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WIRELESS GESTURE CONTROLLED ROBOTIC WHEELCHAIR

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Abstract— An effort has been made to develop a wheel chair control which is useful to the physically disabled person with his hand movement or his hand gesture recognition using acceleration technology. Here acceleration technology is achieved by an accelerometer sensor. Tremendous leaps have been made in the field of wheelchair technology. However, even these significant advances haven't been able to help quadriplegics to navigate the wheelchair unassisted. A wheelchair has been made which can be controlled by simple hand gestures. It employs the sensor which controls the wheelchair by the hand gestures made by the user and interprets the motion intended as per the programming and moves accordingly. Whenever the input is provided by the sensor to the microcontroller i.e. whenever the user changes the direction, the accelerometer records the analog values and sends it to the microcontroller, for the further operations. The microcontroller doesn't work on analog values hence it is converted to digital format before being used in the microcontroller. Depending on the direction of the acceleration and as per the coding, microcontroller forms the 4-bit data set for the control of the motion and then transmits it using 433 MHz ASK RF module transmitter. It is received using 433MHz RF module receiver and the 4-bit data set received is sent to the motor driver for the motion of the wheel chair. Two of the accelerometer axis are used to control four motions i.e. LEFT, RIGHT, FRONT, and BACK. The aim of this paper is to implement wheel chair direction control with hand gesture reorganization which provides a more efficient, calibrated and controlled motion.

Keywords— Accelerometer, Gesture, Wireless, Wheelchair

I. INTRODUCTION

This paper proposes an integrated approach to real time detection, tracking and direction recognition of hands, which is intended to be used as a human-robot interaction interface for the intelligent wheelchair. This paper is to demonstrate that accelerometers can be used to effectively translate finger and hand gestures into computer interpreted signals. For gesture recognition the accelerometer data is calibrated and filtered. The accelerometers can measure the magnitude and direction of gravity in addition to movement induced acceleration. In order to calibrate the accelerometers, we rotate the devices' sensitive axis with respect to gravity and use the resultant signal as an absolute measurement. Integrating a single chip wireless solution with an accelerometer would yield an autonomous device small enough to apply to the fingernails, because of their small size and weight. Accelerometers are attached to the hand. Arrows on the hand show the location of accelerometers and their sensitive directions, that the sensitive direction of the accelerometer is in the plane of the hand. The gesture based wheelchair is suitable for the elderly and the physically challenged people who are unfortunate to have lost ability in their limbs due to paralysis or by birth or by old age. Elders find it tough to move inside the house for day to day activities without help or external aid. Our proposed system makes use of a wheelchair that can be used by elderly or physically challenged to move inside the home without difficulty and without external aid. The elders may also forget the way to the different rooms in house due to the increase in forgetfulness as they become older. The physically challenged, find difficult to move the wheel chair without help from others. By making use of the system, the elderly and the physically challenged can go to different rooms in the house like kitchen, living room, dining room etc by just showing a gesture which is predefined to that particular room. It is also a virtue of the system that even the foot or head can be substituted in place of the hand for users who might find that more convenient. This paper aims to control a wheel chair and electrical devices by using accelerometer sensor technology. Accelerometer sensor is a Micro Electromechanical 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. 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 Right direction

II. WORKING PRINCIPLE:

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The analog input is given by the accelerometer using hand gestures. This is given to PORT A of the microcontroller i.e. PORT A of Atmega 16. PORT A is having in built ADC and will convert analog voltage into digital voltage. Based on these voltages directions are displayed on LCD. This output of the microcontroller is encoded using HT12E IC and then transmitted using the transmitter of 433 MHz ASK RF modules. This is received by the receiver end of the 433MHz ASK RF module and further decoded using HT12D. The further output connections are fed to the motor driver L293D and then to the motors. Speed and direction control is done by using two DC geared motors.

III. HARDWARE

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(i) MICROCONTROLLER**:** ATMEL series AT mega 16 microcontroller has been used for running the whole application because of its better compatibility.

(ii) TRANSMITTER MODULE:

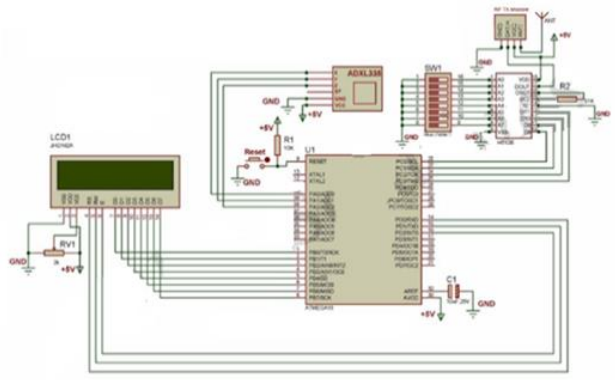

Fig 1: Transmitter Circuit of Accelerometer

(iii) ACCELEROMETER

The ADXL335 is a triple axis accelerometer with extremely low noise and power consumption. The sensor has a full sensing range of ±3g.There is no on-board regulation, provided power should be between 1.8 and 3.6V DC. This accelerometer is used to provide required gestures for mobility of wheelchair. Its 3 axis x, y and z moves the wheelchair in particular direction i.e. hand gesture in x direction will move the wheelchair in forward direction similarly other axis will move the wheelchair in backward, right and left direction. This input device is mounted on hand and hand is moved in a particular direction as shown in the figure 5. ATmega16 controller is used to process these gestures i.e. it reads the analog output values(x, y and z axis values of the accelerometer) of the ADXL 335 accelerometer sensor and converts the analog value to digital values with its analog to digital converter. The digital values obtained by the above method are processed by the ATmega16 microcontroller and according to the tilt of the accelerometer sensor mounted on hand; the robot is driven in the forward, reverse, left, right direction and stops it. Inside the accelerometer sensor minute structures are present that produces electrical charges if the sensor experiences any movement. The output of any axis of accelerometer is an analog voltage proportional to the acceleration in that axis..

