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Lab view based vision controlled wireless wheel chair for disabled and elderly people

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***Abstract*-The paper LabVIEW based Eye controlled wheel chair aims to help the physically challenged and blind person who moves on a wheel chair. Instead of moving the wheel chair by his hand, the chair can be automatically moved to a particular direction as the patient moves his eyes. The paper detects eye direction, with the help of eye ball sensor and moves the wheel chair accordingly. The chair also senses the obstacles in front of it and gives a beep sound.**

Keywords- Dc motor, LabVIEW, sensors, zigbee

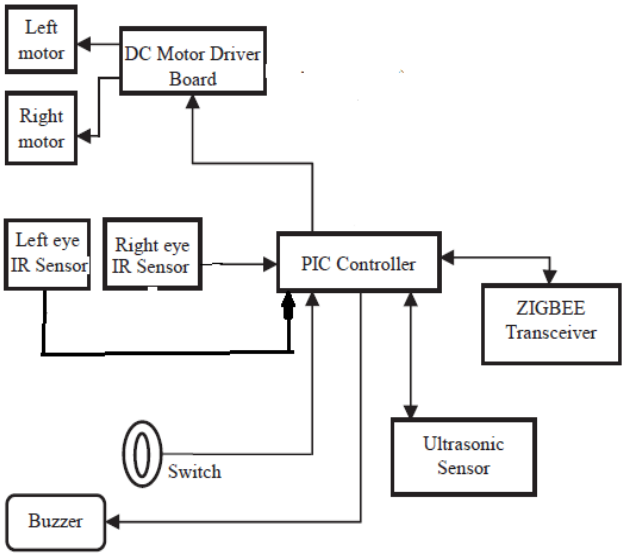
I. INTRODUCTION

Wheel chair is the best assistable device used by elder and disabled people. The controlling of traditional wheel chair is much harder task for elderly people. Eye movements can be captured using eye ball sensor and the wheel chair can be moved to the required direction. Easy to operate, because persons without hands can easily operate this device. The physically challenged people to a great extent get benefitted by this. In recent times there are wide range of assistable and guidance systems available in robotics to make their life less complicated and motile. These robots are very efficient and enable the user to move around with ease. In recent times there are various control systems that are developing and under developing stage especially for people with various disorders and disabilities. The systems that are developed are highly competitive in replacing the old traditional systems. This proposed solution is useful for handicapped people who cannot move their wheelchair on their own. In this paper, there is a wheel chair model as a Robot model, which will contain a Microcontroller and Eye ball sensing system, which functions like right, left, forward operations. The wheel chair is designed in such a way that it can move freely without external support. Through this feature the patients can facilitate movements of their wheelchair on their own.
Model: This is a prototype model of the wireless wheelchair.

Microcontroller: PIC16F877 microcontroller and LabVIEW is the heart of this paper and it is responsible for all the decisions. Eye ball sensor is used to sense the position of the eye to iris and to give signal to the microcontroller. Microcontroller can stair the wheelchair according to eye iris instructions. It also senses and alarm the user about the obstacles in the path to avoid any severe consequences. Wireless device creates a strong communication between wheelchair and PC. By using Zigbee this wireless communication is created. By using this Zigbee module continuous monitoring of movement of wheel chair is possible and can be observed in the PC. Motors will operate at
high voltage to restrict these high voltages to the interface board by using this DC Motor driver board. DC Motors are used to create a movement in wheel of the wheelchair. LabVIEW is a graphical programming language that uses icons instead of lines of text to create application.

A. The Hardware architecture

The hardware architecture manly consist of three modules first one is sensor module, second is control module and third one is communication module. Sensor module senses the



physical parameters. Control module is the heart of the wheel chair. This control module controls all other modules, which are attached to this. Finally third one is communication module which creates communication between wheelchair and PC.

The below overall block diagram shows wireless wheelchair. Each block has their own specification. In this paper PIC16F877 is used as a microcontroller.

