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CHAPTER 1

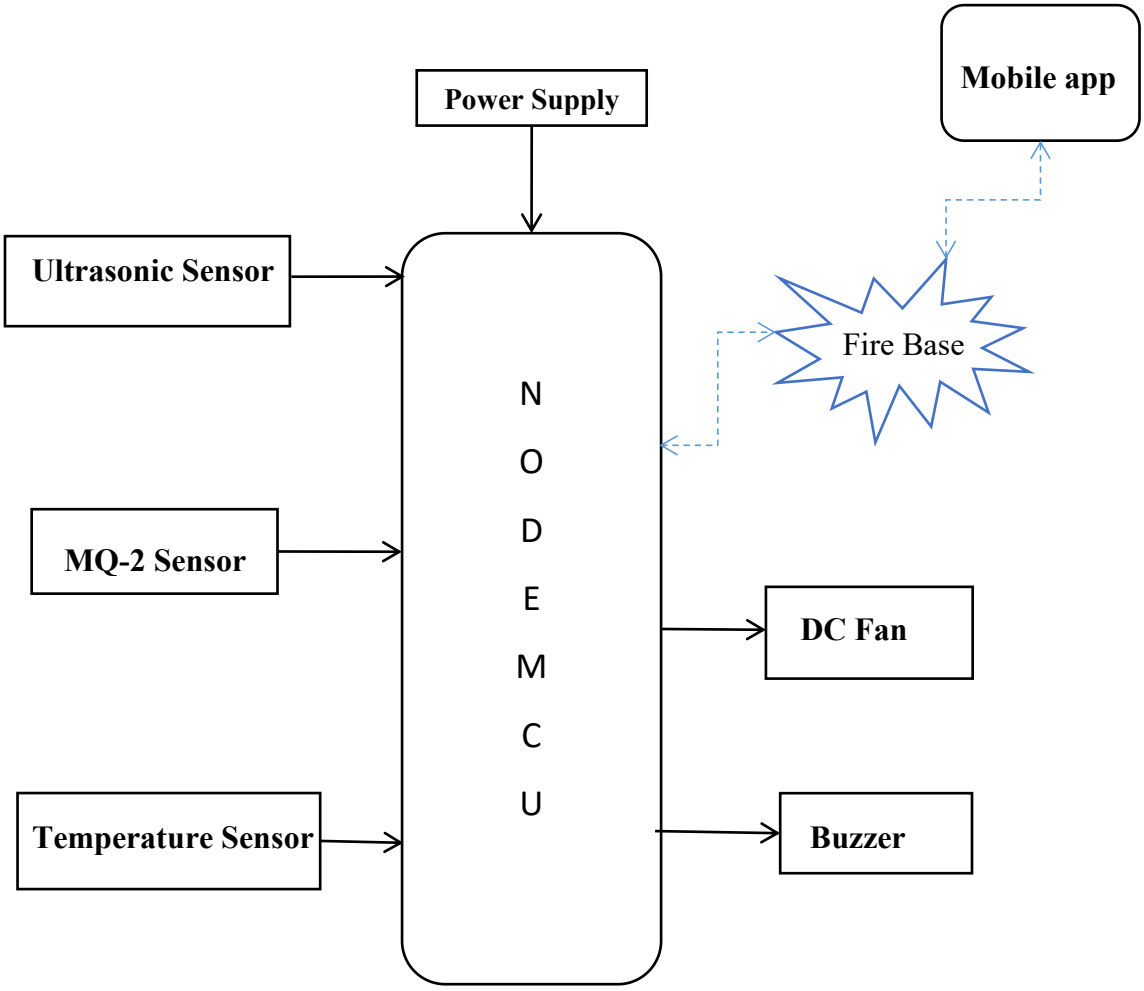
INTRODUCTION TO PROJECT

Car accidents are major concerns across the globe. It causes large number of fatalities and also responsible for lots of money waste directly or indirectly. Therefore, studies on active safety systems and advanced driver assistance systems (ADAS) have been actively taken up with the aim of ensuring safety, including vehicle control for collision avoidance and mitigation; such features are in contrast with those of conventional passive systems, which gives safety through simple warnings . One such smart active system is the autonomous emergency braking (AEB) system. In a recent studies, the European Union (EU) determined that introducing the AEB system could reduce the annual number of deaths and serious injuries in vehicle accidents by more than 8,000 and 20,000, respectively. Generally, an AEB system employs environment-recognition sensors such as RADAR(Radio Detection And Ranging), LIDAR(Light Detection and Ranging), and cameras for detecting risk factors. However, the existing sensor-based systems are able to detect only those vehicles that are within the employed sensors' measurement ranges, and blind spots may occur owing to obstacles. In addition, under bad weather conditions, detection becomes impossible or the detection accuracy drops significantly. For overcoming the limitations of sensor-based systems, recently, with the advancement of IT technology, cooperative safety system has been introduced. This system is grafted with vehicle safety communication.

schemes such as car-to-car communication and car-to-infra (C2I) communication . Currently, international standards for AEB systems are being formulated worldwide, and various studies on AEB systems are being conducted. The existing studies on AEB systems were conducted based on the performance of sensors employed in vehicles and, therefore, they have limitations concerning detection area. For overcoming these limitations, the current study was conducted based on the cooperative safety system grafted with C2I communication. A limitation of the AEB system, that is, the blind zone occurring at a crossroad, was partially solved through C2I communication by employing radars in traffic lights at crossroads. However, compared with direct C2C communication, C2I communication suffers from real-time limitations and limited detection areas of the sensors installed on the road surface. In

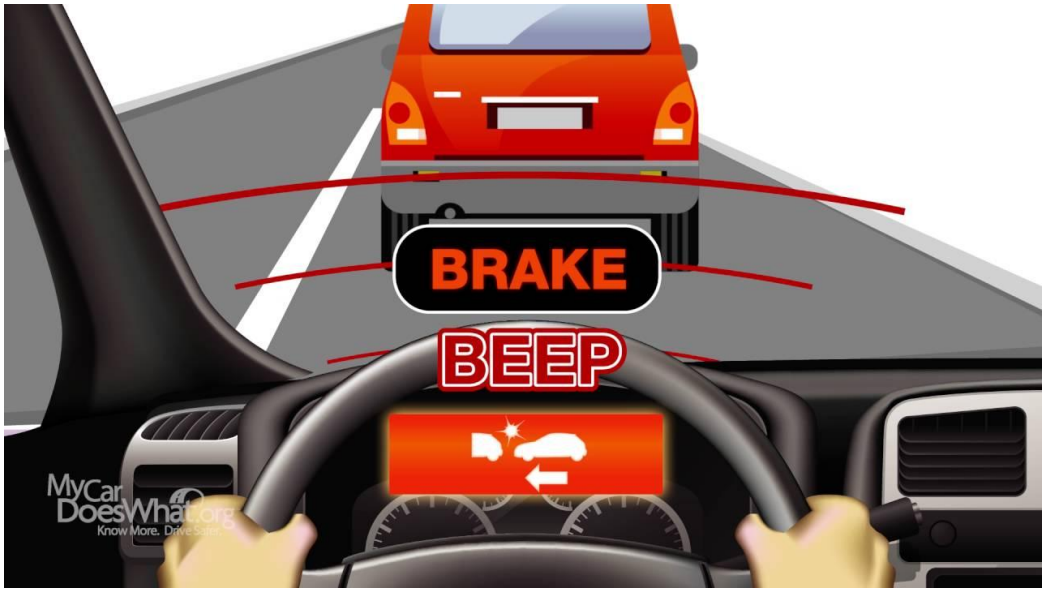
the case of C2C communication, studies on the operating environment and evaluations of pure communication technologies were conducted using the existing sensor-based ADAS, and basic studies on cooperative adaptive cruise control were conducted by grafting ADAS with adaptive cruise control and realizing inter vehicle communication . Consequently, a presentation on the usability of the new conceptual AEB system that employs C2C communication was required. Therefore, in this study, to overcome the aforementioned limitations of vehicle-mounted-sensor-based systems, we propose a new conceptual AEB system that employs C2C communication along with environment recognition sensors. In addition, the usability of C2C communication was compared with that of car-mounted sensors by modifying an existing vehicle-mounted-sensor-based AEB system to incorporate C2C communication.

