A Project Report

on

IoT Based Smart Parking System

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DECLARATION

We hereby declare that the work being presented in this report entitled "**IOT BASED SMART SECURITY PARKING SYSTEM**" is an authentic record of our own work carried out under the supervision of **MS. RANJANA.**

The matter embodied in this report has not been submitted by me for the award of any other degree**.**

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This is to certify that the above statement made by the candidate(s) is correct to the best of my knowledge.

Dr. Somendra Shukla **Ms. Ranjana**

Professor & Head (ECE) **Assistant Professor (ECE)**

Date.....

ACKNOWLEDGEMENT

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We also do not like to miss the opportunity to acknowledge the contribution of our project guide **Ms**. **Ranjana** assistant professor, Electronics and Communication Engineering for her kind assistance and cooperation during the development of our project. It is only his cognizant efforts that our endeavor has seen light of the day.

Last but the least, we acknowledge our friends for their contribution in the completion of the project.

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ABSTRACT

With the exponential increase in the number of vehicles and world population day by day, vehicle availability and usage on the road in recent years, finding a space for parking the bike is becoming more and more difficult with resulting in the number of conflicts such as traffic problems. This is about creating a reliable system that takes over the task of identifying free slots in a parking area and keeping the record of vehicles parked very systematic manner. This project lessens human effort at the parking area to a great extent such as in case of searching of free slots by the driver and calculating the payment for each vehicle using parking area. The various steps involved in this operation are vehicle identification using RFID tags, free slot detection using IR sensors and payment calculation is done on the basis of period of parking and this is done with the help of real time clock.

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CHAPTER 1

INTRODUCTION

The basic definition of Internet of Things (IoT) can be defined as anything that can be connected to the Internet results of "Internet Objects" Internet Objects for sensors, actuators, RFID tag. IoT increases Internet usage, provides connectivity, so the network of devices and objects, or Things "IoT, usually has a network of devices and objects, many objects can collect data from remote locations and connect to control units, find, organize and analyze the data help process. It provides a view where objects (wearable, clock, alarm clock, home devices, and surroundings) are also intelligent and behave live with a computer of thought and communication with embedded devices that communicate with remote objects or people through transmission. Due to the high altitude of any cloud any nodes can be added or removed from the IoT system in real time and IoT is well known to reduce the use of human effort to some extent.

The idea of building a Smart City can now come from the reality of the Internet of Things. Internet-of-Things technology (IoT) has changed many ways in life with smart parking technology (SPS) technology. As parking becomes the most important daily necessity of our lives. That’s why, this program aims to plan and get a good parking plan before you get to your destination to reduce the difficulty of driving around waiting for parking at peak times. In today’s cities, finding available parking is often difficult for drivers, and it is often difficult to increase the number of private car users. This situation can be seen as an opportunity for smart cities to

do something to improve the efficiency of parking spaces, thus leading to reduced search times, traffic congestion and adverse traffic incidents. Recent developments to create low cost; Low-power built-in programs help engineers build new Internet of things.

Fig 1.1 Material Uses

As the population grew in the big cities, demand for cars increased. Ultimately, it causes problems in the parking lot leading to traffic congestion, driver frustration, and air pollution. When we visit various public places, such as shopping malls, a multiplex cinema hall, and hotels during a festival or on the weekend, a serious

parking problem arises. According to a recent study, a driver could take up to eight minutes to park his car because he spends most of his time looking for parking. These searches lead to 30 to 40% congestion. Here we will see how we can turn the parking problem down and make it safer.

1.1 What is an IoT?

 Internet of Things, or IoT, a system of compatible computing devices, electronic and digital devices, objects, animals or people who are provided with unique identifiers (UIDs) and the ability to transmit data over the network without the need for a human or computer system.

Online the online object can be a person with a watchful heart, a farm animal with a biochip transponder, a built-in sensor vehicle to alert the driver when tire pressure is low or there is an Internet Protocol Address (IP) and can transmit information to the web.

More and more organizations in various industries that use IoT to be more efficient, better understand customers to deliver improved customer services, improve decision-making and increase business value.

1.2 How does IoT work?

• The IoT creation program consists of web-enabled devices that enable embedded systems, for example hardware, sensors and processors for communicating, collecting, transmitting and receiving small amounts of data. IoT devices share the sensory information they collect by connecting to an IoT

gateway or other device at the edge where data is sent to the cloud through a local process. In some cases, these devices interact with other related devices and process the information they receive from each other. Devices do most of the work without human communication, or people are able to communicate with devices - such as, set up, give those instructions or access data.

- The communication and communication systems used by these web-enabled devices are largely supported by a specific IoT system installed.
- IoT can also be used in artificial intelligence (AI) and machine learning (Ml) to help simplify data collection processes.

1.3 Why IoT is important

The Internet of Things helps people to live and work smarter, and take full control of their lives. In addition to providing smart devices to make homes work automatically, IoT is important for business. Io gives businesses a real-time look at how their systems really work, bringing insight into everything from automation to operating system and system.

IoT enables companies to implement flexible processes and reduce employee costs.

It also reduces pollution and improves service delivery, makes it less expensive to produce and deliver goods, as well as a clear contribution to customer sales.

Therefore, IoT is one of the most important technologies in everyday life, and will continue to absorb smoke as many businesses see the power of connected devices to keep them running.

1.4 Benefits of IoT to organizations

Internet The Internet of Things works for various benefits to organizations. One of the welfare is very important, and the others work in large industries. Some of the common benefits of IoT empower businesses.

- Monitor their business processes in general.
- Development customer information (CX).
- Save time and money.
- Improve to improve staff productivity.
- Integrate and adapt business models.
- Make better business decisions.
- Make a lot of money.

IoT encourages companies to rethink how they will run their businesses and provide them with tools to develop their business strategies.

In general, IoT has a large number of manufacturing, transport and utility organizations, using sensors and other IoT devices; however, it has also found the conditions for the use of internal agricultural organizations, infrastructure. This

brings welfare with it, such as value savings, time savings, changes in the quality of life of work and paperwork.

- A home automation business can use IoT to monitor and deploy mechanical and electrical systems in a building. On a larger scale, smart cities can help citizens reduce waste and energy consumption.
- IoT affects the entire industry, including healthcare, finance, retail and manufacturing businesses.

1.5 The pros and cons of IoT

- **Other advantage of IoT include the following:**
- the ability to receive information from anywhere at any time on any device.
- advanced communication between connected electronic devices.
- transfers data packets to a network connected at a time and cost savings.
- to perform activities that help improve the quality of business services and reduce the need for human intervention.

Fig 1.2 Internets of Things

Other IoT disadvantages include the following

- As the number of connected devices increases and more information is shared between devices, it is possible for a culprit to theft sensitive data.
- Businesses may eventually face large numbers - and perhaps millions - of IoT devices, and collecting and managing data on all those devices will be a challenge.
- If there is a problem with the system, it is likely that all connected devices will be damaged.
- With no level of international IoT compliance, it is difficult for devices from different manufacturers to communicate with each other.

CHAPTER 2

LITERATURE SURVEY

2.1 IoT Based Smart Parking System Using RFID [1];

This system uses Global Positioning System (GPS) for Navigation of vehicles, which will ease to monitor of vehicles and parking slots.

Advantages

- Easy to manage the parking slots, payments, and vehicle tracking through mobile application.
- Enhanced security via RFID.

