



A Brainy Parking Management System based on Artificial Intelligence

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ABSTRACT

The number of cars on the road is increasing rapidly, causing more traffic problems. The "Brainy Parking System" project offers a brainy, autonomous parking solution with AI and IoT technology. It aims to handle problems in metro cities as well as rural areas. One major issue with current systems is the difficulty in tracking parking fees, which can change based on the time and parking space. This new system allows people to easily locate available parking spots. It uses the same entrance and exit gate, counting vehicles in reverse when they leave. The project combines RFID technology with IoT to enhance efficiency. The smart parking system not only reduces fuel consumption but also lowers urban pollution, contributing positively to the country's economy.

Keywords – Internet of Things, Brainy Parking System, RFID, Sensors

INTRODUCTION

The Internet of Things (IoT) connects various physical objects like mobile phones, laptops, vehicles, buildings, work stations and more via wireless and wired connections. These items contain electronic components, software, ultra sonic sensors, and network connections, allowing them to gather and share data. As the number of families, number of vehicle users and vehicles increases, parking issues rises daily. The rise in car ownership has led to a demand for more parking spaces. This situation rise up traffic problems like traffic jams, limited parking, and road safety especially on narrow Asian roads. Several parking management systems have been developed to control these problems and enhance the convenience for drivers using different algorithms. Many solutions have been proposed to address these traffic challenges. This paper discusses an intelligent parking system that utilizes RFID and IoT technology. Many factors impact parking solutions, and this system enhances identification accuracy, manages parking spaces effectively, provides easy access for drivers with little assistance, and reduces costs for setup. It also minimizes the cost and time of maintenance and different operations.

LITERATURE REVIEW

Big cities often struggle with traffic and parking issues. An Automated Parking System Management is a smart solution that uses the Internet of Things to handle parking garages. Smart parking systems help users locate open parking spots through technology and sensors. Common features of these systems include data routing, easy payment options, and digital parking lots. They work by informing users about available parking spaces. When a user registers, they receive a unique ID. This ID tracks their bookings, show exit times, and calculates costs through their smartphones. The system has three levels: the bottom level focuses

on sensing, the middle level handles data transmission, and the top level manages data storage, processing, and user interfaces.

This section examines a variety of brainy parking systems. One particular system [1] employed sensors and advanced technology to collect and display real-time data; however, it necessitated a costly environment. Another solution [2] provided users with information regarding available parking spaces through an online virtual management system, categorizing options into off-road and on-road. A third system [3] integrated Google Maps, ultrasonic sensors, and cloud data to notify users of available parking spots. Each parking space was equipped with an LED light to signal its availability and facilitate reservations. An infrared sensor [4] was utilized to detect vacant spaces and manage entry and exit gates. Additionally, an RFID tag enabled users to access parking via a mobile application. An algorithm was developed to determine the shortest route from the user to an available space by connecting to the cloud. One system, which utilized Arduino and Raspberry Pi, identified free slots through an internet server and GPS for reservation purposes. Another proposed system [5] relied on infrared sensors and incorporated RFID tags for verification, along with ZigBee technology for communication. Many other research in smart parking system focuses on different technologies and areas. Some are discussed here:

Parking system based on image processing [6], A unique identification number is necessary, and number plates can help with this by identifying vehicles. This approach can effectively manage parking spaces and can also be used for payment processing. One advantage of this system is that it captures images of parking areas, providing information on available spaces. The camera records pictures that show if parking spots are occupied. A single camera can monitor multiple vehicles in the parking lot, functioning like a sensor to take photos of cars. However, a major drawback of this system is its performance in bad weather, which can diminish image clarity. The camera must be positioned well to cover the entire parking area without any obstructions. Additionally, there is no guidance provided within the parking lot.

Intelligent parking system using Bluetooth [7], this system needs a Bluetooth device to locate available parking spaces. The device collects information within its range and sends it to the user. Advantages of this system is users can use their mobile Bluetooth to register and find parking spots. The system uses a rack and pinion mechanism to help guide vehicles to their spots. When a car needs to be parked, the Bluetooth chip automatically picks up its unique ID. The System has a disadvantage that the current system cannot support this technology. Designing the entire parking structure with the necessary mechanism relies on the rack and pinion system.

Car parking using networked wireless sensors and active RFID [8], this system employs wireless sensors to keep track of cars in a parking area. Each vehicle needs an RFID tag for identification. The benefits of this system is simple and cost-effective for users compared to traditional lot management. For example, an RFID reader at the gate can open automatically when it detects a vehicle's tag. Drawbacks of this system is that there is no system in place to guide drivers to available parking spaces.

METHODOLOGY

The smart vehicle parking system uses advanced technology and research from various fields, mainly implemented in Europe, the United States, and Japan. These improvements aim to address the common issues faced by users in parking facilities. The current approach utilizes Radio Frequency Identification (RFID) technology to automate parking systems in malls and buildings. This system offers a much reliable payment method in comparisons to traditional coin-operated systems. This system is simple and helpful to minimize the cost of set up, either as a standalone solution or as an addition to pre-existing systems. It also reduces fraud and minimizes cash handling associated with older payment methods.

Drawback of existing methodology are booking slots cannot be prioritized, so multiple users can't reserve them at the same time. The RFID system does not allow for pre-booking, which helps reduce traffic issues. This application is user-friendly, but it has a significant weakness with the payment gateway.

