CHAPTER 1

INTRODUCTION

In the urban mobility sector, parking place an important role whether parking at work, at home, in the city center or at the outskirts. Making parking a part of city life and connect flowing traffic with stationary traffic.

So here introducing a smart parking system. Smart parking is a parking strategy that combines technology and human innovation in an effort to users few resources as possible such as fuel, time and space to achieve faster, easier and denser parking of vehicles for the majority of time they remain idle.

Smart parking and its sister approach, intelligent transportation, are based on the fundamental ecological principle that we are all connected. Parking and transportation are both essential in the movement of people and goods. The smart parking and intelligent Transportation vision and overlapping technologies are steadily melding into one integrated stream.

Our project is IoT based smart parking slot finder "SMART-PARKO". By using an android mobile app we can find the parking space. Through this, user can easily find out the free slot in the metro politian city. The App Smart parko is an easy to install, simple to use app that the driver install on their smart phone. The driver uses app smart parko to locate best available parking spaces. Once a space is chosen, the driver is directed to their space with smart parko app is clear, precise directions which are GPS controlled.

CHAPTER 2

INTERNET OF THINGS (IoT)

2.1 Concept

Internet of Things (IoT) is one of the most fascinating trends in controlling variety of things or objects intelligently through wired or wireless communication systems.It enables the things to be connected or controlled anytime, anyplace with anyone or anything using any path or network and any service. The main aim of Internet of Things (IoT) is to make different tasks much easier for user control and monitoring.With the help of Internet of Things (IoT), home or office automation systems, environmental or biological monitoring, smart grids etc. can be interconnected, allowing them to share the information between them that affect each other's performance.

IoT consists of things or devices that have unique identities and are connected to the internet through a communication network.It refers to the network of physical objects that are embedded with electronics, sensors, actuators, software and communication connectivity, in which the whole arrangement enables the exchanging of data, remote sensing and control of various objects or things.

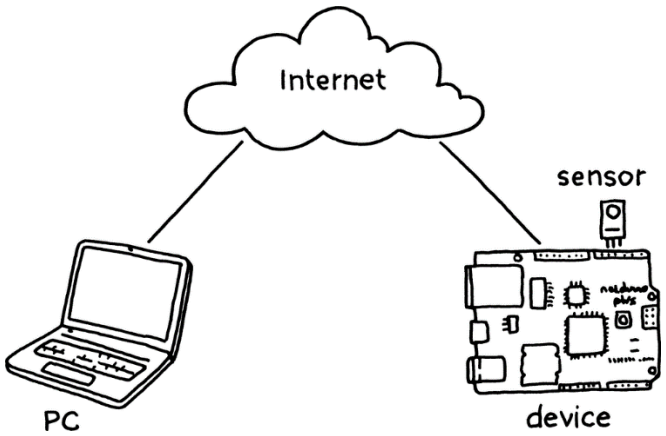

Fig. 2.1: PC and a Device connected to internet

This concept can be viewed as connecting any device by shifting its ON and OFF switch to the Internet.Using IoT, all objects in daily life such as washing machines, lamps, coffee makers, air conditioners, etc. are equipped with identifiers and wireless connectivity in order to provide remote control and exchange of information while executing meaningful applications towards a common user or machine goal.

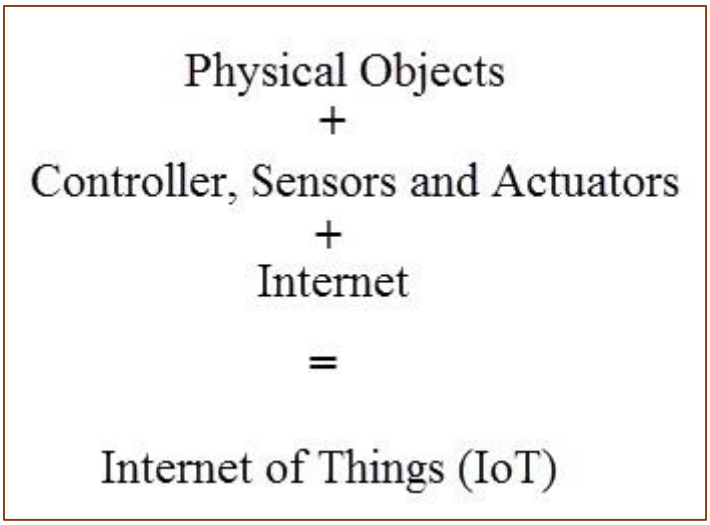

Fig. 2.1: Asimple equation for the Internet of Things is shown in above figure in which a physical object follows the function of the thing and being connected to the internet, it can be controlled and monitored through internet.

The sensor within or attached to the objects are connected to the internet via wired or wireless internet connections. Various local area connections for these sensors include Zig Bee, Bluetooth, RFID, Wi-Fi, etc. These sensors also use wide area networks including GSM, GPRS, 3G, 4G, etc.

2.2 IoT Architecture

The concept of Internet of Things (IoT) is not entirely new as the fields of telecommunication, industrial control and process control are already using it.But to implement the concept of Internet of Things to the latest trends, numerous technological architectures are being developed around the feasibility and applicability of Internet of Things.A reference architecture is proposed which focuses on providing a complete solution to facilitate design, development and readiness of the smart environment as per the Internet of Things model. The following figure shows a simplified architecture of Internet of Things (IoT) domain.

