IOT BASED MOBILE RESCUE ROBOT FOR DISASTER MANAGEMENT

Project report submitted in partial fulfillment of the requirement for the degree of Bachelor of Technology

In

Electronics and Communication Engineering

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CERTIFICATE

This is to certify that the work reported in the B.tech project report entitled **"IoT based Mobile Rescue Robot for Disaster Management"** which is being submitted by **Kritika Chaudhary, Amogh Mishra and Prafull Raina** in fulfilment for the award of Bachelor of Technology in Electronics and Communication Engineering by Jaypee University of Information Technology, is the record of candidate's own work carried out by him/her under my supervision. This work is original and has not been submitted partially or fully anywhere else for any other degree or diploma.

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We wish to express our profound and sincere gratitude to **Dr. Neeru Sharma**, Assistant Professor (Senior Grade), Department of Electronics and Communication Engineering, Jaypee University of Information Technology, Waknaghat for her continuous guidance, encouragement and supervision throughout the course of the project. She gave us moral support and guided in different matters regarding the topic.

We are highly obliged to thank all the staff of the Department of Electronics and Communication Engineering for their continuous assistance in our endeavours. Last but not the least, we are thankful and indebted to all those who have helped us directly or indirectly in the completion of this project.

Date: 20 May, 2019

DECLARATION BY THE SCHOLAR

I hereby declare that the work reported in the M-Tech thesis entitled **"IoT based Mobile Rescue Robot for Disaster Management"** submitted at **Jaypee University of Information Technology, Waknaghat, India,** is an authentic record of our work carried out under the supervision of **Dr. Neeru Sharma**. We have not submitted this work elsewhere for any other degree or diploma.

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ABSTRACT

Increasing climate change is leading to a greater number of natural disasters. As is expected, the possibility of the occurrence of droughts, increased intensity of storms, a sharp incline in the number of forest fires and a lot more will be seen by the upcoming generations. Natural disasters affect human life in unexpected ways. We can never be fully prepared for what is to happen.

In this thesis, we devise a robot that can help people in cases of disaster management and prevention. The robot will successfully be able to detect the presence of humans under debris or in regions where it is difficult and time consuming for people to reach during rescue operations. In case of incidences like earthquakes, collapse of buildings, airplane crashes, forest fires, tsunamis and many more, this robot will help make timely rescue and sense the presence of people in places where the human eye cannot spot a person. The robot will also be a boon in case of spotting places where certain causalities begin to erupt. Forest fires can be prevented by sensing the fire at the very instant it erupts in the forest. Robots can be left to cover a certain amount of area in each forest to ensure that no region is left uncovered. The proposed robot can also be a great help in ensuring that no unwanted presence exists in restricted military areas or banks.

CHAPTER 1

INTRODUCTION

IoT is a network of devices that connect directly with each other to capture and share vital data through a secure service layer (SSL) that connects to central command and control server in the cloud. Let's begin with a closer look at what that entails and what it suggests for the way people collect record and analyze data- not just in healthcare, but in virtually every industry today. The idea of devices connecting directly with each other is, as the man who coined the term Internet of Things puts it – a big deal.

As Kevin Ashton explained a decade after using the phrase at a business presentation in 1999, -Today computers- and therefore, the internet-are almost wholly dependent on human beings for information. The problem is, people have limited, time, attention, accuracy- all of which means they are not very good at capturing data about things in the real world. The solution, he has always believed, is empowering devices to gather information on their own, without human intervention.

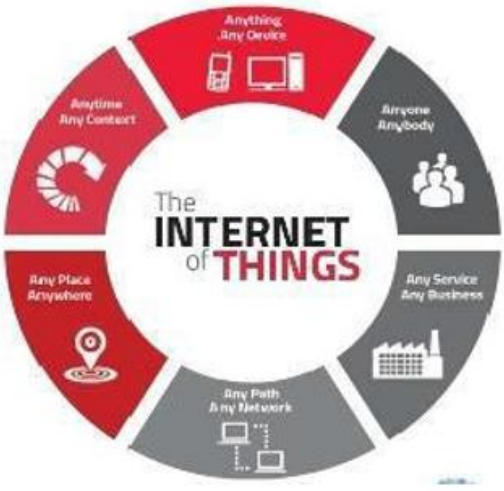


Figure 1.1 Features of IoT

The Internet of Things, also known as Internet of Objects, a wireless network between objects, the network is wireless and self-configuring. IoT is a major component advances which links internet with sensors and working devices.

-smart objects are a key in IoT vision, since embedded communication and information technology would have potential utilize these objects. Using sensors, perceiving the context, built-in networking capabilities help in communication with each other, accessing internet services and interaction with people. Digitally upgrading objects enhancing the physical function by adding the capabilities of digital objects, thus generating added value. Development are apparent today- more and more devices including sewing machine, exercise bikes, electric toothbrush, washing machines, electric meters and photocopies are computerized and equipped with network.

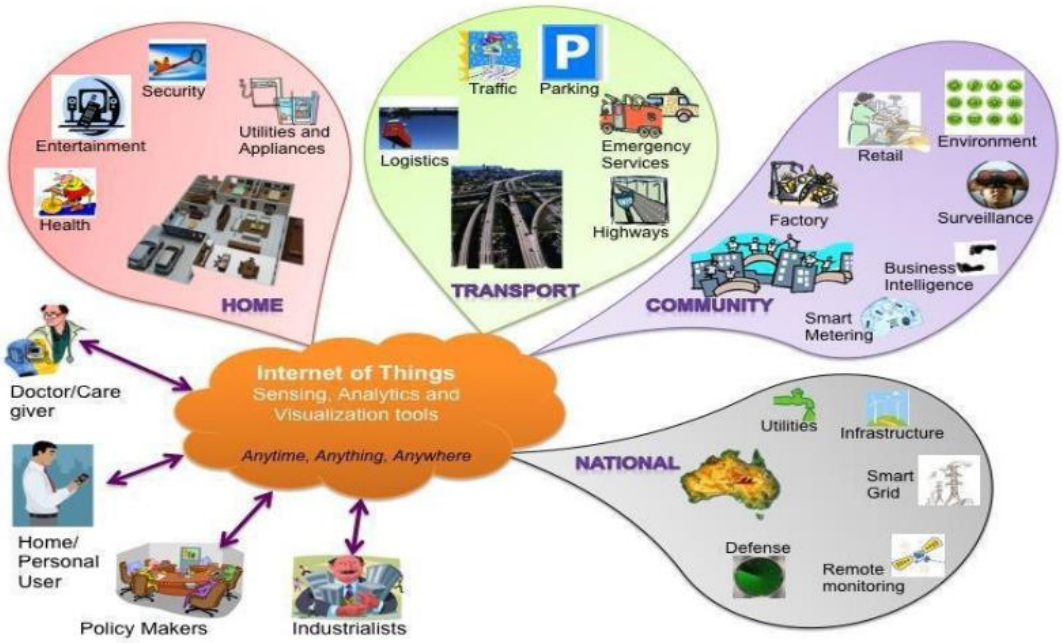


Figure 1.2 Applications of IoT

In different application domains, internet connectivity of everyday objects is used to determine state so that information system can collect up-to-date information on physical objects and processes. This helps in observation of many aspects of real worlds with more detail and negligible cost. This allows better understanding of the process also for more efficient control management the ability to react to events in an automatic, rapid and informed manner, not only opens up new opportunities so to deal with critical

situations, but also enables variety of processes to be optimized. The interpretation of data from real world will likely help in introduction of various business services and deliver economic and social benefits.

