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An Intelligent Wheel Chair For Physically Disabled

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Abstract: This paper implements & develops a wheel chair control for the physically challenged by employing head gesture recognition using MEMS technology. Tremendous advances have been made in the field of wheelchair technology; however, even these significant advances haven't been effective in helping unassisted quadriplegics to navigate the wheelchair. Here, a simple cost effective wheelchair is developed which can be controlled by simple head gestures for directions like left, right, front, and back. A dependent-user recognition voice system and ultrasonic and infrared sensor systems has been integrated in this wheelchair. In this way we have obtained a wheelchair which can be driven with using voice commands and with the possibility of avoiding obstacles and downstairs or whole detection.

This research paper introduces the design and implementation of a novel hands free control system for intelligent wheel chair. This is achievement for those whose limbs are not working and who are blind because it works with the movement of head. It's a god's gift for them because independent in some field. Basically my achievement is their happiness.

Keywords:
MEMS Accelerometer, HM 2007,DC MOTOR, Microcontroller, LM 7805 Voltage Regulator.

INTRODUCTION

The aim of this project is to control a wheel chair and other electrical devices by using MEMS accelerometer sensor (Micro Electro-Mechanical Systems) technology. MEMS accelerometer sensor is a micro electro mechanical sensor which is a highly sensitive sensor and capable of detecting the tilt. This sensor find the tilt and makes use of the right direction along with obstacle detection using ultrasonic sensor. These technologies have greater importance than any other technologies due its user-friendly nature. The obstacle detection mechanism is done by an ultrasonic sensor that makes uses of ultrasonic waves to find the presence of an obstacle in its path. It makes use of the ultrasonic sensors to detect the obstacle present in its expected trajectory and dynamically changes. This microcontroller is capable of communicating with transmitter and receiver modules. The MEMS accelerometer sensor based sensor detects the tilt and provides the information to the microcontroller (on board computer) and the controller judges whether the instruction is right movement or left movement instruction and controls the direction respectively [2]. The controller is interfaced with two dc motors to control the direction of the wheel chair. The voice accelerometer to change the direction of the wheel chair depending on tilt [1]. For example if the tilt is to the right side then the wheel chair moves in right direction or if the tilt is to the left side then the wheel chair moves in left direction. Wheel chair movement can be controlled in Forward, Reverse, and Left and

recognition is done by HM2007 voice recognition IC. The microphone is directly connected at the analog input of voice recognition IC HM2007 keeping the mode selection key in the record mode [3]. We have designed an affordable and simple to use system that takes the input from the voice recognition module and uses the microcontroller's intelligence to operate different devices [4].

PROPOSED METHODOLOGY AND DESCRIPTION

Accelerometer and Voice Controlled

This work describes a wheelchair for physically disabled people & developed it using voice recognition kit and MEMS motion sensor. A user dependent voice recognition system had been integrated in the wheelchair. In this way they had obtained a wheelchair which can be driven using both

motion and voice commands. The circuit model works on the wheels of chair switching relays & motors with MEMS sensor placed on patients head. MEMS is used to send tilt signal to the wheelchair i.e., left or right or front or back. These tilt signals are passed to the controller as instructions. According to the program written for the controller, controller will give instructions to the wheelchair via relay. Here relay acts as a switching circuit. According to the relay operation wheelchair will move in that corresponding direction. If both the inputs to the Motor Driver are Low and high at the same time then the motor is in halt position. If the first output is high, Second output is low then DC Motor moves forward. If the first output is low, second output is high as shown in the circuit model then DC Motor moves reverse [5].

ACCELEROMETER

An accelerometer is an apparatus, either mechanical or electromechanical, for measuring acceleration or deceleration - that is, the rate of increase or decrease in the velocity of a moving object. The measurement of acceleration or one of its derivative properties such as vibration, shock, or tilt has become very commonplace in a wide range of products. Compact acceleration sensor for measuring acceleration is 2 axis. Our new acceleration sensor using the high-quality ADXL202 sensor from analog devices and can measure acceleration from -2g to +2g in either X or Y axis .Save time and money with this pre-mounted and assembled acceleration sensor unit. No need to solder the small SMD ADXL part, this unit comes completely assembled and ready to operate. The compact unit can be easily mounted on a robot or mobile unit, with easy to connect header for signal .Output is in PWM format and can be connected directly to a microcontroller [6].