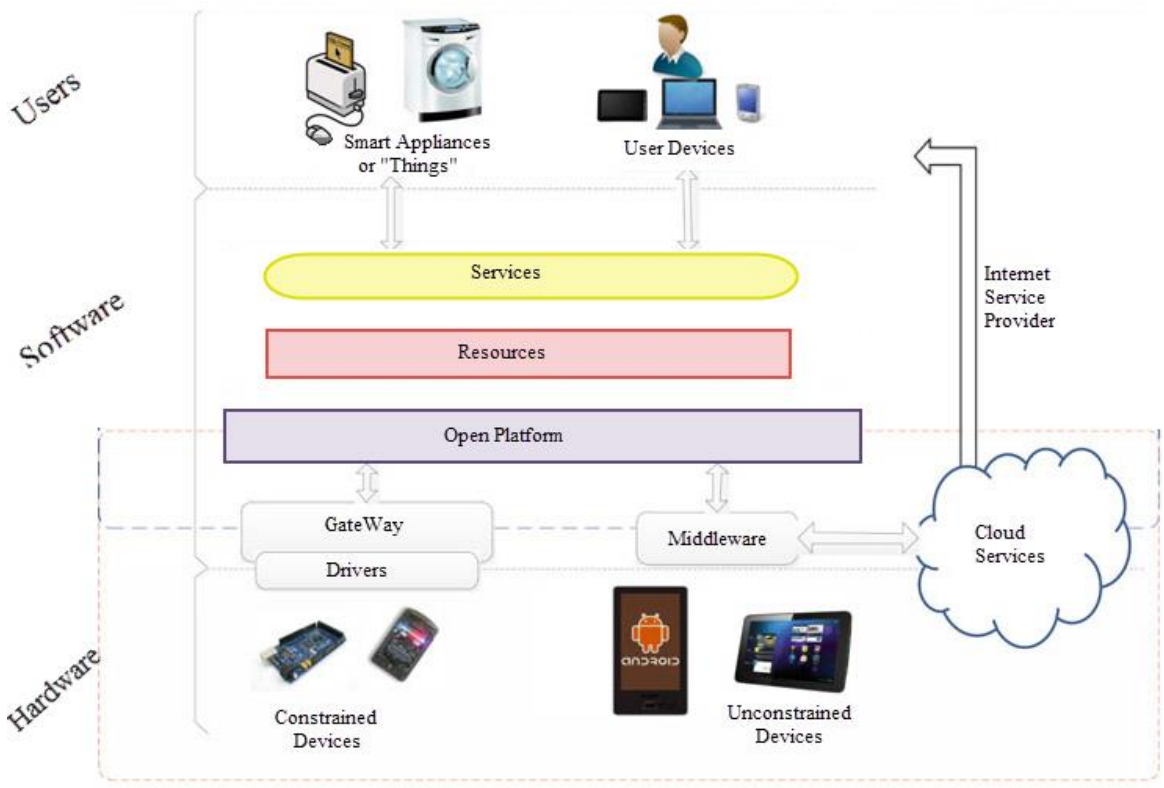

Fig 2.3. IoT Architecture

As shown in the figure 2.3, the architecture of the Internet of Things model can be further subdivided into three major layers. The lowest layer consists of the hardware community, which again is divided into two groups of devices.

The first group of devices are constrained devices which have limited resources and features and hence rely on other devices to perform some processes. The external devices are smart gateways which possess a threat to expose the functionality to the clients.The second group of devices are unconstrained devices which have enough features and resources that are necessary to run processes.Even if the unconstrained devices lack the necessary feature to perform a particular process, they have middleware components that provide the functionalities directly to the client via a platform or third party cloud service.The next layer or the middle layer in the architecture of the Internet of Things is the software layer, which supports an open source platform.

The task of this layer is to provide a mechanism to define and setup the functionalities of the hardware like sensors, actuators, process handling etc. and also organize them I order to build the services (either simple or complex).

The software level also has the task of implementing necessary protocols, connectivity drivers and communication standards. The final layer in the architecture Internet of Things is the user layer. This layer consists of clients which make use of the services provided by the software layer. The clients can be smart phones, TV's, laptops, smart machines, home appliances etc.

CHAPTER 3

OVERVIEW OF PROJECT

Our Project consist of;

- IR Sensor module
- ESP8266 MCU Node
- Server[Laptop]
- Android Application[SMART-PARKO]

IR sensor will detect the entry and exit of cars into car parking space and update the server via ESP8266 node MCU module, which has a Wi-Fi in-build system through which it can be connected to server easily and server will update android application as the information from sensors.

To detect the vehicle slot occupancy the system uses IR sensors. IR sensor will detect the entry and exit of the cars in to car parking space and update the server via ESP8266 node MCU module, which has a Wi-Fi in built system through which it can be connected to server easily and server will update android application as the information from the sensors.

