching for parking. Additionally, the system helps in minimizing fuel wastage and traffic congestion, leading to reduced environmental pollution. The system is designed to be cost-effective, scalable, and energy-efficient, making it suitable for deployment in malls, offices, multiplexes, and other hightraffic areas. Overall, it offers a simple yet efficient solution to modern-day parking problems by optimizing existing infrastructure and providing real-time slot monitoring and guidance. Power Supply IR Sensors Fig. 1. Proposed System Architecture

Fig.1.Proposed System Architecture 1

Architectural Design: The system architecture is divided into three main components: Android Client: A mobile application where users can view parking slots, book spaces, make payments, and cancel reservations. TIoT ESP32 Module: An IoT device that monitors realtime availability of parking spaces and updates the server accordingly. Server-Side Web Service: A backend web service responsible for handling booking requests, payment validation, and email notifications. The IoT ESP32 module constantly updates the server with the occupancy status of parking slots, while users interact with the mobile application to reserve spaces. Once the user makes the payment, the server confirms the booking and sends an android application notification.

Flow Diagram

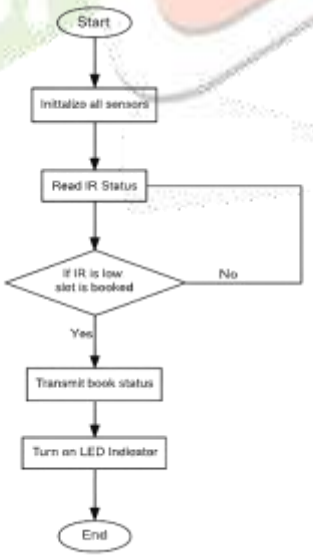

Fig. 2. Flow Diagram 1

Circuit Diagram

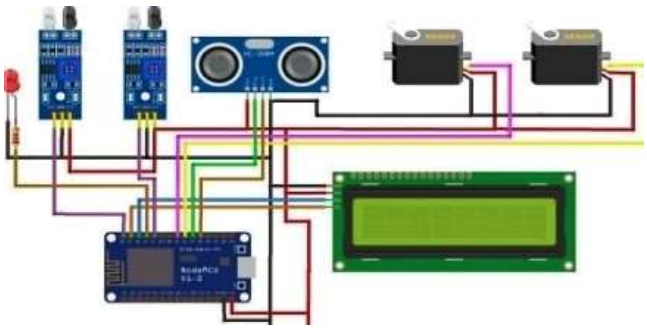

Fig. 3. Circuit Diagram 1

Hardware Components

ESP 32

The ESP32 is a versatile system-on-a-chip (SoC) microcontroller with integrated Wi-Fi and Bluctooth/Bluctooth Low Energy (BLE) capabilities. It's known for its low cost, energy efficiency, and high integration and it is a popular choice for various Internet of Things (IoT) and embedded applications.

