



Voice Controlled Autonomous Vehicle For Physically Challenges Civilians

¹Jayashree N, ²Mohammed Moin Ulla Khan, ³Nafisa Banu G, ⁴Poornima B, ⁵Sneha V

¹ Assistant Professor, ² Student, ³ Student, ⁴ Student, ⁵ Student

Department of Information Science and Engineering,
Cambridge Institute of Technology, Bangalore, India

Abstract: They are used to doing work that humans cannot perform. Hand gestures and voice are two of the most powerful communication techniques. Robotics can be used in many of these scenarios to minimize human error and to make work safer and easier. Defense, industrial robotics, vehicle part assembling industries in the civil side and medical field for surgery are the major fields that prefer hand gesture/voice recognition robots. Robot devices are tougher to control with the help of buttons and switches. It will get difficult and tedious to operate buttons and remote controls. Our project deals with the interface of robots through voice and gesture control. The purpose of this gesture recognition and voice recognition method is to capture human hand gestures, voice and perform applications and move in an individual path that meets the user's demands. This project aims to use these two methods to control a robotic car from a long distance without using any physical contact.

I. INTRODUCTION

Automation and robotics have emerged as two of the industries with the most recent advances in research and development. In relation to technology, it continues to rise to the top of the list. Since industrial robots have to work at a rapid pace and with great accuracy, nearly all of them are autonomous. They serve as vital to our society's capacity to function. They limit human connection and manpower. Our project uses voice and hand gesture controls since these make controlling the robot easy and natural. It is straightforward to converse effectively and cordially with the robots without establishing them feel anything. Location neutrality is the primary benefit of having a mobile phone that can recognize voice commands to remotely operate a robot car. Robotic automatically remote control can be effectively made easier by smartphone applications. The idea of gesture control is reached with the use of a sensor and Arduino. Robots appeared to have an awareness of their own given that they have developed to the point at which they are able to mimic human conduct.

1.1 Literature Survey

[1] Single-Equipment with Multiple-Application for an Automated RobotCar Control System by Saleem Ullah, Zain Mumtaz, Shuo Liu, Mohammad Abubaqr, Athar Mahboob and Hamza Ahmad Madni (2019). This paper is deals about the innovative element of the proposed work in this paper the integration of greater functionalities into vehicles increase the complexity of car-controlling. The proposed system has capability to identity voice commands and makes them to move using Bluetooth technology. They have used two modes of transmission and controlling of the robot car. The first mode is to control a robot car with an android mobile application when the user presses the corresponding touch button in mobile application, a signal is transferred to the micro-controller that is attached to the car through the built-in mobile Bluetooth device motor module to move the wheels of the robot car accordingly to the received signal. The second mode is the hand-gesture system in that accelerometer first senses the acceleration forces from the

direction of the hand and sends them to the micro-controller that is attached to the hand. After receiving the data, micro-controller converts it into different angles, between 0– 450°, and sends it to the RF receiver of the Arduino Uno that is attached to the robot car through the RF sender. After receiving the signal, it will process the data and sends the signal to motor module to move the wheels of the robot car accordingly to the angles.

[2]Voice-Controlled Autonomous Vehicle Using IoT (2019) by Sumeet Sachdeva, Joel Macwana, Chintan Patela, Nishant Doshia. This paper deliberates about the concept of Internet of things which can be accessed by any others part of the world. In this project, the motor will be controlled using voice commands through google assistant in smartphones. To use the google assistant, they use the software called “IFTTT”. In this “IFTTT”, we can create the simple programs to control the devices.

[3] Design of Voice Controlled Smart Wheelchair (2015) by Ali A. Abed. The motivation behind the project to help the handicapped people and patients to control the wheelchair using voice commands. In this project, they use new component called “voice recognition board with HM2007”. This will enable the system to recognize different voices, inflections and enunciations of the target word so that it will recognize the different languages. More interesting part in this project, in order to not respond to some similar words spoken randomly in an environment, secret voice key is preferred to be a word with complex pronunciation in order to not pick up by others and also by utter the words twice in order to respond the system. The direction and velocity of the chair are controlled by pre-defined Arabic voice commands. They have controlled the direction and velocity of the chair by pre- defined Arabic voice commands. They have tested and successfully demonstrated with patients for utterance of Arabic words.

[4] Arduino Based Voice Controlled Robot Vehicle by M Saravanan et al 2020. This paper deliberates to create voice controlled robotic vehicle (VCRV) is to listen and act on the commands of the user. For that, they have developed the android app AMR voice for the voice control robot using MITA2 app. The developed app contains the option to connect to Bluetooth module and access the Bluetooth setting of the phone.

