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## RFID Based Smart Vehicle Parking System Using IoT

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**Abstract:** With the vast growing influx of population in the developed, industrially and technologically sound urban cities, an urgent need to make the cities smart is surmounted. The cities are made smart utilizing data sharing, artificial intelligence, machine learning, analytics, and thousands of RFID tags and sensors. One of the significant concerns of today's smart cities is the growing need to manage the vehicles on-road as well as to create sufficient and well-managed parking lots to prevent urban areas from traffic congestion. This leads to a call for highly automated parking management system self-sufficient in guiding the driver to an available parking space in the nearby area. The proposed system has been implemented with the help of Arduino Uno board for vehicle parking and 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. The user book-parking slot well in advance, all the necessary information is available on the server. Every user has an exclusive username and password. In case any misuse happened then the system will alert the responsible person.

**Index Terms:** IR Sensors, ESP12 Node MCU, IOT, WIFI, RFID Tag etc.

### 1. INTRODUCTION

The Internet of things (IOTs) is a vital technology, it is playing a crucial role in the day-to-day life of human beings. With the help of this technology, now day's humans are getting effective output with very little effort. It reduces the man-made errors made by humans due to negligence [1]. As technology advances, smartphones are an inevitability for every human being. The proposed parking system effectively manages the parking space and it will manage collision among the vehicles at the same time. IoT-based smart parking organized the parking lot very efficiently. It helps the user to find a free space in the parking slot within no time. It ultimately leads to saving time and fuel for the user's [2] [3]. For the development of an innovative parking system, Wireless Sensor Network (WSN) represent two of the most capable IoT technologies i.e. Ultra-High Frequency (UHF), Radio Frequency Identification (RFID), etc. Due to low-cost, low-power technology RFID is used. RFIDs are used to transmit data when powered by the electromagnetic field generated by a reader mainly involving passive devices, named tags [4] [5] [6]. In a variety of application scenarios, the long lifetime of tags makes this technology is highly suitable for development. RFID solutions have a decreased operating spectrum (up to 10 m) inside of boundaries to object to detection and quantification in relatively small areas[7][8]. The consumers go through a once-in-a-time registration process when one's personal information has been questioned to ever be filled out and an account generated with them this account does have information about them and money they can recharge at

local kiosks [9]. In this technique, the customers were also guided to an unfilled parking space using video displays entrance of the parking structure. With empty and occupied slots, these displays show a visual representation of the parking lot, which are green and red respectively [10] [11]. The customer has furnished with such a tag that he gets because once he registers, this tag has been connected with his prepaid account as well as contains confidential information, and this tag uses an RFID system and has been mounted on the surface of the windshield of the customer. A parking fee has been instantly deducted from the user's account [12] based on the period consumed inside the parking area. RFID has been used to register every other customer for once, as well as an RFID tag has been attached to his vehicle instead of repetitively creating a token. There is no wait time in the RFID system, which would be distinctive to him (as if Aadhar number). These same consumers transfer via the entrance easily and park everyone vehicles [13]. When a vehicle has been opted to stay, the IR sensor releases the database and moves via the entrance door to see a big display with stay living parking spaces. It is noticed that a large number of people waste fuel for free parking space. Utilizing IOT, transmit messages on the free or used slot to the website [14] [15].

### RFID - IoT- Smart Parking: The Connecting Link

IoT is based on decentralized integrations of network devices, identifications, sensors, and other smart technologies interconnected to reduce manual work and increment automation. IoT applications are grouped into several domains ranging from an essential internet

connection, education, business, transportation, health and agriculture to smart cities, traffic, remote monitoring, smart metering, and process automation.

In accordance with the fast-growing world both in terms of magnitude and technology, IoT adds to the overall development of the technical arena. The vision of IoT has made all our thoughts and ideas to evolve into reality [2]. Apart from helping users in day to day life, IoT has made considerable advances in the smart city and business sectors. Today Internet of Things application has become an elementary domain for data streams and big data analysis. IoT has allowed making a secure connection between people and devices at any point in time and every sector possible. The applications further help in real time management, disaster management, automated work management, effective asset utilization, and smoother logistics. Mere IoT does not work; it further requires provisions with ubiquity, reliability, efficiency, and high performance.