Disadvantages

- Cost of Implementation is high.
- High maintenance.

2.2 Internets of Things (IoT) based Smart Parking Reservation System using Raspberry-pi [2];

They have used Raspberry-pi implementing KNN algorithm for facial recognition, vehicle size detection and security purposes in an efficient way.

Advantages

- The facial recognition is used for authorization purposes.
- Cost efficiency helps easy installation.

Disadvantages

- KNN algorithm is quite expensive to implement for character recognition.
- Vehicle's size prediction is not much beneficial.

2.3 Smart Vehicle Parking Monitoring System using RFID [3];

They uses Esp32and ultrasonic sensor that collect the parking availability status and assists drivers in finding and selecting the desired parking space among the available parking spaces, and RFID for collecting the information.

Advantages

- System will be secured through RFID.
- Operation is fast.

Disadvantages

- Complexity in the algorithm by interfacing Esp32and Wi-Fi module.
- Application Maintenance required.

2.4 IoT Based Smart Parking System Using Deep Long Short Memory Network

This project is based on LSTM (Long Short Term Memory) technique. They use the deep LSTM network to predict car availability, spaces somewhere, at a certain time and on a particular day.

Advantages

- LSTM's are pretty good at extracting patterns in input feature space.
- They have implemented the algorithm for location-wise, day-wise, and hour-wise.

Disadvantages

- LSTMs are affected by different random weight launches and therefore behave exactly the same as those of the feed-forward neural net. They prefer a light weight implementation instead.
- LSTMs take longer to train. This requires more memory to train.

CHAPTER 3

Description

Car parks usually have people offering printed parking tickets. This is time consuming and creates a lot of traffic. As well as causing traffic jams and commotion, there is also a lot of paper garbage outside the car parks. To avoid all of this, RFID and IoT based Paid Car Parking System can be used. This project uses RFID that can be renewed and can be transferred to the door.

RFID and IoT based Paid Car Parking System include RFID card. This card can be changed and removed from the RFID card reader in the parking lot. The card reader receives card details and sends to the microcontroller. The microcontroller will work if the card is active and has enough balanced.

• If the card is not valid, the microcontroller would open the buzzer and the gates could be opened

• If the card was working, the microcontroller would send a signal to the Driver and the gates would open, allowing the car in the parking.

We also used an IR transmitter and receiver that could be used to detect if a car had crashed and to close a gate based on a signal received from an IR receiver.

The keypad is inserted in the region to change the mode. If the card needs to be renewed, the mode can be changed to refresh mode and the card can be renewed.

Every time a card is exchanged, an amount equal to the parking fee is deducted from the balance. We have attached an LCD display to a project that will display informative messages.

The microcontroller is also synchronized to the IoT module. Whenever a card swipe, information related to the RFID card is sent to the website. Details such as the remaining card balance and timestamp posted on the website. This project can also be done without an IoT module**.**

