

Arduino Based Voice Operated Wheelchair With Obstacle Detection- A Survey

Bhagyashree A J

Student

NIE- Institute of Technology
Mysuru

Harish S V

Asst. prof.Dept of ECE

NIE- Institute of Technology
Mysuru.

Sanjana Prasad S

Student

NIE- Institute of Technology,
Mysuru

Abstract:- Arduino based voice operated wheelchair with obstacle detection is designed to control a wheelchair using the voice of the client. The voice command given is converted to binary numbers by VR3, Voice Recognition Module and those binary data is given to the arduino board for the control of the wheelchair. The result of this design will allow certain people to live with less dependence on others.

This project uses XMEGA 2560 microcontroller circuit and direct current motor to create the movement of wheelchair. An improved version of this technology i.e. obstacle avoidance is being added by using ultrasonic sensors which will enable the client to call the wheelchair to the clients location, say for example if the client is sitting in a sofa in a different room as compared to the wheelchair, the wheelchair will come to him/her on indication. Continuous video streaming will be done to call the wheelchair to the client's location.

Keywords:- Voice recognition, obstacle detection, voice controlled wheelchair, H Bridge, microcontroller, Arduino, video streaming,

1. INTRODUCTION

Independent mobility is a dream for every person with some or the other physical disability. People with disabilities meet barriers of all type. The advancement and development of technology has always influenced several aspects of our lives since a very long time and will continue to do so in the future with more capacity and more unexpected development. In this paper the correlation between the technology advancement and the requirement of the humans for their ease is clearly established, where a wheelchair controlled by human voice is designed. It is mainly designed for physically challenged people who are dependent on wheelchairs and especially those people who cannot use their hand to drag their wheelchair because of some disability. We have also incorporated obstacle detection and wireless video feature as an additional feature for the sake of safety.

1. LITERATURE SURVEY

In 2015, Vishal V Pandey., et al[1], conducted a survey in which they collected dependable hand gesture data for the sensing system, the gesture should be implemented and there should be a time interval between the two gestures. It uses accelerometer. Quadriplegia patients cannot use it. In 2015, Srishti., et al[2], presented a paper on Design and Development of Smart Wheelchair using Voice

Recognition and Head Gesture Control System which uses speech recognition module in voice based systems instead of using whole computer systems, to reduce complexity and size of the total system. A Voice Recognition Module V2 was used. The voice recognition module could recognize the commands through mic. It receives configuration commands or response through serial port interface. In 2016, Kirti Bhagat ., et al[3], presented an automatic obstacle detection using an ultra sound system which helps the user to apply a temporary break in case any obstacle comes suddenly in the way of the robot. The design provided protection from the obstacle collision if any voice mistake happens.

