

REAL-TIME PARKING SYSTEM USING IOT

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Abstract— The real time parking system allows one to find a slot for parking one's vehicle at ease. The project also eliminates the need for human intervention by scanning the RFID (Fastag) to collect user data through which the user is notified in real time of his/her vehicle's current location, in/out time and the amount to be paid which can be done using the wallet linked to the RFID or manually inserting cash into the kiosk.

Keywords— Real Time Parking System, Smart Parking System, Parking System using Raspberry pi and IOT technologies., Advanced Parking System.

I. INTRODUCTION

One of the most prominent problems being observed in cities these days is the hassle involved in finding a free parking slot. Be it at shopping malls or any of the public places, the problems involved in finding a parking slot is ever-growing. Moreover, with the ever growing funds required to maintain personnel such as ticket collectors, security and so on, it is becoming extremely difficult to deploy many such personnel from a financial prospect. Also with every other person opting for the use of a car or bike instead of the public transport, the vehicle density is growing. And with the resources involved, such as, the paper required for ticket, we need a system which is efficiently able to help the user have a seamless experience by being guided to the free slots in real time, avoid the stress involved in waiting in queues, reducing the money spent for tickets, deploying personnel and also get notified of aspects such as calculation of IN/OUT time, if the car is stolen and so on. This is where we propose the system of Real time Parking using IOT, where we address the

above mentioned issues. This system uses the Fast-tag which uses the RFID technology since fast tag is a mandatory requirement now and its information is taken for collecting user details which reduces waiting response from the clients and avoids practical difficulties.

II. LITERATURE SURVEY

There are various intelligent parking systems that are prevalent and these systems require human

intervention. Image processing has been used to make an efficient, intelligent car parking system[1]. The Raspberry Pi determines the number of free slots in a parking system. Raspberry Pi and Cloud applications are linked using a web-socket portal. Google Maps Distance Matrix API is used to find the distance of each parking in a db. Use of Cameras and IR sensors to recognise license number plates. Big Data Analysis and neural network to understand related parking information [2]. IR sensors are used to detect free parking slots. Then the image

In order to develop autonomous car parking systems, Image processing algorithms are used for detecting number plates. An image of the number plate is captured and it is further processed to obtain the characters present in it. The IR sensors are used to detect if the slot is free or not. The timing is noted simultaneously in order to calculate the parking fees. The LCD displays the parking slot availability. And displays "FULL" if there are no parking slots available. The analysis is limited to the number plates that are present in a single row [3].

III. RELATED WORKS

The development of a true sensible parking system which will offer quite simply data regarding vacant areas however conjointly facilitate users to find the area wherever the vehicle will be placed so as to cut back traffics within the car park. Enhancing security and conjointly to assist users realize his/her automobile once he/she forgets wherever the automobile is placed. Conjointly style the payment method victimization mobile payment so as to cut back time and take away bottleneck of the payment method at the entry/exit gate of the car park [4]. Image processing algorithms are used to detect and capture the number plate; this is done in order to reduce illegal car entry. A lift is used to enable cars to be parked at multiple levels [5]. A sensible parking system detective works and finds the place location of a consumer's vehicle. Victimization inaudible and magnetic device, the projected system detects vehicles in indoor and out of doors parking fields, accurately [6]. Wireless device motes support a vehicle location service in parking heaps victimization BLE. A model of internet-of-thing primarily based E-parking system is projected. The projected E-parking system uses an associate degree integrated part known as timer to handle the above-

named problems also on offer sensible parking management throughout the town.[7] The algorithms, system and techniques associated with sensible parking square measure mentioned and reviewed [8]. Thus, the aim of the IOT based Real Time Parking System is to build an

