HAND GESTURE BASED WHEELCHAIR CONTROLLER FOR THE DISABLED

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ABSTRACT

Objective of this project is to make the user more comfortable, secure, and independent and many added advantage at a low cost with the high response circuit design. To be simple and easy to handle the wheel chair by themselves (disabled person); at the same time it should be reliable.

In case of any emergency the patient can just press the button provided which sends the alert messages to the doctors/relatives with the help of GSM (Global System for Mobile Communications) module. Obstacles can be detected automatically which saves the patient from risk. GPS (Global Positioning System) tracker is provided to monitor them. Thus, this design does not consist of bulky equipments to wear for monitoring. So, that the Patient can feel very comfortable and c in using this wheel chair unlike the common one.

Key Words: GPS tracker, GSM module, Obstacles, secure.

1. Introduction

Hand gesture based wheelchair controller is one of the best methods to help the disabled people in which they can control without any strain [1]. A Gesture is a form of non-verbal communication in which visible bodily actions communicate particular messages, either in place of speech or together and in parallel with spoken words. Gestures include movement of the hands, face, or other parts of the body [2]. Here we use MEMS accelerometer sensor to recognize hand gesture which is a Micro Electro Mechanical Sensor which is a highly sensitive sensor and capable of detecting the tilt. This sensor finds the tilt and makes use of the accelerometer to change the direction of the wheel chair depending on tilt. Wheel chair movement can be controlled in Forward, Reverse, and Left and Right direction along with obstacle detection using accelerometer sensor and ultrasonic sensor [3-5].

Automation is the most frequently spelled term in the field of electronics. The hunger for automation brought many revolutions in the existing technologies. One among the technologies, which had greater developments, is the MEMS accelerometer sensor. These had greater importance than any other technologies due its user-friendly nature. MEMS based devices can be easily reachable to the common man due to its simpler operation. User can wear it to his wrist like a watch and can operate it by tilting the accelerometer sensor. Now-a-days people prefer only automatic equipments even though they were healthy enough to operate them manually. Being a disabled person, manual wheel chair makes them uncomfortable and tired [7].If they were seriously injured they should be always accompanied by someone for help. Thus automatic wheel chair controller allows them to move around individually at the same time this provides the safety and secure travelling [7-9].

2. Methodology

In this project wheelchair is operated using hand gesture and to sense the hand gesture MEMS accelerometer is being used. Micro Electro Mechanical Systems (MEMS) is the integration of mechanical elements, sensors, actuators, and electronics on a common silicon substrate through micro fabrication technology. An accelerometer is an electromechanical device that measures acceleration forces. MEMS accelerometer is a single chip with small size and low cost. Because of their small size and weight, accelerometers are attached to the fingertips and back of the hand. In this model we are using ADXL335 accelerometer, which is 3axis accelerometer and gives digital output [10].

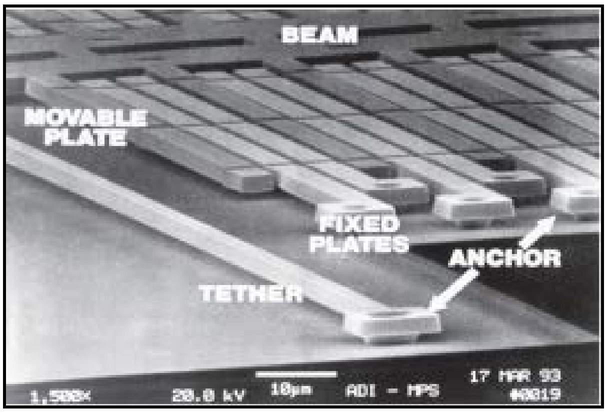

Fig 1:1 MEMS accelerometer

The ADXL335 is a small, thin, low power, complete 3-axis accelerometer with signal conditioned voltage outputs. The product measures acceleration with a minimum full-scale range of ±3 *g*. It can measure the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion, shock, or vibration [9]. The user selects the bandwidth of the accelerometer using the CX, CY, and CZ capacitors at the XOUT, YOUT, and ZOUT pins. Bandwidths can be selected to suit the application, with a range of 0.5 Hz to 1600 Hz for the X and Y axes, and a range of 0.5 Hz to 550 Hz for the Z axis. The ADXL335 is available in a small, low profile, 4 mm × 4 mm × 1.45 mm, 16-lead, plastic lead frame chip scale package (LFCSP_LQ).

