# IOT BASED ROBOT FOR MILITARY APPLICATIONS

Project report submitted in partial fulfilment of the requirement for the degree of

**BACHELOR OF TECHNOLOGY**

**IN**

**ELECTRONICS AND COMMUNICATION ENGINEERING**

**by**

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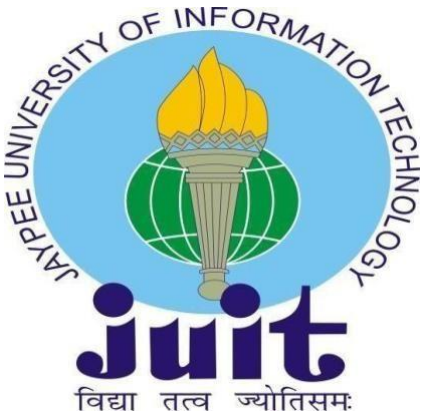
**UNDER THE GUIDANCE OF**
**Dr. Rajiv Kumar**




Department of electronics and communication engineering

**JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT**

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# DECLARATION

We hereby declare that the work reported in the B.Tech Project Report entitled "**IOT Based Robot For Military Applications"** submitted at Jaypee University of Information Technology, Waknaghat, India is an authentic record of our work carried out under the supervision of **Dr. Rajiv Kumar** We have not submitted this work elsewhere for any other degree or diploma.

Aditya Kumar Jaiswal (181007) Avinash Verma (181019)

This is to certify that the above statement made by the candidates is correct to the best of my knowledge.

Signature of the Supervisor

Name of the Supervisor

**Dr. Rajiv Kumar**

Date:

Head of the Department/Project Coordinator

# ACKNOWLEDGEMENT

Besides the hard work, the success of a project also depends highly on the encouragement and guidelines of many others. We take this opportunity to express our sincere and heartfelt gratitude to the people who have been instrumental in the successful completion of this project.

Our first and foremost acknowledgement goes to our supervisor and mentor, **Dr. Rajiv Kumar**, without whose help the completion of this project wouldn't have been possible. It is because of his guidance and efforts that we are able to implement a practical idea based on my field of interest. I would also like to thank my panel **Dr. Vikash Baghel, Dr. Manish Sood, Dr. Shweta Pandit, Dr Anuj Maurya** for giving us an opportunity to present our project and for judging our work and providing us feedback which would certainly help us in the future.

Last but not the least we would like to acknowledge our institution **Jaypee University of Information Technology** for giving us a platform to give us life and implementation, to the various fields we have studied till date.

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# ABSTRACT

Terrorism and insurgency are two of the world's most pressing issues today. Governments and scientists from all around the world are working around the clock to address these issues. Nations spend billions of dollars on research into new defensive technologies capable of protecting civilians from terrorist attacks.

These days big developments in the field of robotazation vicious and critical counter terriest operation handeled by experenced machine which are not only more structured but also in control of human lives.

Our "Unmanned Ground Vehicle" project is designed to perform operations such as border patrol, surveillance, and active combat as a stand-alone unit (automatic) or in collaboration with human soldiers (manual). It's a prototype that demonstrates the growing demand for advanced technologies and precision- driven vehicles to meet today's demands for a first line of defense.

A person in a remote location can easily direct the robot's motion wirelessly, and the vehicle is capable of reaching the pre-programmed destination on its own in situations where personal control is not appropriate. Our defence system consists of two components: a control unit (for controlling movement) and a motion tracking device. There are two settings on both of these units: mechanized and manual. This robot operator will receive a live video streaming from to assist him in dynamically controlling both of the rover's previous modules. The robot could also track the movement of objects in its field of view autonomously.

A human operator controls the rover's manual modes, and live footage is sent back to the base station. A mobile phone will be used to control the robot. One onboard computer takes commands from the command center and sends them to the robot, which controls the motors, GPS navigation, and obstacle detection. The control centre control provides a direct video stream and controlling the robot numerous functionalities.

# CHAPTER 1

## INTRODUCTION

Unmanned ground vehicles (UGVs) are military robots that supplement the capabilities of soldiers. This sort of robot can typically operate outside and broad stectrum, taking the role of humans.This robot can perform numerous activites and help the human to save other live without entering into a dangerous area. It gives information about that area so that a soldier can operate easily.

Unmanned ground vehicles are divided into two categories:

1. Tele-operated
2. Autonomous.

## Tele-operated:

A Tele-operated UGV is a robot that is controlled by a communications link by a human operator at a remote location. The operator can perform task by taking the output of the sensor which is comming from the robot and by the help of live video streaming the can operate easily. Toy remote control automobile is a simple demonstration of Tele-operation concepts. Each vehicle is unmanned and controlled remotely via a link, with the user providing full control based on the vehicle's observed performance.

Tele-operated UGVs are currently in use in a wide range of applications. These vehicles are mostly employed to replace humans in dangerous situations. Explosives and bomb-disabling vehicles are two examples.

## Autonomous:

An autonomous UGV is similar to an autonomous robot, however it is a vehicle that operates on the ground surface. In the actual world, a fully autonomous robot can:

- Gather information about its surroundings.
- It can work a large time without intercession.
- It can repair itself without help from others.
- Detect objects of interest such as people and automobiles.
- A robot may also be capable of self-learning. Autonomous learning entails the ability to: • Learn or acquire new skills without the assistance of others.
- Adapt strategies to the circumstances.
- Adapt to new situations without help

from others.

