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## Smart Vehicle Parking Fee Collection System Using Iot

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### ABSTRACT

*The clogging of traffic level increasing rapidly by the development of population. The amount of population and utilization of personal vehicles also increased. Due to more usage of cars the traffic congestion occurred on the road. It is very difficult and time consuming to find parking space in most metropolitan areas, commercial areas, especially during the peak hours. Parking is habitually costly in all over the world to find proper and secure parking space. Designing of an automated parking fee calculation is made up of RFID technology with IoT. The Vehicle parking fee collection according to the time is done manually in existing system. There are a lot of chances to deceive the amount since it done manually. In order to overcome this manual exploitation, a smart parking system that delivers information to people finding an accurate amount for parking time at online. Hence, through Cayenne webpage we can monitor the total amount provided for our parked time period and user also can hear the SMS through GSM module.*

Keywords -- *RFID, IoT, GSM module, Node MCU, Cayenne app*

### Introduction

Population of the country will be increasing daily and need to improve stability of the parking system. Generally, manual parking entry is following it makes more human errors like mismatching of numbers, customer name, timing of the vehicle parking, etc.[1] In earlier parking fee calculation using license plate recognition aims to solve the problems of identifying the vehicle license plate number at the parking lot. The image processing theories and researches related to character recognition were used to design the system using RGB Image to Grayscale Image, Grayscale Image to Binary Image, Edge Detection, Noise Reduction, Character Segmentation, Character and Number Recognition, etc. The system starts from capturing the image of license plate, processing the image with different techniques and registering date and time of the license plate image both inbound and outbound in the database to calculate the parking fee. [2]The result of the experiment shows that the system is able to recognize the characters in 41 of 50 license plate images or 93.42% accuracy. After that parking in charges will calculate the money and provide bill to the customer. Some manual performances were done this process.

In this regard automatic parking system is mandatory one and it is used to prevent customer from huge traffic, provide exact bill for parking time ,save more time due to reduce the queue, decrease the usage of paper bills and miscalculation ,etc.[3] This system design is based on RFID technology combined with Node MCU and the vehicle entering the parking system means it will be record time in, time out, number of the particular vehicle and provide correct bill for the customer with exact timing. The existing parking management systems needs human efforts for controlling access and recording in excel sheets or on-paper which can be more difficult in an huge parking and leads to many parking errors such as access by unauthorized users, public security, deception to pay parking fees, etc. [4]Vehicles cannot access parking area without RFID tag as identification and the check-in/ check-out can be done very quickly. Users will not have to wait for the identification of their vehicles as it will be done automatically by the tags that are attached to them. This will also ensure security as only the registered vehicles are allowed to access into parking lot.

RFID is relating level of automatic identification technique whereby the information keeps on RFID tags. The RFID tag may be a device that may be connected to or included into the product, animal or person for identification and trailing discrimination non particulate radiation. Some tags are often scanning from many meters away, on the far side the road of sight of the reader. RFID technology is employed in vehicle parking systems of malls and large buildings.[5&6] The system consists of a vehicle counter, RTC module, Micro controller, GSM, IOT module, RFID tags and RFID reader.

## **Methodology of Work**

In earlier need to connect power supply 12V and voltage regulator is used to convert 12V to 5V which is suitable for the selected circuit components like Arduino Uno, RTC module, RFID reader, LCD and NODE-MCU with 5V dc and GSM modem is driven by 12V dc. These components are triggered by a signal means it executes the program after the controller will take RTC value and display the executing value in LCD display. Then the controller will read the value from the RFID reader and until the card is shown. Once the card is shown then it will check whether the card belongs to vehicle 1 or vehicle 2. If that particular card is shown first time, then it will be considered as the Vehicle 1 or 2 IN time and that was displayed in the LCD. If the same card is shown for second time, then it will be considered as the vehicle 1 or 2 OUT time and the value will be displayed in the LCD. [7-9]Then the total

time the vehicle parked in will be calculated by the controller and amount will be calculated according to the time. Once the amount is calculated then the SMS will be sent to the user having the content of total amount and the UPI id where the amount should be paid. [10-12]Also, this value will be displayed in the IOT- cayenne app/ webpage.

