JAET

Journal homepage: http://jae-tech.com

Journal of Applied Engineering & Technology

ISSN : 2523-6032 ISSN-L : 2523-2924

Design of Voice-Controlled Robot Vehicle

Najamu uddin Sohu[1], Akash Manwani[2], Jatendar Dhirani[3], Aisha Baloch[3], Rashid Hussain Wassan[4]

[1]College University (GCU), Hyderabad, Pakistan

[2]Department of Electronic Engineering, Mehran University of Engineering and Technology, Jamshoro, Pakistan.

[3] NCRA Lab, Mehran University of Engineering and Technology, Jamshoro, Pakistan

[4]Department of Software Engineering, Mehran University of Engineering and Technology, Jamshoro, Pakistan.

*Corresponding Author: Najamu uddin Sohu
DOI: https://doi.org/10.55447/jaet.06.01.95

Abstract: One of the systems that is frequently used in both industrial and residential settings is the robot controlling system. The goal of this project is to create a voice-controlled robot car that can wirelessly control the mobility of a vehicle from a remote or distant place. The system is both hardware and software based; the hardware comprises of an Arduino UNO boards, an Radio Frequency (RF) Module, and motor driver modules. To drive the robot car from a distance, the transmitter and receiver sides are programmed using the Arduino IDE and connecting with a personal computer and microphone. A GUI is constructed using Visual Studio. The Arduino UNO board on the robot car receives commands through the RF module and does tasks like as going forward, backward, right, left, and stopping. This project will make it easier and more comfortable to operate robot cars in industrial and hazardous environments to conduct various duties.

Keywords: Arduino, RF Module, DC Gear Motors, Wireless, Robot Car, Voice Controlled

1. Introduction

In this paper, the immediately tackle a fundamental problem in both residential and industrial robot motion control. The movement of the robot car is controlled by human speech via wireless communication. Microsoft Visual Studio is the programmed used to design a graphical user interface (GUI) to control the mobility of robot vehicles from a base station using wireless connectivity. This project combines hardware as well as software. The hardware system contains Arduino UNO Board linked to PC through a USB connection; this interface is accomplished using Microsoft Visual Studio. The Arduino Board is also interfaced to a 433MHz RF transmitter. A microphone is connected to the

Corresponding author: *sohunajam012@gmail.com*

PC for voice control. The robot car is composed of a chassis for the vehicle and four DC gear motors that are managed by an Arduino board using IC L298. For wireless connection, the Arduino UNO Board is additionally connected with 433MHz RF receiver. Giving a command by human voice through a microphone causes the DC Gear motors to rotate clockwise or anticlockwise to achieve the goal. Robot cars can do fundamental activities such as moving forward, backward, right, and left, as well as stopping.

2. Design Implementation

2.1 Block Diagram

The block diagram depicts how the system is built and operates. When a user offers a command through the microphone, the GUI sends the command to the Arduino Board through the USB port, and the Arduino UNO Board sends the signal to the RF transmitter module, which transmits the signal in radio waves. On the robot vehicle side, the RF receiver module receives the signal and delivers it to the Arduino UNO board, which processes it and provides the instruction to the motor control module, which controls the DC gear motor to conduct the desired function.