1.2 Block diagram:



1.3 ADVANCED EMERGENCY BREAKING SYSTEM

AEB is an active safety system that measures the degree of risk between a user vehicle and a forward vehicle using vehicle-installed environment recognition sensors such as radars or cameras. It helps in preventing accidents through automatic brake control in risky situations. In Europe, the enforcement of rules concerning AEB systems from 2014 has been initiated. In Europe, the rules concerning AEB systems have come into effect since the beginning of 2014. In 2009, it was proposed that an informal group, called the Autonomous Emergency Braking System (AEBS)/Lane Departure Warning System (LDWS) informal group, will be formed under the Working Party on Brakes and Running Gear (GRRF), a subsidiary body of a World Forum for Harmonization of Vehicle (WP.29), in order to formulate AEBS/LDWS standards. Economic Commission for Europe (ECE) regulations concerning AEBS are being enacted under the United Nations Economic Commission for Europe (UNECE).



CHAPTER-2

IOT TECHNOLOGY

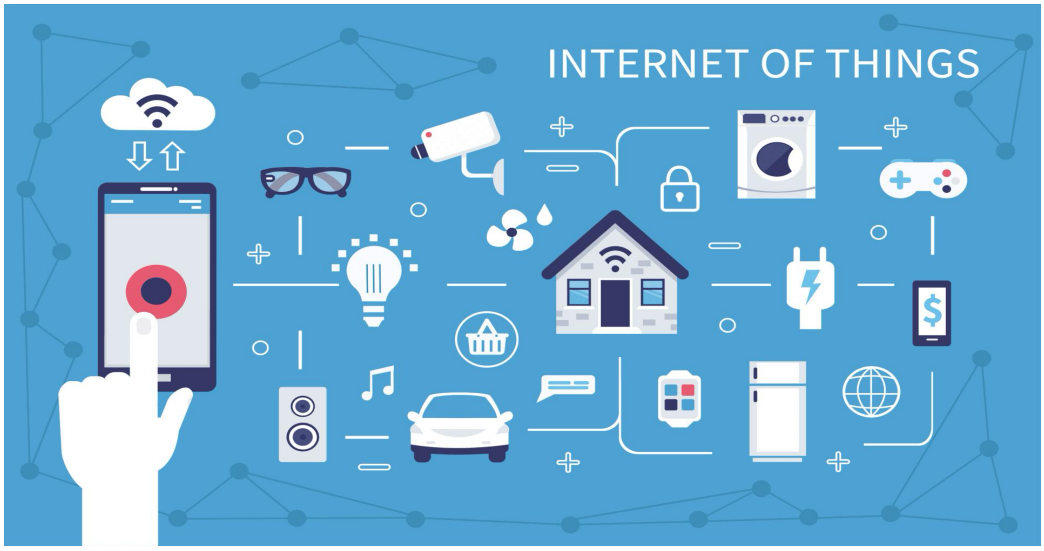
2.1 INTRODUCTION TO IOT:

Internet of Things (IOT) is the networking of physical objects that contain electronics embedded within their architecture in order to communicate and sense interactions among each other or with respect to the external environment. In the upcoming years, IOT based technology will offer advanced levels of services and practically change the way people lead their daily lives. Advancements in medicine, power, gene therapies, agriculture, smart cities, and smart homes are just a very few of the categorical examples where IOT is strongly established.

Over 9 billion 'Things' (physical objects) are currently connected to the Internet, as of now. In the near future, this number is expected to rise to a whopping 20 billion. In the consumer market, IOT technology is most synonymous with products pertaining to the concept of the "smart home", including devices and appliances (such as lighting fixtures, thermostats, home security systems and cameras, and other home appliances) that support one or more common ecosystems, and can be controlled via devices associated with that ecosystem, such as smart phones and smart speakers. The IOT can also be used in healthcare systems.

The Internet of Things (IOT) is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

In the consumer market, IOT technology is most synonymous with products pertaining to the concept of the "smart home", covering devices and appliances (such as lighting fixtures, thermostats, home security systems and cameras, and other home appliances) that support one or more common ecosystems, and can be controlled via devices associated with that ecosystem, such as smart phones and smart speakers.



2.2 IOT – KEY FEATURES:

The most important features of IoT include artificial intelligence, connectivity, sensors, active engagement, and small device use. A brief review of these features is given below :

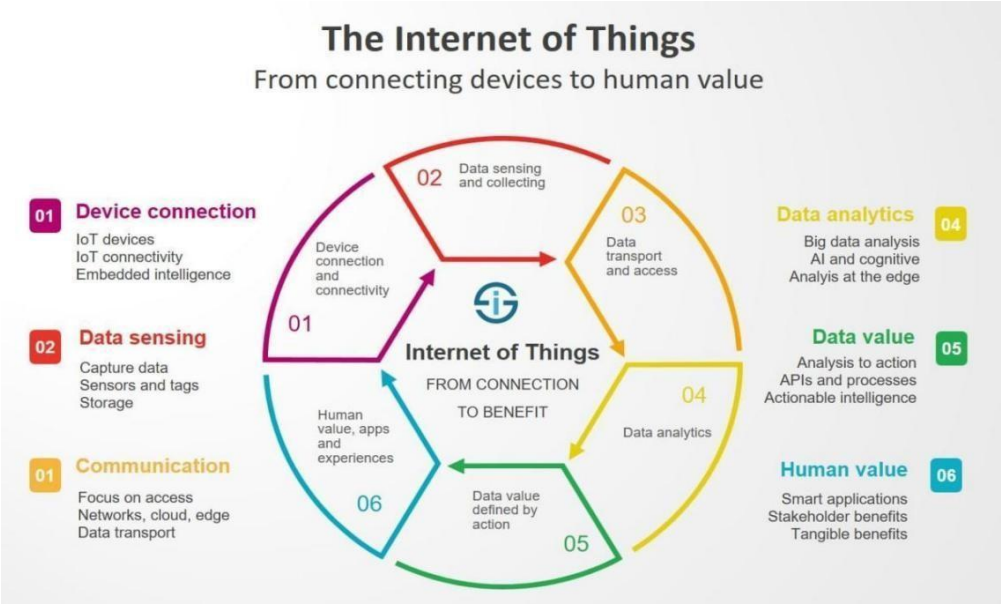
AI – IOT essentially makes virtually anything "smart", meaning it enhances every aspect of life with the power of data collection, artificial intelligence algorithms, and networks. This can mean something as simple as enhancing your refrigerator and cabinets to detect when milk and your favorite cereal run low, and to then place an order with your preferred grocer.

Connectivity – New enabling technologies for networking, and specifically IoT networking, mean networks are no longer exclusively tied to major providers. Networks can exist on a much smaller and cheaper scale while still being practical. IOT creates these small networks between its system devices.

Sensors – IOT loses its distinction without sensors. They act as defining instruments which transform IOT from a standard passive network of devices into an active system capable of real- world integration.

Active Engagement − Much of today's interaction with connected technology happens through passive engagement. IOT introduces a new paradigm for active content, product, or service engagement.

Small Devices −Devices, as predicted, have become smaller, cheaper, and more powerful over time. IOT exploits purpose-built small devices to deliver its precision, scalability , and versatility.



2.3 ADVANTAGES :

Technology Optimization − The same technologies and data which improve the customer experience also improve device use, and aid in more potent improvements to technology. IOT unlocks a world of critical functional and field data.

Reduced Waste − IOT makes areas of improvement clear. Current analytics give us superficial insight, but IOT provides real-world information leading to more effective management of resources.

Enhanced Data Collection − Modern data collection suffers from its limitations and its design for passive use. IOT breaks it out of those spaces, and places it exactly where humans really want to go to analyze our world. It allows an accurate picture of everything.

2.3.1 IOT − DISADVANTAGES:

Privacy − The sophistication of IOT provides substantial personal data in extreme detail without the user's active participation.

Complexity − Some find IOT systems complicated in terms of design, deployment, and maintenance given their use of multiple technologies and a large set of new enabling technologies.

Flexibility − Many are concerned about the flexibility of an IoT system to integrate easily another. They worry about finding themselves with several conflicting or locked systems.