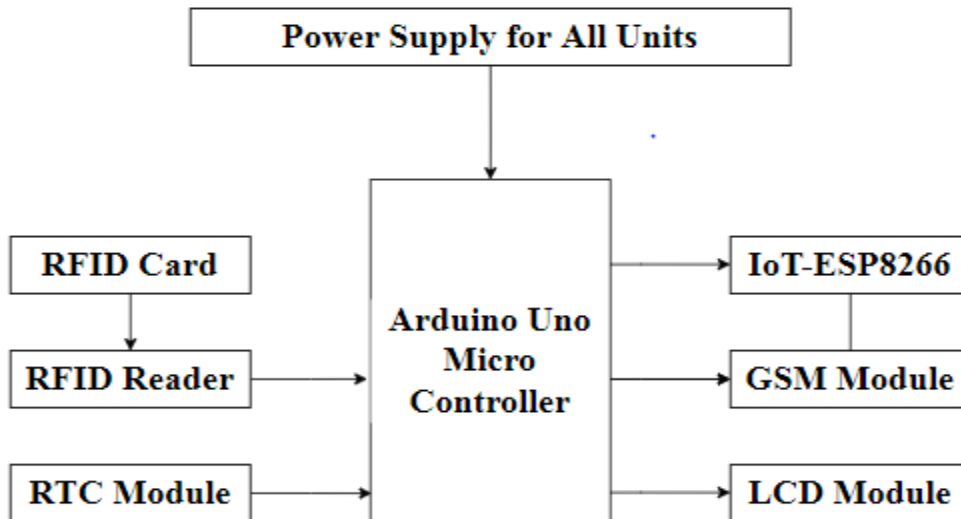


Fig.1 Model of smart vehicle system

## Overview

To monitor the vehicles IN and OUT time in the Parking area and implementation of this smart parking system, labor-intensive error in the parking fee collections can be reduced. The components like Node MCU ESP8266 WIFI module, RTC module, GSM module, external power supply and RFID reader are interfaced with the Arduino micro-controller.[13&14] Even though the vehicle is entering the parking system means RFID reader record the vehicle timings with particular money calculation and the message will be passed into the vehicle customer and parking in charges precisely.

## Hardware requirement

### A. Node MCU ESP8266 WIFI module

ESP8266 is a microcontroller with WiFi capability and it needs external flash memory. In this module receives signals from RFID reader and calculate the value of parking then passed message to in charge and customer. It stores the customer details up to 128 bytes.

### B. RFID

Radio frequency identification is mostly used for recognition devices for tagging purposes. This tag might be prepared by read or write purposes, data collections, monitoring and

broadcast process. Tagging ID used small radio waves and it transmits the vehicle number, consumer name, parking in-out time to the in chargers.

*C. Arduino Uno*

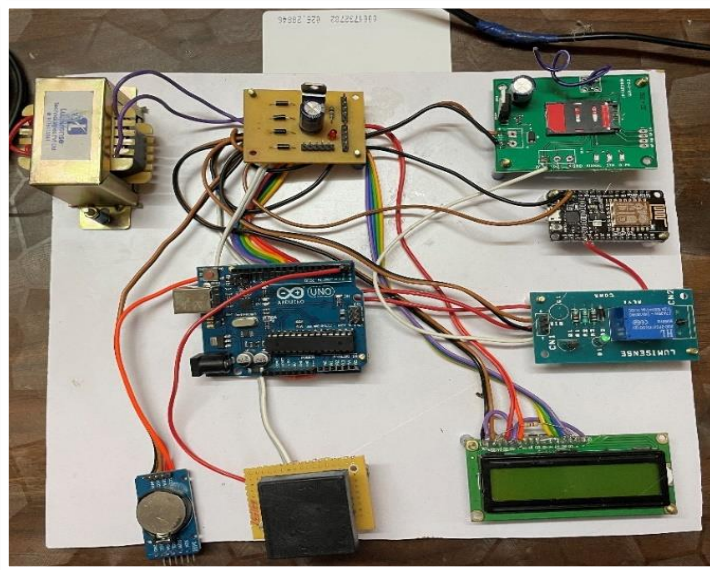
This system receives signals from RFID and Node MCU module and it converts analog input into digital vice-versa. It passes the signals like serial communication as it is simply set or reset the operations and converts the signals on the way to USB drive.