The word –Internet in the catchy term –Internet of Things –the way people use internet today, things will soon also communicate with each other, service, provide data and thus generate added value- or can be interpreted in a stricter sense.

From a technical point of view, IoT is the result of single technology; several technical developments provide capabilities that together help in bridging the gap between virtual and physical world the capabilities include:

Communication and cooperation: objects can network with internet resources and with each other as well, to use data and services and update their state. Wireless technologies including GSM and UMTS, Wi-Fi, Bluetooth, ZigBee and various other wireless networking standards related to Wireless Personal Area Network(WPANs) are of primary relevance.

Addressability: Within IoT, objects can be located via discovery, look-up or name services, and thus remotely configured.

Sensing: objects collect information of the surroundings with sensors, recording, forwarding it.

Actuation: objects contain actuators to manipulate their environment. Actuators can be used to remotely controlreal world process over the internet.

Embedded information processing: smart objects feature a microcontroller, plus storage capacity. Resources can be used to process and interpret sensors.

Localization: smart things can locate their physical place. GPS and mobile phones networks are some technologies to achieve this.

User Interfaces: smart objects can connect to people in correct manner. Flexible polymer based display

and voice, image recognition.

1.1 Emergence of Internet of Things

Emergence of IoT, which involves connecting with data and to each other is important for two reasons:

1. Advances in sensor and connecting technologies are allowing devices to collect, record and analyze data that is usually not accessible before. In healthcare, it helps in collecting patient's data over a period of time enabling preventive care.

2. The devices can gather data on their own and thus removing limitations of human entered data- automation reduces the risk of error which thus increases efficiency.

1.1.2 IoT Building Blocks

Home and Building automation: For Instance, Nest Learning Thermostat, which takes data of the home environment and temperature preferences and thus operating efficiently with that information.

Automative design and manufacturing: Automotive industry is designing automatic applications in vehicles to provide maintenance, fuel and mileage management, driver security and other capabilities that cost less to integrate but have significant potential. Addition of cloud-based server to analyze data and automatically act on it- scheduling a maintenance appointment at right time.

Public transport/smart cities: IoT has already been adopted in various areas such as energy and industrial automation. According to various reports as more connections are made, the value to business and economy will go up.

1.1 Architecture of an IoT system

The different organizations and service providers define, implement and recognize IoT architecture in various ways. However, basic architecture of IoT remains same for implementation and business model. It can be easily understood from four layer model as:

1. IoT devices and gateways

2. Communication network
3. Cloud or Server
4. IoT application

1. **IoT devices:** Any device is IoT if it is capable of communicating with various devices with an internet connection, equipped with sensors and actuators and used to control or record data. IoT devices can build network interface with processors.

   Based on hardware design and capabilities there are following IoT devices-

   1. General Devices
   2. Sensing and Actuating Devices

   Role of Gateways

   The IoT devices may setup communication with different devices via a gateway or without a gateway. The gateways are for protocol conversion. The data is received and sent using a protocol commonly TCP-IP.

2. Communication Network: It is the general internet network having various layers protocols operating in them.

3. Cloud/Server: Cloud stores data collected from different devices and performing data mining and analytics to derive useful information from it. It also manages interconnected devices and networks, managing device communications and implementing IoT applications.

4. IoT Application: IoT application is responsible for processing, mining and analysis of data at the cloud. IoT application is a software at the cloud to extract data, manipulate it to derive important insights and manage securely push insights of the target IoT devices.

CHAPTER 2

LITERATURE REVIEW

Disasters have to be detected as well as managed in order to minimise the loss of life. Since there can be various forms of disaster and it is difficult to prevent all of them, through our project, we aim at the detection and management of a few using an IoT based wireless sensor technique.The world is in a dire need of total automation because some everyday human tasks can be very time consuming. In [1] the author talks about how IoT has proved to be a boon for the world and how it has developed and is continuously developing from the past two decades. It brings into light the various applications along with the future scope of IoT. Some applications being the development of Smart Cities, Smart Agriculture, Industrial Control and many Security and Medical Applications. The incorporation of IoT in our everyday life will lead to complete automation and lesser human efforts. Machine to Machine interaction through protocols has in a way become a possibility. This paper also focuses on different enabling technologies for the Internet of Things. These technologies include Near-field communication and Radio Frequency Identification (RFID), Quick response codes, Optical Tags and Bluetooth and Low Energy (BLE). The Internet of things phenomenon in about a decade will expand to an extent that it touches every aspect of the human life just like the sudden explosion of the Internet happened not very long ago.

In this paper [2], the author firstly talks about wireless sensor networks, which are a type of adhoc network with a large number of sensors deployed in a particular region that are self-organized and self-configured. The sensors form a kind of a cluster that senses the environmental changes that each one is supposed to, individually, and then ensures that the sensed information is passed to the base station where this information is gathered and processed. The paper highlights how we can utilise this wireless network to manage calamities in cases when a human gets stuck in a shallow range or a passage. The aim of the project as proposed by the author is the minimization of loss of life in case of disasters.Based on the data collected by the project, appropriate decisions are made to help the rescue team and direct them, hence making their job easier and more efficient. The author brings forward techniques using Wireless Sensor Networks for Landslide Detection, Forest fire Detection, Detection of Tsunamis and a Microcontroller based Earthquake Detection system. It mentions lab trails for Landslide Detection by monitoring the slope instability which occurs because of pore pressure, dielectric movements or might also occur because of slight movements in

the soil due to the use of WSN. It uses a two layer approach in which data is collected from the sensors by the lower layers. Then, these data packets are sent to the upper layer that groups the information and passes it on to a gateway, also called a sink node. A ZigBee component is used in this case for wireless communication. The gateway then sends a text message or an SMS to the area that is prone to landslides to ensure proper evacuation of the people beforehand. The author then proposes an earthquake detection based on microcontrollers which uses a technique which works on the priniciple of piezoelectric effect. The piezoelectric transducer converts stress into an electrical quantity as its crystals are sensitive to vibrations. And for this they also use 8 Mega Atmel microcontroller with a AVR RISCC architecture. A robotic system for the detection of a live human body become the cherry on the top. It helps reach locations which are inaccessible to people for rescue operations and detects human presence, pointing out of the exact place where the rescue has to be carried out. The author suggests using PIR sensors and cameras for detection of motion and using RF transmitters. Forest fire Detection is to be ensured using WSN, temperature sensors, small scale satellites, GPS modules and antennas to point out to the exact locations and make control operations easier. The author has explained the working of various sensors that have been used like PIR sensor and breathing sensor simulation.

In the next paper [3], the author focuses on the establishment of a robot that detects human presence and is controlled using a mobile phone. This methodology will help rescue people who are stuck under debris or recognise people who are alive in crushed situations which relies on certain variables, like the position of the body or the light intensity in the scene. As described by the author, the embedded system has three main components including Minute Scale, Medium Scale and Complex Embedded Systems. In this proposed work, they use PIR sensor (Piezoelectric below Red Sensor) which absorbs actinic rays and will search a human from three upto a distance of ninety meters. It uses DTMF tones (Dual Tone Multi Frquency). By using this technique, the robot can be operated from any part of the world. CDMA, GSM also come in play. It points out to a new application of this robot aside from rescue operations. It highlights the use of this robot in military applications to detect unwanted presence of terrorists or people in prohibited zones or also for survillence.

The robot is manually controlled by the keys provided in the transmitter section using RF technology. Mobile robot is sent to the field and it is controlled from base station. Base station consists of PC communicated with robot via wireless camera with high band RF communication.