- Robots with autonomy

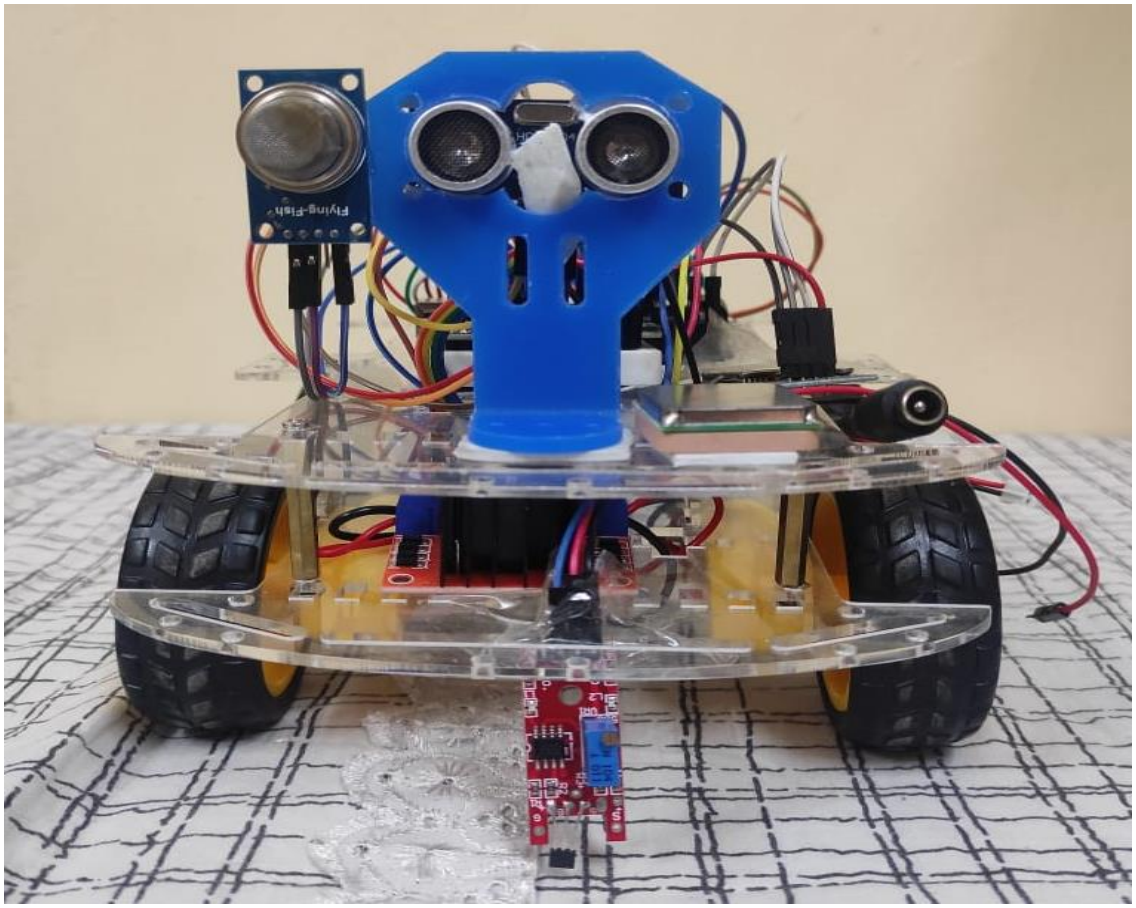


**Fig 1.1** Prototype of project

## 1.1 OBJECTIVE

1. Create a smart robot that can gather information about the surroundings and effectively transmit it to an operator.

2. To display transferred real-time environmental information on the operator's base station computer as a radar.

3. Provide full remote control of the unmanned ground vehicle's movements to the operator.

## 1.2 MOTIVATION

Terrorism and insurgency are the most pressing issues today. Governments, researchers, and scientists are developing new defence systems that can protect civilians from terrorist attacks. In the realm of vehicle automation, significant progress has been made. This inspired our team to develop an (UGV) capable of supporting military operations.

A (UGV) is a robot that can travel and make judgments on open terrain, whether or not humans are present. In this article, we looked at four different UGV control solutions. • Command control mode: In this mode, we've imagined humans making decisions and delivering navigation orders based on the UGV's camera's live visual signal.

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## 1.3 BACKGROUND OF THE STUDY

In the face of terrorism and insurgency, the relevance of remote patrol and surveillance in lowering risk to human lives where physical patrol is regarded destructive cannot be overstated. An unmanned ground vehicle, in which a human operator operates a robot system to gather information about places that are inaccessible at all, is used for this purpose.

(UGVs) are robot that works without any appearence of person. UGV can be used in situations when having a users is inconvenient, dangerous, or impossible. The car will be equipped with sensors to monitor its surroundings and will either make autonomous judgments or pass.

Unmanned Ground Vehicles (UGV) are divided into two categories: remote-operated and autonomous. A remote-operated Unmanned Ground vehicle is one that follows instructions from a users in a communication link. The operator controls every movements using distant sensory inputs like visual line-of-sight observation or digital video cameras.

The basic notion of Tele-operation is used in a remote control toy car. An autonomous Unmanned Ground vehicle, on the other hand, is one that uses artificial intelligence (AI) throughout its whole operation. An autonomous unmanned ground vehicle is capable of travelling from one location to another without the assistance of a human navigator, working for long periods of time without human intervention, and may also.

## 1.4 PROBLEM STATEMENT

(UGVs) are the robots that operate without any apperence of human. It can be operated remotely by a human operator or can operate autonomously. UGVs are vehicles that are extremely nimble. UGVs can typically go forward, backward, and turn left and right.

They're made to carry out missions that would be impossible to accomplish with a human operator. Search and rescue missions, urban street presence, and enhancing police and military raids in urban settings are some of the key application areas.

Our main focus from the aforementioned application is on search and rescue activities. In the event of natural or man-made calamities, rescue robots are dispatched to seek for survivors.

A robot's required functionality or purpose specifies which components it must have. The UGV is a search and rescue robot that is utilized in this project to find victims and survivors of disasters.

The robot is equipped with a camera, sensors, processors, communication system, motor drivers, power supply, and a computer where the operator controls the robot in order to accomplish this.

The following design issues must be addressed due to the nature of the working environment and the desired functionality. The remote control unit must be implemented utilizing a general purpose computer to maximize the system's portability.

To avoid installing extra hardware, only the computer's input and output components must be used. The application should be adaptable.

# CHAPTER 2

## LITERATUE SURVEY

Robots have recently become a vital element of daily life, with applications in a wide range of engineering and technological disciplines. Robots are electromechanical machines that, with the help of artificial intelligence or human guidance, can execute specified activities on their own. A robot is a system that automates one or more tasks, according to the definition. Monitoring an environment's parameters is a critical and tough endeavor. It's critical in places like conflict zones, dangerous surroundings, natural living conditions, and remote, difficult-to-reach places like deep space.

Robots replace humans in monotonous and risky duties that humans prefer not to do or are unable to accomplish, or that occur in hazardous locations.This focus on controlling, sensing and In terms of look, actions, and logic, these robots may resemble humans.

Robotics is the study of automated technologies that can replace humans in hazardous situations and manufacturing operations. The use of robots in industry has grown throughout time, particularly in the automobile industry.

On assembly lines, they do a range of repetitive jobs. Only half of the workers are employed in automobile companies, with the rest working in hospitals, labs, warehouses, energy plants, factories, and a variety of other businesses.

Although robots have replaced humans in harmful tasks, the increased rate of automation is causing severe worries.

A robot's electrical element is used for movement and operation by providing electrical energy to its motors and sensors in order to activate and perform fundamental activities. A robot's electrical system is also utilized for sensing, which involves using electrical signals to measure things like heat, sound, and position. The programme, sometimes called as the brain, is the heart of a robot. It's the artificial intelligence. The application includes some computer programming code that aids the robot in making judgments about when and how to do tasks. Robotics programmes are divided into three categories:

Artificial intelligence (AI), remote control (RC), and hybrid a remote controlled robot has a set of pre-programmed commands that it will only follow.

## 2.1 Proposed System Description

**An IoT-based robot** that can perform the following tasks using Arduino UNO, Ultra Sonic Sensor, IR Sensor, GSM GPRS Module, Metal Detector, and other components.