Fig:1 Block Diagram of Speech Recognition

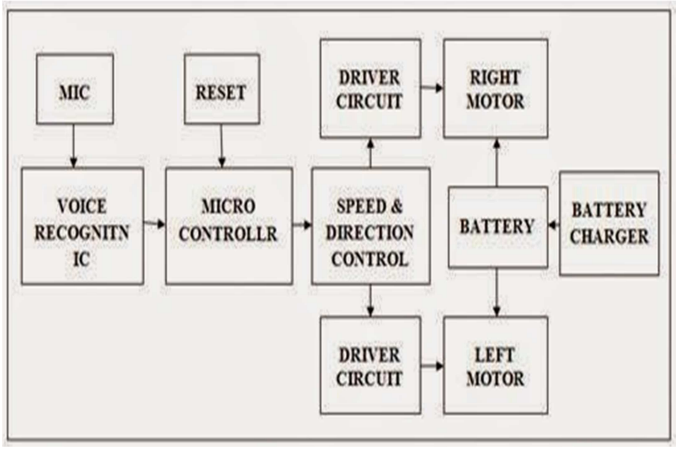
The main objective is to design a system which provides solution for the physically disabled those who can't move by themselves, using speech commands by interfacing the Speech Recognition kit (HM2007) with microcontroller and wheel chair. The Mic is provided to the person sitting on the wheel chair.HM2007 speech recognition kit registers the commands and forward them to the microcontroller. Microcontroller takes commands from speech recognition kit and passes them to the motor drivers. Motor driver receives the commands from PIC microcontroller and moves the motors according to

D.C. Motor

A DC motor uses electrical energy to produce mechanical energy, very typically through the interaction of magnetic fields and current-carrying conductors. The reverse process, producing electrical energy from mechanical energy, is accomplished by an alternator, generator or dynamo. Many types of electric motors can be run as generators, and vice versa. The input of a DC motor is current/voltage and its output is torque (speed). The DC motor has two basic parts: the rotating part that is called the armature and the stationary part that includes coils of wire called the field coils. The stationary part is also called the stator.

HM 2007

A voice module is also introduced that is HM2007 which is used by the person as shown in fig1. HM 2007 can detect 20 words in a second. By this who are not able to on off the devices whenever they required are able to perform that.



PROCEDURE

them. The motors are connected to the wheels of wheelchair [7].

Algorithm steps– The working of the project can be explained in the following steps:

Step 1: Initially 5v power supply is given to the HM2007 speech recognition kit, PIC microcontroller and motor drivers.

Step 2: voice module is ready to receive the commands.

Step 3: If the given voice command is LEFT then the wheel chair moves left side.

Step 4: If the command is RIGHT the wheel chair moves right side.

Step 5: If the command is FORWARD the wheel chair moves forward.

Step 6: If the command is BACKWARD the wheel chair moves backward.

Step 7: If the command is STOP the wheelchair stops moving.

HM2007 is a programmable IC .Up to 20 word vocabulary of duration two second each are detected control functions. HM2007 is a speech recognition kit which is used to train voice commands for the wheel chair operations. Voice module consists of 8 output pins D0-D7. Whenever a command is given,

Microcontroller:

The PIC microcontroller is used in the circuit. It is efficient to use. It is easy for embedded C programming. It has high efficiency. It is easy to use. It has high speed. The microcontroller is connected to HM2007 which gives input to the microcontroller .The microcontroller converts the output in binary form. The signal is given to the motor drivers with 5V power supply. The motor drivers control the motor of the wheel chair.

