Parking Slot Availability Guidance System

Using

Internet of Technology

By

MUDASHARUDDIN
UNIVERSITY ROLL NO-11700114041
COLLEGE ROLL NO-CSE/2014/076

SAGAR MUKHERJEE
UNIVERSITY ROLL NO-11700114055
COLLEGE ROLL NO-CSE/2014/077

SK MD SOHEL FAJAL
UNIVERSITY ROLL NO- 11700114066
COLLEGE ROLL NO-CSE/2014/087

BISHAL SAHA
UNIVERSITY ROLL NO-11700114023
COLLEGE ROLL NO-CSE/2014/093

UNDER THE SUPERVISION OF

DR.PRAMIT GHOSH (CSE, RCCIIT)

REPORT OF PROJECT SUBMITTED FOR PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE DEGREE OF

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RCC INSTITUTE OF INFORMATION TECHNOLOGY
Affiliated to West Bengal University of Technology
CANAL SOUTH ROAD, BELIAGHATA, KOLKATA -700015

CERTIFICATE

This is to certify that the Final Year Project Report on **Parking Slot Availability Guidance System Using Internet Of Things** submitted by **Mudasharuddin** , **Sagar Mukherjee** , **Sk Md Sohel Fajal** , **Bishal Saha** having in 8th semester B.Tech.(**CSE**) is a creditable study of an engineering subject presented in a manner that may be accepted in fulfilment for the degree of **Bachelor of Technology in Computer Science & Engineering** under West Bengal University of Technology (**WBUT**).

……..
Supervisor/Course Coordinator

……
Head of the Department
Department of Computer Sc. & Engg,
RCC Institute of Information Technology, Kolkata

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FINAL EXAMINATION FOR
EVALUATION OF SEMINAR

1. _____

2. _____

(Signature of Examiners)

ACKNOWLEDGEMENT

In performing our project, we had to take the help and guideline of some respected persons, who deserve our greatest gratitude .The completion of this assignment gives us much Pleasure. We would like to show our gratitude to **Dr. Pramit Ghosh, Course Instructor, RCCIIT** for giving us a good guideline for assignment throughout numerous consultations. We would also like to expand our deepest gratitude to all those who have directly and indirectly guided us in writing this assignment.Many people, especially our classmates and team members itself, have made valuable comment suggestions on this proposal which gave us an inspiration to improve our assignment. We thank all the people for their help directly and indirectly to complete our assignment.

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INTRODUCTION

The Internet of Things (IoT) is the network of physical devices, vehicles, home appliances and other items embedded with electronics, software, sensors, actuators, and connectivity which enables these objects to connect and exchange data. Each thing is uniquely identifiable through its embedded computing system but is able to inter-operate within the existing Internet infrastructure.

"Things", in the IoT sense, can refer to a wide variety of devices such as heart monitoring implants, biochip transponders on farm animals, cameras streaming live feeds of wild animals in coastal waters, automobiles with built-in sensors, DNA analysis devices for environmental/food/pathogen monitoring, or field operation devices that assist firefighters in search and rescue operations. Legal scholars suggest regarding "things" as an "inextricable mixture of hardware, software, data and service".

These devices collect useful data with the help of various existing technologies and then autonomously flow the data between other devices.

Devices and objects with built in sensors are connected to an Internet of Things platform, which integrates data from the different devices and applies analytics to share the most valuable information with applications built to address specific needs. These powerful IoT platforms can pinpoint exactly what information is useful and what can safely be ignored. This information can be used to detect patterns, make recommendations, and detect possible problems before they occur.
For example, if I own a car manufacturing business, I might want to know which optional components (leather seats or alloy wheels, for example) are the most popular. Using Internet of Things technology, I can:

- Use sensors to detect which areas in a showroom are the most popular, and where customers linger longest;
- Drill down into the available sales data to identify which components are selling fastest;
- Automatically align sales data with supply, so that popular items don't go out of stock.

The information picked up by connected devices enables me to make smart decisions about which components to stock up on, based on real-time information, which helps me save time and money.
With the insight provided by advanced analytics comes the power to make processes more efficient. Smart objects and systems mean you can automate certain tasks, particularly when these are repetitive, mundane, time-consuming or even dangerous.

Our project is on smart parking system which will implement internet of things to facilitate the real time availability of parking spaces.

Traffic congestion caused by vehicle is an alarming problem at a global scale and it has been growing exponentially. Car parking problem is a major contributor and has been, still a major problem with increasing vehicle size in the luxurious segment and confined parking spaces in urban cities. Searching for a parking space is a routine (and often frustrating) activity for many people in cities around the world. This search burns about one million barrels of the world's oil every day. As the global population continues to urbanize, without a well-planned, convenience-driven retreat from the car these problems will worsen.

Smart Parking systems typically obtains information about available parking spaces in a particular geographic area and process is real-time to place vehicles at available positions .It involves using low-cost sensors, real-time data collection, and mobile-phone-enabled automated payment systems that allow people to reserve parking in advance or very accurately predict where they will likely find a spot. When deployed as a system, smart parking thus reduces car emissions in urban centers by reducing the need for people to needlessly circle city blocks searching for parking. It also permits cities to carefully manage their parking supply Smart parking helps one of the biggest problems on driving in urban areas; finding empty parking spaces and controlling illegal parking

METHODOLOGY

Smart Parking systems typically obtains information about available parking spaces in a particular geographic area and process is real-time to place vehicles at available positions .It involves using low-cost sensors, real-time data collection, and mobile-phone-enabled automated payment systems that allow people to reserve parking in advance or very accurately predict where they will likely find a spot. When deployed as a system, smart parking thus reduces car emissions in urban centers by reducing the need for people to needlessly circle city blocks searching for parking. It also permits cities to carefully manage their parking supply.

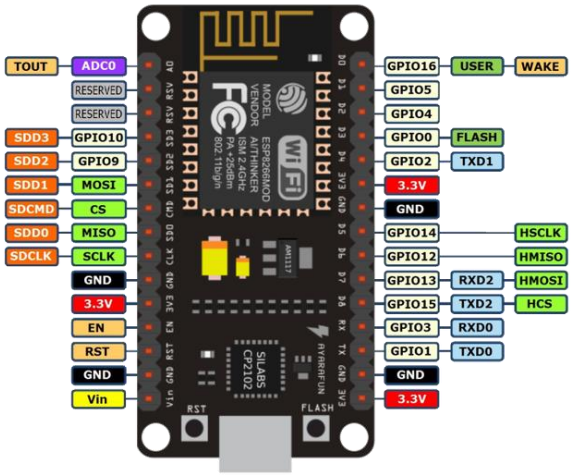
Smart parking helps one of the biggest problems on driving in urban areas; finding empty parking spaces and controlling illegal parking.

The data collection method used was pretty simple. We have used Infrared Sensor (IR Sensor/Proximity Sensor) to collect the data which in here is whether the parking slot is free or occupied. We have embedded the sensor physically to the parking slot so, whenever it is triggered, as it is connected to the internet, will send the data to the remote server where it will be Updated or kept in the database.

For implementing the project we have used various equipments and materials used which are as follows:-

1. **NodeMcu ESP-8266**

NodeMCU is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The term "NodeMCU" by default refers to the firmware rather than the development kits. The firmware uses the Lua scripting language. It is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as lua-cjson, and spiffs.

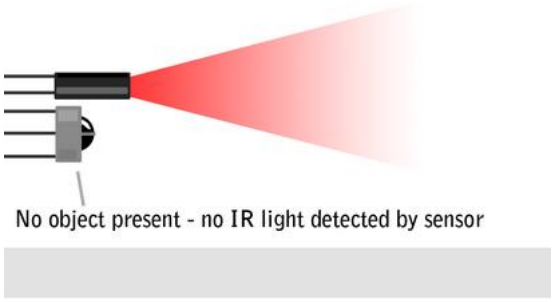


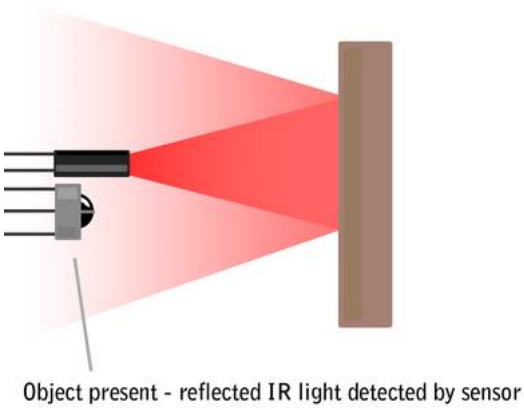
2. IR Sensor

An infrared sensor is an electronic instrument which is used to sense certain characteristics of its surroundings by either emitting and/or detecting infrared radiation. Infrared sensors are also capable of measuring the heat being emitted by an object and detecting motion.

