SMART PARKING SYSTEM USING ARDUINO UNO

An Industrial Training Project Report

submitted

in partial fulfilment of the requirements for

the award of the degree of

Bachelor of Technology

Electronics & Communication Engineering

(JNTUA, Anantapuramu)

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CERTIFICATE

This is to certify that the Industrial Training Project Report entitled **SMART PARKING SYSTEMUSING ARDUINO UNO** is the bonafide record of the Industrial Training Project Report carried out under my Guidance and Supervision by

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in Partial Fulfilment of the requirements for the award of Bachelor of Technology in Electronics & Communication Engineering by JNTUA, and is submitted in the Department of Electronics & Communication Engineering, Brindavan Institute of Technology & Science, NH-7, Peddatekur, Kurnool.

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ABSTRACT:

Objective of this project is to monitor the status of the parking slots availability in shopping malls and also the exact location of their availability at the entrance. This ensures that the customers can easily identify the available slots to park their vehicles instead of slowly randomly searching for a slot. The name smart in this project indicates that this system will automatically detect the free slots and send these status to the entrance display via Internet. The purpose of Internet in this project is to ensure that there is no limit the range of the signal, size of the parking area, no of slots available for parking and also to enable the use of data analytics and projections based on the past usage.

LIST OF FIGURES

CHAPTER-1

1. INTRODUCTION

1.1. INTRODUCTION TO THE PROJECT

Finding a parking slot to park their vehicle has ended up being a disappointing issue to the drivers all the time. It has paved the way for traffic congestion which has turned out to be an alarming problem on a global scale. Also, it has been found that it has led to the burning of world's oil over a million. According to a report, Smart Parking system could benefit in saving 2,20,000 gallons of gas till 2030 and 3,00,000 gallons of gas by 2050 , if it is executed perfectly. In oSrder to alleviate this condition, many smart parking facilities evolved but failed to bring relief to all. They could only give the parking information but didn't prove to "smart" enough.

The Internet is the vast global network of connected servers, computers, tablets and mobiles using the internationally used protocols and connecting systems. Things could be commonly said as any possession or object. The machine-to-machine (M2M) data that is generated has a wide range of uses, but it is specifically seen for Smart Parking here. They aim to give convenience as well as correctness.

Internet of Things plays a vital role in the creation of Smart Cities. The most important factors for the emergence of smart cities are parking facilities and efficient transportation and management. Due to the advancements in the sensor technology and the low-cost features of the Embedded Systems, we say that applications can be created using Internet of Things. According to the latest report made by The International Parking Institute, we found that many innovative parking ideas have been developed.

CHAPTER-2

2. LITERATURE REVIEW

Various methods are prevalent for development of autonomous or intelligent parking systems. Study of these systems shows that these require a little or more human intervention for the functioning. One of the intelligent systems for car parking has been proposed by making use of Image processing. In this system, a brown rounded image on the parking slot is captured and processed to detect the free parking slot. The information about the currently available parking slots is displayed on the 7-segment display. Initially, the image of parking slots with brown-rounded image is taken. The image is segmented to create binary images. The noise is removed from this image and the object boundaries are traced.

The image detection module determines which objects are round, by estimating each objects area and perimeter. Accordingly, the free parking space is allocated. A vision based car parking system is developed which uses two types of images (positive and negative) to detect free parking slot. In this method, the object classifier detects the required object within the input. Positive images contain the images of cars from various angles. Negative images do not contain any cars in them. The co-ordinates of parking lots specified are used as input to detect the presence of cars in the region. Hair-like features are used for feature detection. However, limitations may occur with this system with respect to the type of camera used. Also, the co-ordinate system used selects specific parking locations and thus camera has to be at a fixed location. Limited set of positive and negative images may impose limitations on the system. Number Plate Recognition technique for developing autonomous car parking system uses image processing basis to process the number plates of the vehicles. In this system, the image of the license number plate of the vehicle is acquired. It is further segmented to obtain individual characters in the number plate.

CHAPTER-3

3. INTRODUCTION ABOUT EMBEDDED SYSTEMS

3.1 INTRODUCTION OF EMBEDDED SYSTEM:

An embedded system is a combination of software and hardware to perform a dedicated task. Some of the main devices used in embedded products are Microprocessors and Microcontrollers.

Microprocessors are commonly referred to as general purpose processors as they simply accept the inputs, process it and give the output. In contrast, a microcontroller not only accepts the data as inputs but also manipulates it, interfaces the data with various devices, controls the data and thus finally gives the result.

An Embedded System is a combination of computer hardware and software, and perhaps additional mechanical or other parts, designed to perform a specific function. A good example is the microwave oven. Almost every household has one, and tens of millions of them are used every day, but very few people realize that a processor and software are involved in the preparation of their lunch or dinner.

This is in direct contrast to the personal computer in the family room. It too is comprised of computer hardware and software and mechanical components (disk drives, for example). However, a personal computer is not designed to perform a specific function rather; it is able to do many different things. Many people use the term general-purpose computer to make this distinction clear. As shipped, a general-purpose computer is a blank slate; the manufacturer does not know what the customer will do wish it. One customer may use it for a network file server another may use it exclusively for playing games, and a third may use it to write the next great American novel.

3.2. OVERVIEW OF EMBEDDED SYSTEM:

Every embedded system consists of custom-built hardware built around a Central Processing Unit (CPU). This hardware also contains memory chips onto which the software is loaded. The software residing on the memory chip is also called the 'firmware'.

For applications involving complex processing, it is advisable to have an operating system. In such a case, you need to integrate the application software with the operating system and then transfer the entire software on to the memory chip. Now, let us see the details of the various building blocks of the hardware of an embedded system. As shown in Fig. the building blocks are:

a. Central Processing Unit (CPU)
b. Memory (Read-only Memory and Random Access Memory)
c. Input Devices
d. Output devices
e. Communication interfaces
f. Application-specific circuitry

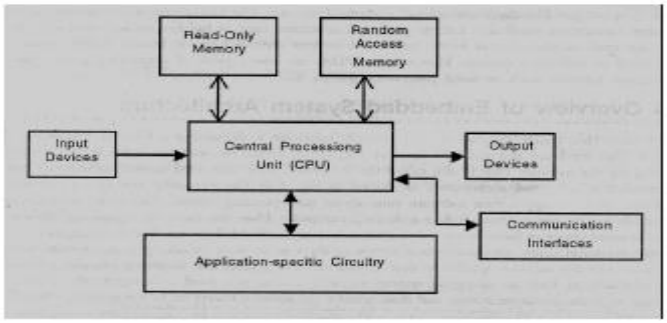


Fig: 3.2 Building blocks of the hardware of an embedded system

- **CENTRAL PROCESSING UNIT (CPU):**

The Central Processing Unit (processor, in short) can be any of the following: microcontroller, microprocessor or Digital Signal Processor (DSP). A micro-controller is a low-cost processor

- **MEMORY:**

The memory is categorized as Random Access 11emory (RAM) and Read Only Memory (ROM). The contents of the RAM will be erased if power is switched off to the chip, whereas ROM retains the contents even if the power is switched off. So, the firmware is stored in the ROM.

