AUTOMATED WHEELCHAIR WITH GESTURE CONTROL

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Abstract : People suffering with physical disability due to illness, accidents or any other disability are in need of wheelchair. Patients who are suffering from low or medium level disability are able to use manual or electrical wheelchairs. In severe cases of disability, the wheelchair lacks mobility and the person cannot use wheelchair and has to depend on external help for movement. This paper aims to develop a wheelchair which can be controlled by voice and gesture by physically handicapped person. Atmega328p based Arduino, Gyro sensor is interfaced with it. The Gyro sensor used will detect the movements made by user and controls wheelchair in respective direction.

Keywords— Wheelchair, Arduino, Gyro Sensor,

I.INTRODUCTION

As per statistical report by World Health Organization (WHO)and World Bank, 15% of total population experience some form of disability [1], day by day the percentile is increasing due to road accidents and disease like paralysis. About 1.85% of population need wheelchair for their daily life [2], in most cases where the disability is low, manual or electrical wheelchair is enough but in severe cases where the patients are solely dependent on external help find it difficult to maneuver. To overcome such problems several companies have introduced “Smart Wheel Chairs”. Smart Wheel Chair can be defined as modified electrical wheelchair which is equipped with various sensors and control system which makes it easier for disabled person to maneuver without the help of relatives or nurses, giving full control to the user and eliminating the user’s responsibility in moving the wheel chair manually. Gyro sensor is used as input devices. The gyro sensor will detect the movements made by user’s hand in X and Y axis and sends it to a Atmega328p based Arduino board. The Arduino then sends corresponding signals to motor controller which drives the motor in respective direction.

II.LITERATURE REVIEW

Literature [3] proposes a system which uses Bluetooth connected to an android phone to control wheelchair using voice command and reed switches which are controlled by tongue to direct the motor to drive motor in left, right, forward and reverse direction through a L293 motor driver and also the use of obstacle sensor to detect obstacle in front of wheelchair.
Literature [4] describes a method by which the voice signal is converted into a text format with the help of android mobile and sent to microcontroller through a Bluetooth module to control the direction of movement of wheelchair.
Literature [5] proposes a system in which MATLAB software is used as speech synthesizer and sends it to ARM Processor. The input to MATLAB is through a microphone, according to the input signal the ARM processor controls the direction of motor.
Literature [6] employs the use of reactive fuzzy logic controller and sensors to avoid obstacles in the path of wheelchair making the wheelchair semi-autonomous, reactive fuzzy logic controller because the voice input from user might be low and it leads to irregular working of wheelchair.
In [7] HM2007 IC is used to synthesize speech by the user, the IC generates the output signal depending upon the user’s speech. The output signal is taken as input to PIC 16F877 microcontroller which controls the input to DC motors

III.INDIAN STATISTICS ON DISABILITY

120 million people are disabled in India out of which 41% of people are physically disabled [8]. The number of physically disabled people are increasing due road accidents and disease. The figure shows the graphical representation of disability in India

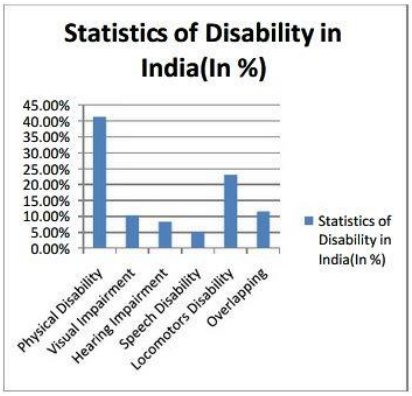
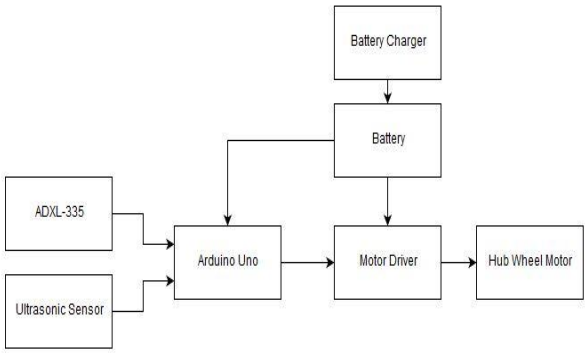


Figure (1)

IV.BLOCK DIAGRAM



Figure(2)

V.METHODOLOGY

ADXL-335 is a MEMS device which converts the gesture motions made by the user into electrical data which is sent to Atmega328p basedArduino board. The microcontroller then processes the input received and drives the motors in corresponding direction, to move forward both motor rotate in forward direction and vice-versa for reverse direction, to rotate right, the right motor stops and left motor moves in forward direction and vice-versa for left rotation. In case of any presence of objects in the path movement path of wheelchair the ultrasonic sensor senses it and sends the input the microcontroller which in turn stops the movement of wheelchair thereby avoiding collision with the object

VI.FLOW CHART

Figure shows the flow chart of the process

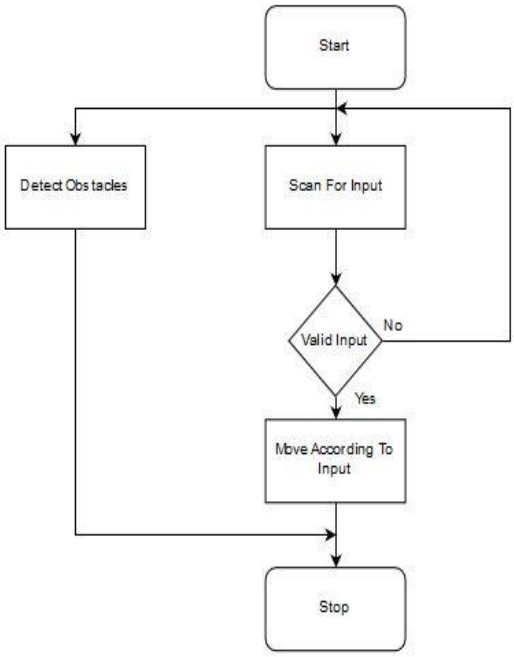


Figure (3)