3.1 BLOCK DIAGRAM

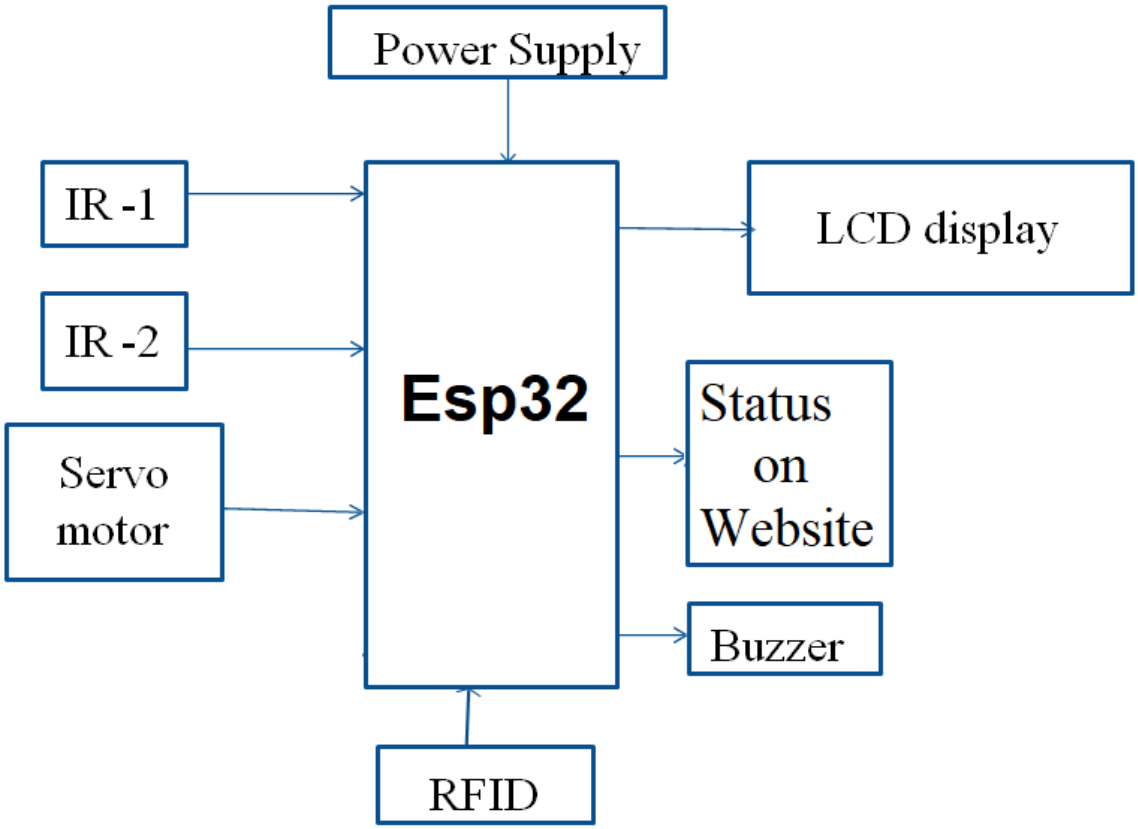

Fig 3.1 Block Diagram

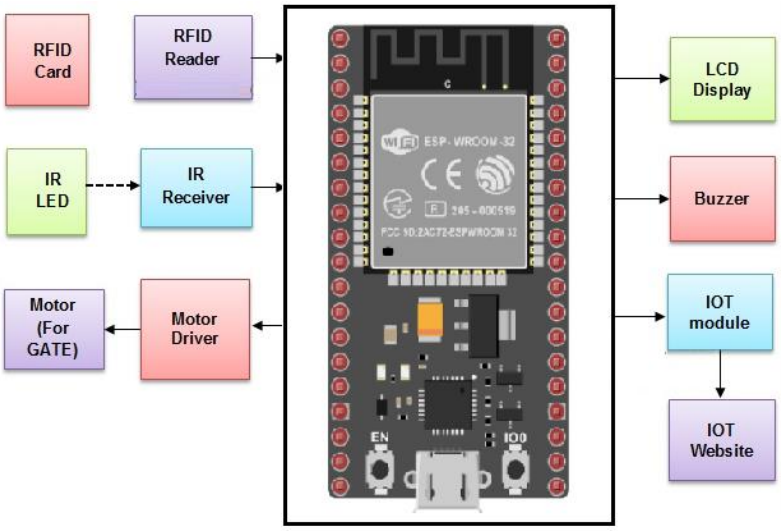

Fig 3.2 Block Diagram

3.2 FLOW CHART

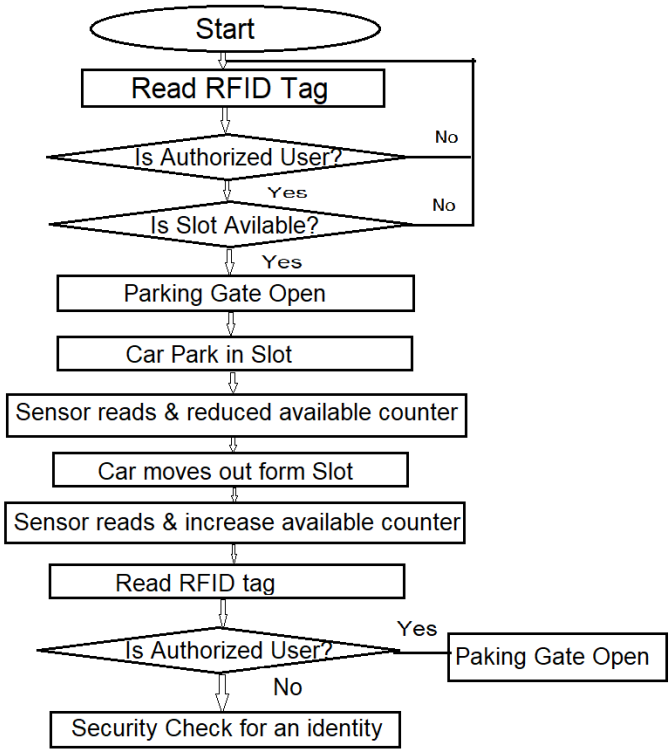

Fig 3.3 Flow Chart

3.2.1 Technical Specifications of the project

The components that are used in the IoT and RFID based Car Parking system is:

1. RFID card and RFID Reader
2. Esp32– which is used to turn ON the buzzer, send data to the IoT and send informative messages to the LCD.
3. LCD Display
4. Buzzer
5. IR Receiver
6. Servo motor – Motor is used to demonstrate the parking entrance gate.
7. Battery – To provide power supply.

3.2.2 Applications and Advantages for the Future enhancement for the IoT and RFID based Car Parking System project

- RFID Car Caring System can be used in all parking spaces including commercial, industrial, and office.
- The good thing about this project is that it will help save a lot of paper and keep the environment clean. This program can be upgraded with the installation of voice announcements. An RFID based Car Parking System is developed for this purpose and can be used to alleviate the operational complexity of the parking system.
- This program can help to reduce costs, increase productivity and save time.
- Accurate time specifications are measured with the help of the RTC Module.

- Prepaid and prepaid cards can be integrated into the system for easy payment options.

CHAPTER 4

SYSTEM ARCHITECTURE

4.1. Proposed System

It has three parts: the first section is a parking space that incorporates Esp32 devices and an IR sensor. The user interacts with the parking lot with the help of these services. User is not able to enter the parking lot without RFID card. The second category contains cloud-based web services that make a mediator between the user's location and the parking space. The cloud is updated according to the availability of parking space. The manager controls cloud services and can be viewed again by the user by checking availability. The third category is on the user side.

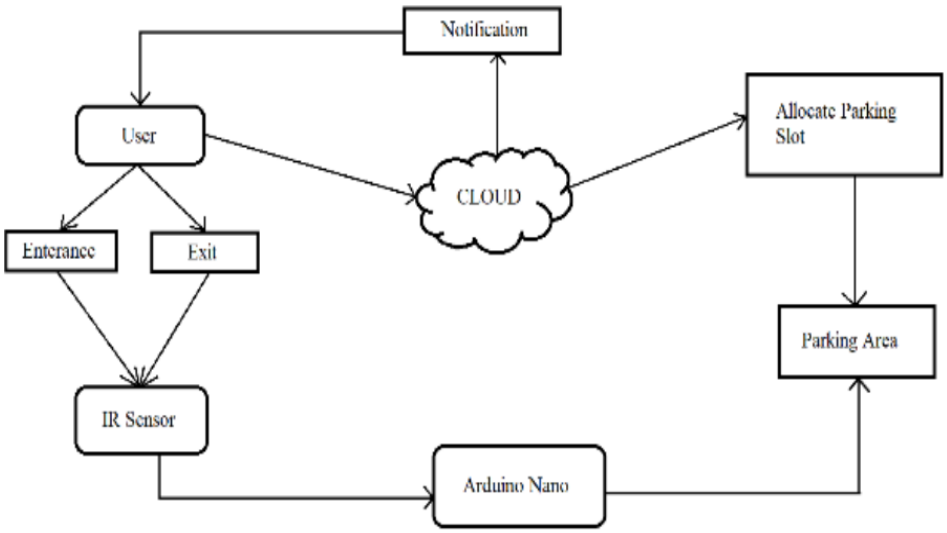

Fig 4.1 Block diagram of Purposed System

4.2. Hardware

The three main hardware components used are the RFID card, the IR sensors. User is only allowed inside the parking lot if the user has an RFID card. The RFID card contains the details of the registered user. When the vehicle enters the parking lot, the reading module scans the RFID registered user tag. Details are sent to Esp32 to check the availability of car parking and at the same time, the user is notified via the website of the parking situation. The module sends the message according to availability. The IR sensor sends signals according to the presence of the vehicle.

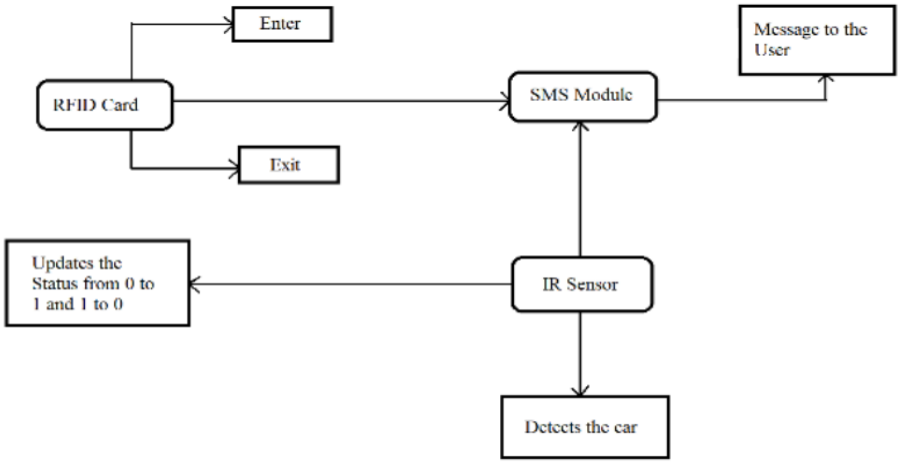

Fig 4.2 Block diagram of Hardware System

4.3. Software

The cloud server acts as a mediator between modules. The cloud server is connected to a Wi-Fi module. The user gets the status through the Website module while the vehicle enters and exits the parking area using an RFID card.

Messages sent by the module are cloud-controlled. As soon as the IR sensor detects the vehicle, the cloud status will be updated from 0 to 1 and as soon as the vehicle moves from the parking lot the vehicle status will be modify from 0 to 1.