Principle of IR Sensor

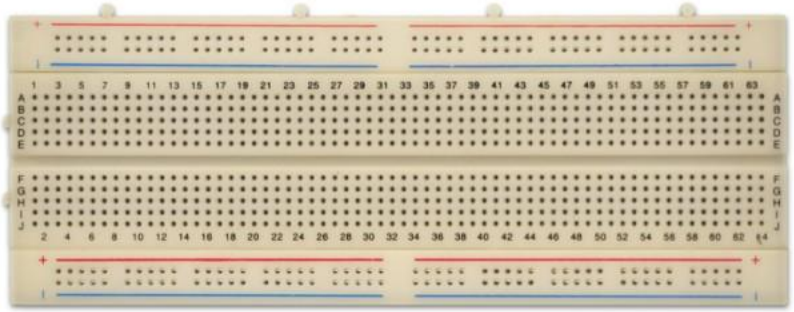
We have already discussed how a light sensor works. IR Sensors work by using a specific light sensor to detect a select light wavelength in the Infra-Red (IR) spectrum. By using an LED which produces light at the same wavelength as what the sensor is looking for, you can look at the intensity of the received light. When an object is close to the sensor, the light from the LED bounces off the object and into the light sensor. This results in a large jump in the intensity, which we already know can be detected using a threshold.





3. Breadboard

A breadboard is a solderless device for temporary prototype with electronics and test circuit designs. Most electronic components in electronic circuits can be interconnected by inserting their leads or terminals into the holes and then making connections through wires where appropriate. The breadboard has strips of metal underneath the board and connect the holes on the top of the board.



4. Jumper Wires

A jump wire (also known as jumper, jumper wire, jumper cable, DuPont wire) is an electrical wire, with a connector or pin at each end, which is normally used to interconnect the components of a breadboard or other prototype or test circuit , without soldering.

5. Batteries

The **nine-volt battery**, or **9-volt battery**, is a common size of battery that was introduced for the early transistor radios. It has a rectangular prism shape with rounded edges and a polarized snap connector at the top.

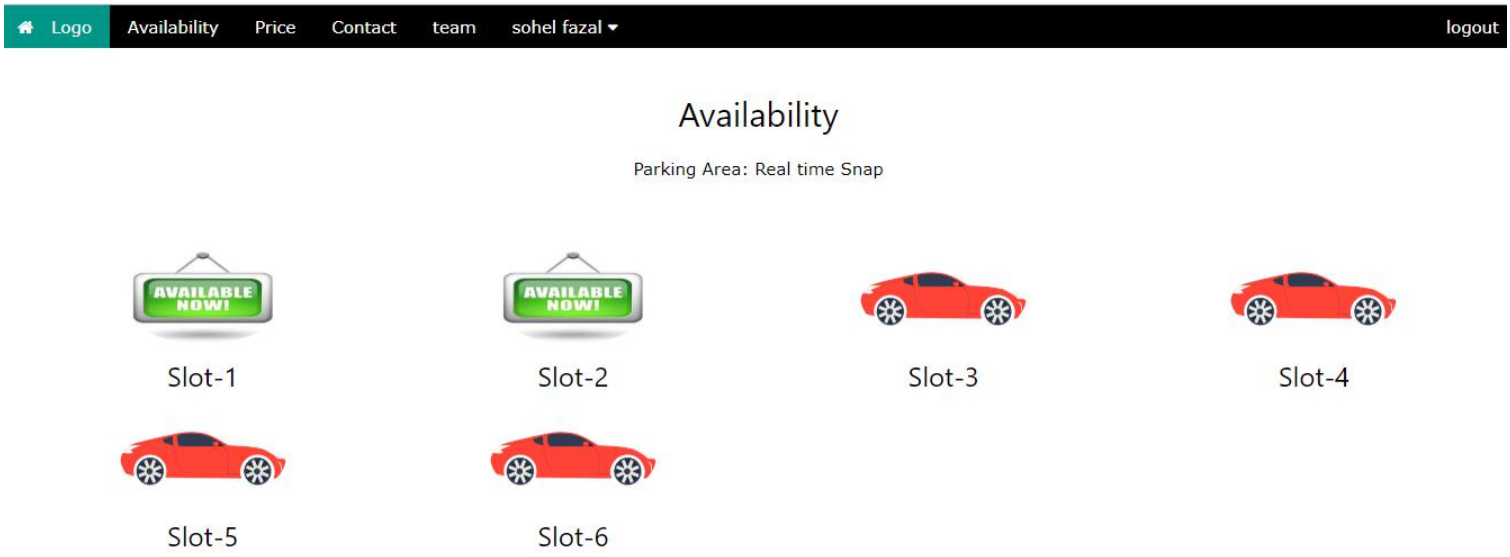
The Software requirements and the Programming languages used are as follows :-

1. Arduino Ide.
2. 000 Web Hosting.
3. Database Management.
4. PHP, SQL, Arduino(majorly).

A simulation on a smaller scale has also been done on remote server where we are successfully able to show the parking slot availability on a real time basis. For this we have used Arduino ide where we have codded the part for sending the data received by the IR sensor after that the data is received at our free hosting websites data base which will act as remote server. As soon as the data is received it is reflected on the website to show the real time availability of the parking slot. We are using a model to implement or simulate for six parking slots which can be easily scaled up according to the need.

IMAGE OF WEBSITES REAL TIME AVALIABILITY:-

The data that we have received from the NODE MCU is collected in a data base having fields as ID, FLAG & TIMESTAMP. ID keeps track of the number of entries, FLAG is a Boolean values which is stored as '0' if the parking slot is free and '1' if the parking slot is occupied, TIMESTAMP is used to keep track of the time when the parking slot got occupied and when the parking slot is free so that the pricing mechanism can be implemented if needed.



We have spent 2-3 weeks for understanding the language of Arduino and Arduino IDE and 2 weeks to implement the web support required inshort we have used most of our time in learning what is Arduino? , How local server works? , How remote server works, How the data is send and reflected on website?