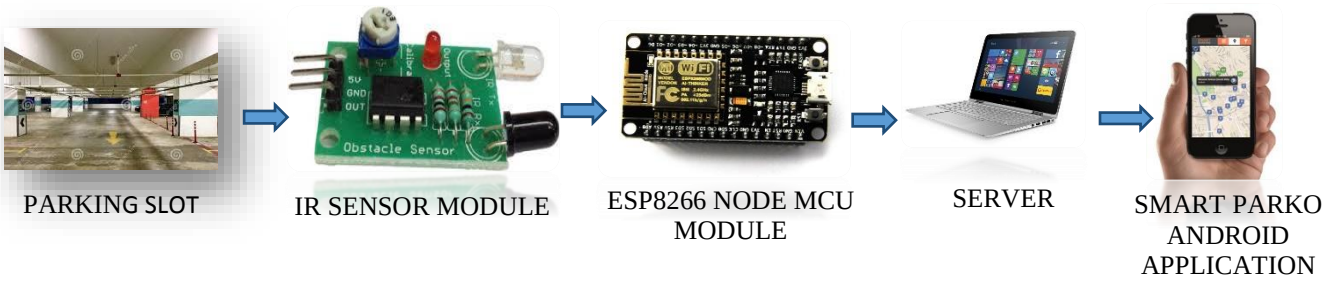

Fig 3.1: overview of Smart-Parko

CHAPTER 4

BLOCK DIAGRAM AND WORKING

4.1 Block diagram

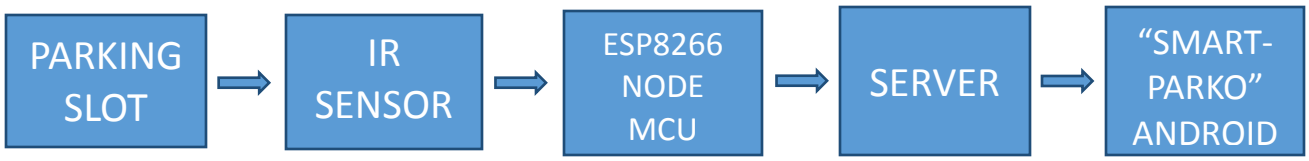

Fig 4.1 Block Diagram

4.2 Working

Imagine you are driving through a strange place, and you need to park your car, at that time our project will be useful. The android application "SMART_PARKO" will guide you to parking slot. Here we using IOT technology. By opening our app it will use GPS and track your current position in google map and show popups of available free parking slots.

By moving to next page of app user can see the available number of vacant car parking. It will be updated each 5 seconds and user can realize the updates.Here IR sensor module will detect the entering and leaving status of cars in slot. IR sensor output will become HIGH, when a car leaves or enters to parking slot.at the entrance of parking slot these sensors are implemented. Two IR sensors are used in this, when the Sensor 1 get HIGH then Sensor 2 get HIGH, it will be considered as Car entering to parking slot.

And if Sensor 2 get HIGH initially then Sensor 1 get HIGH then, it will be considered as Car leaving the parking slot. The output of sensors are fed to a microcontroller 'ESP8266 NODE MCU'.It will update the server and Mobile App via connected in build Wi-Fi in the ESP8266 module.It's programmed such a way that using arduino IDE. Which will make the required updates to app.

In the Arduino IDE, serial monitor will display the IP address of connected Wi-Fi network. By using that IP address the android application's available slot page is programmed. By using this IP address in the PC web browser we can access same data that been in App.

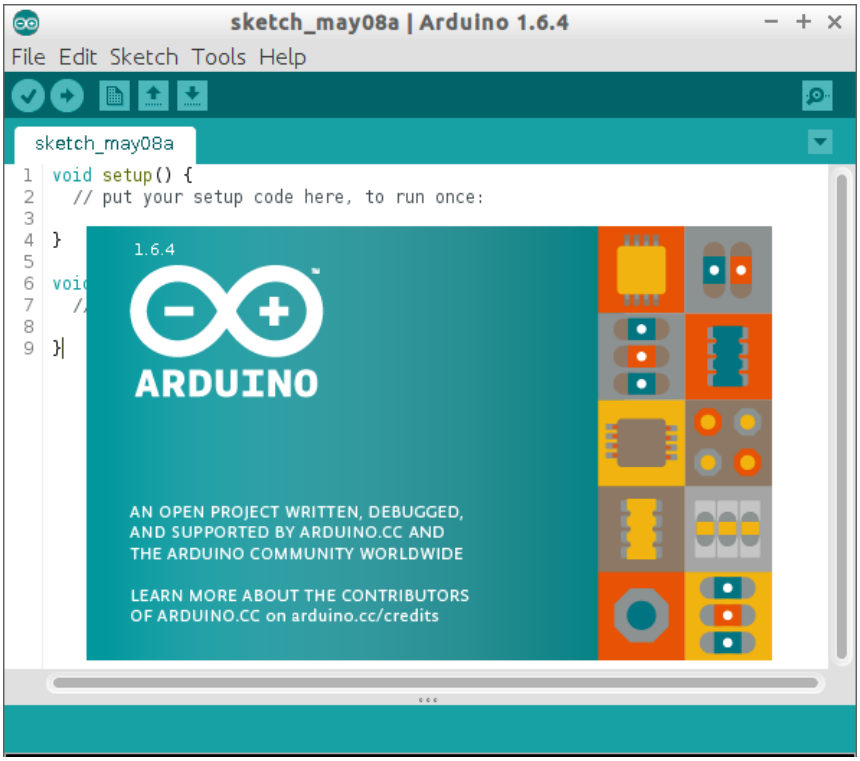

Fig 4.2 Arduino IDE

CHAPTER 5

COMPONENT DESCRIPTION

In this project we use two main modules,

- ESP8266 NODE MCU MODULE
- IR SENSOR MODULE

5.1. ESP8266 NODE MCU MODULE

ESP8266 (presently ESP8266EX) is a chip with which manufacturers are making wirelessly networkable micro-controller modules. More specifically, ESP8266 is a system-on-a-chip (SoC) with capabilities for 2.4 GHz Wi-Fi (802.11 b/g/n, supporting WPA/WPA2), general-purpose input/output (16 GPIO), analog-to-digital conversion (10-bit ADC), Serial Peripheral Interface (SPI), UART (on dedicated pins, plus a transmit-only UART can be enabled on GPIO2), and pulse-width modulation (PWM).

