Arduino Based Voice Controlled Robot Vehicle

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Abstract

This project was developed in a way that the robot is controlled by voice commands. An android application with a microcontroller is used for required tasks. The connection between the android app and the vehicle is facilitated with Bluetooth technology. The robot is controlled by buttons on the application or by spoken commands of the user. The movement of the robot is facilitated by the two dc servo motors connected with microcontroller at the receiver side. The commands from the application is converted into digital signals by the Bluetooth RF transmitter for an appropriate range (about 100 meters) to the robot. At the receiver end the data gets decoded by the receiver and is fed to the microcontroller which drives the DC motors for the necessary work. The aim of Voice Controlled Robotic Vehicle is to perform the required task by listening to the commands of the user. A prior preparatory session is needed for the smooth operation the robot by the user. For the same a code is used for giving instruction to the controller.

Keywords: Robot, Design, Fabrication, Sensor, Automation

1. Introduction :

Our aim is to make a robot vehicle which can be controlled by the voice command of a person. Normally these types of systems are called as Speech Controlled Automation System (SCAS). Our design is a prototype of the above mentioned system. The idea is to create a sort of robot which going to be driven by voice commands. The robot is remotely controlled by a mobile phone; there are many articles that show the communication between a robot and smart phone. Smart phone is a very good interface for remotely automating the robot. It contains many features that can be helpful.

In this design, an android application with a micro controller is used for the required task. The connection between the application and the robot is facilitate with Bluetooth technology. The commands issued will be relayed over through the channel and will be received by the module. The objective of voice controlled robotic vehicle (VCRV) is to listen and act on the commands of the user. Here the system requires accent training, post which the device will start understanding the commands issued; and the commands have been added by codes.
The main motive to build a VCRV is to analyze the human voice and act according to the programmed commands. The most basic commands are backward, forward, right, left, and also stop the robot. The vehicle is to be controlled wirelessly with the use of android smartphone; our intention is to make a robotic vehicle with use of advanced smartphone technology in a very simple and economic way.

In current scenario vehicles are manually controlled and all are done by the person who is driving the vehicle. Every action like start and stop, applying brake, gear transmission, acceleration requires human effort. But nowadays new technologies have been developed that can be integrated with the conventional vehicles to new vehicle form. In the technology era, the space between the physical and the digital world is brought closer by the introduction of gesture concept. For all dangerous tasks, we prefer technology rather than people. Even though these robots are being controlled manually in the early stages, these can now be controlled via voice and gestures. This technology of gesture and voice recognition can be defined by the interaction between the computer and the body language of human beings. This constructs the communication link between technology and mankind. The target of this work is to upgrade the complete security to the robot and to simplify the controlling mechanism [1]. The voice directions are handled, utilizing an advanced mobile phone. The individual human right hand robot is created on a smaller scale controller based stage and can know about its present area. The viability of the voice control conveyed over a separation is estimated through numerous examinations. Execution assessment is completed with consequences of the underlying investigations. The developments to be forecasted are possibly referring to the applications in ventures, medical clinics and how, including the environmental laboratories [2]. Providing human labor is the biggest problem all over the world. With the help of this device, they can move in a wheelchair on their own by just giving voice commands through Bluetooth. If any obstacle is detected while moving it informs the user and stops. It also detects if any fire and smoke occur due to emergency, detects and informs the prescribed number to get the required help. A prototype is developed by incorporating all the features in a single module [3].

The hardware part consists of the mechanical design of the robot, the adequate choice of the motors, and the electronic devices to properly drive the robot joints. The software part contains the high level algorithms that convert the desired word to a sequence of target points, and the control algorithms that ultimately make the robot move according to the specifications. Here the writing mechanism is made by speech recognition technique. This speech recognition can be provided through either by using microphone or by using android applications [4]. Personal robotic assistants help to reduce the manual efforts being put by humans in their day-to-day tasks. The purpose is to implement a voice-controlled system as an Intelligent Personal Assistant (IPA) that can perform numerous tasks or services for an individual. This golem is specially designed for this cluster of individuals as its main purpose is to supply help to associate senior or disabled person [5]. This paper describes easy and simple hardware for implementation of Face, Object and speech detection and recognition. Using an online cloud server. The speech signal commands converted to text form are communicated to the robot over a Bluetooth network [6].