2.4 HOW IOT WORKS:

First, it acquires information with respect to basic resources (names, addresses and so on) and related attributes of objects by means of automatic identification and perception technologies such as RFID, wireless sensor and satellite positioning, in other words, the sensors, RFID tags, and all other uniquely identifiable objects or "things" acquire real-time information (data) with the virtue of a central hub like smart phones.

Second, by virtue of many kinds of communications technologies, it integrates object-related information into the information network and realizes the intelligent indexing and integration of the information related to masses of objects by resorting to fundamental resource services (similar to the resolution, addressing and discovery of the internet).

Finally, utilizing intelligent computing technologies such as cloud computing, fuzzy recognition, data mining, and semantic analysis, it analyzes and processes the information related to masses of objects so as to eventually realize intelligent decision and control in the physical world.

2.5 FIRE BASE:

Firebase evolved from a prior start up founded by James Tamplin and Andrew Lee in 2011. Envolve provided developers an API that enables the integration of online chat functionality into their websites. After releasing the chat service, Tamplin and Lee found that it was being used to pass application data that weren't chat messages. Developers were using Evolve to sync application data such as game state in real time across their users. Tamplin and Lee decided to separate the chat system and the real-time architecture that powered it. They founded Firebase as a separate company in September 2011and it launched to the public in April 2012.

Fire base's first product was the Firebase Real-time Database, an API that synchronizes application data across IOS, Android, and Web devices, and stores it on Fire base's cloud. The product assists software developers in building real-time, collaborative applications.In May 2012, one month after the beta launch, Firebase raised $1.1M in seed funding from venture capitalists Flybridge Capital Partners, Greylock Partners, Founder Collective, and New Enterprise Associates.

In May 2016, at Google I/O, the company's annual developer conference, Firebase expanded its services to become a unified platform for mobile developers. Firebase now integrates with various other Google services, including Google Cloud Platform, AdMob, and Google Ads to offer broader products and scale for developers. Google Cloud Messaging, the Google service to send push notifications to Android devices, was superseded by a Firebase product, Firebase Cloud Messaging, which added the functionality to deliver push notification to IOS and Web devices. In January 2017, Google acquired Fabric and Crashlytics from Twitter to add those services to Firebase. In October 2017, Firebase launched Cloud Fire store, a real-time document database as the successor product to the original Firebase Real-time Database.

Firebase Real-time Database:

Firebase provides a real-time database and back end as a service. The service provides application developers an API that allows application data to be synchronized across clients and stored on Fire base's cloud. The company provides client libraries that

enable integration with Android, iOS, JavaScript, Java, Objective-C, Swift and Node.js applications. The database is also accessible through a REST API and bindings for several JavaScript frameworks such as AngularJS, React, Ember.js and Backbone.js.

Firebase Cloud Fire store:

On January 31st 2019, Cloud Fire store was officially brought out of beta, making it an official product of the Firebase line-up. It is the successor to Fire base's original data basing system, Real-time Database, and allows for nested documents and fields rather than the tree-view provided in the Real-time Database.

Firebase Storage:

Firebase Storage provides secure file uploads and downloads for Firebase apps, regardless of network quality. The developer can use it to store images, audio, video, or other user-generated content. Firebase Storage is backed by Google Cloud Storage.

Firebase Hosting:

Firebase Hosting is a static and dynamic web hosting service that launched on May 13, 2014. It supports hosting static files such as CSS, HTML, JavaScript and other files, as well as support through Cloud Functions. The service delivers files over a content delivery network (CDN) through HTTP Secure (HTTPS) and Secure Sockets Layer encryption (SSL). Firebase partners with fastly, a CDN, to provide the CDN backing Firebase Hosting. The company states that Firebase Hosting grew out of customer requests; developers were using Firebase for its real-time database but needed a place to host their content.

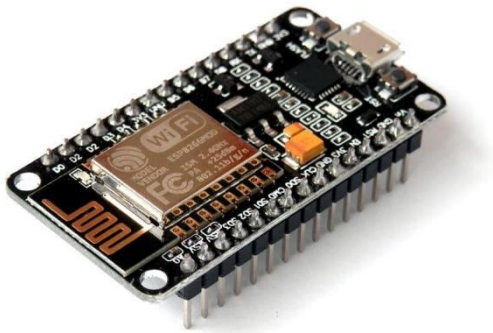
2.6 APPLICATIONS OF IoT:

1. Smart Homes.
2. Smart City.
3. Self-driven Cars.
4. IOT Retail Shops.
5. Farming.
6. Industrial Internet.
7. Health.

CHAPTER 3

3.1 HARDWARE IMPLEMENTATION OF THE PROJECT

NodeMCU is an open source Lua based firmware developed for ESP8266 Wi-Fi chip. By exploring functionality with ESP8266 chip, NodeMCU firmware comes with ESP8266 Development board/kit i.e. NodeMCU Development board.



NodeMCU Development Board/kit v1.0 (Version2)

Since NodeMCU is open source platform, their hardware design is open for edit/modify/build.

NodeMCU Dev Kit/board consist of ESP8266 Wi-Fi enabled chip. The **ESP8266** is a low-cost Wi-Fi chip developed by Espressif Systems with TCP/IP protocol. For more information about ESP8266, you can refer ESP8266 WiFi Module.

There is Version2 (V2) available for NodeMCU Dev Kit i.e. **NodeMCU Development Board v1.0 (Version2)**, which usually comes in black colored PCB.

For more information about NodeMCU Boards available in market refer NodeMCU Development Boards

NodeMCU Dev Kit has **Arduino like** Analog (i.e. A0) and Digital (D0-D8) pins on its board.

It supports serial communication protocols i.e. UART, SPI, I2C etc.

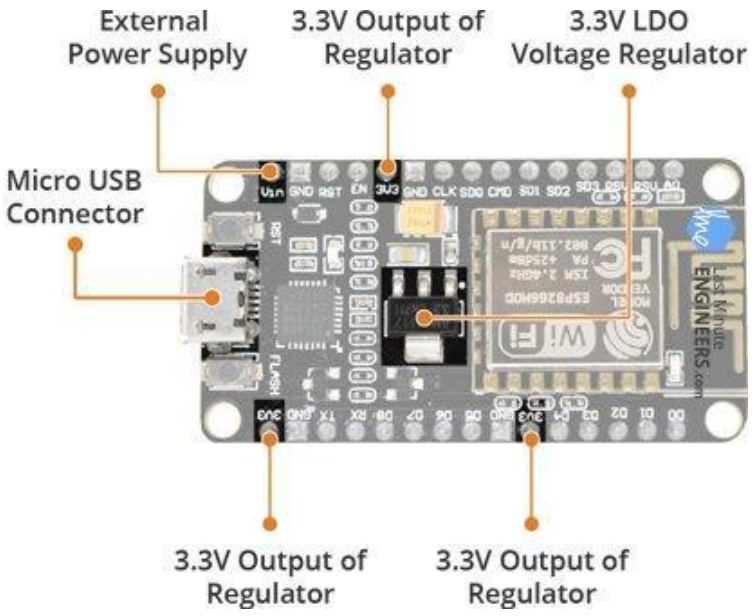
Using such serial protocols we can connect it with serial devices like I2C enabled LCD display, Magnetometer HMC5883, MPU-6050 Gyro meter + Accelerometer, RTC chips, GPS modules, touch screen displays, SD cards etc.

3.2 Power Requirement

As the operating voltage range of ESP8266 is 3V to 3.6V, the board comes with a LDO voltage regulator to keep the voltage steady at 3.3V. It can reliably supply up to 600mA, which should be more than enough when ESP8266 pulls as much as 80mA during RF transmissions. The output of the regulator is also broken out to one of the sides of the board and labeled as 3V3. This pin can be used to supply power to external components.

Power Requirement

- Operating Voltage: 2.5V to 3.6V.
- On-board 3.3V 600mA regulator.
- 80mA Operating Current.
- 20 µA during Sleep Mode.



