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IoT-Based Smart Vehicle Parking system using RFID

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Abstract
The increasing number of vehicles on road has led to the emergence of a major problem in cities in the form of lack of adequate parking space. Parking is also a major challenge in crowded areas like shopping malls, hospitals, and institutes. Hence this work aims to present an automatic real-time system for automated vehicle parking. This system has been implemented with the help of the internet of things (IoTs) which exchanges information or data between the physical devices. The proposed system has been implemented with the help of ESP32 Node MCU to connect parking area with web or internet. The proposed system incorporated an infrared sensor in each slot for getting information about the vacancy position of the parking slot and an amount will be displayed based on the time taken by vehicle. Every user has a registered RFID tag which helps to manage parking space and a smart car parking app to find parking slots in less time .
Keywords:*ESP32 Node MCU, IoT,RFID.*

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I. INTRODUCTION

The number of vehicles are now increasing over the number of total persons in the family. This problem is increasing at such an extend that 40\% of the roads are being used for parking in normal working days. Due to lack of navigation space, Indian cities are being considered as one of the worst options by people. In developed areas such as Europe, people visit any places of interest on foot or available public transport while in India, utilisation of public transport for these purposes is limited.The IoT-based smart vehicle parking system is a parking system that manages parking space and avoids collisions among vehicles using RFID technology. This system helps to find free slots within no time. IoT plays a crucial role in the day-to-day life of humans and helps to get very effective output with very little effort. In conventional parking systems at public places such as institutes, hospitals, etc., one has to look for all lanes to park a vehicle, which involves a lot of investment and manual labour. Also, considerable time is wasted searching for vacant parking spaces, and jams are often created. It is noticed that a large number of people waste fuel for free parking space and time by calculating bill.

Smart parking system will help in lowering the driving time and thus lower the daily consumption of fuel and diminish the harmful vehicle emission that eventually brings reduced global environmental footprint. Also, parking lots can be efficiently filled and space can be utilized at maximum capacity by commercial and corporate entities.Due to their low-cost and low power, RFIDs are used to transmit data when powered by the electromagnetic field generated by a reader. IR sensors are used on each lane to represent whether slots are empty or occupied. ESP32 Node MCU has an inbuilt IoT module that can use the internet to interface with the website. The number of free slots, parking status and parking amount will be displayed by the LCD. The objectives of this project is to implement an IoT based smart vehicle parking system using RFID with low cost sensors, real-time data and application that helps users to search and find available spaces. In general, it helps to optimize traffic and reduce the user's time for searching a parking slot. It also saves user's time by calculating the bills automatically. Thus it not only saves the time and fuel but also decreases the congestion which helps in the reduction of accidents caused by the distraction of searching for parking slot. As it reduces the manual activities which eventually prompts low labor cost as well as saves on resource exhaustion and thus it saves manual labor as well as energy.

L. Mainetti et al. (2015), presents a novel Smart Parking System based on the use of different technologies, such as RFID, WSN, NFC, Cloud, and Mobile.

H. Chandra et al. (2017) developed a smart parking system based on the combination of RFID, Automatic license plate recognition, and IEEE 802.15.4 ALPR and WSN technologies.

II. METHEDOLOGY

The proposed system uses ESP32 Node MCU, RFID card and reader, LCD with I2c module, servo motor and IR sensors. Initially, at the entrance, LCD displays total available slots to the customers. RFID Reader is installed at the gate of parking. As soon as vehicle enters the parking zone RFID vehicle is scanned at the gate, which has all the necessary information about the owner of the vehicle.Now, LCD displays the number of free slots. Once the user park his vehicle, counter will be activated, and the count of the free slots will be decremented by one. All the necessary information will be updated, and it will be made available on the website so that other vehicle owners are benefitted.

