

Smart Parking System Using RFID Based on IoT

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Abstract-

With the exponential increase in the number of vehicles and world population day by day, vehicle availability and usage on the road in recent years, finding a space for parking the car is becoming more and more difficult with resulting in the number of conflicts such as traffic problems. This is about creating a reliable system that takes over the task of identifying free slots in a parking area and keeping the record of vehicles parked very systematic manner. The proposed system reduces human effort at the parking area to a great extent such as in case of searching of free slots by the driver and calculating the payment for each vehicle using parking area. The various steps involved in this operation are vehicle identification using RFID tags, free slot detection using IR sensors and payment calculation is done on the basis of period of parking and this is done with the help of real time clock.

Index terms – IoT, RFID, IR sensors

I. INTRODUCTION

The basic definition of an Internet of Things (IoT) can be defined as anything which could be connected to internet results into “Internet of Things” The things in Internet of Things are sensors, actuators, RFID tags. The things could be tracked, controlled or monitored using remote computers connected through Internet. IoT extends the use of the Internet, providing the communication, and thus inter-network of the devices and physical objects, or „Things“ IoT, in general consist so finer - network of the devices and physical objects, number of objects can gather the data at remote locations and communicate to units managing, acquiring, organizing and analyzing the data in the processes and services. It provides a vision where things (wearable, watch, alarm clock, home devices, surrounding objects with) become smart and behave alive through sense computing and communicating with embedded small devices which interact with remote objects or persons through connectivity. Due to high scalability in the cloud any number of nodes could be added or removed from the IoT system on a real time basis and IoT is well known to reduce human effort storage at extent.

The ideal of creating a Smart City is now becoming possible with the emergence of the Internet of Things. The Internet-of- Things technology (IoT) has created a revolution in many ways in life as well as in smart-parking

system (SPS) technology. As parking becomes a very essential need of our day to day life.

Therefore, this system looks forward to plan and acquire a smart parking system before heading out towards our destination in order to reduce the hassle of driving around looking for a parking spot during peak hours. In present day cities, finding an available parking spot is always difficult for drivers, and it tends to become harder with ever increasing number of private car users. This situation can be seen as an opportunity for smart cities to undertake actions in order enhance the efficiency their parking resources, thus leading to reduction in searching times, traffic congestion and road accidents. Recent advances in creating low-cost; low- power embedded systems are helping developers to build new applications for the Internet of Things.

As the number of population increased in the metropolitan cities, the need of vehicles also got increased. Ultimately, it causes problems in parking which leads to traffic congestion, driver frustration, and air pollution. When we visit the different public places like Shopping malls, multiplex cinema hall & hotels during the festival time or weekends it creates a lot of the parking problem. According to the recent research found that a driver takes nearly 8 minutes to park his vehicle because he spend more time in searching he parking slot. This searching leads to 30 to 40% of traffic congestion. Here we are going to see how to reduce the parking problem and to do secured parking using the smart parking system.

This paper is organized in five sections. After this introduction, in Section II, existing method discussed of the paper Section III about the proposed method explained, as well as the novel feature of the proposed method. Finally, Sections IV and V provide the simulation results and the conclusions, respectively.

II. CAR-PARKING CONCEPT

A car parking is a privately or publicly built place for which a driver pays a for use. Structures for which tolls are charged include toll bridges and toll tunnels. Non-toll roads are financed using other sources of revenue, most typically fuel tax or general tax funds. The building or facility in which a toll is collected may be called a toll booth, toll house, toll plaza, toll station, toll bar or toll gate. This building is usually found near exits, at the beginning or end of bridges, and when you enter a tolled highway. Road

tolls were levied traditionally for a specific access (e.g. city) or for a specific infrastructure (e.g. roads, bridges). These concepts were widely used until the last century. However, the evolution in technology made it possible to implement road tolling policies based on different concepts. The different charging concepts are designed to suit different requirements regarding purpose of the charge, charging policy, the network to the charge, tariff class differentiation etc.

A. Why We Are Designing Car Parking System Using RFID

Car parking system has been criticized as being inefficient in various ways:

1. They require vehicles to stop or slow down and find a space; to parking manual wastes time and raises vehicle operating costs.
2. Collection costs can absorb up to one-third of revenues, and revenue theft is considered to be comparatively easy.
3. Where the parking system are less congested than the normal parking “free” system, the traffic diversion resulting from the toll increases congestion on the parking system and reduce its usefulness.
4. By tracking the vehicle, their drivers are subject to an effectual restriction of their parking space and freedom from excessive surveillance.

B. RFID Based Car Parking System

The modified car parking system is RFID based system in which wireless communication is established for authentic car and gate of parking hence any vehicle pass through parking automatically display a availability of parking space to user and no need to stop at gate and all the problems which are created due to normal parking system is removed by using RFID technology. I.e. this system is helpful in traffic control and also save fuel and time of the user. Here all the work and adjustment did automatically and hence no requirement of workers or security.