Ardunio I.D.E Code

```
/*
 *  #_author: Sagar Mukherjee
 *  #_aliasc: it sends the data to http://smartparkingrcc.000webhostapp.com/write_data.php?value=3000
 *  it will send the data in every 30 sec
 */
//#define sensor D0
#include <ESP8266WiFi.h>

// The WiFi station (receiver) credentials
// Router credentials
const char* ssid     = "Red4Ever";//"bumtum";
const char* password = "8697602718";//"123456789";



const char* host = "smartparkingrcc.000webhostapp.com";
const int httpPort = 80;



int s1=0,s2=0,s3=0,s4=0,s5=0,s6=0;//unsigned long
int Obstacle1=1,Obstacle2=1,Obstacle3=1,Obstacle4=1,Obstacle5=1,Obstacle6=1;



// Declare and define a function for sending data
void broadcast(void) {
  WiFiClient client;

  if (!client.connect(host, httpPort)) {
    Serial.println("\t[E] Server connection failed");
    Serial.println("\t[E] Please check if the listening daemon is up");
    return;
  }

  // Needs manipulation for data sending
  // Generating the server GET request
  String url = "/write_data.php?";
  url += "s1=";
  url += s1;
  url +="&";
```

```
  url += "s2=";
  url += s2;
  url +="&";
  url += "s3=";
  url += s3;
  url +="&";
  url += "s4=";
  url += s4;
  url +="&";
  url += "s5=";
  url += s5;
  url +="&";
  url += "s6=";
  url += s6;



  Serial.println(url);

  client.print(String("GET ") + url + " HTTP/1.1\r\n" +
               "Host: " + host + "\r\n" +
               "Connection: close\r\n\r\n");

  unsigned int timeout = millis();
  while(client.available() == 0) {
    if(millis() - timeout > 6000) {
      Serial.println("\t[E] Server connection timed out");
      Serial.println("\t[E] Server failed to response");
      return;
    }
  }

  Serial.println("[X] Current batch of data has been sent and buffer flushed");
}

/*void var_init_t(void) {

  s1timeup = 0;
  s2timeup = 0;
```

```
}*/

void setup() {
  // Setting pins D0, D1, D2 for inputs using pullup resistor
  pinMode(D0, INPUT_PULLUP);
  pinMode(D1, INPUT_PULLUP);
  pinMode(D2, INPUT_PULLUP);
  pinMode(D3, INPUT_PULLUP);
  pinMode(D4, INPUT_PULLUP);
  pinMode(D5, INPUT_PULLUP);
 /* pinMode(D1, INPUT_PULLUP);
  pinMode(D2, INPUT_PULLUP);
*/
  // Initialize the serial port for debugging and testing
  Serial.begin(115200);

  // WiFi setup routine
  Serial.println("\n[X] Connecting to WiFi station");
  Serial.print("\t[X] Attempting to connect to WiFi\n\t");
  WiFi.begin(ssid, password);

  while(WiFi.status() != WL_CONNECTED) {
    delay(500);
    Serial.print(".");
  }

  //var_init_t();

  Serial.println("[X] Connected to WiFi");
  Serial.println("[X] IP Addr: " + WiFi.localIP());
  Serial.println("[X] Node setup complete...");
}
//THE LOGIC PART
void loop() {
 // static int count =0;
  if(WiFi.status() != WL_CONNECTED) {
    setup();
    return;
  } else {
```

```
//pin mapping nos d0-16 ,d1-5 ,d2-4 ,d3-0 ,d4-2 ,d5- 14.


 //S1
 Obstacle1 = digitalRead(D0);
   if (Obstacle1 == LOW)
     {
       Serial.println("OBSTACLE!!, OBSTACLE!!");
       s1=1;
     }
   else
    {
       Serial.println("clear");
       s1=0;
    }


 //S2
  Obstacle2 = digitalRead(D1);
   if (Obstacle2 == LOW)
     {
       Serial.println("OBSTACLE!!, OBSTACLE!!");
       s2=1;
     }
   else
    {
       Serial.println("clear");
       s2=0;
    }
 //S3
  Obstacle3 = digitalRead(D2);
   if (Obstacle3 == LOW)
     {
       Serial.println("OBSTACLE!!, OBSTACLE!!");
       s3=1;
     }
   else
    {
       Serial.println("clear");
       s3=0;
    }
 //S4
```

```
  Obstacle4 = digitalRead(D3);
   if (Obstacle4 == LOW)
     {
       Serial.println("OBSTACLE!!, OBSTACLE!!");
       s4=1;
     }
   else
    {
       Serial.println("clear");
       s4=0;
    }
//S5
  Obstacle5 = digitalRead(D4);
   if (Obstacle5 == LOW)
     {
       Serial.println("OBSTACLE!!, OBSTACLE!!");
       s5=1;
     }
   else
    {
       Serial.println("clear");
       s5=0;
    }

//S6
 Obstacle6 = digitalRead(D5);
   if (Obstacle6 == LOW)
     {
       Serial.println("OBSTACLE!!, OBSTACLE!!");
       s6=1;
     }
   else
    {
       Serial.println("clear");
       s6=0;
    }
/* //S1
 float volts1 = analogRead(A0)*0.0048828125;  // value from sensor * (5/1024)
 int distance1 = 13*pow(volts1, -1); // worked out from datasheet graph
 delay(500); // slow down serial port
```

```
Serial.println(distance1);
  if (distance1 < 50){
s1=1;
  }
  else{
    s1=0;
 }
 //S2

float volts2 = analogRead(D1)*0.0048828125;  // value from sensor * (5/1024)
int distance2 = 13*pow(volts2, -1); // worked out from datasheet graph
delay(500); // slow down serial port
Serial.println(distance2);
  if (distance2 < 50){
s2=1;
  }
  else{
    s2=0;
 }
  //S3
float volts3 = analogRead(D2)*0.0048828125;  // value from sensor * (5/1024)
int distance3 = 13*pow(volts3, -1); // worked out from datasheet graph
delay(500); // slow down serial port
Serial.println(distance3);
  if (distance3 < 50){
s3=1;
  }
  else{
    s3=0;
 }
  //S4
float volts4 = analogRead(D3)*0.0048828125;  // value from sensor * (5/1024)
int distance4 = 13*pow(volts4, -1); // worked out from datasheet graph
delay(500); // slow down serial port
Serial.println(distance4);
  if (distance4 < 50){
s4=1;
  }
  else{
    s4=0;
```

```
    }
     //S5
   float volts5 = analogRead(D4)*0.0048828125;  // value from sensor * (5/1024)
   int distance5 = 13*pow(volts5, -1); // worked out from datasheet graph
   delay(500); // slow down serial port
   Serial.println(distance5);
    if (distance5 < 50){
   s5=1;
    }
    else{
      s5=0;
   }
    //S6
   float volts6 = analogRead(D5)*0.0048828125;  // value from sensor * (5/1024)
   int distance6 = 13*pow(volts6, -1); // worked out from datasheet graph
   delay(500); // slow down serial port
   Serial.println(distance6);
    if (distance6 < 50){
   s6=1;
    }
    else{
      s6=0;
   }

 */
   delay(1000);
/*
   Serial.print("connecting to ");
   Serial.println(host);

   // Use WiFiClient class to create TCP connections
   WiFiClient client;
   const int httpPort = 80;
   if (!client.connect(host, httpPort)) {
    Serial.println("connection failed");
    return;
   }*/


   /*
```

```
    int s1 = digitalRead(D0);
    int s2 = digitalRead(D1);
    int s3 = digitalRead(D2);
    int s4 = digitalRead(D3);
    int s5 = digitalRead(D4);
    int s6 = digitalRead(D5);
    */
    broadcast();
      }


  delay(500);
}
```