2. BLOCK DIAGRAMS

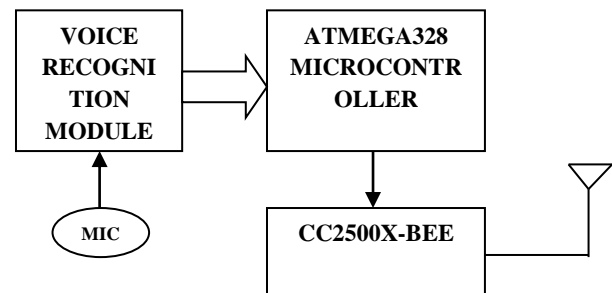


Fig 1: Voice recognition and transmission unit

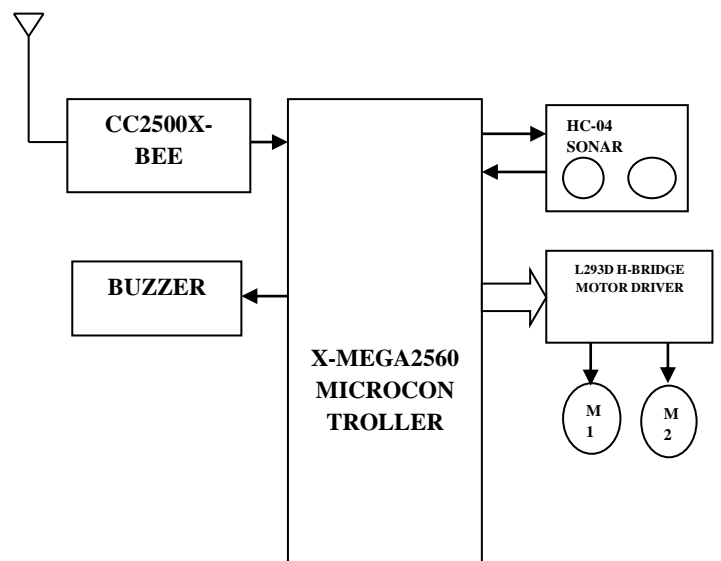


Fig 2: Voice wheelchair control with collision avoidance unit

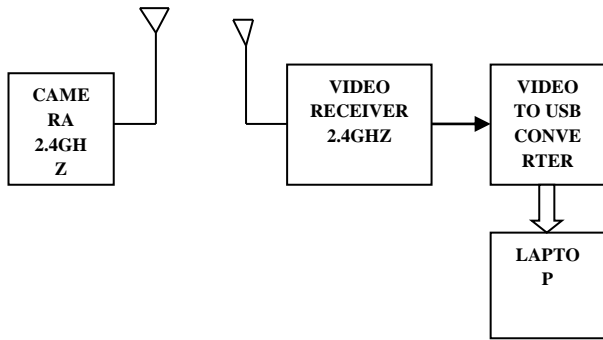


Fig 3: Wireless video streaming unit

3. VOICE RECOGNITION SYSTEM

Voice enabled devices basically use the principal of speech recognition. It is the process in which the speech waveform gets electronically converted into words. Speaker dependent systems are trained by the user that will use the recognizer system. These systems are capable of achieving a high command count and about 98% accuracy for word recognition. This is the most common approach employed in most applications. Speaker independent is a system that got training to respond to a word regardless of who speaks. Therefore the system must respond to a large number of speech patterns, inflections and enunciations of the target word. More often than not, industrial applications require speaker independent voice recognition systems.

Here we are using speaker dependent, Voice recognition module, VR-3 which has a maximum of 7 voice commands effective at same time. Total of 14 words can be trained. Arduino library is supplied. Recognizer is a container where acting voice commands (max 7) are loaded. It is core part of the voice recognition module. The recognizer index has 7 segments for each voice command, one index corresponds to one segment: 0-6 Train -- the process of recording voice commands and Load -- copy trained voice to recognizer

3.1 Condenser MIC

Condenser means capacitor, an electronic component which stores energy in the form of an electrostatic field. The term condenser is actually obsolete but has stuck as the name for this type of microphone, which uses a capacitor to convert acoustical energy into electrical energy. Condenser microphones require power from a battery or external source. The mic has capacitor. The capacitor is made of two plates with a voltage between them. One of these plates is thinner compared to the other, this plate called the diaphragm which vibrates because of sound waves. This causes variation in the voltage stored. Generally when the plates are close together the capacitance increases and when the plates are farther from each other the capacitance decreases. A voltage has to be applied across the capacitor for this to work. This voltage is supplied either by external power supply.

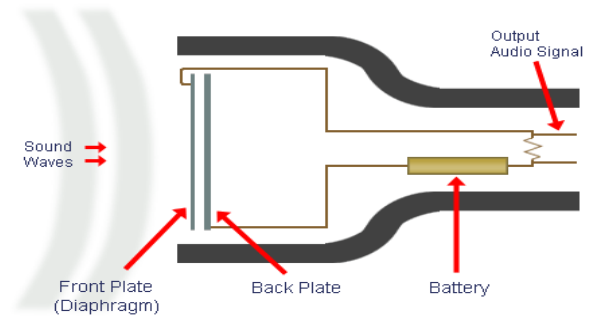


Fig 4: Cross-section of a typical condenser microphone

4. ULTRASONIC SENSOR

Ultrasonic sensors work on a principle similar to radar or sonar. This sensor generates high frequency sound waves which hit the obstacle within the range and the echo signal is received back. After evaluating the echo the sensor calculates the time taken by the sound waves to return to determine the distance.

This technology can be used for measuring speed through air or water, tank or channel level and direction and speed of the wind. To measure the level of tank or channel, the sensor measures the distance to the surface of the fluid. Systems generally use a transducer which generates sound waves in the ultrasonic range which is above 18,000 hertz.

The HC-SR04 operation is similar to the technique adapted by bats and dolphins that use ultrasonic waves to locate and avoid obstacles. This sensor provides a very good non contact detection of obstacles with precise values and stable readings. Apart from this it is also easy to use. Its range is from 2cm to 400 cm or 1" to 13 feet. The operation of the sensor is not affected by sunlight or black material like Sharp rangefinders. It comprises of ultrasonic receiver and transmitter modules.