- **INPUT DEVICES**:

Unlike the desktops, the input devices to an embedded system have very limited capability. There will be no keyboard or a mouse, and hence interacting with the embedded system is no easy task. Many embedded systems will have a small keypad-you press one key to give a specific command. A keypad may be used to input only the digits. Many embedded systems used in process control do not have any input device for user interaction; they take inputs from sensors or transducers 1'fnd produce electrical signals that are in turn fed to other systems.

- **OUTPUT DEVICES**:

The output devices of the embedded systems also have very limited capability. Some embedded systems will have a few Light Emitting Diodes (LEDs) to indicate the health status of the system modules, or for visual indication of alarms. A small Liquid Crystal Display (LCD) may also be used to display some important parameters.

- **COMMUNICATION INTERFACES**:

The embedded systems may need to, interact with other embedded systems at they may have to transmit data to a desktop. To facilitate this, the embedded systems are provided with one or a few communication interfaces such as RS232, RS422, RS485, Universal Serial Bus (USB), IEEE 1394, Ethernet etc.

- **APPLICATION-SPECIFIC CIRCUITRY:**

Sensors, transducers, special processing and control circuitry may be required fat an embedded system, depending on its application. This circuitry interacts with the processor to carry out the necessary work. The entire hardware has to be given power supply either through the 230 volts main supply or through a battery. The hardware has to design in such a way that the power consumption is minimized.

CHAPTER-4

4. DESIGN OF HARDWARE

This chapter briefly explains about the hardware implementation of IoT based Parking System. It discusses the circuit diagram of each module in detail. For implementing the Parking system, there is a need of essential components that are suitable and manipulate Parking spaces. The components use generally includes IR sensors, Arduino

4.1 INFRARED SENSORS

Infrared radiation is an electromagnetic wave with wavelength of 700nm to 1 mm. It is emitted by objects with temperature above 0 Kelvin. Furthermore intensity and wavelength of infrared radiation depends on the temperature of the object. The infrared sensors are the sensors that detect/measure infrared radiation or change in the radiation from outer source or inbuilt source. A simple circuit for obtaining output voltage (signal) consists of a current source, photo detector (dark resistance), a resistor and a voltage output.

Fig: 4.1 Example of basic circuit for signal output

In the circuit when radiation strikes the resistor Rd then its resistance changes consequently changing the voltage output Vo. D*: It is the photosensitivity per unit active area of the detector. Therefore, higher D* means better performance. Noise Equivalent Point(NEP): Noise is caused by the background radiation and it affects the signal output. NEP is the amount of incident radiation when the signal to noise ratio is 1.

Types of Infra-Red Sensors

There are two types of infrared sensor based on its function:

- Thermal Infrared sensor:
- Quantum infrared sensor

These are the types of infrared sensors based on the working mechanism:

- Active Infrared Sensors
- Passive Infrared sensors.

4.1.1 ACTIVE INFRARED SENSORS

Active infrared sensors are the types of infrared sensor that emit infrared radiation which is later received by the receiver. The IR is emitted by a IR Light Emitting Diode (LED) and received by photodiode, phototransistor or photoelectric cells.

There are two types of Active infrared sensors

Break beam sensors

These types of Active IR sensor have emitter and receiver placed in such a way that the IR emitted by the emitter falls directly in to the receiver. During the operation, IR beam is emitted continuously towards the receiver. The flow of IR can be interrupted by placing an object between the emitter and receiver. If the IR is transmitted but altered then receiver generates output based on the change in radiation.

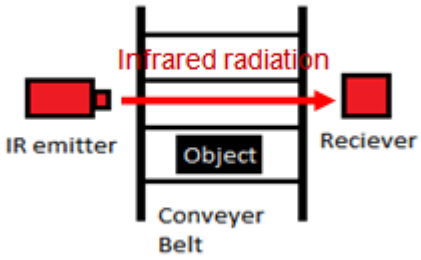


Fig: 4.1.1(a) Break Beam Sensors

Reflectance sensors

These types of sensors use reflective property of IR. The emitter emits an IR beam which is reflected by the object. The reflected IR is the detected by the receiver. The object causes change in the property of the reflected IR or the amount of IR received by the receiver varies. The degree of change is dependent on the reflectance of the object. Thus detecting the change in amount of received IR helps in figuring out the properties of object such as surface geography and reflectance.

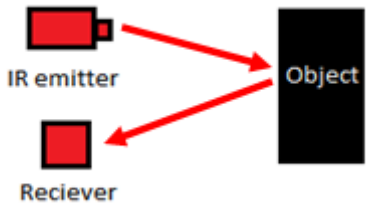


Fig: 4.1.1(b) Reflectance sensor

4.1.2 Passive Infrared Sensor

Passive infrared sensors detect the infrared radiations from outer source. When an object in a field of view of a sensor it provides a reading based on a thermal input. It does not generate any infrared. There are different kind of Passive infrared sensor.

- Thermal passive infrared sensor
- Pyroelectric infrared senor

4.1.3 Pyro electric infrared sensor (PIR)

The infrared sensor has its detecting area. Multizonal Fresnel lens array is associated covers the pyroelectric transducer. This lens is Plano convex lens that are designed to collect the infrared radiation from the different spatial zones. Fresnel lens are made up of material that can transmit infrared range of 8µM to 14µm. This lens dose not view the space in continuous fashion, the detection pattern of sensor is fan shaped .It views as a discrete beams or cones.

The gap between the cones increases with the distance and it is inversely proportional to the sensitivity of the sensor. The PIR sensors have two pins 1 and 2 they are activated when a radiation source passes is in the field of view. Pins are wired as opposite input. Pin 1 activates when radiation source come across the Pin 1 which is positive zone and the sensor values goes up, when the radiation source continues towards Pin 2 which is negative zone the value drops and the value comes to 0, this activity causes the net positive effect on the sensor value.