**BORDER PATROL AND SURVEILLANCE:** It is employed to monitor alien forces entering the region during times of military warfare or border encroachment.

**NEW EXPLORATIONS:** Deep subsurface searches.

**BEFORE RECONNAISSANCE:** Scouting is the phrase used in the military to describe the process of performing a preliminary survey, specifically an exploratory military survey, in order to gain or collect information..

**MINES DETECTOR:** This device detects land mines and reports their location to the base station. To take on perilous missions that may result in the loss of human life.

## 2.2 GENERAL BLOCK DIAGRAM

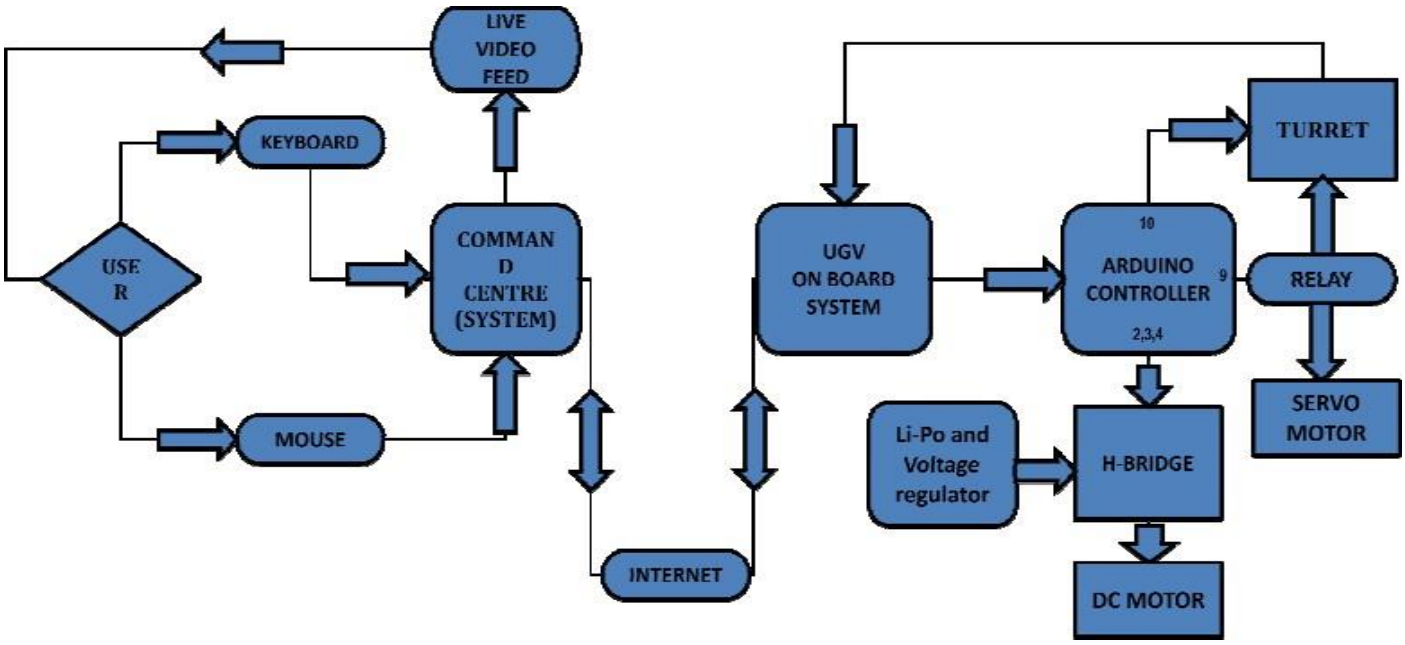



**Fig 2.1** General block diagram of the unmanned ground vehicle

## 2.3 Block Diagram Explanation

1. **Base station:** The base station is a computer system that controls the UGV using a keyboard, mouse for mode control and movement, and live video feedback for monitoring the environment.
2. The UGV's motion and the turret's movement for wide angle vision are controlled by the keyboard and mouse. 3G Internet: A system-to-system communication method for controlling the UGV wirelessly.
3. **On-board system:** A computer system mounted on the UGV that receives and relays commands to the control unit.
4. **Camera**: A device that captures images and provides the video needed for UGV vision.
5. **Control Unit:** The Arduino microcontroller acts as the control unit, receiving signals from the user and other sensors and performing duties like turret movement and UGV movement.
6. **GPS Unit:** A navigation system that obtains location coordinates in autonomous mode.
7. **Compass:** To determine the direction the UGV is facing.
8. **IR sensors** are infrared sensors that are employed in the autonomous mode's obstacle avoidance process.
9. **Servo motors**: are used to control the direction turn of the UGV as well as the turret's two-axis movement.
10. **Motors:** These are primarily used for the UGV movement.
11. **Battery:** The power source feeding the entire UGV with voltage regulation to offer optimum power ratings is a Li-PO battery with voltage regulator.

# CHAPTER 3

## 3.1 HARDWARE/ SOFTWARE USED

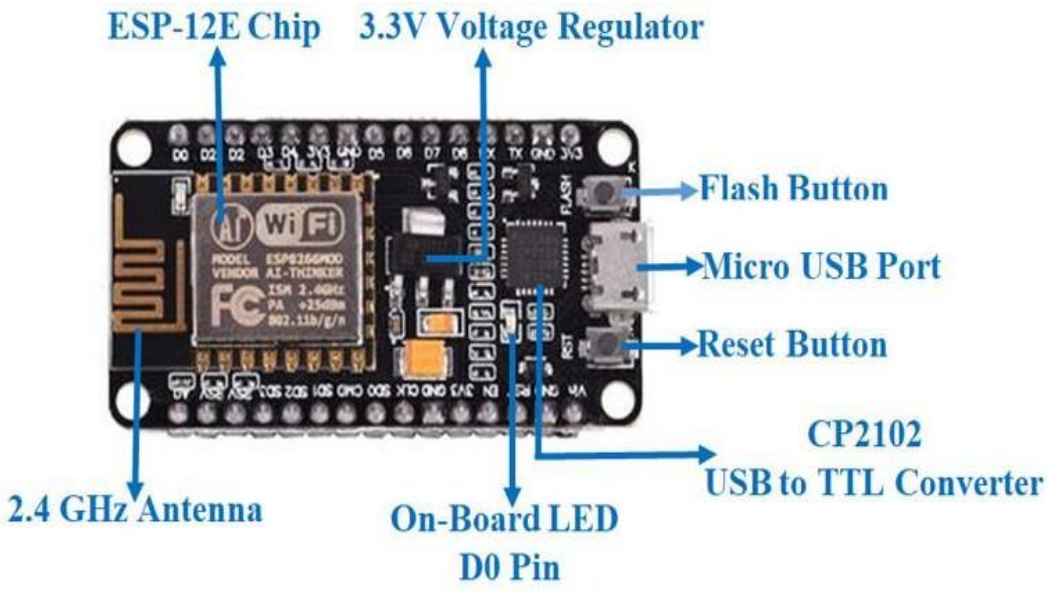



**Fig 3.1** NodeMCU ESP8266

On the NodeMCU ESP8266 development board. This microprocessor supports RTOS and runs at a customizable clock frequency of 80MHz to 160MHz. The NodeMCU has 128 KB of RAM and 4MB of Flash memory for storing data and programmes. Its high processing power, built-in Wi-Fi / Bluetooth, and Deep Sleep Operating characteristics make it ideal for IoT projects.