Robot is provided with four sensors. Based on the signals from the sensors, the movement is controlled automatically. Ultrasonic sensor basically detects the obstacles on the path of the robot. PIR sensor is used as motion detector in the proposed system. Based on the variation of infrared radiation, PIR sensor detects the motion. Temperature and gas sensor can be used for fire detection in the rescue operation. Whenever the signal comes from any of the sensors, the motion of the robot is ceased and at that instant, the buzzer starts to beep. The base station PC starts getting a message regarding motion in the area of rescue and further action is taken accordingly.

[4] shows how an inexpensive autonomous robot can save the lives of a million people in cases of distress again. The author proposes a model on the basis of RF technology and an ARM7 controller integrated with various sensors including the PIR sensor, IR sensor and a temperature sensor. The IR sensor will detect the presence of an obstacle, the PIR sensor detects motion detection while the temperature sensor measure temperature. It suggests that an IR camera can also be incorporated to enhance the project and make it more effective.

While in [5] we are presented with the hardware and software implementation of another mobile controlled robot that can be used for minimizing the loss of life. It shows results of all the sensors used in a graphical and tabular format along with pictures of implemented hardware.

CHAPTER 3

PROPOSED SYSTEM

3.1 Block Diagram

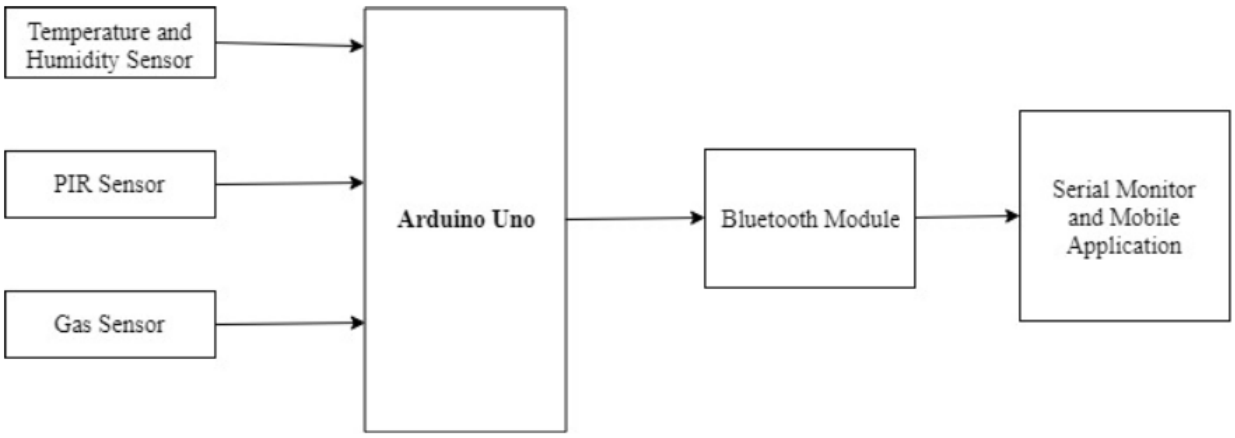


Figure 3.1 Block Diagram

3.2 Working

The undertaking proposes a portable salvage robot that moves in the catastrophe, earthquake region and aides in recognizing the live individuals, harmed individuals, and salvage framework activities. Consequently due to the on auspicious identification in common disasters this can spare valuable life and extraordinary misfortune even without the assistance of extensive number of salvage administrators. The proposed framework comprises of a portable salvage robot, and mobile control.

The mobile rescue robot consists of four units that are namely Sensor unit, Micro-controller, Motor driver unit, Transmission unit. The sensor unit must be directly interfaced to the micro-controller. The sensor devices monitor current readings and sends data to the Micro-controller. The controller circuit is responsible for transmitting this information. Controllers are designed at hardware level. These data's are

updated by the PC/APP so that rescue team can view the real time readings.

The **ATmega328** is a single-chip microcontroller created by Atmel in the mega AVR family (later Microchip Technology acquired Atmel in 2016). It has a modified Harvard architecture 8-bit RISC processor core. As of 2013 the ATmega328 is commonly used in many projects and autonomous systems where a simple, low-powered, low-cost micro-controller is needed. Perhaps the most common implementation of this chip is on the popular Arduino development platform, namely the Arduino Uno and Arduino Nano models.The microcontroller is used to gather the data from the sensor unit in real time and transfer the corresponding information data to the CPU of control room. It also receives commands from the app and transfers it to the robot unit for its movement. The microcontroller is the core of the surveillance robot.

A sensor (also called detector) is a converter that measures a physical quantity and converts it into a signal which can be read by an observer or by an instrument. Four sensors are used in the project. They are ultrasonic sensor, Gas sensor, Temperature sensor and PIR (Passive Infra-Red) sensor. The real-time values observe by the sensors are transmitted to a ATmega328.This data information provide by sensor helps in having good knowledge about the environment in disaster area.

The robot driver unit is primarily concerned about the movement of the robot in x-axis and y-axis. The robot is of conveyor belt type as it helps to maneuver over debris and rugged terrain. Four DC motors of 100rpm will run the wheels of mobile rescue robot. When the wheels are given with positive pulse edge, then robot will moves in forward direction. When the supply is reversed mean the wheels are given with negative pulse edge, then it goes in backward direction and similarly by varying the negative and positive edge, left and right turn can be achieved successfully. The selection of supply given to each motor, L298N is used. This will drive the robot to move in forward, reverse and turn left and right. The transmission unit is used to transmit data. Transmission unit i.e Bluetooth module is mounted on the mobile robot unit; its function is to get information data from the micro-controller and transmitting it to the receiver.

At the receiver end these weather parameters along with real time data of concerned area is displayed on PC/APP. By using wireless communication we can get the exact location of human. The rescue team of Experts & doctors can be sent to the victim’s location for primary treatment and can be sent

to the safe place or hospital in case of emergence.

3.3 Applications

1. Forest fire detection

   One of the major applications of our project is forest fire detection. The robot makes use of the sensors attached to it including the temperature detector for detecting the raiding temperatures. Once it reaches the threshold value which had been set for the temperature above which a fire is born, the temperature sensor raises an alarm. The smoke detector also detects the presence of smoke and combustible gases around. When the humidity sensor finds zero humidity around, it implies very hot weather or fire. The robot can move around in the forests and stay alert.

2. Human body detection under debris

   Humans can be detected by the infrared radiations that are emitted by the body. The PIR sensor has been employed to ensure that human presence is detected even in the cases of earthquakes, tsunamis, airplane crashes and any other incident which requires rescuing people from under debris. The robot avoids obstacles by using the Ultrasonic sensor to sense the presence of entities using ultrasonic waves. In this way, thousands of lives can be saved.

3. Sensing unwanted presence

   Since human presence can be detected using the PIR sensor, this can also be used for various security operations. It can detect the presence of a human in a room or outside the main door and alert the owner at the same time. In case of an intrusion, people can call the police and save their place from cases of theft and robbery. They can also keep an eye on their kids using a PIR sensor along with a camera.

4. Weather Monitoring

   The project can also be used for weather monitoring, indoor and outdoor both. to get exact readings, we can use the project for maintain proper indoor air quality index.

3.4 Limitations

- The project could be embedded with a GPS system.
- Very few disasters can be predicted and managed with the help of the robot.
- Pictures cannot be sent over to people because of the lack of a camera.

CHAPTER 4
COMPONENTS DESCRIPTION

4.1 DHT22 – temperature and Humidity Sensor

Temperature and humidity sensor, as its name suggests, measures the temperature and humidity conditions of the surroundings. DHT22 is a cost effective sensor which has small component size, consumes very less power and has a long transmission range of approximately 20 meters, thus making it suitable for numerous harsh applications.

