

Arduino Based Voice Controlled Robotic Arm and Wheels

Sowmiya Bharani B¹, Sujith K V², Tanushree S³, Yashaswini Tamba⁴

¹School of Electronics & Communication Engineering, REVA University, (India)

²School of Electronics & Communication Engineering, REVA University, (India)

³School of Electronics & Communication Engineering, REVA University, (India)

⁴School of Electronics & Communication Engineering, REVA University, (India)

sowmiyabharani@reva.edu.in¹, sujithkv3134@gmail.com², tanugowda181@gmail.com³,

yashaswinitambe@gmail.com⁴

Article History: Received: 11 January 2021; Revised: 12 February 2021; Accepted: 27 March 2021; Published online: 23 May 2021

Abstract: The present day world is all about various types of technology which has paved the way for multi-functional devices. The one application of technology is automation. Automation deals with technology, programs, robotics to achieve outcomes with minimal human input. Robotics include designing, construction, operation and use of robots. Most robots are used to do repetitive actions, work in hazardous environment and in medical fields too. This kind of robots can also be used in present pandemic situation. Here, a system is being proposed which is a robot with its arm and vehicle moving in a particular direction to place things from place to place. The movements of this robot is controlled using voice commands. The voice commands are received by the android application. The android application and the robotic wheels and arm are associated using a Bluetooth module. This voice commands are further processed using Arduino UNO. Arduino UNO which works as the brain to this project process the voice commands to perform suitable action.

Keywords: Automation, Arduino UNO, Bluetooth Module, Stepper Motor, Servo Motors.

1. Introduction

Technology is developing at a faster rate in this modern era. There are number of new technologies, equipment and machineries etc. which do make things easier. Robots are one among them. Robotics is becoming the most needed and advanced in the field of technology. Designing of Robots according to the desired purpose, their manufacture and applications comes under robotics. The main attraction of this kind of technology in the modern era, since they can be implemented with less cost, in the manufacturing industries it reduces the human labor, perform tasks with more precise than a experienced worker [1]. Not only in the manufacturing industries this kind of Robots work in dangerous environment where the risk for the human life is more, in medical field for example in the present COVID-19 pandemic situation. They can be used to serve medicine and other requires things using high end model. In the earlier days the robots were controlled using remote, mouse or any wired devices. Wired devices can be operated only within the short range depending on the length of wire. In case of increasing the length of wire the cost per production also increases. Sometimes due to various reasons the wire may damage and leads to miss communication between Robot and operator. Here is a system which will act automatically when the voice command is reached. This voice commands ensures the various operations that is to be performed by the Robot. The system is implemented using Arduino UNO. Arduino is an open source which is easy to use both in terms of hardware and software. Arduino UNO is interfaced with Bluetooth module HC-05 which act as a receiver and read the input voice commands send to transmitter section which is nothing but Arduino UNO. The voice commands are processed to drive the motors of robotic vehicle and arm and required tasks are performed.

2. Related works

[2] Robotics is becoming the most needed and advanced in the field of technology. Designing of Robots according to the desired purpose, their manufacture and applications comes under robotics. This kind of Robots can work in dangerous environment like collecting, packing and disposing radioactive waste, in contaminated dusty places, places where the risk for human life is more. [3] In this paper the robotic arm and vehicle is implemented using 8051 microcontroller which is controlled using voice commands. The Bluetooth receiver receives the voice commands from the android device to make robotic arm vehicle operate as per commands. The Bluetooth receiver is interfaced with 8051 microcontroller. [4] The main content in this is that the paper presents a robotic vehicle with 2 wheels and a gripper to pick and place an object from one place to another place using Arduino board. The paper called the robot as rescue robot which can work in disaster region by helping human. [5] presented a voice based robotic arm. This system allow the user to control the actions of robotic arm using voice commands operated via android application. The Arduino UNO is used to control the motors of robotic arm. Bluetooth module was used to send the voice commands from android application to the Arduino

Board .this system gives idea about to control the Robert using voice commands.[6] designed and implemented a pick and place robotic arm. This robotic arm is remote operated using android application. The Robert is moved in either forward, backward, left or right etc. when commands are sent via android application device. Four DC motors are interfaced with microcontroller, two of them are used for arm and other two for gripper movement of Robert. This design was simple with minimal control strategy. [7] This paper presents Android Mobile Phone Controlled Bluetooth Robot Using 8051 Microcontroller. They have developed a remote button in android app using which they can monitor the motions of Robert. To interface controller and android Bluetooth communication is used. [8] Provided a strategy which can be used to control a robot vehicle through speech inputs. The speech recognizer is done by Android application using smart phone which makes communication with the robot using Bluetooth Connectivity.