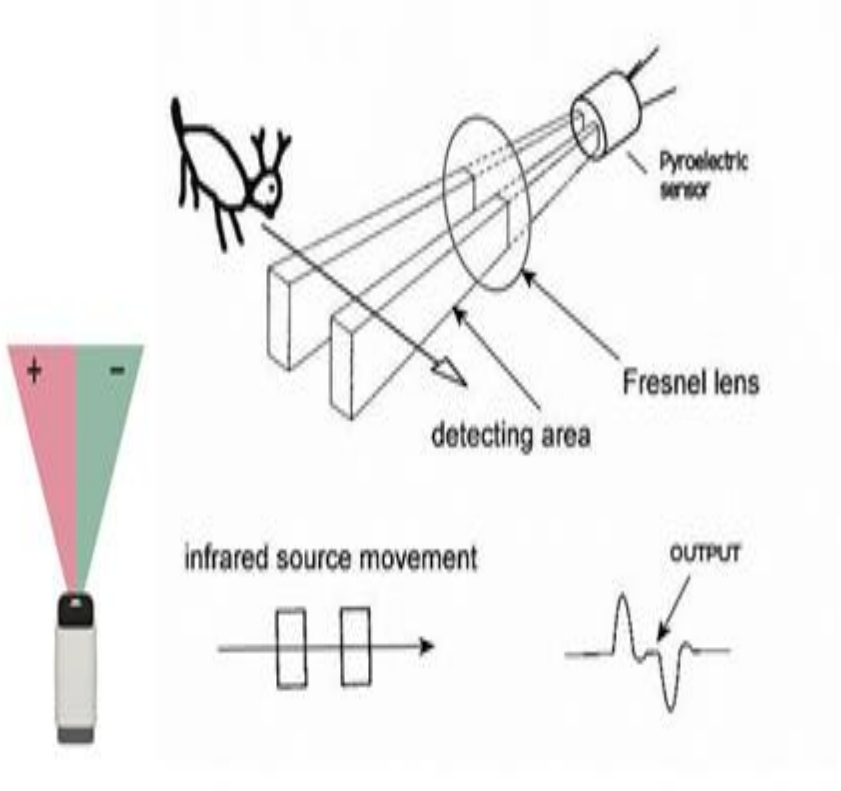


Fig: 4.1.3 Principle of PIR sensor

The radiation strikes pryoelectric films that are made of lithium tantalite. It is dielectric (insulator) in nature so its surface area charges when it is strike by radiated infrared. It has electrodes which gather the charge. The produced charge is measured with FET (Field effective transistor) device that is inbuilt in sensor. Among 3 pins in the FET pin 3 is grounded about 100k and pin 2 is feed into a stage amplifier having signal condition circuits.

The amplifier avoids the high frequency noises above 10Hz. The signal produced is in the range of 1mVpp that is a small voltage around a DC signal. The power source of 3 to 15 volt is required for the FET supplied through Pin 1.Externtal resistor is connected to pin 3 and pin 2 which converts the FET current to voltage. Pin 2 of a FET is followed by Amplifier and comparator

4.2 Arduino Uno

The most common version of Arduino is the Arduino Uno. This board is what most people are talking about when they refer to an Arduino. The Uno is one of the more popular boards in the Arduino family and a great choice for beginners. There are different revisions of Arduino Uno, below detail is the most recent revision (Rev3 or R3).

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button.

Microcontroller	:	ATmega328
Operating Voltage	:	5V
Input Voltage (recommended)	:	7-12V
Input Voltage (limits)	:	6-20V
Digital I/O Pins	:	14 (of which 6 provide PWM output)
Analog Input Pins	:	6
DC Current per I/O Pin	:	40 mA
DC Current for 3.3V Pin	:	50 mA
Flash Memory	:	32 KB (ATmega328) of which 0.5 KB used by bootloader
SRAM	:	2 KB (ATmega328)
EEPROM	:	1 KB (ATmega328)
Clock Speed	:	16 MHz
Length	:	68.6 mm
Width	:	53.4 mm