It is said to be reliable and stable because it uses digital-signal-collecting techniques along with a new humidity sensing technology. A single-chip 8-bit computer is connected with the sensing elements.

4.1.1 Technical specifications

It requires a power supply of 3.3-6V DC. DHT22 outputs a digital calibrated signal. It measures temperature in the range of -40 to 80 degree Celsius with less than +-0.5 degree Celsius accuracy and humidity in the range of 0-100%RH with +-2%RH accuracy. It has an average sensing time period of 2 seconds and uses a polymer capacitor as the basic sensing element. The dimensions of DHT22 vary from 14*18*5.5mm to 22*28*5mm. The model's humidity hysteresis and long term stability account for +-0.3%RH and +-0.5%RH/year.

4.1.2 Working

Humidity is measured by the sensor using a humidity sensing component which includes two electrodes with a moisture holding substrate between them. The substrate generally is a salt or conductive plastic polymer. As water vapor is absorbed by the substrate, it leads to the release of ions which increases conductivity between the electrodes. The change that occurs between the electrodes is proportional to relative humidity of the surrounding area

and thus helps finding near to accurate measurement. The higher the relative humidity, the lower the resistance between the electrodes, and the lower the relative humidity, the more increase in the resistance between the electrodes.

Temperature is sensed by using an NTC component. NTC stands for Negative Temperature Coefficient. It is basically a thermistor, which would be a thermal resistor whose resistance varies with temperature. Generally, the resistance of all resistors changes with temperature ever so slightly that the change is so minute that it becomes hard to measure. Thermistors are made for this special application so that with a slight change in temperature, they experience a drastic change in resistance. NTC leads to a decrease in resistance with an increase in temperature and vice versa.

4.1.3 Pin Out

The connections are made very convenient with four pins packaged in a single row. The table below gives the functions of each pin.

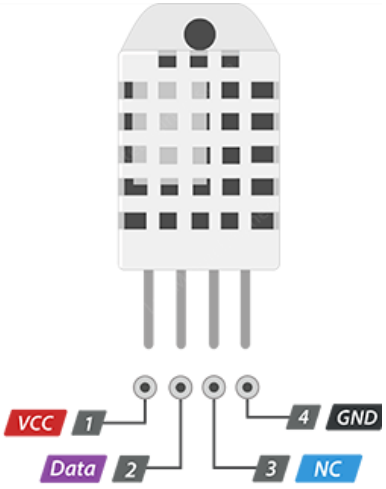


Figure 4.1 Pin out DHT 22

Pin	Function
1	Power Supply (VDD)
2	Output signal (DATA)
3	Null (NC)
4	Ground (GND)

Table 4.1 Pin description DHT 22

4.2 MQ2 -Gas Sensor

Gas sensors are useful for a number of applications like detection of gas leakage at home or in the industry or for checking the indoor air quality index and ensuring good health. They are sensitive to a range of highly combustible gases including H2, CO, propane, LPG, Smoke, CH4, etc. MQ2 belongs to the MQ Sensor Series and is highly sensitive with a quick response time which allows measurements to be taken in a short period. The sensor's sensitivity can be adjusted using a potentiometer.

4.2.1 Technical Specifications

The operating voltage of the MQ2 sensor is +5V. It has an analog output voltage of 0-5 volts and a digital output voltage of 0-5V(TTL logic). It requires a preheat duration of 20 seconds to ensure proper working. It can be used as both, a digital or analog sensor thus.

4.2.2 Working

MQ2 gas sensor is highly sensitive to a number of gases and uses SnO2 as the sensitive material required for measurement purposes. Gas concentration is measured by using a small heater and an electrochemical sensor. It is a metal oxide semiconductor (MOS) type as sensor, which can also be known as Chemiresistors since the detection is based on the change in resistance of the sensing element when the gas which it is sensitive to comes in contact with the material. The gas concentration can be detected by using a simple voltage divider network. Its output is an analog signal and can be read by an analog input of the Arduino. The minimum concentration we can test is 100 ppm while the maximum that can be tested is 10000 ppm. In short, the gas concentration we can get will be between 0.01 and 1%. There exists a nonlinear relation between the concentration and ratio and hence, a formula can't be devised.

4.2.3 Pin out

MQ2 consists of four pins enabling easy connections. The analog output given by pin 3 can be 0-5V depending on the intensity of the gas. This sensor also gives a digital output through pin 4 for which a threshold value can be set using a potentiometer.

Figure 4.2 Pin Out of MQ2

Pin	Function
1	Power (VCC)
2	Ground (GND)
3	Analog output (AOUT)
4	Digital output (DOUT)

Table 4.2 Pin Description of MQ2

4.3 PIR Sensor – Motion Sensor

PIR stands for Passive Infrared Sensor. 'Passive' implies that the sensor does not actually take part in the process, that is, no radiations are actually emitted by the sensor and it is only used for the detection of infrared rays that are emitted by the human body.

4.3.1 Technical Specifications

It actually consists of a pyroelectric sensor which when exposed to heat generates energy. It requires a supply of 3.3-5V with an output digital voltage of 5V TTL. It is a dual element sensor which is highly sensitive and has low noise. It has an adjustable delay time. The actual detection range varies between 5-12 meters. It has a settling time of 60 seconds.

4.3.2 Working

The working of the PIR sensor is a little more complicated as compared to that of the others. The sensor is made up of two slots that are made up of special material that is sensitive to Infrared radiations. Both of the two slots can detect rays to some distance.

When no human presence is detected, both the slots detect the same amount of radiations, which is actually the exact amount of radiations received from the surrounding walls, room or outdoors. This remains unchanged until a person or animal passes by. The slot closer to the position of the creature detects radiations emitted by its body at the very instant when it comes into the vicinity of the creature. This leads to a positive differential change between the two slots and when the creature passes the sensing area, a negative differential charge is generated between the two slots. In this way, the sensor successfully detects the presence of any creature nearby.

4.3.3 Pin out

The sensor has three pins and wiring it to an Arduino is pretty easy.

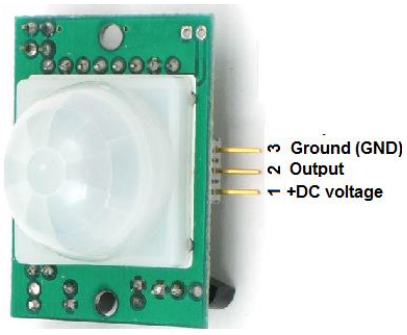


Figure 4.3 Pin Out of PIR Sensor

Pin	Function
1	Power Supply (VCC)
2	Output (DOUT)
3	Ground (GND)

Table 4.3 Pin Description of PIR Sensor

4.4 Ultrasonic sensor

An ultrasonic sensor is said to be one of the best ways to sense the proximity and detect levels with high reliability. It is used to measure distance of an object using ultrasonic sound waves. It has many applications like obstacle detection, water level detection and distance measurement. Ultrasonic sensor is considered to be superior to infrared sensors because no effect of black material or smoke can be seen however, certain soft materials

that do not reflect ultrasonic waves may cause an issue. It is reliable in any environment thus.

4.4.1 Technical Specifications

The ultrasonic sensor requires a supply voltage of 5V DC and supply current of 15 mA with an output voltage of 0-5V with an accuracy of 0.3 cm. It has a beam angle of maximum 15 degrees. It can detect ultrasonic radiations in the range of 2-400 cm with a modulation frequency of about 40 Hz. It is independent of colour, light, dust, smoke and material.

