

IOT Based Smart Parking System Using Raspberry Pi

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Abstract— In recent years the vehicular traffic on roads has grown tremendously. Due to this it is common to see that vehicles are parked haphazardly along the road sides or in no parking zones due to unmanaged parking zones. Today, technology is all about reducing human efforts which is used to streamline everyday problems. Parking system must be smart enough to indicate the empty slots as well as reservation based. Raspberry pi is a credit-card sized computer aimed at providing a computer to every person in the world. This system requires a Micro SD card with a Raspbian OS and the pins are controlled with the help of python commands. In this paper Smart Parking System is implemented which will help the user to know the vacant slot before entering the parking area. Also, the system provides the commuters to book their parking slot before they start from home.

Keywords—Smart parking; IOT; Raspberry; parking slot; Entry; Exit; traffic; Vehicle.

I. INTRODUCTION

The Internet of things (IoT) is the network of physical objects or ‘things’ embedded with the electronics, software, sensors, and network connectivity, which enables these objects to collect and exchange data. Sensor networks are used for sensing and monitoring while raspberry pi collect the data and monitor the data. Thus, smart parking system enables us to detect the empty slots with the help of IR sensors during the entry of the vehicle. Ultimately it is a system that aims to save the energy by providing the appropriate location to the vehicle and therefore vehicle did not need to search it randomly and wasting the fuel. The main objective is to determine which slots are vacant & total numbers of vacant slots available in the parking area. Specific parking slot that is nearest to the driver must be assigned to the vehicle at the entry. This will update the number of available slots at every exit in the database. Also, an app is provided to the commuters so that they can reserve the parking slots in advance. The fare cost is also evaluated from the arrival time to the departure time so that the monetary aspect of maintenance can be fulfilled.

II. REQUIREMENT ANALYSIS AND SYSTEM SPECIFICATION

A. Problem

The major issue of vehicle parking in metropolitan cities, tourist places and industrial sectors has increased towing away of vehicles, theft cases and traffic on roads to multi-folds.

B. Issue

- Provide solution to consumer problem by providing user friendly parking system to park the vehicle.

- Building scalable and high performance architecture to support expansion
- Saving time, effort and resources for parking vehicle in populated areas.
- Reducing road side traffic and tow away cases by providing the required slot area to the consumer.
- Providing the security of vehicle being parked in the designed parking slot

C. Solution

- Data from sensors installed in parking area will provide the status of parking slot (whether vacant or booked)
- MySQL can act as a persistent storage for the information and status of parking area which can be used to allocate slot for the incoming vehicle.
- The RFID readers will help us to identify the number plate of vehicle to maintain a database containing departure and arrival time so that the cost (during which the slot is occupied) can be evaluated.
- The mobile application can help the user to book the parking slot in advance so as to save the time.
- The security is maintained using RFID tags which is to be checked at the entry as well as exit from the parking area.

D. Impact

- A well suited solution for parking will help the consumer to have required slot to park before exiting from their location.
- Return on One-Time Investment (ROI) target is of 1 year.
- The paid parking will help to generate funds that will cover the yearly maintenance of the parking area.
- Fuel wasted for finding a place to park the vehicle can be highly reduced which help to save the scarce will fuel resource which is beneficial for economy.
- The traffic on roads and tow away cases due to wrong parking can be minimized to a greater extent.
- Outcome will help to reduce the time, effort and resources which are major demand.

III. SYSTEM DESIGN

A. Detailed Design

The combination of IR sensors, jumper wires and microcontroller, Raspberry Pi (hardware components) along with the Raspbian OS, Python IDE and Putty Interface provide us with the basis of our system as shown in figure 1.

