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Recognize a voice Wheel Chair with Enhanced Obstacle Detection Features

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ABSTRACT: Normally differently abled people and those who have lost their legs by any accidents or due to malnutrition have a special innovation, wheel chair to give them the pleasure of moving with ease. The idea of wheel chairs that the innovators have come up with mostly involves the handling of the equipment physically with their hands. But this is difficult or impossible for the patients who have lost their hands or aged. With the aim of providing these people an enhanced pleasure of handling the equipment with comfort, the idea of voice controlled wheel chair has been chosen and studied upon. This model uses arduino and voice recognition module which recognizes the word from the user and matches with the predefined instruction in the system and the sensor attached to the design checks for any obstacles including pits and then directs the wheel chair to act accordingly. Hence in addition to the control of the chair by voice recognition, the main focus of this idea is to lay a perfect plan for the most comfortable wheel chair with an extraordinary feature of determining the obstacles and the flaws on the uneven surfaces and proceed as directed by the controller using the artificial intelligence.

KEYWORDS: Voice recognition, obstacle detection, voice controlled wheel chair, pit detection.

I. INTRODUCTION

Every innovation has to get its trends updated over time. Many are designed for sophistication. But some add benefits and have noble impacts when blend with the necessity of one's survival. One among them is wheelchair which has been invented for the movement of the physically challenged. Since then it has been evolving with the innovations for providing the best comfort to the patients. Every stage of its evolution has made a unique change in the lifestyle of the differently challenged person.

Besides the development of new ideas, there were several problems that are unresolved in its outcomes. The examples of such drawbacks that have been arising till now are the discomforts in the seating posture, heavy propulsion, footrest and armrest obtrusion. In the olden days it was simply a manually operated machine but later on the technological development brought into the market wheel chairs which are operating on motors, then came wheel chairs controlled by voice, eye movement, brain waves and so on. There have been several attempts being made to overcome this by designing the wheel chair considering the patients overall comfort. Here is an effort to design a wheelchair with pit and flaw detection techniques. The arduino is used and a model with voice recognition module v3, ultrasonic sensor HC-SR04 and stepper motor is designed.

A. Main components of the system:

- Voice recognition module
- Arduino board (UNO)
- Ultrasonic sensor
- Motor

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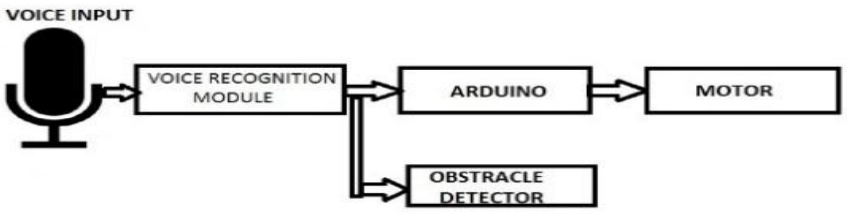
II. PROPOSED MODEL

III. BLOCK DIAGRAM



B.ARDUINO BOARD

It is a single board microcontroller that opens up a new pathway for building up the circuits much easier. It has 14 digital input/output pins(of which 6 can be used as a PWM outputs) and 6 analog input pins. It is used to perform a wide variety of operations by using the software kit provided with it. It is in a way superior to computers as it can sense and control more of the physical world than computers. With the help of these boards, circuits of any kind can be designed and the output can be processed in any desirable form by simple means. It has the flash memory of 32 KB.

Since it's usage will reduce the complexity of the circuit here it is used to convert the ultrasonic sensor signal into vibrator signal. The main feature of the arduino board is that programming is much easier when compared to the other devices. Nowadays due to the technological improvement in arduino the size and complexity of the circuit is reduced.

C. VOICE RECOGNITION MODULE:

The voice recognition module is used for getting the input voice commands. The module used here is arduino compatible.

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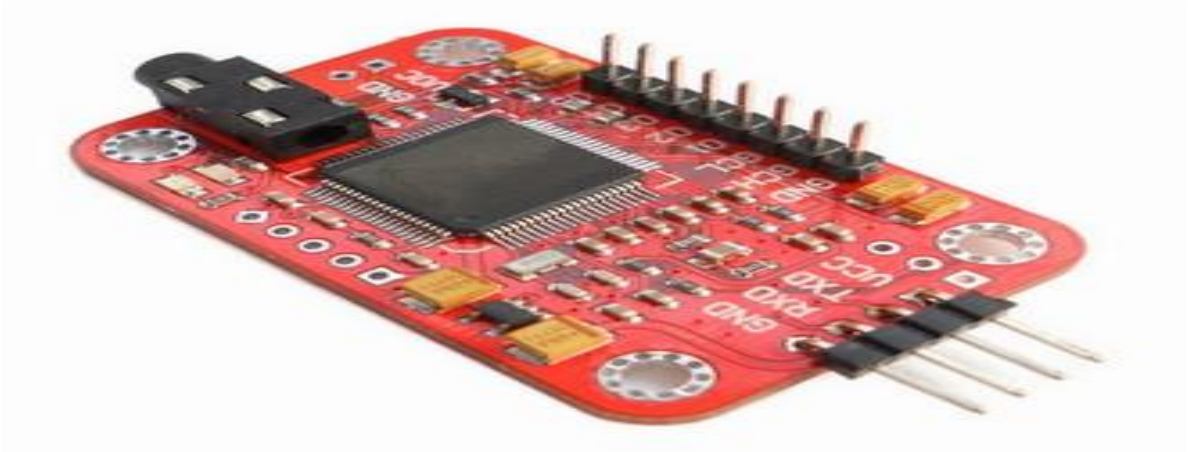