4.4.2 Working

Ultrasonic sensor works by emitting ultrasonic waves at a frequency which is very high for humans to hear. The sensor then waits for the sound waves to be reflected back for calculating the approximate distance of the object or obstacle from the sensor. This method is quite similar to that of a radar. It is made up of a transmitter and a receiver. The transmitter and the receiver are both designed to deliver and receive 40 KHz ultrasonic waves at maximum. Distance is realted to the sound waves travelling through the air at 343.2 m. Once received, the data is displayed by the microcontroller on an LCD interfaces to the microcontroller in cms. It is a non contact sensor, which is also called a proximity sensor.

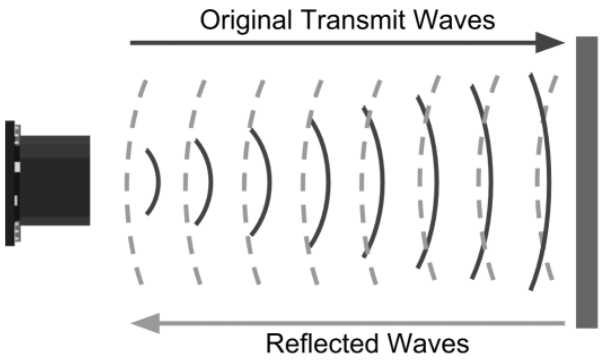


Figure 4.4 Working of Ultrasonic sensor

4.4.3 Pin Out

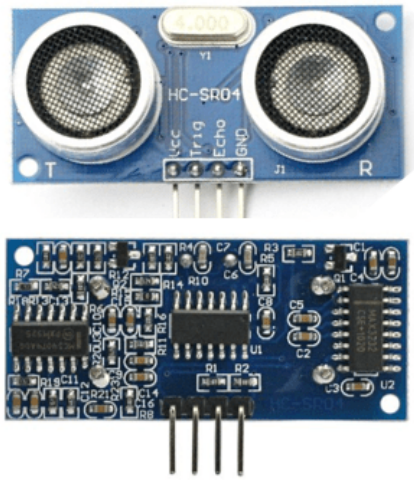


Figure 4.5 Pin Out of Ultrasonic Sensor

Pin	Functions
1	Power Supply (VCC)
2	Trigger (IN)
3	Echo (OUT)
4	Ground (GND)

Table 4.4 Pin Description of Ultrasonic Sensor

4.5 Arduino Uno

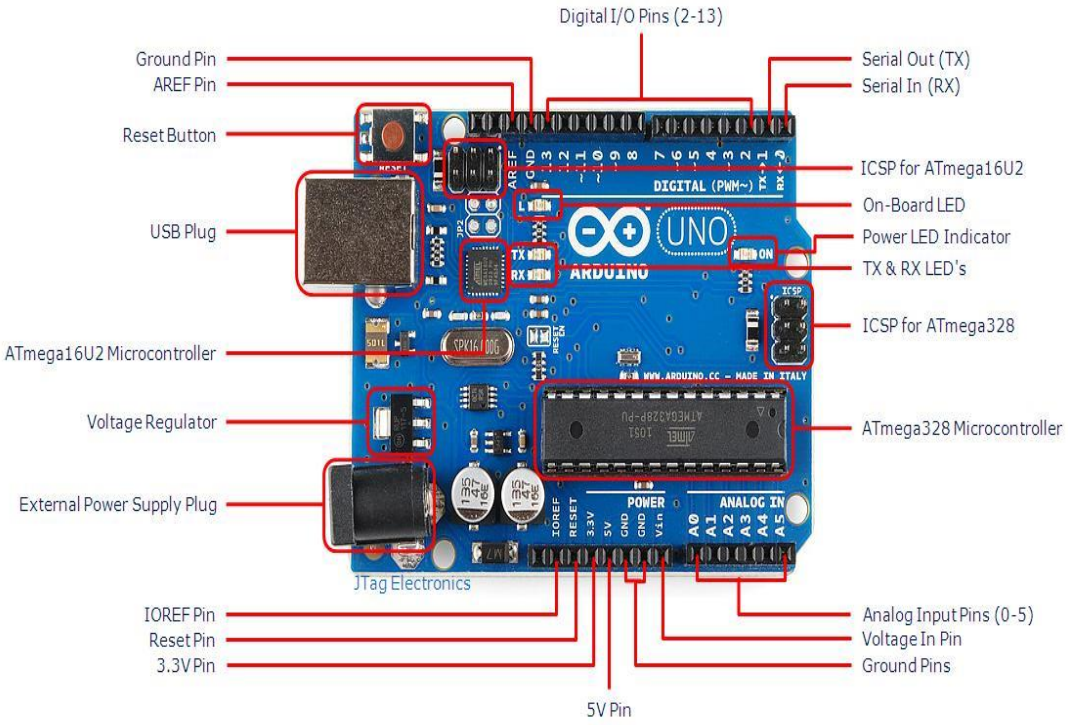


Figure 4.6 Schematic of Arduino Uno

Arduino Uno is an open source electronic platform which is based on the AVR microcontroller ATMEGA328 and is developed by Arduino.

4.5.1 Technical Specifications

Arduino Uno is operated on a voltage of 5V. The input voltage as recommended is 7-12 volts though it can vary from a range of 6-20 volts. There are 14 digital I/O pins of which 6 provide a Pulse Width Modulated output and there are about 6 analog I/O pins. The DC

current per I/O pin is about 40 mA while that required for 3.3 V pin is 50 mA. Arduino Uno has a flash memory of 32 Kilobytes of which 0.5 Kilobytes is used by the bootloader and an SRAM of 2 Kilobytes along with an EEPROM of 1 Kilobyte. The clock speed is 16 MHz.

There exist a large range of projects behind which Arduino could be considered as the brains of the project. Arduino is embedded with all the features that it requires to run the microcontroller and thus, can be directly connected to any computer using a USB cable which transfers data to the controller with the help of an IDE, also known as Integrated Development Environment, software specifically designed for the programming of Arduino. The IDE is completely compatible with Linux system, Windows or MAC systems.

Arduino Uno's programming is carried out using languages like C and C++, making it very easy to learn. It also makes programming more efficient. This AVR microcontroller has a boot loader which is built-in and uploads all the programs on the board.

We can power the Arduino either using a DC adapter, USB or Battery. It is capable of withstanding a peak voltage of about 20 Volts and runs on 5V.
Analog pins of the Arduino labeled as 0 to 5, are used for reading the input coming from certain sensors like temperature, humidity sensor and accelerometer. This input signal then is converted into the digital format for proper data processing. Only voltage is measured because these pins have very high resistance.
The reset switch of the Arduino is toggled to low for resetting the microcontroller. The signal is then sent to the microcontroller for running the program from the very beginning.

4.6 Bluetooth Module (HC 05)

This Bluetooth module makes use of serial communication in order to communicate with devices. It uses the serial port (USART) to establish communication with the

microcontroller. The module can be used for multiple applications including wireless keyboard, headset, mouse and a lot more. The range of this module depends on the receiver and transmitter along with the atmosphere, urban and geographic conditions. This range can be upto about a 100 meters. This is an IEEE 802.15.1 standardized protocol, using which we could build a wireless PAN or Personal Area Network. Frequency Hopping Spread Spectrum (FHSS) uses radio technology for sending data over the air.