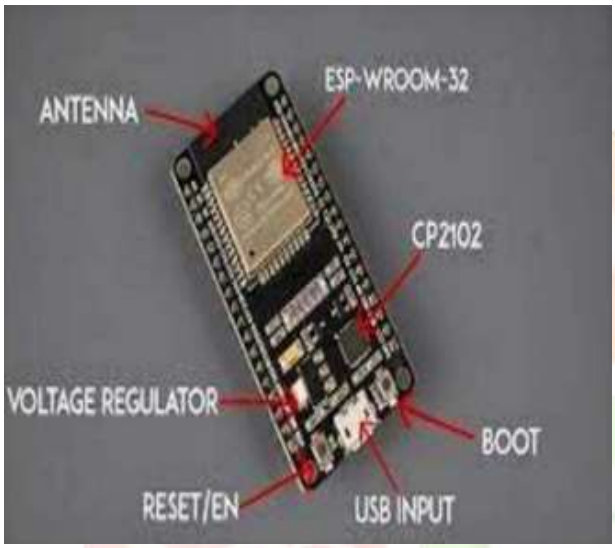

Fig. 4. ESP 32 1

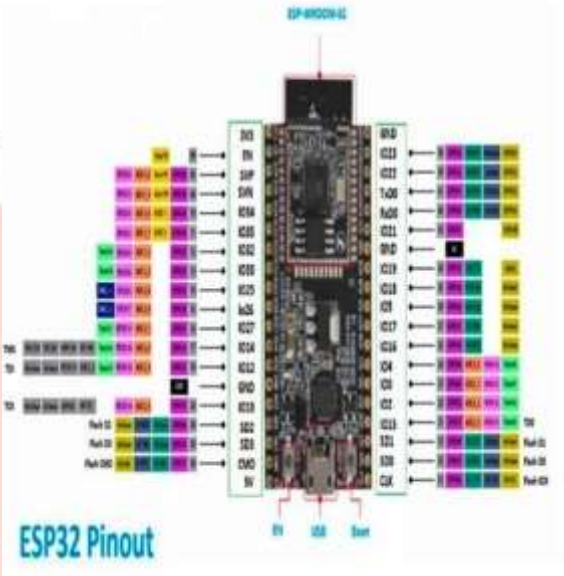

Fig. 5. ESP 32 Pinout diagram 1

Algorithms and Techniques

The Arduino-based technique used in the proposed smart parking system serves as the central control unit responsible for processing sensor data and managing the overall system operation. Infrared (IR) sensors are installed at each parking slot to detect the presence or absence of vehicles. These sensors are connected to the Arduino microcontroller, which continuously reads the signals from them. When a vehicle is present in a slot, the IR sensor detects the obstruction and sends a corresponding signal to the Arduino. Based on this input, the Arduino determines whether the slot is occupied or vacant and updates the status in real-time. This information is then relayed to a user interface, such as an LCD display or a web/mobile application, allowing drivers to easily view available parking slots. The Arduino-based technique is not only cost-effective and easy to implement but also provides accurate and quick responses, making it an ideal solution for managing smart parking systems in busy urban environments

1. Pseudocode for smart parking system

```
Start

Initialize all IR sensor ping as INPUT Initialize dLsplay module ILID or
Serial Monitor)

Loop Forever:
to r eac h packing s1ot:
Read the IR sensor va1ue

II IR sensor is HIGtt Ino vehIele
detected):
Nark slot as 'Vacant'
Else IC IR sensor is LOW (vehicle detected):
Park slot as 'Occupied'

Update the display:
For each slot:
Show slot number and status lVacaot/
Occup ied T

Na 1L £oC a sho ct del ay (e.q., 1 second

Repeat

End
```

IV. RESULT AND DISCUSSION

The proposed Arduino-based smart parking system was successfully implemented and tested in a controlled environment. The IR sensors accurately detected the presence or absence of vehicles in each slot and updated the status in real-time on the display module. The system effectively reduced the time taken to find a vacant parking space, thus minimizing traffic congestion and fuel consumption. It proved to be a cost-effective and scalable solution suitable for small to medium-sized parking lots. Overall, the smart parking system demonstrated significant potential in improving urban parking efficiency and reducing environmental impact.