### IoT Solutions to Smart Cities

Smart cities can be enhanced by Internet of Things (IoT) solutions consisting of the following:

- Sensors are built and installed in an automated form within the infrastructure to sense various conditions.
- Any smart city platform, whether smart traffic monitoring system or smart parking system, is responsible for the collection of data its proper analysis and interpretation for fruitful results, thus providing visualizations to the front end users.
- Flexible network connectivity is a crucial component in helping devices to communicate efficiently with the various smart platforms.

The whole paper is organized as explained in section II through Literature Survey. Section III discusses the proposed system. Section IV shows the Experimental Results The system has shown the performance of an intelligent parking system through advantages in Section V. The conclusion has been given of the intelligent parking system throughout Section VI.

## 2. LITARATURE SURVEY

### 2.1 Smart parking reservation system using short message services (SMS) [1]:

This system provides a unique algorithm which increases the capability of the current cloud based smart Parking system and it also develops a network architecture based on the Internet of Things technology

#### 2.1.1 Advantages

1. Enhanced security due to password requirement.
2. System can be used and applied anywhere due to ease of usage.

#### 2.1.2 Disadvantages

1. Cost of implementation is high.
2. GSM feature creates bottlenecks
3. The microcontroller will have to take a lot of the load which can crash the system.

### 2.2 Intelligent Parking Management System Based on Image Processing. [2]:

The Intelligent parking system aims to manage the parking area by capturing the number plates of each vehicle for unique identification of vehicle. This information is then used for payment calculation of each user.

#### 2.2.1 Advantages

1. The system captures and processes the rounded image drawn at parking lot and produces the information of the empty car parking spaces.
2. A camera is used as a sensor to take photos to show the occupancy of car parks.
3. Single camera can detect the presence of many cars at once

#### 2.2.2 Disadvantages

1. The weather conditions affect the System i.e.in terms of visibility.
2. The camera should be in apposition where it can see all the car parks and not be obstructed by any objects.
3. No guidance is provided in the parking lot.

### 2.3 Car Park Management, with Networked Wireless Sensors and Active RFID. [3]:

This system uses networked wireless sensors in order to monitor the cars in the parking area. Every car consists of an active RFID tag embedded in it in order to uniquely identify.

#### 2.3.1 Advantages

1. The main advantage of the gate management model is its low cost and simplicity over lot management model.
2. Gate management service: Another use of RFID tags is gate management. As an example, a gate can be opened Automatically using an RFID reader and the vehicle's tag at the gate.

#### 2.3.2 Disadvantages

1. No driver guidance systems to guide towards the parking lot.

### 2.4 Automated Parking System with Bluetooth access. [4]:

The Automated parking system uses Bluetooth device to find a vacant space in the parking area and the information about the vacant parking space can be obtained only within the range of the Bluetooth.

#### 2.4.1 Advantages

1. The system uses the use mobile's Bluetooth for identification and registration.
2. The vehicle is transported to the parking location with the help of a rack and pinion mechanism for linear motion.

3. It automatically detects the unique registration numbers to read in the Bluetooth chip to check if the new vehicle is to be parked.

**2.4.2 Disadvantages**

1. Cannot be used in the existing parking system.
2. The whole parking lots is to be designed with mechanical components such as rack and pinion