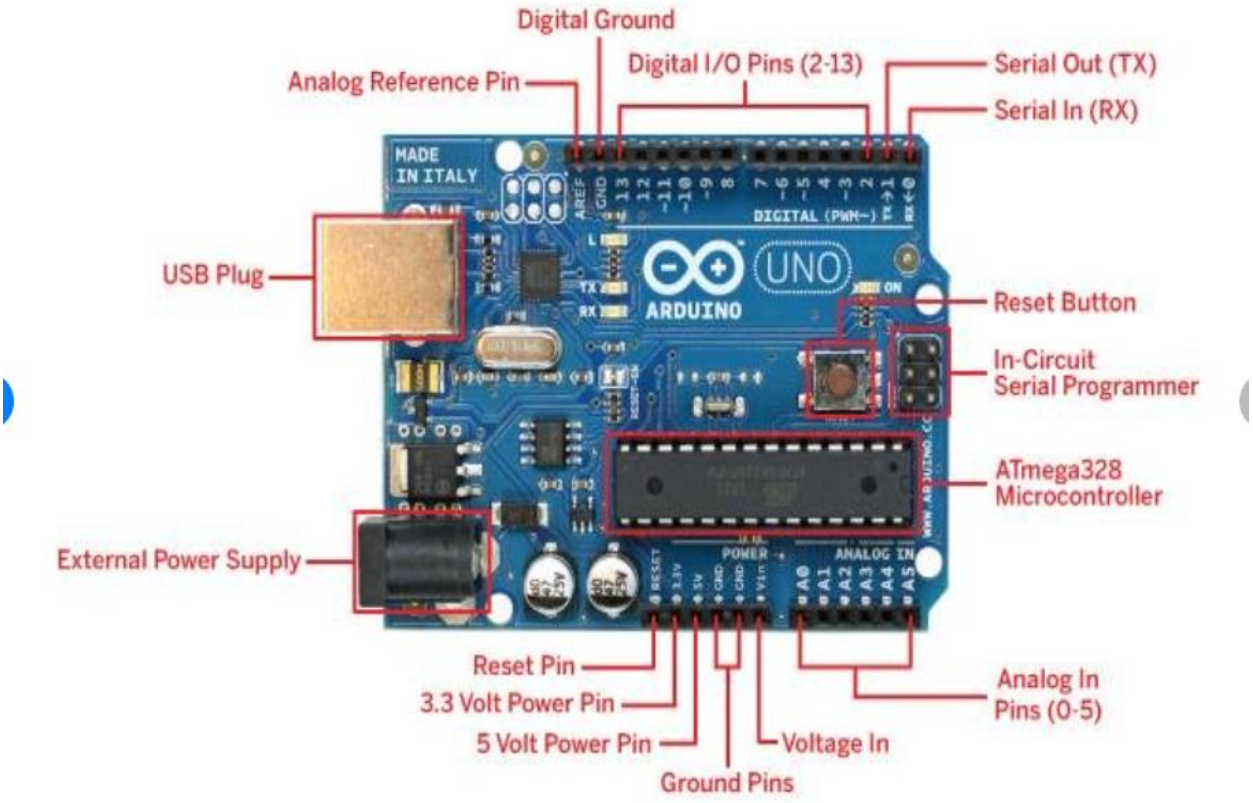



**Fig 3.2** Arduino UNO

UNO (Arduino Uno) is the microcontroller the Arduino programme are the most important (). The purpose and activity of the functions are implied by their names: setup () configures the Arduino hardware, such as defining which I/O lines to use and whether they are inputs or outputs. When the Arduino runs, the loop () function is repeated indefinitely. The programme is written in the Arduino IDE (Integrated development environment) and then uploaded to the Arduino board. The Arduino programme was written and uploaded.

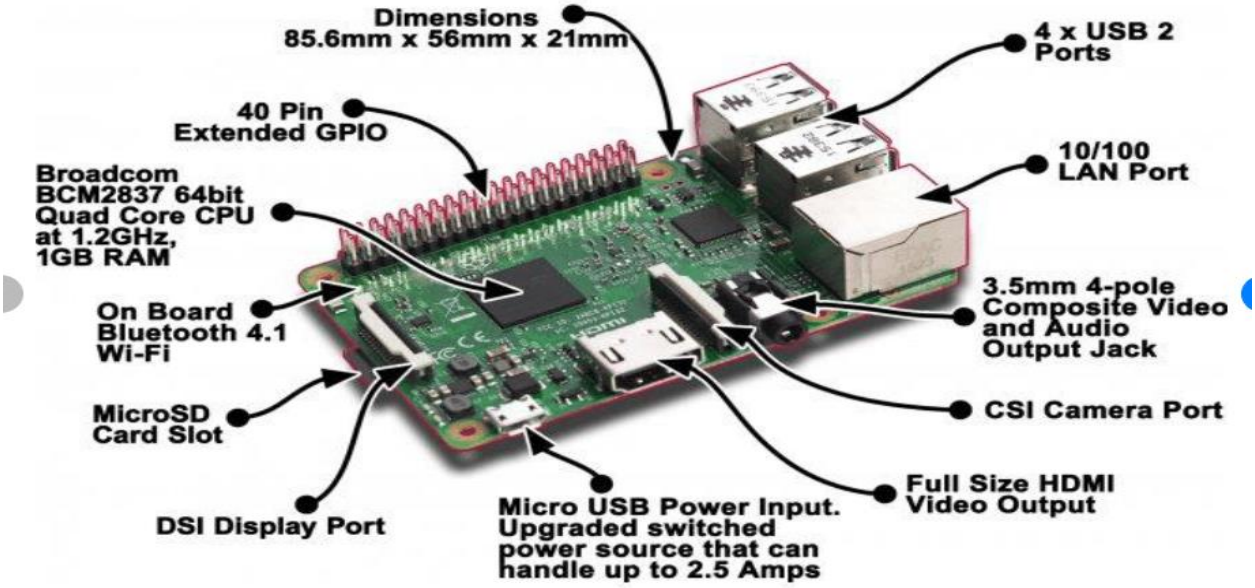



**Fig 3.3** Raspberry Pi

The Raspberry Pi 3 Model B+ is the model in the Raspberry Pi 3 series.