2.1. Features:

1. 3-axis sensing
2. Small, low profile package
3. 4 mm × 4 mm × 1.45 mm LFCSP Low power: 350 μA (typical) Single-supply operation: 1.8 V to 3.6 V 10,000 *g* shock survival
4. Excellent temperature stability
5. BW adjustment with a single capacitor per axis RoHS/WEEE lead-free compliant.

3. Block Diagram

Block diagram is a diagram of a system, in which the principle parts or functions are represented by blocks connected by lines that show the relationships of the blocks. We consider two sections (Transmitter & Receiver).

3.1. Transmitter section

Fig 3:1 shows the functional block diagram of transmitter section. In transmitter section "Micro Electro-Mechanical Systems (MEMS) technology" is used. It is a three axis accelerometer which gets the user instructions by tilting the accelerometer. According to the tilt, sensor produces the output which is an analog output. That analog output is converted into digital by using A/D converter. Depending on the input received from the A/D converter the microcontroller produces the output. Crystal oscillator is used here to generate the clock pulse & to support the RF module with its frequency. It is provided in both the transmitter and the receiver section. RF transmitter transmits the data signals with its carrier wave which can be accepted only by the receiver of the same frequency.

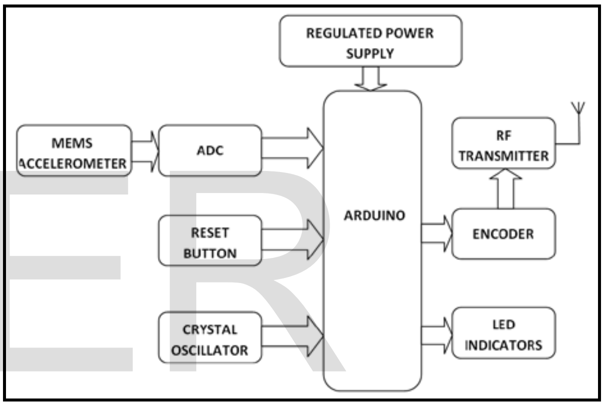

Fig 3:1 Functional Block diagram of Transmitter section

3.2. Receiver Section

From Fig 3:2, the transmitted data signals are received by RF receiver which operates in the same frequency as the receiver. The encoded data signals are separated by the decoder. Then the micro controller produces the output which instructs the driver circuit to close or open the switches in it. Depending on the switches closed it produces either positive or negative output and motor rotates accordingly. Additional feature called **"**emergency button**"** is placed in the wheelchair on pressing, it sends the location and an alert message to the Doctor/relatives which would help the user in an emergency situation. Thus the Patient can feel very comfortable, secure and independent at low cost. If there is any obstacle we use ultrasonic sensor to acknowledge it. Here it is not avoided but it is acknowledged using buzzer which helps the user to decide the path and it is safer than avoiding it automatically.

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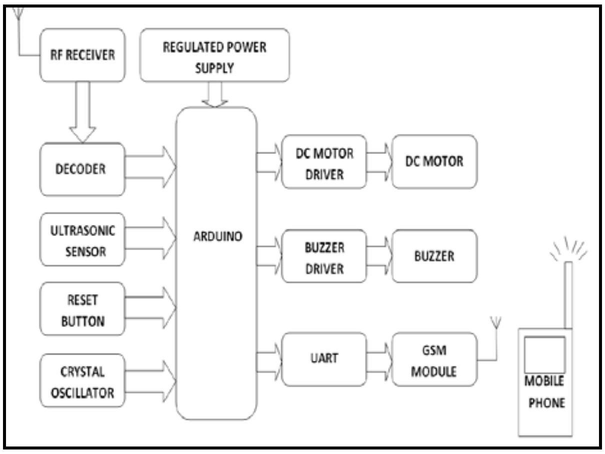

Fig 3:2 Functional Block diagram of Receiver section

4. Software

4.1. Proteus

Proteus combines advanced schematic capture, mixed mode SPICE simulation, PCB (Printed Circuit Board) layout and auto routing to make a complete electronic design system. Proteus is a Virtual System Modelling and circuit simulation application. The suite combines mixed mode circuit simulation, animated components and microprocessor models to facilitate co-simulation of complete microcontroller based designs. Proteus also has the ability to simulate the interaction between software running on a microcontroller and any analog or digital electronics connected to it.

