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Gesture and Mobile Phone Controlled Wheel Chair

Reshma Rajan
Electronics and Communication Department
ER & DCI Institue of Technology
Trivandrum,India

Kader A A
Electronics and Communication Department
ER & DCI Institue of Technology
Trivandrum,India

Divya D S
Electronics and Communication Department
ER & DCI Institue of Technology
Trivandrum,India

***Abstract*— There are people who suffers from various disabilities. Physical disability is most common among that. Mostly those people depend on some other means like wheel chair, another person, handle support etc. for their daily needs. In most cases someone else should always be there with those people to assist them. This hold back them from their dreams and is always a barrier for their success. This paper proposes an idea to help those people, such that either they can move anywhere as they wish without any external help or even if an external support is required, the external person can control the operation by mobile phone. The users can move as they wish just based on the gesture they give. To detect the gesture accelerometer sensor is used. Movement can be forward, backward, left and right. But there might be cases where the person cannot even give proper gestures. So they are forced to depend on others. In such cases it will be easy for both, if the external person can control the wheel chair from a distance using their mobile phone. To assure the safety of the person in the wheel chair, it is necessary to detect the obstacles in the path and to warn the user. Thus considering this fact an obstacle detection and warning is also included.**

Keywords:- Accelerometer, Arduino UNO, Ultrasonic sensor, Wi-Fi module, Motor Driver, Buzzer, Switch.

I. INTRODUCTION

Disabilities should not be an obstacle to success. But based on the survey reports provided by the world health organization and by other authorized authorities the percentage of persons with disability is increasing. There are crores of people suffering from various disabilities. Physical disability is considerably more. Thus they are forced to depend on others even for their day today activities. Those peoples mainly depend on wheel chair for movement. In addition to disabled persons, aged peoples also depend on wheel chair and external support.

1.1 Disability status of India

The figure Fig 1. shows the disability status in India. The figure shows details about persons with disability of seeing, hearing, speech, movement, mental retardation and other multiple disabilities. From this it is clear that many people are suffering from physical disability. These peoples need external support for moving. Mostly they will be depending on wheel chair.

Apart from disabled persons aged peoples also use wheel chair for movement Sometimes it is found that these people always need someone else to assist them.

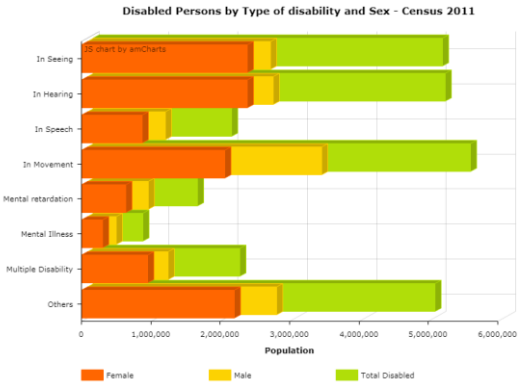

Fig. 1. Disability Status

Considering the above facts, in this paper it is planning to design a wheel chair with the features like, either the user itself can control the wheel chair without any help from external person or the external person can control by using a mobile phone.

User controlling the wheel chair without any external help is achieved based on the gestures provided by the user. But at the same time we should consider the safety of the user. For this purpose, an obstacle detection feature is also added. And if it detects any obstacle, it will alert the user as well.

If external person's help is unavoidable, it will be more efficient if the person can control the wheel chair by means of any wireless media. The proposed idea is to send the required commands from phone by means of Wi-Fi module to control the movement of wheel chair.

The major applications of wheel chair are in hospitals, physically handicapped individuals, aged persons etc.

Thus it is expected that by the introduction of these facilities these people can move as they wish and it will provide more confidence to those people. But there will be some cases where external help is required. In such cases external person control by means of mobile phone is included.