Normal ESP8266 chip needs 3.3V power for working. So we should provide the exact 3.3V for the chip. For better usage of ESP8266, we use NodeMcu board, which is integrated with a ESP8266 chip. Which contains amicroUSB port, so that it can be powered through usb cable. Also it contains an inbuild led for testing.NodeMcu board can be programmed in different ways. That is for easy use NodeMcu board is better than a simple 8266 chip.ESP8266 can be used as an access point or it can be connected to another network.

When it is connected to a network, module can be controlled from other device remotely. Using an app we can control the devices which are connected with the esp8266 module.

5.1.2 ESP8266 – Node MCU Board

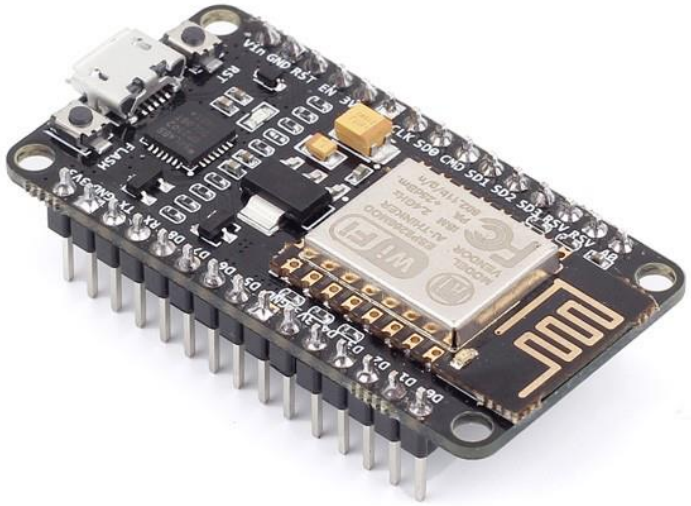

Fig 5.2 : ESP8266 NODE MCU

NodeMCUis an open source IoT platform.It includes firmware which runs on theESP8266 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 dev Kits. The firmware uses the Luascripting language, or it can be simply programed using Arduino IDE. By installing ESP8266 node mcu's board manager in Arduino IDE.

ESP8266 is a highly integrated chip designed for the needs of a new connected world. It offers a complete and self-contained Wi-Fi networking solution, allowing it to either host the application or to offload all Wi-Fi networking functions from another application processor.

5.1.3 NodeMCUPinout

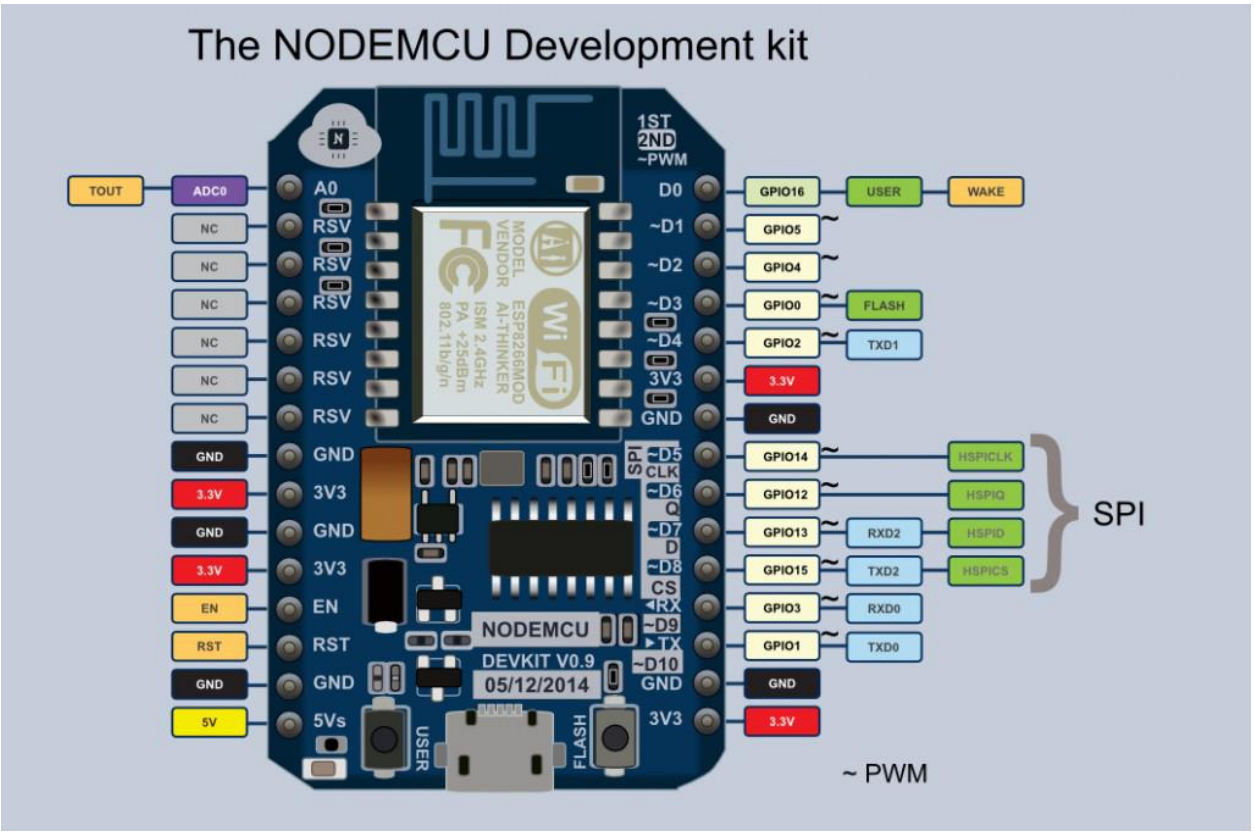

Fig 5.3 Pinout diagram of ESP8266 node MCU

5.1.4 Powering the board

If the board has a USB connector on it then most likely it is powered through this when connected to your PC. Otherwise you will need to power it directly.

