Cost Efficient Automatic Car Parking Facility towards Smart City

Cost Efficient Automatic Car Parking Facility towards Smart City

Aswatha R[1], Deepalakshmi N[2], Dinesh A[2], Arun Kumar R[2], Gokulram R[2]
[1] Assistant Professor, KPR Institute of Engineering and Technology, Coimbatore-641407, Tamil Nadu
[2]UG Student, KPR Institute of Engineering and Technology, Coimbatore-641407, Tamil Nadu
aswatha.r@kpriet.ac.in, deepalakshminatarajan2210@gmail.com

Abstract. The idea of smart cities has recently gained a lot of traction. Both residents and city authorities keep struggling with traffic control and parking in urban cities. The growing number of cars entering the city depletes the city's limited parking services, and the increased spending time searching for a parking spot contributes to more traffic, as well as increased fuel usage and emissions. The paper consists of an integrated, cost-effective parking method for smart cities, in which cars are parked and driven to the best location or block for them, and the parking area is completely used with minimal segmentation or empty space. The smart parking system is a relatively new system that creates a platform for booking parking spaces and effectively using those spaces. The sensor system is based on Arduino boards, and the gateway applications are built on Node MCU single-board computers, all of which are connected together using custom software systems and a mobile app for end-users. With the help of a smartphone application, users can reserve a parking spot in advance.

Keywords: booking parking spaces, Arduino, web, sensor system, Node MCU, smartphone application.

1. Introduction

In this day and era of the current world, almost everyone owns a personal car, but it has become a normal human need. As a result, the need for automobiles has been statistically displayed to rise exponentially every year. Due to construction, it is incredibly hard to discover parking spots in cities, especially during peak hours. The quest for a convenient parking spaces for drivers took approximately 20 minutes, according to research [1]. In the area of intelligent parking system design and enlargement, there is a significant amount of study. The characteristics of the proposed smart parking systems are listed. Actual parking way finding, path instruction, automobile presence detection, and parking spaces control are among the inquiries on car parking accessibility and parking lot allocation. The majority of traffic management proposed in the literature in recent years provide approaches for the design of the data system for available parking spaces, parking booking system, presence tracking and parking structure control, real-time mobility within the parking facility, and so on. We propose a framework enabled by the Internet of Things (IoT) that can transfer data across the network without the need for human interference. IoT enables clients to use low-cost wireless technologies while also allowing them to transfer information to the server. The Internet of Things aids in consumer responsibility. The idea of the Internet of Things started with the identification of objects that could be used to connect various devices. These products can be managed or tracked using a Mobile application. The smart parking

system is the most important solution to decrease fuel waste. Smart parking may be a method for reducing travel time and efficiency, as well as the total price of fuel spent looking for a parking spot. A driver on the driveway causes about 30% of congestion by looking for parking areas for parked cars, wasting both fuel and time [2]. The current parking system uses a Radio-Frequency identification (RFID) based and Global System for Mobile Communication (GSM) based parking system. However, RFID-based systems are usually costly to establish. Unapproved devices can access and alter information on RFID tags without the knowledge of the relevant officials, which raises several safety concerns. RFID tags are instantly harmed when they are in close proximity to metal items. RFID remote processing can be restricted by external electromagnetic radiation, and its frequency spectrum is also restricted to 3 meters. The alerts for GSM-based parking, on the other hand, arrive late because GSM technology is a 2G module. GSM uses pulse transmission scheme, which has the drawback of harmful interference across transmission when different individuals have used the same bandwidth. Although the GSM module cannot be limited to a closer distance by using repeaters, this does result in a higher cost.

2. Literature Survey

Sara Nayak et al. address smart car parking using wireless sensor networks in their article. Cars are parked in parking infrastructure using ultrasonic sensors. It aims at providing parking slot availability as well as transmitting data generated by sensors. The state of availability is shown on the Blynk software platform. The gas sensor detects the leakage of toxic materials, thereby reducing anxiety. It's a simple model designed to allow the customer to park their car in a convenient location [3].

Adesh Jamnik et al. suggest a Digital Ticket Booking and Verification Using Aadhaar Card or Fingerprint and Android Application, which offers a smartphone application with additional features such as reservation and payment mechanism. It provides a solution by controlling the ticket booking method using an Aadhaar card number or a fingerprint, thus reducing the use of carbon printed paper tickets and paper waste. The app used to book the convenient slot in the parking area. We are creating an Android application that will assist the ticket checker in efficiently checking tickets and keeping records [4].