5. TRANSCEIVER

This is an FSK Transceiver module, which is designed using the ChipconIC (CC2500). It is a true single-chip transceiver, It is based on three wire digital serial interface and an entire Phase-Locked Loop for precise local oscillator generation. So the frequency could be setting. It could be used in NRZ/ UART/ Manchester encoding or decoding. Its main advantage is it gives high performance and also costs less. It gives 30 meters range with onboard patch antenna. Usually, this transceiver will be used together with a microcontroller. It could easily be used to design product requiring wireless connectivity. Without requiring any external antenna the operating range is 30 meters.

5.1 Serial Communication

In telecommunication and computer science, the concept of serial communication is the process of sending data one bit at a time, sequentially, over a communication channel or computer bus, in contrast to parallel communication, where several bits are sent as a whole, simultaneously. The former is used for all long-haul communication and most computer networks, because the cost of cable and synchronization

difficulties make parallel communications impractical. Serial computer buses are beginning to dominate even at shorter distances, as improved signal integrity and transmission speeds in newer serial technologies have begun to nullify the parallel bus's advantage of simplicity (no need of (serialiser and deserialiser, or SerDes).

RS-232 (Recommended Standard 232) is the traditional name for a series of standards for serial binary single-ended data and control signals connecting between Data Terminal Equipment and a Data Circuit-terminating Equipment, in Telecommunications. It is commonly used in serial ports.

We are using RS232 protocol for serial communication between the trans-receiver module and the microcontroller board.

5.2 Wireless Communication

Wireless communication involves the transmission of information over a distance without help of wires, cables or any other forms of electrical conductors. The transmitted distance can be anywhere between a few meters and thousands of kilometres. A few devices such as cordless telephones, mobiles, GPS units, wireless computer parts, transceiver and satellite television can be used for wireless communication.

6. THE MOTORS' DRIVER

H-Bridge is preferred way of interfacing a DC motor. Now a day's many IC manufacturers have H-bridge motor driver available in the market, like L293D which is the most commonly used driver circuit.

The driver we are using in this paper is, L293D motor driver. So using one IC we can interface two DC motors which can be controlled in both clockwise and anti-clockwise direction. If you have a motor with fixed direction of motion then you can make use of all the four I/Os. L293D has output current of 600mA and peak output current of 1.2A per channel.

For the protection of circuit from back EMF output diodes are included within the IC.

The output supply has a wide range from 4.5V to 36V, which has made L293D the best available choice for DC motor driver.

A simple representation of interfacing a DC motor with L293D is shown below:

Table 1. Truth table for motor

A	B	Description
0	0	Motor stops or breaks
0	1	Motor runs anti-clockwise
1	0	Motor runs clockwise
1	1	Motor stops or breaks

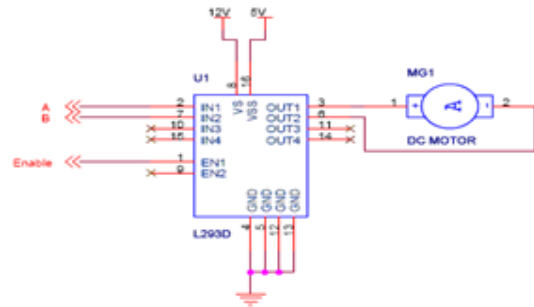


Fig 5: Interfacing DC motor with L293D

7. CAMERA AND RF RECEIVER

8.1 Camera

A camera is a device that records images, either as a still photograph or as moving images known as videos or movies. Here we use convex (bulge) lens. In convex lens we see inverse images. For video transmission we use 5.5 Mhz. In video signals AM modulation takes place. Then it multiplexes and transmits signal. At receiver reception takes place, where demodulation occurs. We get pure video of 1 volt peak to peak and display in monitor. Linear transmission distance: 50-100m.

8.2 Camera RF receiver

In This Section The Signals Are Received And Accordingly The Action Takes Place. We Have Connected A Wireless Camera To This Unit Which Will Send The Audio And Video Signals To The Computer Monitor Through A PCI Based TV Tuner Card. It uses electronic frequency modulation method at a frequency of 1.2GHz. It receives both audio and video signals. The reception sensitivity is +18dB.



Fig 6: Camera and RF receiver

8. CONCLUSION

Voice controlled wheelchair is designed to operate in health sectors and education sectors of disabled citizen which allows them to be more independent. It can be used in schools, hospitals and at home for mundane use. The foremost aim of this paper apart from movement through voice commands is that there is obstacle detection for extra safety and reliability. There is also video streaming using

which the disabled citizen can bring the wheelchair to his/her location. This decreases the level to which they depend on others. Mainly the quadriplegics' and muscular dystrophy patients can benefit a great deal and achieve more than they thought was possible.

9. ACKNOWLEDGMENTS

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10. REFERENCES

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