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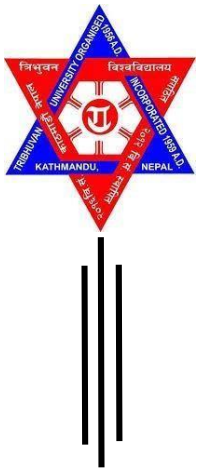

A Final Year Project Report

On "INTELLIGENT ANDROID MONITORING SYSTEM FOR CAR PARKING"

A Final Year Project Report submitted to the partial fulfillment of the requirements for the degree of Bachelor of Science and Information Technology awarded by Tribhuvan University.

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Letter of approval

This is to certify that this project prepared by **Sanjay Aryal, Shailesh Acharya, Nirmal Adhikari and Pashupati Baniya** entitled " **INTELLIGENT ANDROID MONITORING SYSTEM FOR CAR PARKING** " in partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Information Technology has been well studied. In our opinion, it is satisfactory in the scope and quality as a project for the required degree.

Signature of Supervisor …….	Signature of HOD/ Coordinator …….
Signature of Internal Examiner …….	Signature of External Examiner …….

Butwal Multiple Campus

Tribhuvan University

Supervisor's Recommendation

I hereby recommend that the project prepared under my supervision by **Sanjay Aryal, Shailesh Acharya, Nirmal Adhikari and Pashupati Baniya** entitled "**INTELLIGENT ANDROID MONITORING SYSTEM FOR CAR PARKING** "in partial fulfillment of the requirements for the degree of Bachelor of Science in Computer Science and Information Technology to be processed for the evaluation.

……..

Madhav Kahar Goud

Supervisor / Lecturer

Acknowledgment

It gives us immense pleasure to express our deepest sense of gratitude and sincere thanks to our highly respected and esteemed guide **Madhav Kahar Goud** for his valuable guidance, and encouragement in making this project possible. His constructive suggestions regarding this project work and consistent support are sincerely acknowledged. We would like to express our sincere thanks to **Sunil Kumar Yadav**, Head of Department CSIT for supporting us.

Finally, we would like to express our sincere thanks to all our friends and all those who supported us directly or indirectly during this project work and make this project a successful one.

Abstract

The purpose of this project is to track and manage the occupancy of a parking garage and allow customers to find and reserve available parking places. The system-as-is can be described as follows. Conventionally, car parking systems do not have any intelligent monitoring system. Parking lots are monitored by human beings. All vehicles enter the parking and waste time searching for a parking slot. Sometimes it creates a blockage. The condition becomes worse when there are multiple parking lanes and each lane have multiple parking slots. Use of the automated system for car parking monitoring will reduce human efforts. The display unit is installed on the entrance of parking lot which will show LED Panel for all Parking slot and for all parking lanes. The empty slot is indicated by the respective glowing LED Panel. Using this system, a user will be will able to find an available parking lot easily using mobile or web app from anywhere. The system will update parking data every time it changes.

List of Devices Used in This Project

Sensor

A sensor is a device used to measure a property, such as pressure, position, temperature, or acceleration, and respond with feedback. TE Connectivity (TE) is a global technology leader, providing sensors and connectivity essential in today's increasingly connected world.

Figure 1: Sensor

In this project sensors are used as a detecting car and it will show all the available parking slots according to its sensing capability.

Connectors

They are used for connecting sensor and display monitor to the grid board.

Figure 2: Connectors

Arduino

Arduino is an open-source hardware and software company, project and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices.

In this project, Arduino is used for connecting sensors and connectors to the display monitor.

Figure 3: Arduino

Raspberry pi

The Raspberry Pi is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. It is a capable little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python.

Figure 4: Raspberry Pi

In this project, Raspberry pi is used for connecting Arduino and computer monitor to display the sensor data.

LCD monitor

It is used to display the data in a monitor. In this project, LCD monitor is used for displaying sensor data on a monitor.

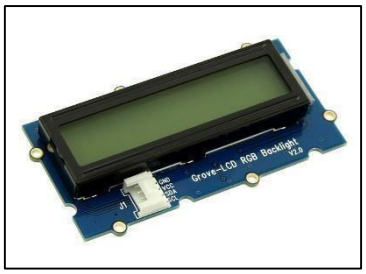

Figure 5: Monitor

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List of Abbreviations

API	Application Program Interface
DFD	Data Flow Diagram
ER	Entity Relationship
ICT	Information and Communication Technology
IOT	Internet of Things

Chapter 1

Introduction

1.1 Introduction

The purpose of this project is to track and manage the occupancy of a parking garage and allow customers to find and reserve available parking places. The system-as-is can be described as follows. Conventionally, car parking systems do not have any intelligent monitoring system. Parking lots are monitored by human beings. All vehicles enter the parking and waste time searching for a parking slot. Sometimes it creates a blockage. The condition becomes worse when there are multiple parking lanes and each lane have multiple parking slots. Use of the automated system for car parking monitoring will reduce human efforts. The display unit is installed on the entrance of parking lot which will show LED Panel for all Parking slot and for all parking lanes. The empty slot is indicated by the respective glowing LED Panel. Using this system, a user will be will able to find an available parking lot easily using mobile or web app from anywhere. The system will update parking data every time it changes.

Some key points of this project will be as follows:

- It will save time as it allows a number of the car owner to indicate the available parking lots.
- Using this system, a user will be able to find an available parking lot easily using mobile or web app from anywhere.
- It will somehow help in eradicating the parking congestion.
- Users will be able to interact with the monitor (LED panel) to know the availability.
- Ultrasonic distance sensor will help the user to know the exact location of parking.

1.2 Problem Definition

Intelligent Android Monitoring Parking System project will be the solution of drawbacks that where occurred in the traditional parking system. This project will help to provide the efficient, effective and speedy way of parking and maintaining the space. There are several problems that will be solved by this project for reliable parking.

- Drivers waste time, fuel and energy searching for parking, whether it be on city streets or in parking lots. Using Intelligent Monitoring System for Parking Lots can minimize this problem by displaying the available slots in LED panel.

- Compared to conventional parking facilities, Intelligent Parking Systems require an area approximately 70% smaller and a 50% smaller volume on average to park an equivalent number of cars. This gives the parking garage developer lots more options such as adding more parking spaces, utilizing more area for non-parking purposes or green spaces, etc.

- Car parking and parking garage development often have a direct effect on the feasibility of a real estate project. The design flexibility of Intelligent parking Systems can help in terms of both feasibility and profitability by enabling parking to be located in areas where conventional parking won't fit.

- Intelligent Parking Systems can reduce CO2 emissions by 85% or more by eliminating the need for cars to drive and idle while searching for parking spaces.