Fig.1. Over all architecture

Main specification of this microcontroller is in built 8 channels 10 bit analog to digital converter and drives up to 1.5 mA current. Microcontroller collects the data from the entire sensor. Based on the data, microcontroller takes the decisions and move the wheel chair. In this paper two types of sensors are used IR sensor and Ultrasonic sensor. IR Sensors are used to identify the movement of the eye ball. IR transmitter transmits the light on the eye and IR Receiver receives the reflected light from the eye. Based up on the IR receivers' information, microcontroller produce torque on wheels using DC motors.

Ultrasonic sensor is used to sense obstacles in the path of the wheelchair to avoid collisions. When any obstacle is sensed by the ultrasonic sensor, the two DC motors will stop at the same time and the alarm rings. When the switch is in ON position ,the DC motor produces torque on both wheels in forward direction only. When compared to IR sensors the ultrasonic range is high and so ultrasonic sensors are used for obstacle detection.

B. Eyeball sensor

The basic principle of this direction sensing is the color of the eyes. There are two main colors in the human eyes. Black and white. The infrared light rays passed to the eye and measure the white portions. The Infrared sensors are placed on either side . The eye ball sensor is connected to the microcontroller. It performs the analysis, processing and amplification of the signals from the sensors' eyeball movements. The eye ball movement is an analog signal which can be converted to a digital signal. Depending upon the movement of the eye ball, the controller provides the output. It can be passed through driver circuit to their direction of right, left, forward, directions. This direction is based upon the eye ball sensor outputs. If the eye ball is large then the accuracy is more. If the eye ball is small then the accuracy is low.

C. Motor control

The Geared type dc motor with 12Vpower supply and 200rpm motor is used to move the wheelchair. DC motors re available from15W through 60kW. These motors possess high torque, continuous S1 or S3 periodic-duty products suitable for a wide variety of applications ranging from pumps to propulsion. The motors operate on battery power or generated "pure" DC power. The motor takes input from the driver circuit, depending upon input ,the motor move in the directions of right, left, forward.

Motor 1		Motor 2		Direction
Input 1	Input 2	Input 1	Input 2	
1	1	1	1	Forward
0	1	0	1	Right
1	0	0	1	Left

Fig.2. Control of the motor direction

The two motors are connected to the driver circuit and they move the wheelchair based on the input signal from the circuit.

Input One	Input Two	Output
1	1	Forward
0	0	Stop

D. Motor Driver

L293D is a dual H-Bridge motor driver with one IC interface two DC motors which can be controlled in both clockwise and anti-clockwise direction. This device is suitable for use in switching application at frequencies up to 5 kHz. The output supply has a wide range from 4.5V to 12V, which is suitable for low speed operation.

F. Port allocation to the microcontroller

Port from PIC microcontroller used. Each port will work like I/O. Every hardware is interfaced with microcontroller by using these ports. These ports are connected to LCD, Zigbee, switch, ultrasonic, IR sensor.

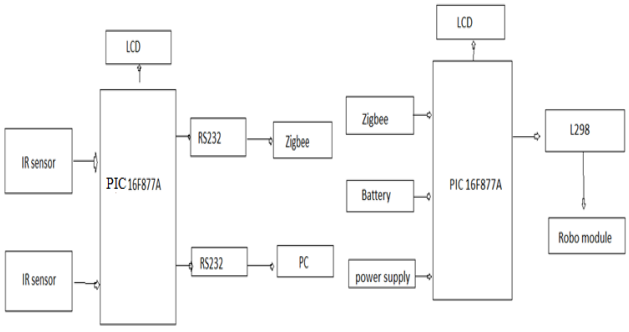


Fig. 3. Port allocation to the microcontroller

G. Ultrasonic sensor

Ultrasonic sensor is used to detect the obstacles in path of wheelchair. If obstacles are detected microcontroller passses the signal is zero and buzzer is activated. Range calculation is done by measuring the time interval between sending trigger signal and receiving signal.

