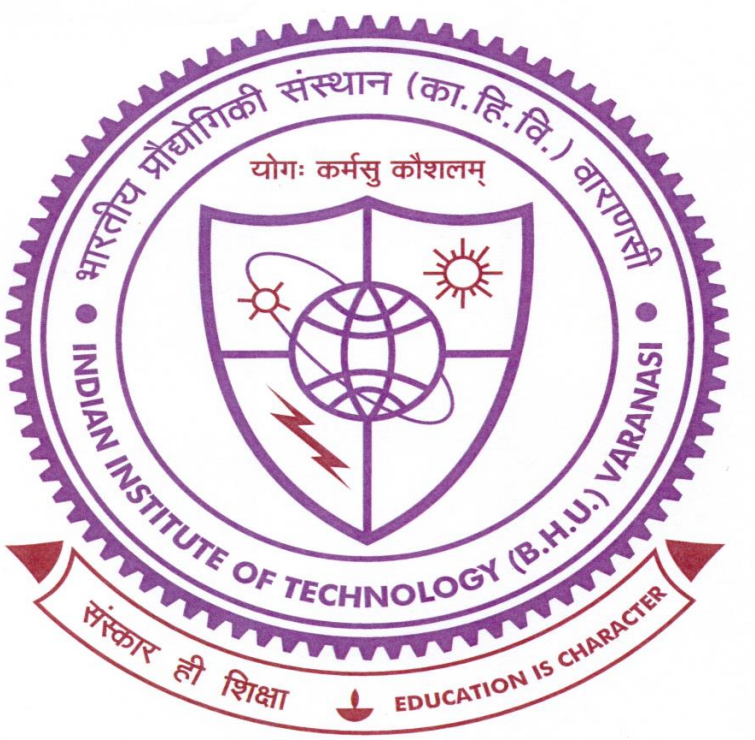

EXPLORATORY PROJECT

VOICE CONTROLLED AND OBJECT FOLLOWING ROBOT

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VOICE
CONTROLLED
ROBOT
EXPLORATORY PROJECT

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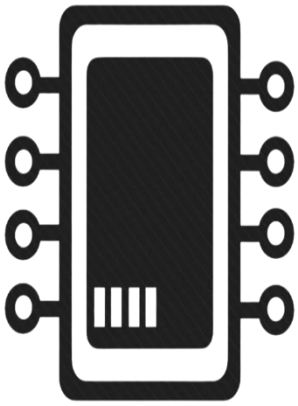
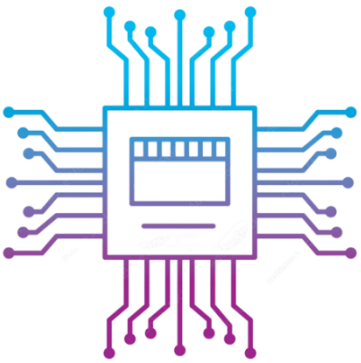
ABSTRACT

This report introduces Bluetooth based voiced controlled robot. Presently, various ways are used to control one. The most user friendly one of them is controlling it by voice commands. And it is well known fact that disabled people face different difficulties regarding their physical movement. In such conditions, the robot whose operation is controlled by human voice command can provide a potential solution to their problem. Controlling the robot with voice commands along with visual feeds helps the robot to operate easily and more accurately. Artificial intelligence based voiced controlled robot help reducing the manual effort being put by human in their day-to-day tasks. The robot can perform different movement, turns, start/stop operation and relocate an object from one place to another as per the user commands. At first, the robot takes voice commands on which objects to grab and displace; then it finds the object using the object detection module. After detecting the object, sorting object takes place using color sorting module. And finally, it grabs and displaces the object using the robotic gripper arm module.

PROBLEM STATEMENT



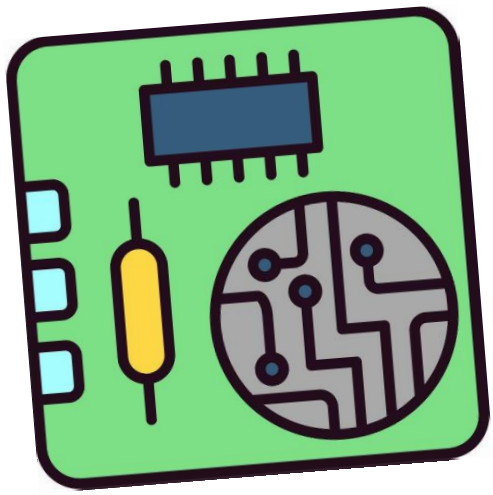
Despite the advancements in robotics and automation, there still exist several challenges in providing adequate assistance to people with disabilities or limited mobility, improving the safety and efficiency of transportation and logistics, and reducing the need for manual labor in various industries such as retail, healthcare, and agriculture. This calls for the development of innovative solutions such as voice-controlled and object-following robotic cars that can navigate environments safely, respond to voice commands, and perform tasks autonomously. Therefore, there is a need to continue researching and developing these technologies to address the existing challenges and improve the quality of life for individuals with disabilities and enhance efficiency and productivity in various industries.



