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Bluetooth-based Speech Operated Robot using Arduino

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ABSTRACT

The purpose of robotics in commercial and residential intention has come to be quite essential for executing challenging work into more conveniently simple way. There is a lot of research work going on to enhance the connection between humans and robot. This article presents a voice-controlled robot using AMR voice application with Bluetooth technology using Arduino Uno microcontroller. The control system of the robot movement will be employed by the voice instructions. In addition, liquid crystal display is utilized to disclose the direction of robot movement based on voice instruction given by human.

Keywords: Voice recognition, Bluetooth, android application, LCD, Arduino.

1. INTRODUCTION

The surprising raise in the robot's utilization and automation offers various advantages as well as it has drawn the attention of both academic investigation and commercial programs [1]. The analysis on numerous techniques of controlling robot has accomplished quite a few successes by introducing a number of innovative and unique methods of robot movement control. Verbal interaction intended for robot controlling is sort of an innovative process among many methods which are introduced regarding robotics control. Previous works on voice-controlled robots [1]-[3] shows that the design of those robot was complicated and none of them were able to interact with users. Robots are anticipated to socialize along with its user however it has not yet arrived at this kind of level [2], [3]. There are numbers of techniques to control robot using voice identification, yet it is reasonably limited.

A survey aimed to collect information from patients concerning the usefulness of new electric wheelchairs concluded that 9 to 10% of patients who use power wheel chairs and who received appropriate training "find it extremely difficult or impossible to use the wheelchair for activities of daily living." Independent mobility increases vocational and educational opportunities, reduces dependence on caregivers and family members and promotes feelings of self-reliance. It is an important aspect of self-esteem that plays a pivotal role in aging in place. While the needs of many individuals with disabilities can be satisfied with traditional manual or power wheelchairs, a segment of the disabled community finds it difficult or impossible to use wheelchairs independently. This population includes individuals with low vision, visual field reduction, spasticity, tremors, or cognitive deficits. The idea of using voice activated technology for controlling the motion of the wheelchair would greatly simply the everyday task for the many people with disabilities who do not have the dexterity necessary to control a joystick on an electric wheelchair. Some of the pointed reasons are difficulties in controlling the wheelchair with a joystick, uncomfortable and inappropriate interface for the disability (because users with severe motor impairments are unable to operate the joystick smoothly). For elderly patients, arthritis is one of the major reasons for wheelchair use. The repeated usage of joysticks and continuous wrist movements can be very painful for an arthritic patient and may result in reinforced difficulties.

For the referred groups of users, a voice-based interface is highly encouraging because it represents a natural and simple way of controlling the device. For other types of disabilities different types of

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interfacing devices can be used. The advent of smartphone applications has tremendously influenced the way in which appliances can be automated. By building a simple user interface smartphone application, the robot can be controlled. The smartphone app recognises human voice, deciphers the commands being said and converts them to text. The text is then sent to the main system that controls the device with the help of Bluetooth technology. Bluetooth is used here as it is a reliable means of communication and can be used for a range of about 100m which suffices the system specifications in this case of voice-controlled robot. With the help of the Arduino Uno ATMega 328P microcontroller board, the corresponding control mechanism of the robot is carried out. This paper presents the prototype of a voice-controlled robot mechanism by the means of a four wheeled robot utilising the AMR voice application.

2. PROPOSED MODEL

This section explains a system, which focuses on the concept of how a robot can be controlled by the human voice. Voice control robot is just a practical example of controlling motions of a simple robot by giving daily used voice commands. In this system, an android app is used as a medium for the transmission of human commands to microcontroller. A controller can be interfaced with the Bluetooth module. The speech is received by the android app and processed by the voice module. Voice is then converted to text and microcontroller will further process this text, which will take suitable action to regulate the robot. The objective is to design a robotic car whose basic movements such as moving forward, backward, turning to left or right can be controlled by the human voice. The hardware development board used here is ATmega Arduino microcontroller board. The software part is done in Arduino IDE using Embedded C programming. Generally, recognition of human voice using module cost way too much. After performing an ample amount of studies on controlling robots, we concluded that yes, there exists a simple and very efficient way to manipulate robots through our voice. This is an ergonomic approach for the ease of robotic application. Such types of robots will provide great helping hands while performing multiple tasks. The result of our studies also shows that there still exists plenty of space for further research and development.