Index.php Code

Connect.db.php

Core1.php Code

LogIn.php Code

Logout.php

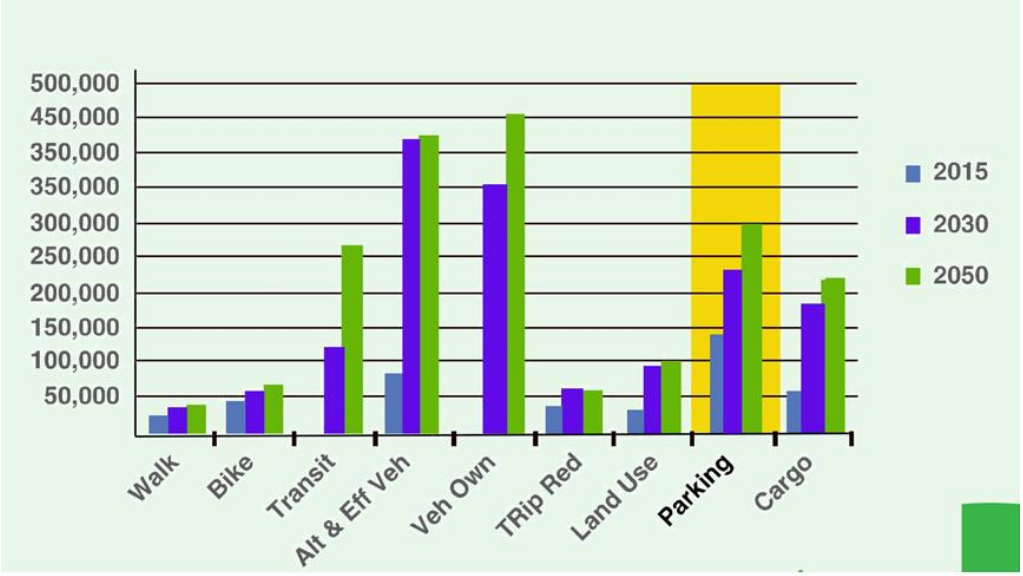
Reg.php

Write_data.php

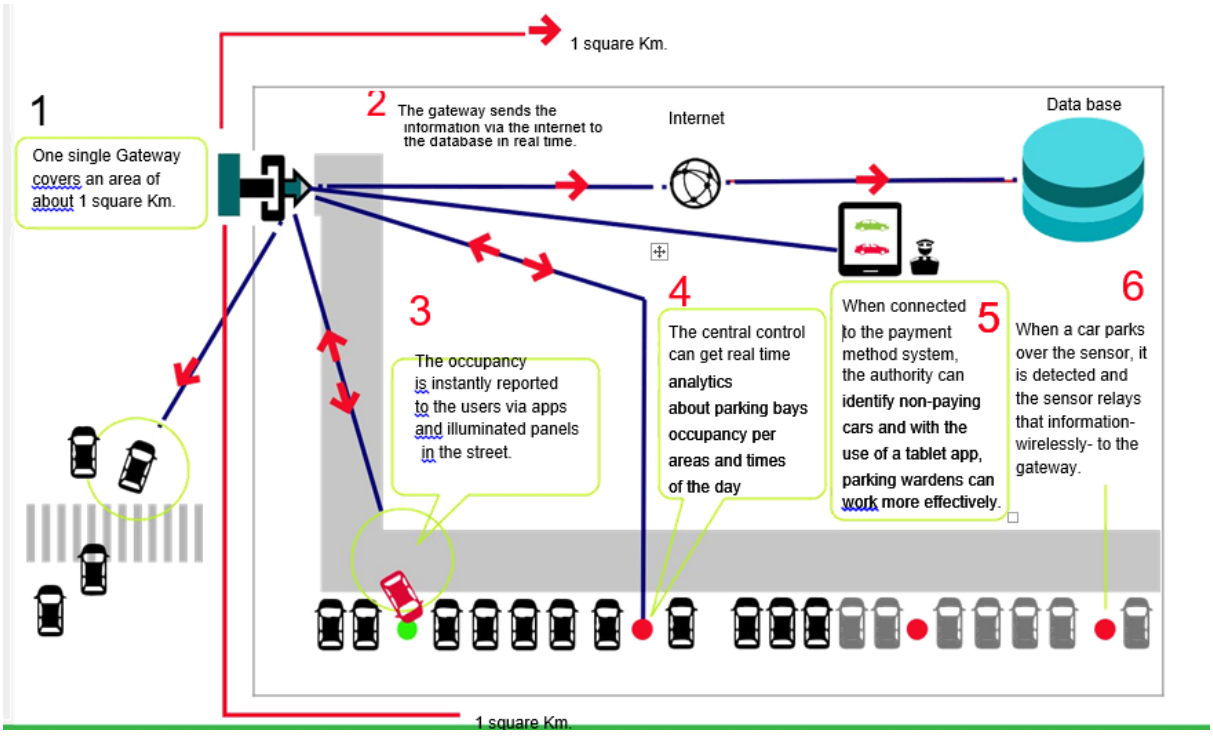
Admin.php Code

DETAILS

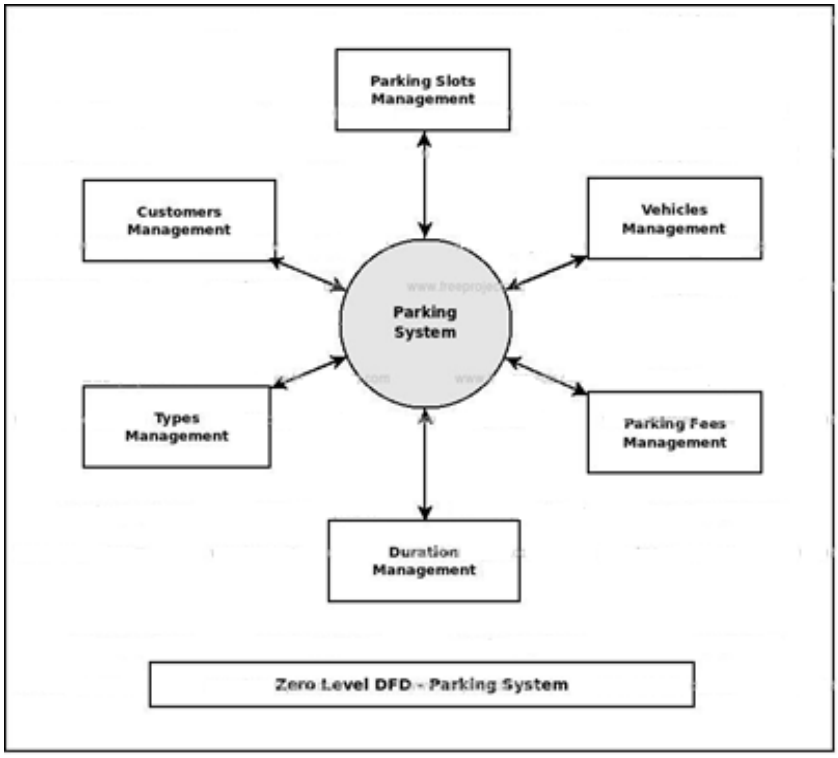
According to a report, Smart Parking could result in 2,20,000 gallons of fuels saving till 2030 and approx. 3,00,000 gallons of fuels saved by 2050 , if implemented successfully .