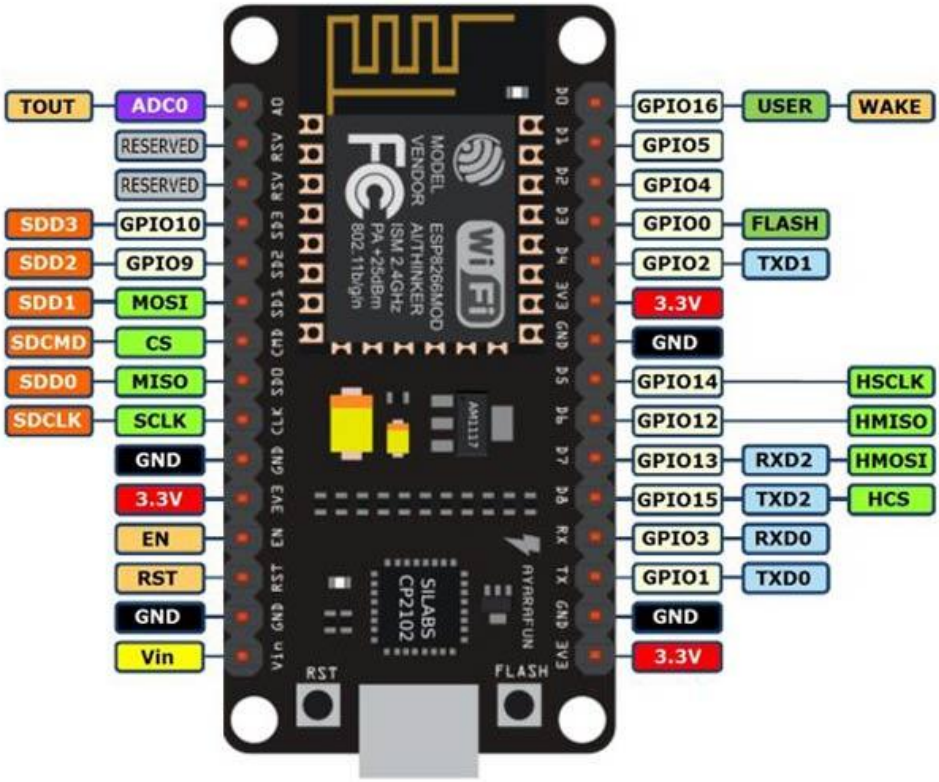
3.3 How to write codes for NodeMCU?

After setting up ESP8266 with NodeMCU firmware, let's see the IDE (Integrated Development Environment) required for development of NodeMCU.

3.3.1 NodeMCU with Arduino IDE

Here is another way of developing NodeMCU with a well-known IDE i.e. Arduino IDE. We can also develop applications on NodeMCU using the Arduino development environment. This makes it easier for Arduino developers than learning a new language and IDE for NodeMCU.

3.4 NodeMCU ESP12 Dev Kit V1.0 Pin Definition:



While writing GPIO code on NodeMCU, you can't address them with actual GPIO Pin Numbers. There are different I/O Index numbers assigned to each GPIO Pin which is used for GPIO Pin addressing. Refer following table to check I/O Index of NodeMCU GPIO Pins –

GPIO Pin	I/O Index Number
GPIO0	3
GPIO1	10
GPIO2	4
GPIO3	9
GPIO4	2
GPIO5	1
GPIO6	N/A
GPIO7	N/A
GPIO8	N/A
GPIO9	11
GPIO10	12
GPIO11	N/A
GPIO12	6
GPIO13	7
GPIO14	5
GPIO15	8
GPIO16	0

It's also very practical since it already has an USB header, so we can program the micro-controller without any additional hardware.

Besides that, the pins are easily accessible, allowing us to take full advantage of the capabilities of the ESP8266, as opposed to other simpler boards, such as the ESP-01, which only expose some of the GPIO of the micro-controller.

Nevertheless, as indicated in some previous tutorials, the numbers of the pins in the board don't map to the numbers of the pins on the ESP8266. So, for example, pin D1 of the board doesn't map to GPIO1 of the ESP8266 (it actually maps to GPIO5).

Naturally, if this is not taken into consideration, it will lead to a difficult debugging process, since we will be assuming that the board is not working correctly.

So, the correct pin mapping is the following [1][2] (NodeMCU on the left and ESP8266 on the right):
D0 = GPIO16;
D1 = GPIO5;
D2 = GPIO4;
D3 = GPIO0;
D4 = GPIO2;
D5 = GPIO14;
D6 = GPIO12;
D7 = GPIO13;
D8 = GPIO15;
D9 = GPIO3;
D10 = GPIO1;

Example code
Just as a very simple example code, we are going to use one of these mapping in the famous blink example. To avoid the need for external hardware, we are going to use the NodeMCU built in LED, which is connected to pin D0 of the board [3].
So, we are going to use the defined D0 constant to control the LED without the need to worry about the mapping to the actual ESP8266 GPIO pin.

```
void setup() {

pin Mode(D0, OUTPUT); //Declare Pin mode

}

void loop() {

digital Write(D0, HIGH);     //Turn the LED on
delay(1000);                 //Wait 1 second
digital Write(D0, LOW);      //Turn the LED off
delay(1000);                 //Wait 1 second

}
```

Note that we could also have used the LED_BUILTIN constant, which would map to the same exact result.

3.5 What is a Buzzer :

There are many ways to communicate between the user and a product. One of the best ways is audio communication using a buzzer IC. So during the design process, understanding some technologies with configurations is very helpful. So, this article discusses an overview of an audio signaling device like a beeper or a buzzer and its working with applications.

An audio signaling device like a beeper or buzzer may be electromagnetically or piezoelectric or mechanical type. The main function of this is to convert the signal from audio to sound. Generally, it is powered through DC voltage and used in timers, alarm devices, printers, alarms, computers, etc. Based on the various designs, it can generate different sounds like alarm, music, bell & siren.

3.5.1 Buzzer Pin Configuration

The pin configuration of the buzzer is shown below. It includes two pins namely positive and negative. The positive terminal of this is represented with the '+' symbol or a longer terminal. This terminal is powered through 6Volts whereas the negative terminal is represented with the '-'symbol or short terminal and it is connected to the GND terminal.

3.5.2 Specifications

The specifications of the buzzer include the following.

Color is black

The frequency range is 3,300Hz

Operating Temperature ranges from – 20° C to +60°C

Operating voltage ranges from 3V to 24V DC

The sound pressure level is 85dBA or 10cm

The supply current is below 15mA

3.5.3 Types of Buzzer

A buzzer is available in different types which include the following.

Piezoelectric

Electromagnetic

Mechanical

Electromechanical

Magnetic

3.5.4 Advantages

The advantages of a buzzer include the following.

- Simply Compatible
- Frequency Response is Good
- Size is small
- Energy Consumption is less
- The Range of Voltage usage is Large
- Sound Pressure is high

3.5.5 Disadvantages

The disadvantages of the buzzer include the following:

- Controlling is a little hard
- Generates Annoying Sound
- Training is necessary to know how to repair the condition without just turning off.

3.5.6 Applications

The applications of the buzzer include the following:

- Communication Devices
- Electronics used in Automobiles
- Alarm Circuits
- Portable Devices
- Security Systems
- Timers

- Household Appliances

3.6 What is a DC Cooling Fan?

A DC cooling fan is a combination of rotor, stater, fan blades and other auxiliary components. There are many semiconductor components in the control circuit, which are now incorporated in one or more ICs. Different models of IC control circuits are different, but the main purpose is to provide more effective control and protection for the effective function of the coil and fan-related characteristics required.

3.6.1 Working principle of DC cooling fan:

Through DC voltage and electromagnetic induction, the electrical energy is converted into mechanical and thus drives the rotation of the fan blades. In simple terms, it is a cooling device that relies on the coil and IC to continuously switch and induct the magnetic ring from driving the fan blades to rotate. Here we are using DC fan as representing as vehicle motors.

3.7 What is the HC-SR04 Ultrasonic Sensor?

The HC-SR04 is a type of ultrasonic sensor which uses sonar to find out the distance of the object from the sensor. It provides an outstanding range of non-contact detection with high accuracy & stable readings. It includes two modules like an ultrasonic transmitter & receiver. This sensor is used in a variety of applications like measurement of direction and speed, burglar alarms, medical, sonar, humidifiers, wireless charging, non-destructive testing, and ultrasonography.

