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Hand Gestures Controlled Intelligent Wheelchair with Device Switch

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Abstract

The main aim of this paper is to use accelerometer sensor (Micro Electro-Mechanical Systems) technology to operate a wheelchair. MEMS (Micro Electro Mechanical Sensors) are a type of accelerometer sensor. This sensor is extremely sensitive and capable of detecting movements. The movement is detected by this micro electro mechanical sensor. The accelerometer is used to modify the direction of the wheelchair based on tilt. As an example, if the tilt is to leave, the wheelchair will go in that direction; if the tilt is to the right, the wheelchair will move in the opposite way. The wheelchair then goes to the left. Wheelchair movement may be regulated in three ways: forward, backward and reverse, Left, and Right directions are all available. This system may also operate devices such as a DC fan and a DC light to assist physically handicapped persons.

Keywords

Intelligent wheelchair, Micro electro-mechanical sensors, Accelerometer, Microcontroller

Introduction

The objective of this task is to utilize MEMS Accelerometer Sensor (Micro Electro-Mechanical Systems) innovation to work a wheelchair. MEMS (Micro Electro Mechanical Sensor) are a kind of accelerometer sensors. This sensor is incredibly delicate and equipped for identifying slant measurements. The slant is identified by this sensor. The accelerometer is utilized to adjust the wheel seat. For instance, assuming the slant is to the right, the wheel seat will head down that path; assuming the slant is to the left, the wheel seat will move in a contrary manner [1-5]. Wheelchair development might be controlled in three ways, forward and backward, and opposite, right, and left movement. This situation may include gadgets, like a DC fan and a DC light to help truly impeded persons. Numerous changes were introduced due to the advancements in atomization or computerization. The MEMS accelerometer sensor is one of the advancements that have evolved the most. Due to their ease of use, they were given higher load than different advances [6]. MEMS accelerometer sensor-based innovations are more open to the overall population because of their simpler working; however, they give a test to the component designers [4]. This paper utilizes a microcontroller that has been coded utilizing implanted C guidelines. The transmitter and beneficiary modules can speak with this microcontroller. The accelerometer (MEMS) sensor identifies the slant and sends the information to the microcontroller (on board PC), which decides if the guidance is for right or left development and manages the course as needs be. The regulator is associated with two DC engines that direct the wheel seat's direction.

Existing System

For those with physical limitations and poor health, the wheelchair has become the most often utilized equipment. Surprisingly, when measured in percentages, the number of wheelchair users in developing countries outnumbers those in rich countries. According to a recent study, wheelchairs serve an essential role in allowing elderly persons with reduced mobility to engage in daily activities [2-5]. Wheelchairs enable people with physical disabilities to move about independently and provide them with self-sufficiency. We propose a wheelchair design that can assist elderly, physically challenged, and visually impaired people in doing their tasks more successfully with minimum assistance from others.

Proposed System

The suggested system uses acceleration technology to produce a wheelchair control that is beneficial to physically handicapped people using their hand movement or hand gesture detection. In the realm of wheelchair technology, significant progress has been accomplished. Even with these enormous advancements in wheelchairs, an innovative model, i.e., a wheelchair that can be operated with just one hand gestures is an enormous innovation. It makes use of a sensor that interprets and controls the user's wheelchair hand motions. If follows with user's desired action and moves in accordance with it. If it alters the direction, the values in the sensor registers change, and those values are sent to the microcontroller. The microcontroller regulates wheelchair directions such as left, right, front, and back depending on the direction of acceleration. The goal of this study is to use hand gesture restructuring to provide wheelchair direction control.

Overview

The Developed framework is a mixture of product and equipment that works for a particular function. Chips and microcontrollers are the two most well-known components utilized in installed goods. General-reason processors are microchips that take, cycle, and result the information. A microcontroller, then again, gets information as contributions as well as monitors it, interfaces it to different gadgets, directs it, and delivers the result. In this task, a straightforward and little capacitive sensor is utilized to distinguish the presence of a youth in the front seat. A vehicle start screen is remembered for the proposed framework to guarantee that the driver is available inside the vehicle. It has a temperature check inside the vehicle.

Literature Survey

Goyal and Saini [6] introduced the accelerometer-based hand motion-controlled wheelchair which depicts the work in signal rearrangement use as application as a wheelchair. For this situation was directed is signal is perceived through 3-axes accelerometer sensor. A framework comprises of purpose sensors for distinguishing the motion or hand developments. In this framework motion is recognized by the MEMS accelerometer sensor (Micro Electro Mechanical System). An accelerometer is an electromechanical component that measures speed. This accelerometer sensor is attached at fingertips and back of hand. It is a portable component. At the point when it is moving the signal is perceived and the wheelchair will work as indicated by the development of sensor. Subsequent to concentrating on a plan of "Accelerometer based hand signal-controlled wheelchair" one came to know the framework absolutely relies upon sensor. If the sensor can't move in calculated position or bearing this framework can't work hence this framework isn't quite so much as easy to understand. This framework doesn't offer solid help for incapacitated or handicapped individuals.