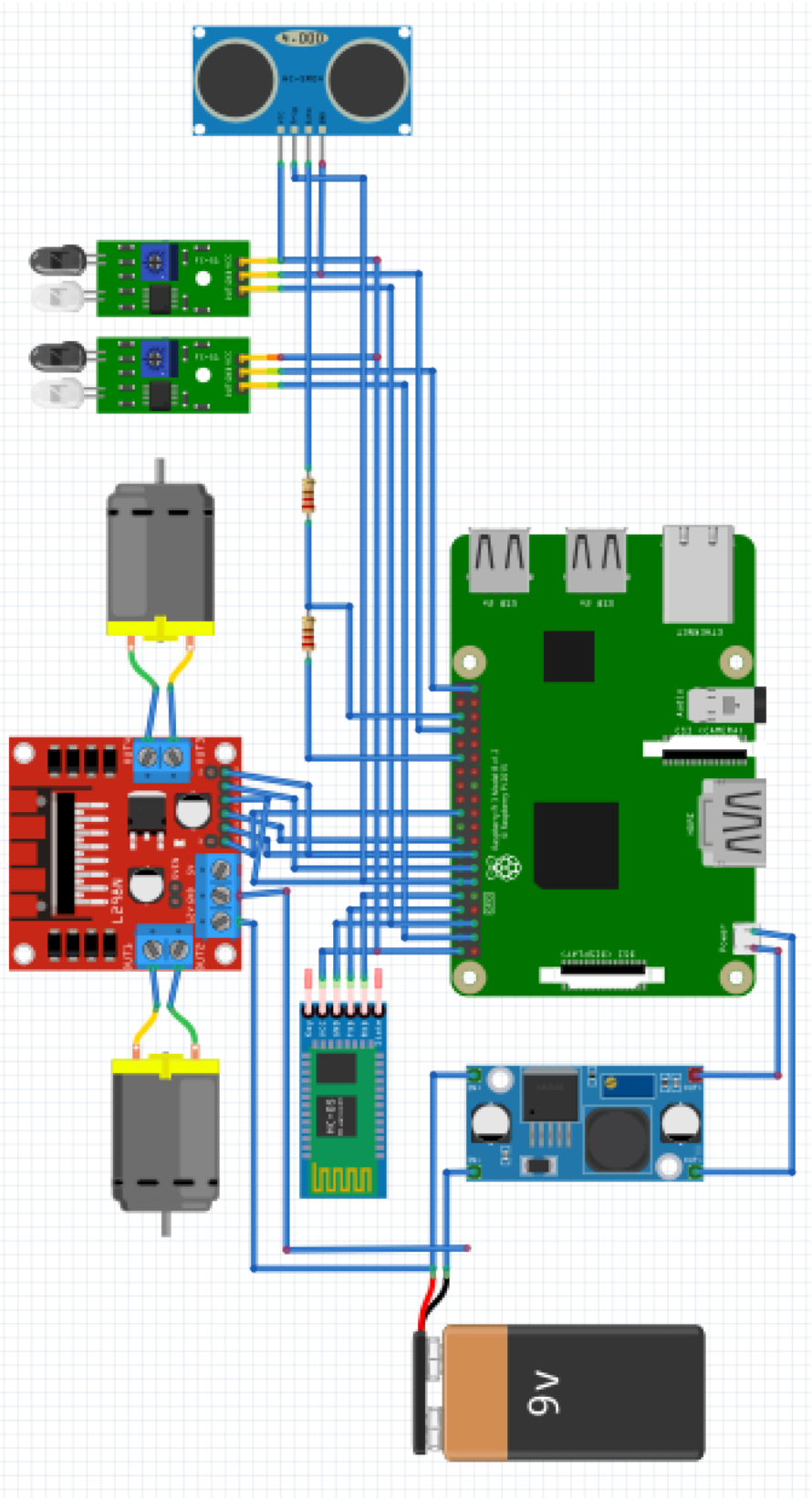
LITERATURE SURVEY OF EXISTING TECHNOLOGIES

- A voice-controlled robotic car has the potential to replace or enhance existing technologies such as:
    - Remote Control Systems: A voice-controlled car can replace traditional remote-control systems for devices like drones, RC cars, and other remotely operated machines.
    - Autonomous Driving Systems: A voice-controlled car can replace or enhance existing autonomous driving systems that rely on sensors and algorithms to make driving decisions.
    - Human Assistance Devices: A voice-controlled car can replace or enhance existing human assistance devices such as wheelchairs, walkers, and other mobility aids.

- Existing technologies that can be replaced by an Object Following Car:
    - Automated Guided Vehicles (AGVs): They require expensive infrastructure, such as magnetic strips or lasers to navigate. An object-following robotic car could provide a more flexible and cost-effective alternative.
    - Autonomous Robots: In some settings, such as healthcare facilities or hotels, autonomous robots are used to transport materials or supplies. However, these robots can be limited in their abilities and require a fixed infrastructure. An object-following robotic car could provide a more flexible and adaptable alternative.
    - Overall, an object-following robotic car has the potential to replace a range of existing technologies in various industries, providing a more efficient, flexible, and cost-effective solution.