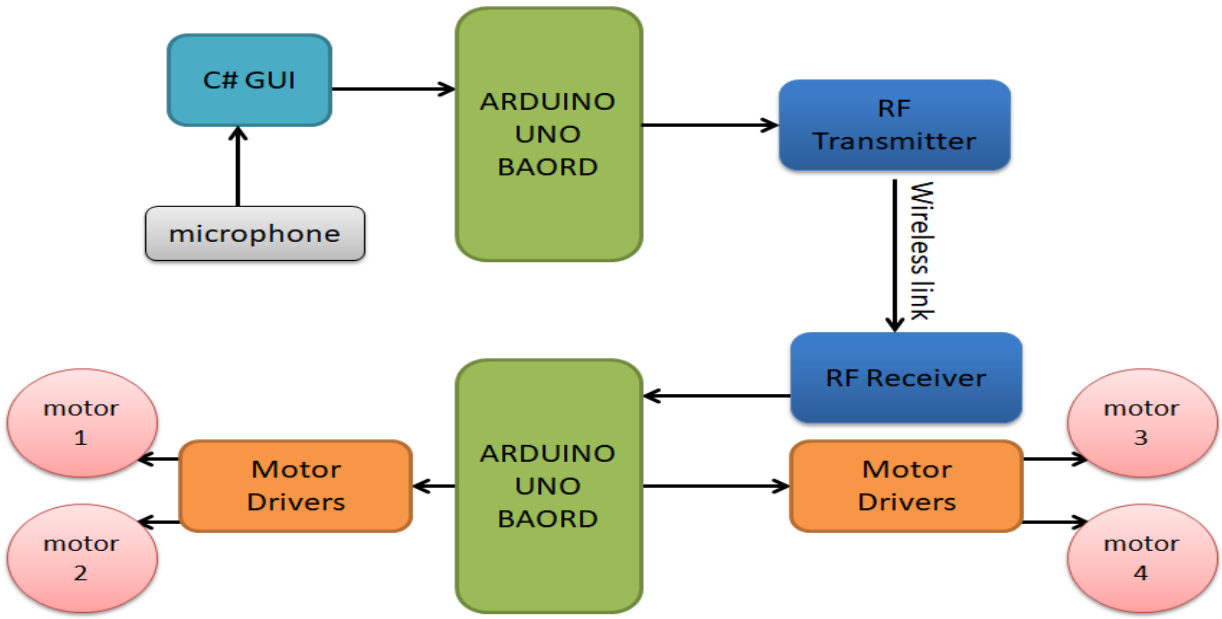

Fig. 1 – Block Diagram of the Designed System

2.2 Circuit Design

The circuit is divided into two parts: a base station and a robot vehicle in a remote area. The base station has a PC using a graphical user interface that is linked with a microphone and an Arduino board through a USB wire. The Arduino is also linked to an RF Transmitter Module. The RF transmitter's data pin is linked to digital pin 2 of the Arduino board. A frame with four wheels and four DC gear motors make up the robot vehicle. The car is equipped with an Arduino board that is interfaced to a battery, four DC gear motors, an RF receiver, and a 7809 regulator IC through motor drivers. Data pin 2 of the Arduino board is wired to the data pin of the RF receiver. The Arduino UNO board's digital pins 4 and 5 are connected to the motor driver for the first motor, the second motor driver to digital pins 6 and 7, the third motor driver to digital pins 8 and 9, and the fourth motor driver to digital pins 10 and 11. Through the use of a 7809 regulator IC, a 12 volt battery powers the Arduino.

3. Project Hardware and Software

The project is divided into two sections: hardware as well as software. The hardware includes an UNO Arduino Board, an RF Module, motor driver module, a battery, and regulator ICs, while the software includes Microsoft Visual Studio with the C sharp programming language and the Arduino IDE.

3.1 Major Hardware Components

Based on the Microchip Atmega328P microprocessor, the Arduino UNO is an open-source microcontroller board manufactured by Arduino.cc. In line with the programming code, Arduino accepts user-supplied instructions [1]. It only supports voltages between 7 and 20 volts, however it can be powered by USB or an additional 9-volt battery.

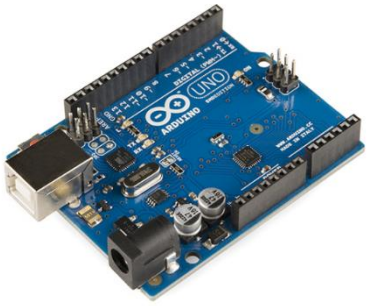

Fig. 2 – Arduino Board used in the designed system

This L298N-based Motor Driver Module: The motor direction and speed may be readily controlled using this L298N Motor Driver Module, which is a powerful engine drive that works well for controlling DC motors [5]. It can operate on 5 volts and give dc motors 12 volts.

Fig. 3 – LN298N Motor Drive used in the system

RF 433MHz Module: The radio frequency used by the RF module has a frequency range of 30 KHz to 300 GHz. The Amplitude Shift Keying (Ask) technique is used. There are two components to this module: a transmitter and a receiver. The Arduino UNO board may communicate through wirelessly with other Arduinos or RF-controlled devices thanks to the RF module.

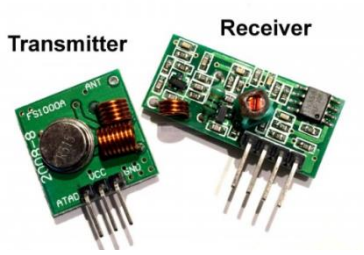

Fig. 4 - RF Transmitter and Receiver Module used in the system

DC Gear motor: Direct current electrical energy is converted into mechanical energy via rotating electrical devices known as motors [1]. The fact that DC motors have a method for adjusting speed and direction is their main advantage [7]. The benefit of gears with motors is that torque may be increased at lowest speeds [5].

Fig. 5 - DC Gear Motor used in the system

Microphone: An instrument that converts sound waves into electrical impulses is a microphone. This signal has the option of being digitally turned into a signal that can be processed by a computer or other digital device, or it can be amplified as an analogue signal.