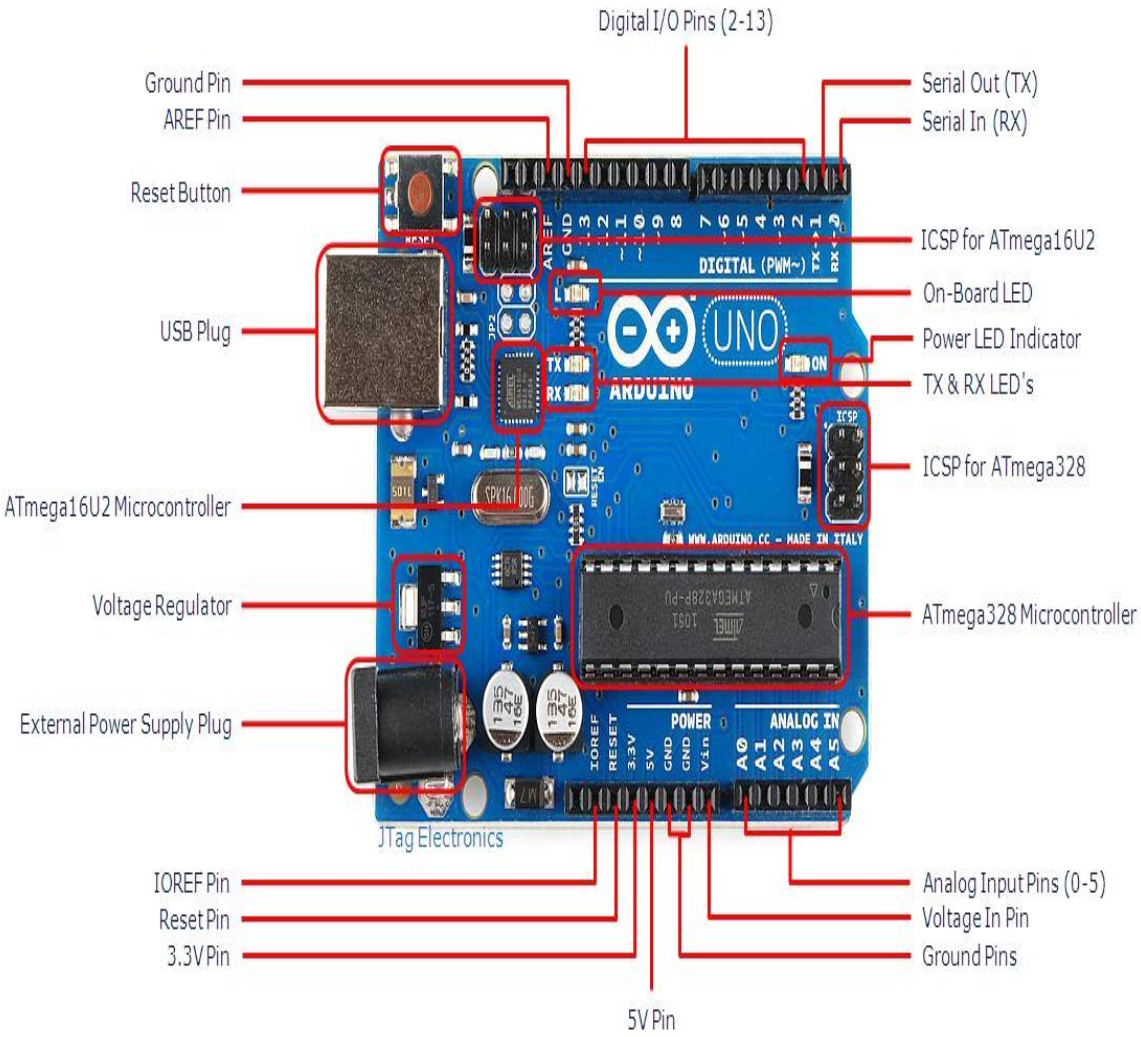


Fig: 4.2 ArduinoUno R3 Board

- **USB Plug & External Power Supply Plug**

Every Arduino board needs a way to be connected to a power source. The Arduino Uno can be powered from a USB cable coming from your computer or a wall power supply that is terminated in a barrel jack. The power source is selected automatically. The USB connection is also how you will load code onto your Arduino board. Please on my other post on how to program with Arduino can be found in Installing and Programming Arduino.

- **Voltage Regulator**

The voltage regulator is not actually something you can (or should) interact with on the Arduino. But it is potentially useful to know that it is there and what it's for. The voltage regulator does exactly what it says – it controls the amount of voltage that is let into the Arduino board. Think of it as a kind of gatekeeper; it will turn away an extra voltage that might harm the circuit. Of course,it has its limits, so don't hook up your Arduino to anything greater than 20 volts.

- **Power Pins**

Voltage In Pin – The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.

- **Ground Pins**

There are several GND pins on the Arduino, any of which can be used to ground your circuit.

- **IOREF Pin**

This pin on the Arduino board provides the voltage reference with which the microcontroller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source or enable voltage translators on the outputs for working with the 5V or 3.3V.

- **Input and Output Pins**

Each of the 14 digital pins on the Uno can be used as an input or output. They operate at 5 volts. These pins can be used for both digital input (like telling if a button is pushed) and digital output (like powering an LED). Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-5k Ohms. In addition, some pins have specialized functions.

- **Serial Out (TX) & Serial In (RX)**

Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip.

- **External Interrupts**

Pins 2 and 3 can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.

PWM – You may have noticed the tilde (~) next to some of the digital pins (3, 5, 6, 9, 10, and 11). These pins act as normal digital pins, but can also be used for something called Pulse-Width Modulation (PWM). Think of these pins as being able to simulate analog output (like fading an LED in and out).

SPI – Pins 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). SPI stands for Serial Peripheral Interface. These pins support SPI communication using the SPI library.

- **Reset Pin**

Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

- **LED Indicators**

Power LED Indicator – Just beneath and to the right of the word "UNO" on your circuit board, there's a tiny LED next to the word 'ON'. This LED should light up whenever you plug your Arduino into a power source. If this light doesn't turn on, there's a good chance something is wrong. Time to re-check your circuit!

Reset Button: Pushing the reset button temporarily connect the reset pin to ground and restart any code that is loaded on the Arduino. This can be very useful if your code doesn't repeat, but you want to test it multiple times.

4.3. POWER SUPPLY:

The power supplies are designed to convert high voltage AC mains electricity to a suitable low voltage supply for electronic circuits and other devices. A power supply can by broken down into a series of blocks, each of which performs a particular function. A d.c power supply which maintains the output voltage constant irrespective of a.c mains fluctuations or load variations is known as "Regulated D.C Power Supply".

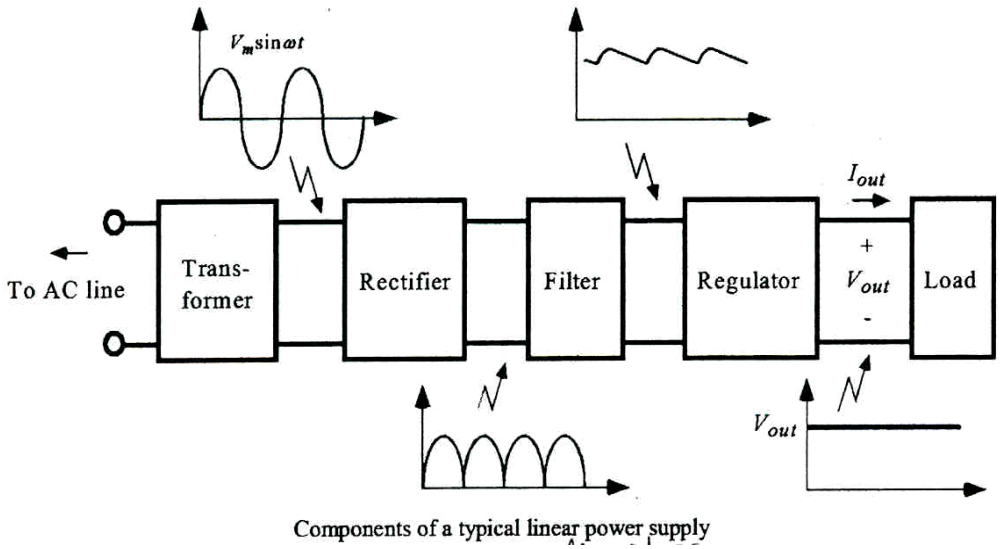


Fig:4.3(a). Block Diagram of Power Supply

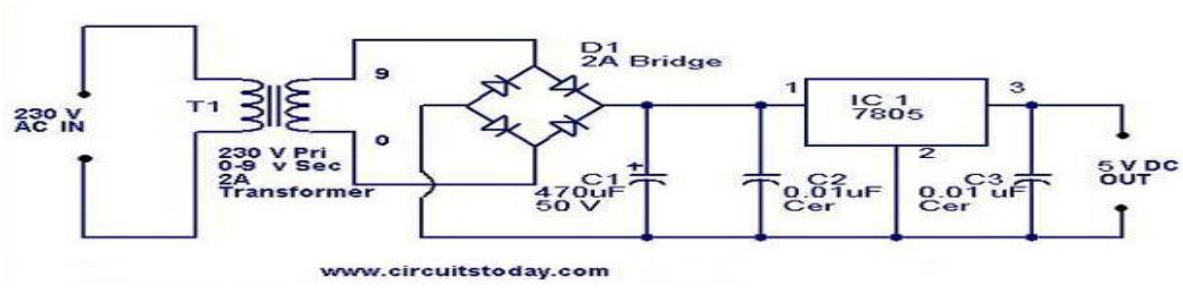


Fig:4.3(b). Schematic Diagram of Power Supply

4.3.1. TRANSFORMER:

A transformer is an electrical device which is used to convert electrical power from one Electrical circuit to another without change in frequency.