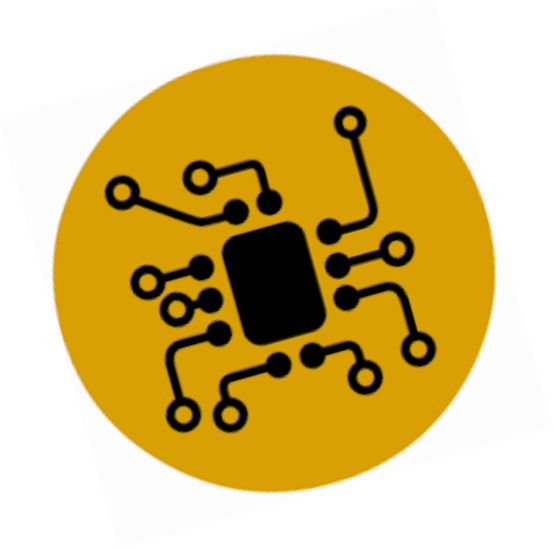


CIRCUIT DIAGRAM

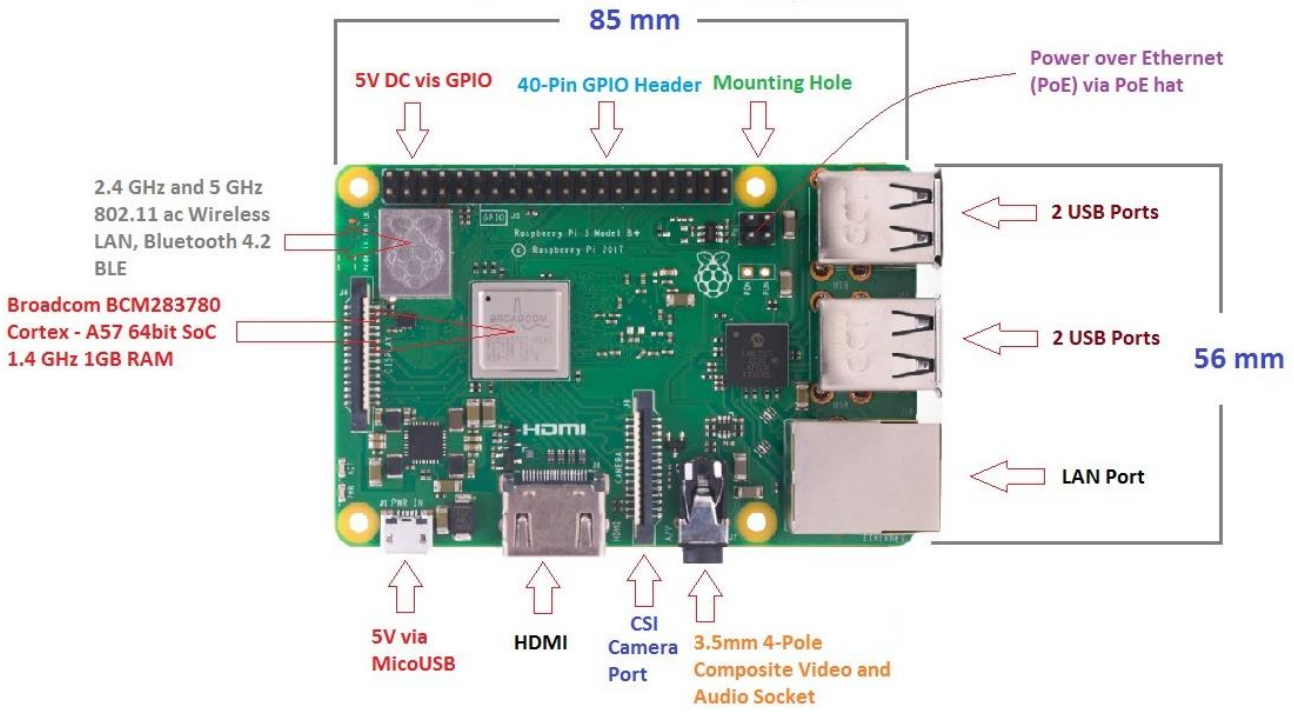


COMPONENTS USED

- **RASPBERRY PI 3B+**
- **BLUETOOTH MODULE**
- **ULTRASONIC SENSOR**
- **INFRARED SENSOR**
- **BUCK CONVERTOR LM2596**
- **L298N MOTOR DRIVER**
- **2000 Mah LI-ION BATTERY**
- **BREADBOARD**
- **RESISTORS**
- **+12V DC MOTOR**
- **JUMPER CABLES**