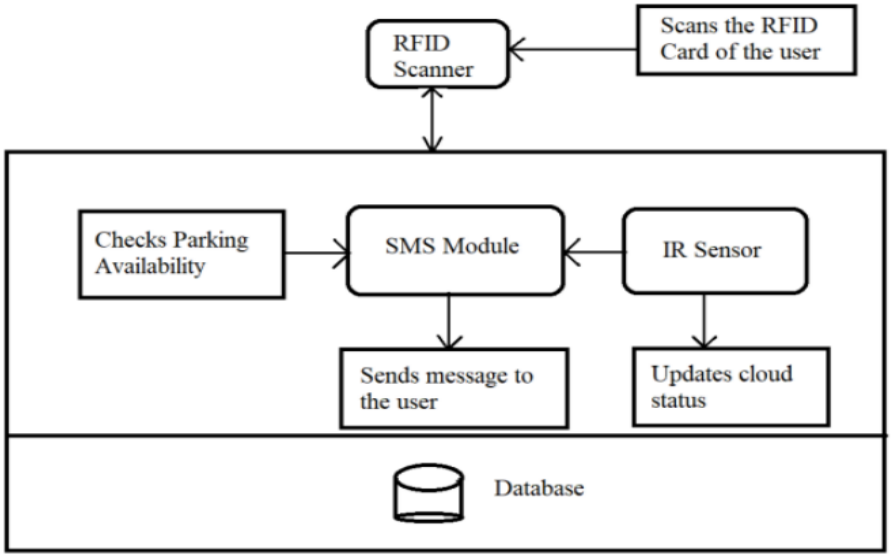

Fig 4.3 Block diagram of Software System

CHAPTER 5

DETAILS OF THE MODULE

5.1. IR Sensor

An infrared (IR) sensor is an electronic device that measures and detects infrared radiation in the environment. Infrared radiation was developed by astronomer William Herchel in the 1800's. When measuring the temperature of each light color (separated by a band), he noticed that the temperature above the red light was too high. IR is invisible to the human eye, as its length is longer than that of visible light (although it is at the same electromagnetic angle). Anything that emits heat (everything with a temperature above Kelvin's five degrees) emits infrared radiation.

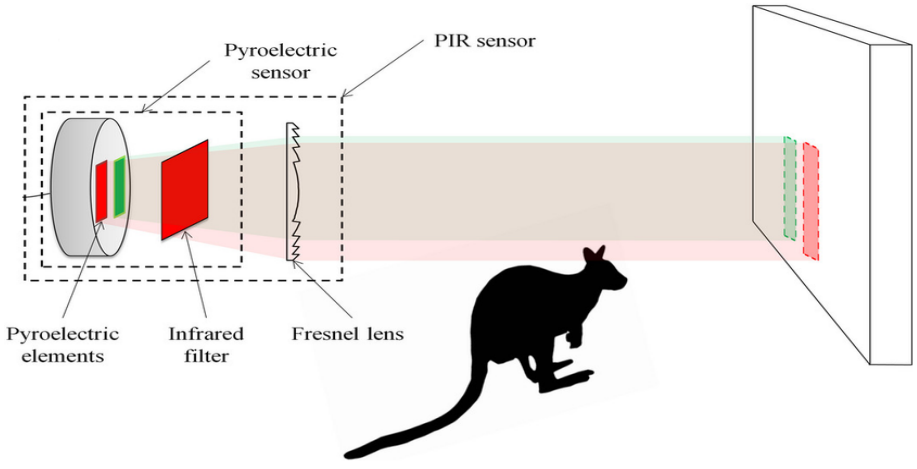

Fig 5.1 Working of IR Sensor

There are two types of infrared sensors: active and inactive. Active infrared sensors emit and receive infrared radiation. The active IR sensors have two

components: a light emitting diode (LED) and a receiver. When an object interacts with sensor, infrared light from the LED indicates the object and is received by the receiver. The active IR sensors act as proximity sensors, and are often used in detection systems (such as robots).

Passive infrared sensors (PIR) only identify infrared radiation and do not glow LEDs. Infrared sensors are made up of:

- Two strips of piezoelectric material (piezoelectric sensor)
- Infrared filter (blocking all other light energy)
- Fresnel lens (which collects light from multiple angles to a single location)
- Housing unit (protecting the sensor from other surrounding natural factors, such as moisture)

PIR sensors are widely used in motion-detection detection, such as home security systems. When a moving object that produces infrared radiation enters the detector's sensor, the difference in IR levels between the two electrical components is measured. The sensor then sends an electronic signal to the embedded computer, which in turn creates an alarm.

Fig 5.2 IR Sensor

5.2. Radio Frequency Identification Card (RFID)

RFID tags are build of integrated circuit, an antenna, and a substrate. It is an identification badge that transfers its contents about an object to the reader module. RFID tag transfers data about an object through radio waves. When RFID tags are attached to devices they can also be used for tracking.

- **WHAT IS RFID?**

RFID is known for “radio-frequency identification” and refers to technology in which digital data enclosed in RFID tags or intelligent labels is captured by the reader through radio waves. RFID is similar to coding that data from a tag or label hold by a device that saves data in a memory RFID, however, has a few advantages over programs that use barcode tracking software. Most importantly, the RFID tag information can be read offline, and the barcodes must be compatible with the optical scanner.

- **How does RFID work?**

RFID belongs to a technology group called Automatic Identification and Data Capture (AIDC). AIDC methods automatically identify objects, collect data about them, and then enter that data directly into computer systems without little or no human intervention. RFID methods use radio waves to achieve this. At the simplest level, RFID systems consist of three components: an RFID tag or smart label, an RFID reader, and an antenna. RFID tags consist of an integrated circuit and antenna, which are used to transmit data to an RFID reader (also called an

investigator). The student then converts the radio waves into data. Data is collected from tags and transferred from the interface to the computer system, where data can be stored in a database and analyzed over time.

- **RFID tags and PRICE Bibles**

As mentioned above, the RFID tag has an integrated circuit and antenna. The marker is also made of protective stuff that keeps the pieces together and protects them from a variety of environmental conditions. Security features depend on the application. For example, employee ID badges that contain RFID tags are made of strong plastic, and the tag is embedded between layers of plastic. RFID tags come in a variety of sizes and styles and may be idle or functional. Passive tags are widely used, because they are small and not too expensive to use. Login tags must be "enabled" by the RFID reader before transferring data. Unlike deviation tags, active RFID tags have onboard power, enabling them to transmit data at all times. For a detailed discussion, see this article: Passive RFID vs. Tags. Active RFID tags.

Smart labels are change from RFID tags because they similar from RFID technology. They are made with an adhesive label embedded within the RFID tag, and can also contain barcode and or other printed information. Smart labels can be coded and printed on demand using desktop label printers, while RFID editing tags are time consuming and require high-quality equipment.

RFID IS USES IN MANY AREAS FOR DIFFERENT ACTIVITIES ARE:

- Asset management
- Tracking of goods
- Staff tracking
- Controlling access to restricted areas
- Badging ID
- Supply chain management
- Counterfeiting prevention (e.g. in the pharmaceutical industry)

- **RFID requests**

Although RFID technology has been in use since World War II, the demand for RFID equipment is growing rapidly, in part because of directives issued by the US Department of Defense (DoD) and Wal-Mart that require its suppliers to make products compliant with RFID.

Whether RFID compliance is required or not, applications that currently use barcode technology are good choice for upgrading to a system that uses RFID or a specific combination of codes. RFID offers many benefits over barcode, especially the fact that the RFID tag can hold a lot more data on something than a barcode. In addition, RFID tags do not detect potential damage to barcode labels, such as ripping and scratching.