Joao Fernandes et al. discussed a low-cost smart parking solution for smart cities based on open software and hardware. For a smart parking system, a low-cost, open hardware and software replacement for existing studies is planned. The prototype shows how Zig Bee technology can be used as a flexible solution for interaction between the device's physical elements while still being efficient in terms of power consumption and cost. It's adaptable, allowing various elements, such as data forms of communication, frontend frameworks, and backend methods, to be used instead of the ones chosen for the functional design [5].

Yusnita Rahayu et al. addressed a secure parking booking system based on GSM technology, and a secure parking booking system based on GSM technology has been established. The Arduino transmits the message to the servo motor, which then sends instruction and notifications to the consumer via the GSM module. As the user reaches the parking area, the reader module scans the RFID card assigned to the registered user, ensuring the protection of the user's identity [6].

IoT-based smart parking system with Real-Time Booking Applications was addressed by Syed Mursal et al. In this device, RFID is used to determine the car's identification, and an IR sensor is used to verify parking availability. It enables for real-time parking lot booking and payment without the need for any client or driver contact. The sensor system improves detection and payment efficiency while lowering costs by simplifying the system, investing in infrastructure, and replacing batteries [7].

3. Proposed System

The project's main goal is to use Internet of Things technology to park a car with more cost effectively. The device works in tandem with the hardware design and software application. The objective of the

suggested research is to generate a process that includes a smart parking model with effective cloud details and system connection to parking areas via IoT innovative technologies. The block diagram has been created and is depicted in the figure 1. It also provides a standardized mechanism for automobile parking lot booking, parking, and management, as well as enabling only permitted cars to access the parking area by scanning the QR code at the gate entry and paying when exiting. [8] We can reserve a slot using our specially built android application, which checks if the parking slots are reserved or not, and if not, new clients can reserve a space. The parking slots are constantly tracking the parking lot's condition. The sensor data is constantly tracked using Arduino, and the information is then uploaded to the server. When the parking lot was utilized and the consumer charged based on the vehicle occupied period, the Node MCU has been used as a Wi-Fi module to collect multiple parking lot details, upload it to the cloud, and make changes in the app.

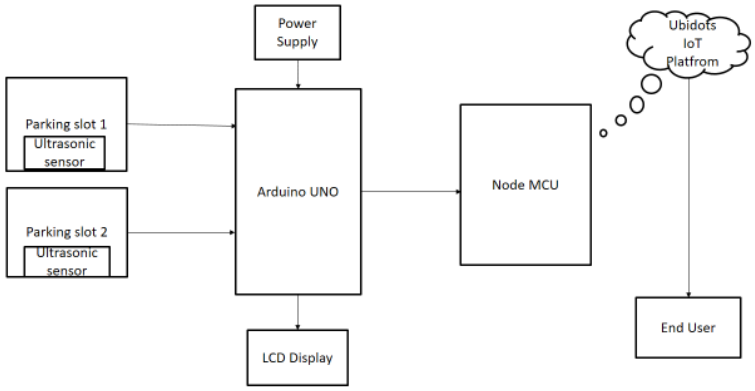

Figure 1. Block diagram

4. Methodology

The following is the sequence of the slot allocation method:

Step1: At first, the user selects a slot using his cell phone. He looks for a parking spot that is close to his spot and sees if one is available. If it is open, he advances to the next stage; otherwise, he returns to the previous state.

Step2: Transfers a parking slot request from a smartphone to an Android program.

Step3: The Parking Control Unit (PCU) receives the user's requested slot number.

Step4: If the payment is completed successful, the allocated parking space will be booked.

Step5: When a client reserves a slot, the state of that slot is changed to RED=BOOKED, and the available slots are changed to GREEN=AVAILABLE.

Step6: The timer starts counting down the cumulative time as soon as the car is parked in the designated location.

Step7: The timer will turn off as soon as the car exits the parking space, and the cumulative amount will be shown.

Modules are parts of a larger system. Three modules make up the Intelligent Parking System.

- User Module
- Administrator Module

- Reservation Module

The user interface/user experience is the subject of this application module. This module gives the user the option of registering, logging in, making a reservation, and paying. If the user is new to the program, he or she must first register by providing personal information. The user signs in with his or her user-id and password after completing the registration process. After logging in, the client searches for a parking spot, reserves it, and then makes an online payment. The application's functional module is the administrator module [9]. It manages the server and executes multiple functions on it in the back end. As soon as a client registers with the program, the admin records all of the customer's information in the server. The admin retains the records of all parking slots (both vacant and filled), their cost for reservation, and customer details in the server, and only the admin has access to modify this information. The payment method is also given by the admin to the customer. Reservation module is the software's key module, and it handles parking slot reservations. When the client is willing to make a reservation, the reservations module enters the scene to provide the consumer with the required details. This reservation module handles the available space, the price of reservation the spot, and the appropriate processing [10]. The figure 2 shows the flow chart.