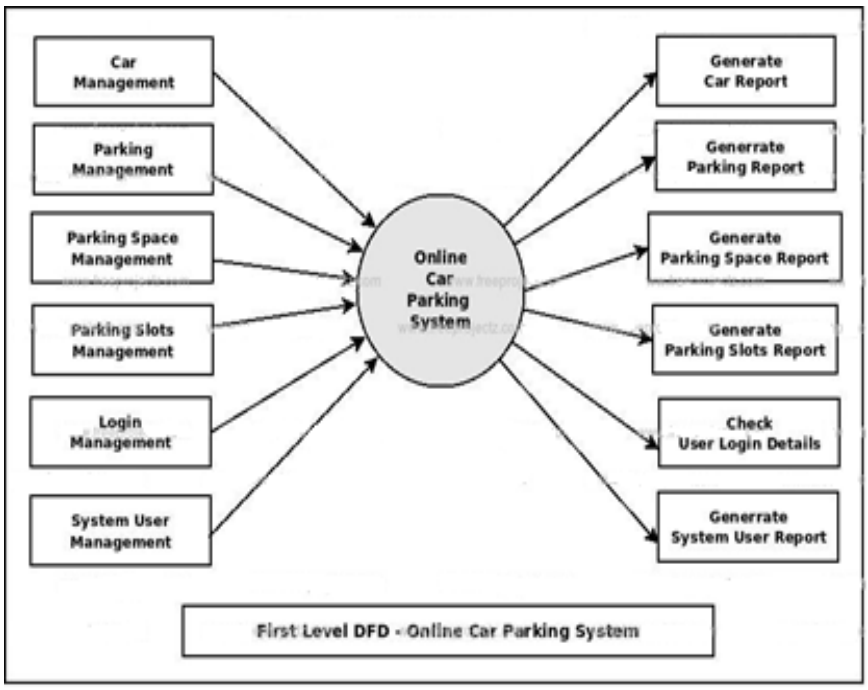


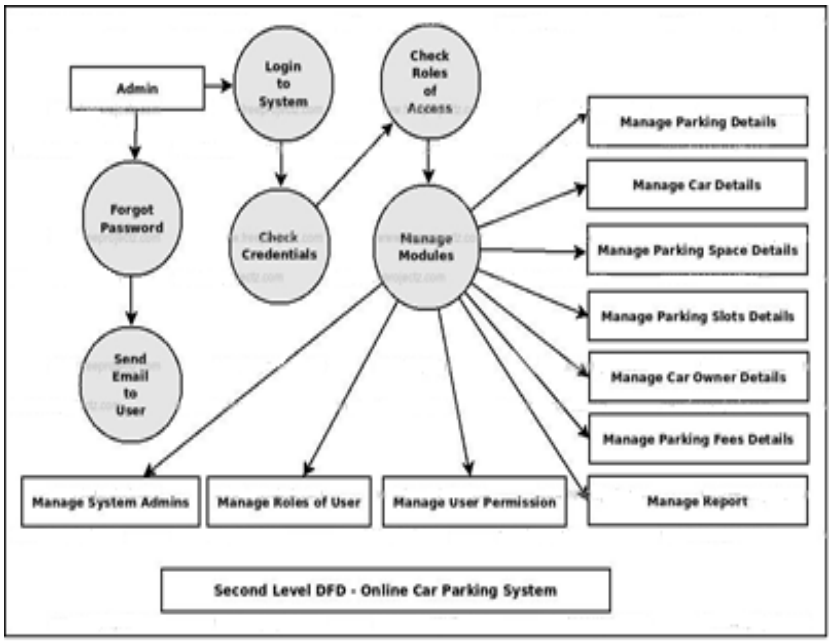
Smart parking work flow analysis:-



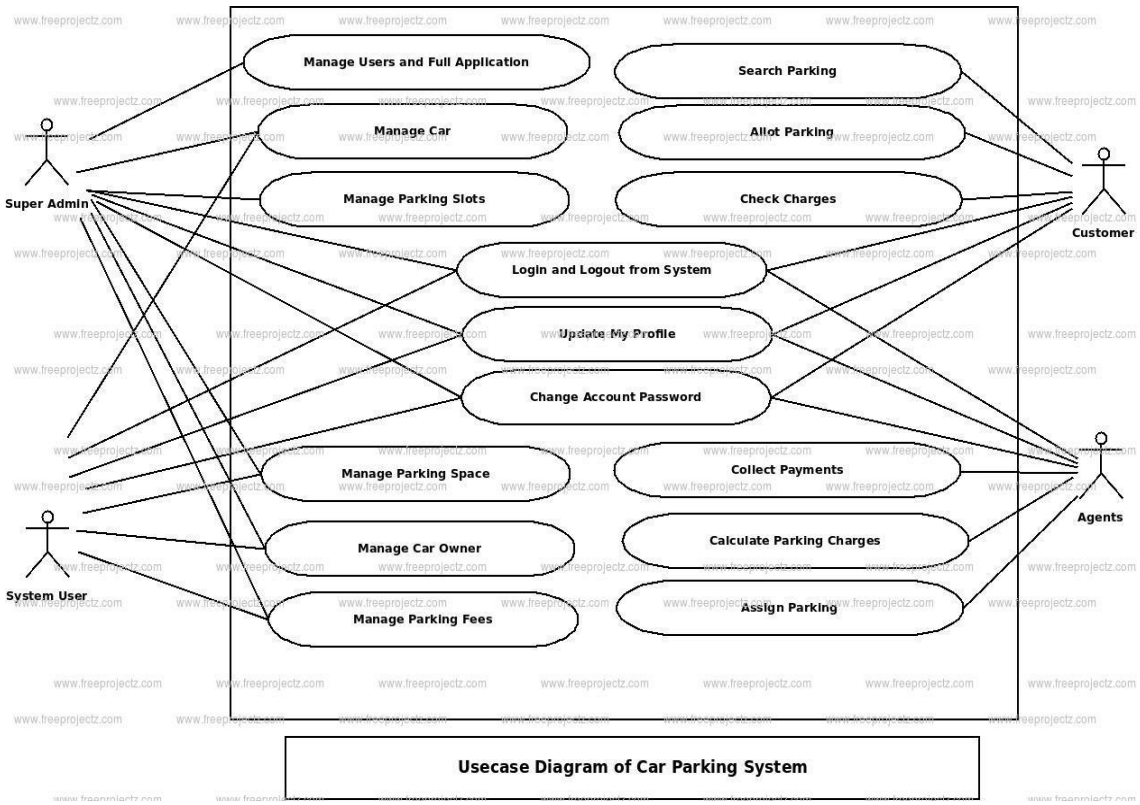
Dataflow Diagram:-





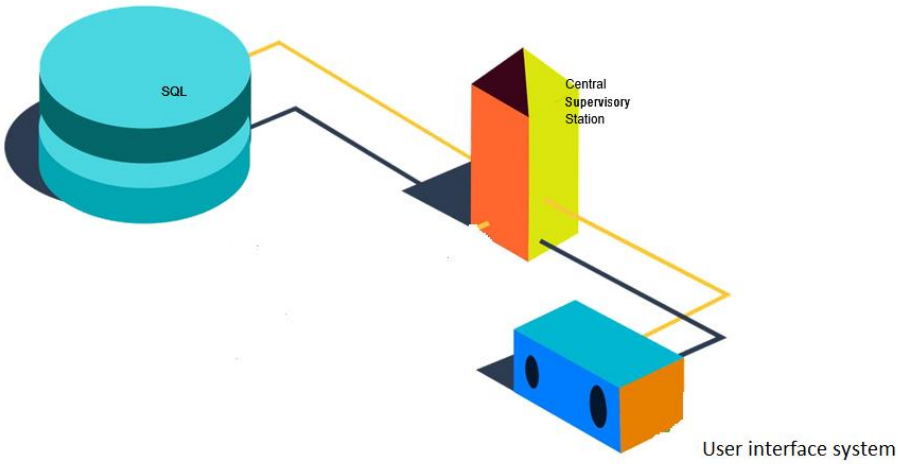


Use case Diagram of smart Parking System:-



Parking assistance system description:-

- The Parking Assistance System include three modules-Monitoring module, Control module and a displaying unit. Along with above three module it will also have centralized supervisory system to maintain a data base of parking space and will have a E-Mail gateway.
- The monitoring module includes ultrasonic sensors/ ambient light sensor which identifies the free parking spaces and transmits the Information to control unit .
- Apart from detecting the car the sensor also provides additional information like the stretch of time the car has been parked and also its health status.
- The control units processes the information and sends the information to Centralized supervisory system.
- Centralized supervisory system receives information of parking space from the controller through UDP. It then sends the information such as slot allotted, time parked, billing information and directional details to the user's mobile phone

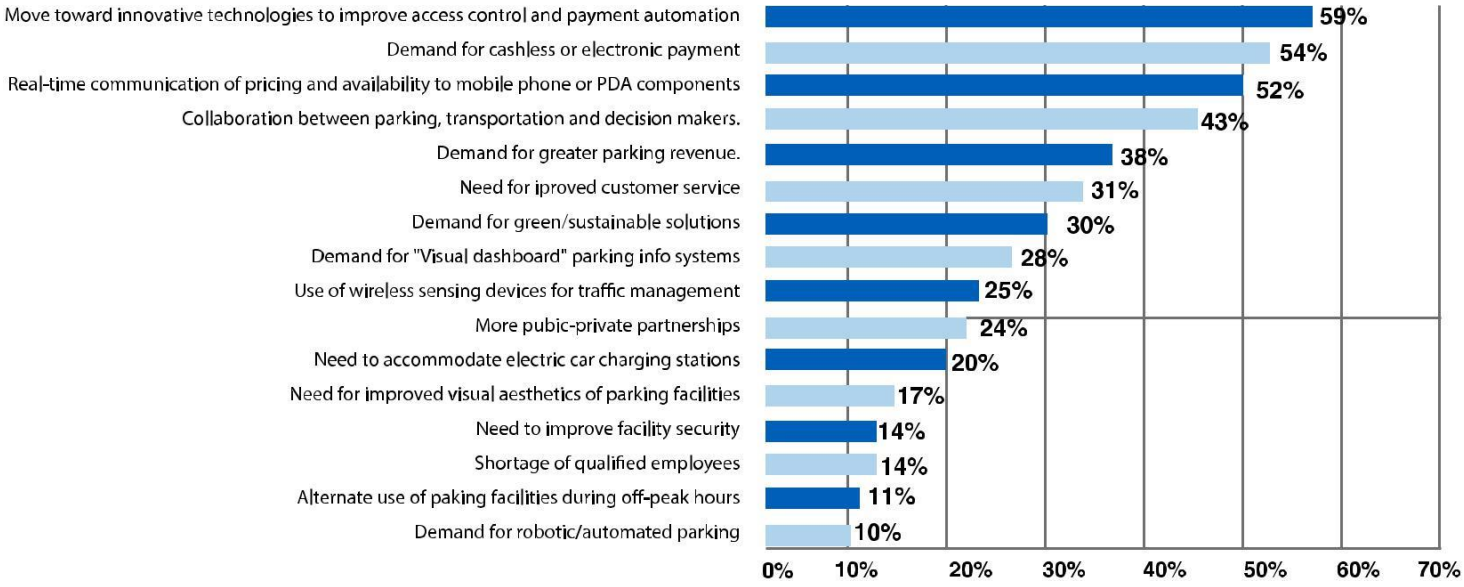


Potential market Landscape

The rapid growth in the number of vehicles worldwide is intensifying the problem of the scarcity of parking space. Again according to industry data, 30% of traffic congestion occurs due to vehicle drivers struggling to find parking space. These in turn are magnifying the necessity of smart and efficient parking systems. Today's intelligent parking management systems are capable of providing extreme level of convenience to the drivers, as well as simplifying and automating the business operation and administrative functions of the parking site owners.

