



e-ISSN: 2278-8875  
p-ISSN: 2320-3765

# International Journal of Advanced Research

in Electrical, Electronics and Instrumentation Engineering

Volume 13, Issue 5, May 2024

**ISSN** INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA

**Impact Factor: 8.317**

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# Automated Time-Based Parking Payment System

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**ABSTRACT :** The Automated Time-Based Parking Payment System presents an innovative solution to streamline and optimize the process of parking fee collection in urban areas. Traditional parking systems often rely on manual methods of payment, leading to inefficiencies, long queues, and potential revenue losses. This system aims to address these challenges by implementing an automated payment mechanism based on the duration of the parking stay. Upon entry to the parking facility, vehicles are registered and assigned a unique identifier, either through license plate recognition or ticket issuance. Throughout the parking duration, sensors track the vehicle's entry and exit times, accurately calculating the parking fee based on the elapsed time. Users can conveniently pay via various methods such as mobile applications, contactless payment cards, or online, the system provides real-time monitoring and reporting capabilities for parking operators, enabling better management of parking spaces, revenue tracking, and optimization of resources. Additionally, it enhances user experience by reducing waiting times and providing flexibility in payment summary, the Automated Time-Based Parking Payment System offers a modernized approach to parking fee collection, improving efficiency, convenience, and revenue generation for parking operators while enhancing the overall parking experience .

## I. INTRODUCTION

The Fully automated systems are being adopted in industries across the world at a rapid rate. Control systems are replacing manual operators and fully automated machines are replacing human labor. Less personnel and smarter machines means less operating and labor costs while increasing the quality of the products or services offered. This study will increase the quality of service of parking lots by integrating a smart system which assists motorists in finding vacant parking slots [1]. It has a Parking Guidance and Information system concept which will efficiently assist motorists and ensure the safety of the vehicles and the valuables inside the vehicle. In this parking system, a database lists the plate numbers of users and records the duration of their use of the parking lot. An Optical Character Recognition (OCR) system is also implemented to recognize the plate numbers of the users as they enter the parking lot. Though this limits the use of the parking lot, it increases the security of the lot which has been deemed as a reasonable trade-off. Kind of problems are faced regularly by every individual because the factor of uncertainty is very high and there are not many possible solutions in existence for solving the issue that may benefit the users by saving their time or keeping their mental state happy and carefree. In our ever-populating cities and districts to find parking space is becoming increasingly difficult as traffic increases. Drivers have to go back and forth desperately looking for parking spaces wasting their valuable, fuel consumption with increased likelihood of causing accidents. With the help of wireless network technology we propose remote parking monitoring and automated guidance which will help save a lot of time. In the existing system we can see that some supervision is required for the parking system and it is not fully automated. The driver has to make sure that the car is parked in a spot without disturbing the convenience of others. In most cases the main problem is finding the spot and trying to secure the spot for parking which in turn leads to increased stress level for the person driving the car. Moreover, the relative analysis of the data is structural to the implementation of the parking procedure. Nowadays, in this busy world it's really hard for a person to find a spot for parking. The current parking system doesn't give the user a specified parking slot inside the area.

## II. EXISTING SYSTEM

Integration with mobile apps: Many parking payment systems now offer mobile apps that allow users to easily pay for parking time, receive notifications, and extend parking sessions remotely. Payment options: With the increasing emphasis on hygiene and safety, more parking systems are incorporating contactless payment methods such as NFC,



QR codes, or mobile payment platforms like Apple Pay and Google Pay. Advanced analytics: Parking operators are leveraging data analytics to optimize parking space utilization, predict demand, and adjust pricing dynamically based on factors like time of day, day of the week, and special events. Sensor Integration:

#### **Sensor level module:**

Here we are implementing CMOS, ultrasonic and Electro-magnetic sensor for the conception of detecting the presence of the car in the parking slot. Then with the help of an arduino and modem we transmit the signal wirelessly to the receiver.

### **III. RECENT WORK**

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#### **3.1 Sensor level module:**

Here we are implementing CMOS, ultrasonic and Electro-magnetic sensor for the conception of detecting the presence of the car in the parking slot. Then with the help of an arduino and modem we transmit the signal wirelessly to the receiver.

#### **3.2 Billing/Payment module:**

In the car parking area we collect information about the driver and store it in a database and using an app we are able to provide options for payment online after which they can park their car and while they exit billing is done and any additional charges are added on to their account.

#### **3.3 Program level module:**

In programming level we process the received signal with mega arduino to find the free parking slots And obtain results. Then it's transmitted to the server with the of modem.