III. PROJECT IMPLEMENTATION

A. What is RFID Based Car Parking System

RFID is a very useful technology in automation of Car Parking System in a Mall/Building. It will automatically deduct the amount from the RFID tag of vehicle owner and open the door for parking and increment the counter of parking. Similarly it will open the door on exit and decrement the parking counter. It will also provide the security besides automation of parking through RFID technology. There is no waiting time for manual processing of receipts.

Principle

RFID is a very useful technology in automation of Car Parking System in big industries. It will automatically deduct the amount from the RFID tag of vehicle owner and open the door for parking and increment the Counter of parking.

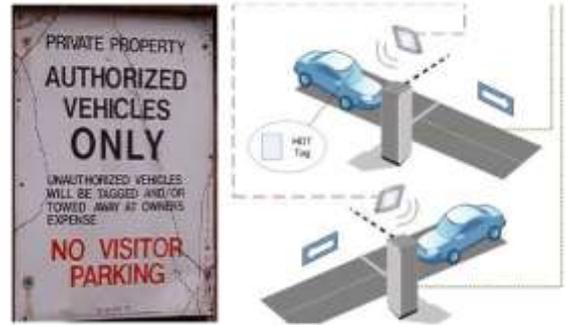


Fig: 1. car parking system.

The system that we have built is a car parking system with RFID authentication. This parking lot will only allow authorized cars that have valid RFID tags to park and will warn all other vehicles. If an unauthorized car instead of warnings, tries to park in the lot, an alarm is sounded alerting the security personnel. Moreover the system also monitors no. of vehicles parked in the lot so that authorized vehicles can be notified about the parking space inside the lot. The system is composed of multiple identical sensors that sense the position of the approaching and parked vehicles

B. Architecture Description

The architecture mainly consists of the following components:-

1. Mobile Application
2. Slot Detection Using IR Sensors
3. Vehicle Detection Using RFID
4. Payment through Online Banking
5. Database
6. RaspberryPI3
7. Tracking of Vehicles

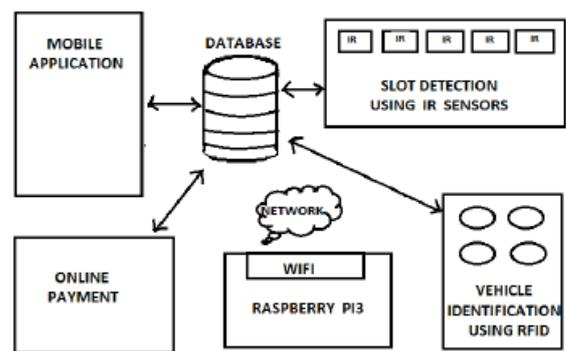


Fig 2: Architecture of Proposed System

The transitions indicate the flow of the data between the database and the rest of the components. As the fig. suggests the user has to first register himself through the mobile application which indeed stores his information onto the server. This data is useful to track the user later if he tries to breach the system policies. After registering into the parking system his user has the privilege to go into the application and checkout for a free parking space available and then he can actually go and park his bike there. The application is updated each time when the bike is detected on the parking area with the help of IR sensors. IR sensors are responsible to detect if a particular slot contains bike or not. Vehicle identification is done with the help of RFID tags which are present on each bike which in deed helps us in calculating the amount to be paid by each user separately. RFID readers are present on the parking area which captures the RFID information of each user. Before generating the parking bill, IR sensors and RFID tags work together to know which vehicle is being parked and depending on the time and the amount the corresponding bill is generated. Raspberry PI3 is a processor which performs all of the above functions through the use of Internet. Payment of the parking bill is done through online banking which will be done using the mobile application. All of the data generated above is stored and retrieved from the database. The tracking system is an integration of several modern embedded and communication technologies. To provide location and time information anywhere on earth, Global Positioning System (GPS) is commonly used as a space-based global navigation satellite system. The location information provided by us GPS systems can be visualized using Google Earth technology. The implement tracking system can be used to monitor various parameters related to safety, emergency services and engine stall.

