Computerization of Wheel Chair Using Patient Iris and Arduino Board

Chetan W. Rawarkar[1], Dinesh S. Chandak[2]

[1] *Student, Electrical & Electronics Engineering Prof Ram Meghe College of Engineering and Management, Badnera Amravati, India*
[2] *Assistant Professor, Electrical & Electronics Engineering Prof Ram Meghe College of Engineering and Management, Badnera Amravati, India*

ABSTRACT

*People who are unable to walk and are using wheel chairs exert great amounts of energy using physical strength to turn and steer the wheels. With eyesight being their guide, the disabled would save energy and could use their hands and arms for other activiti**es.** The purpose of this paper is to develop a wheelchair that will be controlled by the eyes of the person seated in the wheelchair. This will allow people without full use of their limbs the freedom to move about and provide a level of autonomy. The paper will consist of three main parts.*

Keyword: - *Wheelchair, Automation, Iris, Alzheimer's Disease, Arduino Uno.*

1. INTRODUCTION

We wanted to utilize the opportunity to design something which could be a contribution in our own small way to the society. Quadriplegia is paralysis caused by illness or injury to the humans that result in partial or complete loss of limbs and torso. It's a phenomenon which confines the ability of a person to move by him, and he has to rely on someone to carry him around.

Researchers suggest that this leads to a drop in the self-reliance of these people. We realized that technology can intervene and help reinstate confidence of people suffering from Quadriplegia, by creating a medium, through which they can move at will. The complexity lies in the fact that they may be able to move only their eyes and partially their head [1]. We precisely aim at targeting the movements of the eye and the head. The idea is to create a eye monitored wheelchair system where a camera constantly stares at the person's eyes and based on the combined movement of eye and head, decide to move the wheelchair in the direction the person desires to move in. The image database is stored in the person's laptop which has a MATLAB script running which constantly processes them. The script based on the processing determines whether the person wants to move in a particular direction, and communicates this information using serial communication to a microcontroller which drives motors of the wheelchair is the desired direction.

2. PROBLEM STATEMENT

A clinical survey indicates that 9-10% of severely disabled patients having difficulties find it impossible in using powered wheelchair in spite of having some training in handling and operating the wheelchair. This indicates that they are lacked of motor skill and strength and difficult to operate a sophisticated wheelchair functions. Our system aims at user friendly product which requires no rigorous training.

3. PROPOSED METHODOLOGY

Face image is given to MATLAB algorithm eliminate background identify only face. From face eyes are detected. Both eyes will be made separated as left eye and right eye scanning of the eye. Will be done to fix whether is closed or open. If it is closed system will send command to stop the chair, if eyes are open system will check the eye ball position whether it is left or right or in centre. If it is at left, left movement command will given to chair, if it is at centre forward movement command will be executed and it is in right then right movement command will be executed.

Fig no.1 System Overview

Based on a series of snapshots taken and thereafter processed, the motion of the user's eyes are detected, decision to move the Wheel Chair in a particular direction is take.[2] A description of the Algorithm is given in the software section of the report. Continuous snapshots stored in database every frame are taken and feature points extracted are saved i.e. we capture approximately 10 snapshot every process it. Based on the position of the feature points in previous snapshot and current snapshot, a movement is detected and this is communicated to the wheelchair. A decision based on the processing done by the MATLAB application is communicated and received by the load images. So, now we will have a look at the overall code structure of our algorithm and the logic behind the decision making.

4. SIMULATION FLOW

There are multiple aspects to the software design of this project. Since majority of computational work is done in software, a lot of our time went in software design and testing. The MATLAB component is responsible for load the images, determining the movement of eyes,

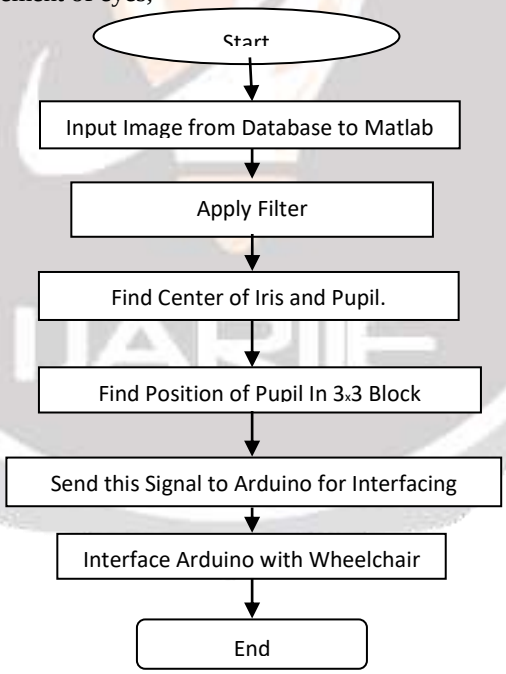

Fig no. 2 Algorithm for Proposed Model

5. INPUT DATABASE FOR PROPOSED MODEL

Due to low processing speeds, practically processing every frame through MATLAB was not possible. Hence every 25th frame was worked upon. Every sample was converted then from RGB to gray scale which reduces the overall information associated with the image thus making image easier to extract and process [7]. Contrast limited adaptive histogram equalization (CLAHE) was also performed. It enhances small data regions so that the histogram of each output region approximately matches the specified histogram. The region of interest was also