This paper describes Voice activation speaker recognition to regulate the Bioloid GP automaton by MFCC and DTW strategies is enforced well in automaton robots. The first step in the speech recognition process is feature extraction. In this paper, Mel Frequency Cepstrum Coefficient (MFCC) on the characteristic extraction process and Dynamic Time Warping (DTW) used have a feature matching technique [7]. It is to develop a robotic vehicle using Arduino and to controls the vehicle with the help of voice based information. The whole mechanism of the project is based upon the device namely Arduino. The feature of “hand gesture” helps it to move wirelessly depending upon the Radio Frequency, which is placed upon the hand of the user [8].

The voice command was given to the Android smartphone that converts speech to text and it communicates with the control unit through Bluetooth. When voice command reaches the control unit the robot should look for the object using a camera attached to it. The robot will rotate 360degree by taking a snap at each interval of time and the snap is analyzed. If the object is detected by the robot then it will calculate the distance between the object and robot [9] [10]. The four-wheeled voice assistant robot that is controlled by an android mobile phone is developed in this paper. The Voice Commands given by the user through the android mobile phone is transferred to the robot by Bluetooth network [11].

The article considers robot voice control software development. Program main window is displayed, as well as the recognition window, in which the operator can check the correct recognition and interpretation of voice commands. We consider the controls that are present on these windows. Control command structure is developed with a detailed description according to the prevailing grammar. To control the robot, it is necessary to compile a library of
words that the operator can input to achieve the set goals. The main elements of this library are discussed and defined through the article. To provide voice control, a sequence of actions is provided, which must be followed by the operator. Also, the commands that may be needed in the case of interactive correction of actions are considered [12]. The Android application (AMR – Voice) is connected to Bluetooth Module (HC – 05), which is directly connected to Arduino Uno R3. We give command to the robot and it performs work according to the given command. Voice Control Robot is much useful for those areas where humans can’t reach. Robot can work in all type of situations like toxic area, in fire situations, polluted area and also on hills. This robot is very useful for those who is physically challenged. This robot is very small in size so we can use this project for spying or espi
dial [13]. The Bluetooth module HC-05 will be interfaced with Arduino on the car for receiving the voice command. The Android app will be used for providing the specific command to the car. Now, on the receiving phase, a Bluetooth module HC-05 will receive the commands [14]. The main goal is to control the robotic vehicle in a desired position and also to control the robot by the voice or push buttons. Human Robotic Interaction is achieved. The goal of voice controlled Robot is to listen and act on the commands received from the user.

2. Materials and Methods

Modeling and designing of the VCRV was done by the following part available in the market and also the programming of the arduino was done and the app was developed by using app inventor on the internet.

2.1 Chassis

A chassis is the internal framework of the artificial object which support in its construction and use Direct inclusion in abstracting services. Figure 1. Shows chassis diagram.

![Figure 1 Chassis](image)

2.2 Gear Motor

A DC motor is a class of rotary electrical machine that converts t
direct current into mechanical energy. All types of DC motors have some kind of internal mechanism either electronic or electro mechanical, so it can change the direction of flow of current in path of motor periodically. The below Figure 2. Shows the Gear Motor.

![Figure 2 Gear Motor](image)

2.3 Wheels

A wheel is circular block of durable and hard material which is placed in axil about which the wheel rotates when a moment is applied by torque or gravity, thereby making one of the simple machines. When placed under a load baring platform, the wheel turning on the horizontal axil makes it possible to transport heavy loads Figure 3. Shows the wheel of this
voice control robotic vehicle.