VII. HARDWARE DESCRIPTION

7.1 Arduino Uno:

It is an Atmega328p based microcontroller board which has 14 digital I/O pins, out of which 6 can be configured to work as PWM outputs, 6 analog input pins, 16Mhz crystal, a USB type A connector and a power jack. In this paper the Arduino is used to process the signals received from gyro sensor and ultrasonic sensor to drive the motor

7.2 ADXL-335:

It is 3 axis acceleration measurement system. It consists of polysilicon surface-micro machined sensor which is built on top of a silicon wafer. The output signals produced are analog voltages in nature which are proportional to acceleration. In this paper the ADXL-335 is used as gyro sensor which is mounted on the user's hand to detect the gesture made in X and Y axis to drive the motor in that particular direction

7.3Ultrasonic Sensor:

It is a sensor which is used to measure distance between the object and itself. It consists of two transducers which are transmitter and receiver, the transmitter sends ultrasonic waves which are reflected back to the receiver by the object, the time taken by waves to bounce back is proportional to the distance between the object and the sensor. In this paper the sensor is used to detect any obstacle in the path of the sensor to avoid collision

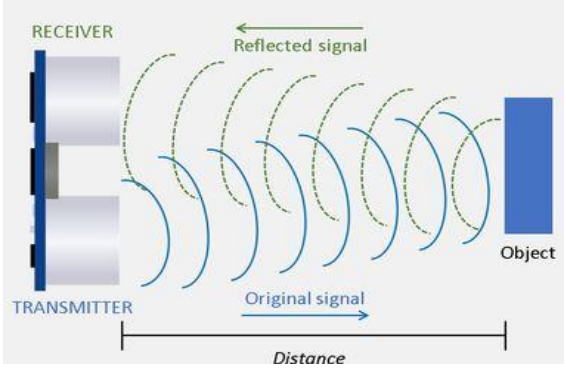


Figure (4)

7.4 BLDC driver:

It is high voltage and current brushless motor driver, it operates on voltage range from12-36v and has maximum current rating of 15A. it consists of MOSFETs which switch accordingly to drive the BLDC motor.

7.5 Hub Wheel Motor:

As the name says it is motor which is directly built into the hub of the wheel, this eliminates the need of drive trains and the mechanical system behind it. These are brushless DC motor which operate on 24-48V DC. In this paper these are used for movement of wheelchair in Left, Right, Forward and Reverse direction. The motors are controlled by Arduino through the driver

7.6 Lead-Acid Battery

This is used to supply power to the BLDC motor drivers which drives the hub wheel motors, Arduino, gyro sensor and ultrasonic sensor operate on 5V which is provided with the help of LM7805 voltage regulator IC by converting 12V into 5V

VIII. RESULTS

Figure (5)

Wireless transmitter Circuit

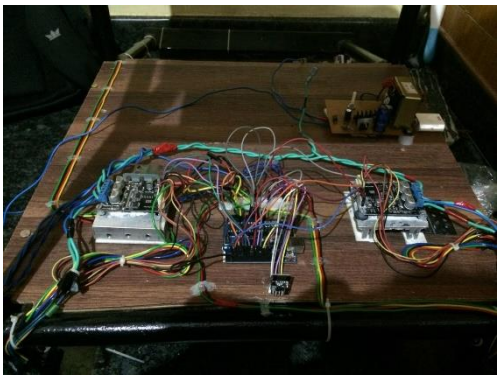


Figure (6)

The above picture shows the frame of the proposed wheelchair. Ultrasonic sensor is placed at the front and behind of wheelchair to detect any obstacles in the path as seen in figure 5 and 6. For the purpose of gesture control, accelerometer sensor is used. By measuring the amount of static acceleration due to gravity, it is possible to find the angle, the device is titled with respect to earth, and thereby sensing the dynamic acceleration we are able to analyse the direction of movement and send signal to driver circuit to rotate the motor in that respective direction

IX.ADVANTAGES AND APPLICATIONS

1. ADVANTAGES

- Can be adopted for existing wheelchairs thus reducing the cost
- Helpful for paralyzed people who are unable to use their hands to move the wheelchair
- Reduces the physical strain exerted on the body
- The system is user friendly and the learning curve is low
- The system is cost economical
- Gives a sense of freedom for the physically disabled people
- Reduces man power needed

2. APPLICATIONS

- Used in hospitals
- Used in health care centers
- Used in old age home

X.CONCLUSIONS

This gesture controlled wheelchair will help the handicapped person to be self-dependent for the purpose of movements for which they mostly dependent on other people. The proposed system is unique and can be implemented on the existing wheelchairs without much change making it affordable to all. The system is able to move the wheelchair in left, right forward or in reverse direction based on the gestures made by the user

XI.FUTURE SCOPE

- Instead of relying on gesture control, which may not be possible for some disabled people, the use of optical sensor to detect eye movement to move the wheelchair
- By using voice synthesizer, the wheelchair can be controlled with the help of voice

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