GPIO header with an extra 40 pins

Camera port for connecting a camera

Micro SD slot for installing and storing your operating system and data

DC power input: 5V/2.5A

Support for Power-over-Ethernet (PoE) (requires separate PoE HAT)

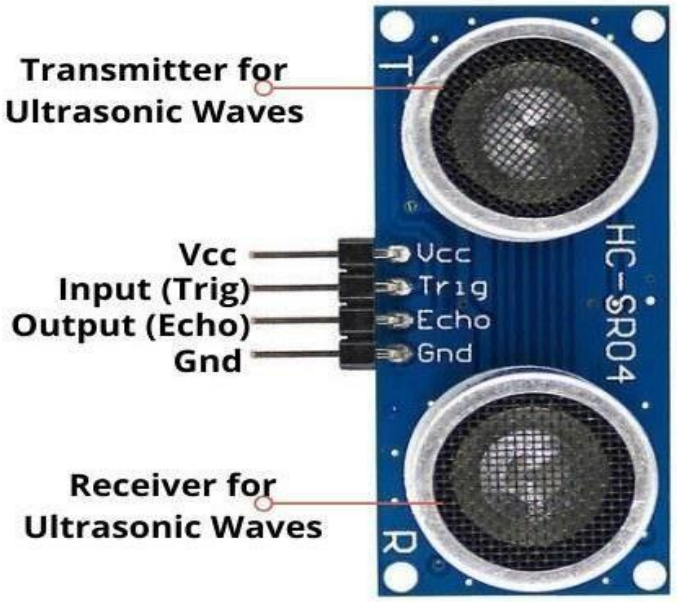



**Fig 3.4** Ultrasonic Sensor

A device that take on ultrasonic sound waves to calculate the distance to an item is known as an ultrasonic sensor.

Ultrasonic sensor, a transducer emits and receives ultrasonic pulses that communicate information.

High-frequency sound() waves echo off walls, resulting in a variety of echo patterns.
This sensor work by transfering out a sound wave that has high frequency than normal human hearing. The transducer that is a sensor whichworks as a microphone, catching and transmitting ultrasonic sound.

Our ultrasonic sensors, like many others, use only transducer to produce a pulse & receive the reflection. To determine the distance to a target.

**Fig 3.5** Infrared (IR) sensor

Sensors that detect and quantify infrared radiation in their environment are known as infrared While testing the temperature, It discovered that the temperature just beyond the red light was the highest (separated by a prism). IR is discreet to the naked eye because its wavelength is longer than visible light (though it is still on the same electromagnetic spectrum). Anything that produces heat emits infrared radiation (temperatures over roughly five degrees Kelvin).

This sensor comes in two types :

Active IR

Passive IR

Active IR Generates and detect IR emission.

**Fig 3.6** GPS Module

This GPS module is formed on  the NEO-6M and is fully functioning. This item has a GPS antenna with a connector and employs cutting-edge automation to deliver the best possible positional data. You'll also get a battery to assist you achieve a GPS lock faster.

This is a GPS module for the v2 platform that has been updated. This GPS module delivers the most accurate position data, allowing your Multirotor control platform to operate more efficiently.

For indoor use, it also has a high sensitivity. A battery and an EEPROM for storing setup information are included in the NEO-6M GPS Module. A UFL cable links the two devices.

**Fig 3.7** Smoke Sensor

Smoke dector detect the gas and smoke and temperature in the environment generally it is used to detect for fire. This smoke detector gives a signal to a control panel . It is also known as alarm it can be operated by any microcontroller only we have to give power to this sensor and connect with it it will act as an alarm for fire and other gases too.


**Fig 3.8** Servo Motor

Servo Motors: It is an mechenical device that uses negative feedback to correct the functioning of a mechanism. Feedback structure are officially defined as structur that use error-correction wave to regulate mechanical position or other parameters. The cruise control in an automobile uses closed loop feedback, making it a servomechanism.

**Fig 3.9** DC Motor

An electric motor converts electrical energy into mechanical energy. Most electric motors use merge magnetic fields and current-carrying conductors to produce pressure, while electrostatic motors rely on electrostatic coerce.

Electric motors are used in fans, blowers, and pumps, as well as machine tools, household appliances, power tools, and disc drives. They can be powered by either direct current or alternating current (for example, a battery-powered portable device or a motor vehicle) (such as from a central electrical distribution grid). The voltage is changed from DC to AC via a motor controller.

Brushless motors have a long life span, require little or no maintenance, and are extremely energy efficient. The downsides are higher startup costs and more complicated motor speed controls.


**Fig 3.10** Camera

A video streaming  that sends pictures in real time network, typically through USB, Ethernet, or Wi-Fi. The development of vid connections, that allows computers to operate as videoconference stations, is the most prevalent application. Because of its extensive use as a video streaming . Other favoured uses include seurety surveillance and computer vision. Due to their low manufacturing costs and versatility, webcams are the most cost-effective form of visual communication.

This video camera is generally used foe live video straming so that we can get the information of the environment what is going on at a perticular place where a human can’t go or we can use it as a spy.

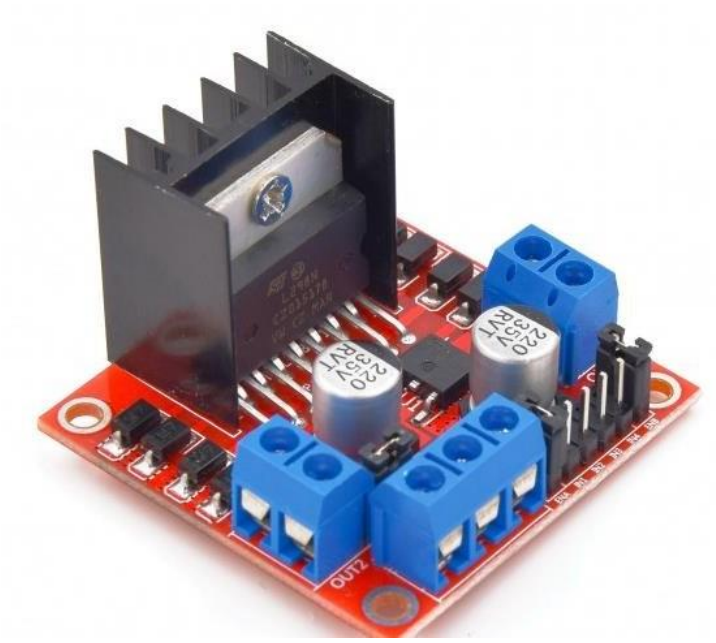



**Fig 3.11** Dual H-Bridge Motor Driver L298N

For managing motor speed and rotation direction, the L298N Dual H-Bridge Motor Controller is a popular choice. LED arrays, relays, and solenoids, among other things, can all be used with it. It's a little but powerful motor driver with a substantial heat sink. It can power 5-35V motors with a maximum current of 2A.

We've used up to four motors with the six onboard screw terminals. It has an inbuilt 5V regulator that can produce up to 1A for components that require 5V power. Do not use the 5V regulated power when supplying more than 12V to motors.