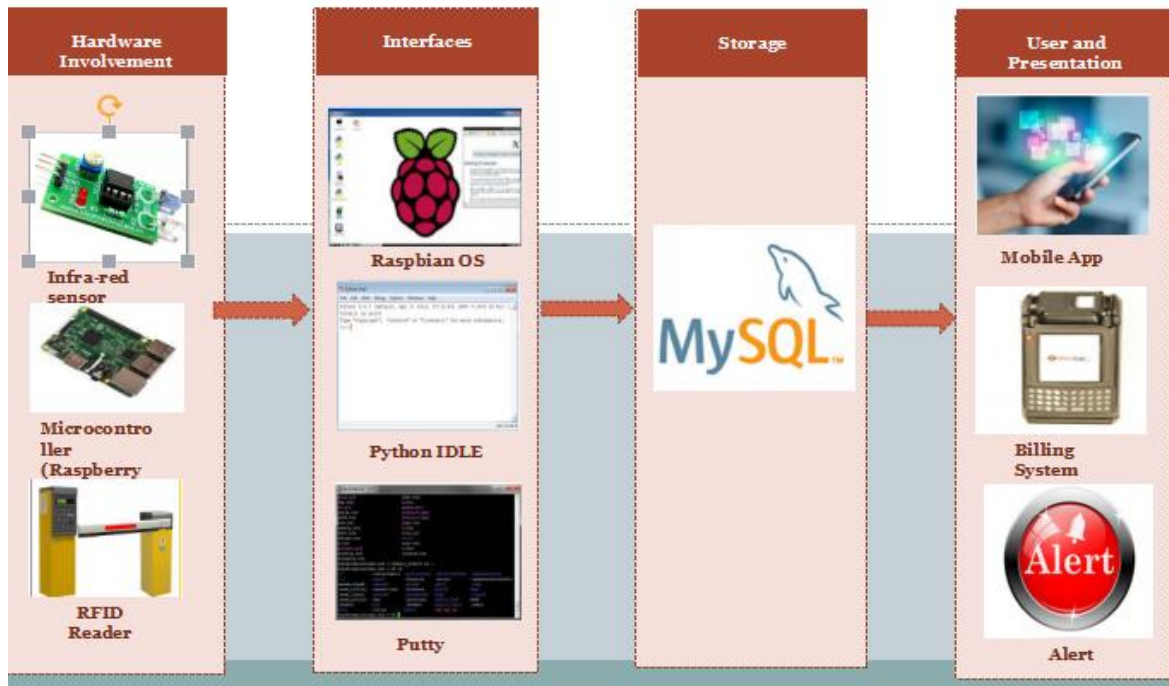


Figure 1: Detailed Design

B. Use Case Diagram

There are 3 main actors in our use case as shown in figure 2.