5. Result and Discussion

5.1. Transmitter section

5.1.1. Simulation

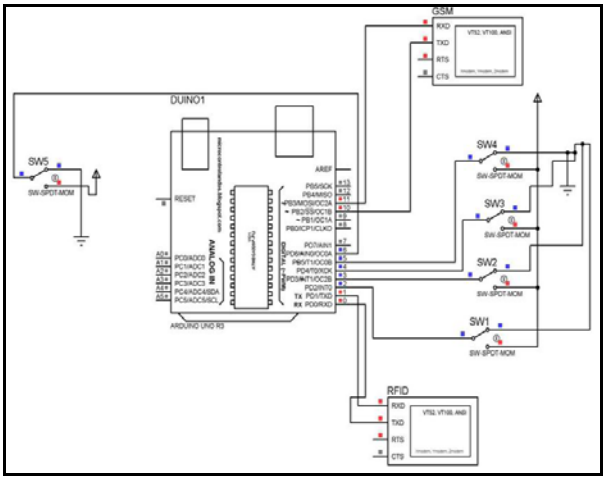

Fig 5:1 Simulation circuit of Transmitter section

In the transmitter section for simulating MEMS we have placed 4 switches which give the specified output when they are closed. Closing SW1 instructs the RF Transmitter to transmit “f”. Similarly Closing SW2 instructs the RF Transmitter to transmit “b”. Closing SW3 instructs the RF Transmitter to transmit “l”. Closing SW4 instructs the RF Transmitter to transmit “r”. The SW5 is given for Emergency button .On closing it receives the information from the GPS tracker along with the emergency message it sends the position to the mobile number programmed in the GSM Module.

5.1.2. Output

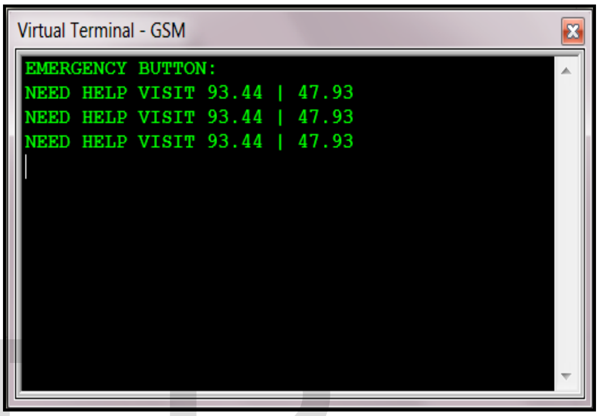

Fig 5:2 Virtual terminal of GSM Module

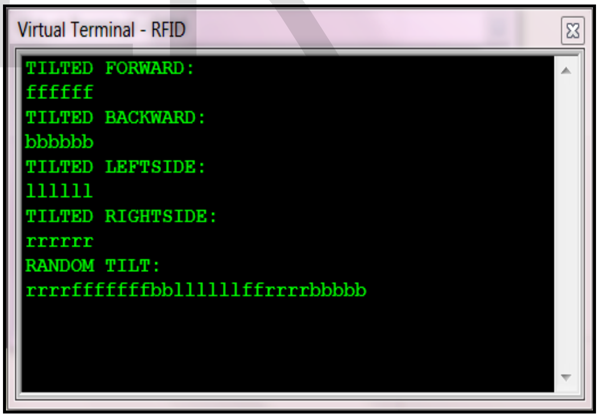

Fig 5:3 Virtual terminal of RF Transmitter

5.2. Receiver section

5.2.1. Simulation

In the receiver section originally the values will be received by the receiver but in simulation we give manual inputs to the receiver thus when “f” is given Driver circuit is programmed to rotate both the motor in forward direction. When “b” is given Driver circuit is programmed to rotate both the motor in reverse direction. When “r” is given Driver circuit is programmed to rotate one of the motor rotates in forward direction and other in reverse direction.

When “l” is given Driver circuit is programmed to rotate one of the motor rotates in forward direction and other in reverse direction.