5.2 IR Sensor Module

Fig 5.5.1 IR sensor module

IR sensor basically consist an IR LED and a Photodiode, this pair is generally called IR pair or Photo coupler.IR sensor work on the principal in which IR LED emits IR radiation and Photodiode sense that IR radiation. Photodiode resistance changes according to the amount of IR radiation falling on it, hence the voltage drop across it also changes and by using the voltage comparator (like LM358) we can sense the voltage change and generate the output accordingly.
IR sensor basically consist an IR LED and a Photodiode, this pair is generally called IR pair or Photo coupler. IR sensor work on the principal in which IR LED emits IR radiation and Photodiode sense that IR radiation. Photodiode resistance changes according to the amount of IR radiation falling on it, hence the voltage drop across it also changes and by using the voltage comparator (like LM358) we can sense the voltage change and generate the output accordingly.

The placing of IR LED and Photodiode can be done in two ways: Direct and Indirect. In Direct incidence, IR LED and photodiode are kept in front of one another, so that IR radiation can directly falls on photodiode. If we place any object between them, then it stops the falling of IR light on photodiode.

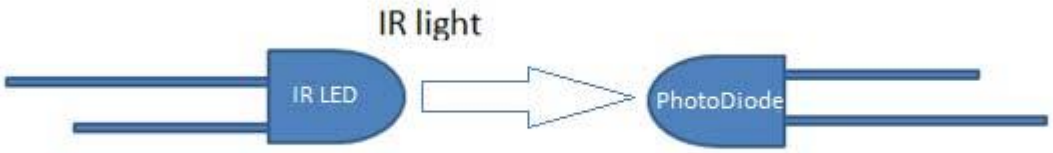

Fig 5.5.2 IR LED and Photodiode

And in Indirect Incidence, both the IR LED and Photo diode are placed in parallel (side by side), facing both in same direction. In that fashion, when a object is kept in front of IR pair, the IR light gets reflected by the object and gets absorbed by photodiode. Note that object shouldn't be black as it will absorb all the IR light, instead of reflect. Generally IR pair is placed in this fashion in IR sensor Module.