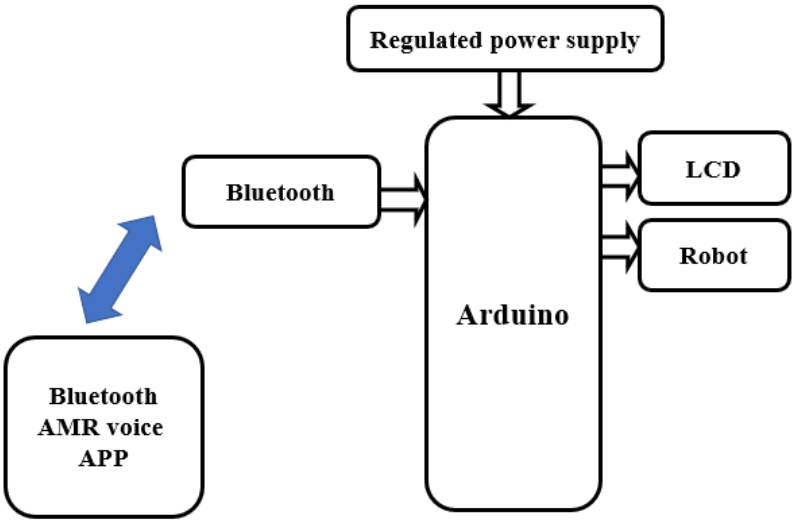

Figure 1. Block diagram of proposed voice-controlled robot using AMR voice application.

2.1. Arduino controller

The Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. The Uno differs from all preceding

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boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter.

The Arduino Uno has in built ADC components and can process both analog and digital signals. The Atmega328 has 32 KB of flash memory for storing code (of which 0.5 KB is used for the bootloader). It has also 2 KB of SRAM and 1 KB of EEPROM. The Arduino Uno has an operating voltage of 5V; a recommended input of 7V-12V can be applied to it. However, the Arduino Uno does not have a current driving capacity to drive all the DC motors attached to it- thereby requiring an intermediate motor driver circuit.

Each of the 14 digital pins on the Uno can be used as an input or output, using pin Mode(), digital Write(), and digital Read() functions. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 kΩ. The Bluetooth interface to the Arduino is achieved with the help of the Serial in-out pins of the Arduino namely: Serial: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip. The Arduino Uno is programmed using the Arduino IDE software using a set of C/C++ functions.

2.2. Bluetooth Module

HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. Bluetooth communication is an effective technology as the range of Bluetooth is found to be 100m. Serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (enhanced data rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR Blue core 04-External single chip Bluetooth system with CMOS technology and with AFH (adaptive frequency hopping feature). It has the footprint as small as 12.7mmx27mm. This simple Bluetooth module architecture easily simplifies the system. The easy to interface module can be connected easily to the Arduino Uno board via the Tx and Rx Serial pins available on the board. The module can be connected to an android smartphone by the means of the smartphone application.

