



Audio controlled wheelchair using ARDUINO

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Abstract-This paper describes the voice controlled wheelchair which operates on user's voice command. Nowadays, the physically challenged persons^[1] use the wheelchair for their movement with or without someone's help. This voice controlled system make them more independent. The wheelchair can be controlled by the simple voice commands given by the user. The person controls the movement of the wheel chair using voice. Few patients such as cerebral palsy and multiple sclerosis are dependent on other people to move from one place to another and due to this they don't have the freedom of mobility. The voice is given as input, it is then processed in the Arduino and with the help of the rotation of the motor the wheelchair starts to move. Depending upon the direction specified in the commands, the Arduino will drive the motors. It can detect any obstacles in the surrounding with the use of object sensor.

Keywords-Voice control; quadriplegic; cerebral palsy; multiple sclerosis; Arduino

I. INTRODUCTION

People with differently abled people usually depend on others in their daily life especially in moving from one place to another. Therefore, voice controlled

wheel chair is built to overcome the problems faced by such people and enable them to operate the wheelchair. The wheelchair will be operated using the voice commands through the given input. The Arduino^[5] will take care about all the directions the user wants. The instruction for each and every direction is written in the form of program in the Arduino itself. The voice commands to the wheelchair will be given by the unilateral mic placed as per the user comfort. The voice recognition will be done by Android application. The output is then received by Arduino^[5]. The already written programs in the Arduino helps Arduino to convert this voice commands into considerable output and the wheelchair will move accordingly. By having a wheelchair control system people will become more independent. The wheelchair control system employs a voice recognition system for triggering and controlling all its movements. By using the system, the users are able to operate the wheelchair by simply speaking to the wheelchair's microphone. The basic movement functions includes forward and reverse direction, left and right turns, rotate and stop.

II. RELATED WORK

People have disabilities^[3] with their hands, foot and lower extremities because of which they are unable to perform regular tasks. Many technologies are available to overcome this problem. To overcome this problem, there are several applications. In the market which help handicapped people to perform their tasks. Proposed design supports voice controlled system for physically disabled persons^[1] incorporating manual operation. If a person is physically challenged, they are dependent upon others for their day to day operations such as orientation etc. Several studies have shown that the independent mobility, which includes power wheelchair, manual wheelchair and walker access the benefit to both children and adults. Independent mobility reduces dependence on caregivers and family members and promotes feelings of self-reliance. Impaired mobility often results in decreased opportunities to socialize, which leads to social isolation, anxiety and depression. While the needs of many individuals with disabilities can be satisfied with traditional manual or power wheelchair, a segment of the disabled community finds it difficult or impossible to use wheelchairs independently. This population includes individuals with low vision, cognitive deficits, etc. The proposed voice-controlled wheelchair^[3] would bring more convenience for the disabled people. The technology can also enhance safety for users who use ordinary joystick-controlled powered wheelchairs, by preventing collisions with walls, fixed objects, furniture and other people. This kind of system reduces the manual effort for acquiring and distinguishing the command for controlling the motion of a wheelchair. The speed and direction of the wheelchair can be selected using

the specified commands. Thus the only thing needed to ride the wheelchair is to have a trained voice. Besides that, the development of this project can be done with less cost and affordable. However this system requires some improvements to make it more reliable. This design could be improved by implementing wireless communication in the wheelchair. By developing this system, we can directly enhance the lifestyle of the disabled people in the community. Lastly, we hope that this kind of system could contribute to the evolution of the wheelchair technology. The motor drive and control system of the intelligent wheelchair has been presented. The proposed microcontroller based voice operated intelligent wheelchair would bring more convenience for the disabled people. The technology can also enhance safety for users who use ordinary joystick-controlled powered wheelchairs, by preventing collisions with walls, fixed objects, furniture and other people.

III. PROPOSED METHODOLOGY

The purpose of this paper is to develop a wheelchair which will move as per the user's commands. This system works on voice commands given by the wheelchair user. The system is fully independent as the user do not need any other person to help him to move the wheelchair. There are basically five commands, which command is given by the user, accordingly the wheelchair will move. The voice commands of the user is recognized in the first step. Once it is recognized, the commands are converted into its equivalent instructions which drive the system. This system consists of two major modules namely Voice recognition module and motor driving module. The voice controlled wheelchair works using unilateral mic, voice recognition module, Arduino

and motors. The input to the system is the unilateral mic. It's capable to take user's voice commands and not bother about other noises. The mic will be placed as per the user's comfort. The output is in the form of voice signals and is transferred to the voice recognition module^[2] which acts as an interface between mic and Arduino. The Arduino then receive the output from voice recognition module thus converting it into binary code. The system is unable to understand any language other than binary code. Thus, the generated voice command is converted into machine understandable form. This system uses the Arduino uno R3. It is connected with motors to drive the wheelchair anywhere. Motors are responsible for the movement of wheelchair. Hence, motors receive input from the Arduino and depending upon the instruction type, motors moves accordingly. This system uses two motors connected with motor driver. There are five different instructions that can be given to the motors, they are forward, backward, left, right, rotate and stop. The movement of wheelchair depends only upon these five commands. The wheelchair responds to the voice command from its user to perform any movement's functions. The basic movement functions include forward direction, left and right turns and stop. In order to recognize the spoken words, the voice recognition processor must be trained with the word spoken out by the user who is going to operate the wheelchair