D. ELECHOUSE Voice Recognition Module

This device has an inbuilt microphone which is used for detecting and receiving the voice commands. This is a speaker dependent voice recognition module. It has the capability of storing a maximum of 80 commands and has the ability to work for 7 commands at a time. Before connecting it to the arduino it must be trained to recognize and respond to the voice commands properly.

The voice command record contains all the 80 voice command with the index from 0 to 79. The recognizer is stores a maximum of 7 voice commands. This is the central part of the module. The recognizer index refers to the 7 different regions where these commands are saved with the index labelled 0 to 6, each corresponding to one region. Train is the procedure of recording the acting commands. Load copies the trained voice to the recognizer. Signature involves the text comment for the record. The commands are organized into groups with 7 commands each.

E. ULTRASONIC SENSOR:

In the wheelchairs, ultrasonic sensor uses ultrasound for sensing the objects, pits and any obstacle. It does this with the phenomenon of transmission and reflection and calculates the distance by using the time taken between each transmission and reflection. To maintain a safer distance from the obstacle a set of sensors S1 are placed in front side of the wheelchair. Initially the sensor is triggered up by supplying a short 10 microsecond pulse to the trigger input and it will automatically make the module send out a 8 cycle burst of ultrasound at 40KHZ and raises its echo. If there is any obstacle in the path of the signal this will return as a Echo to the sensor receiver part.

Test distance= (high level time*velocity of sound (340M/S)/2

By receiving the echo signal from the obstacle the distance between the wheelchair and the obstacle can be calculated using the above formula. If the calculated distance is less than the presetted value then the indication will be sent to the patient through the vibrator. The detection of pit in the path can be achieved by calculating the distance between the pit and the sensor S2 that placed bottom of the wheelchair in 45 degree angle, this also indicated through the vibrator which is placed on the patient body. These days they have a sensor for temperature attached patient's head in order the balance the difference in velocity of air due to the variation in atmospheric temperature. Transmission of the ultrasonic waves depends on the frequency of vibration. For a higher frequency it travels shorter distance when compared to lower frequencies. Ultrasound is reflected by all the materials irrespective of the colour and transparency. These sensors withstand the dust and mist, and function perfectly as it can withstand the accumulation on its surface membrane to some extent.

The ultrasonic sensor used here is HC-SR04. This sensor is compact, arduino compatible, and has high accuracy. It is a four pin sensor containing Vcc, trigger, echo and ground. This transmitter and receiver are inbuilt in the sensor. If there is any obstacle in the path it will be immediately indicated to the user by the vibrator which is also connected to the arduino.

In case of the obstacle and flaw detection, the wave that is transmitted is reflected back from the obstacle and flaw, from which we can measure the distance between the obstacle and the sensor that is fixed to the wheel chair and move accordingly. This is achieved by placing six ultrasound sensors in the wheel chair spreading over a total angle of 180 deg.

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F. STEPPER MOTOR:

The stepper motor is used for the movement of the wheelchair. When compared to other motors the use of stepper more will reduce power usage and will increase the accuracy of controlling the wheelchair. The direction of the wheelchair is obtained as a voice input from the user. Depending on the voice command the wheelchair will move. Stepper motor is suggested primarily as it is comparatively cheaper than others. It is basically a DC motor and rotates in circular motion. The movement is due to the fact that the rotor sequentially attracts and repels the stator. The direction of the magnetic field changes with the direction of the current. The motor's direction depends on both. It performs quick action in case of emergencies by either stopping the movement of the wheel chair or starting the movement all of a sudden. It contains fixed stator and coil wound on it and a rotor that is primarily involved in the circular motion. Here permanent magnet stepper motor is used. The stator and the rotor are made up of permanent magnet having teeth. Torque is used to move the move the rotor. The torque is high. The step angles vary from 45 to 120 deg.

IV. RESULT

The above prescribed model is designed with the latest technologies. The arduino board is the core of the model. The voice recognition module is the latest version which is superior to the previous version in the way that it recognizes 7 commands at a time while the previous version is capable of recognizing only 5 at a time. The ultrasonic sensor used here plays a major role in the pit detection as well as obstacle detection due to its ability to survive and sustain even some undesirable situations. Permanent magnet stepper motor is used since it is bipolar since the polarity impulses energize its phases. This model is purely electrical and reduces the human work by many folds providing pleasure and a high degree of comfort to its users.

V. FUTURE WORK

In future this can be enhanced by including the Global positioning System(GPS). With this ,the places where the patient visits often can be stored in the android and using GPS the patient can be taken to the destination with this wheelchair. This adds the sophistication to the patient by providing ease or reliving him from giving commands frequently even in the places he visits often.

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