- The safety and security of cars, drivers, and pedestrians are always a priority for parking garage development projects. Compared to conventional parking garages, Intelligent Parking Systems are inherently much safer and more secure because they handle driving and pedestrians very well in the parking area.

1.3 Objectives

Intelligent Parking Solutions use of the full potential of digitization: smart sensors, intelligent software and clever analysis of the available data. But what are the objectives of Intelligent Monitoring system?

The objectives of the Intelligent Android Monitoring System For Car Parking will be explained in this project.

- To reduces the time spent by the driver searching for an open parking space.
- To minimize the parking congestion.

1.4 Scope and Limitation

Every project has their own scope and limitations, some of which are discussed below:

1.4.1 Scope

The scope of this project is very broad in terms of another traditional parking system.

- This project can be used for a parking system in any shopping mall, multiplex.
- Can be used for industries, commercial offices, and educational institutes.
- Number plate recognition can also be added to enhance the security of parking lots.
- Space conservation
- Easily extendable to more levels with few modifications.
- In the future, this system or technique will be the one which is used in every industry and even in household apartments.

1.4.2 Limitations

Although there are various scopes, the project has some limitations also which are as follows: -

- Driver or owners who don't know about some term such as a row, the column may find some difficulties.
- In the case of a system crash, the user has to manually locate slots.
- Parking lots also tend to be subject to contamination.

1.5 Features of Project

This project is targeted to both offline and online users. Online users can access data by using the android application. Offline users need to visit the parking area to know the available slots whereas android users can directly know the available space in their smartphone.

The main features of the project are described below:

- Well-designed interface viewable in any resolution and easy user interaction.
- It can be used by both offline and online users.
- Helps in controlling the parking congestion.
- A project can be implemented in any organization and can be extended according to users bases.

1.6 Report Organization

- In chapter 1, we have introduced why our system is built and condition of old and manual systems which are not reliable. And also, the objectives and features of the project are explained in detail with the scope and limitation of the system.
- In chapter 2, we have discussed the existing system along with requirement as well as feasibility analysis of the system. The data modeling and process modeling technique are used to give information about the system requirement.
- In chapter 3, we examined the system design. The system design can be a database schema design, interface design, and process design.
- In chapter 4, we studied which tools are used on our project to make it possible. The testing is also explained in this part with detailed tabular input and output.
- In chapter 5, we have discussed the maintenance and support implemented on the project.
- In chapter 6, we had explored the conclusion and future enhancements of the project.

Chapter 2

Requirement Analysis and Feasibility Study

2.1 Literature Review

We did an overall research on the topic and have read through several articles that raise the same issues in our problem domain.

Sources for this section are mentioned in the reference section.

The current transportation infrastructure and car parking facilities are deemed insufficient in sustaining the influx of vehicles on the road.

The industrialization of the world, increase in population, slow paced city development and mismanagement of the available parking space has resulted in parking related problems. There is a dire for a secure, intelligent, efficient and reliable system which can be used for searching the unoccupied parking facility, guidance towards the parking facility, negotiation of the parking fee, along with the proper management of the parking facility.

The smart parking system implemented mainly in the Europe, United States and Japan is developed with the incorporation of advanced technologies and researches from various academic disciplines. With its deployment in the car parking, it is hoped that it would solve the aforementioned problems faced by the patrons within the car parking.

The smart parking system is considered beneficial for the car park operators, car park patrons as well as in environment conservation. For the car park operators, the information gathered via the implementation of the Smart Parking System can be exploited to predict future parking patterns. In terms of environment conservation, the level of pollution can be reduced by decreasing vehicle emission (air pollutant) in the air. This can be attributed to the fact that vehicle travel is reduced. As fuel consumption is directly related to vehicle miles travelled, it will be reducing as well.

Patrons are also able to benefit from smart parking system as parking space are able to be fully utilized with a safer, optimized and more efficient system implemented; The system is made more efficient as vehicle travel time and search time are significantly reduced due to the information provided by the smart parking system.

With the information provided, drivers are able to avoid car park that are fully occupied and locate vacant parking spaces with ease elsewhere.

The number of vehicles parked illegally by the roadside which leads to traffic congestion is also reduced as it is absorbed into the car parks. Most importantly, traffic

congestion can be reduced. All this would eventually lead to convenience for the patrons.

2.2 Requirement Analysis

The requirement includes both functional and non- functional requirements:

2.2.1 Functional Requirements

Description-We will use an android app for checking the presence of the car on the parking slot.

State-The Android Application Main Page showing empty parking slots.

Input-Positioning a car on parking slot.

Output- Occupied parking slot and empty slot with different colors are marked on the app.

Processing-When cars are sensed on the slots using IR object sensors, the data will be sent over from GSM module using Arduino and will be received by the cloud. The data will, therefore, be fetched on android application.

2.2.2 Non-Functional Requirements

Interface Issue-The user-interface is designed in a way that any user can use the application comfortably and with ease, after all, aesthetic appeal is what keeps the users glued to the application.

Accuracy-It was taken great care of when creating the application, that the requirements were met precisely and no loophole in the system had gone unnoticed.