IR Sensor

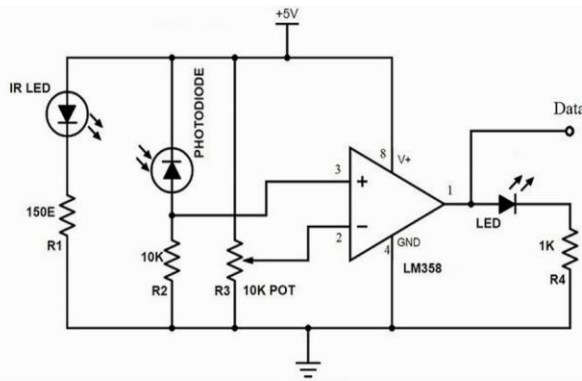


Fig 2. IR circuit

Courtesy: <https://www.pinterest.com/pin/832954893558888374/>

The IR sensors are the most prominently used sensors for Object Detection. These sensors use Infrared radiation for detecting objects. The IR sensor consists of a photo diode which functions as the receiver and the IR transmitter LED which detects objects. The IR sensor consists of 3 pins which are connected to the Raspberry pi for data transmission. The Vcc pin is connected to the 5v of the

autonomous parking system that uses minimal human intervention and overcomes the limitations in the existing systems.

IV. HARDWARE AND SOFTWARE USED

A. Hardware

Raspberry pi

The Raspberry pi is a credit card sized small electronic board. It consists of 40 pins, each of which constitutes a specific purpose. An SD card must be inserted with Raspbian OS installed to boot the system. The GPIO pins are the general process input/ output pins where the hardware is connected.

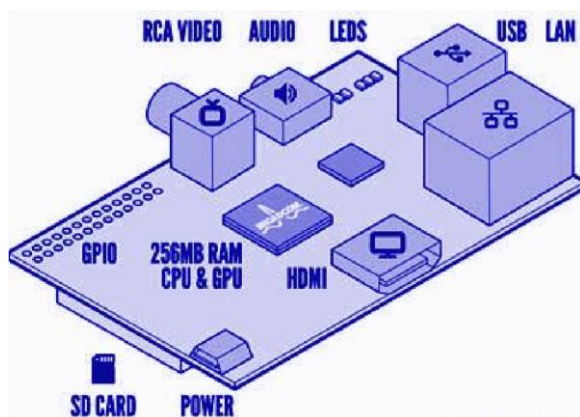


Fig 1. Raspberry Pi components

Courtesy: <https://computer.howstuffworks.com/raspberrypi2.htm>

EM-18 module

The EM-18 module is the most commonly used RFID tag reader. This module scans the RFID tag using electromagnetic fields to get the information from the tag. RFID tag is scanned

V. ARCHITECTURE

A. Design

The architecture is divided into 9 layers on basis of the functional system design.

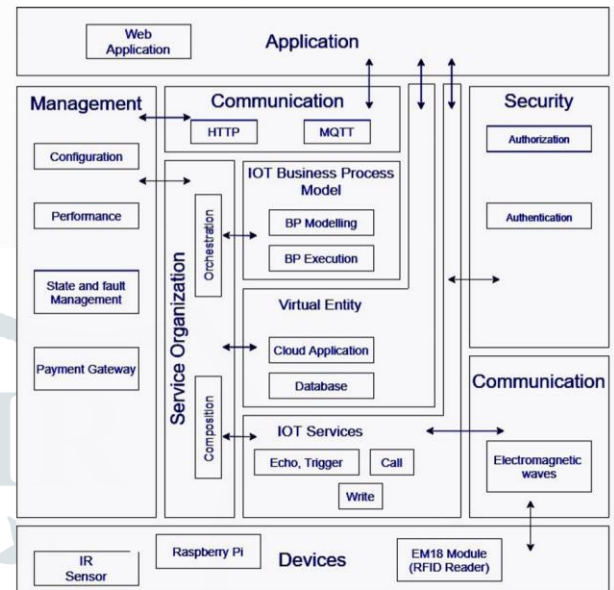


Fig 3. Architecture Diagram-Real Time Parking System using a RFID scanner, in this system a EM- 18 module is used which scans using electromagnetic fields and reads the data. The EM-18 module reads any 125KHZ RFID tags and monitors and transfers data to the attached objects. UART and Wiegand26 are the two output formats of the EM_18 module.

RFID tag

RFID stands for Radio Frequency Identification, used for reading and transferring data from tags. The RFID tag sends waves through radio waves to the EM-18 module which is the RFID reader in this system. This system uses smart bar codes for identification. Our system uses the Fast tag, raspberry pi module. The data pin is connected to the GPIO23 of the raspberry pi. The ground pins of both Raspberry pi and IR sensors are connected with each other. The GPIO24 and ground of the raspberry pi are connected to the 5v buzzer respectively.

