VISVESVARAYA TECHNOLOGICAL UNIVERSITY

Jnana Sangama, Belagavi – 590 018

PROJECT REPORT ON

Eye Controlled Wheelchair

Thesis Submitted in Partial Fulfilment for the Award of Degree of

Bachelor of Engineering

In

Electronics and Communication Engineering

Submitted by

Rhea Shank USN: 1RN15EC119

Greeshma J USN: 1RN15EC183

Ajay Kumar USN: 1RN15EC179

Prasad Shetty USN: 1RN15EC102

Under the Guidance of

Project Guide: Dr. Mamatha A.S

Assistant Professor

RNS Institute of Technology

Channasandra, Dr. Vishnuvardhan Road, Bengaluru – 560 098

Department of Electronics and Communication Engineering

ESTD : 2001

CERTIFICATE

Certified that the Thesis work entitled "**Eye Controlled Wheelchair"** is carried out by **Rhea Shank (1RN15EC119), Greeshma J (1RN15EC183), Ajay Kumar P (1RN15EC179), Prasad Shetty (1RN15EC102)** in partial fulfilment for the award of Bachelor of Engineering in **Electronics and Communication Engineering,** Visvesvaraya Technological University, Belagavi, during the year 2018-2019.

It is certified that all corrections/suggestions indicated for internal assessment have been incorporated in the report. The project report has been approved as it satisfies the academic requirements in respect of project work prescribed for the award of the degree of **Bachelor of Engineering.**

Signature of Guide	Signature of HoD	Signature of Principal
Dr. Mamatha A S	Dr. Vipula Singh	Dr. M K Venkatesha

External Viva

Name of the examiners	Signature with date
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2…….	……...

RNS Institute of Technology

Channasandra, Dr. Vishnuvardhan Road, Bengaluru – 560 098

Department of Electronics and Communication Engineering

ESTD : 2001

DECLARATION

We hereby declare that the entire work embodied in this project report titled, "Eye Controlled Wheelchair" submitted to Visvesvaraya Technological University, Belagavi, is carried out by us at Department of Electronics and Communication Engineering, RNS Institute of Technology, Bengaluru, under the guidance of Dr. Mamatha A S, Professor. This report has not been submitted in part or full for the award of any diploma or degree of this or any other University.

1.Rhea Shank 1RN15EC119

2.Greeshma 1RN15EC183

3.Ajay Kumar 1RN15EC179

4.Prasad Shetty 1RN15EC102

ABSTRACT

The number of persons who are paralyzed and therefore dependent on others due to loss of self-mobility is growing with the population. Researchers suggest that this leads to a drop in the self-reliance of these people. Our project is to make lives of the people suffering from this phenomenon simpler and self-reliant which will boost their confidence and happiness. The main idea is to create an eye-monitored system which allows movement of the patient's wheelchair depending on their eye movements. We will create a device where a patient sitting on the wheelchair will look directly into the camera in a particular direction and will be enabled to move in that direction. The camera signals are monitored by MATLAB which will guide the motors wired to the AtMega 1284P microcontroller through serial interface to move in a particular direction. The major two parts of the project system design are : Eye Detection and motion tracking and ATMega1284P controlled wheel chair assembly. A webcam is mounted on a cap worn by the patient which is responsible for serial communication. The data transfers take place from the eye tracker to a laptop using matlab. The output voltages indicate desired movement directions.

ACKNOWLEDGEMENT

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We express our gratitude to our beloved Chairman **Dr. R N Shetty**, for providing state of art facilities.

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We express our profound gratitude to the coordinators who have given valuable suggestions and guidance throughout the project. We would like to express our sincere gratitude to our internal guide **Dr. Mamatha A S**, Assistant Professor for her guidance, continuous support and motivation in completing the project successfully.

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CHAPTER 1

INTRODUCTION

Quadriplegia or paralysis is one of the growing concerns in any nation small or big. Voluntary muscle is the main actuator enabling people to move their body, paralysis may cause a person not to move their loco motor organ such as arm, leg and others. Paralysis may be local, global, or follow specific patterns. Most paralysis are constant, however there are other forms such as periodic paralysis (caused by genetic diseases), caused by various other factors.

Scientist Stephen W. Hawking is perhaps the most well-known victim of major paralysis – Hawking was diagnosed with incurable Amyotrophic Lateral Sclerosis (ALS) in 1962, thereafter using a wheelchair to move. Many of those suffering close to or complete paralysis usually however still can control their eye movement which inspired us to develop an eye-controlled electric wheelchair.

Our proposed design for eye-controlled wheelchair has the same range of motion and ease of movement that a standard joystick powered wheelchair has but with the addition of several features. The most notable feature is the purpose of this design; all movements are generated solely by eye commands.