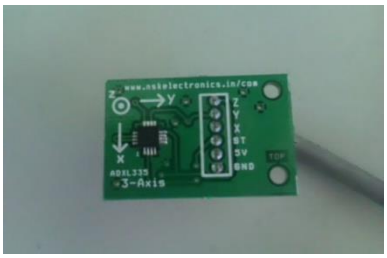

Fig 2: Accelerometer

(iv) RF ASK RECEIVER MODULE:

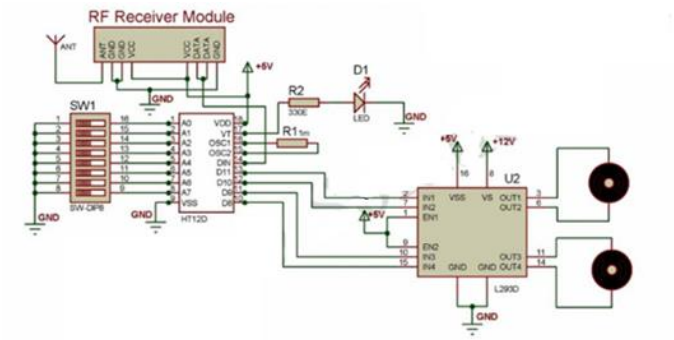

Fig 3: Receiver Circuit of Accelerometer

(v) D.C. MOTOR: A dc motor is used to convert electrical into mechanical energy through the interaction of magnetic fields and current-carrying conductors.

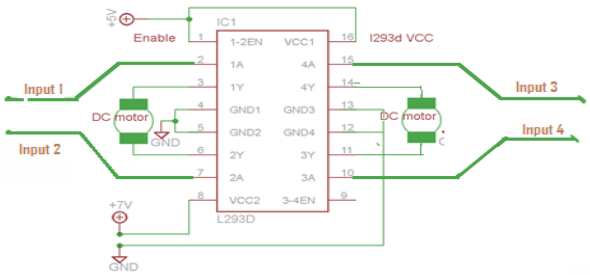

Fig 4: D.C. Motor Circuit

IV.WORKING

To detect different hand gestures, the ADX335 accelerometer sensor has been used. The sensor will be attached to the hand with some material or through a hand glove. The three output signals of accelerometer sensor are analog in nature and it cannot be processed directly by ATmega16 microcontroller. For this, ADC of the ATmega16 microcontroller to convert the analog signals to digital values is used. After converting the analog signals

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of accelerometer sensor to digital values, the ATmega16 microcontroller will process the digital values to find different gestures of the hand. Once the hand gesture is known, the ATmega16 microcontroller will send the required 4 bit signal to the HT12E encoder of RF transmitter circuit. The HT12E will encode the 8 bit address and 4 bit data given to it and then it will transmit the encoded signal serially to the RF module. The RF module will transmit the encoded data and address wirelessly. Also, the microcontroller will display the direction of movement of the robot in the 16X2 alphanumeric LCD. At the receiver end, the RF receiver module will receive the encoded 4 bit data and 8 bit address. Then, it will transmit the encoded signal serially to the HT12D decoder which will decode the received signal to 8 bit address and 4 bit data. After decoding, the HT12D will compare the received 8 bit address with its local 8 bit address. If the received address and the local address are same, then the received 4 bit data is sent to its output pins else the received data is discarded. The 4 bit output of HT12D is sent to the DC motor driver (L293D) of the robot to drive the robot in the desired direction.

V.APPLICATIONS

Some patients that cannot manipulate the wheelchair with their arms due to a lack of force or psychomotor problems in the superior members require electric wheelchair. The wheelchair is operated with the help of accelerometer, which in turn controls the wheelchair with the help of hand gesture. The wheelchair moves front, back, right and left. Due to which disabled and partially paralyzed patient can freely move.

VI. CONCLUSION AND FUTURE SCOPE

When an unfortunate event affects the motor capacity of a person, it is necessary to use devices like wheelchairs that offer a means of displacement for patients with motors problems of the lower limbs. Tremendous leaps have been made in the field of wheelchair technology. However, even these significant advances haven't been able to help quadriplegics navigate wheelchair unassisted. Some patients that cannot manipulate the wheelchair with their arms due to a lack of force or psychomotor problems in the superior members, request electric wheelchairs, frequently manipulated with joysticks; however, the joystick manipulation is even not practical and frequently it must be handled with the mouth. It represents the partial results in the development of a wheelchair controlled by an intuitive interface, where the instructions are given by hand gesture instructions. The advances are presented in the realization of the control software using a Webcam and some distances and presence sensors controlled by a PIC microcontroller that establishes the communication with a program developed in Lab view. This paper is inspired from an IEEE Research Paper Titled "A Wearable Head- Mounted Sensor-Based Apparatus for Eye Tracking Applications" that was presented in the IEEE International Conference on Virtual Environments, Human-Computer Interfaces, and Measurement Systems Istanbul, Turkey, dated 14-16 July 2008. The above paper approach deals with control of wheelchair using eye ball movement with slight modification to it.

VII. REFERENCES

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