B. Software

Raspbian

The Raspbian OS is installed in the SD card of the Raspberry pi, which functions as the operating system for the system. This OS is essential to boot the system. Python2 is also installed in the SD card, the VNC viewer is installed in the computer to view the Raspbian OS and the connection code of the system is in Python 2.

Client Application

The client application is a web application which is written in PHP. This web application can be progressively accessed by the user to make use of the parking system. The web

application on opening would give the user details on the slot availability and once the user selects a slot, he may book the slot and on booking the user receives a notification on the booked slot. Once the user exits on showing the RFID tag, the details of the time and bill amount is further notified to the user's email which is automatically processed from the fast tag of the user and the payment may be done by either of the payment gateways provided.

APPLICATION: The application layer consists of the web application which is the module that the user interacts with. This layer displays the slot availability basis which the user can book the slot as desired.

MANAGEMENT: The management layer describes the entire management of the system in various categories such as the system configuration, which talks about how the system architecture is done. The state and fault management of the system which implies the failure/acceptability rate of the system, the performance and payment gateway is also managed by this layer.

COMMUNICATION: This layer focuses on the interaction between the layers and the interface used for these interactions to pass messages to each other. They consist of protocols such as HTTP, MQTT and various electromagnetic waves.

SECURITY: The security layer focuses on the authentication and authorization of the information and data

IOT BUSINESS PROCESS MODEL: The business process is used in order to run the process smoothly for their concerned services and schemes.

IOT SERVICES: The services included in this system are echo, trigger, call and write.

VIRTUAL ENTITY: Cloud application acts like the virtual entity which stores the data as like a database.

DEVICES: The raspberry pi, IR sensor and smart device are the devices incorporated in this system. The raspberry pi is used as a memory device such as a motherboard which can be used to run the code and transmit data and also to store the data received. The IR sensor senses the object and detects the availability of the slot in the system. The user's smart device may be used to display the web application through which the user can book the slot and check availability of slots.

B. Implementation

time of entry and exit. The user is notified through his mail id. Once the car enters, the IR sensor senses the availability of parking slots which can be viewed by the user and booking can be done as per the availability of the slots. Once the slot is booked, it may be occupied by the user and the IR sensor senses the vehicle and further intimates that the slot is booked and occupied. On exiting the user further scans the RFID tag and the payments may be done by various payment gateways

- The IR sensor is most prominently used for object detection using infrared radiations.
- The IR sensor consists of 3 pins, namely the Vcc pin, Data pin and the ground.
- The sensor consists of a photo diode which acts as the receiver and a led light which is the transmitter.
- The Vcc pin is connected to the 5v of the raspberry pi module.
- The data pin is connected to the GPIO23 of the raspberry pi.
- The ground pins of both Raspberry pi and IR sensors are connected with each other.
- The GPIO24 and ground of the raspberry pi are connected to the 5v buzzer respectively.

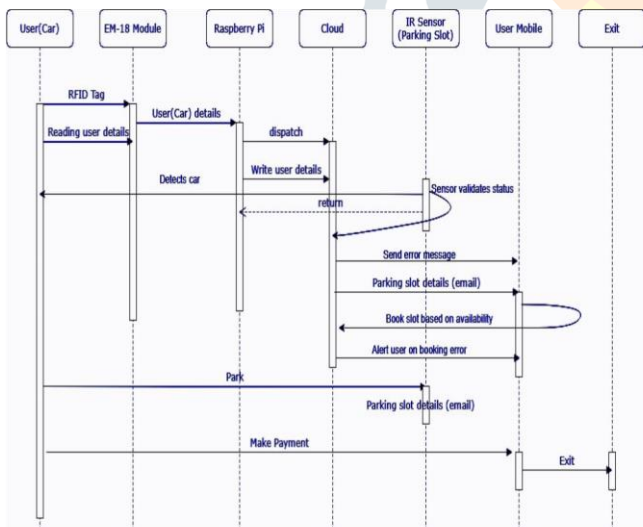
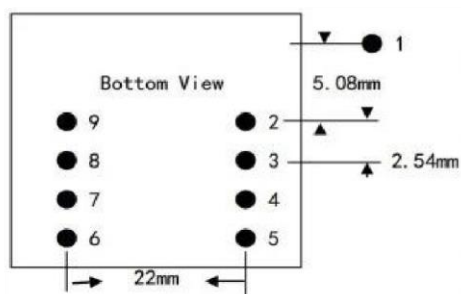


Fig 4. Schedule Diagram

The RFID tag is scanned using an RFID scanner and this system uses the EM-18 module as the RFID scanner for collecting the user details. On scanning, the user's information is obtained which is used to notify the user on various standards. This information is used to send the user information on his entry time, the slot availability, the slot occupancy and bill amount to be paid on calculating the confined.