[5] Design and Fabrication of a Voice Controlled Wheelchair for Physically Disabled People by G, Azam and M T Islam (2015). . The authors have used CAD/CAE tools to eliminate the early flaws and to improve the quality of the wheels and their mechanism. With the combination of these mechanical and electrical parts, the manual wheelchair is turned to be an electrical wheelchair. They have utilized a PIC controller manufactured by Microchip Technology to control the system operations. They have programmed the assembly level code and stored in controller’s memory. In this project, they have developed a cost effective and efficient movable and easily controllable wheelchair that can be controlled via voice commands. By using PIC, they are controlling the motors and using voice recognition board to identify the voice commands. It was allowed to move in a straight line. In voice recognition board, we have to train the board to recognize the voice. There is no further add upon to their project, they have calculated the velocity that wheelchair with and without the load.

[6] Obstacle Avoidance and Voice Control Unit for Autonomous Car (2021) by MA Bhikule, MS, Mankame, MS Khot, MY Nhawkar. In this paper, the authors have done new approach in methodology they have included the obstacle avoidance to their project. when the user is commands move forward to the robot. But at the same time some objects are in front of robot. The robot can avoid the way and search another way to move on. They are using the ultrasonic sensor for detection of obstacle. The ability of the machine to receive and interpret the human voice or to understand and carry out spoken commands can be concluded as speech recognition.

1.2 Proposed Method

Robots are known to be helping and assisting humans daily. Here, we will be discussing the reduction of human interaction in the present pandemic situation. Our objective is to unite two systems—voice control and gesture manipulation—into a single robotic vehicle. This could have wide use across a variety of sectors include construction, healthcare, and quarantine facilities. The vehicle moves in that exact path when the transmitter recognises hand movements and sends signals to the receiver. In a similar way spoken commands can be converted to signal form using an Android application, recorded, and then communicated over Bluetooth to the robotic car. In addition to this, an ESP32 camera module is installed to help in surveillance purposes and advanced areas like face recognition and image processing.

1.3 Voice Recognition:

Any user can control the voice-controlled elements of the robotic vehicle only by voicing commands. The user's speech is then in tandem investigated by the voice module before being gathered up by the microphone. The speech module delivers the appropriate command messages to the robot's microcontroller when it recognises a particular request. At which, the microcontroller evaluates the command information it was given and conducts action that is required. Voice commands are captured by the mobile module and transformed into digital signals after they originate on the transmitter side. subsequently, the robotic vehicle obtains these electrical impulses via the HC-05. The car travels as the outcome of these commands being issued to the Arduino Uno's Motor shield, which is situated there, as well as the DC motors.

Working

SYSTEM ARCHITECTURE AND MODULE DESCRIPTION FOR VOICE CONTROL ROBOT: There are actually two aspects to how the voice-controlled robot works:

Smartphone: This smartphone will act as the microphone to input the voice commands to be transmitted through Bluetooth to the HC-05 Bluetooth module. This smartphone needs to have the AMR_Voice Application installed and paired to the HC-05 Bluetooth module. **Robot Car:** The whole robot car can be considered as the receiver part of the project. It has many components, which are described as below:

HC 05 Bluetooth Module: The HC-05 is a Bluetooth module that can act as a wireless trans-receiver via Bluetooth in between any Arduino microcontrollers and any Bluetooth supported device like a laptop or a smartphone. Here, the HC-05 receives voice commands from the smartphone. The microcontroller takes these instructions beyond that.

Arduino Uno: The ATmega328P microchip provides the base for this microcontroller device. Here, the voice commands are captured by this microcontroller, which subsequently sends them to the Bluetooth module and the L298N motor shield.

L298N H-Bridge Motor Driver: Stepper motors and DC motors can be powered with this high-power L298N motor driver module. This module consists of a 78M05 5V voltage regulator plus an L298 motor driver incorporated circuit. Up to four direct current motors can be controlled by this module, both in terms of direction and speed. We will be utilising this hack in our project to use the microcontroller's commands to power the DC motors.

DC Motors: A DC motor converts electrical energy to mechanical energy. . In our project, these DC motors are controlled by the motor driver module mentioned above. The DC input power for these motors to work is provided by batteries that are connected to the motor driver directly.