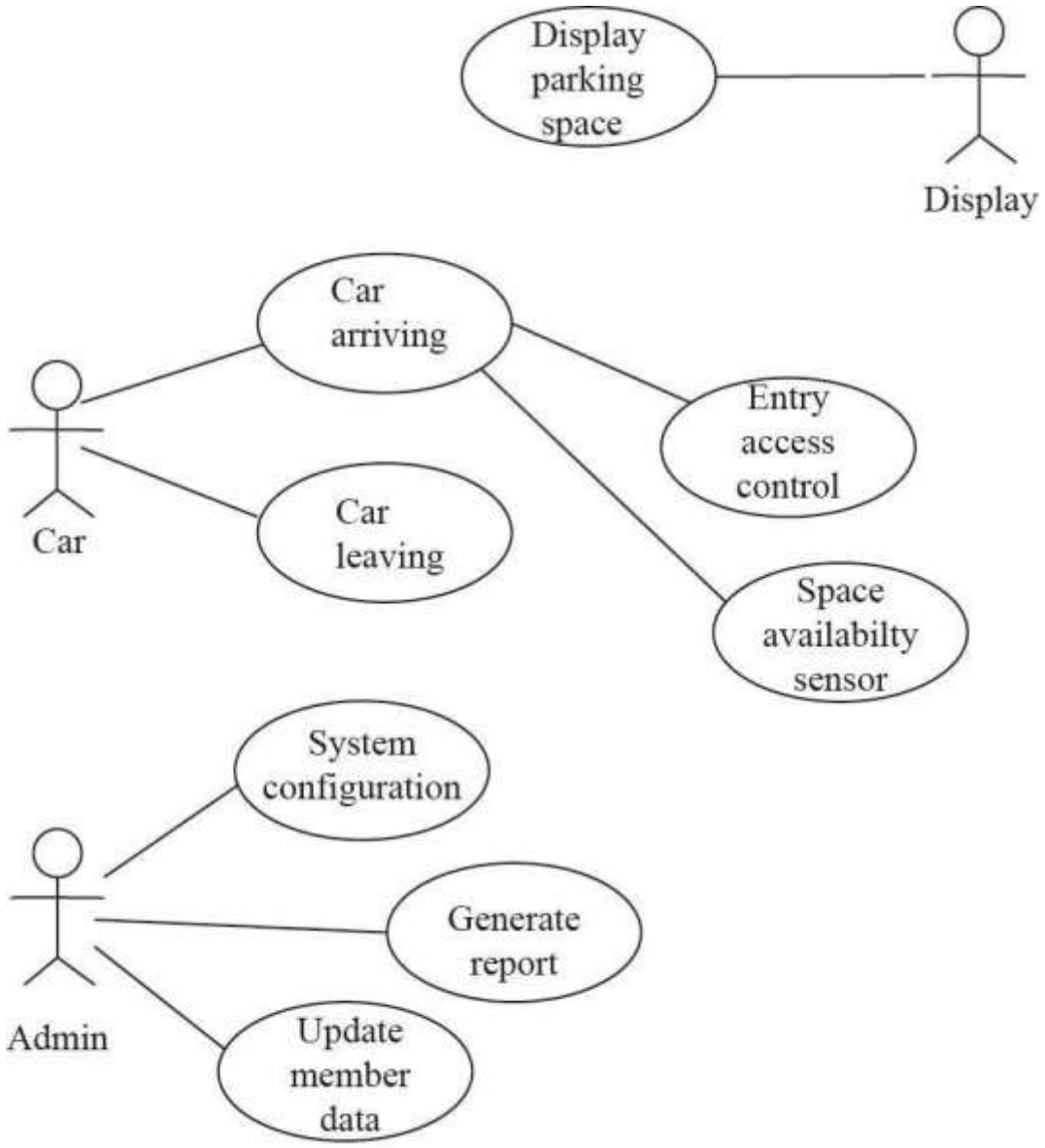


Fig 1: Use case diagram

2.3 Feasibility Analysis

2.3.1 Technical

The system is technically feasible to implement. The compatible platform exists within our domain. The technology guarantees reliability, accuracy and data security. Both at the development site and at the user. The system will be compatible with many other projects such as number plate scanning project. The system experience can be further enhanced by developing the mobile as well as a website platform application to pre-check and find the slots.

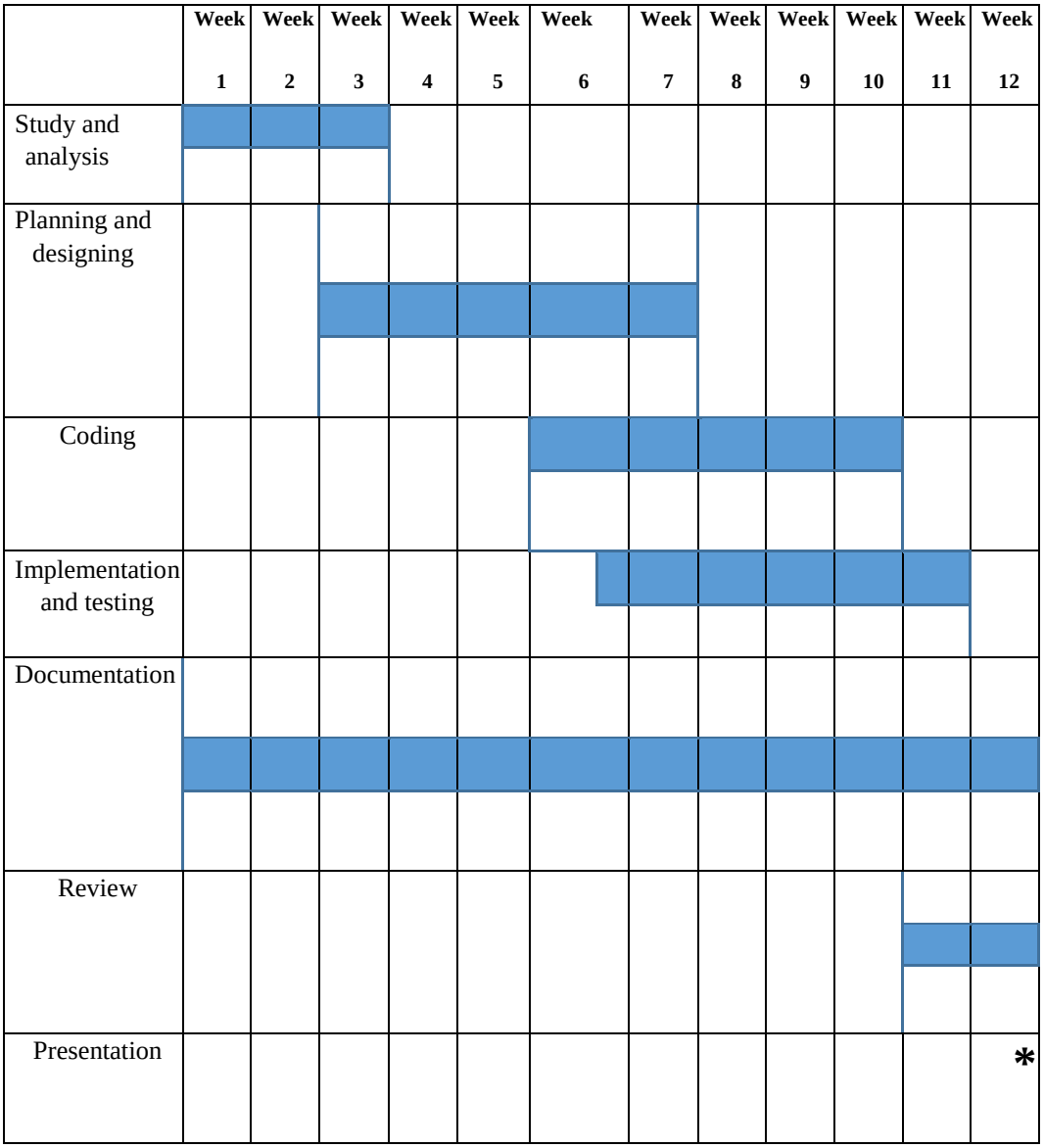
2.3.2 Operational

- Customer satisfaction is guaranteed by this system.
- No major training and new skills are required as it is not the complicated model.
- It will help in the time saving by providing a quick parking location.
- Reduce employees by handling all the work through the computer.
- Saves money by reducing employees and increase quality.