SERVICE ORGANIZATION: All the services comprehended by the IOT system are orchestrated and composed by this layer.



provided through a link to the user's smart device.

C. Connections and Dataflow

IR sensor and Raspberry pi

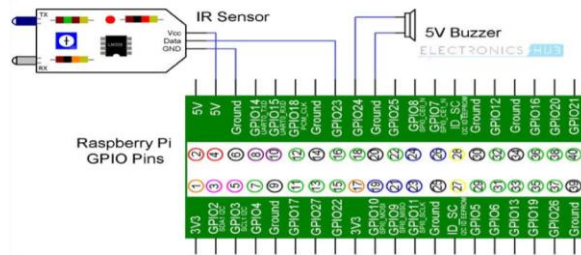


Fig 5. IR sensor and Raspberry i pin configuration

Courtesy: <https://www.electronicshub.org/interfacing-irsensor-with-raspberry-pi>

Fig 6. EM-18 Module pin configuration

Courtesy: [Interfacing EM-18 RFID Reader Module with Arduino Uno](#)

Pin No.	Name	Function
1	VCC	5V
2	GND	Ground
3	BEEP	BEEP and LED
4	ANT	No Use
5	ANT	No Use
6	SEL	HIGH selects RS232, LOW selects WEIGAND
7	TX	UART TX, When RS232 is selected
8	D1	WEIGAND Data 1
9	D0	WEIGAND Data 0

- RFID stands for Radio Frequency Identification, used for reading and transferring data from tags.
- RFID tag is scanned using a RFID scanner, in this system a EM- 18 module is used which scans using electromagnetic fields and reads the data.
- The EM-18 module reads any 125KHZ RFID tags and monitors and transfers data to the attached objects.
- UART and Wiegand26 are the two output formats of the EM_18 module.

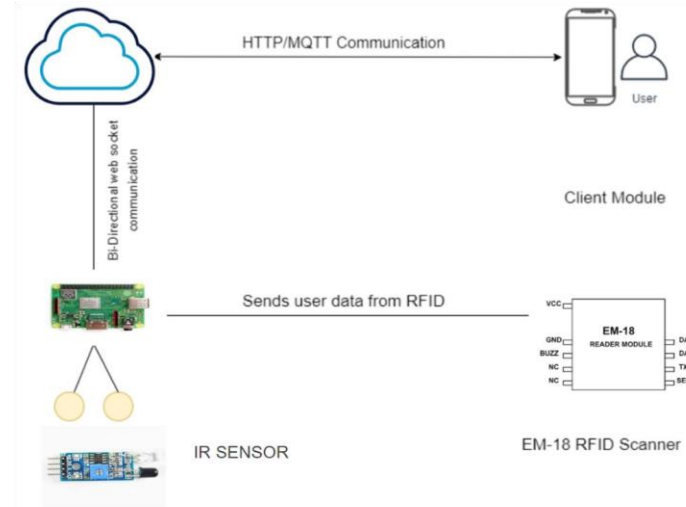
- Using microcontrollers, the UART may be connected to microcontrollers.
- The em-18 module radiates 125KHZ through its coils and when a 125KHZ passive RFID tag is brought into this field.

VI. WORKING

drivers of free slot availability manually. This leads to problems such as high labor costs, time consumption, repetitive manual talents. Our system incorporates the use of RFID to obtain user information stored and let's the user know of free slots using IOT. The user's, are then notified in real time about live slot availability, the aisle and slot details and payment information. The payment can either be done using the wallet linked to the RFID or by manually inserting cash into the kiosk. Manual system in which a personnel is required to track the entry/exit time of the vehicle and is required to manual input in the database. Requires guards at each floor in a multi-level space to indicate the drivers of a free slot availability. Leads to time consumption due to the time involved in searching for an empty slot and could also lead to accidents due to disorganised parking. Often the user is at a crossroads as they tend to forget the parking spot and this makes it a tedious process as they have to search at multiple levels. Current system of notifying users of their parking slot requires a personnel to manually collect user data.