When AC is applied to the primary winding of the power transformer it can either be stepped down or up depending on the value of DC needed.

4.3.2. RECTIFIER:

A circuit which is used to convert AC to DC is known as RECTIFIER. The process of conversion AC to DC is called "rectification.

Bridge Rectifier:

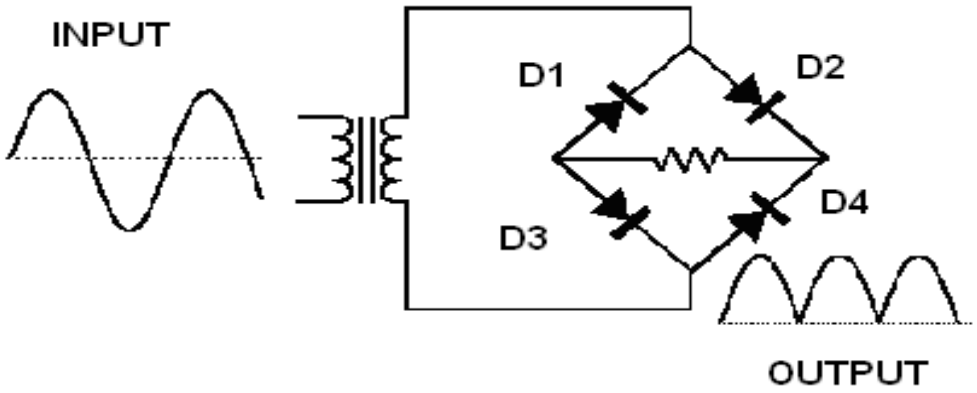


Fig: 4.3.2 Bridge Rectifier

OPERATION:

During positive half cycle of secondary, the diodes D2 and D3 are in forward biased while D1 and D4 are in reverse biased. During negative half cycle of secondary voltage, the diodes D1 and D4 are in forward biased while D2 and D3 are in reverse biased.

4.3.3. FILTER:

A Filter is a device which removes the AC component of rectifier output but allows the DC component to reach the load. We have seen that the ripple content in the rectified output of half wave rectifier is **121%** or that of full-wave or bridge rectifier or bridge rectifier is **48%** such high percentages of ripples is not acceptable for most of the applications. Ripples can be removed by one of the following methods of filtering

4.3.4. VOLTAGE REGULATOR:

As the name itself implies, it regulates the input applied to it. A voltage regulator is an electrical regulator designed to automatically maintain a constant voltage level. In this project, power supply of 5V and 12V are required. In order to obtain these voltage levels,7805 and 7812 voltage regulators are to be used. The first number 78 represents positive supply and the numbers 0512 represent the required output voltage.

4.4. COMMUNICATION NETWORK

In the IOT based parking System, wireless network is used to forward measurement through a gateway towards cloud. The main network used here is IoT. The meaning of IoT is Internet of Things, simply called as Internet of everything. Different wireless communication technologies can be used for

(i) Connecting the IoT device as local networks, and

(ii) Connecting these local networks (or individual IoT devices) to the Internet. The connectivity technologies are NFC, Bluetooth, zig-bee, cellular network etc. In this project, we use cellular network connectivity because of it has widespread mobile networks like 3G and LTE provide reliable high-speed connectivity to the Internet. However, they have a high power consumption profile and they are not suitable for M2M or local network communication.

4.5 ALPHANUMERIC LCD

Liquid Crystal Display also called as LCD is very helpful in providing user interface as well as for debugging purpose. The most commonly used Character based LCDs are based on Hitachi's HD44780 controller or other which are compatible with HD44580. The most commonly used LCDs found in the market today are 1 Line, 2 Line or 4 Line LCDs which have only 1 controller and support at most of 80 characters, whereas LCDs supporting more than 80 characters make use of 2 HD44780 controllers.

Pin Description

DDRAM - Display Data RAM

Display data RAM (DDRAM) stores display data represented in 8-bit character codes. Its extended capacity is 80 X 8 bits, or 80 characters. The area in display data RAM (DDRAM) that is not used for display can be used as general data RAM. So whatever you send on the DDRAM is actually displayed on the LCD. For LCDs like 1x16, only 16 characters are visible, so whatever you write after 16 chars is written in DDRAM but is not visible to the user.

CGROM - Character Generator ROM

Now you might be thinking that when you send an ASCII value to DDRAM, how the character is displayed on LCD? So the answer is CGROM. The character generator ROM generates 5 x 8 dot or 5 x 10 dot character patterns from 8-bit character codes. It can generate 208 5 x 8 dot character patterns and 32 5 x 10 dot character patterns.

CGRAM - Character Generator RAM

As clear from the name, CGRAM area is used to create custom characters in LCD. In the character generator RAM, the user can rewrite character patterns by program. For 5 x 8 dots, eight character patterns can be written, and for 5 x 10 dots, four character patterns can be written.

BF - Busy Flag

Busy Flag is a status indicator flag for LCD. When we send a command or data to the LCD for processing, this flag is set (i.e. BF =1) and as soon as the instruction is executed successfully this flag is cleared (BF = 0). This is helpful in producing and exact amount of delay for the LCD processing.

Instruction Register (IR) and Data Register (DR)

There are two 8-bit registers in HD44780 controller Instruction and Data register. Instruction register corresponds to the register where you send commands to LCD e.g. LCD shift command, LCD clear, LCD address etc. and Data register is used for storing data which is to be displayed on LCD. When send the enable signal of the LCD is asserted, the data on the pins is latched in to the data register and data is then moved automatically to the DDRAM and hence is displayed on the LCD. Data Register is not only used for sending data to DDRAM but also for CGRAM, the address where you want to send the data, is decided by the instruction you send to LCD.