From the reading level to the types of tags available, RFID has also come a long way since World War II and there is a bright future ahead. modify RFID appearance.

For more information on how RFID works and how this technology can be integrated into your business processes, read our RFID basics.

Fig 5.3 RFID Card

5.3 READER Module

This module is a device which scans and gathers the information from the RFID Card. This card can be used to track items. As the car enters the parking area, the user scans the RFID card and all the information stored in card is transferred to the admin through this module.

Radio Frequency Identification Reader (RFID Reader)

What Does Radio Frequency Reader (RFID Reader) Mean?

RFID reader is a tool that helps to receive data from RFID tag, which is used to track individual items. Radio waves are used to transmit information from the tag to the reader.

RFID is a technology similar to concept in bar codes. However, the RFID tag does not need to be scanned directly, nor does it require a line of sight for the reader. The RFID tag must be at RFID reader level, ranging from 3 to 300 meters, for reading. RFID technology allows a number of items has to be scanned fast and allows for quick identification of a particular product, even if you are surrounded by several different things.

RFID tags do not change web codes because of their cost and the need to identify each item.

RFID technology can be used for a variety of purposes including:

- Passports
- Smart cards
- Flight of the plane
- Passing booth
- Home appliances
- Sales tags
- Animal and pet tags

- Car key and lock
- Monitoring heart patients
- Inventory pallet tracking
- Phones and computer calls
- Operation of spacecraft and satellites

RFID technology uses digital data in the RFID tag, which is composed of integrated circuits that contain a small data transmission antenna transmitted through Radio Frequency Identification. Most RFID tags consist of at least an integrated circuit to convert and reduce radio frequency and antenna transmission and reception signal. The frequency range varies from low frequency of 125 to 134 kHz and 140 to 148.5 kHz, as well as maximum frequencies of 850 to 950 MHz and 2.4 to 2.5 GHz. Wavelengths are limited because they can be heard by water.

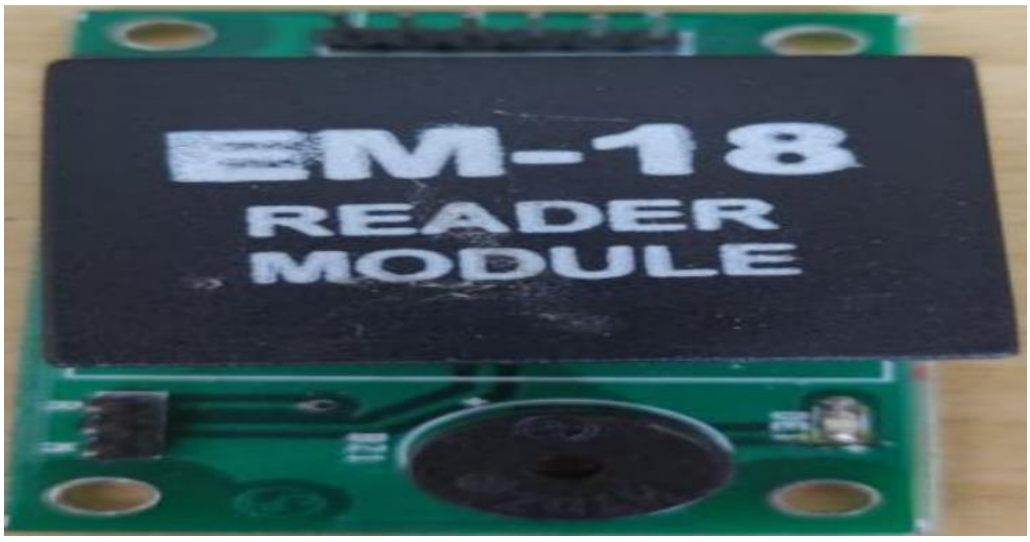

Fig 5.4 Reader Module

5.4. Servo Motor

What is Servo Motor?

A servo motor is motor that can rotate with great accuracy with phase angle. Typically, this type of vehicle contains a control circuit that gives feedback on the present state of the motor shaft; this response allows servo motors to rotate with greater perfection. With the help of servo motor you can rotate an object to a certain angle or a certain distance. It is just made with a simple car that runs in a servo way. If the car is powered by DC power, then it is called a DC servo motor, and if it is an AC controlled motor then it is called an AC servo motor. In this study, we will only discuss the operation of a DC servo motor. In addition to this great separation, there are many other types of servo motors based on the type of gear arrangement and performance indicators. The servo motor usually comes with a gear arrangement that allows us to get a very high servo motor with small and lightweight packages. Because of these features, they are used in many applications such as toy cars, helicopters and flying planes, robots, etc.

Servo motors measured in kg / cm (kilogram per centimeter) most recreational servo motors are measured at 3kg / cm or 6kg / cm or 12kg / cm. This kg / cm tell you how much your servo motor weight can lift in a certain range. Such as A 6kg / cm servo car should be able to lift 6kg if the load is suspended 1cm away from the shaft of the motors, when the distance increases significantly the load is reduced. The position of the servo car is determined by electric shock and its circuits are placed next to the car.

Servo Motor Working Mechanism

It consists of three parts:

- Controlled device
- Output sensor
- Response system

It is a closed loop system where it uses a quality feedback method to control motion and save space on the shaft. Here the device is controlled by a response signal generated by comparing the output signal with the reference input signal.

Here the input signal for reference is compared to the reference output signal and a third signal is generated by the response system. And third signal work for an input signal to direct the device. This signal exists as long as the response signal is generated or there is a difference between the reference input signal and the reference output signal. So the main task of the servomechanism is to keep the output of the system at the required level where there are sounds.

Servo Vehicle Operating System

The servo consists of a motor (DC or AC), a potentiometer, a gear assembly, and a control circuit. First, we use the gear assembly to reduce RPM and increase vehicle torque. Mention where you start the operation of the servo motor shaft, the position of the potentiometer knob is such that no electrical signal is generated in the output port of it. An electrical signal is now provided to the other input limit of

the fault amplifier detector. Now the difference between the two signals, one from the potentiometer and the other from the other sources, will be analyzed in a responsive manner and the result will be given according to the error wave. This error signal works as a first-of-its-kind motor and motor input. Now the car shaft is connected to the potentiometer and as the car rotates so does the potentiometer and will produce a signal. Thus,when the position of the potentiometer's angular changes, the signal of the output response changes. After some time, the position of the potentiometer reaches a point where the output of the potentiometer is the same as the external signal provided. In this case, there will be no discharge from the amplifier to the motor inlet as there is no difference between the external used signal and the signal generated in the potentiometer, and in this case the vehicle stops moving.

Interaction with Servo Motors and Microcontroller:

Interfacing hobby Servo motors like s90 servo motor with MCU is very simple. The Servos have three wires coming out of it. Of these two will be used for Sales (good and bad) and one will be used for the signal to be sent from the MCU. MG995 Metal Gear Servo Motor widely used in RC cars humanoid bots etc. Image of MG995 shown below:

The color rendering of your servo motor may vary so check your relevant datasheet.

All servo motors work directly with your + 5V supply's but we should be aware of the current value the car can use if you plan to use more than two servo motors a servo shield should be built.

Fig 5.5 Servo Motor Cable

Servo Motor Control:

All engines have three outlets. Of these two will be used for Sales (good and bad) and one will be used for the signal to be sent from the MCU.