The proposed real time parking system works as follows :

Initially a car enters the shopping mall, on entering the User's RFID tag is scanned (since Fast Tag is mandatory, the proposed system can also be upgraded to use this option to get User details at ease). Once the RFID tag is scanned using electromagnetic fields by a RFID scanner, this system uses the EM-18 module that is the most commonly used RFID reader. The RFID connection is done with a python program on connecting the pins to the raspberry pi module. Once the user details are obtained the user is notified via email and the link would show a web application which



which is further updated in the web application.

Fig 8. Block diagram

Today's public/private parking management is based on MPS (Marshaling Parking System). The MPS is a type of parking where a personnel is required to be on ground so as to store information such as entry/exit time and also to indicate

VIII. FUTURE SCOPE

Image processing algorithms can be used to overcome the limitation of IR sensors in detecting other objects, by scanning the image from a CCTV camera and deciding on slot status based on the detected object.

IX. CONCLUSION

It is apparent that the demand for the smart car parking system will continue to increase in the upcoming years. With the automobile industry growing at a rapid and alarming rate and with the need for an efficient and organized parking system within public and private spaces the norm of the hour, the advanced parking system is an effective and cost-effective project that aims to bring down the involvement of personnel and resources such as the dispensing of paper, fuel (for searching if available slots) and bring about an organized approach to the existing automated system.

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REFERENCES

shows the slot availability. The user may select the slot desired and on clicking the book option, the web application is redirected to the next webpage where the slot details are entered. Once booked, the user is notified via email on the booking confirmation and one may park the vehicle at the slot. On exiting the slot, the IR sensor detects the slot availability and continuously changes the status of the slots. The Raspberry Pi is continuously sending the slot information and the web page is updated simultaneously. And on exiting, the user must check out the RFID tag and the user is again notified with the bill amount based on time of occupancy and a link which will redirect the user to payment gateway process and further the IR sensor detects the slot availability and Raspberry Pi sends this information

VII. LIMITATIONS

IR sensors may give faulty readings if any other obstacles apart from cars are detected in that slot.

[1] Jiang Ruili, Wang Haocong, Wang Han, Eoin O'Connell, Sean McGrath "Smart Parking System Using Image Processing And Artificial Intelligence" (Year of Publication : 2018)

[2] Akash Gupta, Priyansh Rastogi, Shaurya Jain "Smart Parking System Using Cloud Based Computation And Raspberry Pi" (Year of Publication : 2018)

[3] Abhirup Khanna, Rishi Anand "IoT Based Smart Parking System" Published in: 2016 International Conference on Internet of Things and Applications (IOTA) Date of Conference: 22-24 Jan. 2016 Date Added to IEEE Xplore: 08 September 2016

[4] Khamoula Hassoune, Wafaa Dachry, Fouad Moutaouakkil, Hicham Medromi "Smart Parking Systems: A Survey" (Published in: 2016) 11th International Conference on Intelligent Systems: Theories and Applications (SITA) Date of Conference: 19-20 Oct. 2016 Date Added to IEEE

Xplore: 08 December 2016

[5]“S mart Parking Victimization Iot Technology”
(Published in: 2018) fifth International Conference on
Business and Industrial analysis (ICBIR). Date of
Conference: 17-18 could 2018. Date more to IEEE
Xplore: twenty one Gregorian calendar month 2018

[6]E lakya R ,Juhi Seth, Pola Ashritha, R Namith

“Smart Parking System For Web Of Things.” (Published
in: 2016 IEEInternational Conference on client physical
science (ICCE) Date of Conference: 7-11 January. 2016.
Date more to IEEE Xplore: fourteen March 201

[7]P ampa Sadhukhan “ An Iot-based E-parking System
For Sensible Cities.” Published in: 2017 International
Conference on Advances in Computing,
Communications and scientific discipline (ICACCI).”
Date of Conference: 13-16 Sept. 2017. Date more to
IEEE Xplore: 04 December 2017

[8]“S mart Parking System Supported Web Of Things:
A Review.” Published in: 2018 Fourth International
Conference on Computing Communication
management and Automation (ICCUBEA). Date of
Conference: 16-18 Gregorian calendar month. 2018.
Date more to IEEE Xplore:

25th April 2019