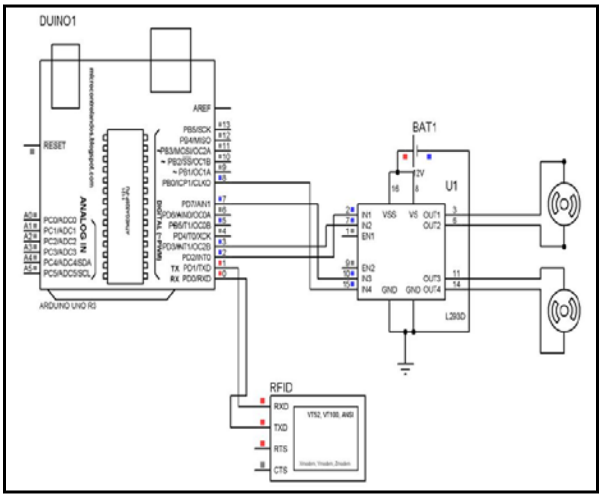

Fig 5:4 Simulation circuit of Receiver section

5.2.2. Output

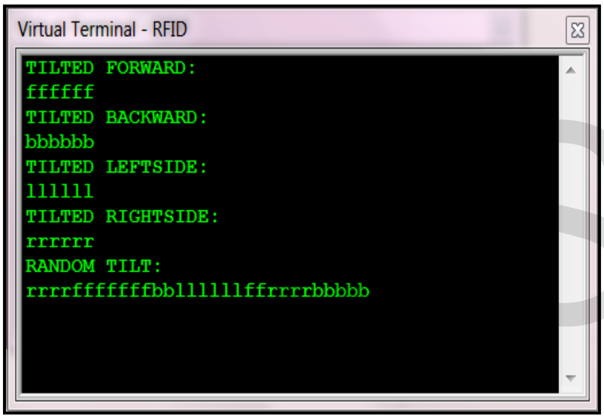

Fig 5:5 Virtual terminal of RF Receiver

6. Conclusion

The motive of this project is to help the poor disabled people with the highly effective automatic controlled wheel chair.

Thus in this project we were able to control some of the overall draw backs of the other techniques which were prescribed or used earlier. We have replaced low cost highly effective wheel chair and long lasting mainly concentrated on its cost and effectiveness which is not considered in the previous papers. In this project, we have introduced MEMS accelerometer which is known for its convenience. RF transmitter and RF receiver (wireless) is used for transmission and reception of the data from the accelerometer sensor which eliminates the usage of wires, thus the bulkiness of the project is reduced. Design will be simple & easy to handle. Ultrasonic sensor will be placed in front of the wheel by which obstacles can be detected and they are programmed only to turn ON the buzzer (because automatic change in the direction may be dangerous).Then user will give another alternate direction to move on which saves the patient from risk. In case of any emergency the patient can just press the button which will be placed in the wheel chair. It makes the GSM module to send the recorded alert messages to doctors/relatives. It is also designed to send the location to help the user with the help of GPS tracker. This design does not consist of bulky equipment to wear for monitoring. So, that the patient can feel very comfortable, secure and independent at a very low cost.

REFERENCES

[1]Rafael barea Luciano Boquete and Manuel Mazo; “System for Assisted Mobility Using Eye Movements Based on Electrooculography”, IEEE, Vol 10, no 4, pp.209-218, December 2002.

[2]Diksha Goyal and Dr.SainiS.P.S; “Accelerometer Based Hand Gesture Controlled Wheelchair”, International Journal on Emerging Technologies, no 0975-8364, pp.15-20, June 2013.

[3]Tom Carlson; “Collaborative Control for a Robotic Wheelchair : Evaluation of Performance, Attention and Workload”, IEEE ,Vol 42, no 3,pp. 876-888,June 2012.

[4] Sehoon Oh, naoki Hata and Yoichi Hon; “Integrated Motion Control of a Wheelchair in the longitudinal, Lateral and Pitch Directions”, IEEE, pp.153-185, June 2011.

[5] Kohei Arai and Ronny Mardiyanto; “Eyes Based Electric Wheelchair Control System”, IJACSA, vol 2, no 12, 2011

[6] Lai Wei, Huosheng Hu, Tao Lu and Kui Yuan; “Evaluating the Performance of a Face Movement Based Wheelchair Control Interface in an Indoor Environment”, IEEE, pp. 14-18, December 2010.

[7] Rahul C M and Nalini C Iyer; “Voice and Accelerometer Controlled Wheelchair”, IJRET, no 2319-1163, pp. 2321-7308.

[8] Amundson JS and Amundson SG, “A joystick controlled wheelchair”, Biomed Sci Instrum, Vol 27, pp. 131-133, 1991.

[9] http://en.wikipedia.org/wiki/Accelerometer

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[10]http://www.robotelectronics.co.uk/acatalog/I2
C_Tutorial.html