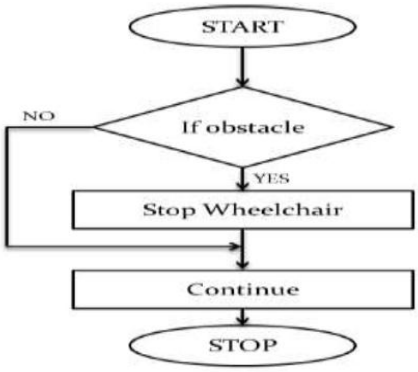


Fig.4. Motor condition loop

H. Zigbee

It is one of the wireless communication protocols. Using this, data is transferred to PC or LabVIEW. It will work like a transducer which can receive and transmit data. The values are passed through LabVIEW . It transfers data up to 1km using appropriate high gain antennas in outdoor RF line of sight range.

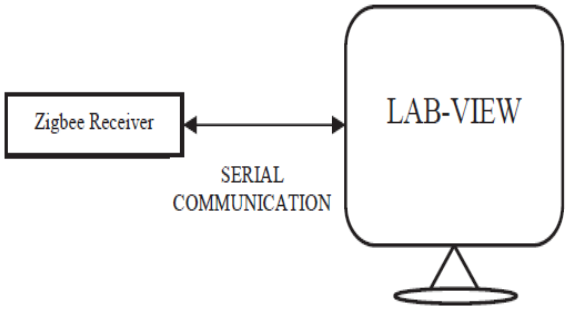


Fig.5.Zibee connected with LabVIEW

Zigbee is interfaced to LabVIEW by serial communication. In the receiver end, the received data is collected by MAX 232, and it is transmitted to RS232 transmitted pin and this data is fed to PC or LabVIEW.

II. *Lab VIEW*

LabVIEW is a graphical programming language that uses icons instead of lines of text to create application. LabVIEW 7.1 is the version used for this model. LabVIEW make use of G Programming Language. It is a Flowchart-like dataflow programming model, using which we can quickly tie together data acquisition, analysis, and logical operations and understand how data is being modified. From a technical standpoint, G is a graphical dataflow language in which nodes (operations or functions) operate on data as soon as it becomes available. The flow of data through the application graphically with wires connecting the output of one node to the input of another.

J. *Motors*

We have used the NI Vision LabVIEW version 7.1. The vision acquisition module of LabVIEW is used to capture the real time input of eye. The PIC microcontroller interfacing block is used to interface the LabVIEW to the motor driver and motor. The signal given to the motor is digital with the 0 indicating 0Vand 1 indicating 12V.

Based on the output of the sensor the wheel is controlled using LabVIEW. If the statement is true the output is provided to the motor and the motor runs. These conditions are shown in the below program.

The eye ball sensor senses the left eye and gives the output to LabVIEW using serial communication. After receiving the signal the wheel chair moves left.

