ORIGINAL RESEARCH

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Intelligent Voice Controlled Wheel Chair for Disabled People

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Abstract

This paper describes intelligent voice-controlled wheelchair which operates on user's voice commands. The disabled people cannot move from one place to another on their own. They continuously need someone to help them in getting the wheelchair moving. This voice-controlled system makes them more independent. A voice-controlled wheelchair can provide easy access for physical disabled person who cannot control their movements especially by hands. This voice-controlled wheelchair helps them to drive the wheelchair without anyone's help. This system can be controlled by the simple voice commands given by the user. Depending upon the direction specified in the commands, the Arduino will drive the motors. The speech recognition is done by voice recognition module, connected with Arduino. The principle of the developed wheelchair consists of motor system, voice recognition module that would be controlled by the microcontroller. The automatic obstacle detection system is included to the developed wheelchair by using ultrasonic sensors in order to break the developed wheelchair immediately when any obstacles suddenly come in the way of the developed wheelchair. Therefore, the developed voice-controlled wheelchair can provide easy access for people with physical disability and also offer automatic protection from obstacle collision if the mistake of any voice commands occurs.

Keywords

Wheelchair, Voice control, Disabled people, Voice recognition, Obstacle detection

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1. INTRODUCTION

People with arms and hand impairment finds difficult to use a normal wheelchair as their hands are not capable of operating the normal wheelchair and cannot move it to any direction. 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 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 mic placed as per the user comfort. The voice recognition will be done by voice recognition module. The output from this module is then received by Arduino. The already written programs in the Arduino helps Arduino to convert this voice commands into considerable output and the wheelchair will move. 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 backward direction, left and right turns, stop, and water. This paper describes the design and development of a voice controlled automatic wheelchair by proposing a wheelchair that can be operated by the simple voice commands given by the user. In addition, the developed wheelchair is equipped with the ultrasonic sensors to stop the movement of the wheelchair when any obstacles are detected. This will provide more safety to the users. Hence manual and joystick operated wheelchair are out of question for physically disabled patients. So, the development of voice operated wheelchair will solve the problems faced by the patients and make them independent of mobility.

2. LITERATURE REVIEW

People have disabilities with their hands and foot 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 activities. Proposed design supports voice activation system for physically disabled persons incorporating manual operation. If a person is handicapped, they are dependent upon others for their day-to-day operations such as small kind of movements 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 friends and family members and promotes feelings of self-reliance. The proposed voice-controlled 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. The main Advantages of this is it reduces human efforts. This is helpful to physically handicapped people who could not able to operate home appliances with their hand. This will help to save energy to some extent, since some people feels lazy to go and switch off the appliances manually. It is easy to operate for the people who are tried and does not need to operate the home appliance manually by hands. And it reduces risk while operation done by physically disabled person. The main limitations are it requires extra supply to operate the model. Only the installed voice is recognized by the module. The cost of the module is quite higher.

This kind of system reduces the manual effort for acquiring and distinguishing the command for controlling the motion of a wheelchair.