Chen et al. [7] introduced the hand Gesture recognition utilizing an ongoing following strategy and Hidden Markov models which depict the presentation close by signal rearrangement framework to perceive the consistent signal before stationary background. In this framework the movement of the item gives significant and valuable data for object limitation and extraction. Generally speaking, framework incorporates four modules, for example, follows ongoing following, extraction, highlight extraction, Hidden Markov model preparing. To follow the moving hand and concentrate the hand locale when applied the real time hand following and extraction calculation. To describe the spatial component and movement examination to characterize the transient element to utilize a Fourier Descriptor. Combine the spatial and worldly component from input picture arrangements as our element vector then apply the Hidden Markov model then perceive the info signal.

Smitha et al. [8] developed a framework way to deal with ongoing recognition, Tracking and reorganizational direction of hands which is utilized for communication between human robot and insightful wheelchair. This framework planned that the accelerometer sensor is utilized adversary to change over fingers and hand motions into computer interpreted signal. The accelerometer information is aligned and sifted for motion or finger redesign. For the wheelchair control we utilize a 3-pivot accelerometer, which really deciphers finger and hand motions into computer deciphered signal. This framework isn't reasonable for patients for taking care of view so it not so easy to understand.

Patil and Varalakshmi [9] introduced the hand gesture recognition for MP3 player utilizing Image handling Technique and PIC16F8779 describes the signal is perceived by the picture handling through web camera. This framework proposed the motion picture is taken from web camera and picture will be handled in remote interface using MATLAB regulator. While catching pictures is sent to the MATLAB it campers to the data set through the (x, y, and z) readings of specific objects. The development of the item toward any path then, at that point, values is noted by accelerometer the development of accelerometer to the specific arrangement of bearings it will perceive the motions or specific heading to work application. This system utilized the K-L Transform for perceiving reason through picture handling. One issue of this framework is the caught picture is generally in the confounding undertaking of isolating various wellsprings of pictures when it's different or noisy, so it isn't quite so much as successful.

Li and Kitani [10] introduced Pixel-Level Hand Detection in Ego-Driven Videos in this framework other depicts that hand motion perceived by pixel-level utilizing picture processing. In this framework the hand motion or any developments of hand is perceived by the Ego Centric videoed which presents such as quick changes in enlightenments, huge camera movement and complex hand recognition control. To quantify the exhibition, present the new space that contains dataset containing 200 million marked pixels using inner self driven hand identification which contains hand pictures contains taken under the different illumination conditions. Utilizing both dataset and accessible pictures gives the perceiving execution utilizing wide scope of local appearance highlights.

Experimental Setup

The following are the essential components of this research:

1. Microcontroller (16F877A)
2. Power supply that is regulated (RPS)
3. ACCELEROM- ETER SENSOR MEMS
4. Driver circuit for the relay.
5. LED light with DC fan
6. Drivers for DC motors
7. Indicators with LEDs

Figure 1 shows the schematic block diagram of hand gestures-controlled wheelchair. The MMA7660FC is a 1.5-gram 3-hub accelerometer with advanced yield (I2C). It is a low-power, low-profile capacitive MEMS sensor highlighting a low-pass channel; 0g offset and gain adjustment, and 6-bit computerized information transformation at a client configurable testing rate. Sensor information refreshes, item direction, and signal acknowledgment should be in every way possible utilizing the gadget's hinder pin (INT). The gadget arrives in a little DFN compartment that is 3 mm x 3 mm x 0.9 mm.

Proteus is a program that exclusively takes hex files. After the machine code has been translated to hex code, the Proteus must dump the hex code into the microcontroller. Proteus is a coder that includes a microcontroller in addition to the one that will be programmed. This microcontroller contains software that receives the hex file from the photo compiler and puts it into the microcontroller to be programmed. Because the Proteus coder requires electricity to function, it is supplied via a power supply circuit constructed and linked to a microcontroller in Proteus. The program that will be dumped into the microcontroller is modified in proteus, compiled, and executed to check for mistakes, and then the program is dumped into the microcontroller to use a dumper when it has been successfully built. The PIC C compiler is being used to compile code for PIC microcontrollers.