2.3.3 Economical

The system is economically feasible to implement. There is no need for expensive hardware components and paid software to build the system. Users even do not need any computing device to use the service.

Fig.2: Gantt Chart



The figure above shows the schedule of the project with the major phases. Initially, the requirements for the systems were gathered and analyzed properly. Later the system designing, user interface designing, and database designing were done. The coding phase was the longest phase of the project life cycle. The testing was done corresponding with the implementation so that changes can be done at the same time. The documentation of the system was carried out from the starting of the project.

2.4. Structuring System Requirements

2.4.1 Data Modeling:

A data model is a detailed model that captures the overall structure of data in an organization.

Entity-Relationship (E-R) diagram are commonly used in data modeling.

• ***E-R Diagram***

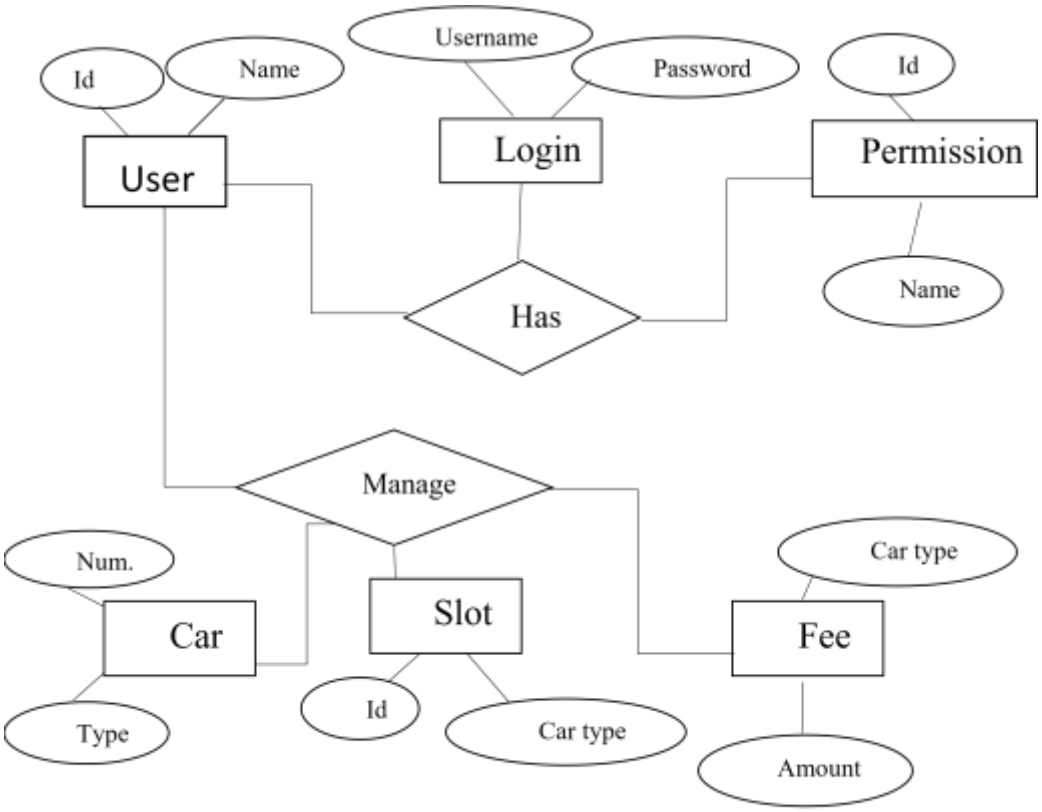


Fig 3: ER diagram of car parking

ER-Diagram is a data modeling technique that graphically illustrates an information system's entities and the relationships between those entities.

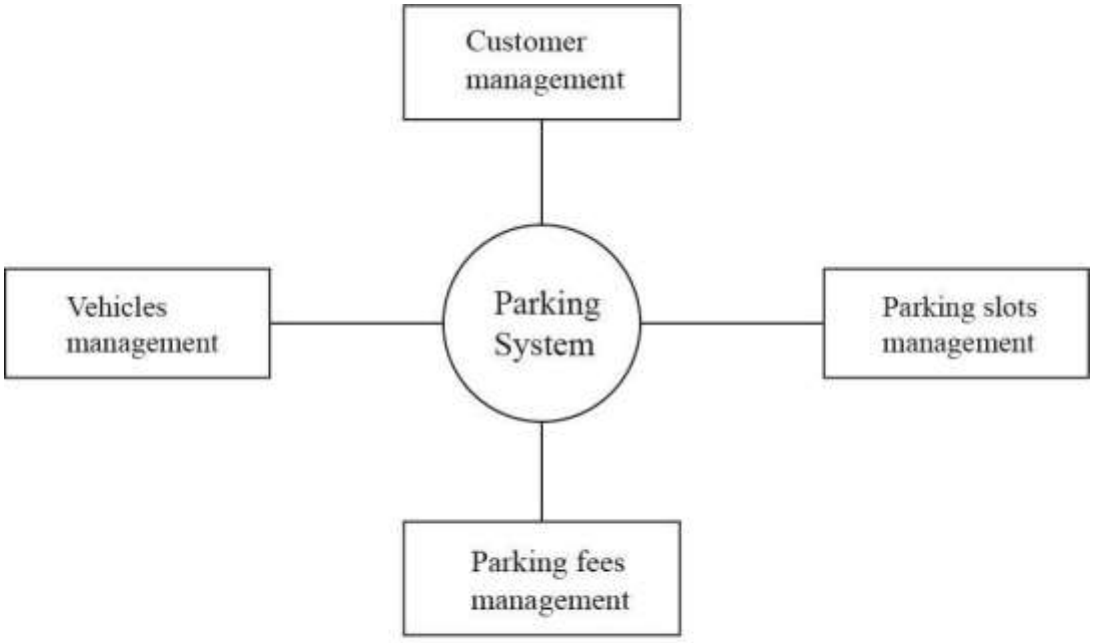
2.4.2 Process Modeling

Process modeling graphically represents the process that capture, manipulate, store, and distribute data between a system and its environment and among system components. Each process transforms inputs into outputs.