When vehicles want to exit parking, the system also checks all the steps required to update the count and the counter will increase the count of free slot by one. LCD also displays the parking amount calculated based on the time occupied by vehicle in the parking area. The system is synchronized with the website. Here, IR sensors are used to collect data i.e, to detect the presence of vehicle in slot. When Node MCU connects the hotspot, it will act as a web server and will update website data

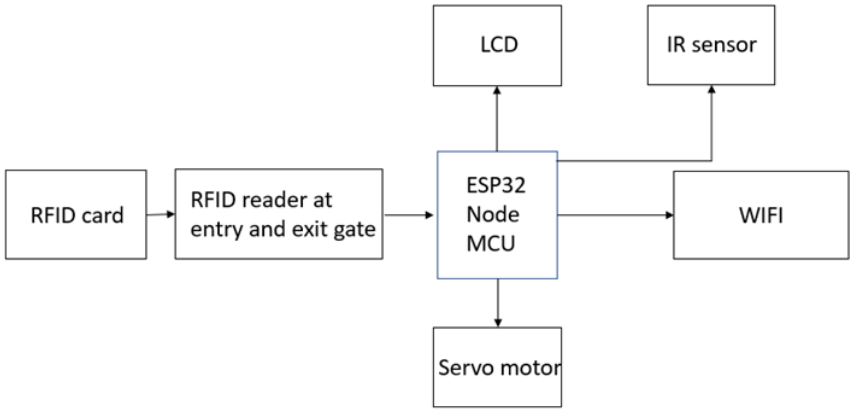

Figure 1: Block diagram

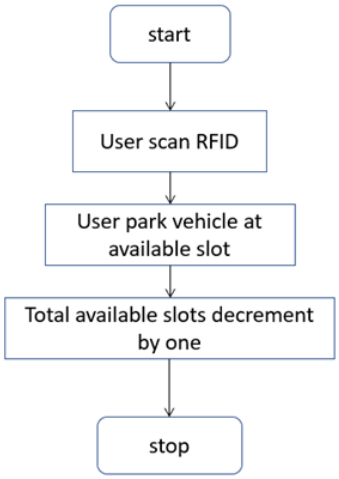

Figure 2: Flow chart of vehicle allocation

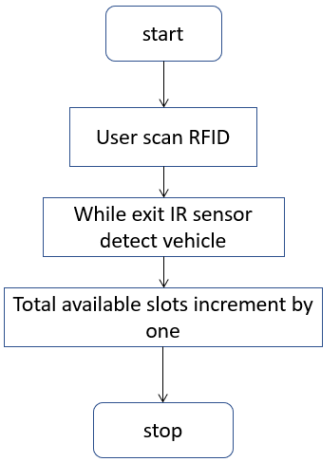

Figure 3: Flow chart of vehicle dislocation

III. THE SIMULATION

Proteus was used for simulation as shown in figure 5. Initially, LCD displays the available number of slots, and IR sensors are used to indicate the presence of vehicles. When the switches are in the ON position, sensors will sense them, and the LCD displays a number less than the initial count, and the count will increase if the switches are in OFF position.

When Node MCU connects the hot spot, it displays the available slots after pressing the button 'Get slots'. Totally 6 slots are available and if any sensor detects the presence, app displays '5' as the available slots. This app was created using flutter- a simple and high performance framework to compile application for mobile, web and desktop from a single code base.