**Fig 3.13** Metal Sensor

A metal sensor is a sensor that sense metallic object in the environment as this sensor works by transmitting electromagnetic field from the search coin from the ground.

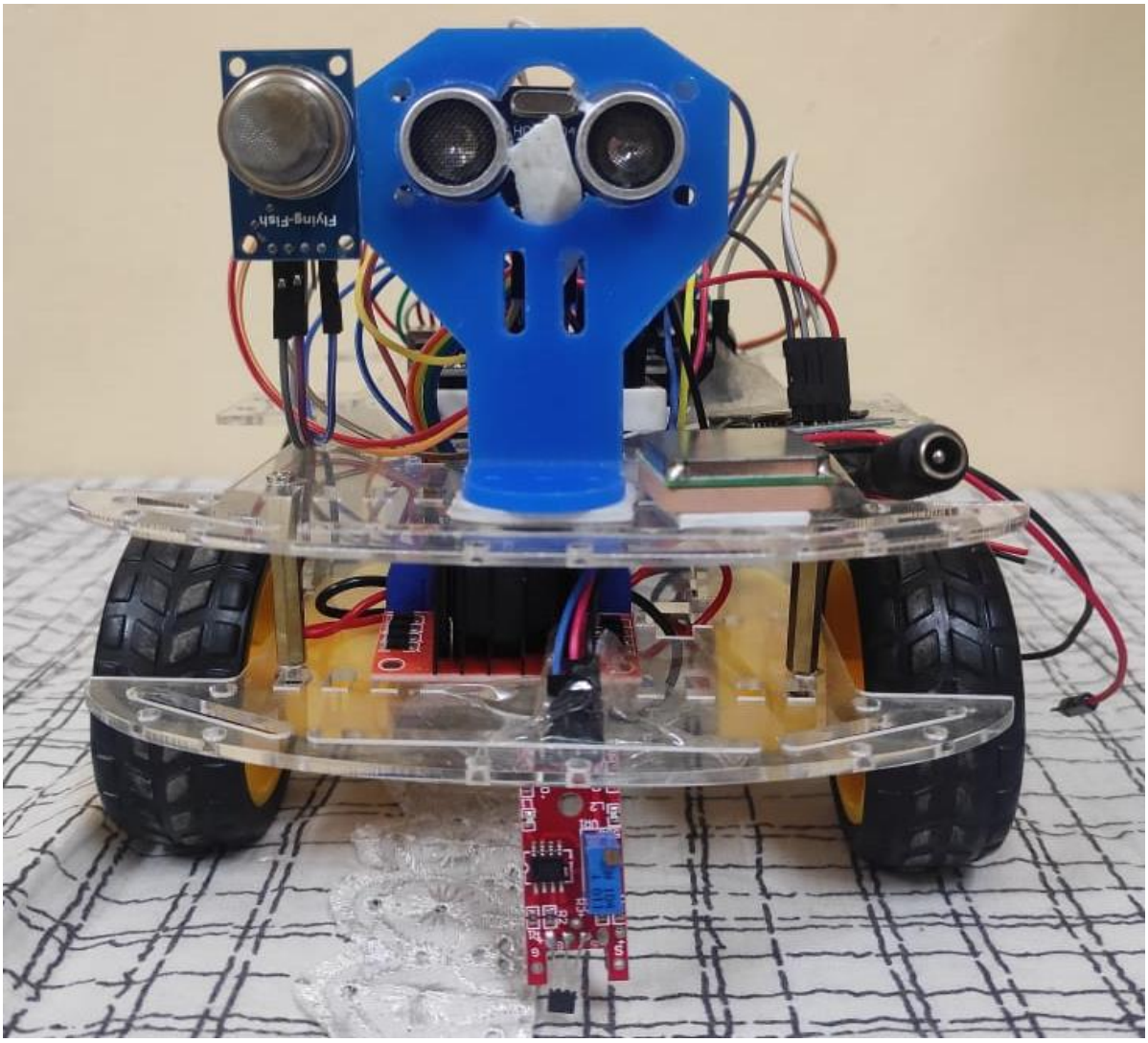
This metal detector is used for detecting the object in front of the sensor. When sensor comes close to the metal then it gives information to the control system from where it is operated.

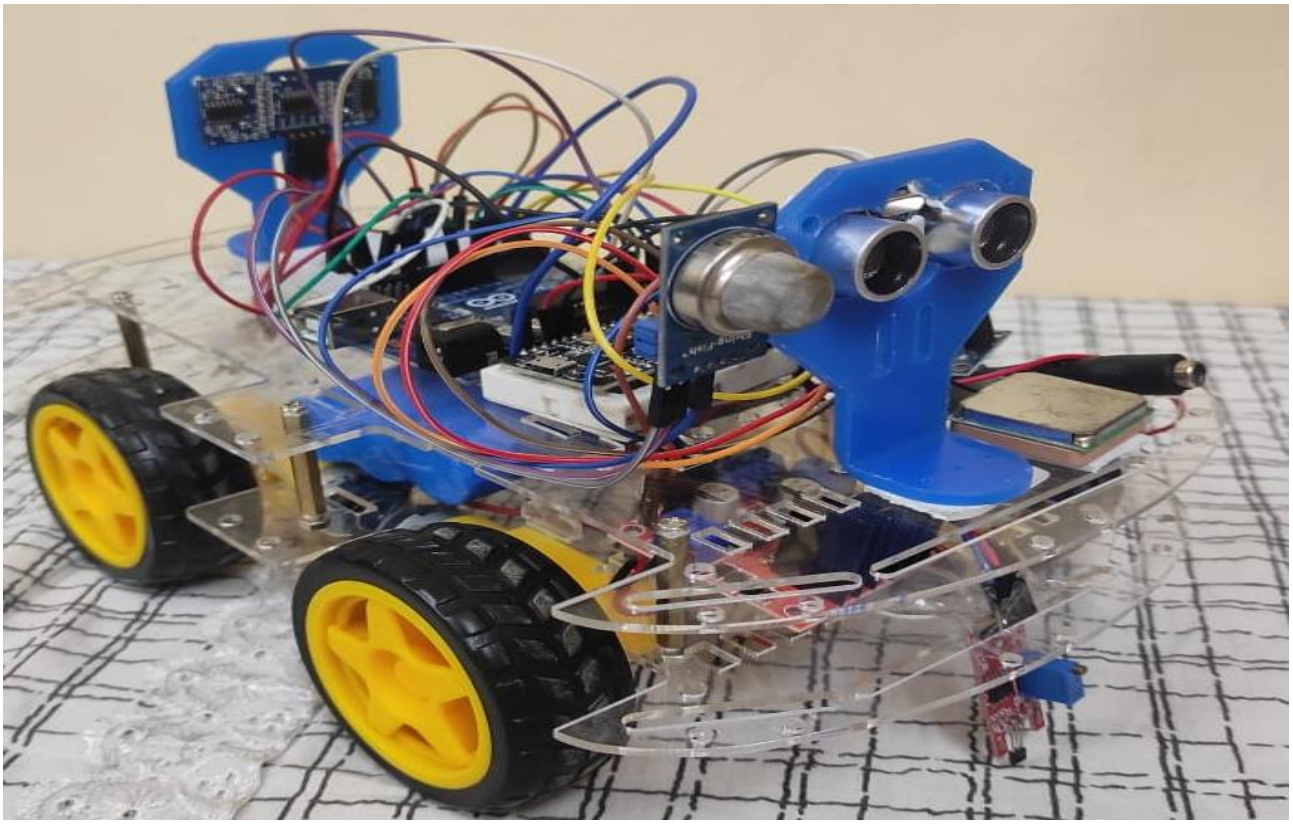
This metal detector is used in airports, malls metro station etc. To detect the metal object.