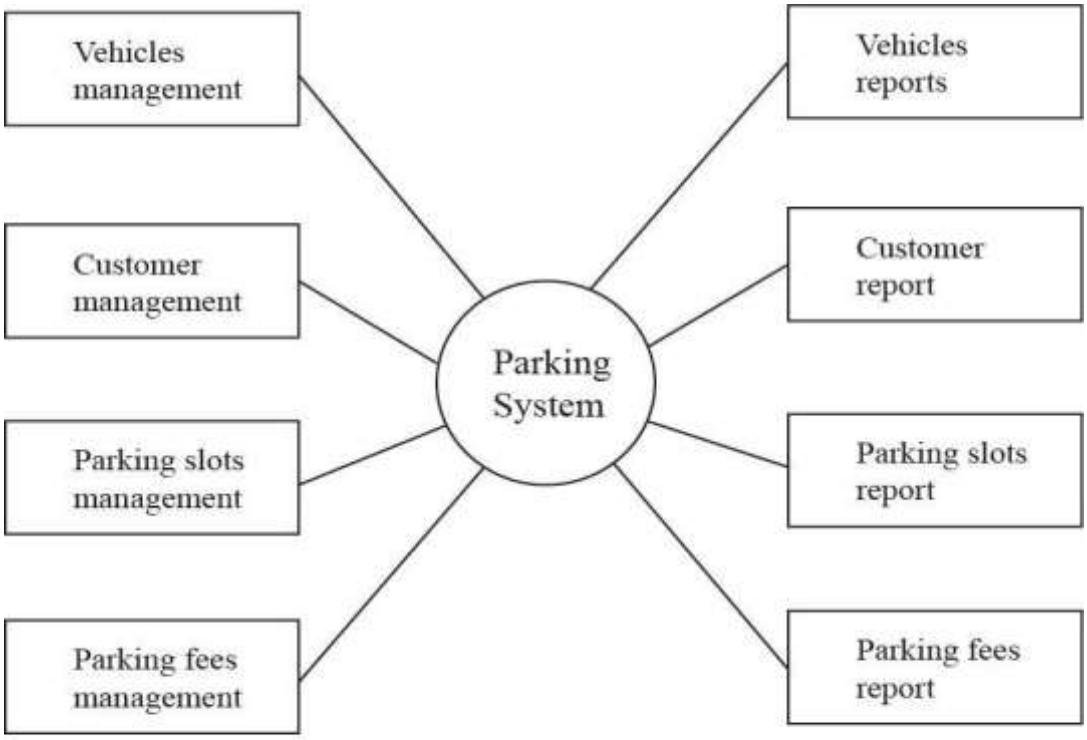
Data Flow Diagram (DFD) is commonly used in process modeling.

• ***DFD***

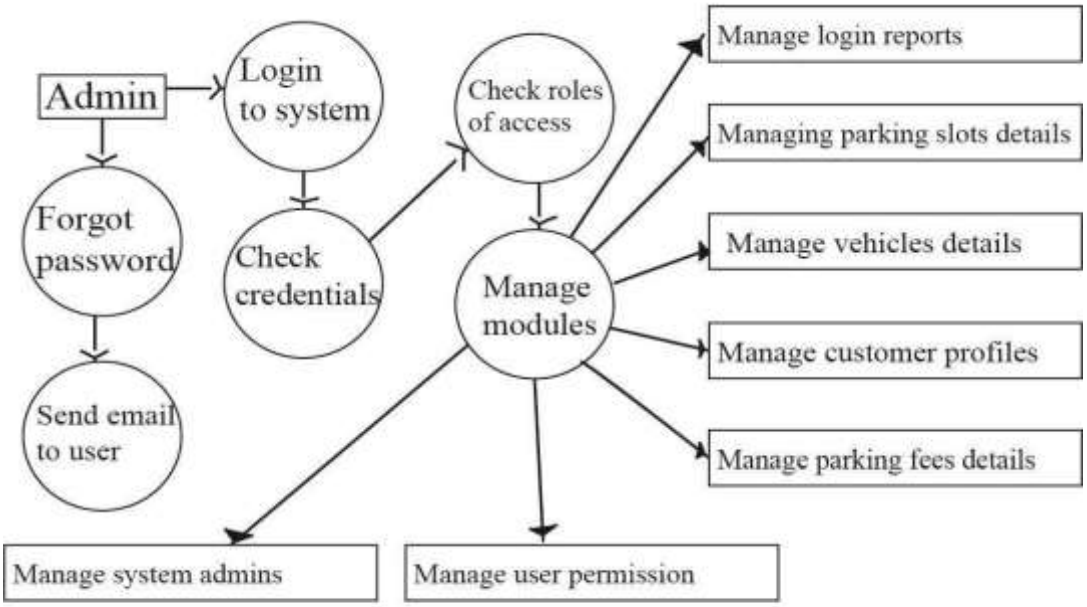
A DFD is a pictorial representation of the movement of data between entities and the processes and data stores within a system. They can be used to analyze an existing system or model.



Zero level DFD - Parking system



First level DFD - Parking system



Second level DFD - parking system

Fig 4: Data flow diagram

Chapter 3

System Design

3.1 Database Interface Design

A database schema represents the logical configuration of all or part of a relational database. It can exist both as a visual representation and as a set of formulas known as integrity constraints that govern a database. Those formulas are expressed in a data definition language, such as SQL. As part of a data dictionary, a database schema indicates how the entities that make up the database relate to one another, including tables, views, stored procedures, and more.

3.1.1 User Interface Design

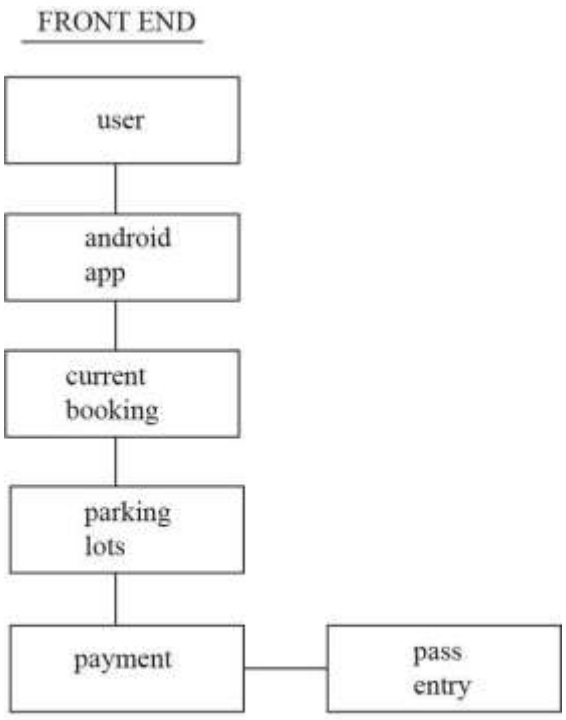


Fig 5: structure of user interface

The front-end design is the interface which appears when the users are browsing the website. The front end provides the login and registration service to access different services. The user can request for slots after login to the system using request car parking form. The user can message the admin and view the nearby car parking location.