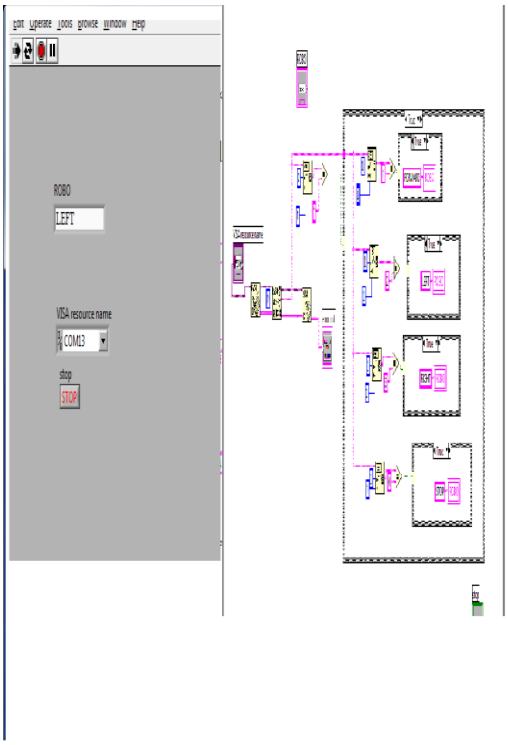


Fig.6. LabVIEW control the motor direction in left

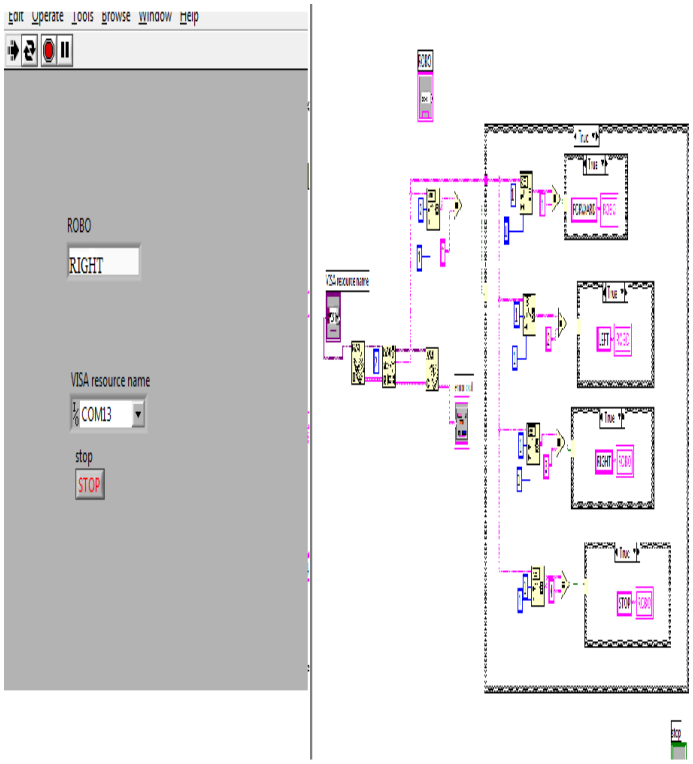


Fig.7. LabVIEW controlling the motor in right direction

The eye ball sensor senses the right eye and gives the output to LabVIEW using serial communication after that wheel chair moves right.

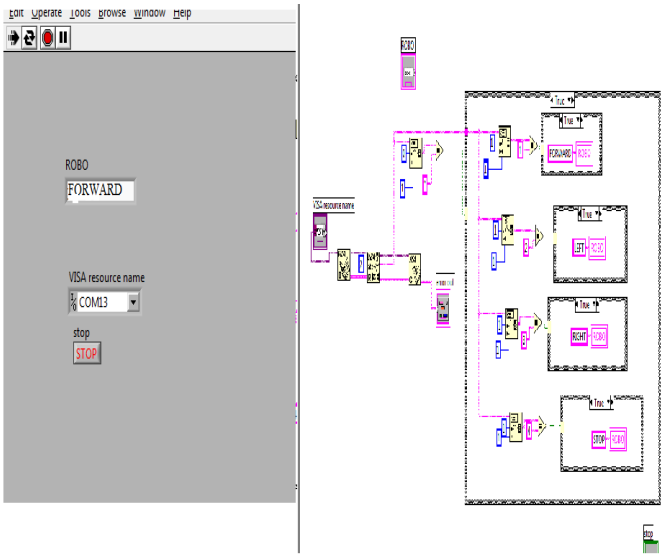


Fig.8. LabVIEW controlling the motor in Forward direction

Here the eye ball sensor senses both the eyes and the output is given to LabVIEW using serial communication after that both the motors start to rotate and moves forward.

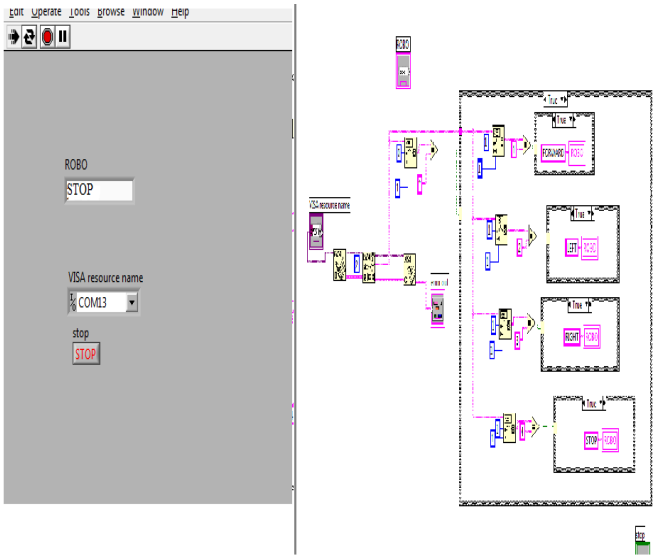


Fig.9. LabVIEW controlling the motor will be stop

If there is any obstacle in front of the wheel, ultrasonic sensor senses the obstacles and the motor stops running and the buzzer gets activated producing beep sound.