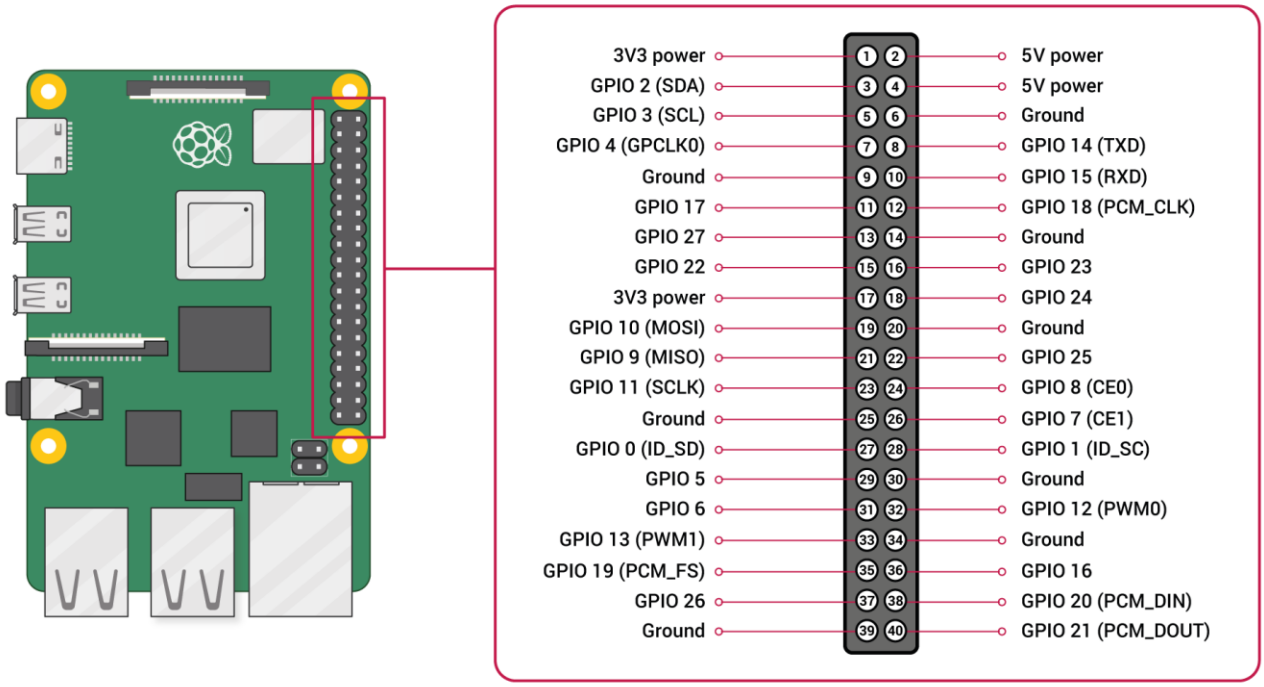


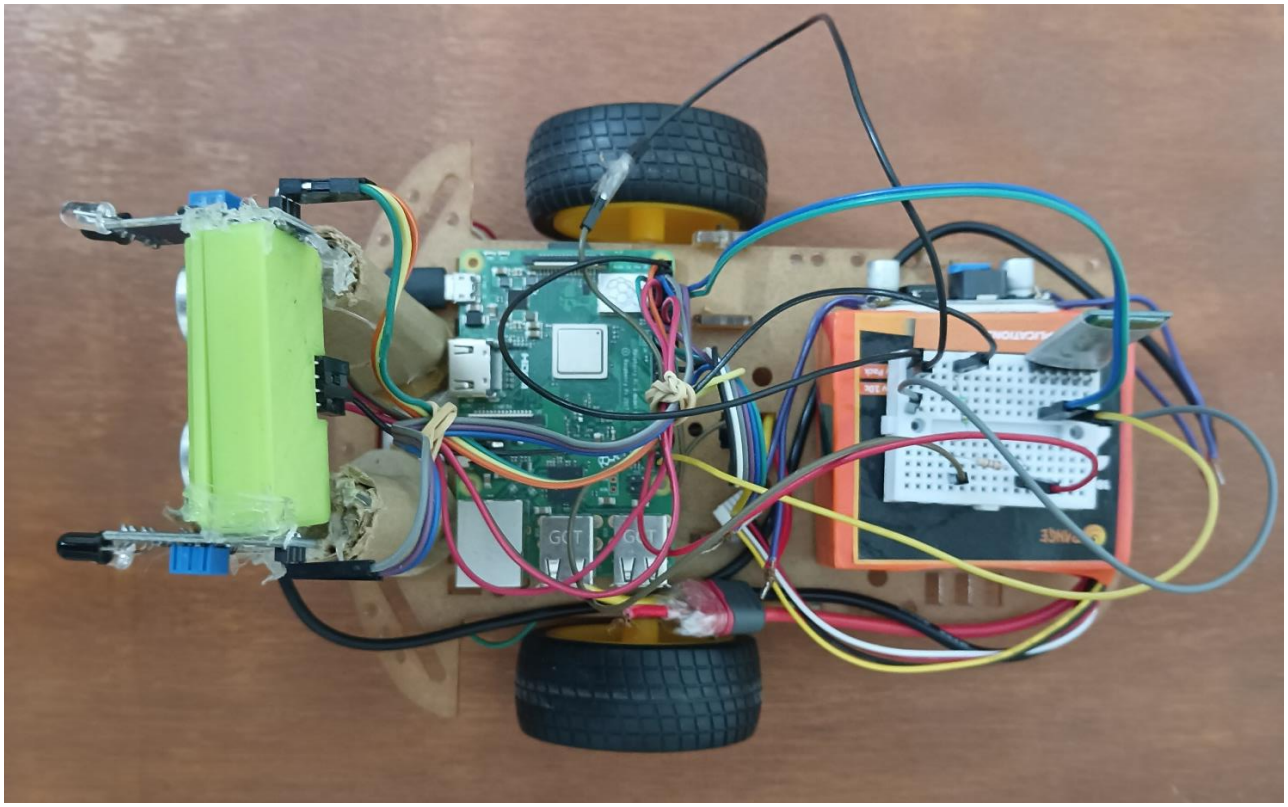
RASPBERRY PI MODEL 3B +



The Raspberry Pi 3 Model B+ is the latest product in the Raspberry Pi 3 range, boasting a 64-bit quad core processor running at 1.4GHz, dual-band 2.4GHz and 5GHz wireless LAN, Bluetooth 4.2/BLE, faster Ethernet, and PoE capability via a separate PoE HAT. The dual-band wireless LAN comes with modular compliance certification, allowing the board to be designed into end products with significantly reduced wireless LAN compliance testing, improving both cost and time to market. The Raspberry Pi 3 Model B+ maintains the same mechanical footprint as both the Raspberry Pi 2 Model B and the Raspberry Pi 3 Model B.

Basically, for our project, Raspberry Pi is basically playing the role of a microcontroller onto which our command codes run i.e., it is the motherboard of the project. All the sensors