limited to capture only the eyes of the patient to avoid accidental noise capture. The requisite condition for our algorithm was to continuously analyze different captured video frames, based on which the motion of the robot was determined, the captured video was sampled every 25^{th} sample [9]. The sampling rate was chosen in due consideration with the maximum image processing capacities of MATLAB and our hardware prototype in accordance with the algorithm implemented. Some of the vital functions of Image Processing Toolbox implemented in the algorithm are as mentioned. Now after detecting the eye movements, we have to come up with a decision algorithm that will help the controller to drive the motors accordingly:

a. Valid Left: The decision to turn left will be considered as valid if the eye turns left and stays there for a cycle. This action will be detected as a left turn request. After that, the patient will turn right to again look forward. Thus, this signal should be considered as void.

b. Valid Right: Similarly, the decision to turn right will be considered as valid if the eye turns right and stays there for a cycle. This action will be detected as a right turn request. After that, the patient will turn left to again look forward. Thus, this signal should be considered as void.

c. Valid Straight: The signal to go straight is when a person looks left and right or right and then left. This will be detected as to go straight.

Below Figure represented the position of iris moves the wheel chair as per the direction of the iris represented.

I. For Straight instruction the iris position is shown in figure

Fig no. 2 Straight instruction

II. For Stop instruction the iris position is shown in figure

Fig no. 3 Stop instruction

III. For Right instruction the iris position is shown in figure

Fig no. 4 Right instruction

IV. For Left instruction the iris position is shown in figure

Fig no. 5 Left instruction

5. Testing Strategy

The UI of the system is designed in such a way that it is easier for the people to use. Also it has the facility for adjusting the threshold according to the eye size for capturing the pupil movement

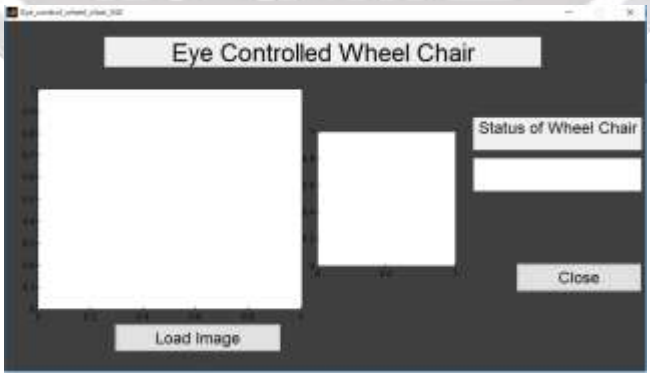

Fig no. 6: Snapshot for GUI

6. Result

The input and its corresponding images shown below are produced after using algorithm on input image for processing in MATLAB. The project performs satisfactory with performance accuracy of around 70-90%. The

results after testing it for 100 to 200 attempts to move in a random direction were made by both us. The results were tabulated below [17]. Now, in this step we actually detect the eye movements. The idea is to compare the current position of the eye with the previous position. Thus, the difference in the coordinates will help us to predict the motion in the particular eye. But sometimes, it may be possible that only one of the either eye will be detected. In that case, we will give preference to the eye that is detected currently.

Table -1: Accuracy Result

Name of Image	Table Column Head		
	No. of Images	Successful Attempts	Accuracy
Left	L01, L02, L03, L04, L05, L09	03	60%
Right	R10, R20, R50, R100, R120	04	70%
Streight	C20, C30, C40, C60, C70, C80	04	70%
Stop	CL20, CL30, CL40, CL50, CL60, CL70	05	80%

The system accuracy could have been improved for it was calibrated for the height and width of his eyes. Better lighting can improve the accuracy by providing brighter snapshots to process. The initial pre-processing contrast stretches the image around the mean, which helps in improving the accuracy by making the detection more accurate. Successful attempts were counted as all those attempts which resulted in movement of the wheel chair in the desired direction. For the system to be accurate, each time a system is configured for a person, alter the height and length of the specified eye so that the system recognizes the eye of the person with high precision.

4. CONCLUSIONS

In this system we present an innovation in ordinary wheelchair by adding motor type mechanism and making easier and simple wheelchair to handle by using eye motion tracking for physically disabled and paralyzed. The aim of this system is to contribute to the society in our small way by setting out an idea for a system which could actually better the lives of millions of people across the globe. The future scope of this system would be to develop a mobile app to manage the wheelchair control. Also introducing home automation in the system would be an added feature of the wheelchair where a disabled person can turn on/off home appliances without getting up from his position.

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