BLUETOOTH BASED VOICE CONTROLLED ROBOT

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***Abstract*—The purpose of robotics in commercial & residential intention has come to be quite essential for executing challenging work into more conveniently simple way. There are a lot of researches working on to enhance the connection between humans and robot. The paper presents the designing & development of a voice controlled robot using mobile phone based on Arduino Uno microcontroller. The control system of the robot movement will be employed by the voice and the robot will response the commanding persons by generating sounds of human voice instruction. The proposed system will be designed based on microcontroller which is connected to smart android phone through Bluetooth module for receiving voice command. The voice command is converted to text by an app of the android phone and sends necessary data to the microcontroller for controlling robot movement. After receiving the data the robot responses according to the command by performing proper movement to the proper direction according to the voice command. In arduino module consists of pre installed program in which particular instructions are programmed. After getting each command the robot will act according to the instruction .**

Keywords :Arduino Uno, HC-05 bluetooth module,amr voice app

I. INTRODUCTION

In this project a robotic vehicle operated by human speech commands has been designed. A robot is usually an electro-mechanical machine that is guided by computer and electronic programming[1]. Many robots have been built for manufacturing purpose and can be found in factories around the world. Designing of the latest inverted ROBOT which can be controlling using an APP for android mobile. And in which we use Bluetooth communication to interface Arduino UNO and android[2]. Arduino can be interfaced to the Bluetooth module though UART protocol. According to commands received from android the robot motion can be controlled. The consistent output of a robotic system along with quality and repeatability are unmatched. This robots can be re-programmable[3] and can be interchanged to provide multiple applications. In this project, the system operates with the use of a android phone Bluetooth device which transmits voice commands to an Arduino UNO to achieve this functionality. An ARM series microcontroller is used together with an Android Application for the desired operation[4]. The Android Application is connected to the Bluetooth module (HC-05) present on the Robot via Bluetooth. The commands are sent to the robot using push buttons or voice commands present on the android application.

II. TECHNOLOGY USED

The robot will be based on microcontroller Arduino Uno because of its versatile features along with numerous advantages which is based on Atmega328P and an open source platform with the benefit of physical computing. The system will utilize Bluetooth technology and Standard communication interface known as SPI interface. Bluetooth uses radio waves with safe, less power consuming device to connect and exchange data between devices without using of any kind of physical contact like wires and cable. SPI interface is a synchronous serial information process utilized by microcontrollers for interacting along with one or more peripheral devices swiftly through limited ranges[5]. There are two main applications that robot will be able to perform which are discussed below.

A. Movement control of the robot using voice command

The movement of the proposed robot will be controlled by the voice command of the user. The user will use an android operated smart phone to give voice command. The command can be fetched using an app which will convert the voice command into text. The phone will be connected to the microcontroller using a Bluetooth module. After conversation of the voice command into text, the app will send necessary data to the microcontroller using Bluetooth of the phone and microcontroller will receive the data using Bluetooth module[6]. According to the command, the robot will move forward, backward, left, right or fully autonomous. For driving

the robot there will be two geared DC motors with gripped tyre, which will be operated by the help of DC motor driver. A host Bluetooth device is capable of communicating up to 7 bluetooth modules at same time which is helpful.

B. Communicate with the user by talking while performing each command

To communicate with the user, the robot will be able to talk while executing a specific command. After power up the robot, it will greet the user and ask for command for performing its action. When user will command for any specific direction, the robot will be saying by generating voice record that the robot is moving for that direction and ask for next command. Until the robot will receive the next direction, it will continue to follow the previous command. Each command robot will receive, it will generate sound of every sentences defined for its each actions. As example, for backward command, the robot will say "The robot is moving backward".

III. PROPOSED SYSTEM

A. Functional diagram

The functional diagram of the proposed robot is shown in Fig 1. The central processing unit will be a microcontroller connected with an android operated smart phone via a Bluetooth module. It will be used to give voice command using an app and will convert the voice command into text as well as send the data to the microcontroller using Bluetooth.

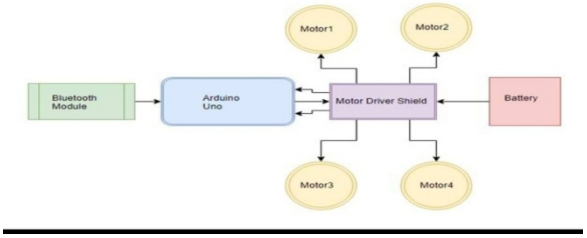


Fig. 1: Functional block diagram of the proposed robot model.