are attached to its GPIO pins and it reads as well as sends the data to all the sensors and drivers respectively connected to it through these pins.

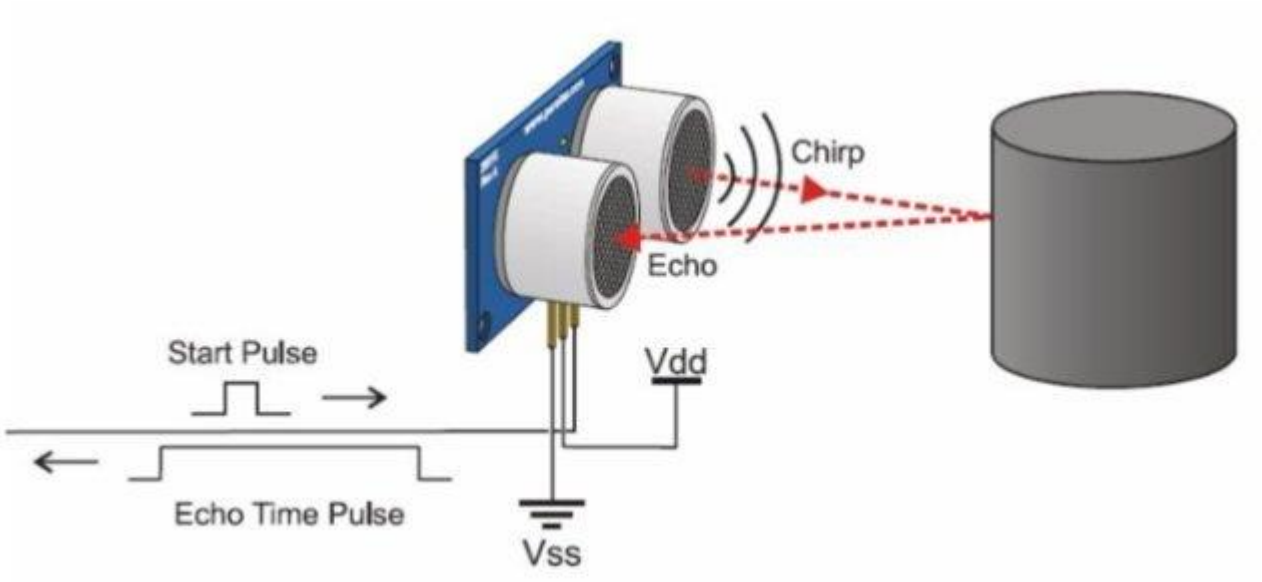

3V3 power 1 2 5V power
GPIO 2 (SDA) 3 4 5V power
GPIO 3 (SCL) 5 6 Ground
GPIO 4 (GPCLK0) 7 8 GPIO 14 (TXD)
Ground 9 10 GPIO 15 (RXD)
GPIO 17 11 12 GPIO 18 (PCM_CLK)
GPIO 27 13 14 Ground
GPIO 22 15 16 GPIO 23
3V3 power 17 18 GPIO 24
GPIO 10 (MOSI) 19 20 Ground
GPIO 9 (MISO) 21 22 GPIO 25
GPIO 11 (SCLK) 23 24 GPIO 8 (CE0)
Ground 25 26 GPIO 7 (CE1)
GPIO 0 (ID_SD) 27 28 GPIO 1 (ID_SC)
GPIO 5 29 30 Ground
GPIO 6 31 32 GPIO 12 (PWM0)
GPIO 13 (PWM1) 33 34 Ground
GPIO 19 (PCM_FS) 35 36 GPIO 16
GPIO 26 37 38 GPIO 20 (PCM_DIN)
Ground 39 40 GPIO 21 (PCM_DOUT)



ULTRASONIC SENSOR

The HC-SR04 is an affordable and easy to use distance measuring sensor which has a range from 2cm to 400cm (about an inch to 13 feet).

