

AN IoT-based Smart Parking System using Cloud database

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Abstract—In recent times, the concepts of smart cities had attained a greater reputation. The internet of things plays a significant role in connecting various physical devices and automating them to make human life much easier. By using different software, we can connect objects and transfer information. Continuous efforts are being taken in the particular field to improve the efficiency and assurance of urban foundations. Nowadays government has made it a priority to make cities smart across the country. Various things make a city smart, one such main thing is a smart parking system. Parking is almost a need in every metro city. In this system, the user can keep tracking the availability of parking slots from the cloud server. Here the registered users don't want to waste their effort and time on seeking the availability of a parking spot in the specified parking area. The parking detail is sent to the user via SMS. Thus, the wastage of time for the particular registered user in search of free space is minimized.

Keywords—RFID Card, Arduino, Reader Module, GSM Module, IR Sensor, IoT, cloud database

I. INTRODUCTION

The internet of things states the internet of sensible physical objects -“things”- that is been embedded with software, sensors, or other technologies and their main motive is for connecting and exchanging information with other systems and devices over the internet without involving human interactions [14, 16]. Cloud computing is nothing but the mediator between things and applications. It is directly related to IoT. To interact with the actual world entities clouds can extend their capability by holding the IoT system.

A main feature of IoT is a large amount of data resources can be accessed. The factors that justify both IoT and cloud include scalability, interoperability, power consumption, availability, and capability of storing. In this system, automatic retrieval, image analysis, vehicle measurements, etc. are maintained by IoT [15]. The particular devices could be traced, managed, and monitored using accessible computing with the help of the internet [1]. The aim of creating a smart city is becoming achievable with the evolution of the internet of things. According to the current valuation, the vehicle's population is steadily increasing and estimated to reach 1.6 billion

within 15 years [7].

Here is a solution for the problem that is been rose. Thus, this system acts as a key solution to lessen the wastage of fuel, to lower air pollution and it also helps in traffic congestion [4]. In this system, the user can interact with the cloud database as well as the parking lot and get notified about the parking space availability [2].

II. RELATED WORKS

An algorithm is used to improve the efficiency of a Cloud based smart parking system. It is used to find the parking space with the lowest cost [9]. Here the registered user can access the cloud server and know about the details of the parking slot. It considers the number of an available parking slots and the distance of the particular slot from the user. An application is installed on the mobile to know about the information. With this system, waiting time can be reduced. This paper does not include the characteristics of the security. [10]To find the slot to park the registered user's vehicle, a smart mobile application with a wireless sensor node is used. This technology improves efficiency and accuracy. Here the ID and ticket key are given only to retrieve the vehicle. In this technique, an RFID card is given to the user and the user's privacy is not protected. [8]This system proposed a way for the parking area to identify the car which is already parked in the parking slot. The main aim of this system is to be user-friendly and inexpensive. It helps to sustain the data of about 90% accuracy.[6]A real-time smart parking system is implemented with the help of IoT to provide data about the nearest free space availability. To improve security, a vehicle number plate is detected. Through mobile payment, the registered user can pay for the parking space. Here the users receive the relevant details about the free space through a message. It also detects the license plate text. Here the ultrasonic sensor is used to reduce the cost for a user. Various researches are done to illustrate the best model but still, there are not enough studies describing how to design an IoT-based smart parking system for common people. Therefore, this issue needed further investigation. This paper overcomes various disadvantages that arise in the above research papers and gives the best model for smart parking systems using cloud databases.

III. SYSTEM ARCHITECTURE

This system consists of three main categories. The first category includes a parking lot which consists of an Arduino device and IR Sensor. This device is very much helpful for the user to interact with the parking slot available in that area [3]. The next category includes the cloud-based web services that act as a negotiator between a parking lot and a registered user. The cloud services are administrated by the executive and then it is permitted for the registered user to view and check for the availability of parking slot [6]. The last category includes the user side. Based on the availability, the user receives the message through the GSM module [3].

The hardware component consists of an RFID card, GSM module, and IR sensor. Once the registered user enters the parking lot, his RFID card is scanned and the user gets details about the position of the parking slot. IR sensor sends the signal according to the existence of vehicles. The software component includes cloud server which connects to the Wi-Fi module that acts as an arbitrator between the modules. Once the IR Sensor identifies the existence of a vehicle in the particular slot, the position of the cloud will be refreshed from 0 to 1 and vice versa. Here figure 1 represents the system architecture of IoT based smart parking system using cloud database

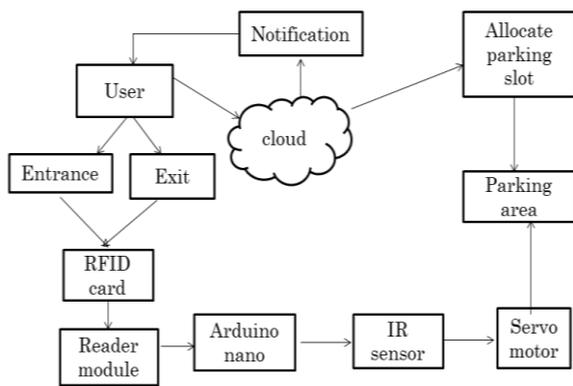


Fig.1. System architecture

IV. IMPLEMENTATION

In the above section, we have discussed the system architecture. Here we are going to discuss the block diagram and implementation of an IoT-based smart parking system using a cloud database. Once the registered user enters the parking area, his RFID card is scanned through the reader module. RFID card acts as a credit card or identification badge that contains information about an object [18].