Before Booking

Fig. 6. Before Booking Page

After Booking

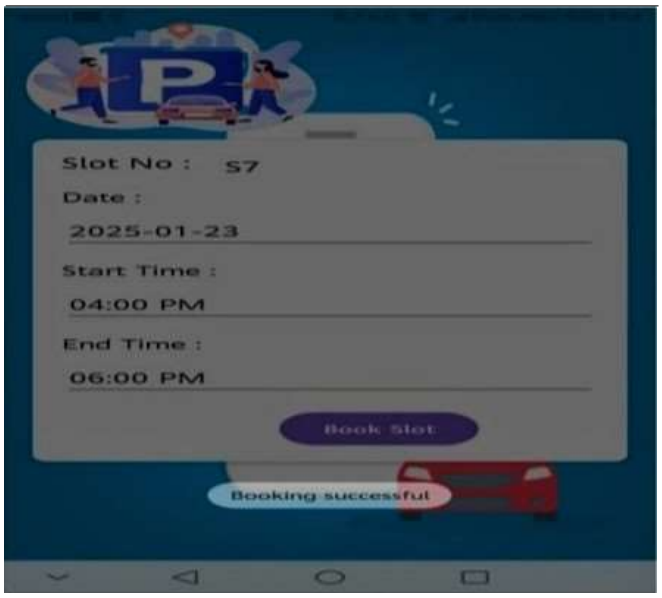

Fig. 6. After Booking Page

V. CONCLUSION

The Android-Band Parlting Booking Syskm using loT and ESP32 represents a significant step forward in addreseing the challenges of urban parking management. By integrat- ing real-time slot detection, reservation, and user interaction through a dedicated Android application, the «ysiem offer a seomlevs and intelligent solution for both users nod parking lot operators. The use of the ESP32 microcontroller ensures efficient communication between the sensors and the mobile inurface, enabling accurate availability updaiei and enhancing aystem responsiveness.This smart parking system reduces the time and effort required by users to find parking, thereby decreasing traffic congestion and fuel wastage, which in turn tonttibuies to lowet environmental pollution. The real-time boolting featura empowcrs users to plan ahcad and secure parking slots remotely, while the secure payment system adds a layer of convenience and reliability. Furthermore, the system is designed to be scalable and cost-effective. mak- ing it adaptable for various utban stings, ftom small lois to large commercial complexes. Alttiough the deYclopmcnt is still ongoing. with features like payment validation and booking cancellation currently under refinement, the project kas slmady mcc several crucia) milestones. The team mmains w•nmittcd to delivering a us¢r-friendly, robust, end efficient smart parking solution that aligns with the gmwing needs of modem ciiies. Upon completion, this system will not only improve the parking experience but alan scrvr as a foundation for future enhanoenunts, such es dynamic pricing, machine learning-band occupant preditiion, arid broader sniati city integration.

REFERENCES

[1] Saryauanshi, S.. & Sñjinke. A. (2019). loT bg»ed smart parking system. laiernaîîonal R secret Jowna4 of Bogineoirig ctxt Technology (IRfBTk B4I,2454-MŒ..

[2] Sharma, A., & Jain, R. (2018). Smart parking system using loT. International Journal of Engineering and Advanced Technology (EAT), 7(6), 70-73.

[3] Kumar, M., & Verma, A. (2020). Real-time car parking system using Arduino and 10T. International Journal of Innovative Technology and Exploring Engineering (UITEE), 9(3), 1001-1005.

[4] Patel, N., & Desai, H. (2019). Android-based smart car parking system. International Journal of Scientific and Technology Research, 8(10), 2116-2120.

[5] Basha, S. M., & Suresh, S. (2018). Smart parking systems and sensors: A survey. International Journal of Engineering and Technology, 7(2.23), 61-65.

[6] Ramesh, T., & Rajalakshmi, K. (2020). IoT based smart parking manage- ment system. International Journal of Scientific Research in Computer Science, Engineering and Information Technology (ISRCSEIT), 6(1), 24-30. [7) Singh, A., & Chouhan, S. (2019). Arduino based smart parking system using IR sensors. International Journal of Engincering Sciences & Research Technology (JESRT), 8(5), 31-35.

[8] Sharma, N., & Patel, D. (2018). A review on smart parking system using loT. Intemational Journal of Trend in Scientific Research and Development (UTSRD), 2(4), 1652-1656.

[9] Rathod, R., & Kulkarni, A. (2020). Automated smart parking system using 0T, International Journal of Scientific and Research Publications (LISRP), 10(4), 717-720.

[10]Chavan, R, & Dhamdhere, S. (2018). Parking slot detection and booking using Android application. International Journal of Computer ions, 180(22), 1-4. & Pandey, A. (2019). Smart parking system using ESP32 and pp. International Journal of Research and Analytical Reviews (URAR), 6(2), 923-928.

[12] Dey, N., & Roy, A. (2020). 0T based smart parking system: A review. International Journal of Emerging Technologies and Innovative Research (UETIR), 7(6), 298-303.

[13] Rao, B. V., & Naik, P. (2019). A smart parking system using IoT. International Journal of Computer Science and Mobile Computing (LICSMC), 8(5), 50-56.

[14] Shelar, A., & Ghadge, M. (2020). Android-based parking system using 1oT and cloud. International Journal of Scientific and Technology Research, 9(2), 3661-3664.

[15] Khandelwal, R., & Gupta, A. (2019). ESP32 based real-time parking management system. Intemational Journal of Recent Technology and Engineering (URTE), 8(1), 305-308.