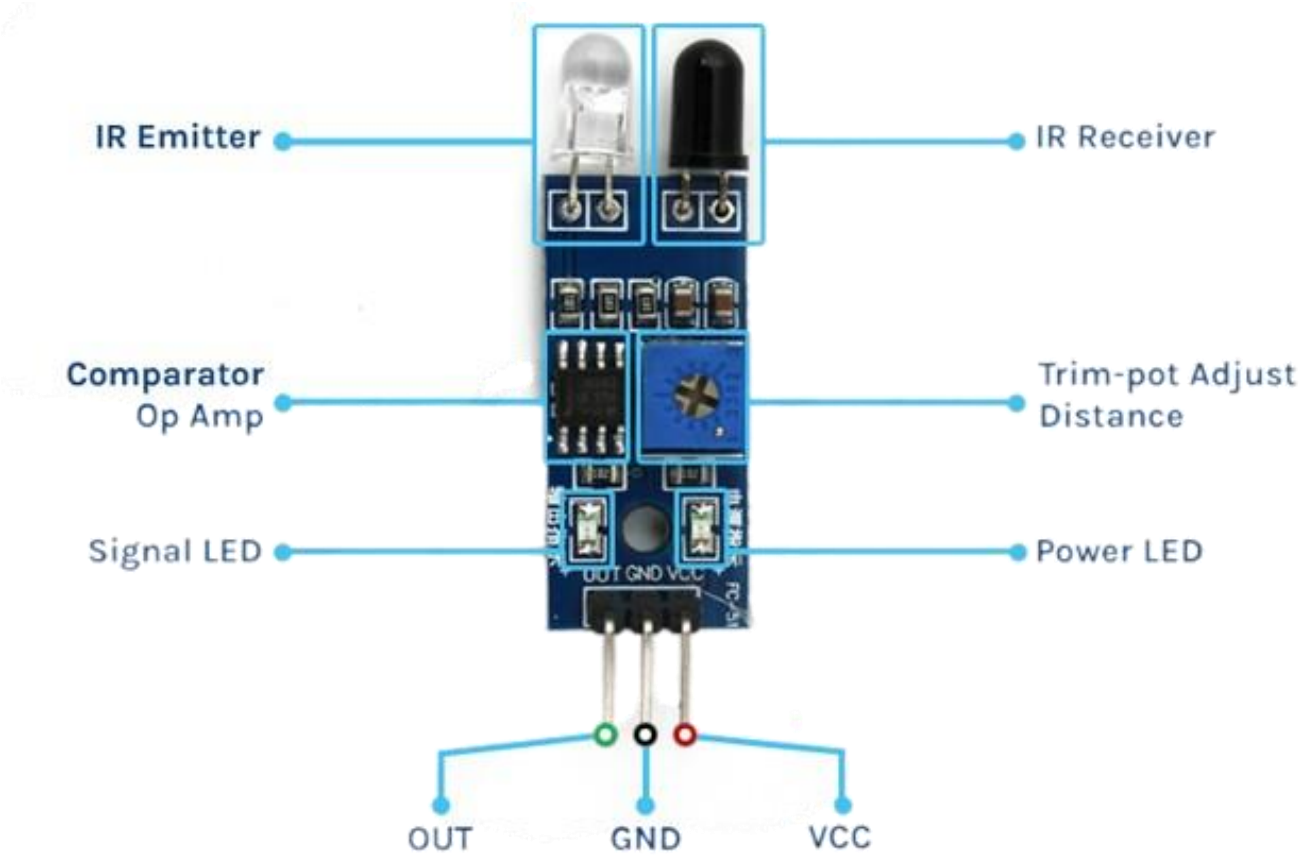
The sensor is composed of two ultrasonic transducers. One is transmitter which outputs ultrasonic sound pulses and the other is receiver which listens for reflected waves. It's basically a SONAR which is used in submarines for detecting underwater objects.



It emits an ultrasound at 40 000 Hz which travels through the air and if there is an object or obstacle on its path It will bounce back to the module. Considering the travel time and the speed of the sound you can calculate the distance.