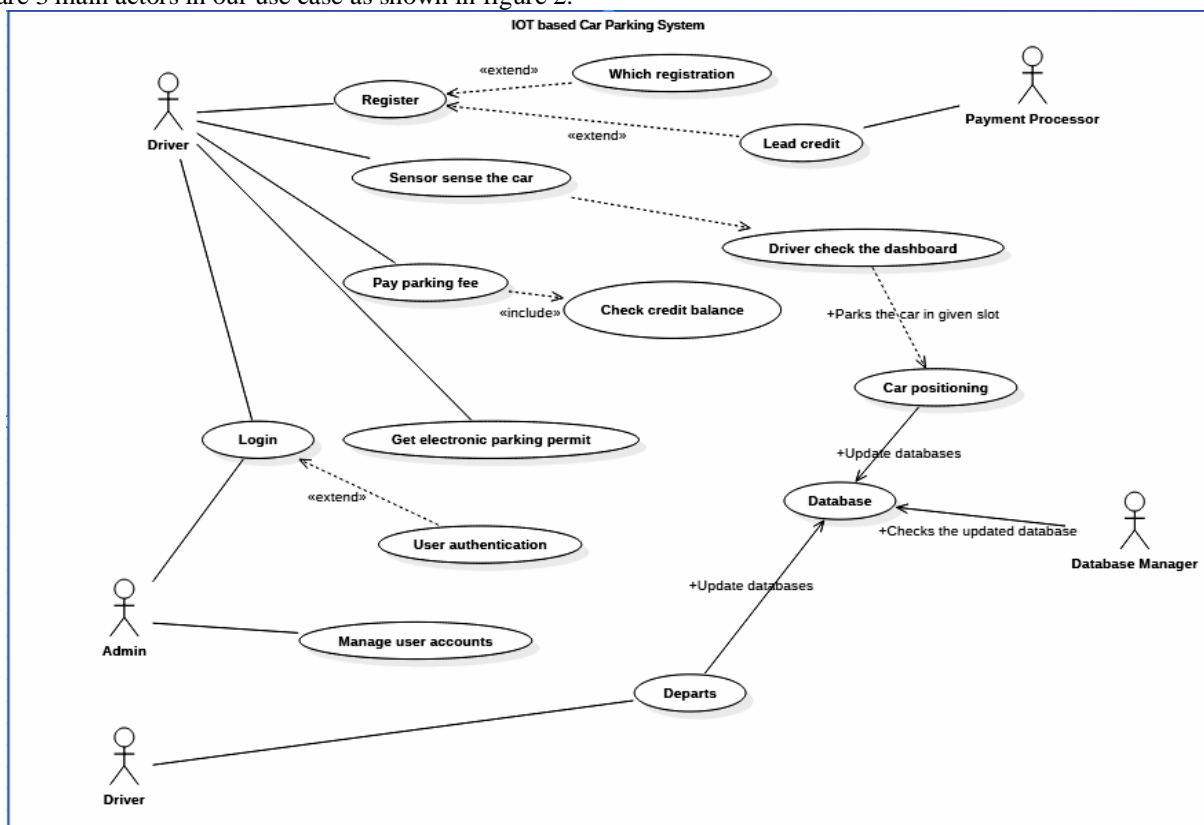


Figure 2: Use Case Diagram

- Driver: whose major roles are
 - a. To register into the application when used first time.
 - b. To login (if already a user)
 - c. To pay the payment for the services used
- Admin: whose major role is to manage the account
- Database Manager: who needs to manage the transactions happened and maintain backup (in case of any loss)

C. Class Diagram

We have defined two classes, namely User Information and Booking Information as shown in figure 3.

- **User Information** stores all the information about the user i.e. login credentials such as username, password etc.
- **Booking Information** contains the information regarding the booking such as the unique booking Id and other booking details.

The class is further classified into subclasses i.e. Private Car, Micro, SUV, Two Wheeler.