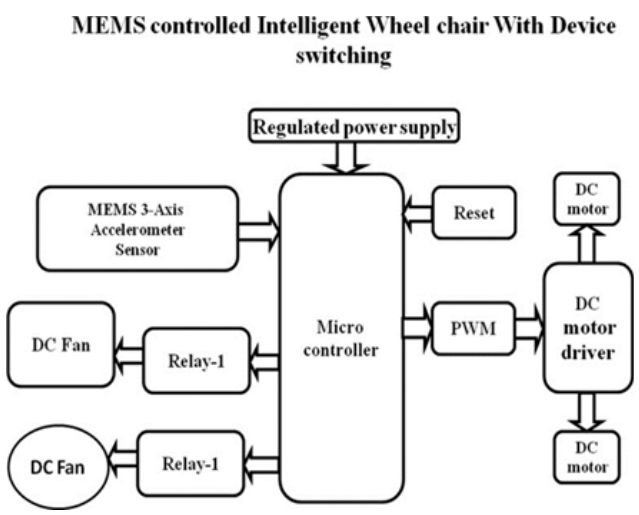

Figure 1: Block diagram of hand gestures controlled intelligent wheelchair with device switch.

Working

When a 230 V AC power source is supplied to the kit, the RPS (regulated power supply) converts it to a 5 V DC power supply. We're employing the MEMS sensor for impaired people in this project. When they maneuver their wheelchair, they wish to use MEMS accelerometer sensor-based gadgets since they are easier to use, and it challenges the device's creators. Figure 2 shows the schematic diagram of the hand gesture controlled intelligent wheelchair. Figure 3 shows the prototype of the device which is controlled with device switch.

Results and Discussion

This research is to set up a Hand Gesture Controlled Wheelchair for the genuinely impaired individuals who face trouble in moving starting with one spot then onto the next in day today life. Nowadays joystick-controlled wheel seats are accessible in the market whose cost ranges between Rs 80,000 to Rs 150,000. The proposed Hand Gesture Controlled Wheelchair is just Rs 22,000 only. An accelerometer is utilized as a sensor which gives a simple sign of its development in any of the 6 hub headings that is positive X pivot, negative X hub, positive Y hub, negative Y hub, positive Z hub, negative Z hub. In this venture we have thought about X and Y pivot for the heading. Further the contribution from sensor is given to encoder which sends the information remotely through the transmitter, then, at that point, the information is obtained at the collector end and the sensor information is decoded lastly given to microcontroller. In view of information received the from accelerometer the microcontroller conveys the message as needs be to transfers to move the wheelchair in forward, in reverse, left, right headings. The accelerometer utilized here is MEMS (miniature electromechanical framework). Hand Gestures controlled intelligent wheelchair with Device Switch was created to assist disabled persons, particularly those who are unable to move the technology was developed successfully to move the wheelchair in all directions the people with disability are increased day by day because of accident in both rural and urban. In this project, it is made ease for disabled people to move one place to other place by using MEMS technology. Around 54,36,604 people are affected from movement disability. The developed model will be very helpful for them. table 1 and table 2 show the direction of movement of wheelchair on minimum threshold angle and Components in the Model and input voltage supplied to each component.

