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# Eye Position Based Wheel Chair Control for Physically Challenged

**R. Darwin**

Department of Electronics and Communication, Kumaraguru College of Technology, Coimbatore, India

**Corresponding Author: darwin.r.ece@kct.ac.in*

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***Abstract—*** A powered wheel chair is a mobility-aided device for persons with moderate/severe physical disabilities or chronic diseases as well as the elderly. In order to take care for different disabilities, various kinds of interfaces have been developed for powered wheelchair control such as joystick control, head control and sip-puff control. Many people with disabilities do not have the ability to control powered wheel chair using the above mentioned interfaces. The proposed model is a possible alternative. In this project, we have considered mainly the patients with the problem of Quadriplegia. These patients have paralysis below neck region. In this, we use the optical-type eye tracking system to control powered wheel chair. User‘s eye movement are given as input in the form of a image to MATLAB software. When user looks at appropriate angle, software will provide command based on the angle of position of pupil i.e., when user moves his eyes balls, left (move left), right (move right), up (move forward) and down (stop or reverse). In all other cases wheel chair will proceed straight. Once the image has been processed it moves onto the second part, Arduino. These will take the output from the laptop via a Bluetooth device and convert the signal into command signals that will be sent to the wheelchair motor circuit for movement. This project mainly focuses on wheel chair that process based on the movement of the eye. Adding to this, the wheel chair can also be used to people who has finger movements by using the touch control via mobile.

***Keywords—***Quadriplegia, Arduino

## I. INTRODUCTION

This project is mainly focused on the Quadriplegia patients. So basically they cannot move any part of their body except their neck and head. So they would have to depend on other people for their travel. In order to avoid that situation, we have built a prototype for the wheel chair based on the eye movement. We have also built the model which can be accustomed for the movement controlled by touch using the touch screen mobile phones. These are useful for the patients who can enable finger movements. In 2006 a group of Taiwanese engineers developed a "Powered Wheelchair controlled by Eye-Tracking system" [5]. They used pupil-tracking goggles linked to a computer in order to translate gaze direction into chair movement. In 2012 a group of engineers had a paper published [6] discussing a new method to guide and control a wheelchair. This group suggested a contact lens with a reflected coating or reflective coating to administer onto the subject.

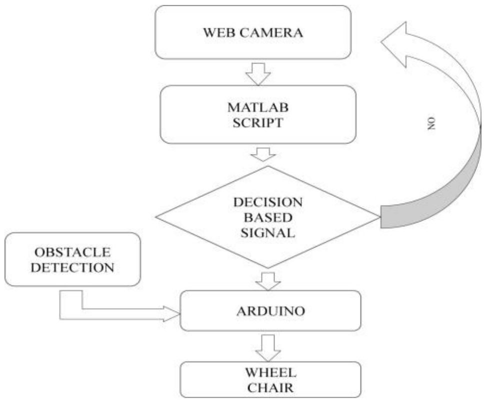
This paper is organized in the following manner, Section I contains the introduction of Quadriplegia and the need for assistance in quadriplegia patients, Section II contain the problem statement related to the disease, Section III contain the flow chart showing the steps to be followed for the wheel chair project, Section IV contain the hardware components required, Section V shows the mechanical design, Section VI and Section VII contain the software tools and the commands used, Section VIII and IX contain the simulation results and the control section of the wheelchair, and Section X concludes research work with future directions.

## II. PROBLEM STATEMENT

The main objective of this project is to design a wheelchair system which is vision based. Utilizing the camera to procure client pictures and breaking down client expectation utilizing head and eye motions.The project design should be such that it should not cost more and can be used by all category peope. The principle in the plan was to precisely recognize the eyemovementss. Since, the setup is for human utilization we need to take an additional think about the wellbeing of the setup.

## III. FLOW CHART




## IV. HARDWARE COMPONENTS

Arduino is the major functional hardware of this project. The arduino board used is duemilanove which means two thousand nine in Italian. The main purpose of arduino is running a single program again and again. The board can operate on an external supply of 6 to 20 volts. The recommended range is 7 to 12 volts. Here we use 12v power supply from the voltage regulator which converts the sum of supplies from the two 9v batteries i.e.(18v) into 12v.