C. Block diagram

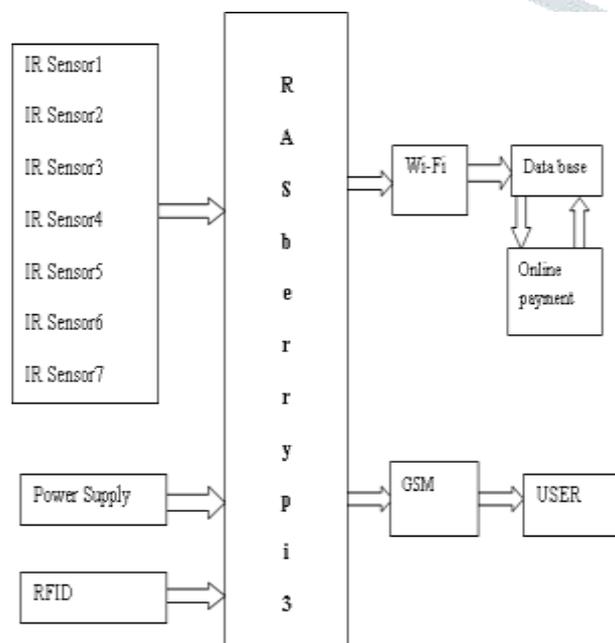


Fig: 4Proposed Block diagram

Raspberry Pi 3 Microcontroller



Fig: 5 Raspberry Pi 3 Microcontroller

Raspberry Pi is the Visa measured adaptable PC is fit for the essential number of the things that purchaser desktop accommodating PC will, like spreadsheets, word-getting ready and beguilements. The Raspberry Pi has a Broadcom BCM2837 framework on a chip, which wires anARM1176JZF-S 700MHz processor, video focus IV GPU, and was at first passed on with 256 megabytes of RAM, later refreshed (Model B and Model B+) to 512 MB. It avoids an undeniable hard plate or strong state drive; regardless it utilizes a SD card for booting and chose gathering, with the Model B+ utilizing a Micro SD.

GSM

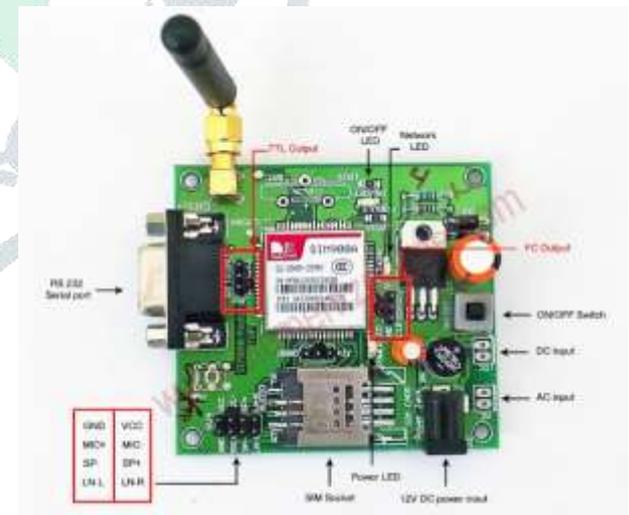


Fig: 6 GSM

GSM (Global System for Mobile communications) is an open, digital cellular technology used for transmitting mobile voice and data services. GSM supports voice calls and data transfer speeds of up to 9.6 kbps, together with the transmission of SMS (Short Message Service). GSM

operates in the 900MHz and 1.8GHz bands in Europe and the 1.9GHz and 850MHz bands in the US.

IR SENSOR

Infrared radiation is electromagnetic radiation (EMR) with longer wavelengths than those of visible light, and is therefore invisible to the human eye. It is sometimes called infrared light.

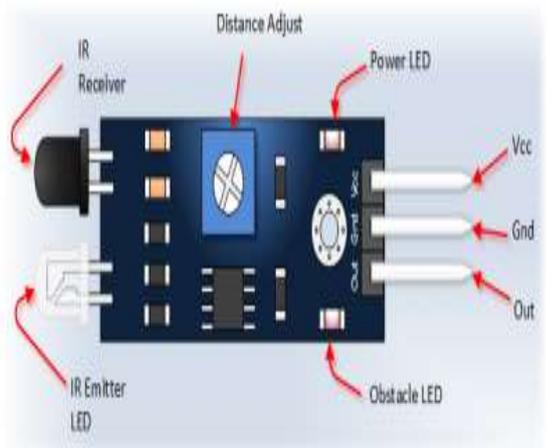
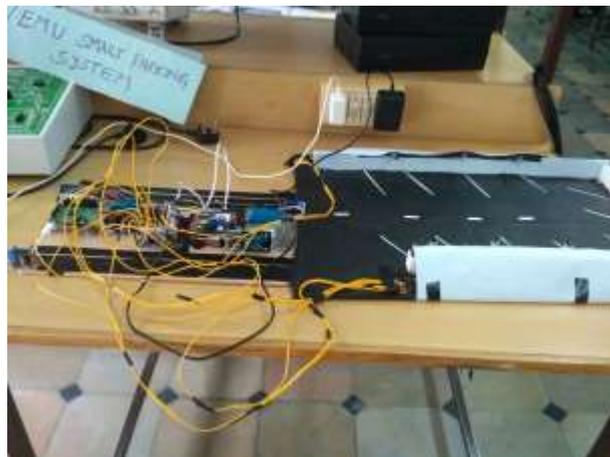
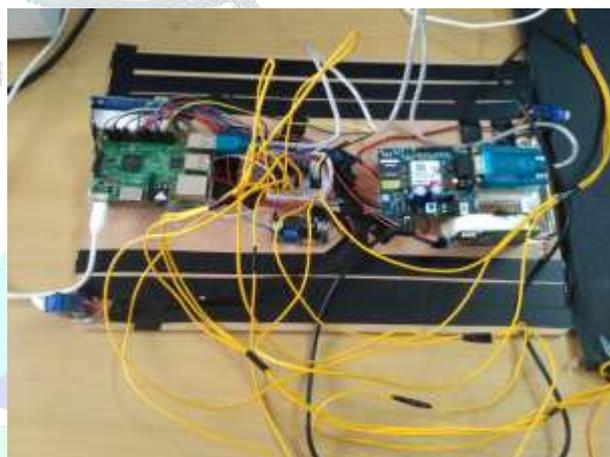