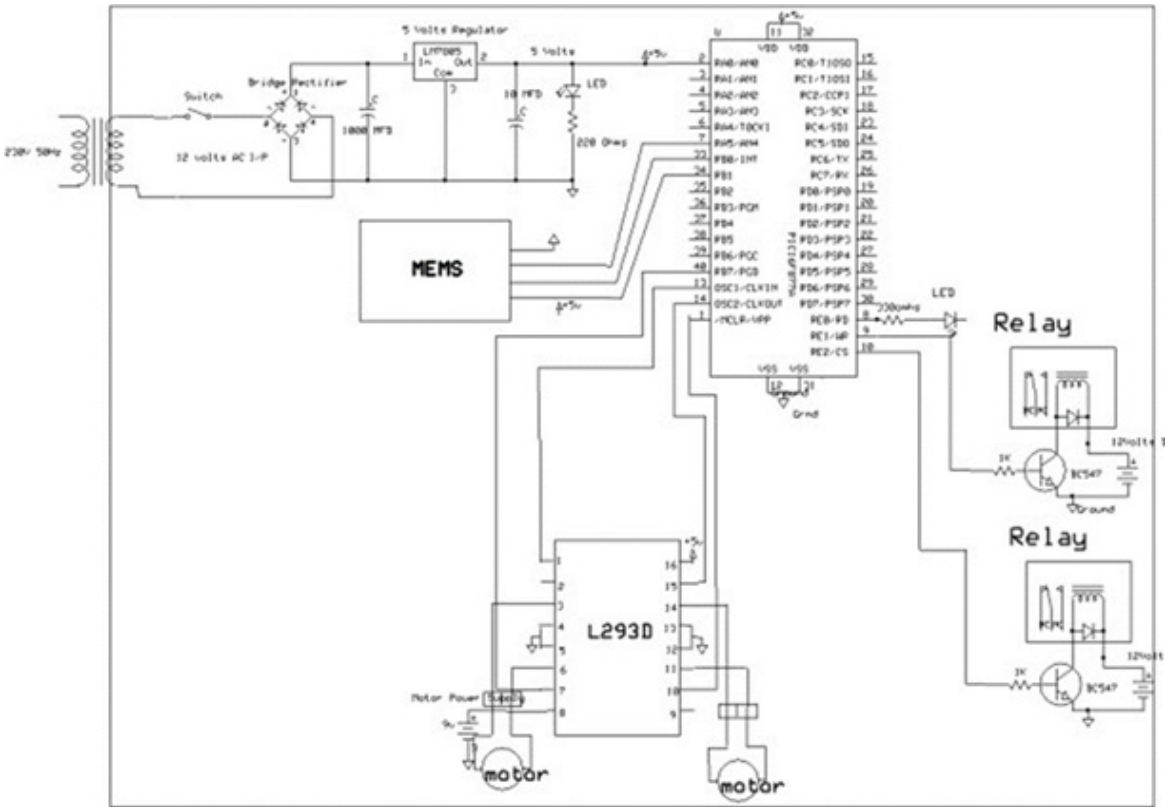

Figure 2: Schematic diagram of hand gestures controlled intelligent wheelchair with device switch.

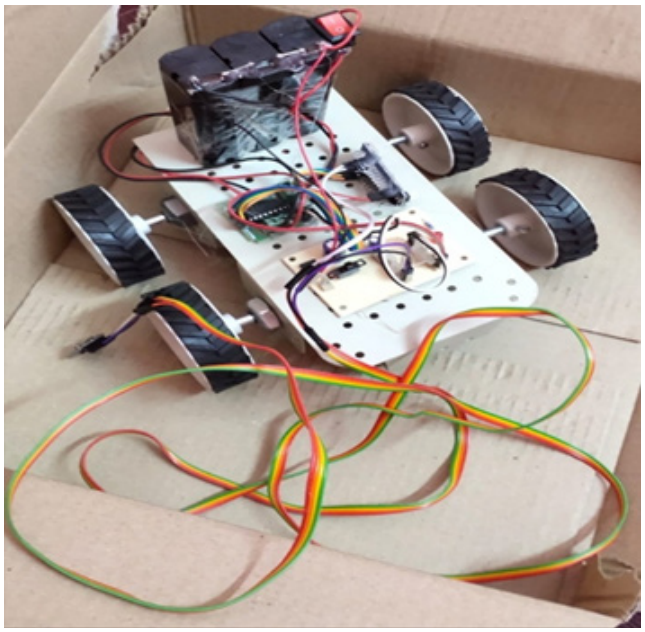

Figure 3: Hand gestures controlled intelligent wheelchair with device switch.

Conclusion

With the use of hand gestures, it can control the wheelchair mobility of impaired persons. Various bodily movements, such as eye gazing, leg movement, and head movement, can be used to improve performance. The wheelchair is fully capable of carrying the load up to 110 kg and moving accordance with the gesture given by the person who is using the wheelchair

Table 1: Direction of Movement of wheelchair on minimum threshold angle.

Movement of wheelchair	Threshold angle of hand gesture
Forward	25° forward
Backward	35° forward
Stop	0°
Left	30° left
Right	30° right

Table 2: Components in the Model and input voltage supplied to each component.

Components	Input (V) supplied
Motors	24
IC7805	11.91
IC 7812	11.91
ADXL	4.9
LM324	4.9
HT12E	4.9
Transmitter Module	4.9
HT12D	4.9
Receiver Module	4.9
89S52 micro controller	4.9
L293d	11.91 and 4.9
Relays	11.91

certain improvisation and improvement can be done to make the wheelchair more reachable to those whose whole body is paralyzed. In future certain eye gestures on brain signals can be used as input to make it better.

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Conflict of Interest

TThe corresponding author declares no conflict of interest that is relevant to the content of this article.

Credit Author Statement

K. Rishika Renita and S. Harish Kumar: Study conception, Design; M. Vishnu Vardhan: Data collection, Writing - original draft preparation, Writing - review and editing. All the authors read and approved the manuscript.

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