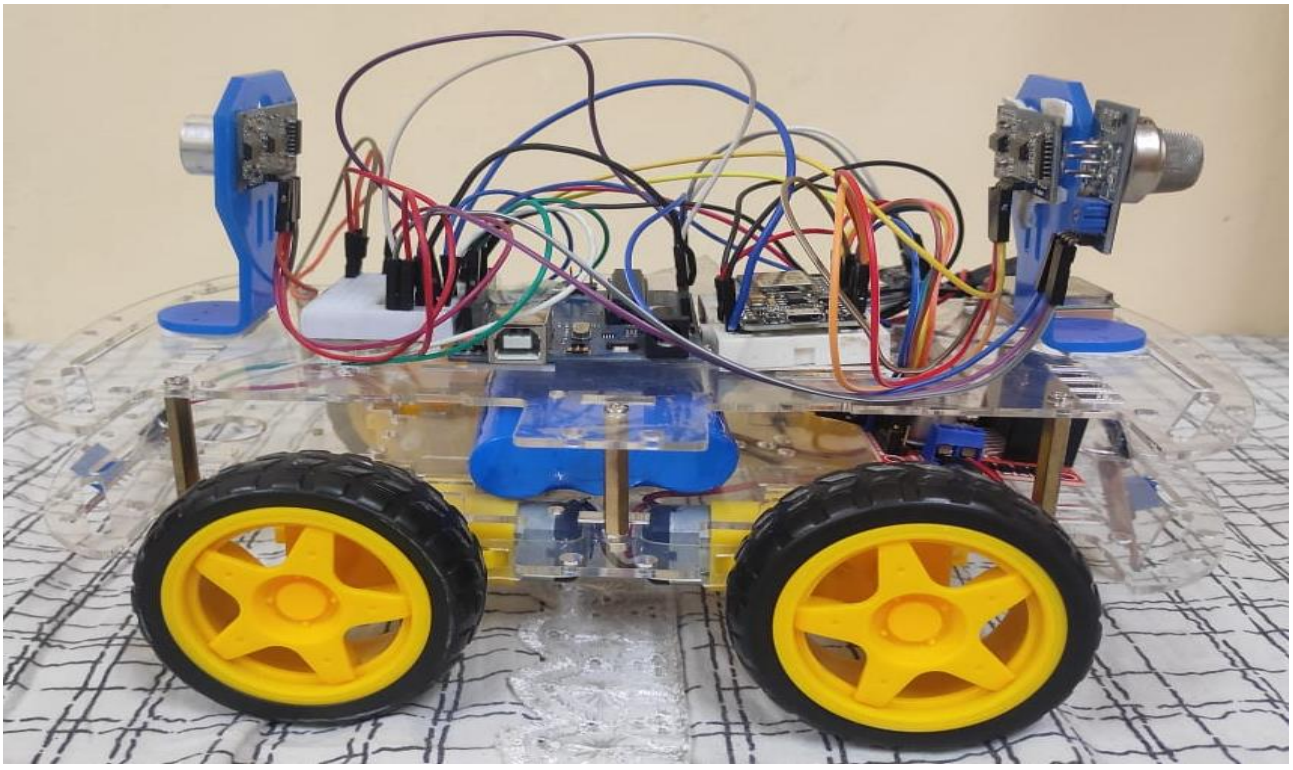
**Fig 3.14** 12 Volt 2500 MAh Lithium Ion Battery

It is the power source of our model by the help of this battery we are able to run our dc motors and the H- bridge also this is capable of running the motor for a long time just because it is 12 volts and it is rechargeable also we can run the battery and recharge it also by the help of adapter it contains two terminal negative and positive we only have to connect with these terminal and it will run the entire model.

## 3.2 Proposed Model







# CHAPTER 4

## 4.1 APPLICATIONS

**1. RECONNAISSANCE**- Scouting is the military term for conducting a initial study, especially an probing military study, in order to gather information.

**2. BOMB DISPOSAL-** Used to defuse and deactivate explosives, with the option of adding a robotic arm as a bonus feature.

**3. SEARCH AND RESCUE-** It proves to be a reliable machine for quickly locating people or goods in the event of natural or man-made disasters, rendering human labour useless.

**4. BORDER PATROL AND SURVEILLANCE**- It is employed to monitor alien forces entering the region during times of military warfare or border invasion.

**5. ACTIVE COMBAT SITUATIONS-** UGVs with loaded explosives, armament, and shields have proven to be useful throwaway assets on the battlefield without risking human life.

**6. STEALTH COMBAT OPERATIONS-** Spying without attracting the enemy's attention is an efficient combat strategy.

**1. NEW EXPLORATIONS** – Deep cave searches.

**2.** It is capable of executing dangerous operations without risking human life

## 4.2 LIMITATIONS

i. The obstacle avoidance IR sensors on board are exceedingly directed; they perform inefficiently in sunlight and fail to identify black substance.

ii. The battery's current capabilities, i.e. (Li-PO and Ni-Cd). These batteries can only power the system for a certain amount of time, which is determined by their current capabilities, after which the batteries will drain, leaving the system powerless.

iii. For communication between the base station and the UGV, the system requires high data speeds of 3G internet services. Failure to provide such high data rates would result in inefficient processing and, as a result, a system that is unreliable.

iv. The computers utilised on board and at the base station must have excellent computing capabilities and processing speeds.

v. The GPS used on board to determine the UGV's present location will not lock onto a value until and until the UGV is in direct line of sight with at least four satellites.