The working principle of this module is simple. It sends an ultrasonic pulse out at 40 kHz, which travels through the air, and if there is an obstacle or object, it will bounce back to the sensor. By calculating the travel time and the speed of sound, the distance can be calculated.

3.7.1 HC-SR04 Ultrasonic Sensor Pin Configuration:

This sensor includes four pins and the pin configuration of this sensor is discussed below.

- Pin1 (Vcc): This pin provides a +5V power supply to the sensor.
- Pin2 (Trigger): This is an input pin, used to initialize measurement by transmitting ultrasonic waves by keeping this pin high for 10us.
- Pin3 (Echo): This is an output pin, which goes high for a specific time period and it will be equivalent to the duration of the time for the wave to return back to the sensor.
- Pin4 (Ground): This is a GND pin used to connect to the GND of the system.

3.7.2 Applications:

The applications of HC-SR04 sensor include the following,

- This sensor is used to measure speed as well as the direction between two objects
- It is used in wireless charging
- Medical ultrasonography
- This is used to detect objects & avoid obstacles using robots such as biped, path finding, obstacle avoidance, etc.
- Depth measurement
- Humidifiers
- This sensor is used to plot the objects nearby the sensor by revolving it
- Non-destructive testing
- By using this sensor depth of pits, wells can be measured by transmitting the waves through water.

3.8 What is MQ-2 sensor?

MQ2 gas sensor is an electronic sensor used for sensing the concentration of gases in the air such as LPG, propane, methane, hydrogen, alcohol, smoke and carbon monoxide.

MQ2 gas sensor is also known as chemiresistor. It contains a sensing material whose resistance changes when it comes in contact with the gas. This change in the value of resistance is used for the detection of gas.

MQ2 is a metal oxide semiconductor type gas sensor. Concentrations of gas in the gas is measured using a voltage divider network present in the sensor. This sensor works on 5V DC voltage. It can detect gases in the concentration of range 200 to 10000ppm.

MQ-2 sensor

3.8.1 Working Principle:

This sensor contains a sensing element, mainly aluminium-oxide based ceramic, coated with Tin dioxide, enclosed in a stainless steel mesh. Sensing element has six connecting legs attached to it. Two leads are responsible for heating the sensing element, the other four are used for output signals.

Oxygen gets adsorbed on the surface of sensing material when it is heated in air at high temperature. Then donor electrons present in tin oxide are attracted towards this oxygen, thus preventing the current flow.

3.8.2 Applications of MQ2 Gas Sensor:

- It is used in domestic gas leakage detectors.
- It is utilized in a variety of applications, including breath analyzers, smoke detectors, fire detection systems, and air quality monitoring systems.
- It is also used in Industrial Combustible gas detectors.
- It can be used as a portable gas detector.

3.9 What is a Humidity Sensor?

Humidity Sensors are the low cost-sensitive electronic devices used to measure the humidity of the air. These are also known as Hygrometers. Humidity can be measured as Relative humidity, Absolute humidity, and Specific humidity. Based on the type of

humidity measured by sensor, these are classified as Relative Humidity sensor and Absolute Humidity sensor.

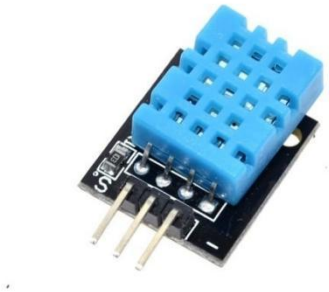
Humidity Sensor
Based on the parameters used to measure humidity, these sensors are also classified as Capacitive Humidity Sensor, Resistive Humidity Sensor, and Thermal Conductivity Humidity Sensor.

Some of the parameters to consider while choosing these sensors are the Accuracy, Linearity, Reliability, Repeat-ability and Response time.

3.9.1 Working Principle of Humidity Sensor:

Relative humidity sensors usually contain a humidity sensing element along with a thermistor to measure temperature. For a capacitive sensor, the sensing element is a capacitor. Here the change in electrical permitting of the dielectric material is measured to calculate the relative humidity values.

Low resistivity materials are used for the construction of a Resistive sensor. This resistive material is placed on top of two electrodes. Change in the resistivity value of this material is used to measure the change in humidity.

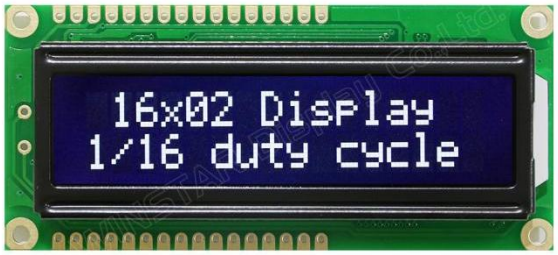


TEMPERATURE AND HUMIDITY SENSOR

3.10 What is the LCD 16×2?

The term LCD stands for liquid crystal display. It is one kind of electronic display module used in an extensive range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc. These displays are mainly

preferred for multi-segment light-emitting diodes and seven segments. The main benefits of using this module are inexpensive; simply programmable, animations, and there are no limitations for displaying custom characters, special and even animations, etc.

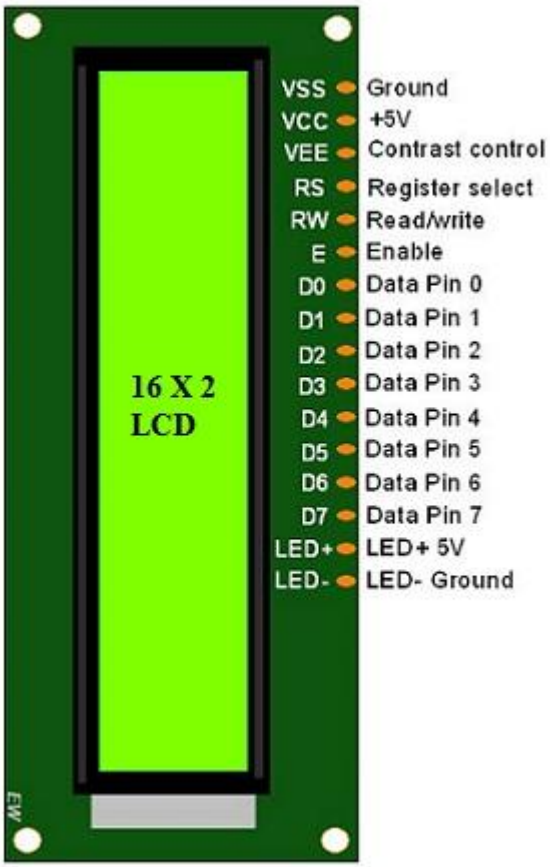


16*2 LCD Display

3.10.1 LCD 16×2 Pin Diagram

The 16×2 LCD pin out is shown below.

- Pin1 (Ground/Source Pin): This is a GND pin of display, used to connect the GND terminal of the micro-controller unit or power source.
- Pin2 (VCC/Source Pin): This is the voltage supply pin of the display, used to connect the supply pin of the power source.
- Pin3 (V0/VEE/Control Pin): This pin regulates the difference of the display, used to connect a changeable POT that can supply 0 to 5V.
- Pin4 (Register Select/Control Pin): This pin toggles among command or data register, used to connect a micro-controller unit pin and obtains either 0 or 1(0 = data mode, and 1 = command mode).
- Pin5 (Read/Write/Control Pin): This pin toggles the display among the read or writes operation, and it is connected to a micro-controller unit pin to get either 0 or 1 (0 = Write Operation, and 1 = Read Operation).
- Pin 6 (Enable/Control Pin): This pin should be held high to execute Read/Write process, and it is connected to the micro-controller unit & constantly held high.
- Pins 7-14 (Data Pins): These pins are used to send data to the display. These pins are connected in two-wire modes like 4-wire mode and 8-wire mode. In 4-wire mode, only four pins are connected to the micro-controller unit like 0 to 3, whereas in 8-wire mode, 8-pins are connected to micro-controller unit like 0 to 7.
- Pin15 (+ve pin of the LED): This pin is connected to +5V
- Pin 16 (-ve pin of the LED): This pin is connected to GND.



Pin diagram

3.10.2 Features of LCD16x2:

The features of this LCD mainly include the following.