II. LITERATURE SURVEY

Congcong Ma et.al in Activity Recognition and Monitoring for Smart Wheelchair Users discuss the requirement of introducing wheel chair for aged peoples. In this their posture and activities are monitored mainly by using pressure sensors

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and the data is collected by the Arduino and based on those values, required movement is done. Sensors helps to identify abnormal movements also. This clearly gives a view of using sensors to detect the posture and to move accordingly. [1]

Shraddha Uddhav khadilkar et.al in Android phone controlled Voice, Gesture and Touch screen operated Smart Wheelchair discuss about controlling wheel chair based on the voice and gesture detected by a smart phone. In this the inbuilt features of the phones are used. Along with these other sensors are also included to detect various parameters. This helps to improve the result. [2]

Ambarish D. Pundlik et.al in Voice and Gesture Based Wheelchair Using AVR and Android explains about voice and gesture controlled wheel chair. Where android phone is used for giving proper gesture and voice commands. There is one obstacle sensor to ensure the safety. Also message can be sent to a predefined number if any issues are found. [3]

S.Shakthidhar et.al in Arduino and NodeMcu based Ingenious Household Objects Monitoring and Control Environment introduces the concept of using Arduino with an Wi-Fi module nodemcu for controlling household objects. Thus the concept of Wi-Fi module for controlling objects by an external person and interfacing with Arduino is efficiently discussed in this. [4]

III. SYSTEM REQUIREMENTS

The details of the main components used for this system design are:

A. ARDUINO UNO

This is based on ATMEGA 328. It is an open source microcontroller. The features of ATMEGA328 are: 32Kbytes of In-System Programmable Flash with Read-While-Write capabilities,1Kbytes EEPROM, 2Kbytes SRAM, 23 general purpose I/O lines, 32 general purpose working registers. Among the I/O pins 6 are analog pins and 14 are digital pins. This has an in built 6 channel 8-bit ADC. PWM pins are available.

B. ACCELEROMETER SENSOR

Accelerometer could sense the change in the direction or position. Accelerometer is an electromechanical device that measures the force of acceleration due to gravity in g unit. ADXL335 is the used in this. Based on the movement it will change the coordinates of X, Y and Z. Tilting can also be detected using this. 3.3v. is the working voltage. But 5v can be given it will adjust to 3.3v.

C. ULTRASONIC SENSOR

HC-SR04 is the sensor used here. Waves of ultrasonic frequency are send. It will wait for the echo pulses. Depending on the time duration it took to receive the echo pulse distance can be calculated. Ultrasonic frequency is 340m/s. Distance can be calculated based on this.

D. WIFI MODULE

NodeMCU ESP8266 is the module used here. It has 128 KB RAM and 4MB of Flash memory. Integrates 802.11b/g/n HT40 Wi-Fi transceiver, so it can not only connect to a WiFi network and interact with the Internet, but it can also set up a network of its own, allowing other devices to connect directly to it. Data from Wi- Fi module is given to Arduino.

E. MOTOR DRIVER IC

L293D is the driver used. This can be used to drive two motors. Forward and reverse movements are possible for wheels connected to the driver. Two enable pins are there to control the motors. H- bridge circuit is present.

IV. PROPOSED SYSTEM

Wheel chair is used as a support of moving for disabled or aged persons. In the previous works, its mostly by using android phone. But in this paper, gesture control using accelerometer sensor is used. Sensor is wearable as a band in user's hand. Thus as the user move the hand and based on the direction to which it is moved, value of the axis of the sensor will vary. Thus accelerometer axis gives different values. And based on the values microcontroller can be programmed to move in different directions. Based on the direction detected it can move forward, backward, left, and right.

Thus while moving there are chances of colliding with obstacles. To avoid these and to ensure the safety of the user an ultrasonic sensor is used. Ultrasonic sensor can be programmed accordingly to detect the distance of obstacle from wheel chair and if it cross safe distance, warning will be given. Buzzer is used to warn the user.