4.6.1 Technical Specifications

The Bluetooth module has a red LED that shows the status of the connection. It indicates whether it is connected or disconnected. Before the module gets connected to the device and is continuously receiving power, the red LED keeps blinking. On getting connected to another device, the LED starts blinking at a slower rate of about two seconds. HC-05 works on a 3.3V power supply but also can be connected to a 5 V supply voltage since it has been embedded with a 5 to 3.3 V regulator. The Bluetooth module has for the receiver and transmitter, a level of 3.3 V and the microcontroller can detect about 3.3 V level, therefore there is no requirement for the shifting of the transmission level of HC-05 but there is a requirement of the shifting of the transmission voltage from microcontroller to the receiver of the HC-05 module.

4.6.2 Working

The HC-05 module has been made with two operating modes, one of them being the Data mode in which the sending and receiving of data is possible from the other Bluetooth devices while the other mode is called the AT Command mode in which the settings of the default device can be changed. The Bluetooth module can be operated in either of the two modes by making use of the key pin. Pairing the HC-05 module to the microcontrollers is an easy task because it operates on SPP (Serial Port Protocol). Powering the module with a voltage of 5V and connecting the receiver pins of the Bluetooth module to the transmitter pin of the microcontroller and the transmitter pin of the Bluetooth module to the receiver pin of the microcontroller. Once powered up, the key pin is grounded in order to enter the command mode however, if it is left free, then it will automatically enter the data mode. No

sooner is the module powered up, we are able to find all the Bluetooth devices as ‘HC-05’, then we should connect both the devices using the default password ‘1234’ and start using it as a means of communication.

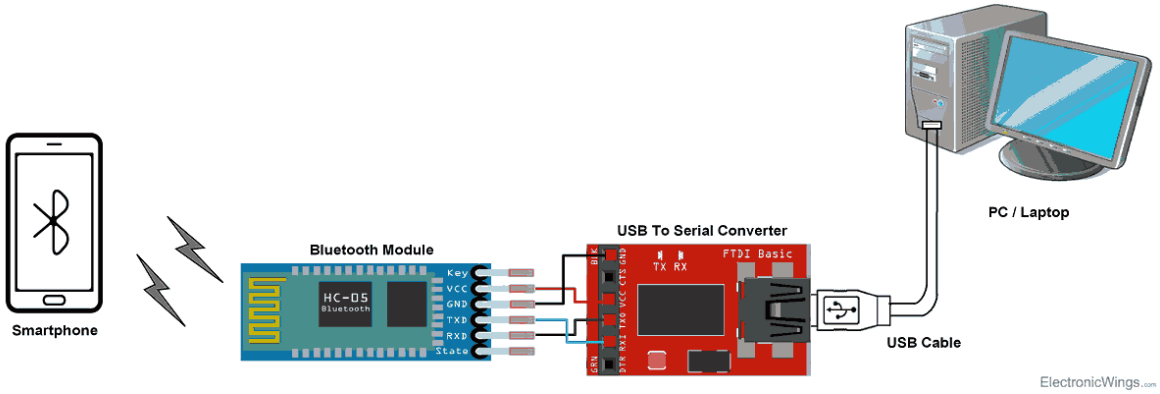


Figure 4.7 Working of Bluetooth module

4.6.3 Pin out

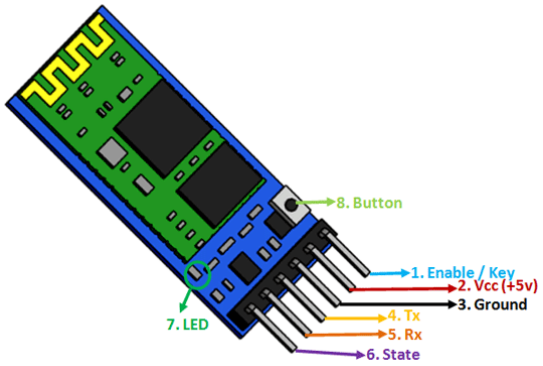


Figure 4.8 Pin Out of HC 05

Pin	Function
1	Enable Key
2	Power Supply (VCC)
3	Ground (GND)
4	Transmitter (TX)
5	Receiver (RX)
6	State
7	LED

Table 4.5 Pin Description of HC 05

4.7 Motor Driver L298N

The motor driver is a monolithic circuit which is integrated into other packages. It has a very high voltage, current. It has two enable inputs which have been created to help disable or to enable the device aside from the signals that are input to it. There has been given an additional input for supply for the logic that only works at low voltage. The lower transistors have emitters that connected to each other on every bridge and the external terminal makes use of the external resistor for sensing.

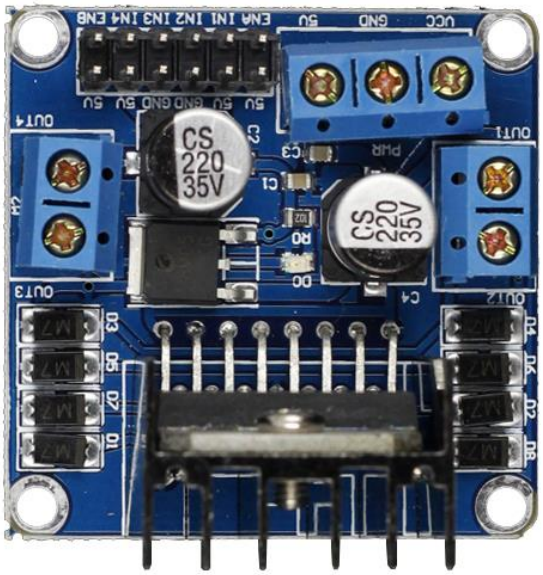


Figure 4.9 Schematic of L298N

4.7.1 Technical Specifications

The motor driver operates on very high voltage that could be upto 40 V. Peak current being 3 A. A very large output current is found to exist. It has a 25W power rating. We have a full bridge driver, two in built H-bridges, stepper motors, relay coils, inductive loads, two phase DC motors and is capable of driving the two-phase to four-phase stepper motor. The stabilivolt tube 78M05 can be utilized to get a 5V from the given power supply. For the protection of the chip from any kind of damage when the driver voltage exceeds 12 V, an external 5 V logic supply has to be used. The driver voltage is about 5-35V while the logic voltage is of 5V. The PCB size is fixed as 4.2x4.2 cm.

4.7.2 Working

The driver motor is capable of driving two motors. ENA and ENB, the two enabled terminals are effective enough at a high level. The state of the motor and control mode are shown below in the table.

ENA	IN1	IN2	The State of DC Motor A
0	X	X	Stop
1	0	0	Brake
1	0	1	Rotate Clockwise
1	1	0	Rotate Counterclockwise
1	1	1	Brake

Table 4.6 State of motor A and the control mode

For the regulation of the speed of motor A by Pulse Width Modulation, we need to set the IN1 and IN2 in order to rotate the direction of the motor and then for the Pulse Width Modulated output for enabled terminals. The motor has been said to be in 'Free Stop State' when the enabled terminal's sign is 0 while it is enabled and the set to INT1 and INT2 as 00 or 11 is known as the 'Brake' mode and the motor will stop rotating. For clockwise rotation, IN1 and IN2 values are 0 and 1, respectively, while for anticlockwise rotation, the values are to be 1 and 0.