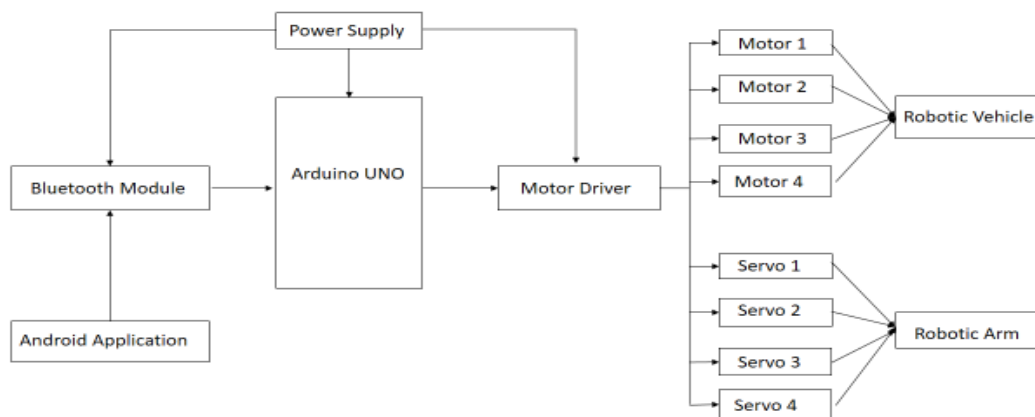
3. Design of robotic arm

The main reason to design this kind of Arduino Based Voice Controlled Robotic Arm and Wheels is that, this Roberts can work in dangerous environment like collecting, packing and disposing radioactive waste, in contaminated dusty places, places where the risk for human life is more. This Roberts can also lift very heavy objects, performing the same motion repeatedly etc. here in this project there are two main section hardware and software. Hardware which gathers physical components of system, software ensures signal processing by encoding the computer instruction.

4. System Design

The system design consist of mentioned Fig-01. The voice commands are recognised by the android application. Processed and sent to the Arduino board via Bluetooth module. The voice commands as to match with the predefined commands.

Fig-1 Schematic representation of system design



The proposed system allow us to controlling the robot arm and vehicle by an android device using voice commands.The Arduino UNO which is a brain of the system is integrated with bluetooth device that helps to recognize and read voice commands. The robotic arm and vehicle then operates as per the voice command received via android application. For this Arduino UNO is used in the system which makes it possible to operate the robot arm and vehicle via android app. The controle device used here is a android based smartphone etc.

Command	Response
Forward	Vehicle moves in forward direction
Backward	Vehicle moves in backward direction
Left	Vehicle moves in left direction
Right	Vehicle moves in right direction
Up	Arm moves in upward direction
Down	Arm moves in downward direction
Open	Wrist opens
Close	Wrist close
Stop	System stops operating

Table-1 Commands and its responses for Robotic Vehicle and Arm

Table-1 consist of commands and its responses. The voice command listed above was tested for robotic vehicle and arm movements using the android AMR voice command application. All commands responded accordingly to the system. At the receiver side the Bluetooth module HC05 was synchronized with transmitter which is nothing but an android application. Bluetooth synchronization was obtained for various ranges. Maximum range that was obtained around 8.5m -12m depending up-on the location.

5. Hardware Section

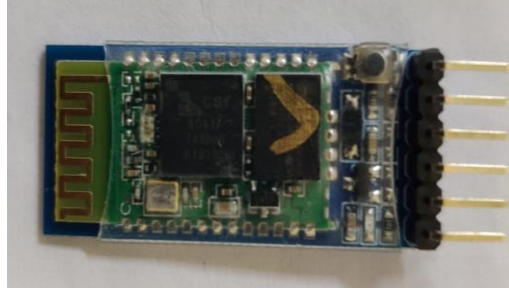
Hardware implementation consist of Arduino Uno, HC-05 Bluetooth module, DC motors, Servo motors, L293D Motor Driver Shield for Arduino, robotic arm.