Motor driver will be required for controlling the movement of the robot and it will be operated by the microcontroller to control two different motor of left and right by controlling the direction of rotation of motors. An ultrasonic sensor will be interfaced to detect obstacle and help robot to operate full automatically. A EEPROM module in microcontroller for storing the pre-recorded instructions. 4 Digital output lines from Arduino L293D motor driver circuit.

B. Circuit Diagram

The circuit diagram of proposed system as shown in Fig 2, consists of Arduino Uno R3. Arduino Uno is an AVR ATmega328P microcontroller (MCU)-based development board with six analogue input pins and 14 digital I/O pins. The MCU has 32kB ISP flash memory, 2kB RAM and 1kB EEPROM. The board provides the capability of serial communication via UART, SPI and I2C. The MCU can operate at a clock frequency of 16MHz. In this project, digital I/O pins 2, 3, 4 and 5 of Arduino are configured as output pins. Pins 0 and 1 of Arduino are used for serial communication using two data pins known as RX and TX. Echo and trig pins of ultrasonic sensor will be connected to the digital pin of 7 and 8 of microcontroller.

Motor driver L293D has 16 pins where 4 pins are used to connect two DC motors and another 4 input pins are connected to the microcontroller for controlling the motors. Operational amplifier LM 358 and power amplifier LM 386 will be used to construct motor driver circuit.

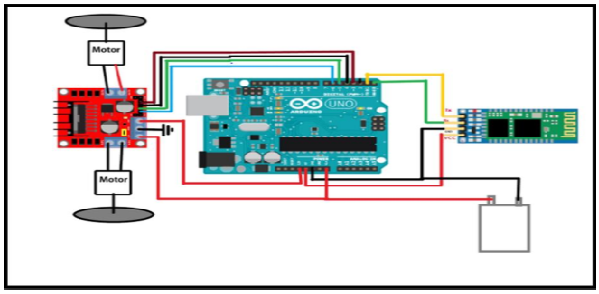


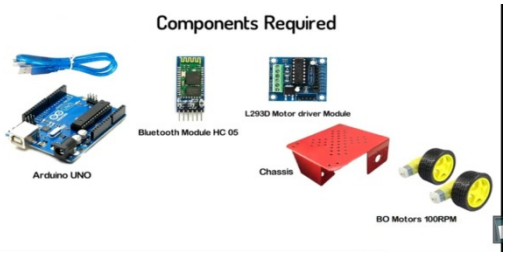
Fig .2: Circuit diagram of the the proposed robot model

IV. DESIGN AND IMPLMENTATION

Arduino controls the movements of the robot according to received commands. The robot moves forwards, backwards, left and right, and stops according to the voice commandsforward, backward, left, right and stop, respectively. The author's prototype of the voice-controlled robot is shown as below.

As we see in Fig 3, L293D motor driver is a dual H-bridge high-current motor driver IC. It is used here because digital pins of Arduino cannot source enough current to drive the motors of the robotic car. H-bridges are also useful in controlling the direction of rotation of a motor[7]. Enable pins 1 and 9 of the IC, being active high, are connected to 5V. Four output pins of L293D IC are connected to motors M1 and M2 on the receiver side.

RX of the Bluetooth module is connected to TX of Arduino Uno which is digital pin 1 and TX of Bluetooth module is connected to Rx of Arduino Uno which is digital The mobile application used, is programmed in such a way that the voice commands given to the handset are received by the micro-phone and these analog voice commands HC-05 Bluetooth module. HC-05 module is an easy-to-use Bluetooth Serial Port Protocol (SPP) module[8], designed for transparent wireless serial connection setup. Serial port Bluetooth module has a fully-qualified Bluetooth V2.0+EDR (enhanced data rate) 3Mbps modulation with complete 2.4GHz radio transceiver and baseband



(i) (ii)

Fig. 3: Implemented model view of proposed robot
(i) Motor driver circuit, (ii) Amplifier, Bluetooth and sonar sensor circuit

Download the application "BT VOICE CONTROL FOR ARDUINO" from Google play store and install it. First make sure your HC-05 Bluetooth module is paired with your mobile. The default password for pairing is "1234" or"0000". Check once you get started with the application, the Bluetooth of the mobile is automatically enabled. Click on "connect robot" option present in options menu. Now select HC-05 to get paired with the module. After pairing it is ready to use. Now click on the "MIC" icon and speak or instruct the robot verbal .When you speak "left" your speech gets recognized and converted into text. That text is transferred to robot through Bluetooth. The robot receives the string, decodes it and compares it with the Instructions that are described in the program and moves the robot in forward direction. The same in the case of Up, Left, Right, down, Stop.