*D. RTC and GSM module*

RTC module is used to find the date and time of parking vehicle and this information is passing through the Node MCU to Arduino Uno controller. GSM-SIM 800A module converts the datum like audio, video, text message to the vehicle in charge along with consumer at the literal time. It receives signals from setting up of antenna as well as addition to SIM800A system.

*E. LCD module*

Liquid crystal displays the statement get from Arduino controller. It shows the consumer incoming time and leave-taking time, space of the parking structure, traffic particulars, malfunctions, etc.



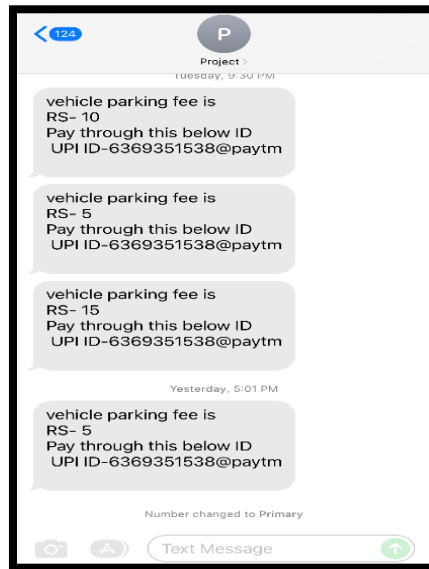
**Fig.2. Hardware setup of Smart Vehicle Parking Fee Collection System**

## **Software Requirement**

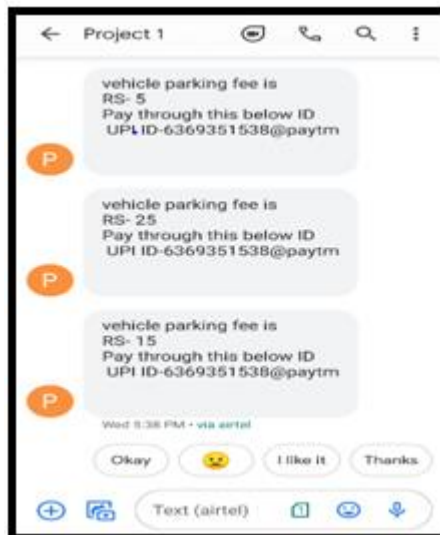
*A. Cayenne App*

This app is affording rapid proto type and split the exact details receive from transmitters. It is used to evaluate the vehicle information from 360 angles moreover distantly control the devices. These information stores the datum in the direction of cloud it easily

retrieve in favor of inquiry purposes too. [15]Add more device to be seen in the online dashboard. From beginning to end the dashboard lot details is accessible in board. It can tenuously watch and organize the Cayenne and can support many devices as well. Further than adding as many Raspberry Pi/Arduinos as desire, be able to select beginning a variety of sensors, extensions and actuators.



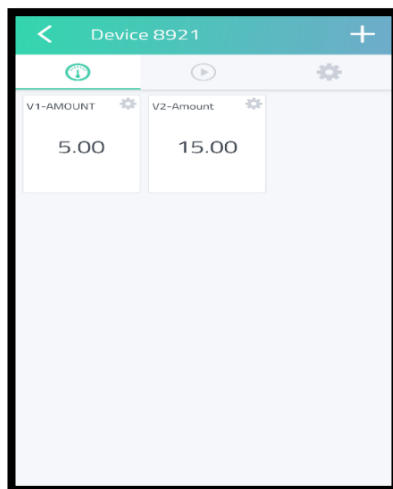
**Fig.3. Vehicle-1 SMS Notification**



**Fig.4. Vehicle-2 SMS Notification**

The closing stages of the progression monitor display the total of parking point in time and invoice also convey to the consumer and in charge using Node MCU based on IoT platform. Intellectual parking system can realize automatic vehicle identification and information management based on RFID, improve efficiency and security.[16] Read card, inspect card, integrated with Real time clock displaying, so that in charges can more effectively manage

the vehicle parking fee collection. For break through the traditional parking management pattern, it is the future development direction of the parking IoT management.



**Fig.5. Amount shown in the IoT platform**

## Conclusions

This module initiated and determined to build up a technology device which would be very useful for the society to help in collecting the vehicle parking fee. According to the obtainable system using the IR sensor and IoT, further which is high in cost. So, it is decided to find to simply solution using some of the main components like RFID module, RTC module, GSM module. This mechanism will inspect the RFID Tag of the vehicle which is parked and monitor the vehicle, when it was parked and then calculate the amount as per the timing of the vehicle. Then the parking fee amount will be stored in the IoT platform. The GSM modules send the message notification to the concern person about the parking fee. This would help to collect the parking fee in various parking lots.