The Servo motor is controlled by PWM (Pulse with Modulation) which is supplied with control cables. There is low heart rate, high heart rate and recurrence rate. The Servo motor can turn 90 degrees from any direction to its neutral position. The servo motor expects to see a heartbeat every 20 milliseconds (ms) and the pulse length is what will determine how far the car is turning. For instance, a heartbeat of 1.5ms will move the car to turn 90 °, such as a heartbeat shorter than 1.5ms shank to 0 ° and if it is prolonged than 1.5ms instead it will turn the servo to 180 °.

The Servo motor operates on the principle of PWM (Pulse wide modulation), meaning that its rotation angle is controlled by the pull time entered in its Control PIN.

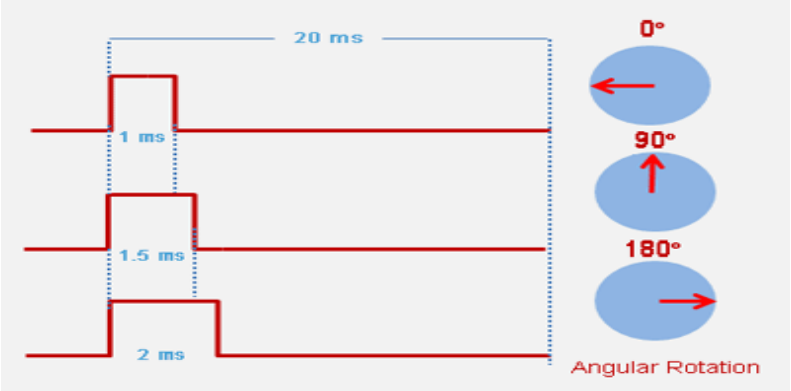

Fig 5.6 Servo Motor Phase Angles

Basically, a servo motor is built with a DC motor controlled by a flexible resistor (potentiometer) and other gears. The high speed of the DC motor is converted into torque by Gears. We know that WORK = FORCE X DISTANCE, in DC motor Force is small and distance (speed) is high and in Servo, high power and short distance. The potentiometer is connected to the Servo output shaft, counting angle and setting the DC motor to the required angle.

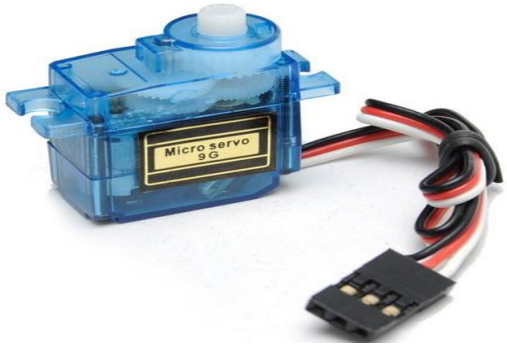

Fig 5.7 Servo Motor

5.5. Esp32 Module

A predecessor of ESP32, the ESP8266 has a built-in processor. However due to the many functions involved in updating the Wi-Fi stack, most applications use a separate little controller for data processing, integrated sensors sense and digital input-output provides data. With ESP32 you may not want to use an additional micro-controller. The ESP32 has Xtensa Dual-Core 32-bit LX6 microprocessors, running up to 600 DMIPS. ESP32 will work on rest boards and modules from 160 MHz to 240MHz. That's a good speed for anything that requires a microcontroller with connecting options.

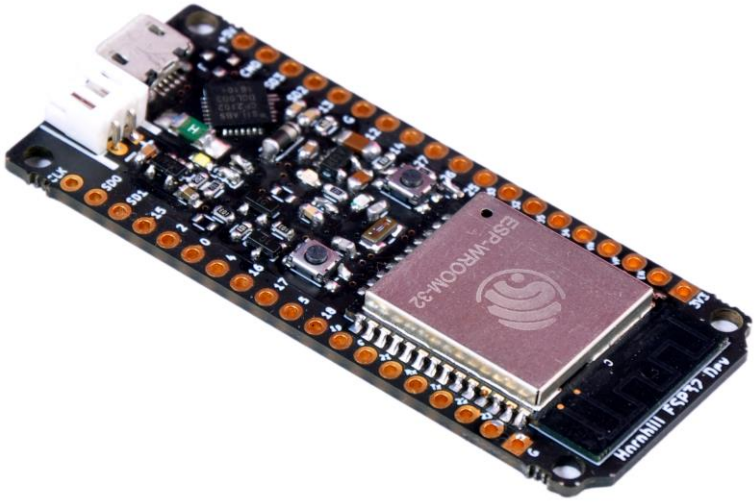

Fig 5.8 ESP32

These two cores are called Protocol CPU (PRO_CPU) and Application CPU (APP_CPU). That means the PRO_CPU processor handles Wi-Fi, Bluetooth and other internal components such as SPI, I2C, ADC etc. APP_CPU excluded application code. This division is done in the Express if Internet Development

Framework (ESP-IDF). ESP-IDF is the official framework of microcontroller software development. Arduino and other development initiatives will be based on the ESP-IDF.

ESP-IDF uses free RTOS to switch between processors and data exchange between them. We've done a lot of tutorials on free RTOS and with all the free ESP32 tutorials we'll try to cover this feature in more detail. While the feature set is good for the price at which the chip is sold, the difficulty is very great. For the chip to be widely accepted, it will require significant efforts from Express if and the community.

Internal Memory

Processors bind internal memory for the following uses:

- 448 KB ROM for startup and key functions.
- 520 KB on SRAM chip data and instruction.
- 8 KB SRAM on RTC, called RTC SLOW Memory and can be accessed by co-processor
- During the Deep-sleep mode.
- 8 Kbytes SRAM on RTC, called RTC FAST Memory and can be used to store data; is available
- is the main CPU during RTC Boot from Deep-sleep mode.

- 1 Kbit for EFUSE, which uses 256 bits in the system (MAC address and chip configuration) and the remaining 768 bits reserved for client systems, including Flash-Encryption and Chip-ID

External Flash and SRAM

Many modules like ESP32 Wroom use an external Flash-W25Q32 (4MB) External application code. The chip supports 4 x 16 MB of external QSPI flash and SRAM with AES-based hardware encryption.

ESP32 accesses QSPI and SRAM external flash with fast cache.

- Up to 16 MB of external flash formatted memory in the CPU code space, which supports 8, 16 and 32-bit access coding is supported.
- Up to 8 MB of external SRAM formatted memory in the CPU data space, supporting 8, 16 and 32-bit access. Data reading is known as flash and SRAM. Data encryption is known as SRAM.