3.1.2 Admin Panel Design

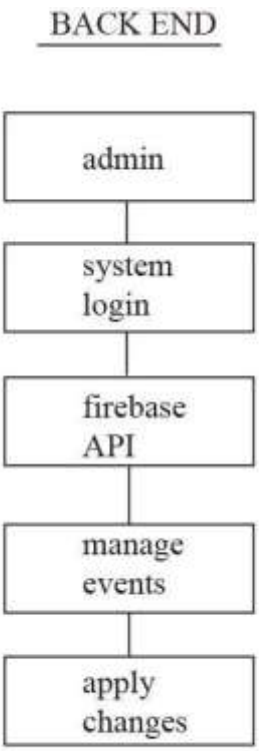


Fig 6: structure of admin panel

Admin Panel is the interface where administrations and other site officials with appropriate privileges can manipulate the content of the website. The admin can view and arrange user information.

Chapter 4

Implementation and Testing

4.1 Implementation

The implementation phase is one of the important phases of project development. In this phase, we implement our conceptual design into the working program by using various tools. The successful implementation of the project is nearer steps towards the project completion. Project implementation was not an easy step to us as we encountered various issues related to the programming logic as challenges.

Our project is completely based on the V model so if the requirement changes then there is no big deal in changing the system's part. The application should maintain a database that contains the list of available space in parking slots. Whenever there is slots request, the system searches the database for the list of available slots. Then, the customer will park his vehicles on that empty place.

4.1.1 Overview of Development Methodology

System "Intelligent Android Monitoring System for Car Parking" is developed based on the V Model. The first phase of the V model is a business need and it falls under the category of requirement analysis and gathering. After gathering the requirements feasibility study of the system was studied. After feasibility, we start designing the entire system as per the requirement. When the designing is done, we start creating the module for each component. The creating of a module is done in the coding part. Once coding is done, we start testing the individual modules and testing is known as unit testing. Unit testing of each component must be done and are completed. In unit testing, we should test the individual modules. Once unit testing is completed, we start integrating the system that is linked with each other. Once the whole system is integrated, we start the integration testing. For example, we test whether our application shows the available slots to every user who searching for a vacant area to park his/her vehicle. Once the integration testing is done, we test the whole system and make sure whether the overall system is working correctly or not. During the coding and testing phase, we found many errors while conducting the project. To minimize such errors, the V model is used for development as we can do the verification and validation of the system together.

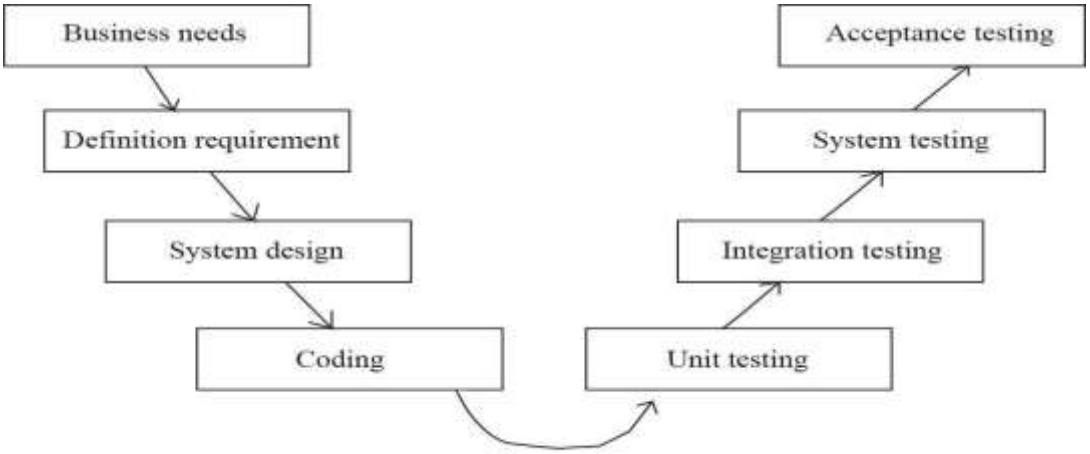


Fig 7: V-model of development

4.1.2 Tools Used Front end

- Android User Interface is used to access the available slots in the parking area when the user is online.
- The monitor is used to display available slots when the user is offline.

Back end:

- Google Firebase was used for creating and managing the database.
- Google MIT app inventor (Kodular).

Documentation Tools:

- Adobe Illustrator was used for designing of:
  - Data flow diagram
  - ER diagram
  - Use case diagram
- MS Word was used for creating a Gantt Chart.
- MS Word was used as a text editor for the documentation process.

4.2 Testing

The testing phase can be carried out manually or by using automated testing tools to ensure each component works fine. After the project is ready, we tested its various components in terms of quality, performance to make it error-free and remove any sort of technical jargons. The testing phase can be carried out manually or by using automated testing tools to ensure each component works fine.

4.2.1 Unit Testing

During the coding phase, each individual module was tested to check whether it works properly or not.

Different errors found during unit testing were debugged. Some of the major test cases are listed below:

Test Case No: 01

PURPOSE	Search for free parking slots in the parking area
INPUT	Park a car on parking slots
EXPECTED OUTPUT	The occupied slot will not be displayed with a different color than that of empty slot on the relevant application

Test Case No: 02

PURPOSE	Search for free parking slots in the parking area
INPUT	Remove a car from a parking slot
EXPECTED OUTPUT	The free slot will be displayed with different color than that of empty slot on the relevant application