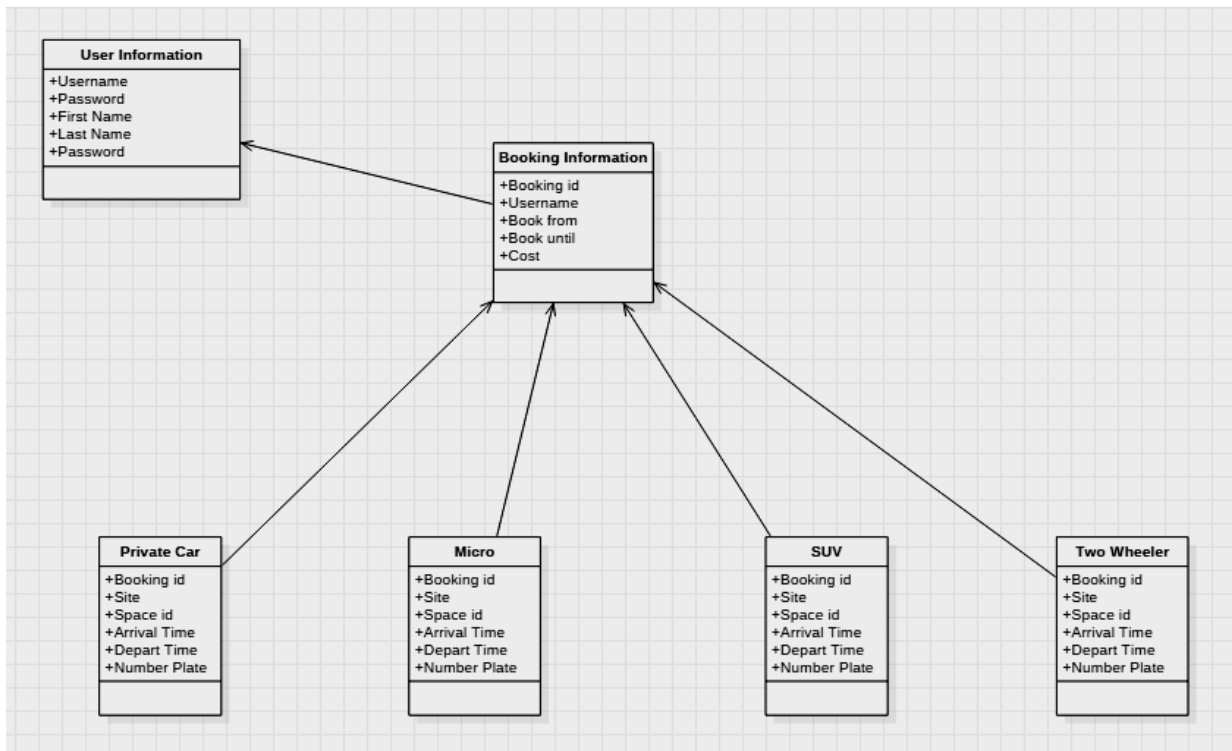


Figure 3: Class diagram

D. Sequence Diagram

Sequence diagram basically describes the interaction among objects (sequential order) as shown in Figure 4 and 5.