K. Wireless communication use to wheelchair movements

The wireless communications used for the wheelchair movements control the receiver part of the microcontroller and manage the wheelchair. The power supply ,12V is connected to zigbee, motor, motor driver.

The power supply board transmits the signal in wireless communication mode. The wheelchair receives the signal and control the motors. The receiver part is connected to the wheelchair. The wireless communication mode is ON. The control to wheelchair direction of the left, right, forward, and stop the wheelchair movements.

The diagram represents to wireless controlling wheelchair prototype.

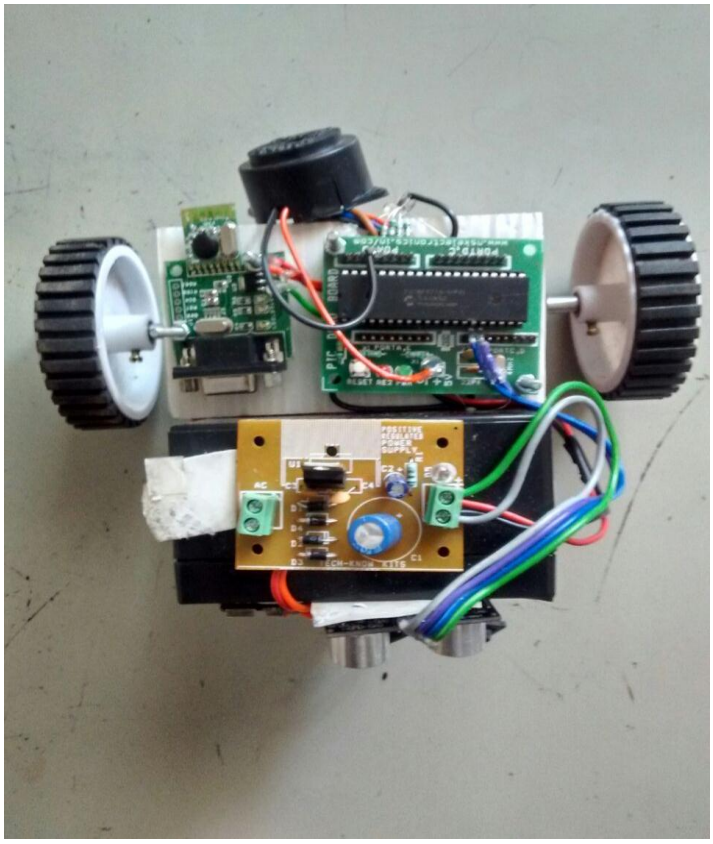


Fig.10. Wireless Motor control wheelchair

III. CONCLUSION AND FUTURE WORK

Today, Robots play a major role in industrial applications. In future these may come in every field. They could change the way the people live. Even though wheelchair robots are the creation of human, they are more efficient and accurate. In this paper we developed a robotic wheelchair with an in-built programmed microcontroller to which sensors are connected. This microcontroller makes the wheelchair move in straight, left and right directions with the help of motors. This paper enables the disabled patients to move their wheelchair on their own without the help of any other person.

However, the only drawback with this paper is as the wheelchair requires eye-ball movement as an input to the controller for its working, a lot of strain is created to eyes.

In the real time application we can use long range ultrasonic for the sensing of Obstacles in little far distance and always monitor the position of wheelchair like as it bend forward or right or left. Thus this paper enables to help the physically challenged person to move freely with own control of wheelchair and that is the sensor based automated wheelchair.

To make the system more interactive with disabled persons some additional sensors can be added in the future work.

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