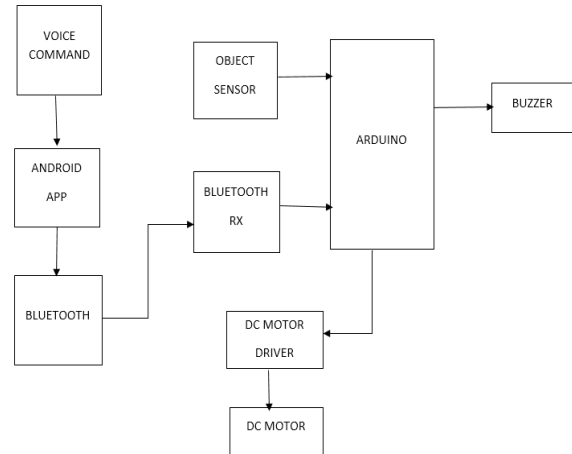


Fig:1 System Architecture

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A. Hardware Description

The system uses four major hardware, they are mic, voice recognition module, Arduino and motors.

1. Mic

A microphone is an example of a transducer, a device that changes information from one form to another. Sound information exists as patterns of air pressure; the microphone changes this information into patterns of electric current. The recording engineer is interested in the accuracy of this transformation, a concept he thinks of as fidelity. A variety of mechanical techniques can be used in building microphones. The two most commonly encountered

in recording studios are the magneto-dynamic and the variable condenser designs.



Fig:2 Mic

2.ArduinoUnoR3

The Arduino Uno R3 acts as an intermediate agent between the voice recognition module and the motors to drive the wheelchair. It is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins, 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller. It receives the input given to the voice recognition module and converts into the format accepted by the motors and thus the motors works according to the command given. The Arduino needs to be interfaced to the motors as well as the voice control module.



Fig:3 Arduino Uno R3

3.D.C.motor

The Arduino is coupled with motors to drive the system as per the user's demand. The proposed system consists off our,DC magnetized, 100 rpm motors (Johnson motors) to equalize the weight distribution and stall torque. The motors will be

attached to all the four wheels and two motor drivers will be connected to each side.



Fig:4 DC motor

4. Ultrasonic sensor

An Ultrasonic sensor is a device that can measure the distance to an object by using sound waves. It measures distance by sending out a sound wave at a specific frequency and listening for that sound wave to bounce back. By recording the elapsed time between the sound wave being generated and the sound wave bouncing back, it is possible to calculate the distance between the sonar sensor and the object.

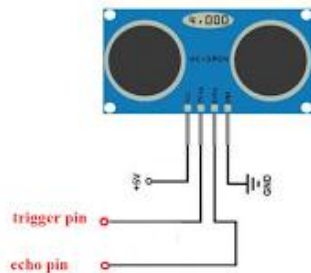


Fig:5 Ultrasonic Sensor

B. Software Description

1) Android Application

Android apps can be written using Kotlin, Java, and C++ languages. The Android SDK tools compile

your code along with any data and resource files into an APK, an Android package, which is an archive file with an .apk suffix^[7]. One APK file contains all the contents of an Android app and is the file that Android-powered devices use to install the app. Each Android app lives in its own security sandbox, protected by the following Android security features:

- The Android operating system is a multi-user Linux system in which each app is a different user.
- By default, the system assigns each app a unique Linux user ID (the ID is used only by the system).



Fig:6 Android App

2) Arduino IDE

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus^[7]. It connects to the Arduino and Genuino hardware to upload programs and communicate with them.



Fig:7 Arduino IDE

Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension .ino. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom righthand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

IV. SCOPE OF THE PROJECT

This system will be a Real-Time Voice controlled Wheelchair for the physically disabled person. This system will be designed to operate the wheelchair based on the voice of the user and control the movement according to the command given by the operating person. The voice would be given through a mic and would be converted into binary format by Android Application. Thus this binary format would be checked with the binary code fed to the microcontroller, if true the command will be performed. More specifically, this system is designed to allow an admin and users to give the voice command to the wheelchair. These command would be performed within seconds. On the whole it's

basic operation would be left, right, stop, go, back and rotate. Basically it's a wheelchair controlled by voice.