Figure 3 Wheels

2.4 Adruino UNO Board

Figure 4 shows Adruino UNO is an open source micro controller board placed on the micro chip ATmega328p micro controller and developed by Adruino.cc. The board has 6 Analog pins, 14 digital pins programmable with Adruino IDE via a Type B USB cable. It can power by external main volt battery.

Figure 4 Adruino UNO Board

2.5 L298D Motor Driver

The L298 Driver is a high voltage high current dual bridge driver designed to accept standard TTL Logic levels and drive inductive loads. The emitter of the lower level transistors of each bridge are connected together to the corresponding external terminal can be used for the connection of an external sensing resistor Figure 5. Shows the L298D Motor Driver.

Figure 5 L298D Motor Driver

2.6 HC05 Bluetooth module

Figure 6. Shows HC05 module is a simple Bluetooth module is a simple Bluetooth serial port protocol module designed for wireless serial connection setup. It has a footprint as small as 12.7mm X 27mm. It will simplify the overall design cycle.
2.7 App Development

The application to control the vehicle was coded and created using app available on the Google play store known as MIT AI2 Companion. This app was developed by MIT Figure 7. Shows MIT AI2 App.

2.8 Android App Developed – AMR_VOICE

Figure 8. Shows Developed Android app with the help of the app we developed an app and named it as AMR_VOICE. The app contains the option to connect to Bluetooth and access the Bluetooth settings of the phone.

2.9 Connection Diagram

The block diagram of the voice controlled robotic vehicle is as follows. The Figure 9. Shows the connections in the circuit are made as per the following diagram.
3. Result and Discussion

Human voice is identified using a microphone in the android smart phone. This voice is analyzed and converted into English words using the android operating system codes and Artificial Intelligence software. Speech recognition is the inter-disciplinary sub-field of computational linguistics that develops methodologies and technologies that enables the recognition and translation of spoken language into text by computers. It is also known as automatic speech recognition (ASR), computer speech recognition or speech to text (STT). It incorporates knowledge and research in the linguistics, computer science, and electrical engineering fields.

From the technology perspective, speech recognition has a long history with several waves of major innovations. Most recently, the field has benefited from advances in deep learning and big data. The advances are evidenced not only by the surge of academic papers published in the field, but more importantly by the worldwide industry adoption of a variety of deep learning methods in designing and deploying speech recognition systems.

The Figure 10. Shows the assembly image for voice control robot using aurdino software. The project was completed according to the specification and needs. Simple movements can be controlled with the voice. The proposed system is basically based on Voice Controlled Robotic Vehicle helps to control robot through voice commands received via android application. The Voice Controlled Vehicle is controlled through voice commands given by the user who is operating the project. These voice command needs to be given through an android app which is installed on the users android mobile. Speech recognition is done within the android app and then a respective command is sent to the voice controlled robot vehicle. Microcontroller fitted on the Vehicle decodes these commands and gives an appropriate command to the motors connected to the vehicle.
The project has several advantages and some of the are discussed below:

- It can be developed into a real-world vehicle for transportation purposes.
- The robotic vehicle can be used where humans find difficult to reach but human voice reaches like in a small pipeline, in fire situations, in highly toxic areas etc.
- It can be integrated with wheelchairs for assisting disabled persons.
- It can be used to bring and place small objects.
- In military applications such as observation of enemy camp using cameras

4. Conclusion:

The “Voice Controlled Robotic Vehicle” project has many applications and in present and future. The project can be made more effective by adding features to it in the future. The project has applications in wide variety of areas such as military, home security, rescue missions, industries, medical assistance etc. We were successful in implementing a simple model of voice controlled robotic vehicle using the available resources. The implementation of this project is easy, so this robot is beneficial for human life. The Voice Control Robot is useful for disable people and monitoring purpose. It works on simple voice command, so it is easy to use. It is useful for those areas where humans can’t reach. The size of this robot is small, so we can use this robot for spying purpose. It can be used for surveillance. We can implement web cam in this robot for security purpose. The voice recognition software has an accuracy and for identify a voice command and it is also highly sensitive to the surrounding noise.

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