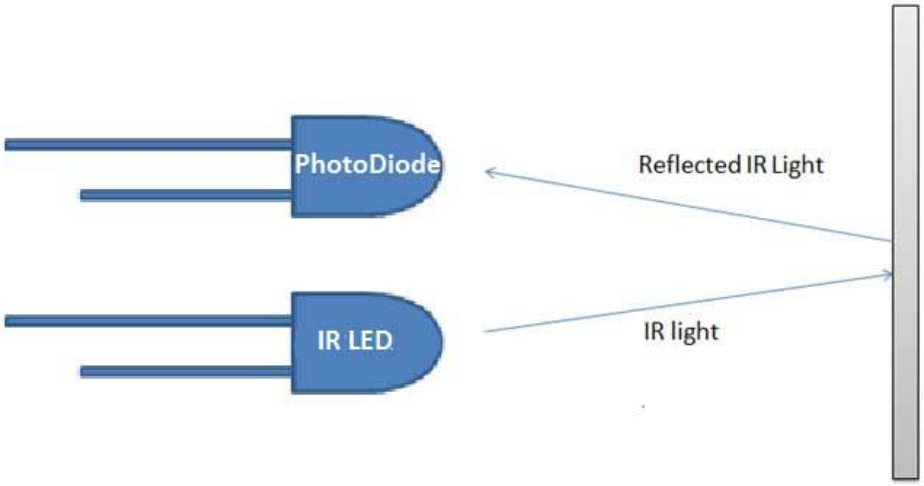

Fig 5.5.3 working principle of IR LED and photodiode

5.2.1 Circuit Diagram of IR sensor module.

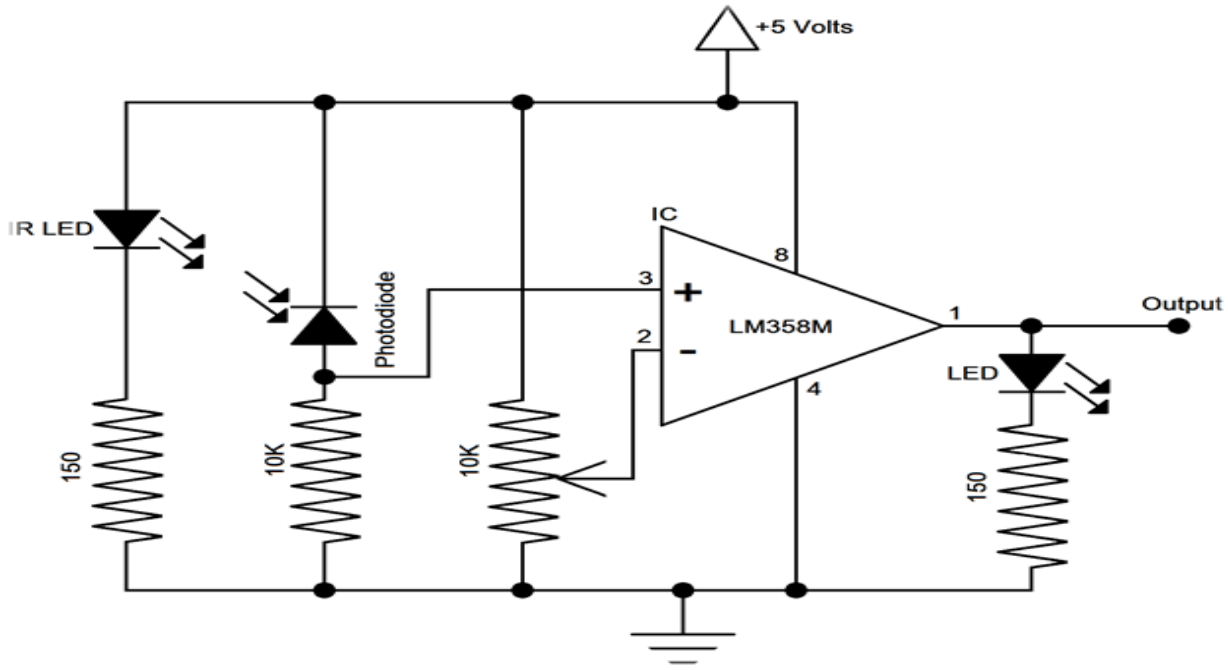

Fig 5.3 circuit diagram

5.2.2IR LED

IR LED emits light, in the range of Infrared frequency. IR light is invisible to us as its wavelength (700nm – 1mm) is much higher than the visible light range. Everything which produce heat, emits infrared like for example our human body. Infrared have the same properties as visible light, like it can be focused, reflected and polarized like visible light.

Fig 5.4.1 IR LED

IR LED looks like a normal LED and also operates like a normal LED, it consumes 20mA current and 3vots power. IR LEDs have light emitting angle of approx. 20-60 degree and range of approx. few centimeters to several feet's, it depends upon the type of IR transmitter and the manufacturer. Some transmitters have the range in kilometers.

5.2.3PhotoDiode

Photodiode is considered as Light dependent Resistor (LDR), means it has very High resistance in absence of light and become low when light falls on it. Photodiode is a semiconductor which has a P-N junction, operated in Reverse Bias, means it start conducting the current in reverse direction when Light falls on it, and the amount of current flow is proportional to the amount of Light. This property makes it useful for IR detection.

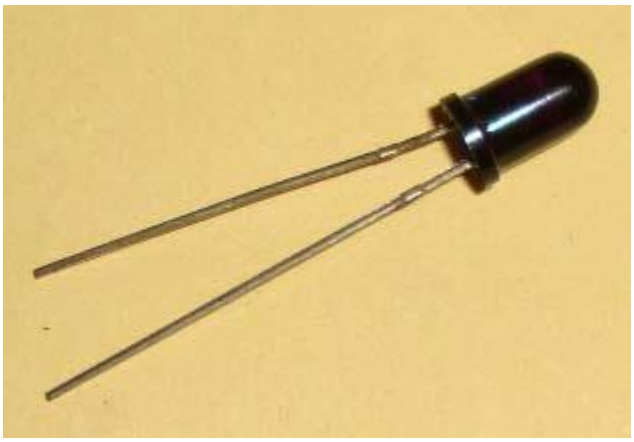

Fig 5.4.2 Photodiode

5.2.4LM358

LM358 is an operational amplifier (Op-Amp) and in this circuit we are using it as a voltage comparator. The LM358 has two independent voltage comparators inside it, which can be powered by single PIN, so we can use the single IC to build two IR sensor modules. We have used only one comparator here, which have inputs at PIN 2 & 3 and output at PIN 1. Voltage comparator has two inputs, one is inverting input and second is non-inverting input (PIN 2 and 3 in LM358). When voltage at non-inverting input (+) is higher than the voltage at inverting input (-), then the output of comparator (PIN 1) is high. And if the voltage of inverting input (-) is Higher than non-inverting end (+), then output is LOW.

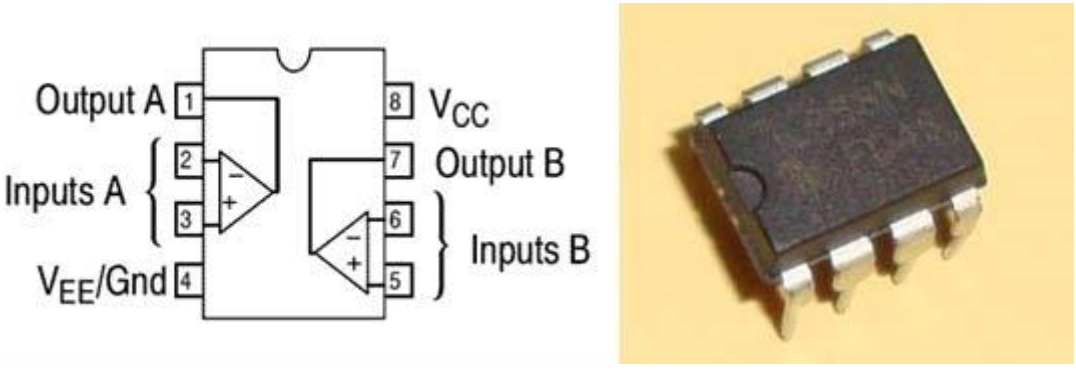

Fig5.4.4 LM 358

CHAPTER 6

ANDROID APPLICATION "SMART-PARKO"

An android application named "SMART-PARKO" is used in this project. The output of project is displayed out to android app. It got two main screens. In first screen the App will switch on GPS and find users position and display Available nearby parking slots,

By moving to next page, user can see the number of slots free for parking his car. This page will be updated in each 5 seconds and user can notify the slots availability in a convenient and accurate manner. Android application is developed using MIT APP INVENTOR.