Considering the case of aged peoples there can be situations like, where they cannot give proper gestures for movement. They may need assistance form others. The most effective and efficient method of controlling is by using a mobile phone. The external person can control the movement of the wheel chair by giving proper signals from mobile phone. This is fed to the Arduino by using Wi-Fi module. Thus the signals will reach the microcontroller. Based on that movement can be controlled.

Introducing these methods will help the user to move with and without assistance from others. Even if others assistance is required, that person need not be always with the user, they can do other works along with assisting the user. This feature makes this more efficient. In this case also obstacle detection and warning will be given.

The Block diagram for the proposed system is as shown in the figure. As shown, Signals from accelerometer sensor, ultrasonic sensor, Wi-Fi module are given to Arduino. Based on the program the values will be processed. Based on the data the direction to which it should move will be decided. Accordingly, motor driver will drive the wheels and will move.

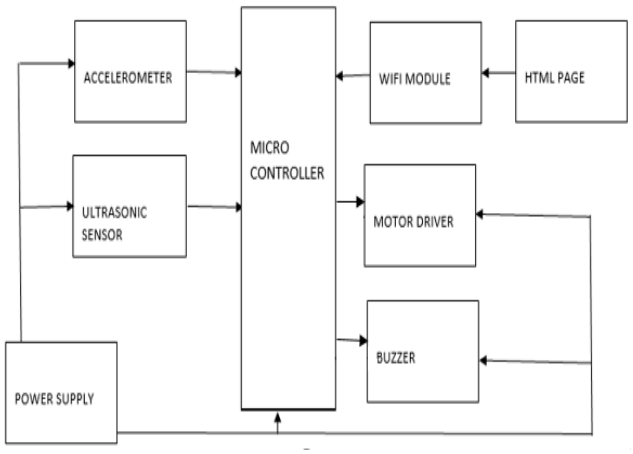

Fig. 2. Block Diagram

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Circuit diagram of the proposed system is as shown below.

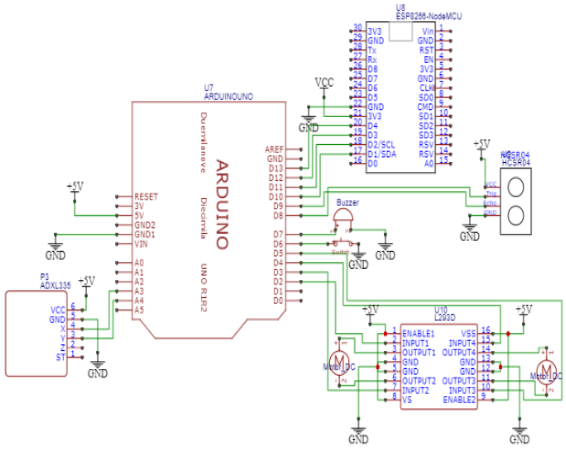

Fig. 3. Circuit Diagram

As shown in the circuit, ADXL335, ESP8266, LPDSP32, Buzzer, Switch are connected to Arduino. The data from the ADXL335 is considered only if the switch is turned on. If the switch is off only external person can control the wheel chair with a mobile phone.

V. EXPERIMENTAL RESULTS

The connections are given as per the block diagram. Proper power supply is given to each module. Accelerometer sensor is tied as a band in user's hand. user will move the hand as per the wish. Based on that wheel chair will move. At the same time, itself obstacles are also detected