V. SOFTWARE DEVELOPMENT

The microcontroller is programmed using Arduino IDE which is the official software based on C programming supplied from vendor and is used to program Arduino Uno.

Fig. 4: Descriptive diagram of model software
(i) Speech recognition (ii) movement and (iii) communication with user.

An android software is created that gets voice command information and transform into textual content utilizing google speech recognition technology. Fig 4 shows the process for Speech recognition, movement and communication with user. The android software is using google speech to text technology to convert voice command into to text and then the text is sent to the Arduino Uno. Arduino Uno is programmed to receive a textual command via Bluetooth and according to the command it is programmed to move forward, left, right, backward and stop.

VI. CONCLUSION

A. Speech Recognization Process & Movement of the Robot according to the Voice Command

By using the android app the textual content was transmitted to the Arduino using Bluetooth through mobile phone handsets which had built-in microphones to process the signal and the robot made movement according to voice command. The instructions utilized for the movement of the robot. The robot was able to move forward, backward, left and right according to the input given to L293D from Arduino Uno which gave input according to the command received from user. If user gave the voice command "autonomous" the robot started moving autonomously without hitting any obstacle. The avoidance of the obstacle was guided by the ultrasonic sensor which was able to senses the obstacle. Then it gave command to microcontroller to move in such a way so that the robot did not face any obstacle on its way.

B. Interaction with User by generating human voice

Speaking ability of the robot was developed using the pre written program in c in which pre-defined functions are given to control with respect to human voice on the following robot as shown in Fig 5.

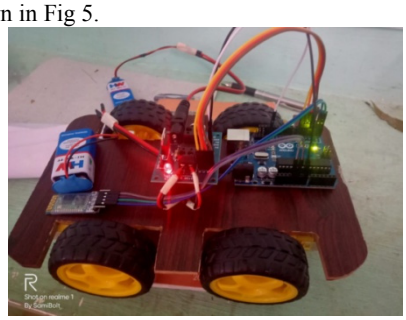


Fig. 5: overview of the implemented robot.

The robot can be used for surveillance or reconnaissance. The robot is useful in places where humans find difficult to reach but human voice reaches. E.g. in fire situations, in highly toxic areas. It is the one of the important stage of Humanoid robots. Speech and voice recognition security systems. This project work has been narrowed down to short range Bluetooth module. Using a long range modules and other connectivity devices will result in connectivity with the robot for long distances. Power Optimization such sleep and wakeup schedules can be incorporated.Table 1 shows the functioning of the robot through the voice command.

TABLE I
Input For Different Logic

TABLE I
FUNCTIONS OF DIFFERENT VOICE COMMAND

Voice command	Function
Forward	• Robotic car moves forward
Backward	• Robotic car moves backward
Right	• If previous command was forward, the car turns right and continues to move forward • If previous command was backward, the car turns right in backward direction and continues to move backward
Left	• If previous command was forward, the car turns left and continues to move forward • If previous command was backward, the car turns left in backward direction and continues to move backward
Stop	• Robotic car stops moving

VII. FUTURE SCOPE

The integration of voice recognition and navigation system into robotic vehicle which helps for disabled people. This speech control system, though quite simple, shows the ability to apply speech recognition techniques to the control application. Our robot can understand control Commands spoken in a natural way, and carry out action. The method is proved for real-time operation. Simply in this system an android application is used to recognize human voice and is converted to text, text is further processed and used to control robotic movements. The prototype revealed the simplicity of a voice controlled system such as the wheelchair. It depicts how control mechanism can be obtained without having to use any other control mechanism such as buttons or joystick. Further future development can be conducted by developing a system which will be able to receive voice command through direct voice recongnization hardware to recognize the voice command and no android app will be needed for controlling the robot. The developed device used prerecorded human voice sound to communicate with user but artificial intelligence can be implemented for interjection purpose so that the robot will be able to interact more appropriately by analyzing the testing enviroment and user's behaviours.

ACKNOWLEDGEMENT

The experience has enabled us to use many of the theoretical ideas we had acquired into practical use. With a deep sense of credit we sincerely thank our assistant Professor, ***M.Shanthi,***,*Dept. of Electronics and Communication Engineering,* for facilitating us to work in a flexible manner giving us all the necessary support throughout the research and project work and supervising to come up with a meaningful report. Finally ,we would like to thank Head of the Department all the staff members of Electronics and communication department, Narayana Engineering College, Nellore.

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