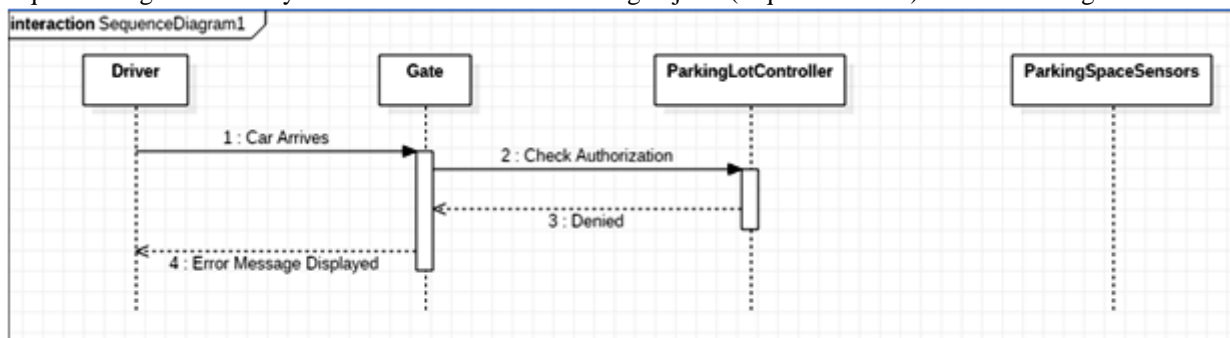


Figure 4: Sequence diagram

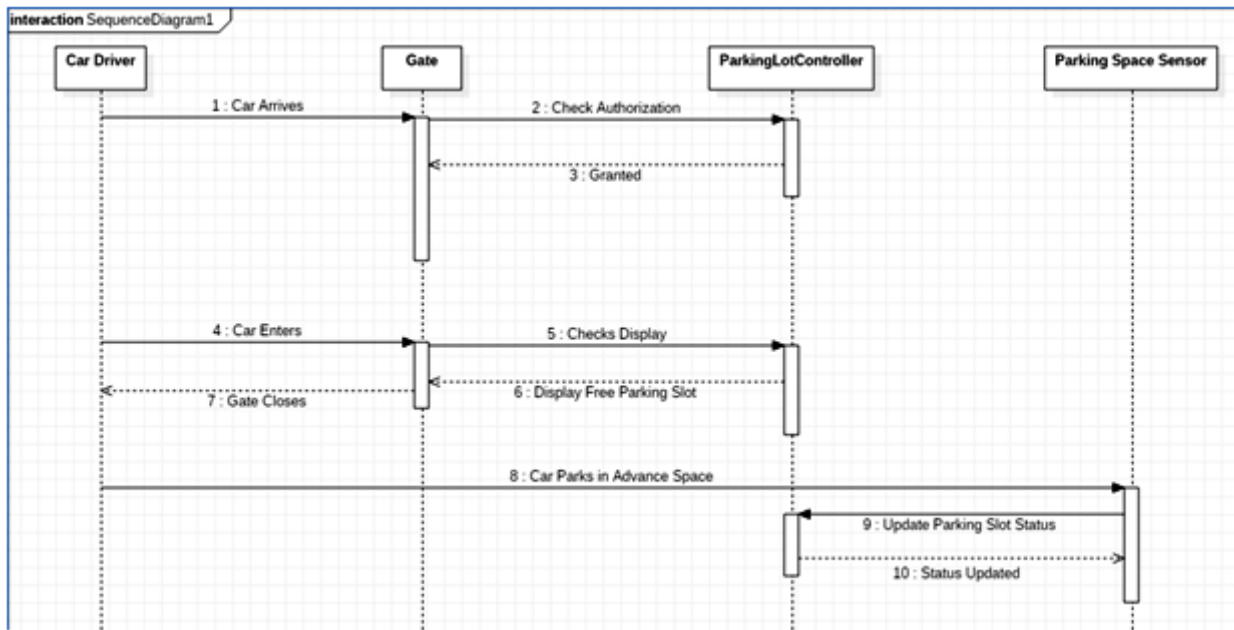


Figure 5: Sequence diagram

- Entry Case: When a car attempts to enter, the system checks for an available slot. If not found, the car is denied entry. Else, the car is allowed entry and the system suggests the nearest available slot.
- Exit Case: When a car attempts to leave the parking, the system detects which slot has been most recently emptied and makes the requisite changes in the database.

IV. RESULTS

A. User Interface Representation

The user interface and parking slot status information is shown as per figure 6 and 7 respectively.