**3. PROPOSED METHOD**

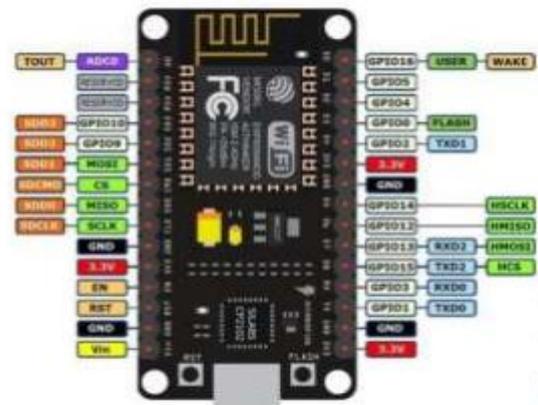
The proposed system uses ESP12 Node MCU, RFID Vehicle reader, RFID tags/Vehicle, I2C module, and an LCD. ESP12 Node MCU board is acting as a brain for the proposed system. The RFID vehicle consists of various details of the users such as vehicle number of users, name of the owner of the vehicle, registered contact number of the owner of the vehicle, and the balanced amount of the owner. The card reader system extracts the details stored in the card as the Vehicle enters and exits. The LCD will display the output of the proposed model. ESP12 Node MCU has an inbuilt IOT module that can use the internet to interface with the website. IOT module used to tell continuous real-time that is to reflect on to the website. The number of free slots and the occupied slot will be displayed by the LCD.

to hooking up all sorts of I2C sensors and peripherals. It supports Both I2C Master and I2C Slave. The functionality check of I2C interface will be done with the help of a program. The frequency generated by the clock signal is 100 kHz. It also involves LCD, DC motor, IR sensors, and RFID.

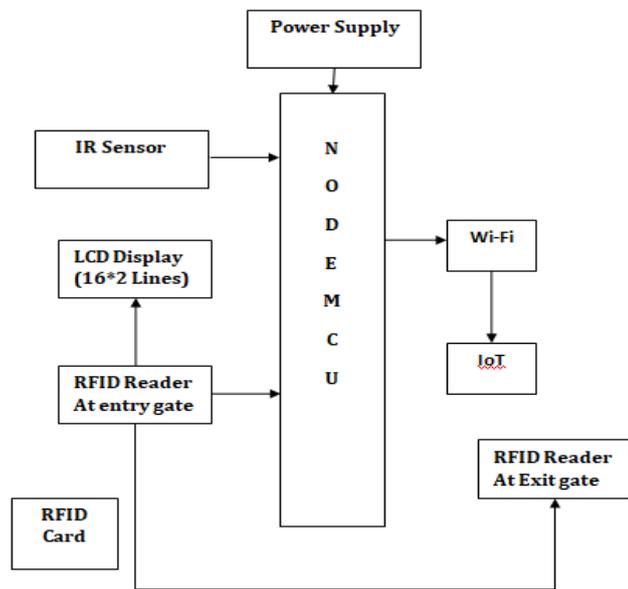
**A. HARDWARE DESCRIPTION**

**NODEMCU MICROCONTROLLER**

The NodeMCU is an open-source firmware and development kit that helps you to Prototype your product within a few Lua script lines. ESP8266 has powerful on-board processing and storage capabilities that allow it to be integrated with the sensors specific devices through its GPIOs with minimal development up-front and minimal loading during runtime.



**Fig.2: Node MCU Microcontroller**

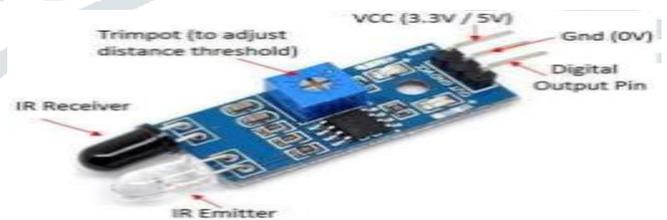


**Fig.1: Block Diagram of IOT based smart Vehicle parking system-using RFID**

The RFID vehicle is given to each registered user, which stores various details such as Vehicle number; the vehicle belongs to, the registered contact number to communicate, and the amount available in the vehicle. The card reader system extracts the details stored in the vehicle as to the vehicle enters and exits. The LCD will display messages to the vehicle owner. ESP12 Node MCU has an inbuilt IOT module that can use the internet to interface with the website. IOT module is used to tell continuous real-time that are to be reflected on to the website. The LCD is used to display the number of available slots. Circuit diagram involves Node MCU development board. I2C Pins are used

**IR SENSOR**

An IR sensor is basically an electronic device which is used to detect the presence of objects. Infrared light is emitted by this device. If this device does not detect any IR light reflected back this means that, there is no object present. If the light is detected by the sensor then there is an object present.