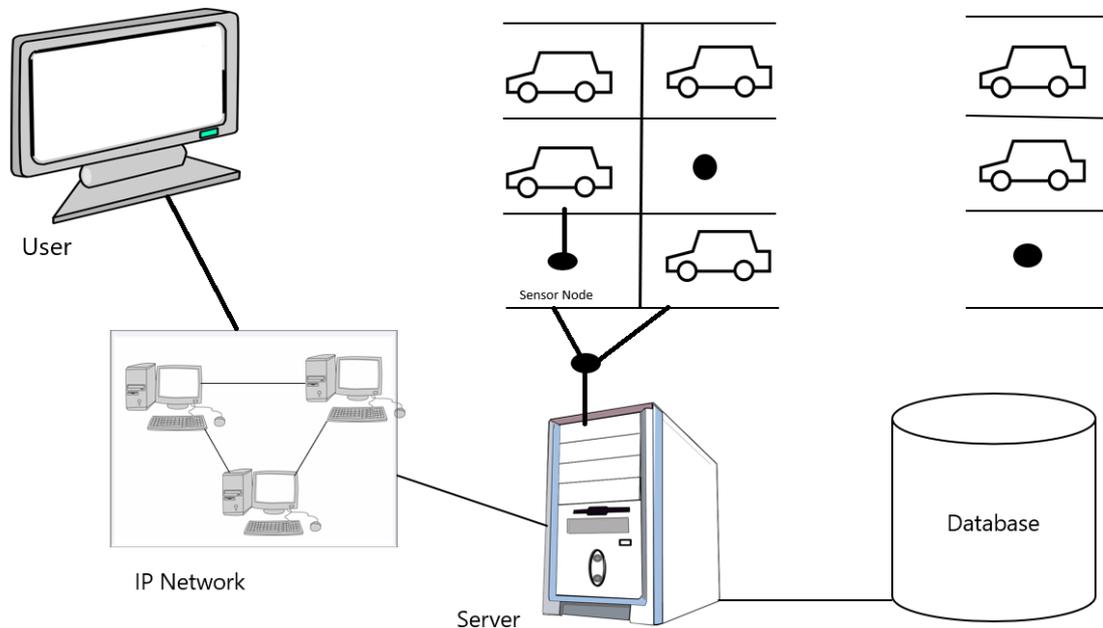


Figure 1: Smart Parking System Diagram

PROPOSED PLAN

Here, System uses two approaches: RFID and IoT. The system has an IoT-based intelligent system that display available parking spaces and helps users get the nearest parking area. A main benefit of this project is that it minimizes the time spent of vehicle user for searching parking space and helps the managing body to reduce traffic congestion on the road, rural areas, and metro cities.

RFID technology (Radio Frequency Identification) uses electromagnetic and electrostatic to recognise the object like human being, animal uniquely. This technology is a wireless communication. It operates with radio frequency range of electromagnetic spectrum. This technology has three parts – Antenna (used for scanning), Transceiver (for receiving the signals), Transponder (for sending the response). An antenna and transceiver form a RFID reader when they work together. For sending the signals, this technology uses radio waves by which RFID tag is activated. When the tag active once, it sends the signal to antenna back, by which the signal converts into data.

RFID Technology has three types of systems:

First, Low frequency RFID system uses frequency between 30 KHZ to 50 KHZ. Second, High Frequency RFID system has frequency range 3 MHZ to 30 MHZ. Third, UHF RFID system has the frequency between 300 MHZ to 960 MHZ.



Figure 2: RFID Technology Working System

This system also aims to minimize the number of workers needed in the garage. At the entrance, there is a 7-meter countdown counter. The exit counts vehicles in ascending order based on Arduino programming, monitoring how many cars are inside the garage. The garage door automatically closes when the maximum counter is reached and remains shut until new cars enter. This paper can be enhanced with devices that save time and minimize congestion, such as GPS systems. When vehicle's user at their parking point, they must present their vehicle parking card in front of the RFID reader. The parking card is known as a RFID tag. This card contains parking information and will be placed at the centre of the parking card reader. To park, users show their RFID card at the entry gate, which has a card reader installed. The RFID card holds information about the parking fees. The reader logs the time when a car enters and sends this data to the microcontroller. When a user exits, the reader captures the time of departure. The entry and exit times are used to calculate the parking fees.

RESULT

The need for smart vehicle parking systems is growing quickly. These systems let users check parking space availability in real time. Current options do not offer features for reserving spots or checking for free spaces. This paper aims to connect parking areas to the internet, saving users time and money. It also helps prevent car theft. Additionally, this system lowers the fuel used while searching for parking.

APPLICATIONS

This system is effective for parking cars and helps reduce traffic jams. It can be used in malls, hospitals, and multi-story buildings. The process is quick and easy to set up, making booking simple. Payments are handled manually, so there's no need to worry about online transactions.

CONCLUSION

The Smart Vehicle Parking System uses IoT technology to tackle common parking issues. It is easy to set up and cost-effective, helping to lower carbon emissions from vehicles waiting for spaces. This system cuts down the time drivers spend looking for parking in large facilities. It also addresses illegal parking and helps reduce traffic congestion. By keeping track of each vehicle, it reduces the need for staff in parking areas, which lowers costs and minimizes errors. Additionally, it aids in identifying stolen cars, making it very useful today. This innovative parking solution addresses various traffic-related challenges.

FUTURE SCOPE

Smart cities have long been an ambitious vision. Our next goal is to develop a car parking system that serves as a key part of a smart city. This system will allow authorized entities, such as highway centres, emergency services, traffic control, and police, to access important information managed by the parking centre. Sensors will track the availability of parking spots and send updates to parking meters. These meters will then relay the information to the central information hub.

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