Wi-Fi Direct

ESP32 also supports Wi-Fi Direct. Wi-Fi-Direct is a great way to connect with your peers without having to find an access point. Wi-Fi-Direct is easy to set up and the data transfer speed is much better than Bluetooth. This can be used to configure ESP32 projects from a phone / tablet that supports Wi-Fi directly. There is no code example in the ESP-IDF SDK at the time of writing. The use of ESP-IDF Wi-Fi has the following features in development:

- Infrastructure BSS channel mode / P2P mode / soft-AP mode support

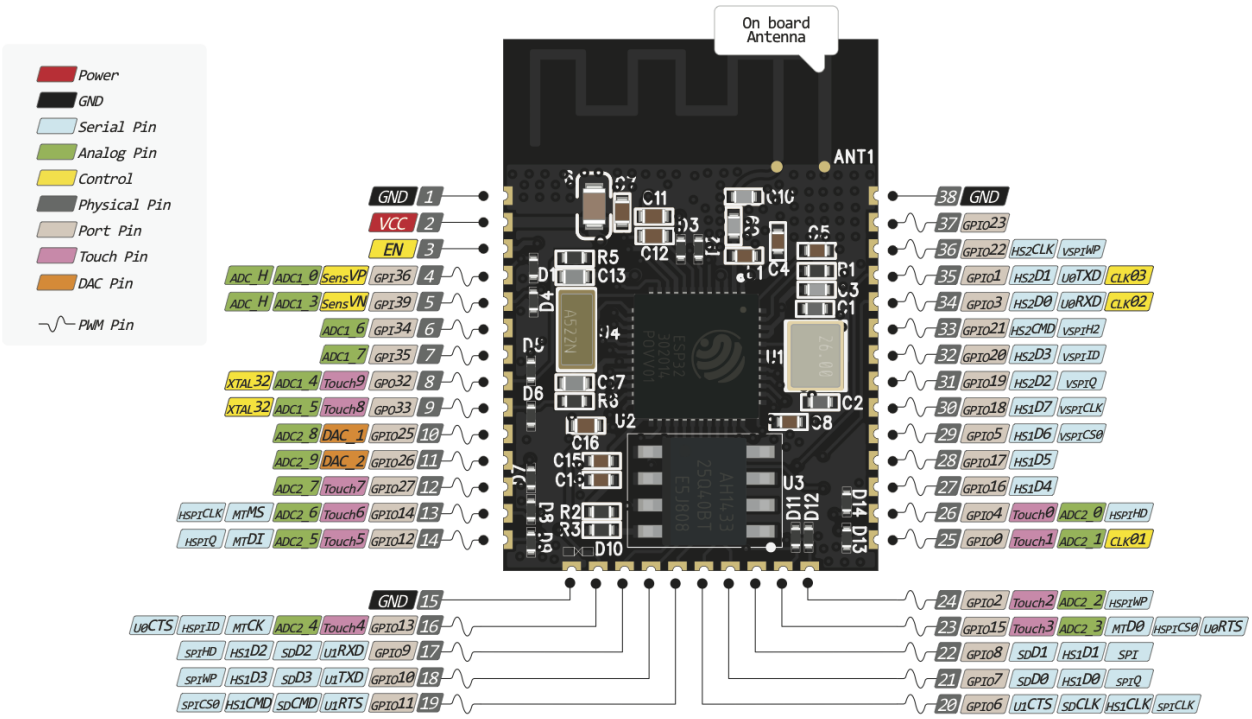

Fig 5.9 Pin Diagram of ESP32

- P2P acquisition, P2P group owner, P2P group client and P2P Power Management.

- WPA / WPA2-Enterprise and Wi-Fi protected setup driver.

- Moreover 802.11 gives security features such as pre-authentication and TSN authentication.

- Open the interface of various EAP layer verification programs such as TLS, PEAP, LEAP, SIM, AKA or a specific client.

- The clock / power gate is integrated with the 802.11.The flexible power management are pliable in the current connection mode that provides minimal power usage.

- Flexible variable rate algorithm sets the appropriate transmission rate and transmits power according to Signal Noise Ratio (SNR) and packet loss details

- Automatic redirect and response to MAC to avoid packet drop in cause funeral pace.

5.7. LCD DISPLAY

Nowadays, we often use devices made of LCDs such as CD players, DVD players, digital clocks, computers, etc. These are widely used in the screen industry to replace the use of CRTs. Cathode Ray Tubes use more power compared to LCDs, and heavier and larger CRTs. These devices are small and power consumption is very low. The LCD 16 × 2 operating system says, it blocks light rather than spills. This article discusses the overall view of the LCD 16X2, pin suspension and its functionality.

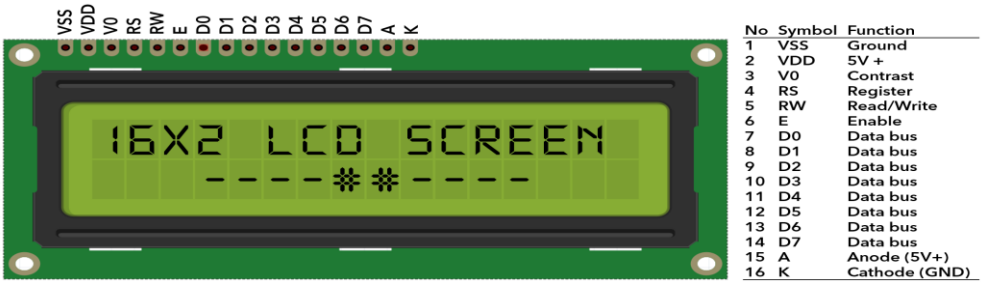

Fig 5.10 LCD

Liquid Crystal Display 16 × 2 (LCD)

The full form of LCD is liquid crystal display, It is one type of electronic display module used in many types of applications for example various circuits and devices for instance as mobile phones, computers, calculators, TV sets, etc. The main benefits of using this module are inexpensive; is simply edited, animated, and has no limits on displaying custom characters, special animation etc.

LCD drawing 16 × 2 Pin

The 16 × 2 LCD pinout is shown below.

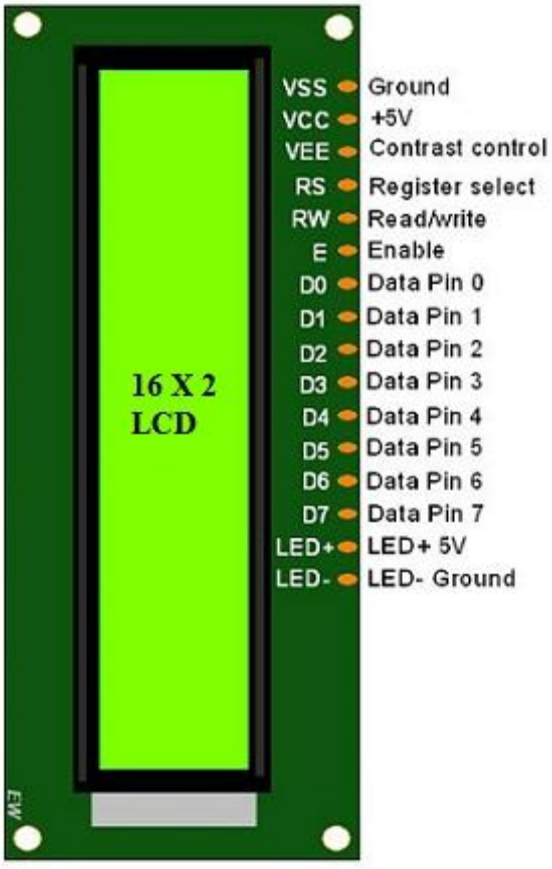

Fig 5.11 LCD Pin Configuration

- Pin1 (Low / Source pin): This is a GND display pin, used to connect the GND end of a microcontroller unit or power source.
- Pin2 (VCC / Source Pin): This is a display power supply pin, used to connect a power supply pin.
- Pin3 (V0 / VEE / Control Pin): This pin controls the difference of the display, which is used to connect a flexible POT that can deliver 0 to 5V.
- Pin4 (Register Select / Control Pin): This pin turns between a command or data register, which is used to connect a microcontroller unit PIN and detects 0 or 1.
- Pin5 (Read / Write / Control Pin): This pin switches the display between read or written variable , and is connected to the microcontroller unit pin to get 0 or 1.
- Pin 6 (Enable / Control pin): This pin should be held at the top to perform the reading / writing process, and is connected to the microcontroller unit and kept high.
- 7-14 Anchors (Data Anchors): These anchors are used to send data to the display. These anchors are connected to two-wire mode such as 4-wire mode and 8-wire mode. In 4-wire mode, only four pins are connected to the microcontroller unit such as 0 to 3, and in 8-wire mode, 8 pins are connected to the microcontroller unit as 0 to 7.
- Pin15 (+ve pin LED): This pin is connected to + 5V (VCC).