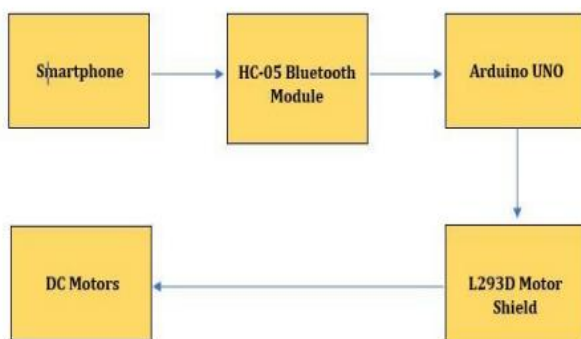


Fig. Block Diagram of Voice Control



Fig. Voice Control App

1.3 Gesture Controlled:

The gesture-controlled robotic vehicle moves according to the hand movements of the user because we place the transmitter on the hand glove. The transmitter on the hand glove also contains an accelerometer sensor and it gives an analogue output which is further converted to digital, and the signal is received by the receiver and further these instructions are sent to the motors using the motor drivers which finally makes the robotic vehicle move. When the user tilts the hand to the front side the robotic vehicle moves forward and continues to move in the same direction until the next command is given by the user. When the hand is tilted backward the robotic vehicle changes its present state and it starts moving in the backward direction until the next command is given. In the same way when the user turns the hand right side the robotic vehicle turns right till the next command. When the user tilts the hand to the left side the robotic vehicle turns left. And the robotic vehicle stops when the user's hand is stable. This way the robotic vehicle can be controlled

Working

SYSTEM ARCHITECTURE AND MODULE DESCRIPTION FOR GESTURE CONTROL ROBOT:

The gesture control robot mainly consists of two divisions **TRANSMITTER**: The transmitter part of the circuit will be transmitting 10 the command signals to the receiver part of the circuit. This whole process is done using the help of Radio Frequency, or RF in short. RF Modules are used widely in many consumer related applications such as garage door openers, wireless alarm systems, 6 industrial remote controls, smart sensor applications, and wireless home automation systems. This transmitted RF signal is then received by the receiver module, from where it is forwarded to the motor drivers, which in turn relay the commands to the motors attached, making the wheels move according to the commands. The module description for the Transmitter circuit is given below:

MPU6050: The Micro-Electro-Mechanical System (MEMS) MPU6050 has a 3-axis Gyroscope and 3-axis Accelerometer embedded. This helps in measuring of an object's acceleration, velocity, orientation, displacement, and several other motion-related variables. In our project, it serves to recognize movements of the hands and then send to the microcontroller the command signals that originate from these gestures.

Arduino Uno: The ATmega328P microchip provides the base on this microcontroller device. This microcontroller used here to receive the input gesture signals from the MPU6050 module and then relay them to the Trans receiver module.

nRF24L01 Wireless Trans-receiver module: The nRF24L01 The transmitting transceiver module features GFSK modulation for data transmission and is meant for use in the 2.4 GHz globe ISM frequency band. To increase range, we will also be using a mountable antenna that you can attach to the module in addition to the module it. With a 1000m range, this PA/LNA antenna is amazing. The command signals go to the receiver component through RF signals via this whole trans-receiver circuit. This module receives the input signals from the microcontroller and sends it to its counterpart in the receiver section of the project. **RECEIVER**: The transmitter portion of the circuit is going to relay gesture signal commands to the reception part. In the interest of demodulate or decode the original signal, the RF receiver has been tailored to receive the signal from the RF transmitter. The module description for the Transmitter circuit is given below:

nRF24L01 Wireless Trans-receiver module: To receive the RF signals sent as its counterpart in the transmitter circuit, we are going to utilize another trans-receiver module, just like in the transmitter circuit. The microcontroller collects these signals and analyzes them correctly.

Arduino Nano: Arduino Featuring virtually identical ATmega328P microchip, the Nano and Arduino Uno are very similar. The Arduino Nano and Arduino Uno both the same, with one difference that the earlier model is smaller. This microcontroller will be used during our project to relay the signals generated by the before talked about receiver module.

L298N H-Bridge Motor Driver: This L298N Motor Driver Module is a high-power motor driver module used for driving DC and Stepper Motors. This module consists of an L298 motor driver IC and a 78M05 5V regulator. Up to 4 DC motors can be controlled with directional and speed controls In our project, this module will be receiving the commands that are relayed to it from the microcontroller, and then are conveyed to the motors, which move according to the gesture instructions received.

DC Motors: Electrical energy is converted to mechanical energy by a DC motor. These DC motors in our project are administered by the already mentioned motor driver module. Batteries that are connected directly to the motor driver deliver the DC input power that's required for these motors to run.