- The operating voltage of this LCD is 4.7V-5.3V
- It includes two rows where each row can produce 16-characters.
- The utilization of current is 1mA with no backlight
- Every character can be built with a 5×8 pixel box
- The alphanumeric LCD's alphabets & numbers
- Is display can work on two modes like 4-bit & 8-bit
- These are obtainable in Blue & Green Backlight
- It displays a few custom generated characters

3.10.3 Applications:

- LCD televisions
- Computer monitors
- Instrument panels
- Aircraft cockpit displays
- Indoor and outdoor signage.

CHAPTER 4

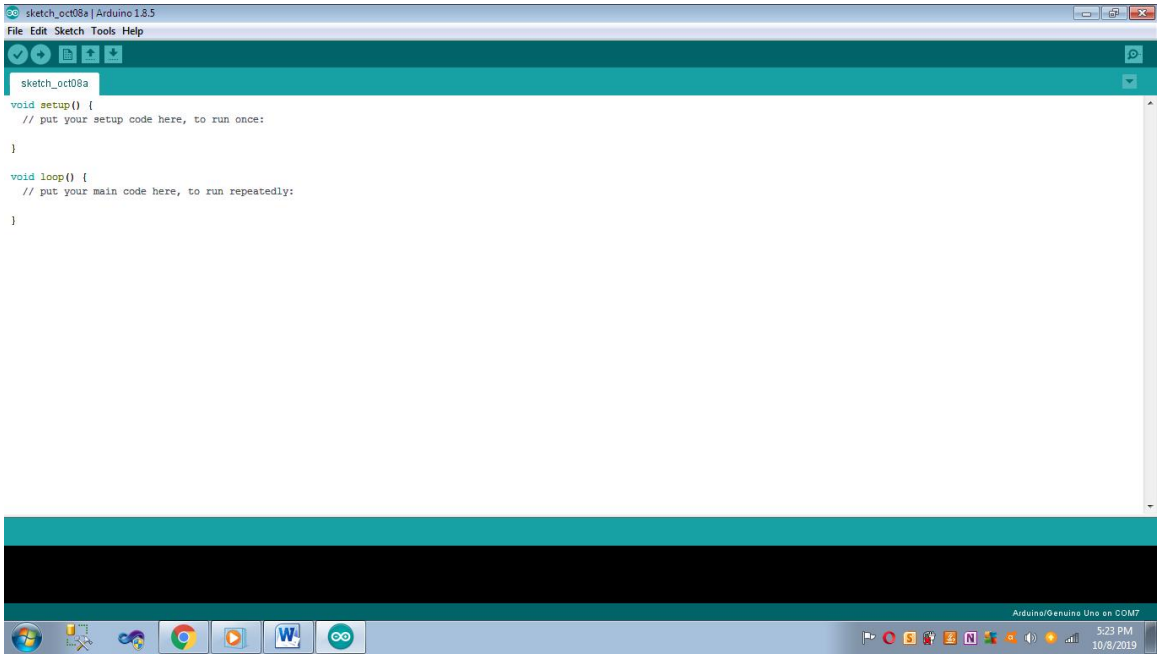
4.1 FIRMWARE IMPLEMENTATION OF THE PROJECT DESIGN

The software applications to be used for accident prevention, detection and reporting system are Arduino IDE, Google map and messaging app.

4.2 ARDUINO IDE:

The Arduino Integrated Development Environment (IDE) is a cross-platform application (for Windows, mac-OS, Linux) that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the help of 3rd party cores, other vendor development boards. A program written with the IDE for Arduino is called“sketch”. Sketches are saved on the development computer as files with the extension.pde. Arduino Software (IDE) prior to 1.0 saved sketches with the extension.pde. Arduino IDE was created for people with no profound knowledge of electronics. Arduino IDE also contains a message area, a text console, a toolbar with buttons for common functions and a series of menus.

- Inexpensive - Arduino boards are relatively inexpensive compared to other micro-controller platforms. The least expensive version of the Arduino module can be assembled by hand, and even the per-assembled Arduino modules cost less than $50
- Cross-platform - The Arduino Software (IDE) runs on Windows, Macintosh OSX, and Linux operating systems. Most micro-controller systems are limited to Windows.
- Simple, clear programming environment - The Arduino Software (IDE) is easy-to-use for beginners, yet flexible enough for advanced users to take advantage of as well. For teachers, it's conveniently based on the Processing programming environment, so students learning to program in that environment will be familiar with how the Arduino IDE works.
- Open source and extensible software - The Arduino software is published as open source tools, available for extension by experienced programmers. The language can be expanded through C++ libraries, and people wanting to understand the technical details can make the leap from Arduino to the AVR C programming language on which it's based. Similarly, you can add AVR-C code directly into your Arduino programs if you want to.
- Open source and extensible hardware - The plans of the Arduino boards are published under a Creative Commons license, so experienced circuit designers can make their own version of the module, extending it and improving it. Even relatively inexperienced users can build the breadboard version of the module in order to understand how it works and save money



4.2.1 Arduino IDE: COM Port Setup

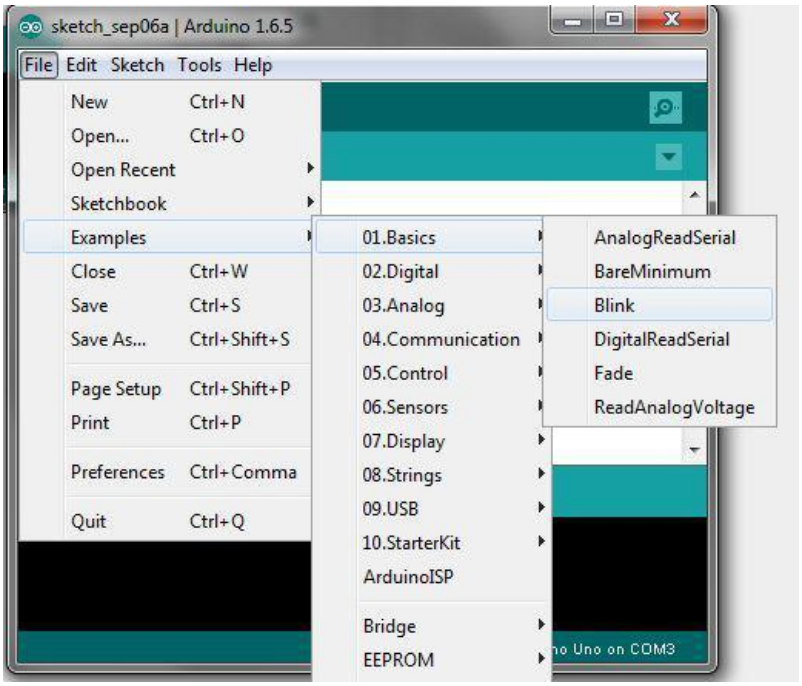
At this point, your board should be set up for programming, and you can begin writing and uploading code

One common procedure to test whether the board you are using is properly set up is to upload the “Blink” sketch. This sketch is included with all Arduino IDE releases and can be accessed by the **File** pull-down

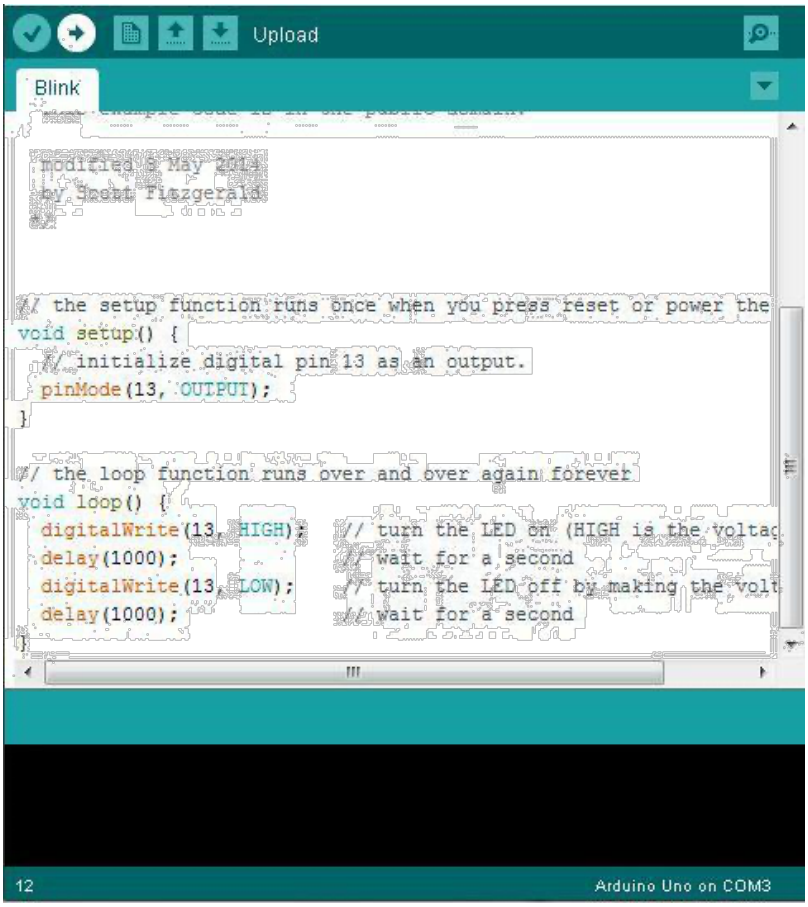
menu and going to **Examples,01.Basics,** and then select **Blink**.Standard Arduino Boards include a surface-mounted LED labeled “L” or “LED” next to the “RX” and “TX” LED's, that is connected to digital pin