Fig: 7 IR Sensor



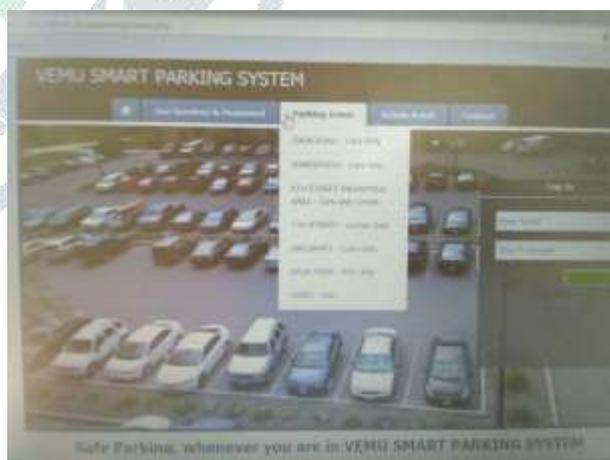
The above figure shows the working model of smart parking system. It shows the different parking planes of the model.



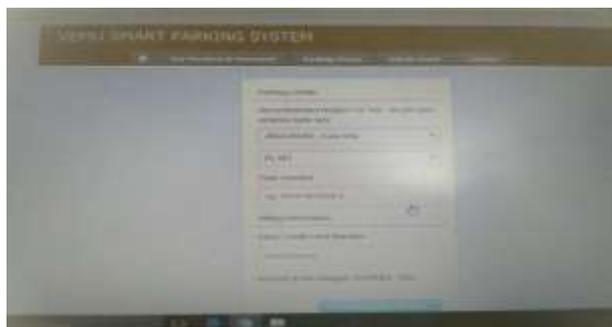
IV. EXPERIMENTAL RESULTS



The above figure shows the main page of Smart Parking System for processing online.



The above figure shows the selection of parking lane for choosing empty parking slot available.



The above figure shows online parking slot reservation and payment for slot.

TABLE I COMPARISION OF EXISTING AND PROPOSED METHODS

Methods	Name of the method	Drawbacks of existing and advantages of proposed methods
Existing methods	1. Smart Parking Reservation System Using Short Message Services (SMS).	<ul style="list-style-type: none"> • Cost of implementation is high. • GSM feature creates bottlenecks. • The microcontroller will have to take a lot of the load which can crash the system.
	2. Intelligent Parking Management System Based On Image Processing.	<ul style="list-style-type: none"> • The weather conditions affect the System i.e.in terms of visibility. • The camera should be in apposition where it can see all the car parks and not be obstructed by any objects. • No guidance is provided in the parking lot.
Proposed method	Smart Parking System Using RFID Based on IoT	<ul style="list-style-type: none"> • A car parking is a privately or publicly built place for which a driver pays a for use. • Enhanced security due to password requirement. • System can be used and applied anywhere due to ease of usage. • RFID is a very useful technology in automation of Car Parking System in big industries • It will automatically deduct the amount from the RFID tag of vehicle owner and open the door for parking and increment the Counter of parking. • This parking lot will only allow authorized cars that have valid RFID tags to park and will warn all other vehicles. • the system also monitors no. of vehicles parked in the lot so that authorized vehicles can be notified about the parking space inside the lot • To provide location and time information anywhere on earth, Global Positioning System (GPS) is commonly used as a space-based global navigation satellite system • Vehicle identification is done with the help of RFID tags.

V. CONCLUSION

Our system minimizes the parking waiting time in a large-sized parking facility. It also helps in maximizing their venue generation for the parking facility owners. It would also help reduce the need for man-power in the parking facility which would greatly reduce the cost and errors in the process. Also this method would minimize the usage of paper ensuring a green system. This work can be further

extended to booking of parkings lots over a period of time from advance. The mobile application can be extended up on other operating systems such as iOS, Windows ,etc. In the server , services can even be extended to the safety measures such as fire, theft, etc.

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