V. RESULT

The speech recognition is achieved by the use of Arduino board and Bluetooth. And the output is tested on the movement of the wheelchair by different commands given by the user.

VI. CONCLUSION

The design and implementation of a voice controlled wheelchair for disabled people using arduino and Bluetooth module for controlling the motion of a wheelchair designed. The direction of the wheelchair now can be selected using the specified voice commands. The design not only reduce the manufacture cost compared with present market but also will give great competitive with other types of electrical wheelchair. The only thing needed to ride the wheelchair is the voice commands of the person. A system that can directly enhanced the lifestyle of a physically disabled person in the community is implemented. This project has many advantages like safety, comfort, energy saving, full automation etc. The technology is enhanced safely for users who use wheelchair, by preventing collision with walls, fixed objects, furniture and other people with the help of object sensor. Thus all the drawbacks of the various types of wheelchair are overcome by this "voice controlled wheelchair".

REFERENCES

- [1] Prof. Manoj V. Bramhe , Navya Vijay , K. Bhagyashree Rao , "Voice Controlled Wheelchair for Physically Disabled Person", International Journal of Advanced Research in Electrical, Electronics and

Instrumentation Engineering, Vol. 6, Issue 2, February-2017.

[2] M. Anousouya Devi, R. Sharmila, V. Saranya, "Hybrid Brain Computer Interface in Wheelchair Using Voice Recognition Sensors". International Conference on Computer Communication and Informatics (ICCCI -2014), Jan. 03 – 05, 2014, Coimbatore.

[3] Luis A.M. Riascos, "A low cost stair climbing wheelchair", International Electrical and Electronics Engineering, 2015.

[4] Ruijiao Li, Lai Wei, Dongbing Gu, Huosheng Hu, "Multi-layered Map based Navigation and Interaction for an Intelligent Wheelchair", International Conference on Robotics and Biomimetics, December 2013.

[5] Jesse Leaman and Hung Manh La, "A Comprehensive Review of Smart Wheelchairs: Past, Present, and Future", IEEE TRANSACTIONS ON HUMAN-MACHINE SYSTEMS, 2017

[6] D.K. Rathore, P. Srivastava, S. Pandey, and S. Jaiswal, "A novel multipurpose smart wheelchair," in Proc. IEEE Students' Conf. Elect., Electron. Comput. Sci., Bhopal, India, Mar. 2014, pp. 1–4.

[7] U. Yayan, B. Akar, F. Inan, and A. Yazici, "Development of indoor navigation software for intelligent wheelchair," in Proc. IEEE Int. Symp. Innovations Intell. Syst. Appl. Proc., Alberobello, Italy, Jun. 2014, pp. 325–329.

[8] F. Leishman, V. Monfort, O. Horn, and G. Bourhis, "Driving assistance by deictic control for a smart wheelchair: The assessment issue," IEEE Trans. Human-Mach. Syst., vol. 44, no. 1, pp. 66–77, Feb. 2014.

[9] S. Jain and B. Argall, "Automated perception of safe docking locations with alignment information for assistive wheelchairs," in Proc. IEEE/RSJ

Int. Conf. Intell. Robots Syst., Chicago, IL, USA, Sep. 2014, pp. 4997–5002.

[10] R. Simpson, "Smart Wheelchair Component System," J. Rehabil. Res. Develop., vol. 41, no. 3B, pp. 429–442, 2004.

[11] J. Pineau, R. West, A. Atrash, J. Villemure, and F. Routhier, "On the feasibility of using a standardized test for evaluating a speech-controlled smart wheelchair," Int. J. Intell. Control Syst., vol. 16, no. 2, pp. 124–131, 2011.

[12] C. Gao, T. Miller, J. R. Spletzer, I. Hoffman, and T. Panzarella, "Autonomous docking of a smart wheelchair for the automated transport and retrieval system (ATRS)," J. Field Robot., vol. 25, nos. 4/5, pp. 203–222, May 2008.

[13] C. Gao, M. Sands, and J. R. Spletzer, "Towards autonomous wheel chair systems in urban environments," in Field and Service Robot, 2010, pp. 13–23.

[14] Akash S A, Akshay Menon, Arpit Gupta, Md Waheeb Wakeel, Praveen MN. "A novel strategy for controlling the movement of a Smart Wheelchair using Internet of Things". IEEE Global Humanitarian Technology Conference South Asia Satellite September 26-27, 2014.

[15] Jesse Leaman, Hung Manh La, Luan Nguyen "Development of a Smart Wheelchair for People with Disabilities". IEEE International Conference on Multisensor Fusion and Integration for Intelligent Systems (MFI), Sep. 19-21, 2016.