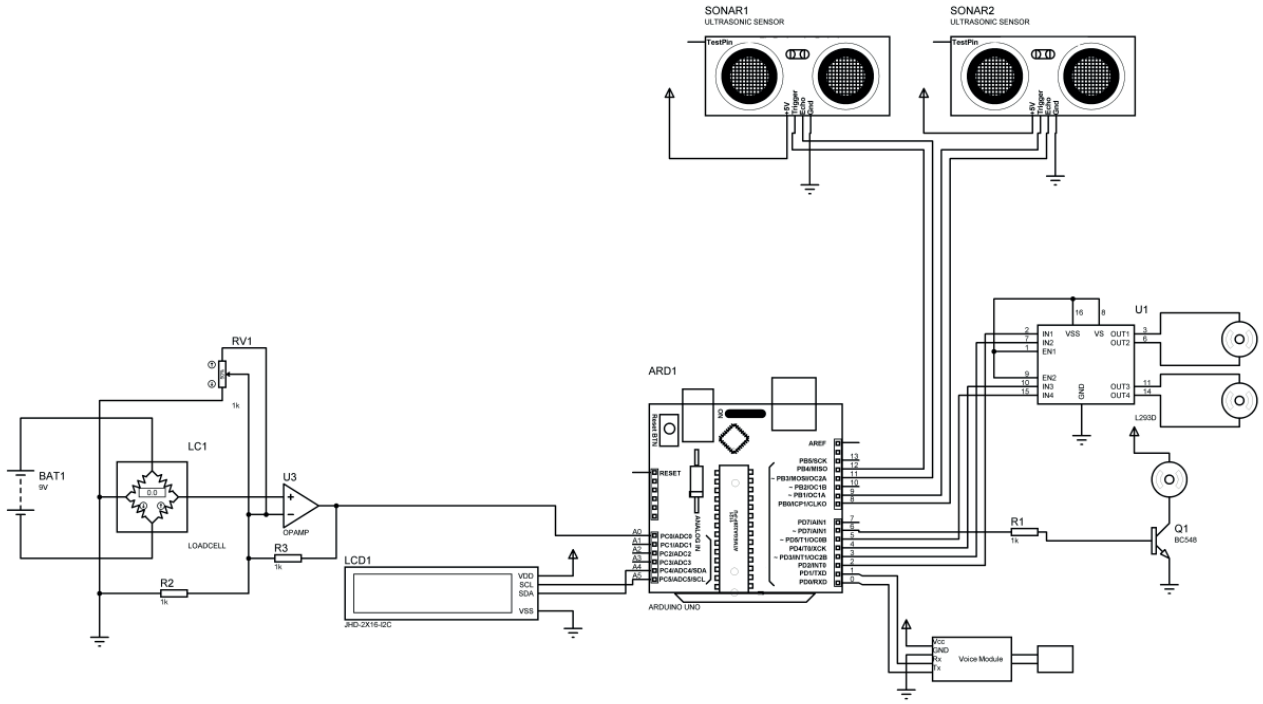
The speed and direction of the wheelchair can be selected using the specified commands. Thus, the only thing needed to ride the wheelchair is to have a trained voice. Besides that, the development of this project can be done with less cost and affordable. However, this system requires some improvements 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 life style 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

3. PROPOSED SYSTEM

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 sixcommands, 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 recognition is done through voice recognition module. The output of this module is directed to Arduino which uses a motor driver IC to drive the motors. The voice-controlled wheelchair works using mic, voice recognition module, Arduino and motors. The input to the system is the unilateral mic. It is 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 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. 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 move accordingly.

This system uses two motors connected with motor driver. There are six different instructions that can be given to the motors, they are forward, backward, left,



right, stop and water. The movement of wheelchair depends only upon these six commands The wheelchair responds to the voice command from its user to perform any movement's functions. We also provide a ultrasonic sensor for the obstacle detection. The basic movement functions include forward direction, left and right turns and stop.

4. WORKING METHODOLOGY

The working principle of developed wheelchair can be explained by the circuit diagram given below. There are six types of commands in the wheelchair, Forward, Backward, Left, Right, Stop and Water. The wheelchair will move when the power supply is given and the load is activated. For the forward command wheelchair will moves in Forward direction and two motors will rotates in forward direction. For Backward command the wheelchair will moves in Backward direction and the two motors will rotates in backward direction. For the Left command the right motor will rotates and the wheelchair moves towards left direction. For Right command the Left motor will rotates and the wheelchair will move towards Right direction. For the Water command the submersible pump will dispense water through the pipe. The two ultrasonic sensors on front and back side of the wheelchair will detect the obstacles while moving the wheelchair and the wheelchair will stops. The Display unit displays the weight applied, and the commands which is given to the voice module.