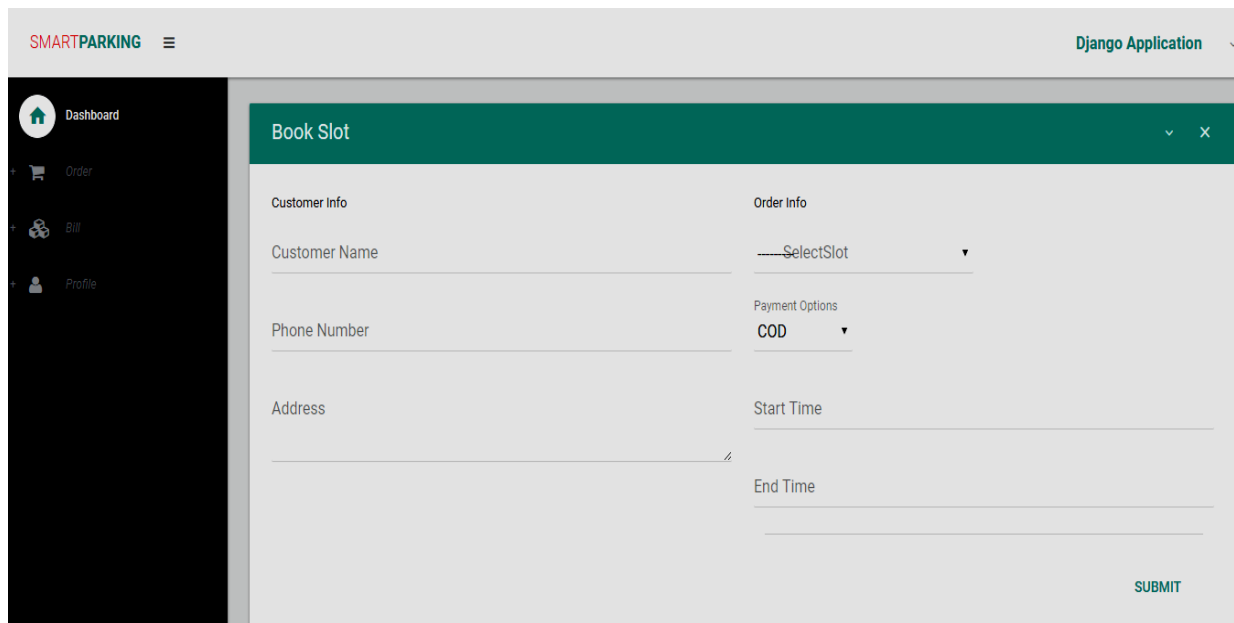


Figure 6: User interface

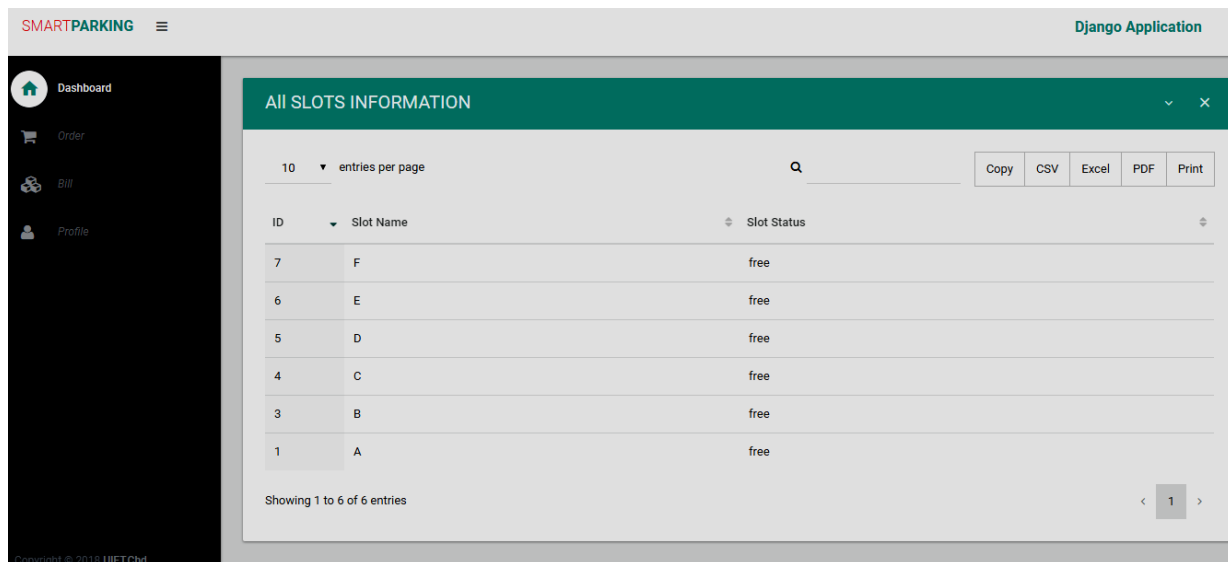


Figure7: All slots-status Page

B. Snapshots of System

The snapshot of the parking system is shown in figure 8.