## References

- [1]. Thirunavukkarasu M, Ravindran R, Saravanan C.G, Rajamanickam N, "Production of gaseous fuel from jatropa oilby cerium oxide based catalytic fuel reactor and its utilisation on diesel engine" 2016 Thermal Science, Vol. 20, Suppl. 4, pp. S1127-S1135.
- [2]. B. Kalaimathi, V.S Charumathi, T Aishwarya, M. Annie Prasanna, Sara Vijayakumar, "Raspberry PI Based Intelligent Car Parking System", 2021 Smart Technologies, Communication and Robotics (STCR), pp.1-5, 2021.
- [3]. José Rafael Rojano-Cáceres, Jesús Antonio Rosas-Percastre, Teresita Alvarez-Robles, J. Andrés Sandoval-Bringas, "Making Parking Lot Accessible Through IoT", Universal Access in Human-Computer Interaction. Access to Media, Learning and Assistive Environments, vol.12769, pp.485, 2021.

- [4]. Vijay Paidi, Hasan Fleyeh and Roger G. Nyberg “Smart parking sensors, technologies and applications for open parking lots” – (IET) Intelligent Transport Systems- pp. 735-741
- [5]. Manjusha Patil and Vasant N. Bhonge “Wireless Sensor Network and RFID for Smart Parking System” - International Journal of Emerging Technology and Advanced Engineering – 2021- pp. 188-192
- [6]. M. Kannan and N. Jagadeesh “A secured IoT parking system based on smart sensor communication with two-step user verification” – Autonomous and Connected Heavy Vehicle Technology – 2022- pp. 141-159
- [7]. P.Kanakaraja, L.S.P. SairamNadipalli, S.V. AswinKumer “An implementation of advanced IoT in the car parking system” –Materials Today: Proceedings -Volume 37, Part 2 –2021- pp. 3143-3147
- [8]. G.Shobana, S.Balasubramanian, “Smart Parking Fee Detection Using Contour Detection Algorithm”-IEEE- Dec. 2021- pp. 1192-1197
- [9]. Hiroaki Nakanishi; Toru Namerikawaet, “Parking Lot Allocation and Dynamic Parking Fee System Based on a Mechanism Design Approach”-IEEE- July 2019- pp. 2683 - 2689
- [10]. A.Z.M. Tahmidul Kabir; Nirmol Deb Nath; Fukrul Hasan proposed “Automated Parking System with Fee Management Using Arduino”-IEEE- July 2019- pp. 01-06
- [11]. I.M. Hakim, D. Christover and A. M. Jaya Marindra, "Implementation of an Image Processing based Smart Parking System using Haar-Cascade Method," 2019 IEEE 9th Symposium on Computer Applications & Industrial Electronics (ISCAIE), Malaysia, 2019, pp. 222-227.
- [12]. P. Mirunalini, B. Bharathi, N. Ananthamurugan, S. Suresh and S. Gopal, "Multi-Level Smart Parking System" 2018 International Conference on Computer, Communication, and Signal Processing (ICCCSP), Chennai, 2018- pp. 1-4.
- [13]. Mujeeb Ur Rehman and Munam Ali Shah, "A smart parking system to minimize searching time fuel consumption and CO2 emission", 2017 23rd International Conference on Automation and Computing (ICAC), 2017.
- [14]. M. Owayjan, B. Sleem, E. Saad and A. Maroun, "Parking management system using mobile application," 2017 Sensors Networks Smart and Emerging Technologies (SENSET), Beirut, 2017, pp. 1-4.
- [15]. A. Bazzi, H. Ghandour, A. Chebbani, M. Ghareeb and S. Abdul-Nabi, "RFID based Paid Parking System" 2017 International Conference on Current Trends in Computer, Electrical, Electronics and Communication (CTCEEC), Mysore, 2017 – pp. 1238-1241.
- [16]. H. Chaudhary, P. Bansal and B. Valarmathi, "Advanced CAR parking system using Arduino," 2017 4th (ICACCS), Coimbatore, 2017, pp. 1-5.