Voice Recognition Module

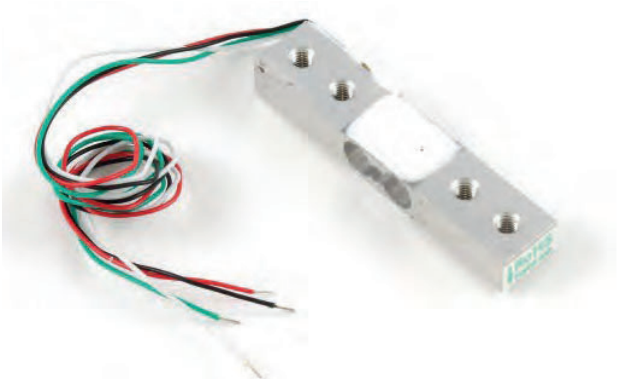
The JHD162A dot-matrix liquid crystal display controller and driver LSI displays alphanumeric, Japanese kana characters, and symbols. It can be configured to drive a dot-matrix liquid crystal display under the control of a 4- or 8-bit microprocessor. Since all the functions such as display RAM, character generator, and liquid crystal driver, required for driving a dot-matrix liquid crystal display are internally provided on one chip, a minimal system can be interfaced with this controller/driver The JHD162A character generator ROM is extended to generate 208 5×8 dot character fonts and 325×10 dot character fonts for a total of 240 different character fonts. The low power supply (2.7V to 5.5V) of the JHD162A is suitable for any portable battery-driven product requiring low power dissipation.

b) LCD Display

The voice recognition module i. e., v3.1 is used to recognize the voice commands given by the user and it can be trained by the user. It's a 48-pin single chip CMOS voice recognition LSI circuit with on-chip analogue front end. In this system, the Voice recognition module is trained and it takes the input from mic available in the system. The wheelchair uses the voice Recognition module interfaced with the Arduino Uno R3 to convert the voice commands into motor understandable Instructions to move the wheelchair as commanded by the user.

Load Cell

This straight bar load cell (sometimes called a strain gauge) can translate up to 20 kg of pressure (force) into an electrical signal. Each load cell is able to measure the electrical resistance that changes in response to, and proportional of, the strain (e. g., pressure or force) applied to the bar. With this gauge, you will be able to tell just how heavy an object is, if an object's weight changes over time, or if you simply need to sense the presence of an object by measuring strain or load applied to a surface. This straight bar load cell is made from an aluminium alloy and is capable of reading a capacity of 2KG of weight



5. FUTURE SCOPE

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 unilateral mic and would be converted into binary Format by voice recognition kit. 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. This command would be performed within seconds. On the whole it's basic operation Would be left, right, stop, go, and back. Basically, it's a wheelchair controlled by voice.

6. CONCLUSION

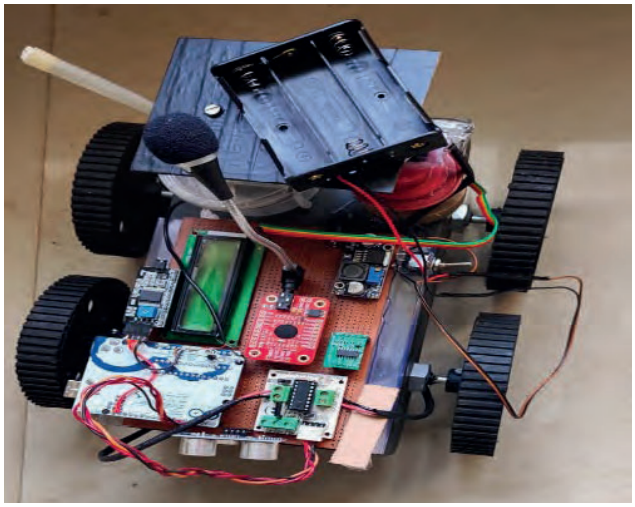
i. The design and implementation of a voice-controlled wheelchair for disabled people using Arduino and voice Recognition module for controlling the motion of a wheelchair is designed. The direction of the wheelchair now Can be selected using the specified voice commands.

ii. 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 synthetic Voice commands of the person.

iii. 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.

iv. The technology can also be enhanced safely for users who use ordinary joystick-controlled wheelchair, by Preventing collision with walls, fixed objects,

furniture and other people. Thus, all the drawbacks of the joystick-Controlled wheelchair are overcome by this "voice-controlled wheelchair"



HARDWARE SET UP

7. RESULT AND DISCUSSION

The design construction and development of automatic voice-controlled wheelchair are done and shown in the figure. To verify the performance of wheelchair the relationship between Voice command, Motor drive, DC motor, Arduino are determined. The results of relationship between Voice command, Motor drive, DC motor and Arduino are display on the display unit. In addition, the ultrasonic sensor is tested to confirm the performance of obstacles detection system. These sensors are used to measure the distance between obstacles and wheelchair at 20 cm distance. The submersible pump is tested for the dispense of water for 2 second. The load results the movement of wheelchair when the load is activated.

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