Commands and Instruction set

Only the instruction register (IR) and the data register (DR) of the LCD can be controlled by the MCU. Before starting the internal operation of the LCD, control information is temporarily stored into these registers to allow interfacing with various MCUs, which operate at different speeds, or various peripheral control devices. The internal operation of the LCD is determined by signals sent from the MCU. These signals, which include register selection signal (RS), read/write signal (R/W), and the data bus (DB0 to DB7), make up the LCD instructions (Table 3). There are four categories of instructions that:

- Designate LCD functions, such as display format, data length, etc.
- Set internal RAM addresses
- Perform data transfer with internal RAM

Sending Commands to LCD

To send commands we simply need to select the command register. Everything is same as we have done in the initialization routine. But we will summarize the common steps and put them in a single subroutine. Following are the steps:

- move data to LCD port
- select command register
- select write operation
- send enable signal
- wait for LCD to process the command

Sending Data to LCD

To send data we simply need to select the data register. Everything is same as the command routine. Following are the steps:

- move data to LCD port
- select data register
- select write operation
- send enable signal
- wait for LCD to process the data

CHAPTER-5

5. DESIGN OF SOFTWARE

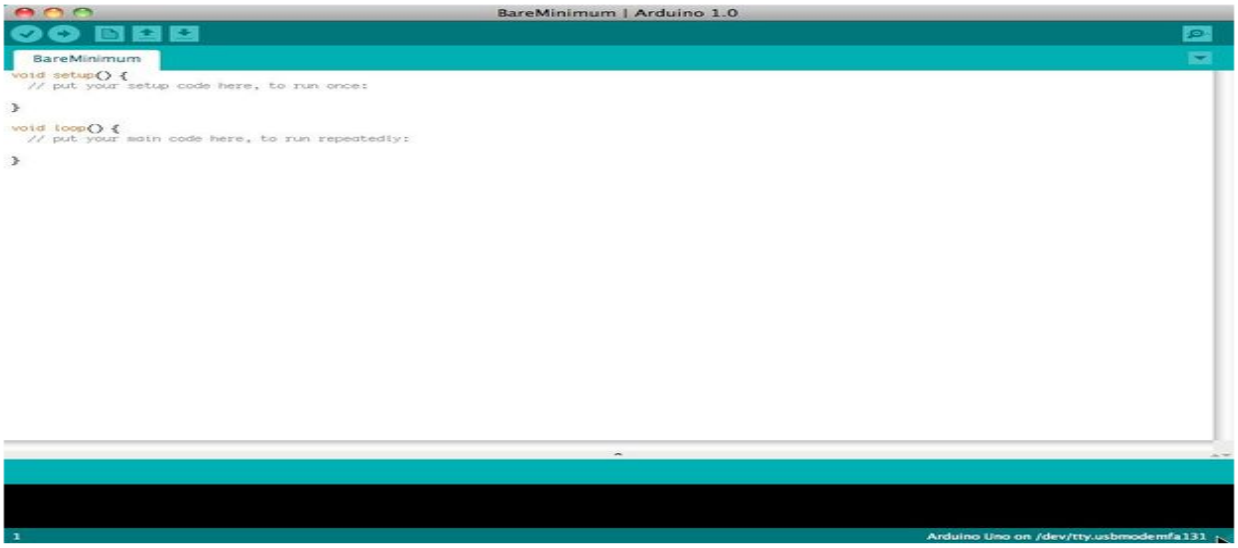
5.1. INTRODUCTION TO ARDUINO IDE SOFTWARE:

This is free software (evaluation version) which solves many of the pain points for an embedded system developer. This software is an Integrated Development Environment (IDE), which integrated text editor to write program, a compiler and it will convert your source code into HEX file. Here is simple guide to start working with Arduino IDE Vision which can be used for:

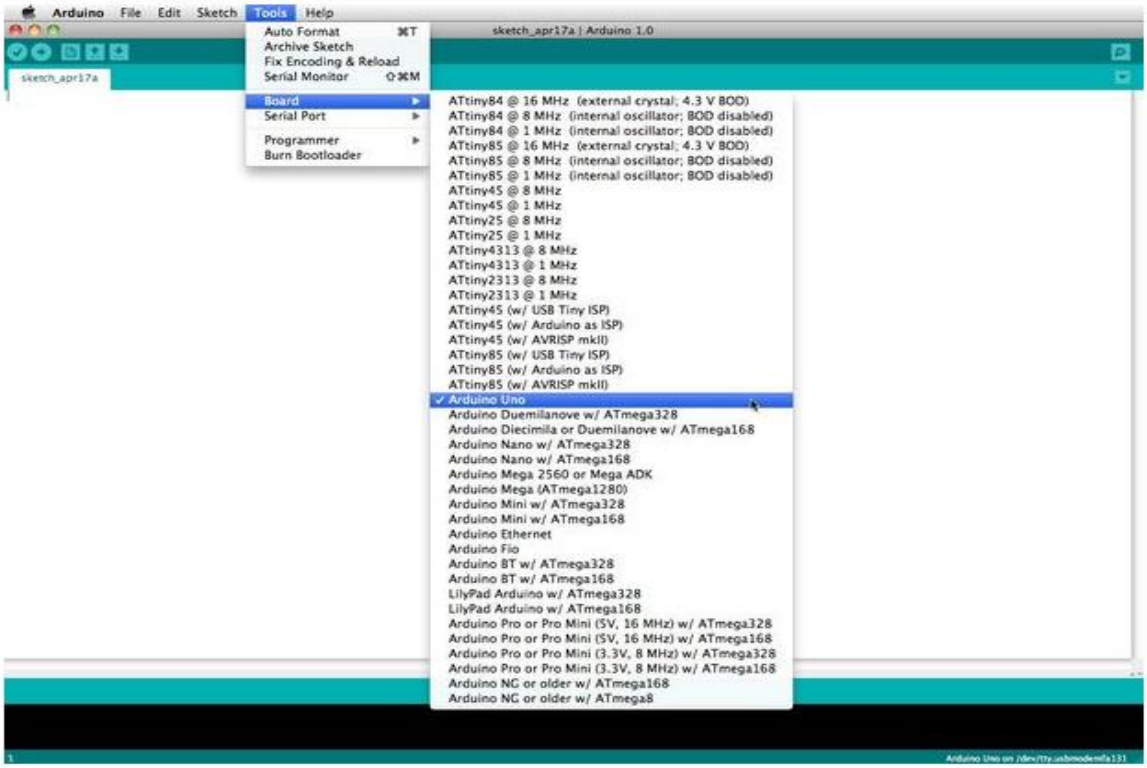
- Writing programs in Arduino IDE
- Compiling and assembling programs
- Debugging programs

5.2. SOFTWARE STEPS:

Before you can start doing anything with the Arduino, you need to download and install the Arduino IDE (integrated development environment).



After the opening IDE the settings are changed in order to connect to the Arduino.