#### **3.4 Display level module:**

In display level there are two aspects which are taken care of. Firstly, the parking area once booked Changes the color of LED in the parking slot to indicate that it's taken. Secondly, the user's mobile Application and the server works at the client level and admin level.

### **IV. PROPOSED WORK EXPLANATION**

When a vehicle enters the parking facility, the system records the entry time using sensors or ticket issuance. Time Tracking: The system continuously tracks the duration of the vehicle's stay within the parking facility. Fee Calculation: Based on the duration of stay, the system calculates the parking fee according to the predetermined rates.

#### **Payment Options:**

The system offers various payment options such as cash, credit/debit card, mobile payment apps, or prepaid parking cards.

#### **Payment Confirmation:**

Once the payment is made, the system confirms the transaction and updates the payment status for that vehicle.

#### **Exit:**

When the vehicle exits the parking facility, the system records the exit time and calculates any additional fees if the vehicle exceeded the allotted time.

#### **Receipt Generation:**

The system generates a receipt for the transaction, detailing the entry and exit times, parking duration, and total



amount paid.

**Pi camera:**

The Pi camera module is a portable light weight camera that supports Raspberry Pi. It communicates with Pi using the MIPI camera serial interface protocol. It is normally used in image processing, machine learning or in surveillance projects.

**ESP32-CAM:**

The ESP32-CAM can be widely used in intelligent IoT applications such as wireless video monitoring, Wi-Fi image upload, QR identification, and so on. The ESP32-CAM suit for IOT applications such as: Smart home devices image upload. Wireless monitoring



**0.9 inch oled display:**

Product Overview. This 0.96 Inch I2C/IIC 4pin OLED Display Module BLUE can be interfaced with any microcontroller using SPI/IIC/I2C protocols. It is having a resolution of 128x64. The package includes display board, display, 4 pin male header pre- soldered to board.



**IR sensor:**

An IR (infrared) sensor is a type of photodetector that detects infrared radiation emitted by an object or surface within its field of view. It measures the level and magnitude of infrared energy in order to provide data on the temperature, movement, presence or absence of objects and other environmental conditions.



**12v to 5v adapter:**

An adapter or adaptor is a device that converts attributes of one electrical device or system to those of an otherwise incompatible device or system. Some modify power or signal attributes, while others merely adapt the physical form of one connector to another.



**Buzzer:**

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers, train and confirmation of user input such as a mouse click or keystroke.



**V. RESULTS AND DISCUSSION**

The implementation of the Automated Time-Based Parking Payment System has yielded several significant results and insights, prompting fruitful discussions. Key findings include:

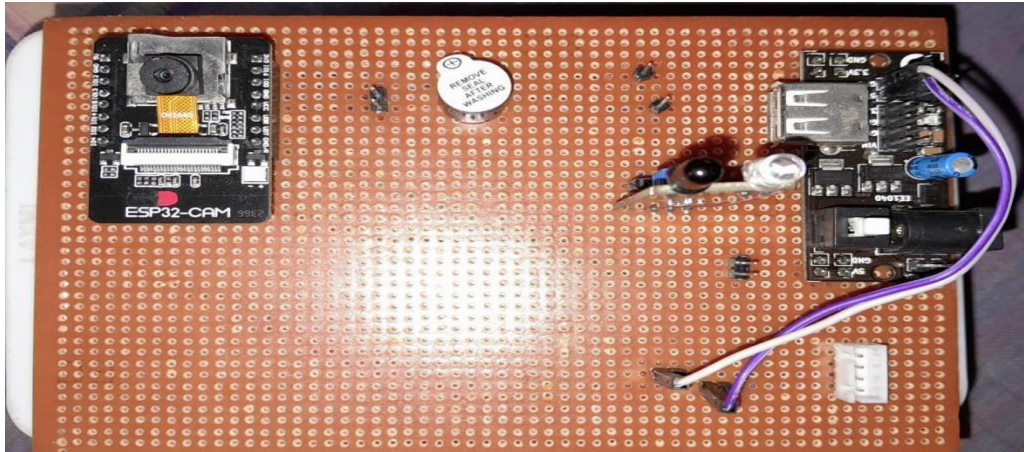
1. Efficiency: The system has streamlined the parking payment process, reducing wait times and improving overall efficiency for both users and parking management.
2. Revenue Generation: By accurately tracking parking durations and implementing fair payment structures, the system has contributed to increased revenue generation for parking authorities.
3. User Satisfaction: Feedback from users indicates higher satisfaction levels due to the convenience and transparency offered by the automated payment system.