4.2.2 Integration Testing

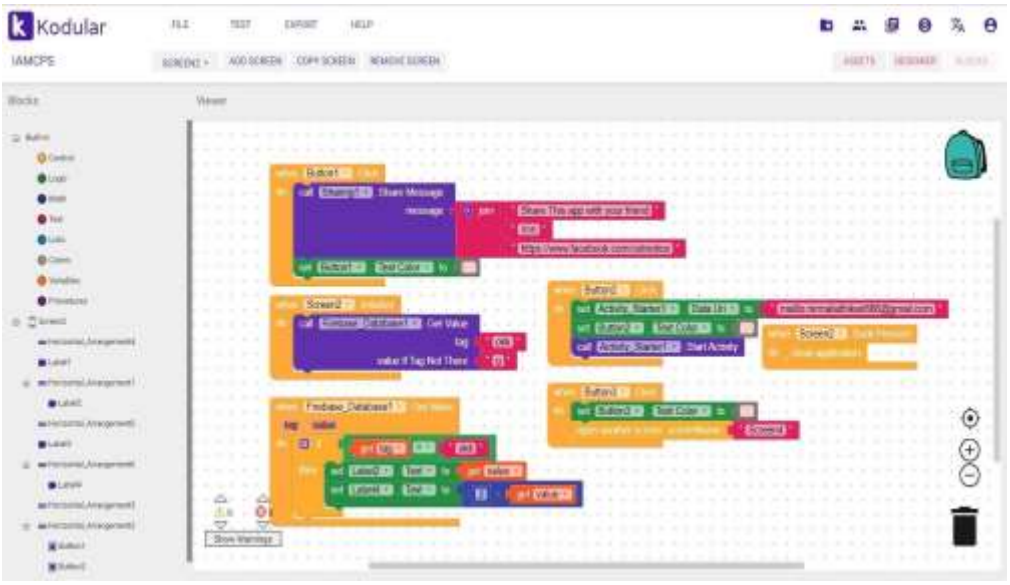
Integration testing was done after unit testing by combining different individual modules.

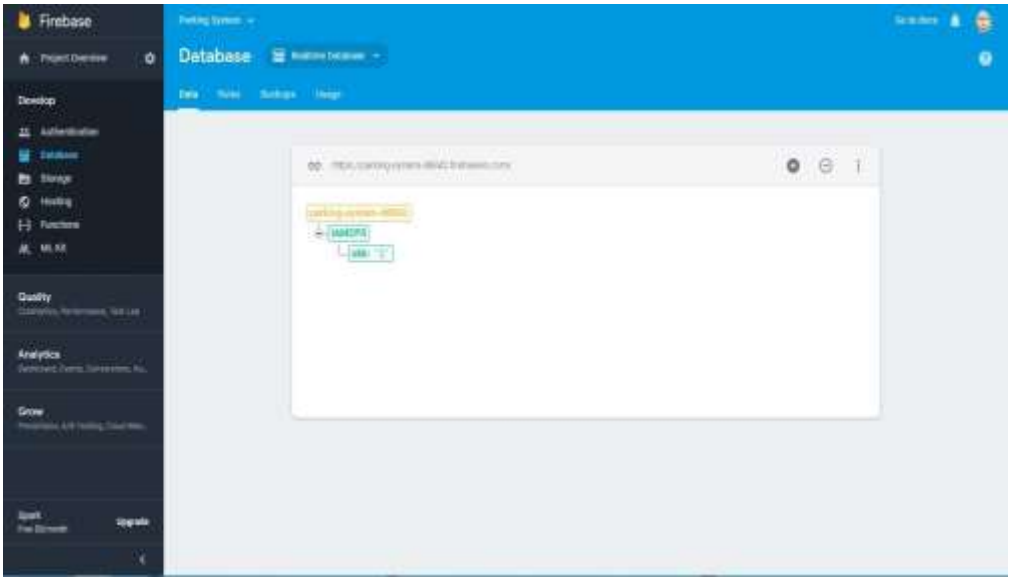
Some of the major test cases are listed below:

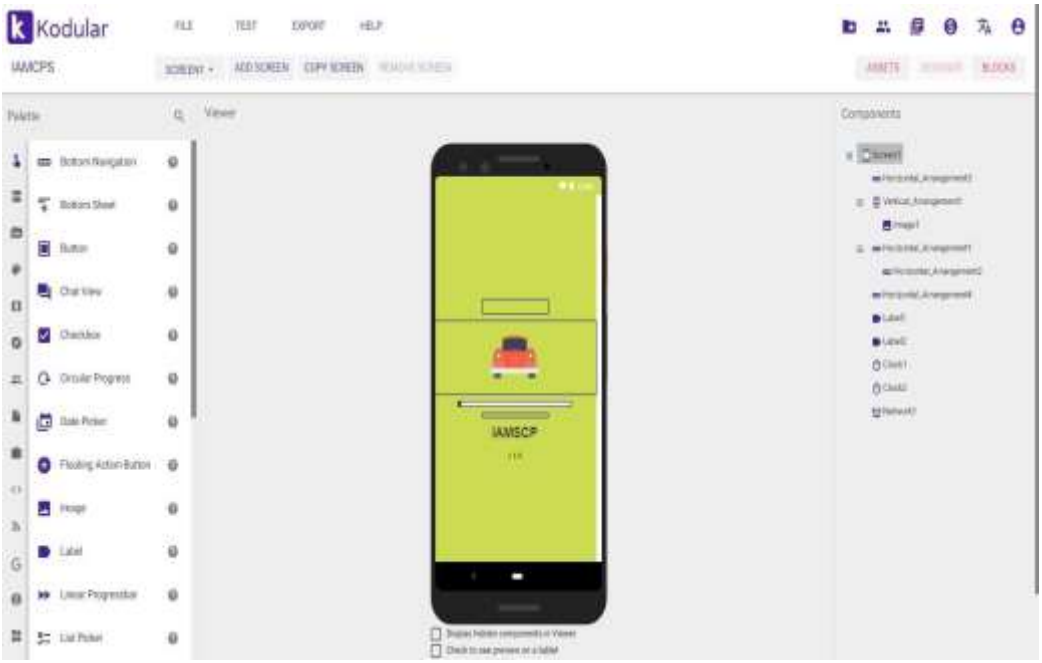
S.No.	Test Input	Expected output	Result
1.	**Request for parking slots when a user is offline:** **Admin will view available slots by clicking the "View available slots" button.** Available slots will be shown with name and location.	The user should request the parking slots when he is offline and for this, he is supposed to see the display monitor and he will park his car in that place.	Test Successful.
2.	**Request for parking slots when a user is online:** **Using the feedback button** By clicking feedback button user can send any issues occurred while using the car parking android application.	The user should request the parking slots when he is online and it is possible using the android application.	Test Successful.