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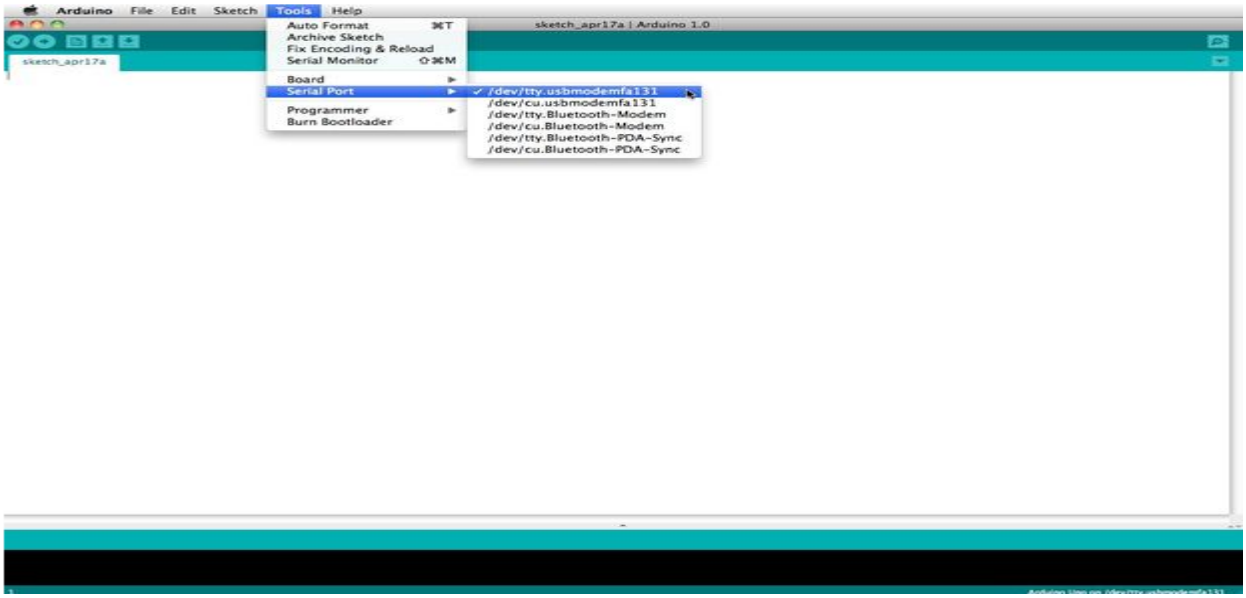
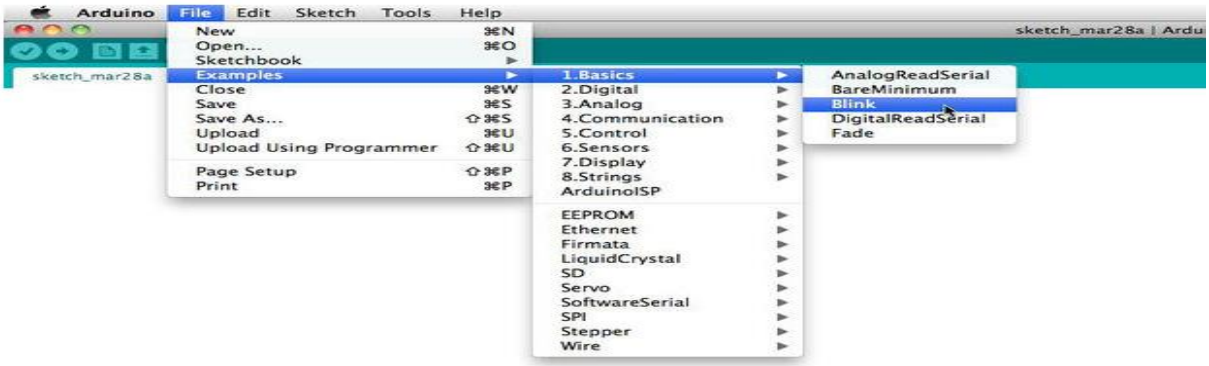


Arduino programs are called sketches. The Arduino programmer comes with a ton of example sketches preloaded. This is great because even if you have never programmed anything in your life, you can load one of these sketches and get the Arduino to do something.



CHAPTER-6

6. PROJECT DESCRIPTION

This chapter deals with working and circuits of "**IOT based Parking system**". It can be simply understood by its block diagram &circuit diagram.

6.1. BLOCK DIAGRAM:

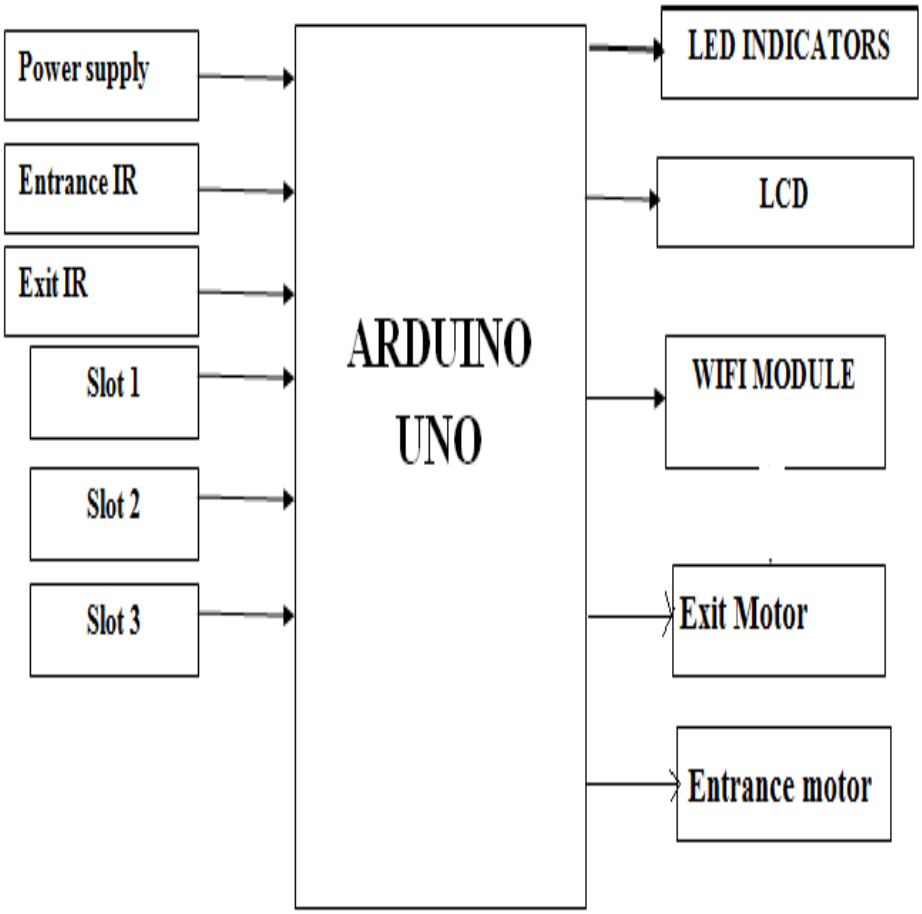


Fig: 6.1 Block diagram

6.2. SOFTWARE REQUIREMENTS:

- Arduino Uno

6.3. HARDWARE REQUIREMENTS:

- Power supply
- Arduino
- IR sensor
- Android Mobile
- LCD

6.4. WORKING:

Objective of this project is to monitor the status of the parking slots availability in shopping malls and also the exact location of their availability at the entrance. This ensures that the customers can easily identify the available slots to park their vehicles instead of slowly randomly searching for a slot. The name smart in this project indicates that this system will automatically detect the free slots and send these status to the entrance display via Internet. The purpose of Internet in this project is to ensure that there is no limit the range of the signal, size of the parking area, no of slots available for parking and also to enable the use of data analytics and projections based on the past usage.