Figure 1 Arduino Duemilanove

### A. BLUETOOTH MODULE

The commands which are generated in the simulation are communicated to the arduino using a Bluetooth module HC-05. This Bluetooth module provides wireless connection to between the laptop and the hardware. The ultrasonic sensor sends the distance from the obstacles which are located in front of them. According to the values received, the arduino board avoids the obstacle and moves along the path. The commands are received in digital mode and they are processed and sent to the H-bridge, which operates the motors. The arduino receives power supply from the voltage regulator.

Figure 2: Bluetooth Module

### B.ULTRASONIC SENSOR

The ultrasonic sensor used is HC-SR04 which is widely used for detecting the objects and measuring the distance from the object. It is mainly based on transceiver principle. It has two parts namely transmitter and receiver. The transmitter converts the AC into ultrasound and transmits the signal. The signal is reflected back by the object and it is received by the receiver. The receiver performs reverse operation of converting the ultrasound signal into AC signal. This operation helps us identify the distance of the object from the point of transmission.

Figure 3: Ultrasonic Sensor

## V. MECHANICAL DESIGN

For the mechanical part, we have considered a prototype which is built by using a metallic plate and two wheels. Each wheel is anchored with a motor. For the image processing part, the laptop camera is used for capturing the instantaneous video. Instead of the camera of the laptop we can also use the web camera or we can also use the mobile handsets with a better picture quality. This can be done by connecting the networks of both laptop and the capture device with a same wireless network.

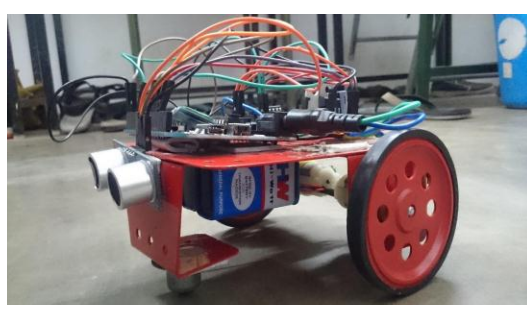


Figure 4: Mechanical Setup of the Prototype

## VI. SOFTWARE TOOL

The MATLAB signal processing tool is capable of obtaining the stills from the camera and to analyze it with the proposed algorithm so that it can control the wheel wheel chair based on the position of the eyes.

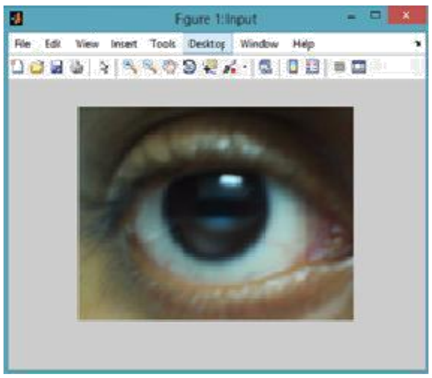



Figure 5: Input for the straight looking eye

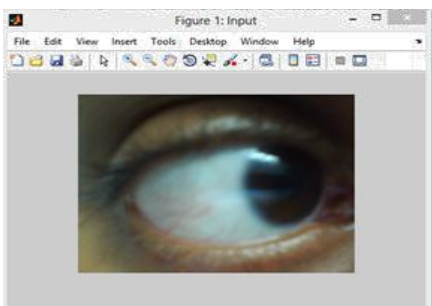



Figure 6: Input for Left looking eye (as per user) and the image looks Right (as per computer)

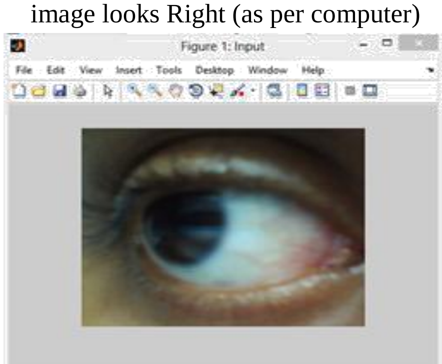



Figure 7: Input for Right looking eye (as per user) and the image looks Left (as per computer)

## VI. COMMAND GENERATION

For the right side movement of wheelchair right side motor stops and left side motor works . For the left side movement of wheelchair left side motor stops and right side motor works. For the straight movement of wheelchair left side motor and right side motor works. For the reverse movement of wheelchair left side motor and right side motor works. When the command is stop both the motors stops working.

## VII. SIMULATION RESULTS

Different pupils where used for testing and the best results were gained by pupils directly from the tester, which was not really surprising. Obtaining them is not that simple though. An algorithm from Hugh Transform operator was used, which requires too much calculation time to be used in real-time environments, but is fast enough for getting the first pupils.