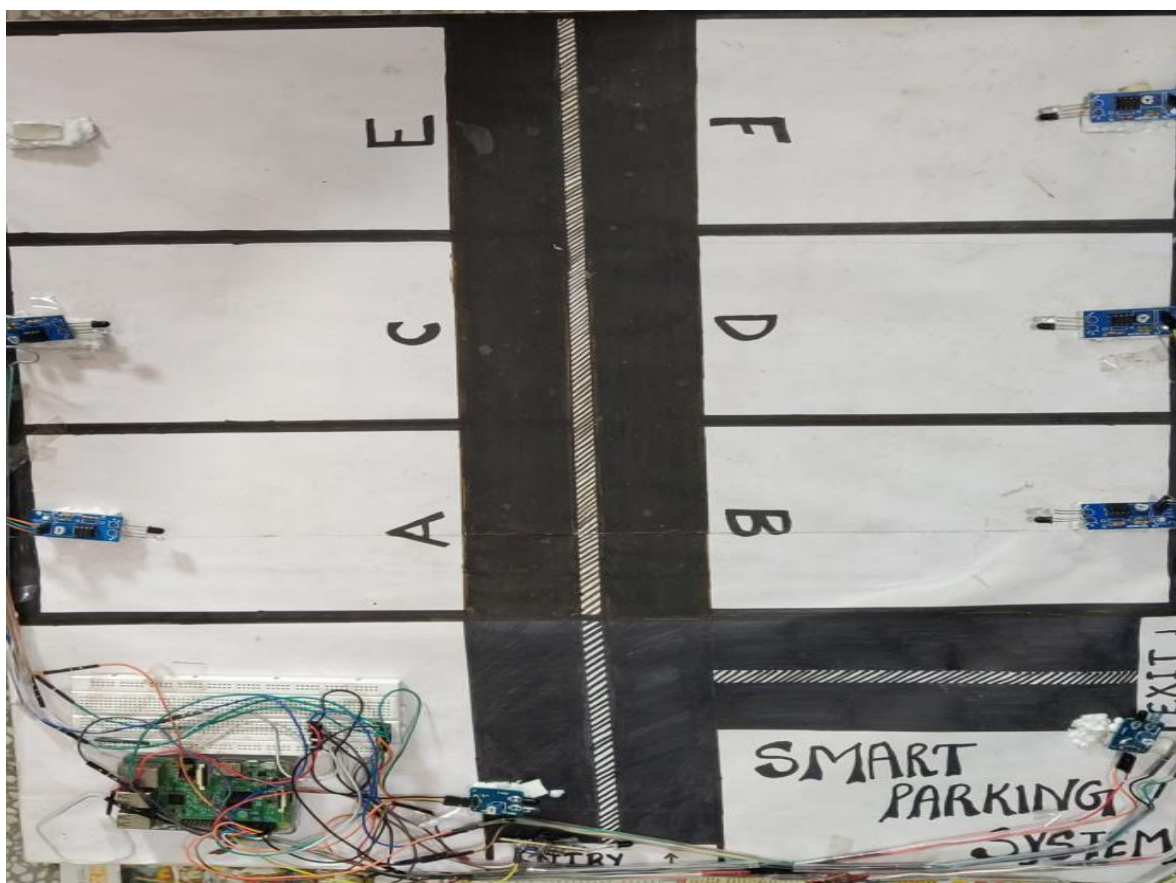


Figure 8: Complete View of Parking System

The figure 9 shows the entry and exit sensors installed at the parking system. The complete circuit diagram using Raspberry Pi implemented on Breadboard is shown in figure 10.