6.4.1 COMPONENTS:

Ardunio:

The Arduino Uno is an open-source microcontroller board designed by Arduino.cc and based on the Microchip ATmega328P microprocessor. The board includes digital and analogue input/output (I/O) pins that can be used to connect to expansion boards (shields) and other circuits. The board features 14 digital I/O pins (six of which are capable of PWM output), 6 analogue I/O pins, and is programmable through a type B USB cable using the Arduino IDE (Integrated Development Environment). It can be powered by a USB cable or an external 9-volt battery, with voltages ranging from 7 to 20 volts. It's similar to the Arduino Nano and Leonardo microcontrollers.

IR Sensor

An infrared (IR) sensor is a type of electrical gadget that detects and measures infrared radiation in its surroundings. In the year 1800, an astronomer named William Herchel made an unintentional discovery of infrared light. He found that the temperature just beyond the red light was the highest while measuring the temperature of each hue of light (separated by a prism). Because its wavelength is longer than visible light (though it is still on the same electromagnetic spectrum), IR is invisible to the naked eye. Infrared radiation is emitted by anything that emits heat (anything that has a temperature).

LCD Display:

A liquid crystal display, or LCD, gets its name from its definition. It is made up of two different states of matter: solid and liquid. A liquid crystal is used to create a visible image on an LCD. Liquid crystal displays (LCDs) are ultra-thin display screens that are commonly seen in laptop computers, televisions, cell phones, and portable video games. When opposed to cathode ray tube (CRT) technology, LCD technology allows for significantly thinner displays. Two polarized panel filters and electrodes are among the components that make up a liquid crystal display. LCD technology is utilized in notebooks and other electronic devices such as small computers to display images. A lens projects light onto a layer of liquid crystal.

Entry part:

The Submission A servo motor, IR sensor, LCD, and ultrasonic sensor are all connected to an Arduino Mega microcontroller as part of the project. When the IR sensor detects the presence of a car, the servo motor operates as a gate at the entrance, opening and closing. The parking places that are available for car drivers are displayed on the LCD

Exit part:

The Exit Part of the project consists of Arduino Uno to which a servo motor, IR sensor and the object counter are interfaced. The servo motor acts as a gate at the entrance and it opens and closes when the IR sensor detects presence of car. The object counter circuit is designed using IC 555 and IC 4026 to count the number of cars exiting the parking space.

Servo motor:

A servomotor is a linear or rotatory actuator that permits exact control of angular or linear position, velocity, and acceleration. It is made comprised of an appropriate motor and a position feedback sensor. It also necessitates a complex controller, which is frequently a separate module created exclusively for servomotors.

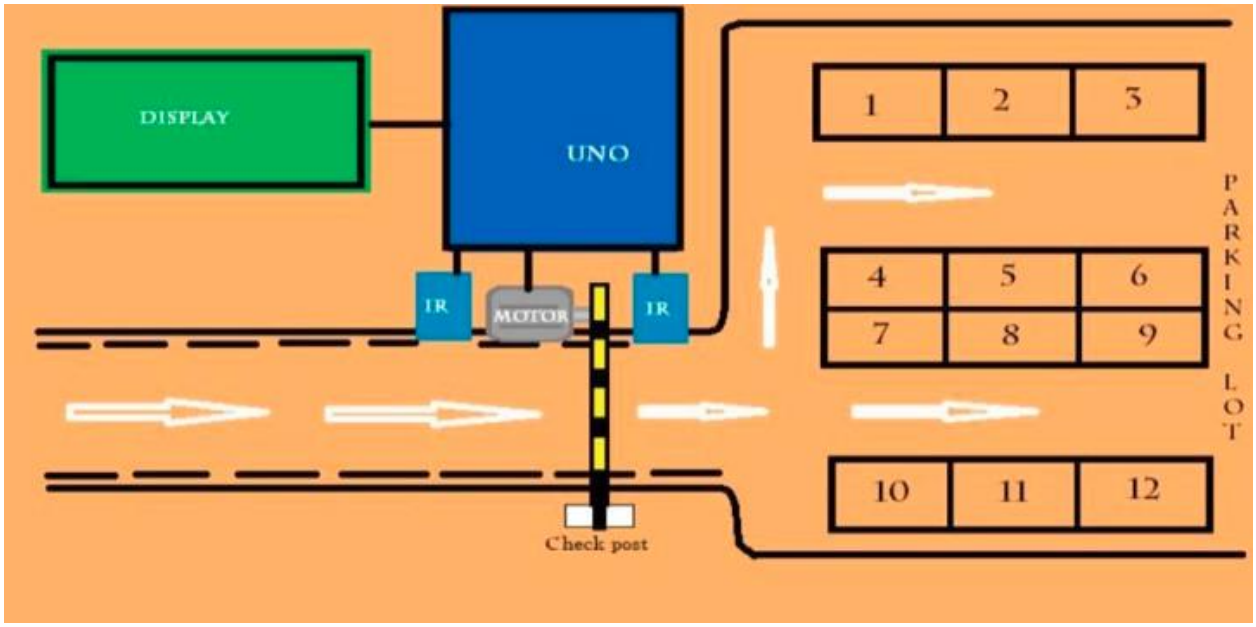


Fig: 6.2 Schematic Diagram of IOT Parking System

CHAPTER-7

7. CONCLUSION

Smart parking systems gives rise to new solutions with the help of Internet of things. The system have always been at the core of constructing smart cities. In this project, we address the issue of parking. It presents an IOT based Cloud integrated smart parking system. The system provides real time information regarding availability of parking slots in a particular parking area. With the help of this mobile application user can book a parking slot for them from remote location. The efforts made in this paper are indented to improve the parking facilities of a city and thereby aiming to enhance the quality This designed automatic smart parking system which is simple, economic and provides effective solution to reduce carbon footprints in the atmosphere. It is well integrated to access and map the status of parking slots from any remote location through web browser. Thus it reduces the crisis of car parking across a remote city and also it eliminates unnecessary travelling of vehicles across the filled parking slots in a city. So it reduces time and it is cost effective also.

CHAPTER-8

8. REFERENCES

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THANK YOU