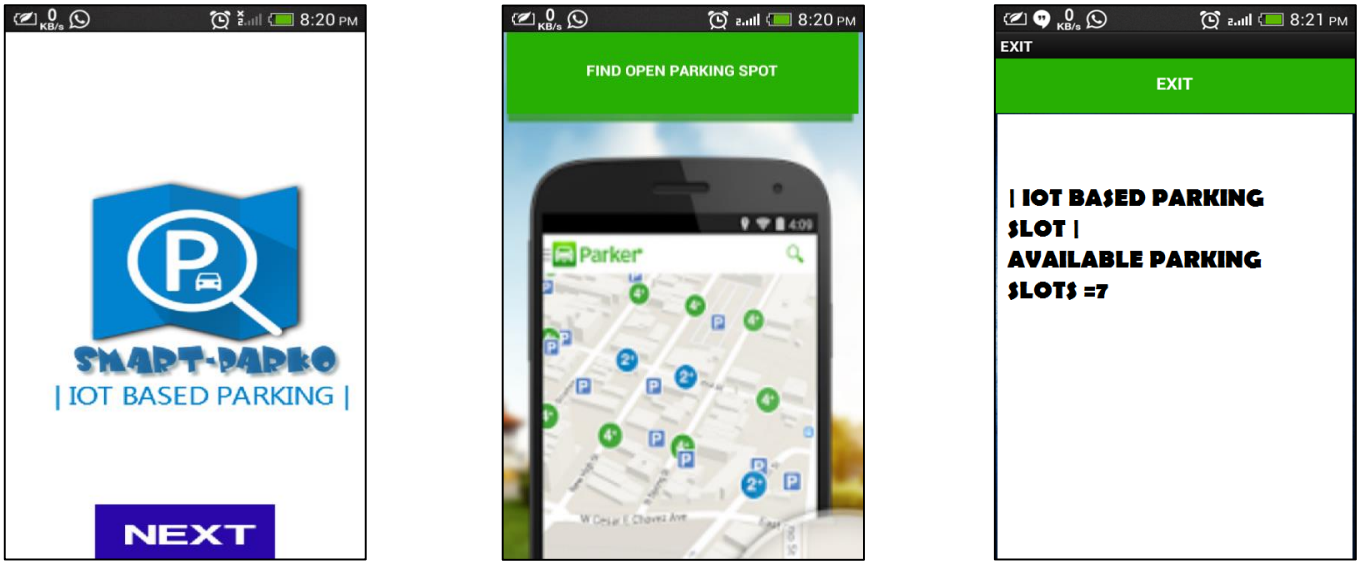

Fig 6.1 Android application "Smart-Parko"

CHAPTER 7

FUTURE SCOPE

Our proposed project system can be used almost everywhere were parking is becoming more tedious. However some additional advancement do exist that can be used along with the proposed system. This concept can be implemented in real world by following add-on features,

- Parking payment service can be implemented
- Parking slot suggestions can be provided through Android app
- Advance parking slot booking service can be implemented.

CHAPTER 8

CONCLUSION

The project named 'SMART-PARKO' was intended to reduce the effort on parking cars. The proposed system mainly aims to reduce the effort of human, by providing systems to monitor almost all aspects of the parking slot and make updated with available slots. Different sensors incorporated constantly monitor the state of the parking slot. Moreover, unlike in the normal systems proposed early we in this system incorporates a monitoring app and a live feed system which has made our project one step above all others.

CHAPTER 9

REFERENCES

1 Benenson, K. Martens and S. Birr. 2008. "Parkagent: An agent-based model of parking in the city," Comput. Environ. Urban Syst. Vol. 32, no. 6, pp. 431–439, November

2 ESP8266 Arduino - Everything ESP8266 - ESP8266 Community Forumwww.esp8266.com/arduino

3 Hardesty, Larry (August 19, 2010). "The MIT roots of Google's new software". MIT NEWS OFFICE.

APPENDICES

ESP8266 NODE MCU

1. General Overview

1.1. Introduction

Espressif Systems' Smart Connectivity Platform (ESCP) is a set of high performance, high integrationwireless SOCs, designed for space and power constrained mobile platform designers. It provides

Unsurpassed ability to embed Wi-Fi capabilities within other systems, or to function as a standalone Application, with the lowest cost, and minimal space requirement.