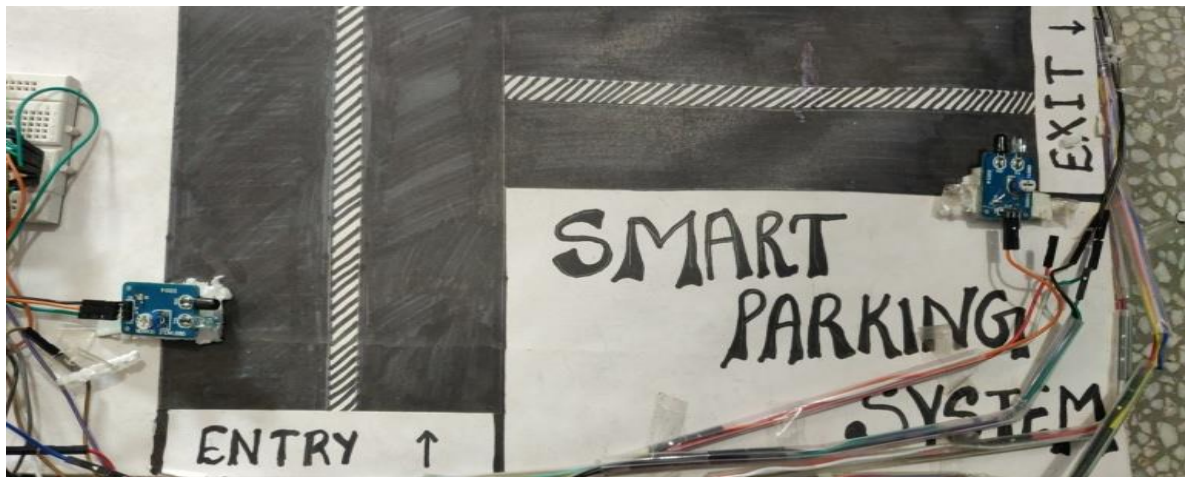


Figure 9: Entry and Exit sensors

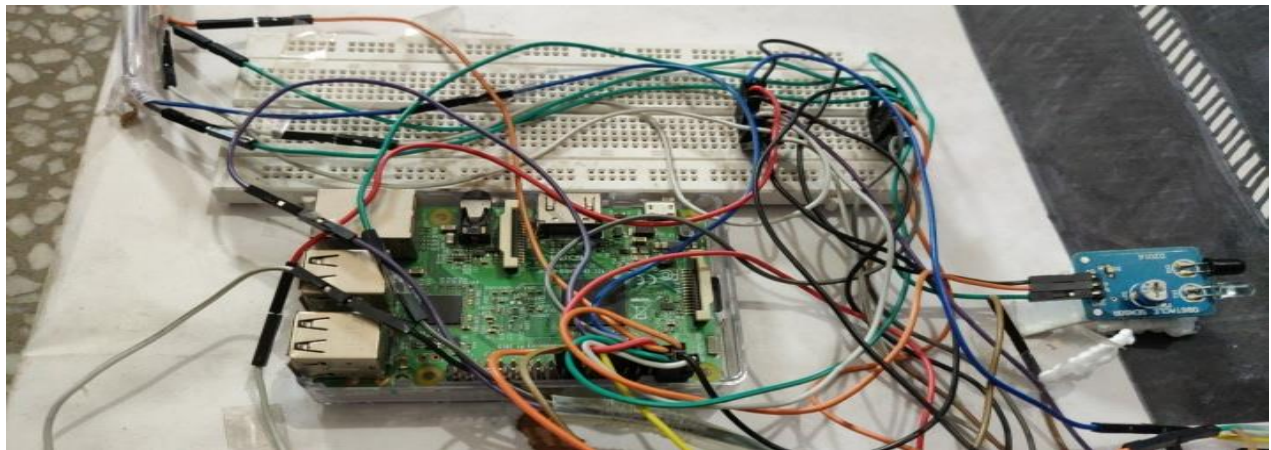


Figure 10: Raspberry Pi and Breadboard

V. CONCLUSION AND FUTURE SCOPE

This system can be implemented in the places where the parking is the main concern such as the bus stand, railway station, metro stations, shopping malls and institutions etc. Also, it can be made more users friendly by providing the android interface in which user can book the parking slot in advance when the user is in the range of the parking area. This can lead to a better traffic management. Additionally, the manual parking can be upgraded by replacing the human with the accelerator technique in such a way that the driver will get a notification with a unique slot ID, where they can locate their car. This can automate the smart way to this system from the entry of car to the exit of car with minimal human interaction

REFERENCES

- [1] Gubbi, J., Buyya, R., Marusic, S., & Palaniswami, M. (2013). Internet of Things (IoT): A vision, architectural elements, and future directions. *Future generation computer systems*, 29(7), 1645-1660.
- [2] Lee, I., & Lee, K. (2015). The Internet of Things (IoT): Applications, investments, and challenges for enterprises. *Business Horizons*, 58(4), 431-440.
- [3] Rao, Y. R. (2017). Automatic smart parking system using Internet of Things (IoT). *Int. J. Eng. Tech. Sci. Res*, 4, 2394-3386.
- [4] Khanna, A., & Anand, R. (2016, January). IoT based smart parking system. In *Internet of Things and Applications (IOTA), International Conference on* (pp. 266-270). IEEE.
- [5] Bao, F., & Chen, I. R. (2012, September). Dynamic trust management for internet of things applications. In *Proceedings of the 2012 international workshop on Self-aware internet of things* (pp. 1-6). ACM.
- [6] Forcier, J., Bissex, P., & Chun, W. J. (2008). *Python web development with Django*. Addison-Wesley Professional.
- [7] Holovaty, A., & Kaplan-Moss, J. (2009). *The definitive guide to Django: Web development done right*.
- [8] Zhao, C. W., Jegatheesan, J., & Loon, S. C. (2015). Exploring iot application using raspberry pi. *International Journal of Computer Networks and Applications*, 2(1), 27-34.
- [9] Maksimović, M., Vujović, V., Davidović, N., Milošević, V., & Perišić, B. (2014). Raspberry Pi as Internet of things hardware: performances and constraints. *design issues*, 3, 8.
- [10] Kumar, R., & Rajasekaran, M. P. (2016, January). An IoT based patient monitoring system using raspberry Pi. In *Computing Technologies and Intelligent Data Engineering (ICCTIDE), International Conference on* (pp. 1-4). IEEE.