Discussion points may include further enhancements to the system, addressing any challenges encountered during



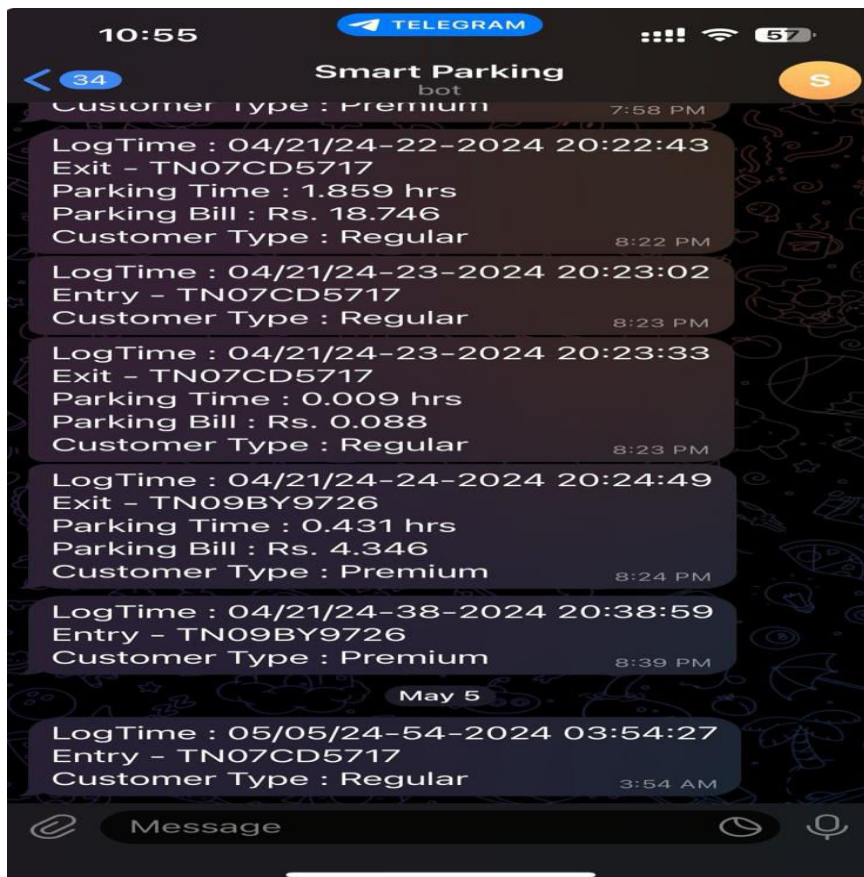
implementation, and potential expansions or adaptations for different parking environments or cities. Additionally, considerations for data privacy, system scalability, and future technological advancements should be taken into account for ongoing discussions and improvements.

### 5.1 Hardware View



### 5.2 Telegram Bot Notifications:

Telegram bot notifications provide users with real-time updates on their parking sessions, including start times, remaining time, and expiration alerts. Telegram bots support multi-language communication, enabling parking operators to deliver notifications and assistance in users' preferred languages, catering to diverse user demographics.





### 5.3 Advantages of Telegram Integration:

Telegram integration allows for instant notifications to users regarding parking status, including reminders for expiring parking sessions and payment confirmations. Users can easily communicate with the parking system through Telegram, enabling quick inquiries, issue resolution, and feedback submission. Telegram's end-to-end encryption ensures secure transmission of sensitive payment information, safeguarding user privacy and financial data.

### 5.4 User Feedback and System Reliability:

In an automated time-based parking payment system, user feedback is crucial for ensuring system reliability and continuous improvement. By gathering feedback on user experiences, parking operators can identify areas for improvement and implement changes to make the system more user-friendly and efficient. This contributes to increased user satisfaction and loyalty.