- Pin 16 (-ve LED pin): This pin is connected to GND (0 Volt).

Features of LCD16x2

Features of this LCD mainly include the following.

- The operating capacity of this LCD is 4.7V-5.3V
- It includes two rows where each row can produce 16 characters.
- The current consumption is 1mA without background light
- All characters can be created with a 5 × 8 pixel box
- Alphabets and numerical LCDs numbers
- Can the display work in two modes like 4-bit & 8-bit
- These are available via Blue & Green Backlight
- Displays a few custom characters.

5.8. BUZZER

There are many options for communicating information between product and user. One of the most common audio communication options is the buzzer. Understanding some of the technologies and fixing buzzers is helpful during the construction process, so in this blog post will explain the standard configuration, provide buzzer tones, and introduce standard drive circuit options.

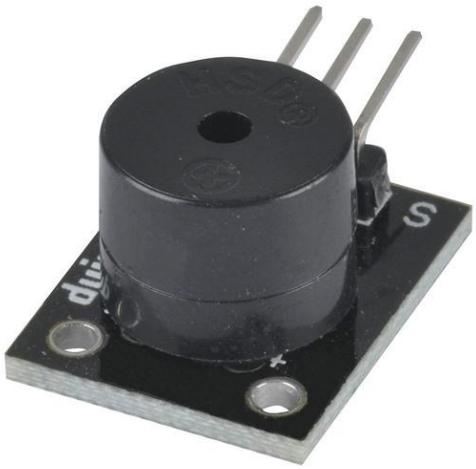

Fig 5.12 Buzzer

Magnetic and Piezo Buzzers

Two of the most common technologies used in the construction of buzzer are magnetic and piezo. Most applications use a magnetic or piezo buzzer, but the decision as to which technology to use is based on a number of different factors. Magnetic buzzers operate at lower frequencies and higher currents (1.5 ~ 12 V,> 20 mA) compared to piezo buzzers (12 ~ 220 V, <20 mA), while piezo buzzers generally have higher sound pressure (SPL) has the magnetic field of buzzing. However, it should be noted that the large SPL found in piezo buzzers needs larger tracks.

In a magnetic buzzer, the current is driven by a telephone coil that produces a magnetic field. A ferromagnetic flexible disc is pulled from the coil where the current is located and returns to the "resting" position where the current does not travel through the coil. The sound from the magnet buzzer is generated by the movement of the ferromagnetic disk in the same way that a cone on a

speaker produces sound. A magnetic buzzer is a tool that is currently in use, but a power source is usually a volt. Currently the use of the coil is determined by the power used and the restriction of the coil.

Buzzers are used in the same systems as magnetic buzzers. Piezo buzzers are made by placing electrical contacts on both sides of the piping disk and supporting the disk at the edges of the enclosure. When a voltage is applied to all two electrodes, the piezoelectric material is impaired due to the electrical energy used. The movement of the piezo disk inside the buzzer creates noise in the same way as the movement of a ferromagnetic disk in a magnetic buzzer or speaker mentioned above.

CHAPTER 6

PROGRAMMING

```
#include <SoftwareSerial.h>

#include "Servo.h"

#include <SPI.h>

#include <MFRC522.h>

#define SS_PIN 10

#define RST_PIN 9

#define PICC_0 0xD4

#define PICC_1 0x87

#define PICC_2 0x75

#define PICC_3 0xA7

MFRC522 rfid(SS_PIN, RST_PIN);

Servo myservo;

int blueTx=2;

int blueRx=3;

SoftwareSerial mySerial(blueTx, blueRx);
```

```
String myString="";
void setup() {
  myservo.attach(6);
  myservo.write(0);
  mySerial.begin(9600);
SPI.begin();
rfid.PCD_Init();
}
void RFID_S() {
  if (! rfid.PICC_IsNewCardPresent())
    return;

  if (! rfid.PICC_ReadCardSerial())
    return;

  Serial.print(F("PICC type:: "));
  MFRC522::PICC_Type piccType = rfid.PICC_GetType(rfid.uid.sak);
```

```
Serial.println(rfid.PICC_GetTypeName(piccType));
if (piccType != MFRC522::PICC_TYPE_MIFARE_MINI &&
  piccType != MFRC522::PICC_TYPE_MIFARE_1K &&
  piccType != MFRC522::PICC_TYPE_MIFARE_4K) {
  Serial.println(F("Your tag is different  MIFARE Classic."));
  return;
}

 if (rfid.uid.uidByte[0] != PICC_0 ||
    rfid.uid.uidByte[1] != PICC_1 ||
    rfid.uid.uidByte[2] != PICC_2 ||
    rfid.uid.uidByte[3] != PICC_3 ) {
  Serial.println(F("This is a confirmed Card."));
  Serial.println(F("Motor On!!"));
  myservo.write(90);
  delay(3000);
  myservo.write(0);
```

```
  }


  rfid.PICC_HaltA();
  rfid.PCD_StopCrypto1();


}
void Blue_motor() {
   while(mySerial.available())
  {
    char myChar = (char)mySerial.read();
    myString+=myChar;
    delay(5);    }


  if(!myString.equals(""))
  {
    Serial.println("input value: "+myString);
      if(myString=="on")
```

```
    {
      myservo.write(90);
      delay(3000);
      myservo.write(0);
   myString="";
  }
}
}
void loop() {
  Blue_motor();
  RFID_S();
}
```

CHAPTER 7

RESULT AND DISCUSSION

The demand for a smart parking system is growing exponentially. This allows the user to have real-time access, information to the parking space to driver. The current system in the world does not contain parking spaces and parking availability checks. The existing system was a vision-based monitoring system that estimates the number of parking spaces available in the area by calculating the number of incoming and outgoing vehicles that take a lot of time and attempt to find empty place for parking vehicle. The next system was a sensor-based system that used ultrasonic sound waves i.e., ultrasonic sensor to detect vehicle detection and then a two-line parking using the concept of more than one parking vehicle. The effect of the paper is to make the parking space connected to the world and reduces time and can be very costly for the user. The effect of this paper is to reduce car theft. This paper reduces the fuel efficiency of a car used in car searches.

CHAPTER 8

CONCLUSION

The idea of smart homes has always been a dream. There has been some progress over the last few years to make the dream of a smart city a reality. Advances in the Internet of Things and cloud technology have created new opportunities for smart cities. Smart parking has always been at the heart of building smart cities. The system provides real-time process and parking information. This paper improves the efficiency of saving users time to find the right parking space. It helps to solve the growing problem of traffic congestion. For future work users can book a parking space from a remote location. GPS, booking locations and license plate scanner can be installed in the future.

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