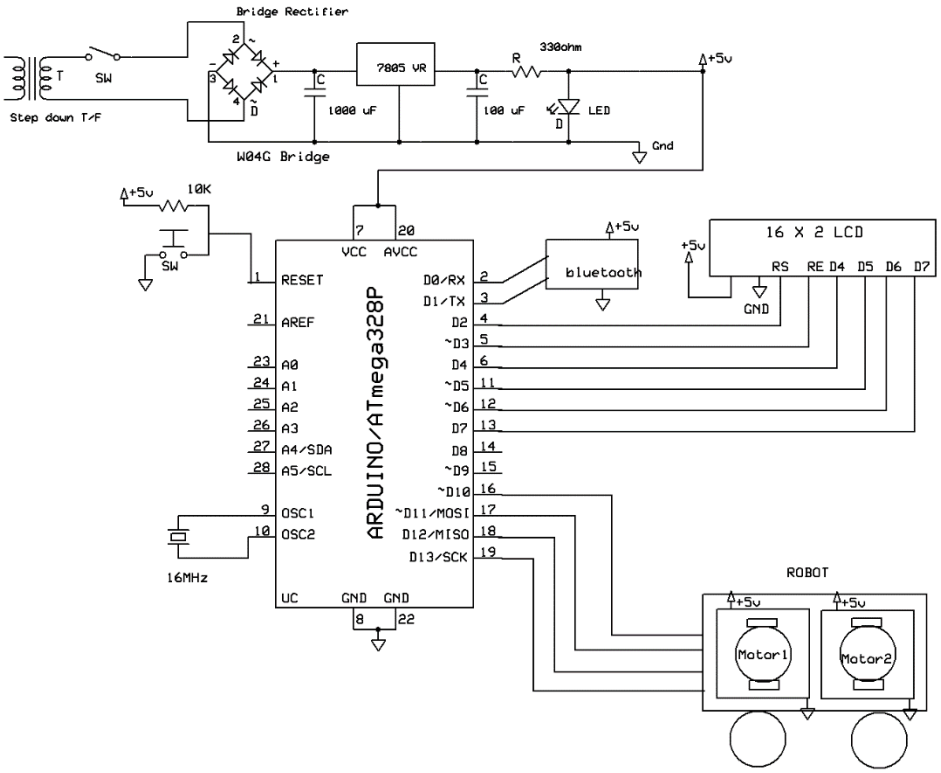

Figure 2. Schematic circuit diagram of proposed voice-controlled robot.

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2.3. DC Motor

The robot utilised two DC motors that drive the two wheels at the front while the two wheels at the back follow the ones at the front. According to the command voiced out to the app, the Bluetooth module deciphers it, converts it to text and sends it to the Arduino board. The microcontroller then processes the command and correspondingly, passes a signal to the motor shield for the right motor to move. The electric signal that is sent to the motor is converted to mechanical energy that, hence, rotates the shaft of the motor. The wheel attached to the shaft of the motor then rotates, producing a linear forward or backward motion of the robot. Two 30 rpm gear motors were used in this system that is powered by a total of 12V supplied to the motor shield.

3. EXPERIMENTAL RESULTS

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. An android software is created that gets voice command information and transform into textual content utilizing google speech recognition technology. 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.

4. CONCLUSIONS

This article presented a voice-controlled robot using AMR voice application with Bluetooth technology using Arduino Uno microcontroller. The control system of the robot movement is employed using the voice instructions. In addition, liquid crystal display is utilized to disclose the direction of robot movement based on voice instruction given by human. Further future development can be conducted by developing a system which will be able to receive voice command through direct voice recognition hardware to recognize the voice command and no android app will be needed for controlling the robot. The developed device used pre-recorded human voice sound to communicate with user but artificial intelligence can be implemented for interaction purpose so that the robot will be able to interact more appropriately by analysing the testing environment and user's behaviours.

REFERENCES

[1] Z. H. Abdullahi, et al., "Mobile Robot Voice Recognition in Control Movements", International Journal of Computer Science and Electronics Engineering, vol. 3, Issue 1, pp. 11-16, 2015.
[2] T. Alexenko, et al., "Android-based Speech Processing for Eldercare Robotics", IUI'13 Companion Proceedings of the companion publication of the 2013 international conference on Intelligent user interfaces companion, pp.87-88, Mar. 2013.
[3] V. A. Badadhe, P. Deshmukh, S. Bhujbal, P. Bhandare, "sBOT: A Face Authenticated and Speech Controlled Robot," International Journal of Advanced Research in Electronics and Communication Engineering, vol. 2, no. 2, pp. 160-167, 2013.
[4] J. Potts and S. Sukittanon, "Exploiting Bluetooth on Android mobile devices for home security application", proceedings of Southeast can, 2012.
[5] R. Pahuja and N. Kumar, "Android Mobile Phone Controlled Bluetooth Robot", Using 8051 Microcontroller" proceedings, vol. 2, no. 7, pp. 2347-3878, 2014.
[6] K. Kannan, J. Selvakumar, "Arduino based voice-controlled robot", International Research Journal of Engineering and Technology, vol. 02, no. 01, Mar-2015
[7] K. R. Mamatha, et al., "Implementation of voice-controlled robot using android application", International Journal of Latest Research in Engineering and Technology, pp. 165-168, 2016.

ISSN: 2278-4632
Vol-10 Issue-5 No. 4 May 2020

[8] H. Rashid, et al., "Design and implementation of voice-controlled robot with human interaction ability", International Conference on Computer, Communication, Chemical, Materials and Electronic Engineering, Rajshahi, Feb. 2017.

[9] A. Chaudhry, "Arduino based voice-controlled robot", 2019 IEEE International Conference on Computing, Communication, and Intelligent Systems, Greater Noida, India, January 2020.