Fig. 6 - Audionic Microphone used in the system

Battery: The project makes use of a 12V nickel-metal hydride (Ni-MH) battery to power the hardware components.

Fig. 7- NiMH 12V Battery used in the system

4. Software Requirements

4.1 Microsoft Visual Studio

Microsoft Visual Studio is a Microsoft integrated development environment (IDE) [8]. It is a programming environment that supports numerous languages, including C, C++, C#, and others, as

well as interaction with hundreds of hardware devices and hundreds of built-in libraries for a wide range of applications [8].

4.2 Arduino IDE

Open source software is used to build programmes and upload them to the Arduino board [1]. It is a multi-stage application written in C and C++ [5]. The Arduino IDE includes a text editor for writing code, a message box, a text terminal, a series of menus, and a toolbar with buttons; programming codes are referred to as sketches [1].

4.3 Set up the development environment for the system. Speech

Both Windows Vista and Windows 7 include built-in speech engines. The Scheme. The speech managed-code namespace in the.NET Framework allows access to Microsoft's voice synthesis and recognition technologies in Windows [9]. This allows you to utilise the voice command with a PC-attached microphone.

4.4 Working Mechanism

The block diagram of a simple voice-controlled robot vehicle depicts a base station and a robot vehicle. A PC with a graphical user interface and a microphone comprise the base station. Using a microphone, the GUI recognises voice instructions to run a robot car and sends them to the Arduino UNO board, which is connected to the PC through a USB connection. Before delivering the GUI instruction to the RF transmitter, the Arduino UNO assessed it. The RF transmitter generates a radio wave signal as instructed by the Arduino UNO. vehicle-mounted robot An RF receiver is linked to the Arduino UNO board. After being picked up by the base station's RF transmitter, the radio signal is delivered to the Arduino UNO board by the RF receiver. The Arduino UNO board controls and runs the motor by reacting to radio signals from the base station with high-frequency impulses to the motor drivers. The motor drivers govern the rotation of the motors in line with the instructions given by the Arduino UNO board and deliver 12 volts to the dc gear motor. The robot-vehicle can therefore go forward, backward, right, left, and stop using voice instructions.

Because the robot vehicle is compact, less room is needed. Since the robot vehicle and PC are connected by an RF module, we may access the robot car from a distance of a few metres, it has minimal energy use. Simple to use as a voice-activated control. The application of the research work is based on some real-time applications of voice-controlled robot vehicle are:

- The robot is beneficial in locations that are hard for people to access but that RF waves can. For instance, during fires, in extremely poisonous environments, or in tiny pipes.
- The robot can be employed for observation or research.
- Use the equipment and appliances' controls.
- Security system using voice and speech recognition.
- Using vocal commands sent through a microphone, a novice driver may simply operate the voice-controlled robotic automobile.

5. Result and Discussion

The outcome of this project is simple, voice controlled robot which moves forward, backward, right, left and stop. The GUI gives the command to Arduino Board which sends command to the Arduino of robot with the help of RF module wirelessly. The Arduino on robot receive the command wirelessly with help of RF Receiver and Arduino gives the instructions to the motor drive to control

the motion of robot. For the different commands the some motors are ON and some remains OFF or some in clockwise and some are in anticlockwise rotations.

Table 1 – Outcome of the designed system and Task perform by Robot Car

Voice command	Rotation of Motors	Action
Forward	1, 2 Motors moves clockwise and 3, 4 Motors anticlockwise	Robot car moves in forward direction
Backward	1, 2 Motors moves anticlockwise and 3, 4 Motors clockwise	Robot car moves in Reverse direction
Left	1, 2 Motors moves clockwise direction only	Robot car turns left side
Right	3, 4 Motors moves anticlockwise direction only	Robot car turns Right side
Stop	All motors stop rotation	Robot car stop doing current action