This sketch will blink the LED at a regular interval, and is an easy way to confirm if your board is set up properly and you were successful in uploading code. Open the “Blink” sketch and press the “Upload” button in the upper-left corner to upload “Blink” to the board.

Upload Button: 



4.2.2 Arduino IDE: Loading Blink Sketch



4.3 MESSAGING APP:

Messaging apps are apps and platforms that enable messaging, many of which started around social networking platforms, but many of which have now developed into broad platforms enabling status updates, chat bots, payments and conversational commerce (e-commerce via chat).

4.4 GPS:

The Global Positioning System (GPS) is the only fully functional Global Navigation Satellite System (GNSS). The GPS uses a constellation of between 24 and 32 Medium Earth Orbit satellites that transmit precise microwave signals, which enable GPS receivers to determine their location, speed,. GPS was developed by the United States Department of Defense. Its official name is NAVSTAR-GPS. Although NAVSTAR-GPS is not an acronym, a few backronyms have been created for it. The GPS satellite constellation is managed by the United States Air Force 50th Space Wing.

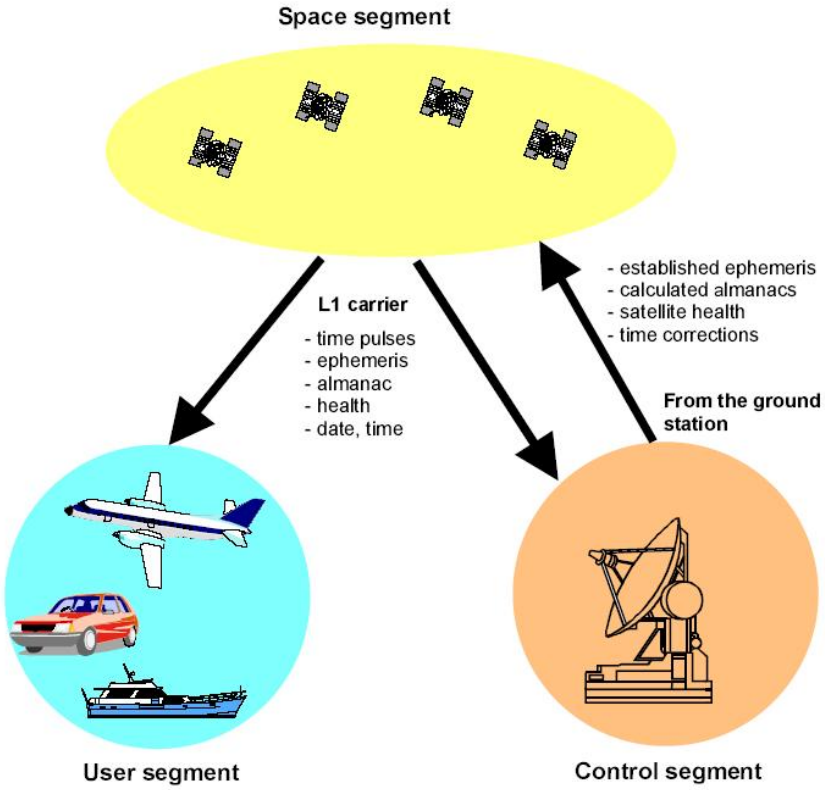
Global Positioning System is an earth-orbiting-satellite based system that provides signals available anywhere on or above the earth, twenty-four hours a day, which can be used to determine precise time and the position of a GPS receiver in three dimensions. GPS is increasingly used as an input for Geographic Information Systems particularly for precise positioning of geo spatial data and the collection of data in the field.Precise positioning is possible using GPS receivers at reference locations providing corrections and relative positioning data for remote receivers. Time and frequency dissemination, based on the precise clocks on board the SVs and controlled by the monitor stations, is another, use for GPS.Astronomical observatories telecommunications facilities and laboratory standards can be set to precise time signals or controlled to accurate frequencies by special purpose GPS receivers.

Similar satellite navigation systems include the Russian GLONASS (incomplete as of 2008), the upcoming European Galileo positioning system, the proposed COMPASS navigation system of China, and IRNSS of India.Following the shooting down of Korean Air Lines Flight 007 in 1983,President Ronald Reagan issued a directive making the system available free for civilian use as a common good. Since then, GPS has become a widely used aid to navigation worldwide, and a useful tool for map-making, land

surveying, commerce,scientific uses, and hobbies such as geocaching. GPS also provides a precise time reference used in many applications including scientific study of earthquakes, and synchronization of telecommunications networks.

4.5 Space segment:

The space segment (SS) comprises the orbiting GPS satellites, or Space Vehicles (SV) in GPS parlance. The GPS design originally called for 24 SVs, eight each in three circular orbital planes, but this was modified to six planes with four satellites each.



4.6 GOOGLE MAP:

Google Maps is a web mapping service developed by Google. It offers satellite imagery, aerial photography, street maps, 360° panoramic views of streets(Street View), real-time traffic conditions, and route planning for traveling by foot, car, bicycle and air (in beta), or public transportation.