Arduino UNO: Arduino UNO is a circuit boards which make microcontroller easy to use. Arduino UNO uses series of microcontrollers called AT mega AVRs. It as inbuilt power pins, digital input and output pins (pin 2 – pin 13), analog input pins (pin A0 –pin A1). Pin 0 and Pin 1 are named RX and TX respectively for receiving and transmitting serial data which can be used to send and receive data from GPS module, Bluetooth module, Wi-Fi module etc. in this project Arduino UNO acts as a brain to control the actions of Robot.

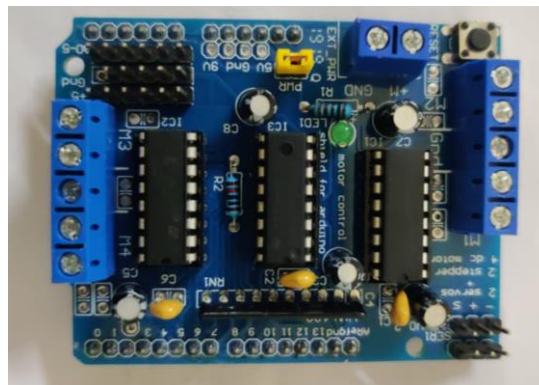


HC-05 Bluetooth Module : Bluetooth modules are easy to use which are designed for transparent wireless serial connection setup. This bluetooth modules are interfaced with controllers or PC which make serial

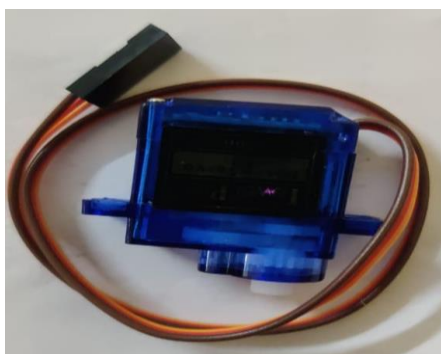
communication easy. In this project HC-05 bluetooth module is used which makes interface between android application and controller where voice commands are received, encoded and sent. At the receiver side it decodes the received data and sent to arduino board to drive the motors using motor driver shield. HC-06 can work only as a slave while HC-05 can perform both task i.e., slave as well as work as master thus it can accept connection from other devices and can also provide the connection to other devices. In this project, we are using it in slave mode, which means it will accept the connection from the android application.



Motor Driver Shield : Motor driver interfaces between motor and control circuits. It is a dual H-bridge motor driver Integrated Circuit. They are generally used in mechanics and robotics. It acts as an interface between motor and Arduino microprocessor in the circuit. The controllers are not that efficient in terms of current to drive the motors as they require high amount of current. Motor drivers take low current control signals from controllers and convert them into high current signals sufficient to drive the motor. Motor driver shield L293D for arduino is used using this we are able to control 4 DC motors, 2 servo motors.



DC motor and Servo motor : Four DC motors are used to control the movements of robotic vehicle and servo motors are used to control the actions of robotic arm. Servo motors is a closed loop mechanism that incorporates positional feedback in order to control the rotational or linear speed and position. DC motors can rotate all around 360° where as servo motors can rotate 180° which more precise and efficiency.



Software section

The bluetooth module is paired up with android application. The voice commands are recognized by the android application. The voice commands are converted into text form that as to be matched with the predefined commands. Predefined commands are used to control the specific action of robot. In a noisy environment, the

success rate significantly decreases than in a quiet environment. Speech Recognition works best if the receiver is near the client.