**Fig.3: IR Sensor**

**RFID Module**

RFID Module It is used for applications like robotics, Navigation payment system etc. which was an acronym for “Radio Frequency identification” which typically detects and discover precise item as commanded.

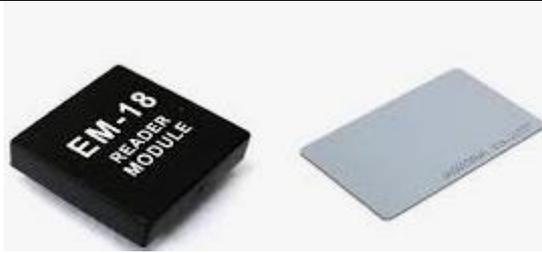


Fig.4: RFID Reader and Tag

LCD MODULE

It includes alphabets and numerics which is used to display atmost 32 characters.



Fig.5: LCD Display

DC MOTOR

Small DC motors are used in **tools, toys, and appliances**. The universal motor can operate on direct current but is a lightweight brushed motor used for portable power tools and appliances. Larger DC motors are currently used in propulsion of electric vehicles, elevator and hoists, and in drives for steel rolling mills.



Fig.6: DC Motor

B.WORKING FLOW CHART

1. Flow Chart For vehicle Allocation

The microcontroller Arduino Uno is having 14 digital input/output pins along with 6 analog pins. The communication and interfacing with the sensors are done with the help of Arduino IDE. The flow chart shows an overall working of vehicle allocation. For allocation of vehicles, check availability slot. If available then scan the RFID. After scanning the slot, allocate and update the server from the total slot will decrease by one.

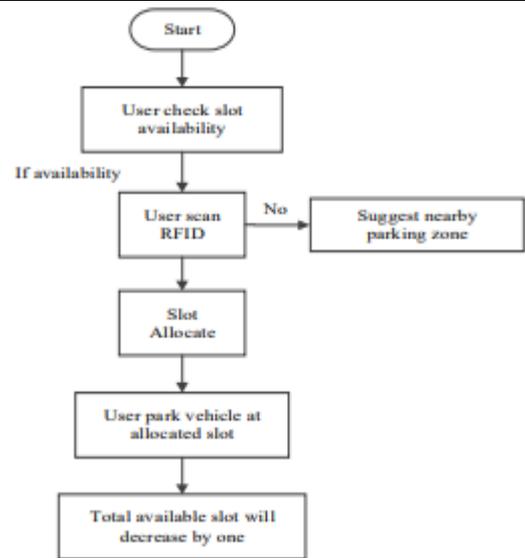


Fig.7: Flow chart for vehicle allocation

2. Flow Chart For vehicle dislocation

During dislocation of the vehicle, the user scans the RFID vehicle while exiting from the parking slot IR sensor detects the particular vehicle. The count is updated and incremented by 1. How much time the vehicle is a park and according to their time amount will be detected.

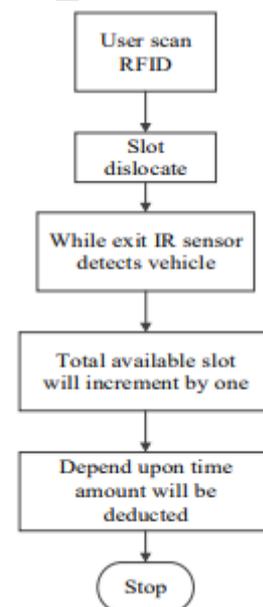
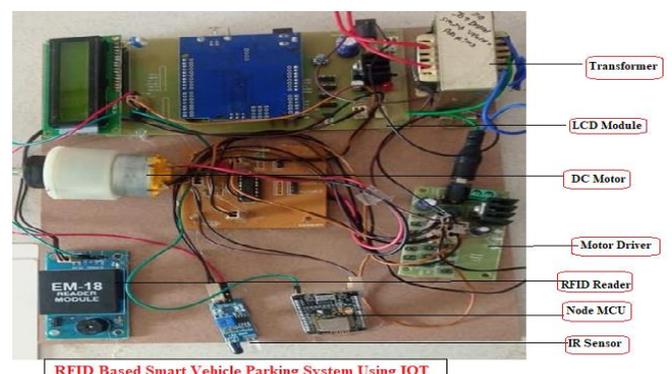