Thus, we can summarize our project as follows: the main idea of this project is to design a vision-based wheelchair system. Using the camera to acquire user images and analysing user intent using eye movements. We wanted to come up with the system that is not expensive and thus can be afforded by all. The main task in the design was to accurately detect the eye movements. Since, the system is for human use we must take an extra care about the safety of the system.

1.1 PROBLEM DEFINITION

PROBLEM STATEMENT: The challenging problem faced by the paralyzed people is their independent mobility. They need external help to perform their daily activities.

SOLUTION:

To help quadriplegic patients achieve independent mobility with the help of a wheelchair whose movements are controlled by their eye movements.

1.2 MOTIVATION

Along with the advent of technology, there have also been issues that need to be catered to. One of the ever-increasing problems is the mobility of patients suffering from quadriplegia. Few incidents like visiting old age homes and personal experiences of one of the team member's grandparents has motivated the team to take up this project.

1.3 OBJECTIVES

- To help quadriplegic patients to move independently from one place to another with the help of wheelchair by movements of the eyeball.
- Corresponding the eye movements to specific wheel chair controls(movements).
- Adjusting the camera position and stability in relation to the eyes and head.
- Specifying the power requirements to the wheel motors.
- Designing the wheel chair prototype.

1.4 PROPOSED METHODOLOGY

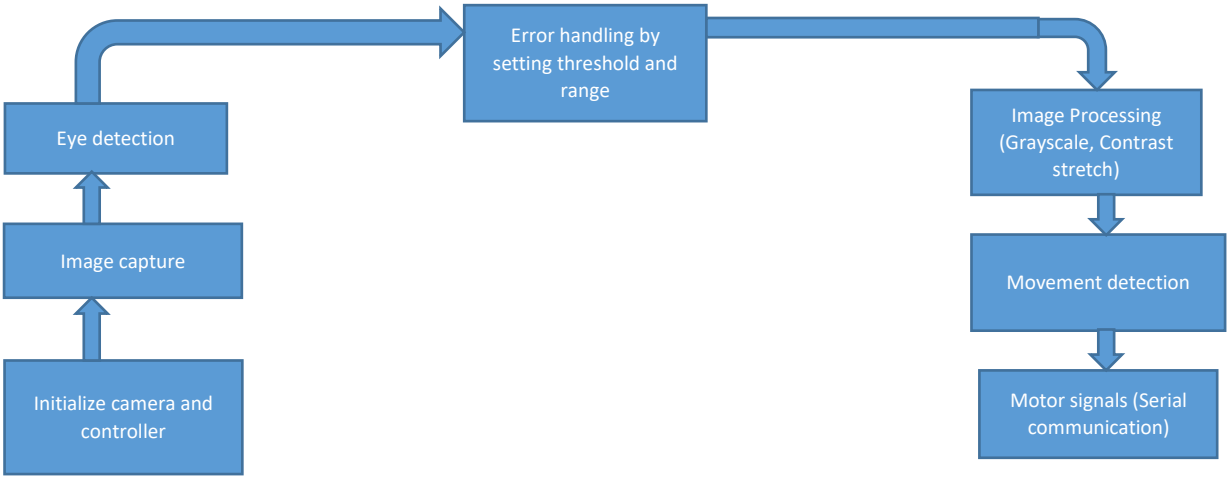

Fig1: System level block diagram

The working of the above block diagram is as follows:

1. Initialization: Initially we set up the serial communication that will be used later for the interface between MATLAB and the controller, the video capture and the program variables.

2. Image and Video Processing: We then take continuous video frames and sample the input and save it as the screen shots. Each frame is then converted into the black and white frames. For the accurate results, we perform contrast stretching on each frames to make the dark region darker and bright region brighter. This will enable the detection of the eyes better.

3. Estimation: Now, after working on each frame we try to detect the eyes. This we do by estimating the position of left as well as the right eye. Thus, we set the threshold and detect the position of the eyes which can be used for the further processing.

4. Detection: 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.

5. Motion: 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.

1.5 ADVANTAGES

- User friendly
- Helpful for the paralysis stroke patient who doesn't have much stamina or mobility
- Reduces human activity
- Reduces physical strain
- Spontaneous output
- Increase the number of disabled people in employment.
- Useful in hospitals and old age homes.

1.5 DISADVANTAGES

- Accuracy
- Movement restriction on slopes and steps.

Few of the applications are that they are useful in hospitals, old age homes, quadriplegic patients.