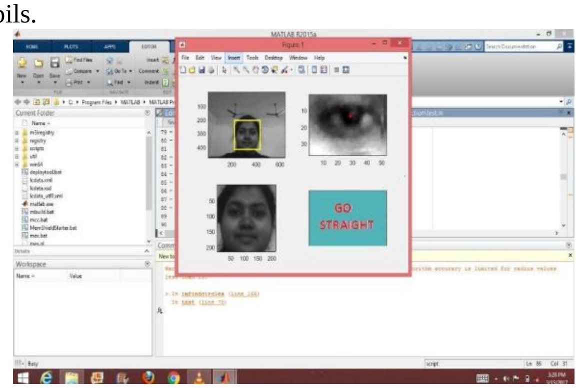



Figure 8

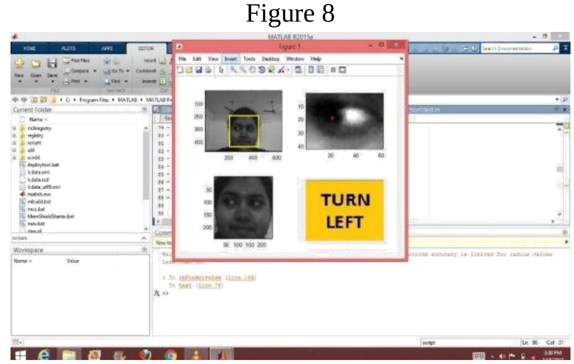



Figure 9.

Figure 8 and Figure 9 shows the simulated results of the proposed model with various eye positions and the corresponding command for the wheel chair, so that the wheel chair can move independently based on the eye movements of the paralyzed person.

## VIII. TOUCH CONTROL BASED WHEEL CHAIR

The wheel chair has also been built based on the touch control so that it can be used by normal patients who do not suffer from Quadriplegia and can be able to move fingers. This is implemented via mobile phones with a touch control or command driven control. It is done by a software, Bluetooth to Arduino in mobile and it has two modes.

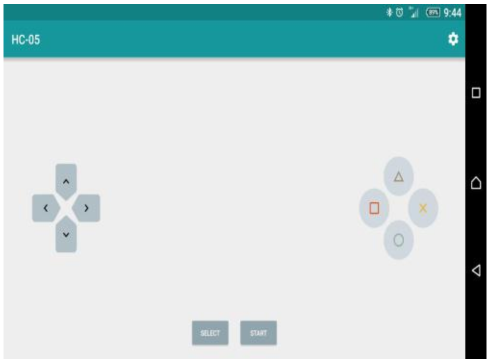



Figure 10. Controller mode

## IX. CONCLUSION

The idea of eye controls of great use to not only the future of natural input but more importantly the handicapped and disabled. One of the primary objectives for Eye Movement controlled wheelchair is to empower totally paralyzed patients to make their life more open and to give them chance of autonomy and development. This type of wheelchair is controlled by eye movement , the camera capture the image and focus on eye in image and the center position of pupil will be found then the different value of X,Y coordinates will be set for different commands like Right, Left ,Forward ,reverse and stop.Here we have provision to switch between two speed levels.Then signals pass to the motor driver. It controls speed and direction of DC motor. DC motor move Right, Left, Forward ,reverse and stop. The efficiency of the system is of 70-90 % which is appreciable. Adding to this, the wheel chair can also be used to people who has finger movements by using the touch control via mobile.

## FUTURE RECOMMENDATIONS

Despite the fact that our model performs agreeably, yet a considerable measure of work should be done before making the item economically feasible. Additionally since the criticality of the application is so high. It should be ensured that the framework is not lethal to the strength of the individual. A great deal of testing should be done before making such an item a reality.

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## Authors Profile

*Mr.R. Darwin* pursed Bachelor Degree from St.Xavier's catholic College in 2005 and Master Degree from Kumaraguru College of Technology in the year 2009. He is currently pursuing Ph.D, and currently working as Assistant Professor in Department of Department of Electronic and Communication,Kumaragu College of Technology since 2009. He has published more than 2 research papers in reputed international journals. He has 8 years of teaching experience. He was awarded Amateur Wireless Station License, Grade-RESTRICTED issued by Ministry of Communications and IT, Government of INDIA, 2015.

 