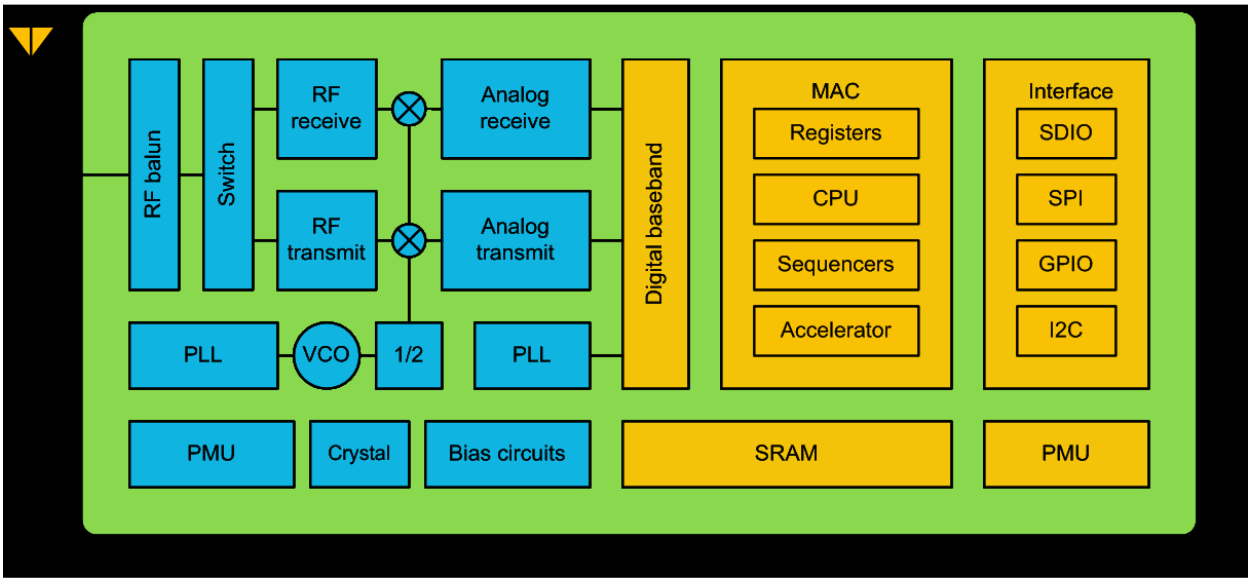

Figure 1 ESP8266EX Block Diagram

ESP8266EX offers a complete and self-contained Wi-Fi networking solution; it can be used to host the application or to offload Wi-Fi networking functions from another application processor.When ESP8266EX hosts the application, it boots up directly from an external flash. In has integrated cache to improve the performance of the system in such applications.Alternately, serving as a Wi-Fi adapter, wireless internet access can be added to any micro controller based design with simple connectivity (SPI/SDIO or I2C/UART interface).

ESP8266EX is among the most integrated Wi-Fi chip in the industry; it integrates the antennaswitches, RF balun, power amplifier, low noise receive amplifier, filters, power management modules, it requires minimal external circuitry, and the entire solution, including front-end module, is designed to occupy minimal PCB area.

ESP8266EX also integrates an enhanced version of Tensilica's L106 Diamond series 32-bit processor, with on-chip SRAM, besides the Wi-Fi functionalities. ESP8266EX is often integrated with external sensors and other application specific devices through its GPIOs; sample codes for such applications are provided in the software development kit (SDK).

Espressif Systems' Smart Connectivity Platform (ESCP) demonstrates sophisticated system-level features include fast sleep/wake context switching for energy-efficient VoIP, adaptive radio biasing for low-power operation, advance signal processing, and spur cancellation and radio co-existence features for common cellular, Bluetooth, DDR, LVDS, LCD interference mitigation.

1.2. Features

- ✓ 802.11 b/g/n
- ✓ Integrated low power 32-bit MCU
- ✓ Integrated 10-bit ADC
- ✓ Integrated TCP/IP protocol stack
- ✓ Integrated TR switch, balun, LNA, power amplifier and matching network
- ✓ Integrated PLL, regulators, and power management units
- ✓ Supports antenna diversity
- ✓ Wi-Fi 2.4 GHz, support WPA/WPA2
- ✓ Support STA/AP/STA+AP operation modes
- ✓ Support Smart Link Function for both Android and iOS devices
- ✓ SDIO 2.0, (H) SPI, UART, I2C, I2S, IR Remote Control, PWM, GPIO
- ✓ STBC, 1x1 MIMO, 2x1 MIMO
- ✓ A-MPDU & A-MSDU aggregation & 0.4s guard interval
- ✓ Deep sleep power <10uA, Power down leakage current < 5uA

Programing Code

```
#include "ESP8266WiFi.h"
WiFiServerserver(80);
// WiFi parameters to be configured
const char* ssid = "KAREEM";
const char* password = "123456789";
WiFiClient client;

inti,e,l;
void setup() {

  // put your setup code here, to run once:
pinMode(D2,INPUT);
pinMode(D1,INPUT);

Serial.begin(115200);
delay(10);
WiFi.begin(ssid, password);
// while wifi not connected yet, print '.'
// then after it connected, get out of the loop
while (WiFi.status() != WL_CONNECTED)
{
delay(500);
Serial.print(".");
}

//print a new line, then print WiFi connected and the IP address
Serial.println("");
Serial.println("WiFi connected");
```

```
 // Print the IP address
Serial.println(WiFi.localIP());
 // Start the server
server.begin();
Serial.println("Server started");
delay(500);
}

void loop() {

  // put your main code here, to run repeatedly:
//  Serial.print("Sensor1:");
//  Serial.println(digitalRead(D1));
//    Serial.print("Sensor2:");
//  Serial.println(digitalRead(D2));
if(digitalRead(D1)==1)
    e=1;
delay(100);
if(e==1 &&digitalRead(D2)==1)
  {
i++;
    e=0;
  }
if(digitalRead(D2)==1)
  l=1;
delay(100);
if(l==1 &&digitalRead(D1)==1)
  {
i--;
    l=0;
```

```
  }
Serial.print("AVAILABLE SLOTS OUT OF 7= ");
Serial.print(i);
Serial.println(".");
  //browser code
WiFiClient client = server.available();
client.println("HTTP/1.1 200 OK");
client.println("Content-Type: text/html");
client.println();
// your actual web page that displays available slots
client.println("<!DOCTYPE HTML>");
client.println("<html>");
client.println("<head></head><body><h1>ESP8266 -IOT BASED SMART PARKING SLOT FINDER </h1>");
client.println("<head>PARKING STATION AT MESCE KUTTIPPURAM</head>");
client.println("<h1>TOTAL PARKING SLOTS = 7");
client.println(" ");
client.print("<meta http-equiv=\"refresh\" content=\"2\">");
client.println("<t><h1>FILLED PARKING SLOTS: </h1></t>");
client.print(i);

if(i==7)
client.println("PARKING IS FULL");
delay(1000);
            }
```