CHAPTER 2

LITERATURE SURVEY

The paper by Kohei Arai, Ronny Marciano [1] "A prototype of electric wheelchair controlled by eye-only for paralyzed user", February 2011 using the Electrooculogram method obtains the gaze direction by sensing the electrooculographic potential. This is done by measuring the potential using electrodes placed on face where human eye is an electric dipole with a negative pole at the fundus and positive pole at the cornea. Disturbances due to EWC vibration is potentially a problem. Also, when the user moves their head then the gaze estimation is difficult. It is found that the proposed EBEWC system has 10% degradation of success rate with noise.

The paper by Jhansi S Kandalgaonkar at International Journal of Engineering and Technology [2]" Eye directive wheelchair" published on 2nd July 2015 makes use of the User's eye movements which are translated to screen position using optical type tracking system without any tracking system. Obstacle detection sensors are connected to the Arduino to provide necessary feedback for proper operation of the wheelchair and to ensure user's safety. The system functioned with an overall accuracy rate of 70-90 %. The components used were Wireless camera, computer, Arduino Microcontroller, 8 bit Atmel Microcontroller, or a 16 bit Atmel Microcontroller, obstacle sensors and battery with overall of 22.5 Volts output with 7.5Ahr capacity.

The paper by Jonathon Delrosario, Matthew Kiep at University of Florida EEL 4924-Spring 2012 [3] "Eye Move" uses the MSP430 that will receive inputs from the pressure sensors, object sensors, PC and motors and the necessary outputs are obtained. PWM will be used to power and control the motors. The motor driver will receive a PWM signal from the processor and amplify the signal to power up the wheelchair. The-components used are head mounted camera, laptop system, open source image processing software, microprocessors, pressure and object detection sensors, wheelchair, and motor drivers. Eye tracking is not heavily used in mainstream products but are beginning to pick up as input to electronics. This will allow people without full use of their limbs the freedom to move about and gives a certain amount of autonomy.

The paper by Dr. Shaik Meerawali published at International Journal of Scientific and Engineering Research [4] " Design and Development of Hand Glove Control based wheelchair based on MEMS", is an electric powered wheelchair which is controlled by hand movement. As per our need to control wheelchair, we use only two fingers of hand gloves. On these two fingers we place two photodiodes at upper side and two tactile micro switches below the finger as sensors. The signal coming from these gets encoded and sends to the transmitter to transmit. On the other hand, at receiver side we get this signal with the help of receiver and send it to the decoder to decode it. Micro-controller is already being programmed for different code combinations, so that the decoded signal gets converted into appropriate movement of wheelchair with the help of relays and DC motor. The critical part of the system is image processing at real time which can be addressed by using better high-end image processing software.

The paper by Prof. Chitte P.P, Miss. Kenmar [5]" A hand gesture-based wheelchair for physically handicapped person", 8th August 2013, was published at International Journal of Engineering trends and technology. In this paper, the main aim of our project is to detect wheel chair control and the cost effective and security problems by alarms is discussed. To develop this Project, we are using MEMS sensor, and the system is fully controlled micro-controller. In this paper hand glove controlled Smart Wheelchair is A model of the system has been developed which is believed to provide better control to people with severe disabilities in comparison to the traditional joystick-controlled because of the lesser amount of force required to manipulate the hand glove in contrast to the joystick and it includes the integration of an obstacle avoidance and collision detection system.

The paper written by Aleksander Pajkanovic, Branko Dokic [6]" Wheelchair control by Head Motion", 1st February 2013 was published at Serbian Journal of Electrical Engineering. The prototype consists of the digital system (an accelerometer and a microcontroller) and a mechanical actuator. The accelerometer is used to gather head motion data. To process the sensor data, a novel algorithm is implemented using a microcontroller.

The output of the digital system is connected with the mechanical actuator, which is used to position the wheelchair joystick in accordance with the user's command. Sensor data is processed by a novel algorithm, implemented within the micro controller. Thus, user head motion is translated into electric wheelchair joystick position. The mechanical actuator is compatible with several different types of standard electric wheelchair.

The paper by Mr. Mularidhar Kranchhit, Geetha Patel and Sonali Rathore published at International seminar on Non-conventional energy sources for sustainable development of rural areas [7] " Head and Tongue Operated Wheelchair using Hall effect and MEMS sensor" has a tongue driven wireless assistive technology which consists of an array of Hall Effect sensor and small permanent magnet. It translates user's command into control commands by detecting and classifying their voluntary tongue motion by using small permanent magnet, held on the tongue using tissue adhesive or tongue piercing. The magnetic field generated from the magnet will change inside and outside the mouth as the user will move his tongue. These variations are sensed by the three Hall Effect sensors that are placed as an array outside the mouth.

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