Emerging Trends in Parking

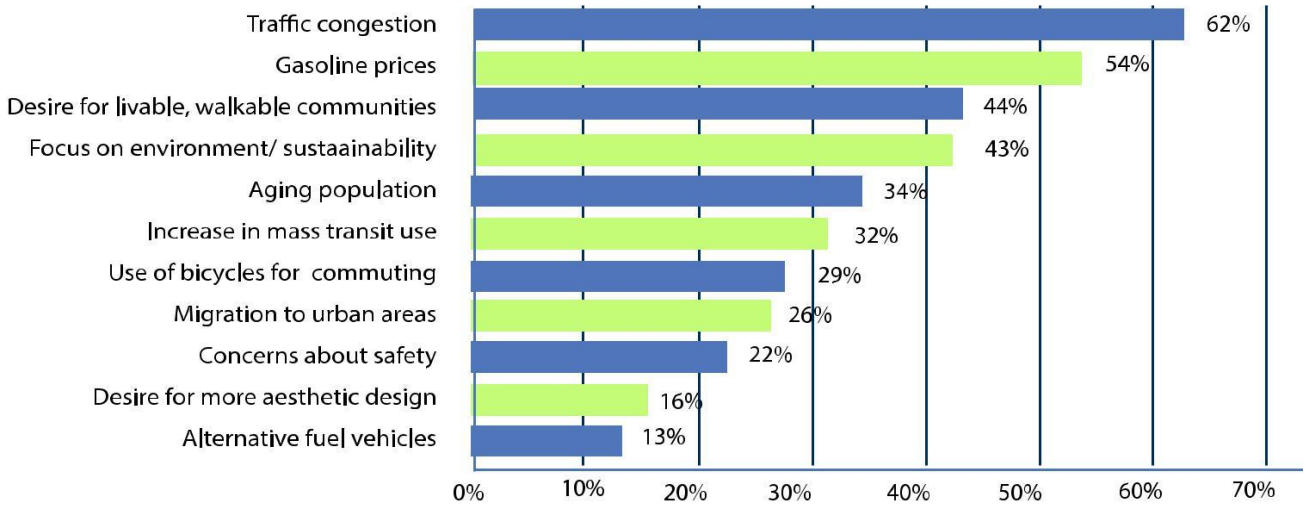
Following are the trends having the greatest effect on Parking Industry



The high growth rate in the registration of new cars worldwide, with major boom from regional economies such as Asia Pacific (APAC), will open the window of opportunities for parking management business. The ongoing and upcoming smart city projects worldwide will create room for the intelligent parking management systems. The global parking management industry is expected to grow at a Compound Annual Growth Rate (CAGR) of 11.4% from 2014 to 2019.

The parking management market is estimated to be at $5,025.9 million in 2014. The market is expected to grow in tandem with the growth in vehicle ownerships and parking facilities development. Need for smooth traffic flow, business benefits to the parking site operators, and decreasing hardware and connectivity costs are the key drivers for the parking management industry.

Traffic congestion and gasoline prices leads the list for the major societal changes having significant influence on parking.



Challenges Indian Specific Ecosystem

- Absence of a robust billing platform leading to possible revenue leakages
- Interoperability between devices/lack of standards.
- Although other countries have solutions deployed, Smart parking does not really provide much solution to two wheelers as yet in India.
- Various Security issues and threats to the installed on-site parking meter.
- The IoT enabled Parking System shall support mechanisms to correlate charging data/records from different IoT Application Service Providers.
- The IoT enabled Parking System shall support triggering M2M Devices to report on-demand information regarding collected data from other M2M Devices
- Smart parking providers will need to establish reliable application programming interfaces (APIs) that enable service partners to provide consumers with access to smart parking services on-line through a variety of channels, including the web, mobile phone apps, connected personal navigation devices and car telematics services.

The high growth rate in the registration of new cars worldwide, with major boom from regional economies such as Asia Pacific (APAC), will open the window of opportunities for parking management business. The ongoing and upcoming smart city projects worldwide will create room for the intelligent parking management systems. The global parking management industry is expected to grow at a Compound Annual Growth Rate (CAGR) of 11.4% from 2014 to 2019.

The parking management market is estimated to be at $5,025.9 million in 2014. The market is expected to grow in tandem with the growth in vehicle ownerships and parking facilities development. Need for smooth traffic flow, business benefits to the parking site operators, and decreasing hardware and connectivity costs are the key drivers for the parking management industry.

APPLICATION

Smart Parking would enable the following :-

- Accurately predict and sense spot/vehicle occupancy in real-time.
- Guides residents and visitors to available parking.
- Optimize Parking Space Usage
- Simplifies the parking experience and adds value for parking stakeholders, such as drivers and merchants
- Help traffic in the city flow more freely leveraging IoT technology.
- Enables intelligent decisions using data, including real–time status applications and historical analytics reports
- Smart Parking plays a major role in creating better urban environment by reducing the emission of CO2 and other pollutants
- Smart Parking enables better and real time monitoring and managing of available parking space , resulting in significant revenue generation
- Provides tools to optimize workforce management