### 5.5 Discussion on Future Improvements:

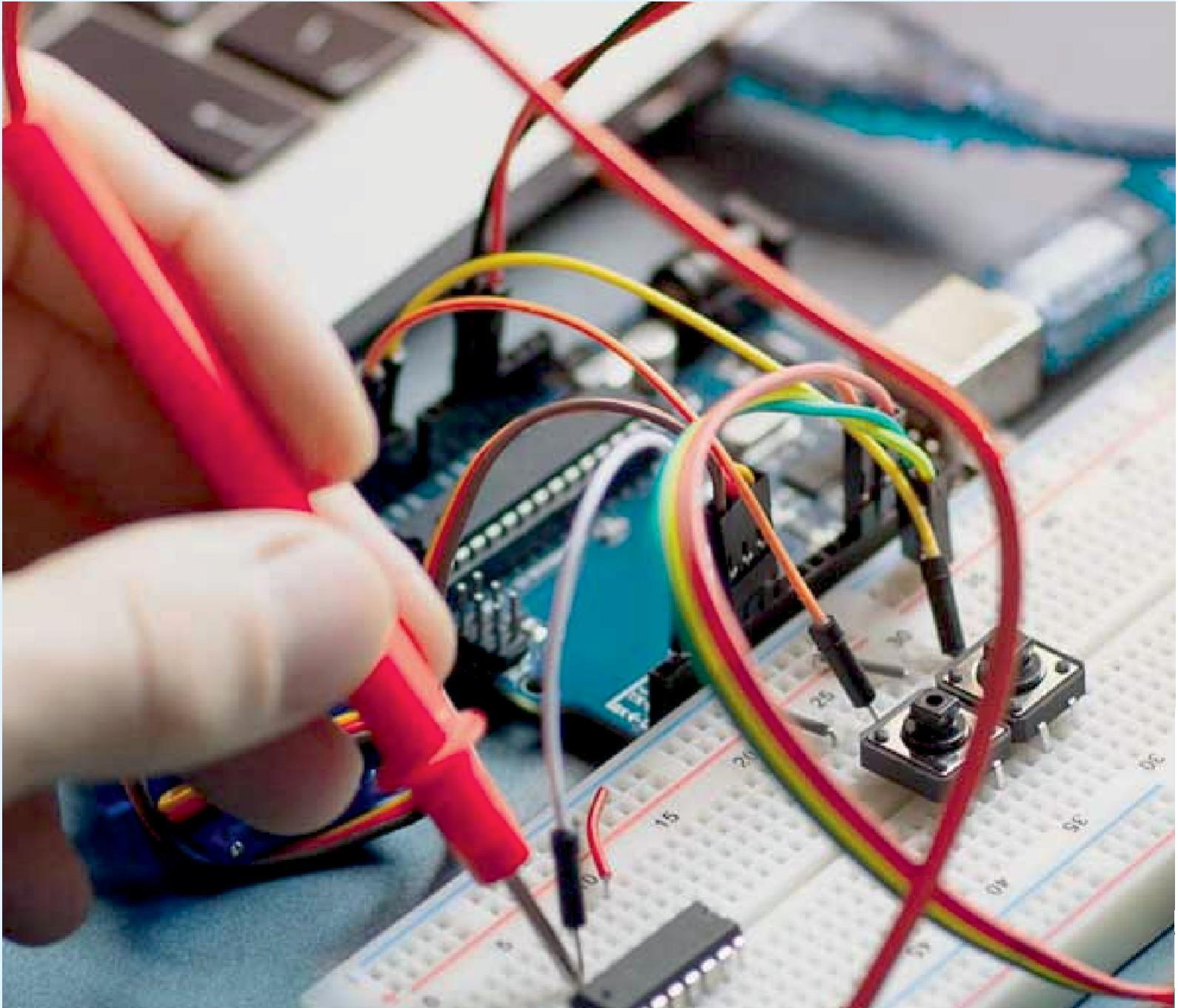
Integrating the parking payment system with popular navigation apps like Google Maps or Waze can provide users with real-time information on parking availability, rates, and directions to the nearest parking facilities. Deploying smart parking sensors in parking lots enables real-time monitoring of parking space occupancy. Integrating these sensors with the payment system can provide users with accurate information on available parking spaces and streamline the parking process.

## VI. CONCLUSION

The implementation of an automated time-based parking payment system offers numerous benefits for both parking management and users. By leveraging technology such as mobile apps or automated kiosks, the system streamlines the payment process, reduces waiting times, and minimizes the need for manual intervention. It enhances user experience by providing convenience, flexibility, and transparency in parking transactions. Furthermore, the automated system improves revenue collection and reduces the risk of revenue leakage associated with traditional cash-based systems. It allows for better monitoring and analysis of parking usage patterns, enabling informed decision-making for parking infrastructure planning and optimization. Overall, the adoption of an automated time-based parking payment system represents a significant advancement in parking management, offering efficiency gains, cost savings, and enhanced user satisfaction. As cities continue to evolve and embrace smart technologies, such systems are becoming increasingly essential components of modern urban infrastructure.

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