4.7.3 Pin Out

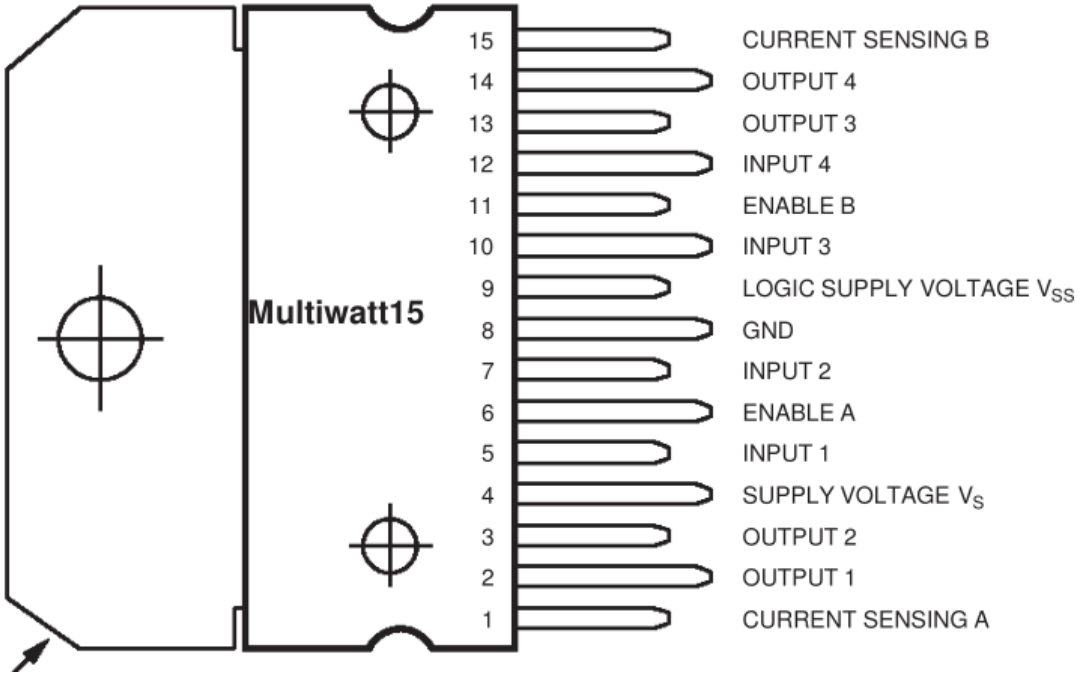
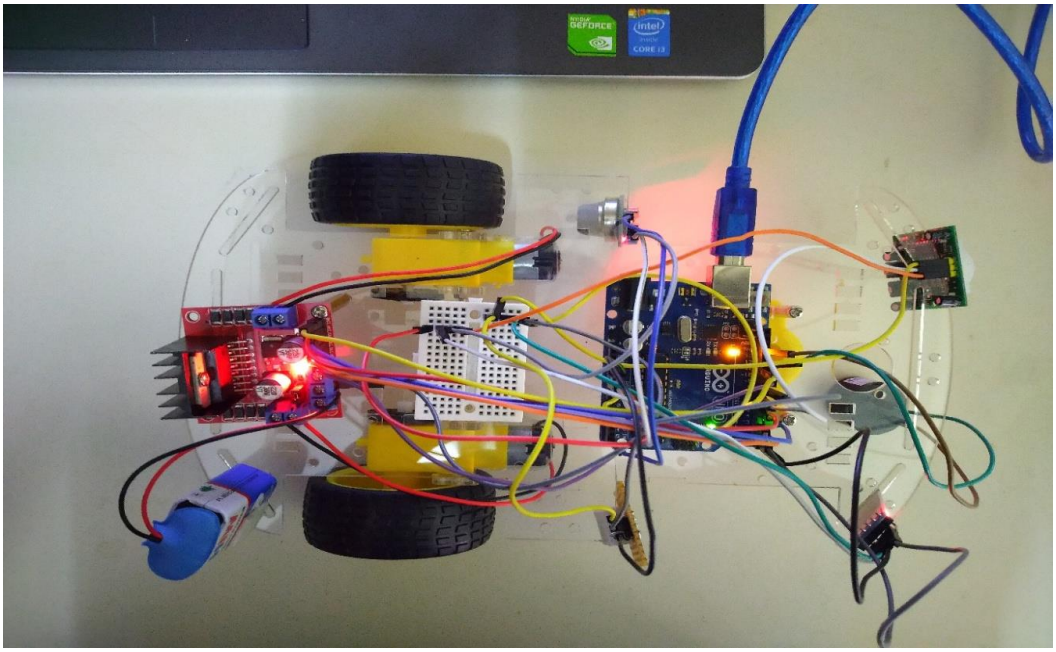


Figure 4.10 Pin Out of L298N

CHAPTER 5

RESULT AND DISCUSSION



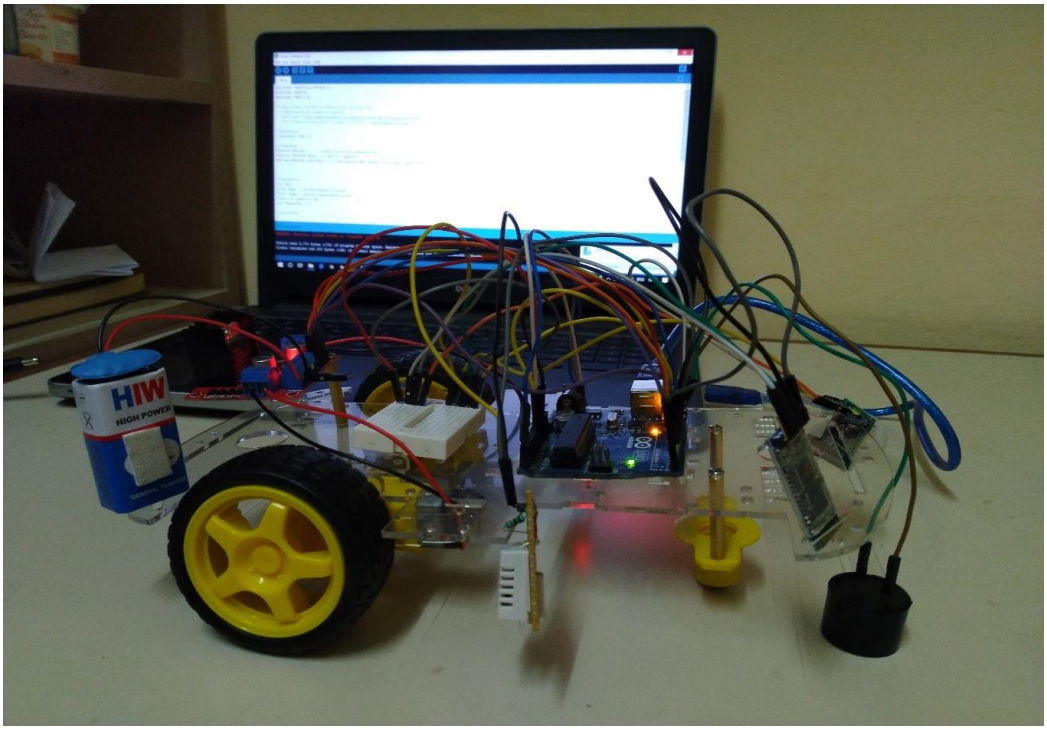


Figure 5.1 : Mobile Rescue Robot

In figure 5.1, it shows structure of mobile rescue robot & assembly of hardware components on the top of mobile rescue robot.

Hardware contains different sensors, L298N motor driver module and Bluetooth module.