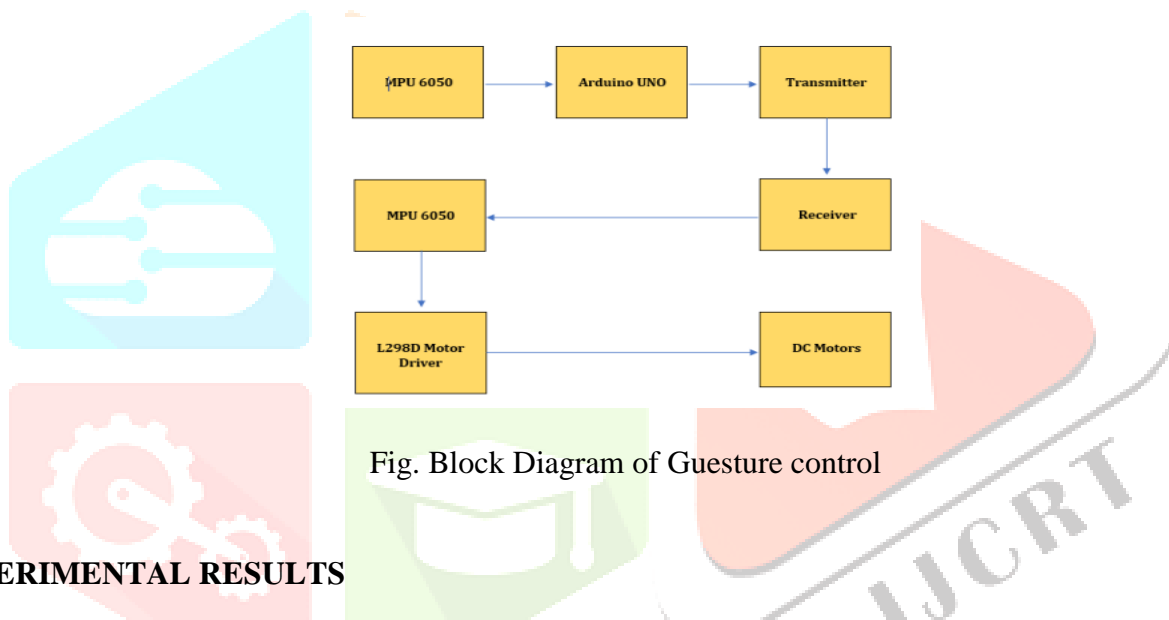


Fig. Block Diagram of Gesture control

EXPERIMENTAL RESULTS

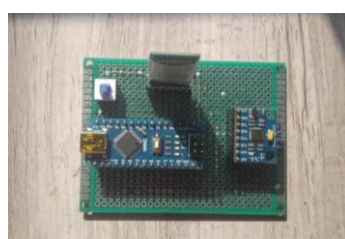
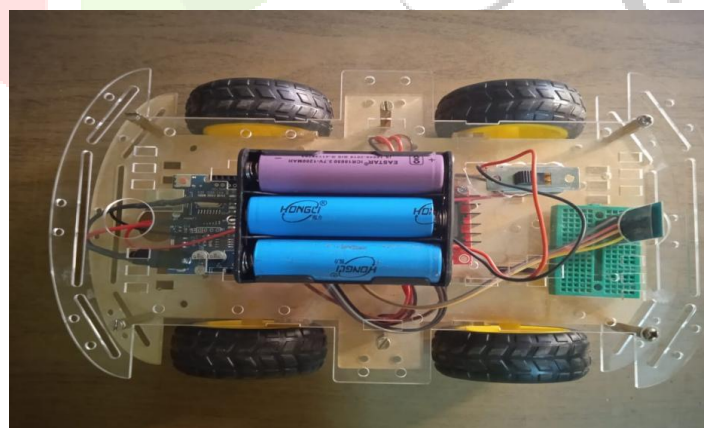


Fig. Experimenta Setup

CONCLUSION

As a result of this, the robotic vehicle could be commanded by words or gestures, enhancing its usefulness in the current global epidemic scenario. With this method, we will be able to control without fear of contact and minimize unwanted human contact wherever it occurs. As closely following the autonomous vehicle involves a substantial risk of virus transmission, wi-fi integration will provide a greater range than the formerly used Bluetooth module. Decreasing human presence in areas including hospitals and quarantine zones would be significantly helped by this.

REFERENCES

- [1] <https://www.ijitee.org/wpcontent/uploads/papers/v9i2/B7185129219.pdf>
- [2] https://www.researchgate.net/publication/333894884_GESTURE_CONTROL_ROBOT
- [3] <https://www.ijert.org/hand-gesture-controlledrobot>
- [4] https://www.google.co.in/amp/www.instructables.com/id/Wi-Fi-Voice-Controlled-Robot-WithNodeMCU/%3famp_page=true
- [5] <https://circuitdigest.com/microcontrollerprojects/accelerometer-based-hand-gesturecontrolled-robot-using-Arduino>
- [6] IOT (Internet of Things) Programming: A Simple and Fast Way of Learning IOT Kindle Edition by David Etter (Author)
- [6] Deepak Kumar Lodhi et al, International Journal of Computer Science and Mobile Computing, Vol.5 Issue.5, May- 2016, pg.no 433-438.