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Fig. 4. Demo

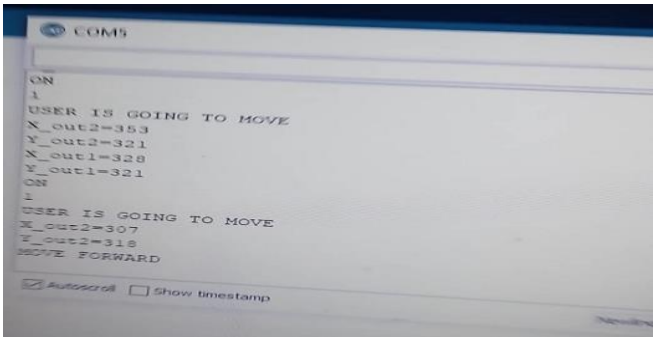

Fig.5. Move Forward

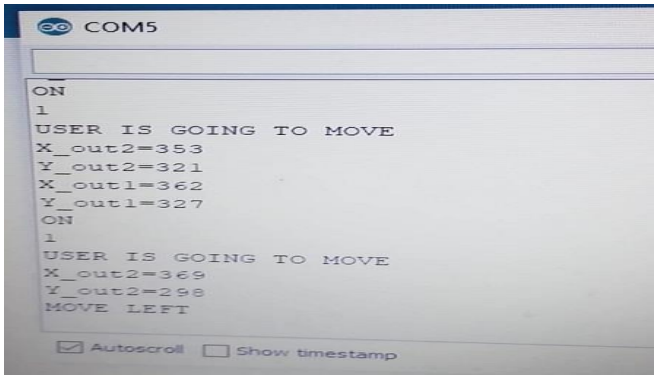

Fig. 6. Move Left

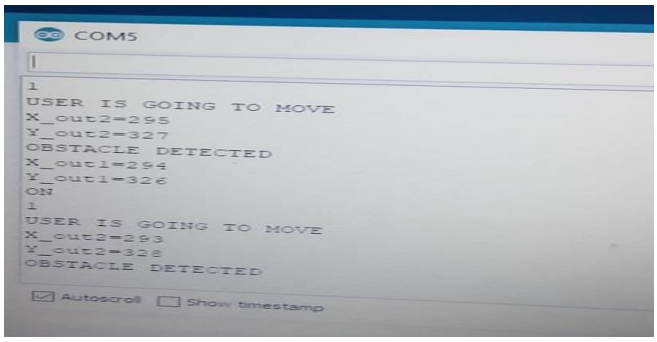

Fig. 7. Obstacle Detection

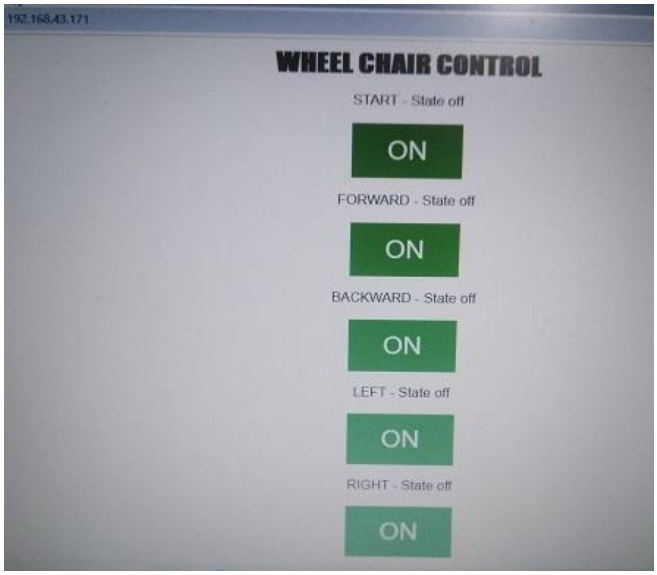

Fig. 8. For external control

There is provision to control by an external user only if the user is not controlling. Thus as per the directions of the external person also, wheel chair can be moved.

VI. CONCLUSION

Gesture and web page can be used to control the movement of the wheel chair. Movement to Forward, Backward, Left and Right are possible. Safety of the user is assured in both cases by using ultrasonic sensor and wheel chair. Thus it gives an efficient means of controlling wheel chair.

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VII. FUTURE SCOPE

This concept can be modified by including audio control for wheel chair. Also to make it more efficient temperature sensor, pressure sensor etc. can also be used. By adding these features it will be more user friendly and efficient.

VIII. REFERENCES

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