CHAPTER 5

CODING

```
#include<SoftwareSerial.h>
SoftwareSerial Serial1(2,3); //make RX arduino line is pin 2, make TX arduino line is pin 3.
SoftwareSerial gps(10,11);
#include<LiquidCrystal.h>
LiquidCrystal lcd(4,5,6,7,8,9);

#define x A1
#define y A2
#define z A3

int xsample=0;
int ysample=0;
int zsample=0;

#define samples 10

#define minVal -50
#define MaxVal 50

int i=0,k=0;
int    gps_status=0;
float latitude=0;
float logitude=0;
String Speed="";
String gpsString="";
char *test="$GPRMC";

void initModule(String cmd, char *res, int t)
{
   while(1)
   {
      Serial.println(cmd);
      Serial1.println(cmd);
      delay(100);
      while(Serial1.available()>0)
      {
          if(Serial1.find(res))
          {
            Serial.println(res);
            delay(t);
            return;
          }

          else
```

```
            {
              Serial.println("Error");
            }
        }
        delay(t);
    }
}

void setup()
{
    Serial1.begin(9600);
    Serial.begin(9600);
    lcd.begin(16,2);
    lcd.print("Accident Alert    ");
    lcd.setCursor(0,1);
    lcd.print("          System          ");
    delay(2000);
    lcd.clear();
    lcd.print("Initializing");
    lcd.setCursor(0,1);
    lcd.print("Please Wait...");
    delay(1000);

    Serial.println("Initializing....");
    initModule("AT","OK",1000);
    initModule("ATE1","OK",1000);
    initModule("AT+CPIN?","READY",1000);
    initModule("AT+CMGF=1","OK",1000);
    initModule("AT+CNMI=2,2,0,0,0","OK",1000);
    Serial.println("Initialized Successfully");
    lcd.clear();
    lcd.print("Initialized");
    lcd.setCursor(0,1);
    lcd.print("Successfully");
    delay(2000);
    lcd.clear();
    lcd.print("Callibrating ");
    lcd.setCursor(0,1);
    lcd.print("Acceleromiter");
    for(int i=0;i<samples;i++)
    {
        xsample+=analogRead(x);
        ysample+=analogRead(y);
        zsample+=analogRead(z);
    }

    xsample/=samples;
    ysample/=samples;
    zsample/=samples;
```

```
   Serial.println(xsample);
   Serial.println(ysample);
   Serial.println(zsample);
   delay(1000);

   lcd.clear();
   lcd.print("Waiting For GPS");
   lcd.setCursor(0,1);
   lcd.print("         Signal        ");
   delay(2000);
   gps.begin(9600);
   get_gps();
   show_coordinate();
   delay(2000);
   lcd.clear();
   lcd.print("GPS is Ready");
   delay(1000);
   lcd.clear();
   lcd.print("System Ready");
   Serial.println("System Ready..");
}

void loop()
{
      int value1=analogRead(x);
      int value2=analogRead(y);
      int value3=analogRead(z);

      int xValue=xsample-value1;
      int yValue=ysample-value2;
      int zValue=zsample-value3;

      Serial.print("x=");
      Serial.println(xValue);
      Serial.print("y=");
      Serial.println(yValue);
      Serial.print("z=");
      Serial.println(zValue);

      if(xValue < minVal || xValue > MaxVal    || yValue < minVal || yValue >
MaxVal    || zValue < minVal || zValue > MaxVal)
      {
         get_gps();
         show_coordinate();
         lcd.clear();
         lcd.print("Sending SMS ");
         Serial.println("Sending SMS");
         Send();
         Serial.println("SMS Sent");
         delay(2000);
```

```
          lcd.clear();
          lcd.print("System Ready");
       }
}

void gpsEvent()
{
   gpsString="";
   while(1)
   {
    while (gps.available()>0)                    //Serial incoming data from GPS
    {
     char inChar = (char)gps.read();
       gpsString+= inChar;                                 //store incoming data from GPS to
temparary string str[]
       i++;
      // Serial.print(inChar);
       if (i < 7)
       {
        if(gpsString[i-1] != test[i-1])              //check for right string
        {
           i=0;
           gpsString="";
        }
       }
      if(inChar=='\r')
      {
       if(i>60)
       {
          gps_status=1;
          break;
       }
       else
       {
          i=0;
       }
      }
   }
    if(gps_status)
      break;
   }
}

void get_gps()
{
   lcd.clear();
   lcd.print("Getting GPS Data");
   lcd.setCursor(0,1);
   lcd.print("Please Wait.....");
    gps_status=0;
```

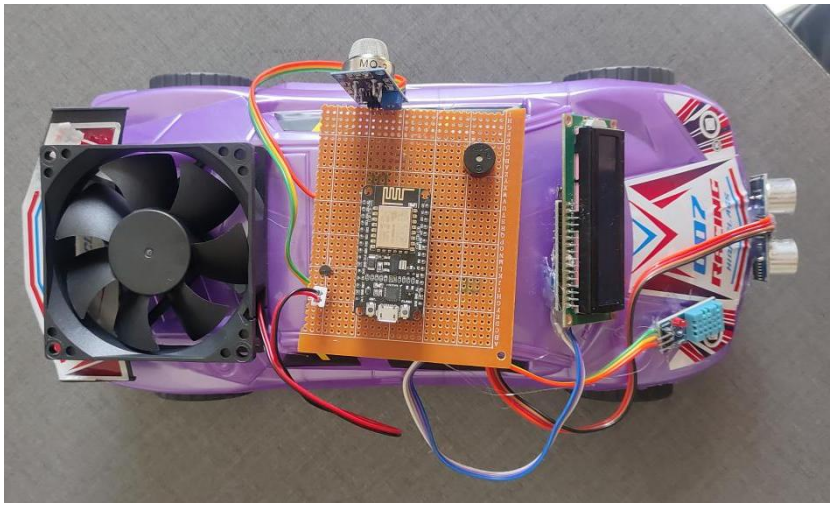
```
    int x=0;
    while(gps_status==0)
    {
     gpsEvent();
     int str_lenth=i;
     coordinate2dec();
     i=0;x=0;
     str_lenth=0;
    }
}

void show_coordinate()
{
      lcd.clear();
      lcd.print("Lat:");
      lcd.print(latitude);
      lcd.setCursor(0,1);
      lcd.print("Log:");
      lcd.print(logitude);
      Serial.print("Latitude:");
      Serial.println(latitude);
      Serial.print("Longitude:");
      Serial.println(logitude);
      Serial.print("Speed(in knots)=");
      Serial.println(Speed);
      delay(2000);
      lcd.clear();
      lcd.print("Speed(Knots):");
      lcd.setCursor(0,1);
      lcd.print(Speed);
}

void coordinate2dec()
{
   String lat_degree="";
      for(i=20;i<=21;i++)
         lat_degree+=gpsString[i];

   String lat_minut="";
       for(i=22;i<=28;i++)
         lat_minut+=gpsString[i];

   String log_degree="";
      for(i=32;i<=34;i++)
         log_degree+=gpsString[i];

   String log_minut="";
      for(i=35;i<=41;i++)
         log_minut+=gpsString[i];
```

```
      Speed="";
      for(i=45;i<48;i++)                  //extract longitude from string
         Speed+=gpsString[i];

       float minut= lat_minut.toFloat();
       minut=minut/60;
       float degree=lat_degree.toFloat();
       latitude=degree+minut;

       minut= log_minut.toFloat();
       minut=minut/60;
       degree=log_degree.toFloat();
       logitude=degree+minut;
}

void Send()
{
    Serial1.println("AT");
    delay(500);
    serialPrint();
    Serial1.println("AT+CMGF=1");
    delay(500);
    serialPrint();
    Serial1.print("AT+CMGS=");
    Serial1.print("");
    Serial1.print("+916281444391"); //mobile no. for SMS alert
    Serial1.println("");
    delay(500);
    serialPrint();
    Serial1.print("Latitude:");
    Serial1.println(latitude);
    delay(500);
    serialPrint();
    Serial1.print(" longitude:");
    Serial1.println(logitude);
    delay(500);
    serialPrint();
    Serial1.print(" Speed:");
    Serial1.print(Speed);
    Serial1.println("Knots");
    delay(500);
    serialPrint();
    Serial1.print("http://maps.google.com/maps?&z=15&mrt=yp&t=k&q=");
    Serial1.print(latitude,6);
    Serial1.print("+");                        //28.612953, 77.231545
//28.612953,77.2293563
    Serial1.print(logitude,6);
    Serial1.write(26);
    delay(2000);
    serialPrint();
```

```
}

void serialPrint()
{
   while(Serial1.available()>0)
   {
      Serial.print(Serial1.read());
   }
}
```

CHAPTER 6

OUTPUT



CHAPTER 7

CONCLUSION

In this study paper, the usability of the proposed Car 2 Car communication-based AEB system is being compared with that of the existing vehicle-mounted-sensor-based system. An analysis model is being built for determining the usability of the Car 2 Car communication-based AEB system. The analysis model considered the vehicle-mounted sensor and C2C communication environments. Furthermore, the existing Car-mountedsensor-based AEB system was realized using this model. In addition, a new conceptual AEB system is proposed and will be developed by combining Car 2 Car communication technology with environmentrecognition sensors along with application of IOT. In the C2C communication-based AEB system, collision is being avoided regardless of driving conditions and obstacles through collision risk detection within the range of inter vehicle communication using wireless sensor network. In addition, in the case of the existing vehicle mounted-sensor-based AEB system, the collision avoidance relaxation rate is being no more than 3%. In contrast, in the case of the C2C communication-based AEB system, the collision avoidance relaxation rate will be reached approx. 100%. Therefore, the usability of the C2C communication technology was demonstrated through the aforementioned comparative analysis. Future studies will be aimed at testing the proposed system in the C2C communication environment with an actual vehicle used in practice and analyzing the proposed system in various scenarios and driving environments.

7.1 ADVANTAGES:

- Cost effective
- Collision Avoidance
- Assured safety
- Victim life can be save
- Low power consumption
- GPS
- Mobile Application
- Increases safety while driving and avoids accidents**.**

CHAPTER 8

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