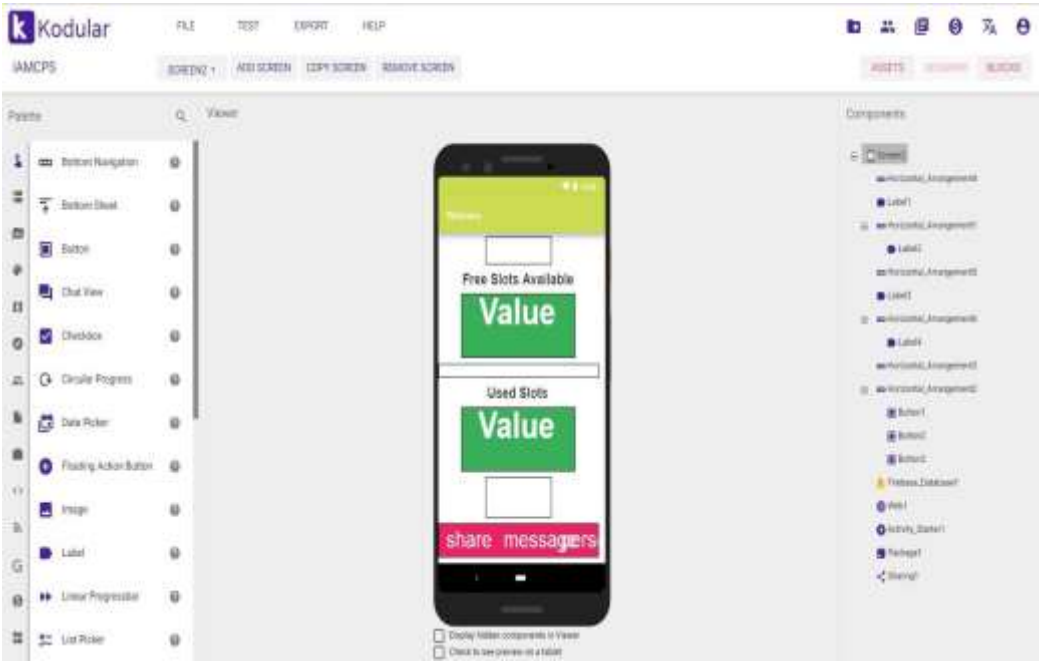
4.2.3 System Testing

System testing has done after integrating testing in order to ensure that the whole systems function properly. After the integration testing, the whole system working process was checked. The output was as per the system specifications and hence the system was found to work properly.


Kodular
IAMCPS


Firebase
Database


Kodular
IAMCPS
Palette
Viewer
Components
IAMSCP


Kodular
IAMCPS
Free Slots Available
Value
Used Slots
Value
share messages

Chapter 5

Maintenance and Support

5.1 Maintenance

Car Parking is implemented in the Iot cloud (Firebase). For now, our system is implemented with Python IDE and Arduino IDE. The project database is need to be trained and maintain from time to time. Therefore, our project needs to maintain the server frequently and we should need to display the records of a available slots time to time. Also, admin can edit, add and delete the user details. Each and every sensor need to be maintained properly for efficient work. There should be proper reliable connection must be established for proper functioning of the system. According to the feedback of customer, the system must be maintained time to time to fulfill the user requirement.

5.2 Support

We have used the advanced version of the Waterfall Model i.e. V Model. V model focuses on verification and validation so we can quickly change the requirement of the system. If any changes need to be made then we can make it for sure in a short period of time as the V model allows us to do so. Admin can support the general user as user can send their feedback to the admin directly. Support to a general user is very important. If needed then we need to take cloud service for the data storage but this should be followed under the economic feasibility of the project.

Chapter 6

Conclusion & Future enhancements

6.1 Conclusion

Today the world has become a global village where everything is online. There are so many webs based and mobile-based solutions provided in the market for the comfort of the people. In today's era where ICT has touched each and every sector the concept of this project was developed in order to provide a solution for parking car in an efficient manner. With the implementation of this system, the users will be able to find the vacant space in parking slots without searching it. We can apply this system to business organization, government service. Many sectors will be benefited by this system. During the entire project development period, we were able to develop our skills. This project enabled us to manage time and it makes effective and efficient use of slots.

The smart parking system based on the IoT concept has been implemented using various sensor circuitry and cloud (server). It is an efficient system for car parking which prevails traffic congestion. Using resources like Arduino IDE, Arduino UNO, Firebase database and which monitors the parking area. We chose the Smart Car Parking System using Arduino and android because concepts of IoT are helping people a lot. Here we can easily check free parking slots with our object sensors and other modules using internet and android app with concepts of IoT, which helps people and other professional organization.

6.2 Future enhancements

Some of our future enhancements are:

1. This project can be easily converted to large scale by adding similar hardware parts and programming for the same.
2. This project can also be integrated with automatic number plate recognition system.
3. It can be integrated with an online payment system.
4. The security feature can be enhanced by adding more advanced surveillance system.
5. The parking availability information system and parking reservation system should provide advanced navigation services.
6. An automated navigation system should assist in safe driving.
7. As in-facility navigation system should provide the best possible traffic management. 8. Provisions of effective security for the safety of cars

Arduino Code

```
#include <Wire.h>

#include <LiquidCrystal_I2C.h>



// Set the LCD address to 0x27 for a 16 chars and 2 line display LiquidCrystal_I2C
lcd(0x20, 16, 2); const int trigPin1 = 3; const int echoPin1 = 2; const int trigPin2 = 5;
const int echoPin2 = 4; long duration1, distance1; // Duration used to calculate
distance long duration2, distance2; int count=0;  int freeSlot=0; void setup() {

lcd.begin(); // Initializes the interface to the LCD screen, and specifies the dimensions
(width and

height) of the display Serial.begin(9600); pinMode(trigPin1, OUTPUT);
pinMode(echoPin1, INPUT); pinMode(trigPin2, OUTPUT); pinMode(echoPin2,
INPUT);

} void loop() { digitalWrite(trigPin1, LOW); delayMicroseconds(2);
digitalWrite(trigPin1, HIGH); delayMicroseconds(10); digitalWrite(trigPin1, LOW);
duration1 = pulseIn(echoPin1, HIGH); digitalWrite(trigPin2, LOW);
delayMicroseconds(2); digitalWrite(trigPin2, HIGH); delayMicroseconds(10);
digitalWrite(trigPin2, LOW); duration2 = pulseIn(echoPin2, HIGH);  distance1 =
duration1/58.2;  if(distance1<10)    distance1 = 1;  else distance1 = 0;



 distance2 = duration2/58.2;  if(distance2<10)    distance2 = 1;  else distance2 = 0;
count = distance1 + distance2; lcd.setCursor(0,0); // Sets the location at which
subsequent text written to the LCD will be displayed lcd.print("used slot: "); // Prints
string "Distance" on the LCD lcd.print(count); // Prints the distance value from the
sensor delay(10); freeSlot = 2 - count; lcd.setCursor(0,1); lcd.print("free slot: ");
lcd.print(freeSlot); Serial.println(freeSlot); delay(2000);

}
```

Reference

[1] https://www.instructables.com/id/Arudino-Automated-Car-Parking-System/

[2] https://www.smartparking.com/

[3] https://www.slideshare.net/DebasisNayak5/rfid-based-car-parking-systemfinal-ver