Fig.8: Flow chart for vehicle dislocation

4. EXPERIMENTAL RESULTS



RFID Based Smart Vehicle Parking System Using IOT

Fig.8: Experimental Setup

## 5. ADVANTAGES

The above Setup shows the experimental kit of iot based smart vehicle parking using RFID



**Fig.9: Showing LCD that Slot Available**



**Fig.10: The output on display when vehicle check-in**



**Fig.11: After check in of vehicle -1 The slot is full. The display shows slot not available**



**Fig.12:After vehicle-1 check out the output displayed on the LCD screen**

1. Smart Parking System reduces the time to locate a vehicle in parking areas and hence it reduces fuel consumption.
2. It also eliminates the unnecessary travelling of vehicles across the filled parking slots in a city.
3. Developing Smart Parking Systems within a city solves the pollution problem.
4. Fuel saving (According to a recent report, Smart Parking can result in 2, 20,000 gallons of fuel saving till 2030 and approximately 3,00,000 gallons of fuel saved by 2050).

## 6. CONCLUSION

Presently for one day, the smart cities have proposed an effective parking system that ensures vehicle traffic. Significant advancements in the Internet of Things and Cloud technology have taken place. Throughout the system model parking issue, the integrated smart parking system based on the IOT cloud could be resolved. Realtime parking communication is done with both the user through the website. Ultimately, it improves the standard of living of consumers.

### Future Scope

The Future Scope is to adopt this Smart Parking System (SPS) so that availability of parking slots could be viewed on a mobile phone Application or even to satellite navigation device so that drivers will always be aware of whether there are available parking slots or not. And enhance to send notifications to the user's mobile phone when vehicle enters to a particular shopping malls and some streets in a city etc.

## REFERENCES

1. Thanh Nam Pham<sup>1</sup>, Ming-Fong Tsai<sup>1</sup>, Duc Bing Nguyen<sup>1</sup>, Chyi-Ren Dow<sup>1</sup> and Der- Jiunn Deng<sup>2</sup>. "A Cloud Based Smart-Parking System Based on Internet-of-Things Technologies". IEEE Access, volume 3, pp. 1581 1591, september 2015.
2. Renuka R. and S. Dhanalakshmi. "Android Based Smart Parking System Using slot Allocation reservations". ARPN Journal of Engineering and Applied Sciences. VOL. 10, NO. 7, APRIL 2015.
3. ElMouatezbillah Karbab, Djamel Djenouri, Sahar Boulkaboul, Antoine Bagula, CERIST Research Center, Algiers, Algeria University of the Western Cape, Cape town, South Africa, "Car Park Management with Networked Wireless Sensors and Active RFID" ,,978-1-4799-8802-0/15 ©2015 IEEE
4. Harmeet Singh, Chetan Anand, Vinay Kumar, Ankit Sharma, "Automated Parking System With Bluetooth Access", International Journal Of Engineering And Computer Science ISSN:2319-7242, Volume 3 Issue 5, May 2014, Page No. 5773-5775
5. ThanhNamPham<sup>1</sup>, Ming-FongTsai<sup>1</sup>, Duc Bing Nguyen<sup>1</sup>, Chyi-Ren Dow<sup>1</sup> and Der- Jiunn Deng<sup>2</sup>. "A Cloud-Based Smart-Parking System Based on Internet-of-Things Technologies". IEEE Access, volume 3, pp. 1581 1591, september 2015.

6. Renuka R .and S.Dhanalakshmi.“ Android Based Smart Parking System Using slot Allocation reservations”.ARPN Journal of Engineering and Applied Sciences.VOL.10, NO. 7,APRIL2015.
7. SushilPalande, Surekha Gangurde, AkshayPote. “Automatic Pay And Park System”. International Journal of Scientific and Research Publications, Volume5, Issue5, May 2015.