RESULTS/OUTPUT

Our Website:- https://smartparkingrcc.000webhostapp.com

Image 1:-

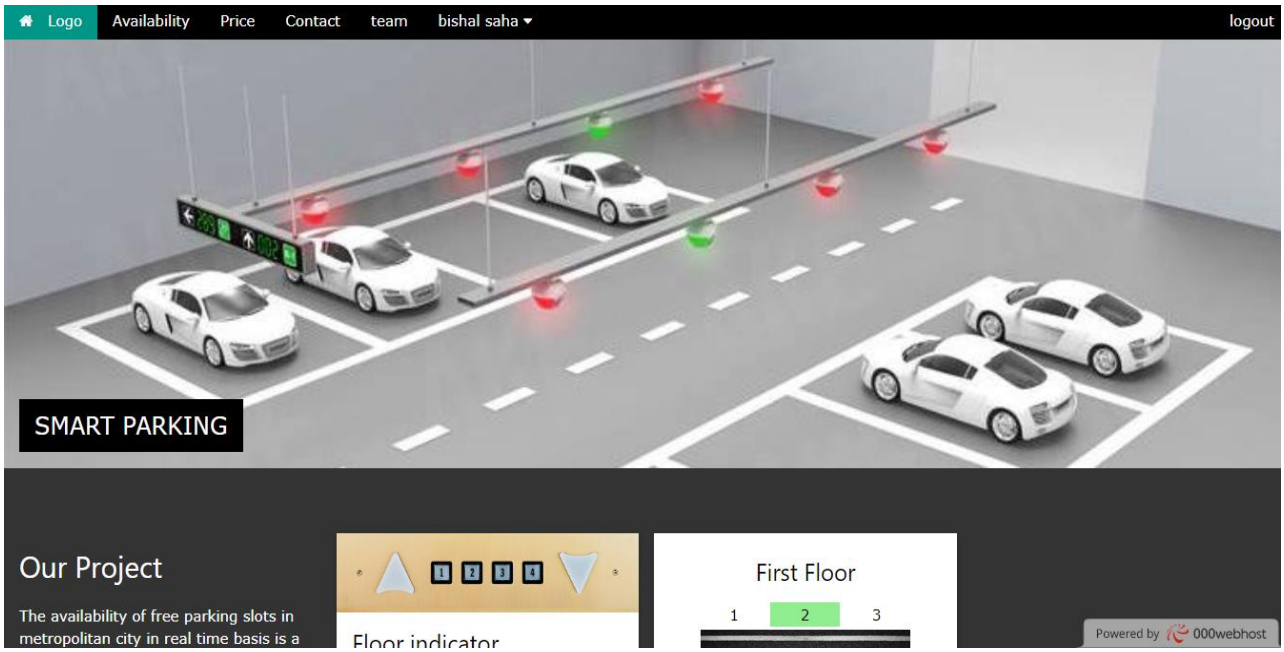


Image2:-

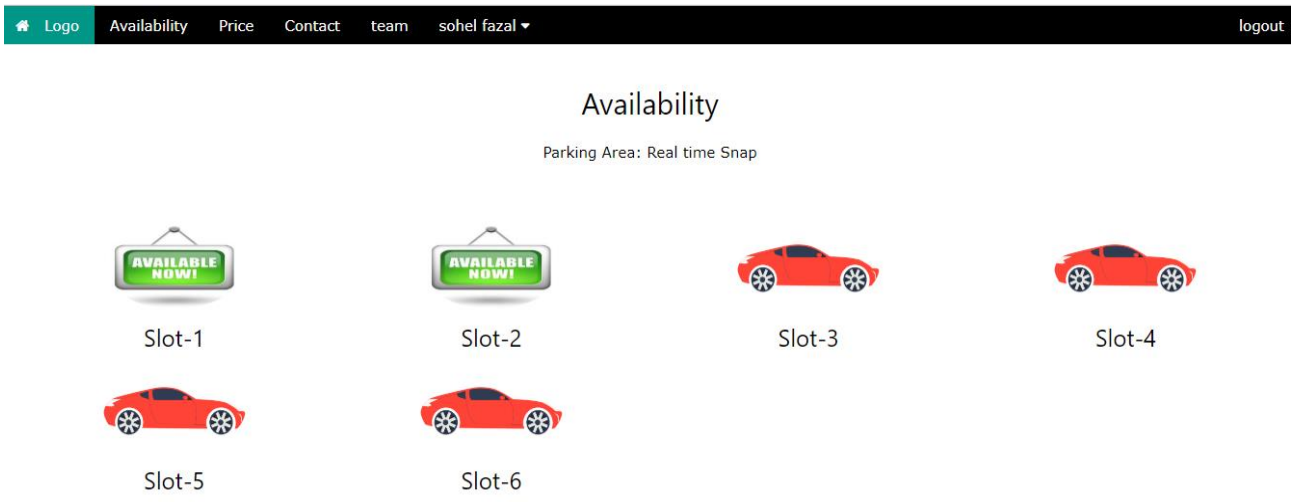


Image3:-

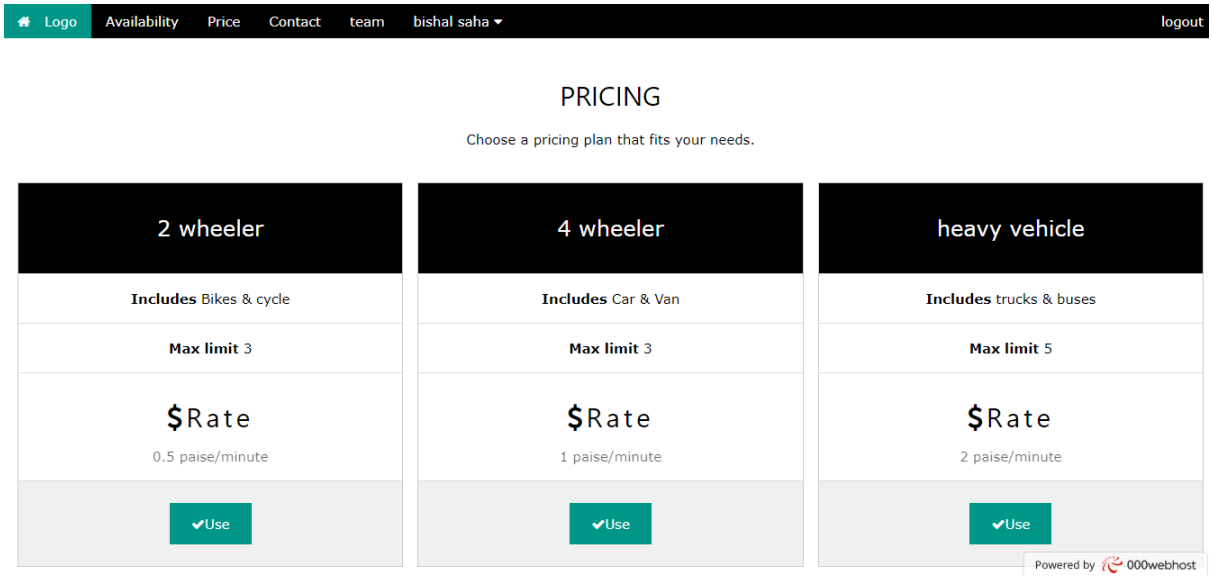


Image4:-

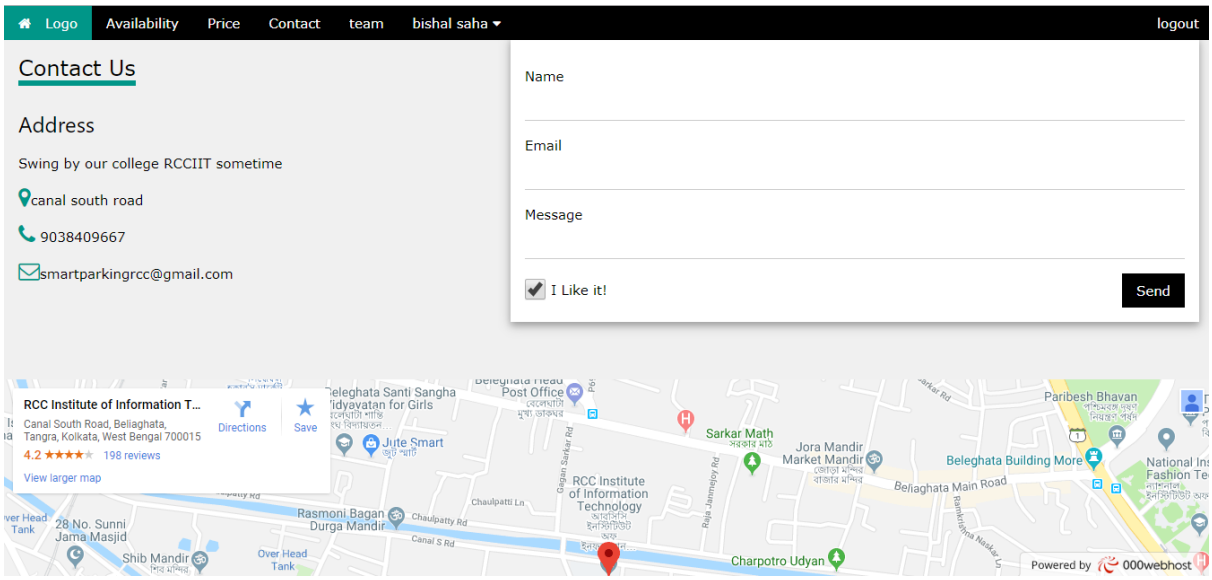
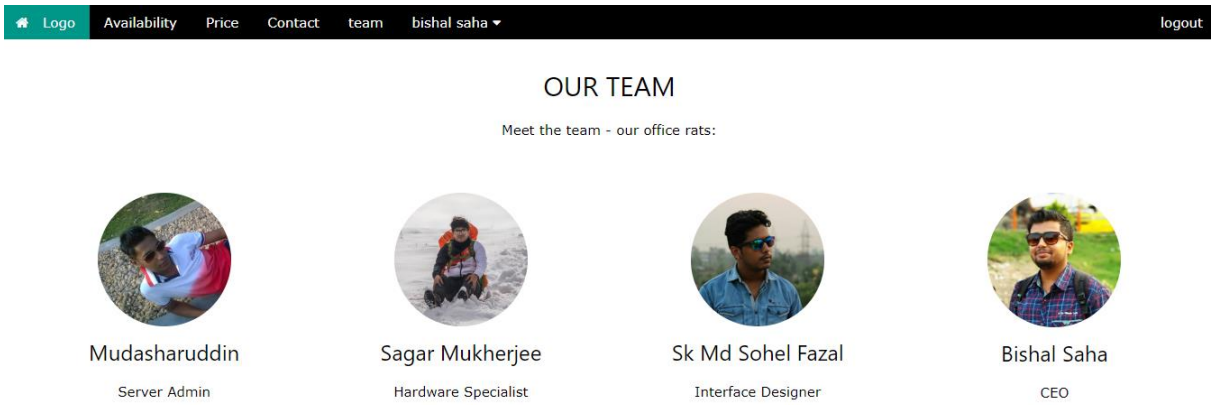
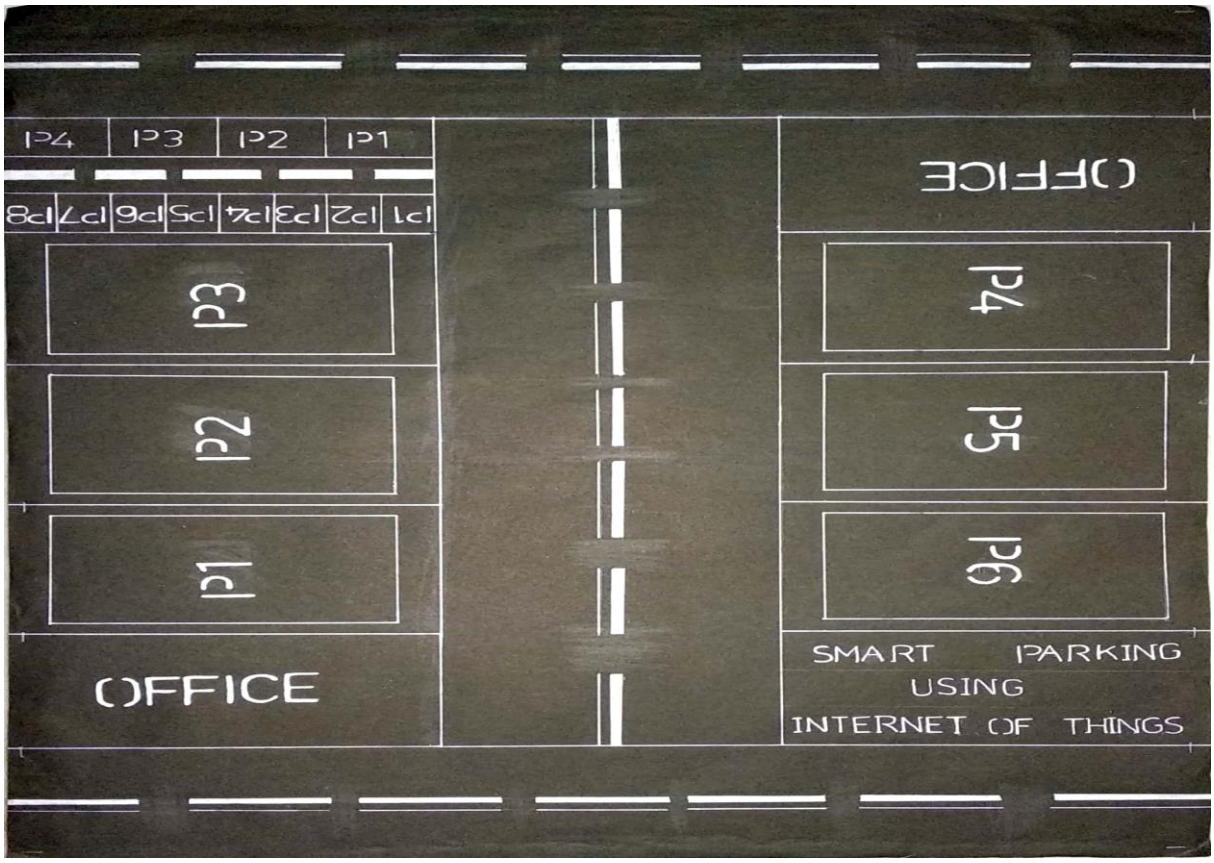