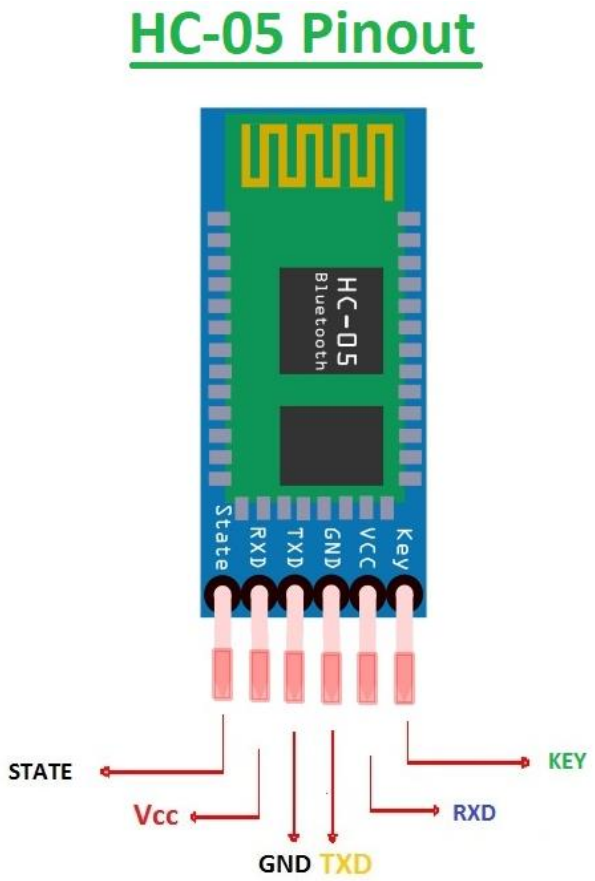
INFRARED SENSOR

The working of the IR sensor module is very simple, it consists of two main components: the first is the IR transmitter section and the second is the IR receiver section. In the transmitter section, IR led is used and in the receiver section, a photodiode is used to receive infrared signal and after some signal processing and conditioning, you will get the output.



An IR proximity sensor works by applying a voltage to the onboard Infrared Light Emitting Diode which in turn emits infrared light. This light propagates through the air and hits an object, after that the light gets reflected in the photodiode sensor. If the object is close, the reflected light will be stronger, if the object is far away, the reflected light will be weaker. If you look closely toward the module.

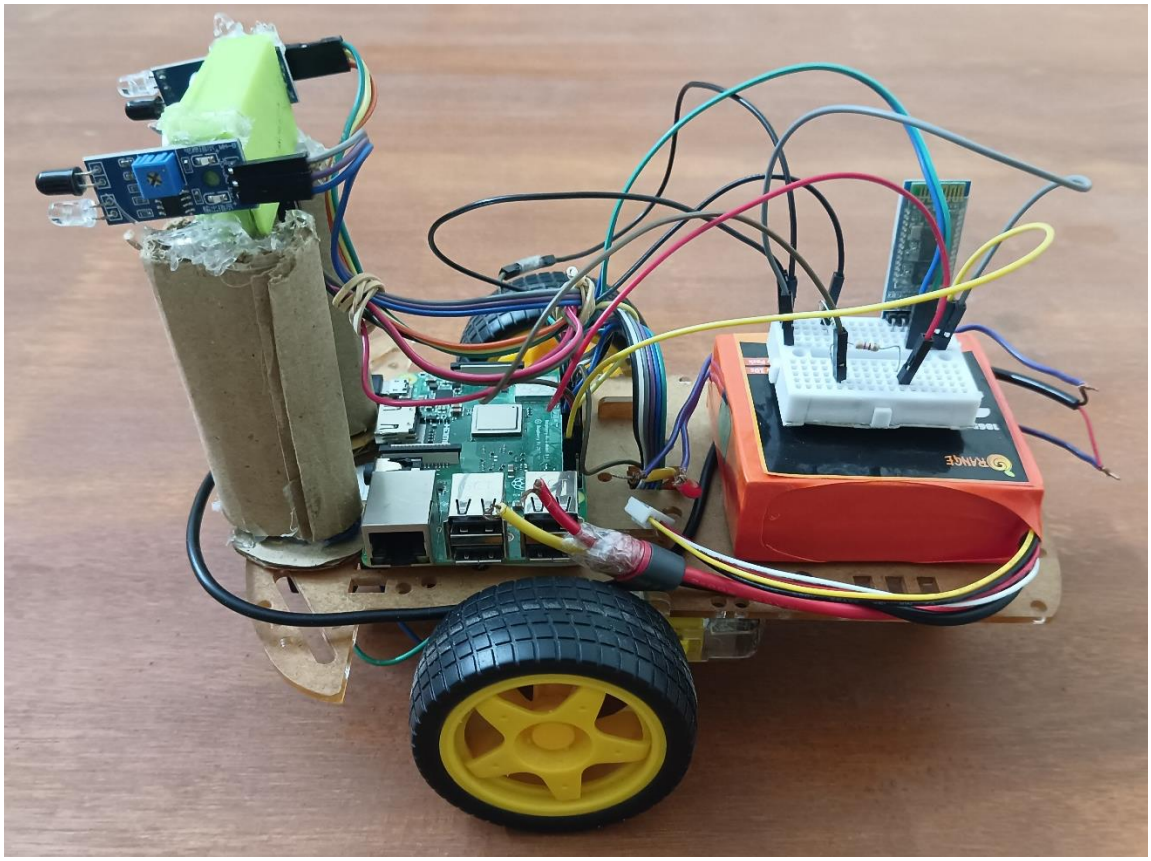
BLUETOOTH MODULE



HC05 module is a Bluetooth module which uses serial communication. It is mostly used in electronic projects. It can work either as a slave or a master.