6. Conclusion

In this paper we have implemented a Arduino Based Voice Controlled Robotic Arm and Wheels which can be moved to the desired places with in a range to pick and place certain objects. The systems can be operated using voice commands where the robotic vehicle can move in forward direction, backward direction, left direction and right directions and the arm can pick objects from one place and place to the desired places. We can use this type of system in hazardous environment like collecting, packing and disposing radioactive waste, in contaminated dusty places, places where the risk for human life is more. This Robots can also lift very heavy objects, performing the same motion repeatedly etc. The above system is implemented in a cost friendly manner using Arduino UNO as a brain of the system. Arduino is a new operating system which is open source and easy to learn. Programming Arduino UNO is made user friendly by Arduino IDE Integrated Development Environment. IDE is software building application which combines common developer tools into a single graphical user interface. The proposed system is operate within a Bluetooth range of certain metres. The range be expanded using Wi-Fi modules.

References

1. Hilmii K&AhmetV, "Design of Voice Controlled Vehicle", International Conference on Advance Automotive Technology Yildiz; Technical University; Istanbul; Turkey(2016)
2. Dhalyope I, Shalihu ASA, Alka NSU, HarunaA, "Voice Controlled Pick and Place Robotic Arm Vehicle Using Android Application" American Journals of Engineering Research (AJER)-ISSN: 2320-0936 Volume-6, Issue-
3. Tahir Shaikh, Sanjay Guptha, Arthi Gadagey, Athula Menon, Assistant Professor Tilottama Deore, "Voice based robotic arm vehicle", International Journals of Innovations Science and Research Technologies ISSN No:-2456-2165 Vol-3, Issue-3, March (2018)
4. Professor C.S. Amol JBhosale, ty Pawar Harshad, Jagtap Amol, Kambel Dnyaneshwar, "Voice Controlled Robot using Arduino pick and place objects", International Journals of Innovative in Engineering Research and Technologies [IJIERT] Vol-4, Issue 6, June (2017)
5. Sharavanan M, Selva Babhu B, Anandu Jayan, Angitha Anandgand Ashwin Raj, "Arduino based Voice Controlled Robot Vehicle", IOP Publications Conf. Series: Material Science and Engineering 993 (2020) 012125
6. Barat Shreshth Awasti, Sabya Sanci Pandey, Ashish Singh, Patil M v, "Robotic Arm Wirelessly Controlled by Android Application", International Journal of Engineering and Technological Research (IJETR) Volume-3, Issue-6, June (2015)
7. Rithika & Khush Narender, "Android Mobile Phone Controlled Bluetooth Robot Using Microcontroller 8051", International Journals of Scientific Research and Engineering (IJSRE), Volume-2. ISSN: 2347-3878
8. Yharis, Imaduddin, Mohammad, Sharmad, Mhoezul "Speech Recognition System for Voice Controlled Robot with Real Time Obstacle Detections and Avoidances", International Journals of Electricals Electronics and Data Communications, Volume-4, ISSN: 2320-2084.
9. Vairavan R, Ajith SS, Shabin AS, Godwin C Joshe "Obstacles Avoidance Robotic Vehicle using Ultrasonic sensor and Arduino Controller", International Research Journal of Engineering and Technology Volume-05 Issue: 02 (2018)
10. Priya Ranjana, Abishek Khana, "Solar Powered Android Based Speed Control of a DC Motor via Secured Bluetooth", (2015) Fifth International Conference on Communication System and Network Technology.
11. Saikh Khaled Mostaque, Bishal Karmakar "Low Cost Arduino Based Voice Controlled Pick and Drop Service with Movable Robotic Arms", European Journals of Engineering Science and Research Volume-1, November (2016)
12. A REVIEW ON LAND USE LAND COVER CHANGE DETECTION, R.R. Joshi, P. P. Kabade, International Journal Of Advance Research In Science And Engineering <http://www.ijarse.com> IJARSE, Volume No. 10, Issue No. 03, March 2021 ISSN-2319-8354(E).
13. Steffan Mammen Thomas, Neema Andrew, Shukumar S, Sherin Jacobh, "Low-Cost Robotic Arm for differently abled using Voice Recognition", Proceedings of the Third International Conference on Trend in Electronics and Informatics (2019)

- ^{14.} “Speech reorganisation and its applications” in voice-based robotic control system, LuoZhizeng; ZhaoJingbing *Intelligent Mechatronics and Automations*” Proceedings (2004).