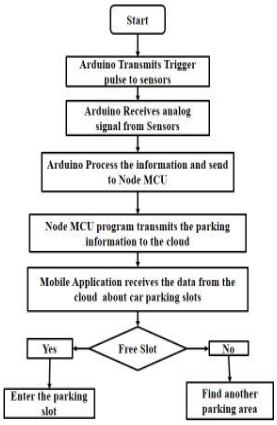

Figure 2. Flowchart

5. Results & Discussion

The need for an intelligent parking system is growing considerably. This enables users to have access to the attainability of parking spaces in real time. In today's world, the current system does not include the parking booking and parking slot capacity checker services. The current system was an eyesight control system that calculates the number of accessible parking spaces in the city by calculating the number of incoming and outgoing cars that take a huge amount of time and efforts as shown in figure 3.

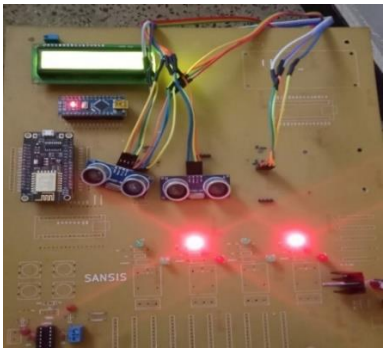

Figure 3. Hardware design

In this project sensor used to determine the availability of the car in the garage. The sensor information are stored in the cloud. Users can check their availability through a mobile application and whenever parking slot availability information changes, the changes reflected in the mobile application too. The user enter the slot only scan their register information through scanner and exist also scan the information and leave. This will enhance the safety of the car and user easily monitor the vehicle through application. The payment was simple, user paid according to their usage time as shown in figure 4. In result it reduced manpower to check the parking space and also reduced fuel waste during searching for the parking space. In a forward planning it extends its working by real time view of the vehicle to be done at the next step.

Figure 4. App screen

6. Conclusion

In concept of smart cities, the development of the Internet of Things and cloud computing have given increase to modern opportunities. Intelligent parking services and traffic control methods will always be at the heart of smart city construction. In order to achieve tender and effective use of the car parking area, we have recommended a smart car parking structure. Basically, the non-booked parking slot is continuously detected by this specific system and the server-side information is updated using a site planned for the separate parking area. The total time usage for information updating is much lower even than previous systems. The scheme that we suggest provides data in real time about the accessibility of parking spots in a parking place. Clients from distant communities could use our software platform to reserve a parking spaces for people. The project is used to prevent traffic congestion in garage such as shopping centre, theatres, scenic spots, and other congested places, reducing time, fuel usage, and emissions. The activities undertaken in this report are focused on improving a city's parking facilities and further improving the quality of life of its residents.

References

[1] Abdul Ahad, Zishan Raza Khan, Syed Aqeel Ahmad, May 2016, *Intelligent Parking System* Scientific Research Publishing, Vol.**4**, No.2, pp. 160-167.
[2] Syed Mursal August 2020, *IOT based smart parking system with Real-Time booking Application*, IEEE.
[3] Suprit Atul Gandhi, Hasan Mohammad Shahid, May 2017, *Smart Parking System* Asian Journal of Convergence in Technology, Vol.**4**, No.1.
[4] Arduino.cc. (2018). Arduino - ArduinoMega2560, retrieved date: 21Oct.2018, online available at: https://www.arduino.cc/en/Guide/ArduinoMega2560.
[5] Kannapiran Selvaraj, Arvind Chakrapani, April 2017, *Smart Dustbin Monitoring System using LAN Server and Arduino*, International Journal of Advances in Computer and Electronics Engineering, Volume **2**, Issue 4, pp. 20 - 23.
[6] S, D., & H, A. (2019). AODV Route Discovery and Route Maintenance in MANETs. 2019 5th International Conference on Advanced Computing & Communication Systems (ICACCS). doi:10.1109/icaccs.2019.8728456

[7] H. Anandakumar and K. Umamaheswari, An Efficient Optimized Handover in Cognitive Radio Networks using Cooperative Spectrum Sensing, Intelligent Automation & Soft Computing, pp. 1–8, Sep. 2017. doi:10.1080/10798587.2017.1364931
[8] Ionic Framework, 2018, Build amazing apps in one codebase, for any platform, with the web. Available from: https://ionicframework.com/ Hasan k
[9] Khaoula Hassoune, Waffa Dachry, Fouad Moutaouakki and Hicham Medromi, 2016, *Smart parking system: A Survey*, IEEE.
[10] Khanna, Abhirup, and Rishi Anand, 2016, *IoT based smart parking system.* 2016 International Conference on Internet of Things and Applications (IOTA) IEEE.