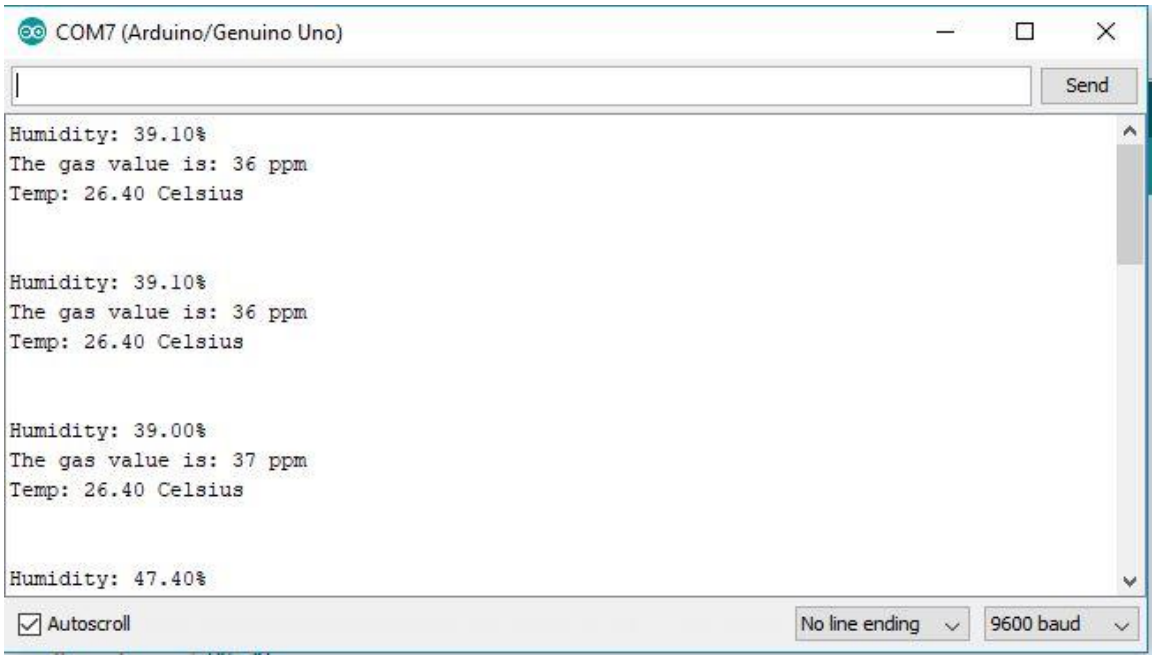


Figure 5.2: Real Time Sensor Data

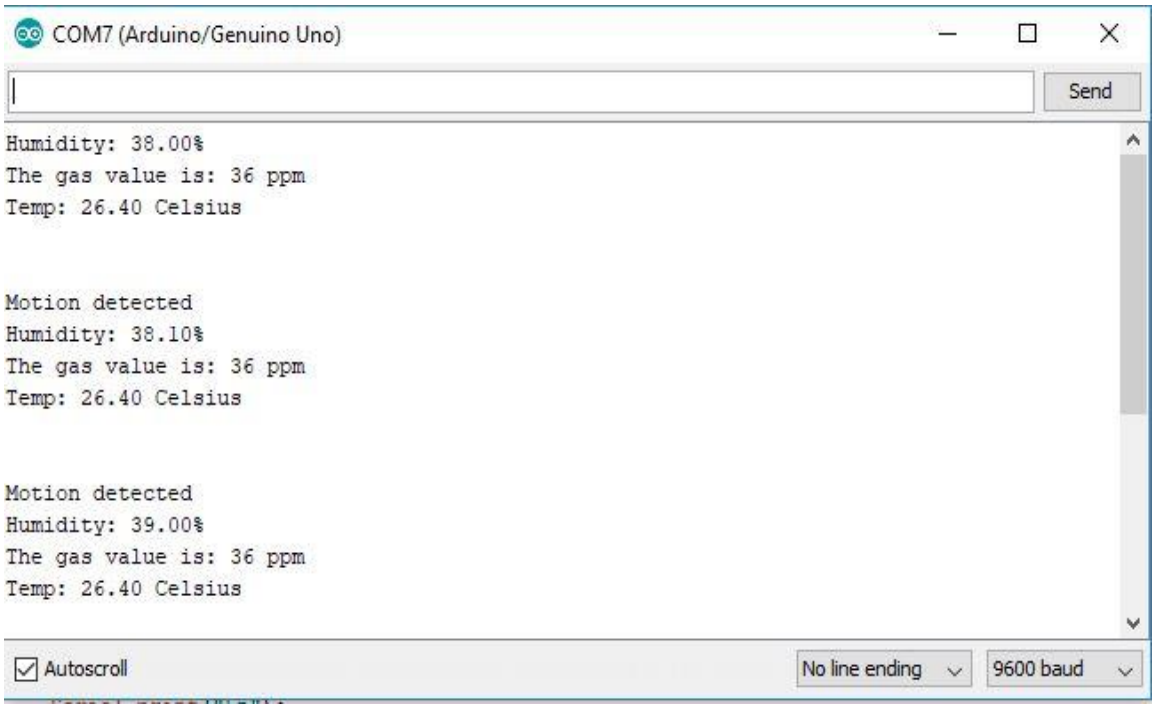


Figure 5.3: Notification whenever a motion is detected

In figure 5 and figure 6, it demonstrates the real time data of all the sensors like temperature (°c), humidity (%), and gas concentration (ppm) with the notification whenever a motion is detected. Real time data is gathered at the control room and as according to real time data legitimate security action will be made.

CHAPTER 6
CONCLUSION

6.1 CONCLUSION

IoT is an emerging technology in the world today. It will soon lead to an easier way of life with minimum human effort and intervention. We used IoT to make an automated system that can help detect fires, rescue people from under debris, sense human presence and can in certain cases also be used for weather monitoring. IoT helps link devices so that minimum human effort is required. Human life is very precious. In this case, without much human intervention a lot more lives can be saved. Rescue is an essential part of disaster management and it needs a timely action to be taken. The project can also be used for security issues where unwanted human presence has to be detected as in cases of restricted military areas, medical rooms, forced entry into houses and in banks or restricted company areas. We have used Arduino Uno as the baseline of our project. It makes interfacing of the components easier.

6.2 FUTURE SCOPE

A lot more modifications can be made to this project as it has a huge scope. Too many disasters happen all around the world and we need a proper system for tackling and managing them. This can be provided by interfacing a lot more sensors like the rain sensor, seismometers and photodetectors to the project. Addition of a camera could enhance the efficiency and working of the robot by great means. Pictures of the intruders in cases of breach of security could be sent over to the person concerned. Pictures of the locations to ensure what and how much damage has occurred could also be managed to achieve. A GPS system would help get a more precise location of the affected region. A lot of work can still be carried out in case of this project. It can help in natural as well as unnatural disasters or events that take place in the course of the coming time.

REFERENCES

1. Bulipe Srinivas Rao, Prof. Dr. K. Srinivasa Rao, Mr. N. Ome "Internet of Things (IOT) Based Weather Monitoring system", International Journal of Advanced Research in Computer and Communication Engineering ISO 3297:2007 Certified Vol. 5, Issue 9, September 2016.

2. Nevonprojects.com, 'IOT Weather Reporting System'. Available:http://nevonprojects.com/iot-weather-reporting-system/.

3. Ravi Kishore Kodali and Snehashish Mandal, "IoT Based Weather Station", 2016 International Conference on Control, Instrumentation, Communication and Computational Technologies (ICCICCT), December 2016.

4. Johnson Bernadette (2010,May 3). How the Internet of Things Works[Web blog]. Retrieved May 4, 2010, https://computer.howstuffworks.com.

5. Smith Fred (2015, October 17).TheInternet of Things (IoT) – essential IoT business guide [Web blog]. Retrieved October 20, 2015, https://www.i-scoop.eu/internet-of-things-guide/