Image 5:-



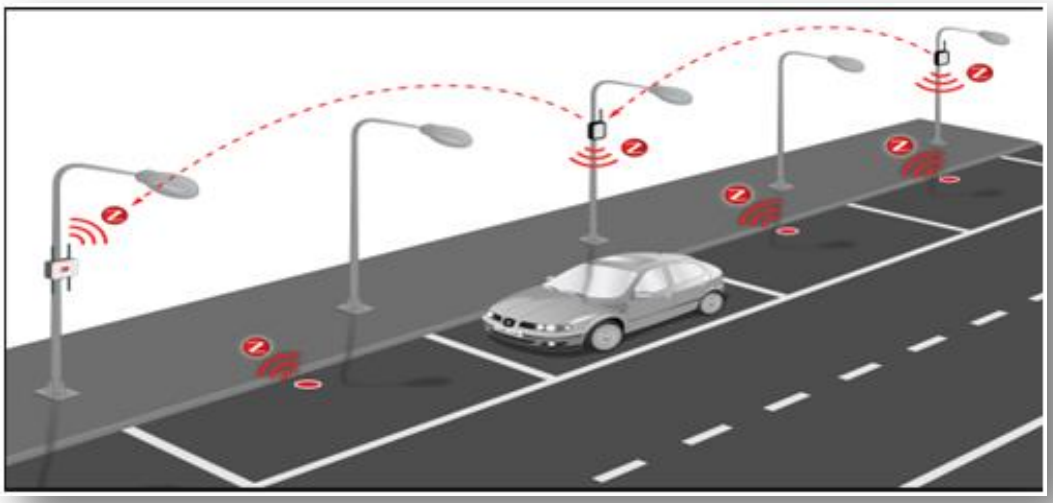
Simulated Working Model Picture:-



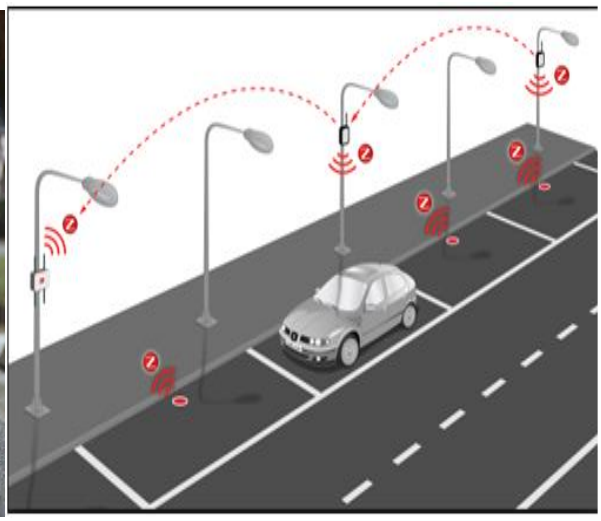
Possible Future Enhancements:-

L shaped roads:- L shaped roads are often the cause of accidents in parking areas or anywhere, so we will implement a sensor enabled procedure which will warn and allow only vehicle flow in one direction along with showing the speed of the vehicles so as to implement speed limits. The turning area will behave like a critical section and will be accessible by only one vehicle at a time to avoid accidents.the diagram is as below:-

Intelligent lighting system:- This system will help to save the power which is wasted in a parking area, highways, freeways i.e any kind of road in which lights are always on but this system will only enable lights if any vehicle is passing or will be on with reduced intensity which will save a lot of power.



<u>Identification between Animals and Vehicle</u>:-It may happen that the light may light up if any animal passes over the sensor so a method of prediction based on the speed of movement will be enabled which will calculate the speed and depending on that the light will lighten up and in addition to that error will be less as vehicle have greater surface area and hence have higher probability of triggering the sensors.



And depending upon the requirements many other functionalities can be added as simply others things needs to be added cause the main things like sending data to remote server and reflecting them to a website has been done so scalability will not be difficult.

CONCLUSION

The major enablers or drivers for smart parking, essentially are the problems of urban livability, transportation mobility and environment sustainability. Primarily Smart Parking technology is about enhancing the productivity levels and the service levels in operations. Some of the underlying benefits could be lowering operating costs, while building value for customer to drive occupancy, revenues and facility value. We have evolved from traditional servicing channels like toll-booth and parking attendants to incorporate automated pay stations, meters and gates.

Parking is a $ 25 billion dollar industry which has seen minimalistic innovations and implementations. The majority of investments has always been in creating energy-efficient hybrid and electric vehicles, which in-turn still doesn't solve the problem of global gridlock causing the same burden on urban gridlock. Finally, in the long run, smart parking can actually transform the very makeup of our urban landscapes, making them more amenable to people rather than cars.

Street to Vehicle communication would be pivotal and crucial along with the Vehicle to Vehicle communication as the success and market readiness of Autonomous vehicle ecosystem lies in collecting and interpreting the data at the Street Level.

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