Motor Driver:

Motor Driver has built-in current sensing capability. It can take up to 30A peak current load and can be operated up to 20 KHz PWM. Motor driver can be interfaced with 3.3V and 5V logic levels. Motor driver has built-in protection from under / over voltage, over temperature and short. . The DC Gear motor, consisting of a DC electric motor and a gearbox, is at the heart of several electrical and electronic applications. Precision Micro drives have been designing and developing such high quality mini DC gear motors in an easy-to-mount package for a range of products and Motor driver is used to drive the two DC motors for the wheelchair movements. The output of controller is given to the inputs of motor driver and depending upon the inputs given to the motor driver the motor output pins rotates the motors by which the motor moves.

Human Voice Controlled Home Appliances

230V AC supply is converted to 5V DC using 12V step down transformer, Round bridge rectifier, smoothening circuit and LM7805 Voltage regulator. The working principle of speech recognition comprises of the fact that command given by any person generates vibrations or disturbances called as sound pulses. These analog waveforms are converted to digital form and decoded to appropriate commands including words and Sentences. Initially, train the voice recognition module HM2007 with the suitable commands and say the commands after that. The commands will be stored in binary form and fed to Atmega16 microcontroller through 8 bit data bus using latch IC.

The microcontroller operates according to the program fed into it. Port B is used to take input from voice recognition module and Port C is used to control output devices.

by the IC. The speech recognition system is completely assemble and easy to use programmable speech recognition circuit . It has 8 bit data out which can be interfaced with PIC microcontroller.

Hardware Implementation –

Power supply: 9v or 12v battery is used for giving power supply for voice module, controller and motor driver. 7805 regulator IC is used to give constant dc 5v output which is given as operating voltage for the voice module, controller as well as motor driver.

Voice module HM 2007:

It is a voice recognition IC, voice analysis, recognition process and system

the binary value of the address where that particular command is trained, is given to the output pins D0-D7.

According to the program fed, microcontroller will respond to the instructions and will turn on/off the devices as and when required.

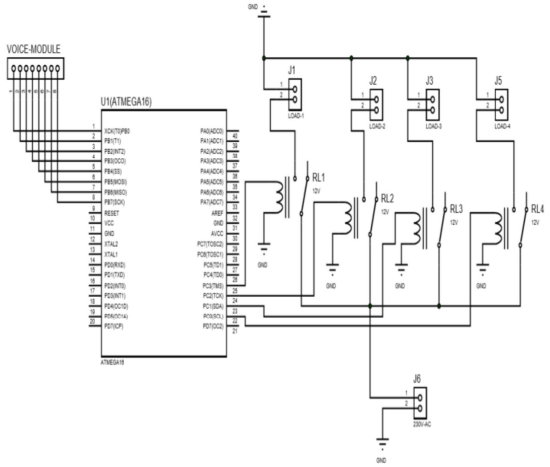


Fig:2 CIRCUIT DIAGRAM of CONTROL

RESULT: The voice recognition system was first tested in a quiet room with one user as shown in Fig 2. All commands were correctly recognized by the system. Next we tested it with a different user on whom the system was not trained. About 5% errors occurred here, for example words like "accept" were recognized as "except". This was because the recognizer heard a different pronunciation. Although, if the person had spoken the command multiple times the recognizer had sufficient examples to properly determine what pronunciation the person spoke. The wheelchair with all the setups is shown in Fig 3.

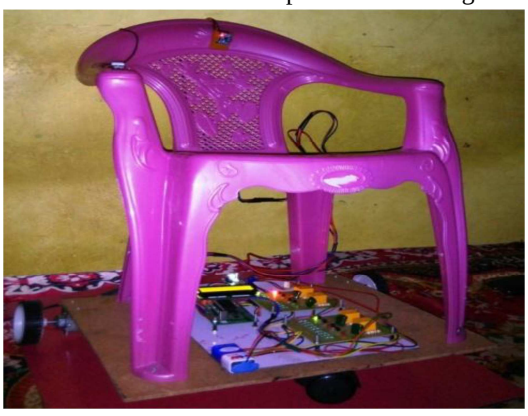


Fig:3 The wheelchair

CONCLUSION AND FUTURE SCOPE: From the above obtained results, we conclude that the developed head gesture based control of wheel chair is tested and works satisfactorily in an indoor environment with minimum assistance to the person suffering with paraplegia and quadriplegia.
It has a good response with MEMS activating the motors connected to the wheels of the chair.

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