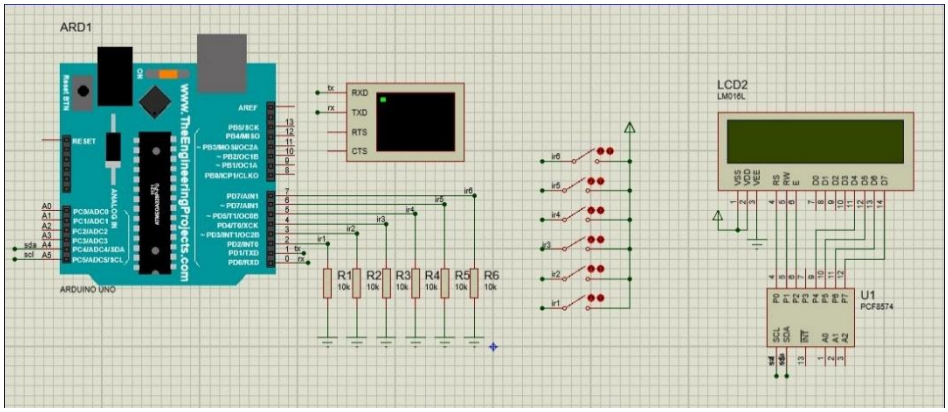

Figure 4:Simulation

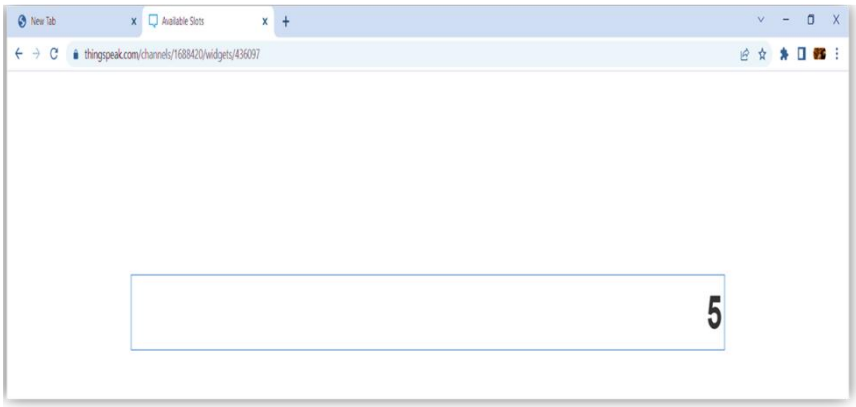

Figure 5: Website

Thing speak enables sensors, instruments and website to send data to the cloud where it is stored in either a private or public channels by default, but public channels can be used to share data with other.

IV. HARDWARE IMPLIMENTATION .

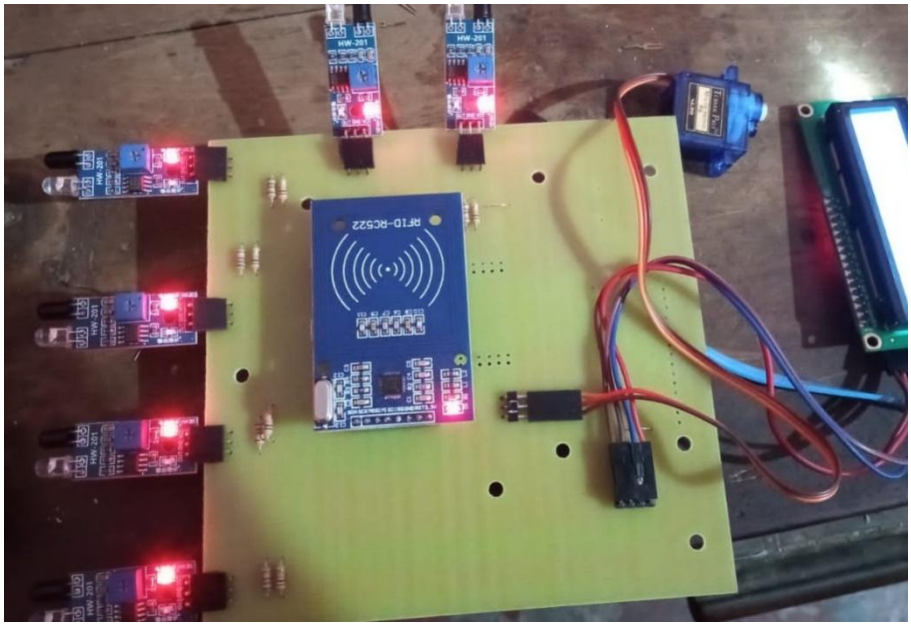

Figure 10:Hardware

V. CONCLUSION

Smart vehicle parking helps to solve the issues faced in vehicle parking using RFID technology. Recently, the advancement in the internet of things and cloud technology helped to obtain an effective output with very little effort. In order to check the slot availability, users can download smart car parking app. Also, LCD displays slots before entering the car parking area and parking amount based on time. Real-time parking communication through websites improves the standard of living of consumers. Smart parking system lowers the daily consumption of fuel and diminishes the harmful vehicle emissions that eventually brings reduced global environmental footprint. Overall, it helps to optimize traffic..

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