Fig. 8- Base Station for Voice Controlled Robot Vehicle

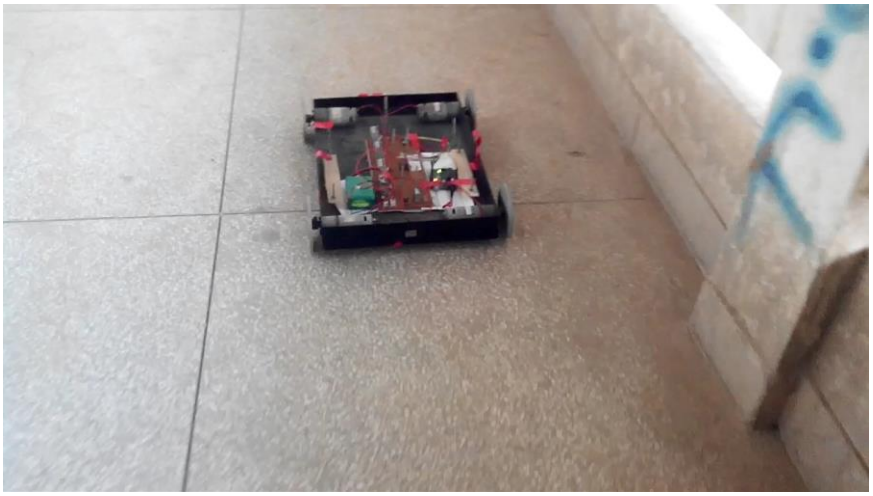

Fig. 9- Voice Controlled Robot Vehicle

The results we are able to obtain via the design and execution of our suggested system are as follows:

- The user may speak orders such forward, backward, right, left, and stop to operate the robot car. The robotic vehicle makes forward, backward, right, and left movements before stopping what it is doing.
- The GUI must receive the voice command using a microphone connected to the PC.
- The NET Framework, which gives Windows users access to Microsoft's voice recognition and speech synthesis capabilities, performs speech recognition.
- The speech recognition system accurately recognises voice commands with a 75% accuracy rate.
- The robot car's microcontroller decodes these orders and delivers the proper instructions to the motors linked to the vehicle.

6. Conclusion

Our project's planned work demonstrates how RF modules may be used to drive a robot. Voice commands are successfully conveyed across radio waves, causing the required actions to take place. This work requires less human resources in situations where human interventions are problematic. For those with disabilities, its voice recognition technology is simple and helpful. Robot vehicles with low power requirements and strong torque are powered by DC gear motors.

7. Future Recommendation

In order to increase the effectiveness of speech recognition, effective devices with little environmental interference should be utilised together with appropriate programming methods. By designating a decoder to each receiver, a single GUI base station may wirelessly manage a variety of robot vehicles. When a command is sent through an encoder, the appropriate decoder will decode it and carry out the action. The robot vehicle may be developed to carry out additional activities in dangerous environments, such as picking up and dropping off items, and it can employ a variety of sensors to gather data on temperature, pressure, gas detection, etc.

References

[1]. G. Anandravisekar, A.Anto Clinton, T. Mukesh Raj, L. Naveen, M. Mahendran “IOT Based Surveillance Robot”, International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181, Vol.7 Issue 03, March-2018.

[2]. Gade Haripriya, Yasa Divyavani, Aitha Rasagnya Devi, M.Sravan, Kumar Reddy, “Arduino Based Voice Controlled Robot”, Complexity International Journal (CIJ) , Volume 25, Issue 01, ISSN: 1320-0682, March 2021.

[3]. Abhinav Salim, Ananthraj C R, Prajin Salprakash, Babu Thomas, “Voice Controlled Robotic Arm”, International Research Journal of Engineering and Technology (IRJET), volume 04, Issue 02, April-2017.

[4]. Humayun Rashid, Iftekhar Uddin Ahmed, Sayed Bin Osman, Qader Newaz, Md. Rasheduzzaman, S M Taslim Raza, “Design and Implementation of a Voice controlled Robot with human interaction ability”,

International Conference on computer, communication, chemical, materials and electronic engineering, 2627 January, 2017.

[5]. Shubh Srivastava, Rajanish Singh, "Voice Controlled Robot Car using Arduino", International Research Journal of Engineering and Technology (IRJET), volume 07 Issue 05 May 2020.

[6]. Mrs. J.Aruna Jasmine, Mr. J Richard Jim Reeves, Mrs. Daya Mary Mathew, "Design of an IOT based Autonomous Vehicle with the Aid of Computer Vision", International Journal of Scientific & Engineering Research Journal, Volume 10, Issue 11, November 2019, ISSN 2229-5518

[7]. Sumeet Schdev, Joel Macwan, Chintan Patel, Nishant Doshi, " Voice Controlled Autonomous Vehicle using IoT", 3rd International Workshop on Recent Advances on Internet of Things: Technology and Application Approaches (IoT-T&A 2019), November 4-7 Coimbra, Portugal.

[8]. Sayed Mazhar Ali Shah. (2021), "Multi-Way Controlled Robot Vehicle Using Arduino and RF Module," Journal of Applied Engineering & Technology (JAET), Vol. 5 No. 1 (2021), Print ISSN: 2523-6032, Online ISSN: 2523-2924, pp. 1 – 8.