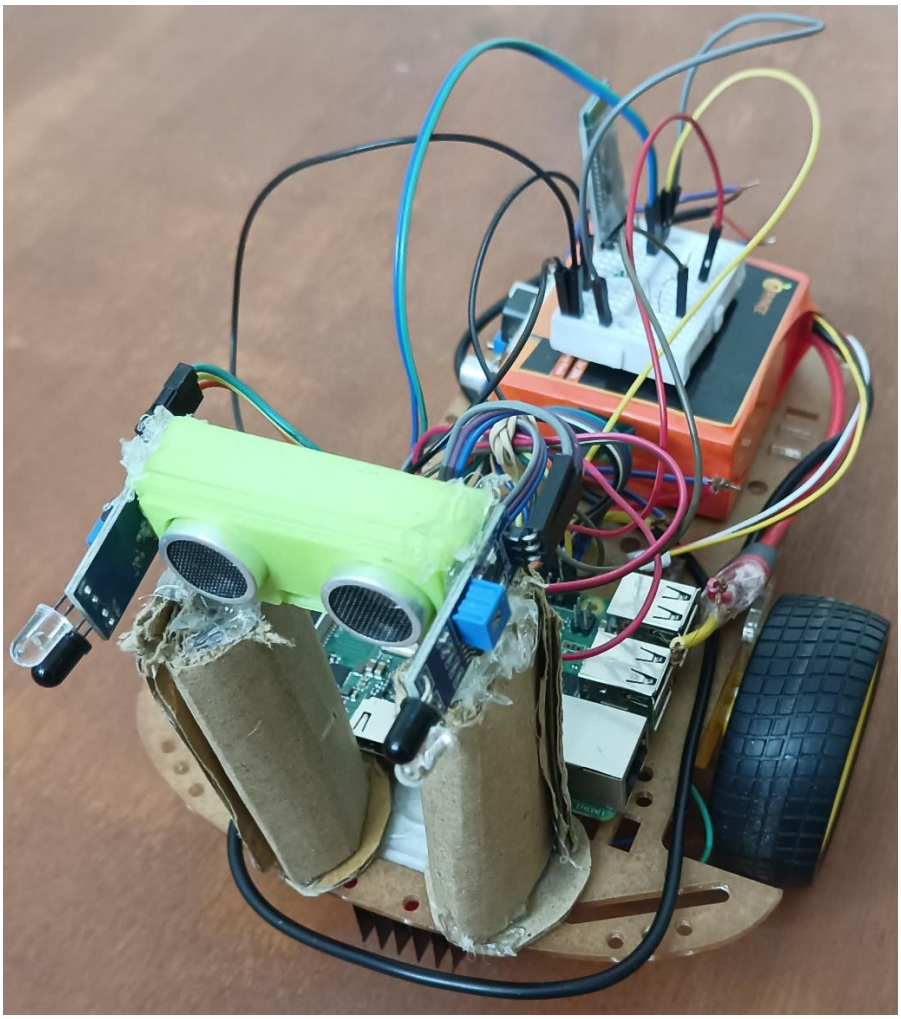
The particular module that I have can be powered from 3.6 to 6 volts, because it comes on breakout board which contains a voltage regulator. However, the logic voltage level of the data pins is 3.3V. So, the line between the Arduino TX (Transmit Pin, which has 5V output) and the Bluetooth module RX (Receive Pin, which supports only 3.3V) needs to be connected through a voltage divider in order not to burn the module. On the other hand, the line between the Bluetooth module TX pin and the Arduino RX pin can be connected directly because the 3.3V signal from the Bluetooth module is enough to be accepted as a high logic at the Arduino Board.

PRELIMINARY RESULTS AND INSIGHTS:



- Serial Communication: It uses the Bluetooth Module HC05 to communicate between the Raspberry Pi and the Mobile which takes input of the command.
- Sensor Interfacing: Mainly the sensors in our robot are being used when it has to fulfill the task of object following. Therein it uses Ultrasonic sensor and the Infrared sensor to fulfill the task. These send data to the Raspberry Pi via GPIO pins.

- Data Processing: The microcontroller can then read the sensor data and process it accordingly.
- What all our project is capable of? It can move around on the basis of predefined commands:
    - **Forward**
    - **Backward**
    - **Right**
    - **Left**
    - **Follow an Object**
- Data Flow: These all commands have a series of instructions that are sent to the Motor Driver which further sends it to the motors and the bot moves around accordingly.



INFERENCES, DISCUSSIONS, CONCLUSIONS

- A voice-controlled and object-following robotic car can provide a more accessible and independent means of transportation for individuals with disabilities or limited mobility, improving their quality of life.

- The use of sensors and advanced technologies in a voice-controlled and object-following robotic car can enhance safety and reduce the risk of accidents and injuries, making it a safer option than human-operated vehicles in some cases.

- By being able to perform tasks autonomously and follow specific routes, a voice-controlled and object-following robotic car can improve the efficiency of transportation, logistics, and material handling, reducing the need for manual labor and improving productivity.

- The use of object-following robotic cars in industries such as retail, healthcare, and agriculture can lead to improved efficiency, reduced labor costs, and a more convenient and seamless experience for customers and patients.

- The combination of voice control and object following can lead to a more versatile and adaptable robotic car that can be customized to meet the specific needs and requirements of different industries and users.

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