Fig.2. RFID Card

At the same time, the data from the RFID card gets transferred to the Arduino Nano in the form of radio waves. This tag is used for tracking when it is attached to the devices. The Arduino Nano is the one in which the memory operation of digital and analog pins is done. Arduino Nano sends the signal to the IR sensor. An infrared sensor is an electronic device that emits infrared light to sense some aspects of the surroundings like detecting the existence of objects. If the sensor does not recognize any infrared light reflected it means the particular slot does not have any vehicle in it. If the sensor detects the light, then the object is present in the particular area. Then the user receives a message about the availability of free space through the mobile communication network of the GSM module. GSM module is a circuit that acts as a communication setup between mobile phones and microcontrollers. The message is conveyed in the form of voice messages, MMS, and SMS. High data transmission is permitted by GPRS extension in GSM [17]. Then the barrier gate is opened or closed with the help of a servo motor according to the availability of free space. Servo motor is a type of rotator device that permits the control of linear and angular motion. Electrical signals are transferred to the servo motor to produce motion. Now the vehicle is successfully parked in the parking lot. Here the WIFI module helps the system by storing all the information in the cloud. Using TCP/IP protocol it sends the data of the embedded system to the communication network [20]. The WIFI module acts as a negotiator between the cloud server and the devices. It has a 32-bit controller that contains 16 gpio with 80kb user data. The cloud is refreshed every 2 minutes.

V. FLOW CHART

Here figure 3 represents the flow chart from which the registered user enters the parking area till he successfully park the vehicle in the particular parking slot and figure 4 represents the real time view of the parking area.

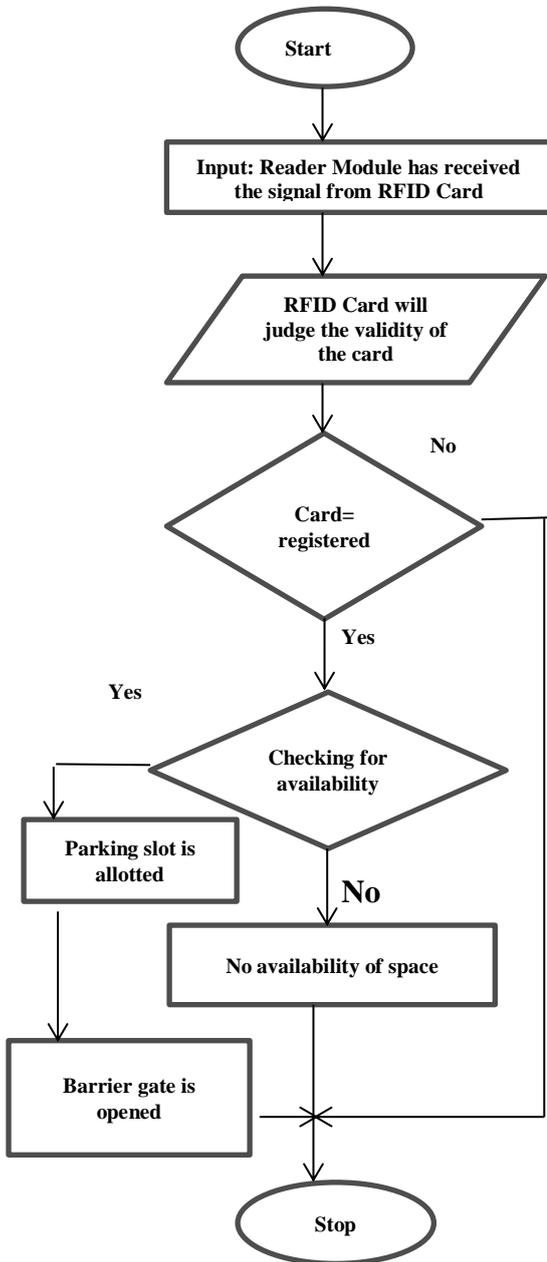


Fig.3. Flow chart



Fig.4. Real view of the parking area

VI. CHALLENGES

- To make the smart parking system to be available, we must improve the existing infrastructure.
- IoT devices consume more power. So the maintenance cost will be high [12].
- If the particular free parking slot has any other object other than the vehicle, the sensors may detect and think that the particular slot is not free [13].
- The installed apparatus is very expensive and can be stolen.

VII. FUTURE SCOPE

The future scope of IoT-based smart parking systems is expecting the arrival of multilayer parking, automated billing system, etc. The project can also be enhanced for tracking the vehicle speed on the roads, to differentiate the vehicles of VIP's and staff.

VIII. CONCLUSION

It is a dream for several countries to implement the concept of smart cities. The ultimate aim is to enrich the standard of living. The improvement of cloud technologies and the internet of things had given hope for better possibilities in that field. The system that we propose brings forth real-time data regarding the availability of free space in the parking lot. The importance of IoT-based smart parking systems using cloud databases is progressively increasing day by day. The concept of IoT based smart parking system has been implemented using a cloud server and different sensors available. In this system, the registered user can view the real outlook of the parking lot of any registered buildings like shopping malls, hospitals, sports stadiums, and many more public parking lots. It is a well-organized system of car parking that forbids traffic obstruction [5, 9], lowers air pollution, increases safety [19], improves user experience [11], etc.

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