# CHAPTER 5

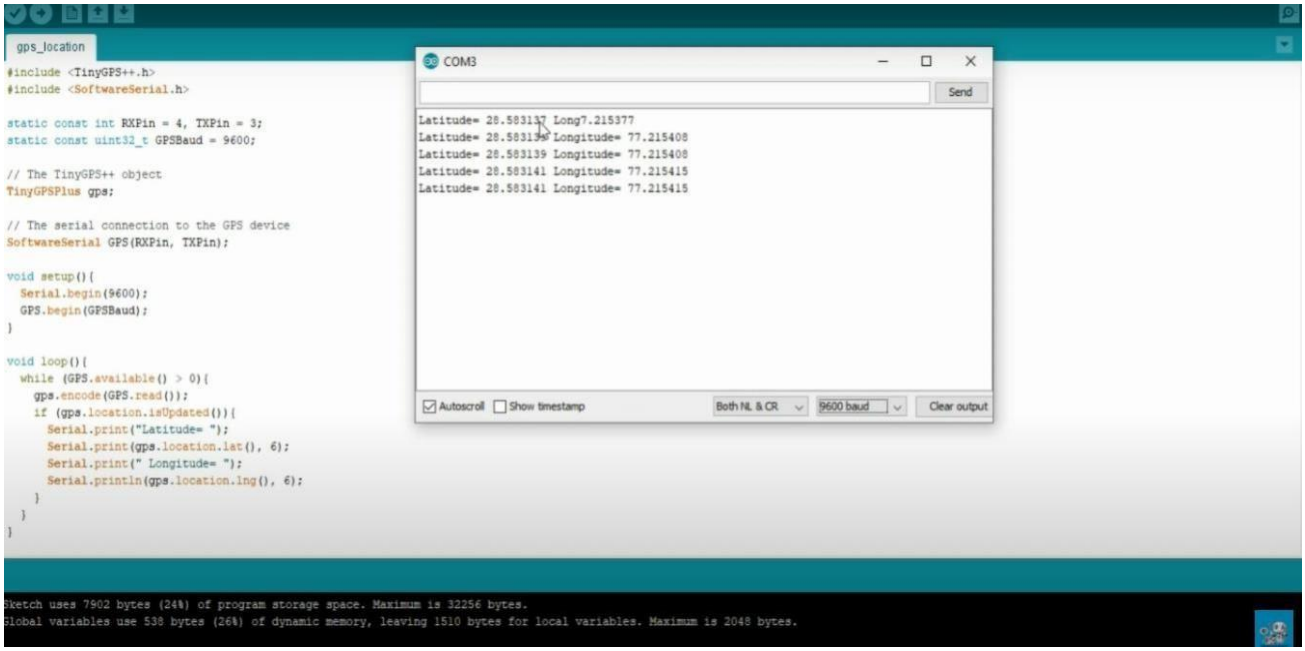
## RESULTS AND FUTURE WORK

## 5.1 FUTURE WORK

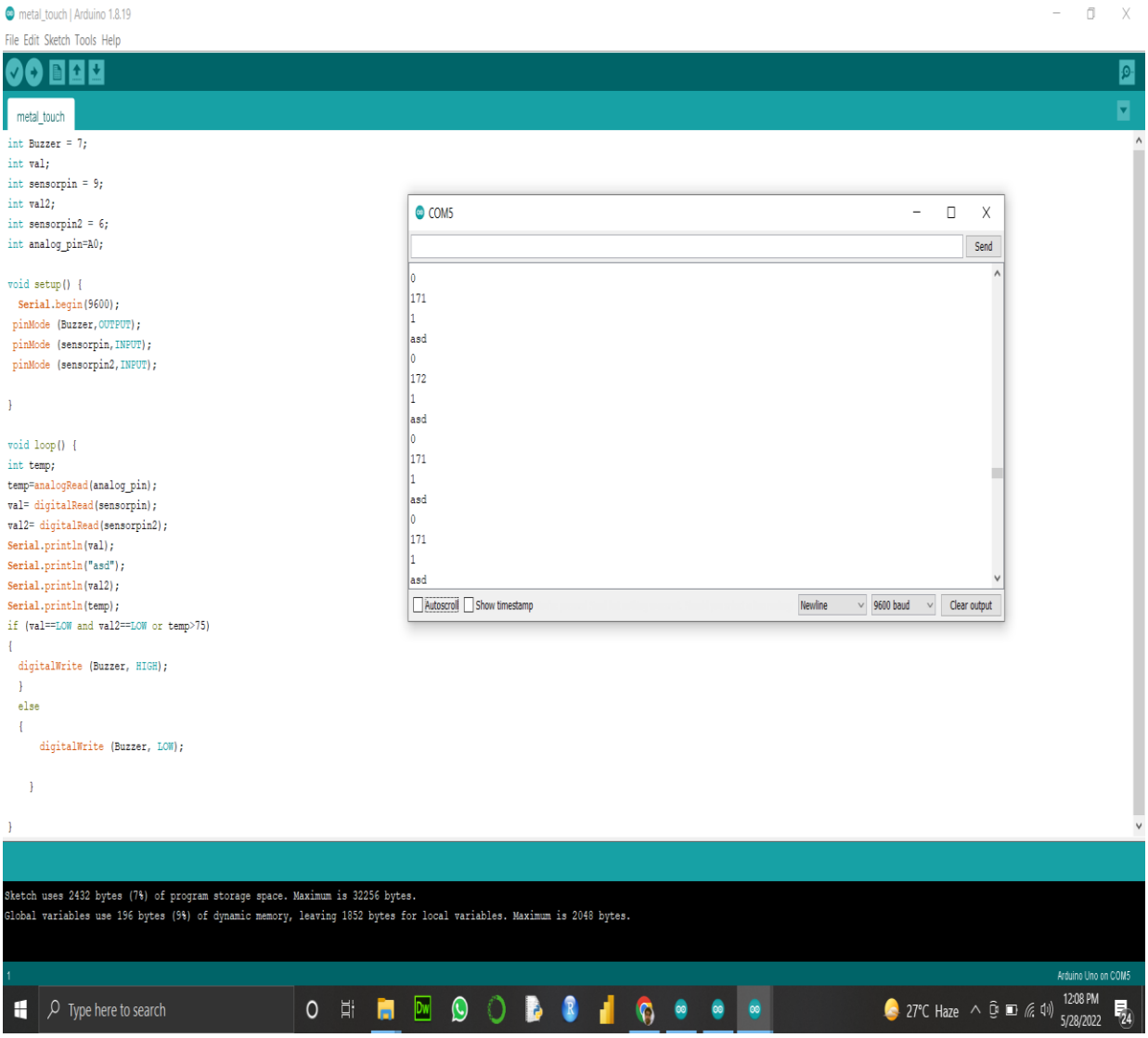
- To expand the capabilities of the UGV, extra sensors such as passive infrared sensors, thermal imaging, and gsm gprs module should be added.
- To provide more consistent motion tracking, optical flow can be combined with other image processing methods like frame differencing and edge detection.
- To improve the UGV's current functionality, high-end technology can be incorporated.
- The use of secure satellite communication channels improves the security of UGV operations.

## 5.2 RESULTS

- **GPS Coordinates**



- Metal And Gas Sensor



## 5.3 CONCLUSION

- The incorporation of various technologies under one roof has given us the path to achieve goals which have never been realized in such an efficient manner in the past.
- These technologies bring about a self-relying and able machine to tackle situations on its own and ease a human's job in the present day scenarios.

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