

FINAL YEAR PROJECT (Proposal)

EyeRoll



Hufsa Rizwan (hufsariz@gmail.com)

Haider Ali Mirza (haider.a.mirza@hotmail.com)

Mohammad Jameel Baig (mjameelbaig@gmail.com)

Executive Summary:

The ability to move freely and communicate easily is highly valued by all people. However, sometimes it is difficult for motor disabled people. Statistics suggest that approx. 15% of the population in USA are suffering from some kind of motor disability, which confines the ability of the person to move by themselves. Due to motor disability, people are unable to control computer systems or even move around on their own. Researchers suggest that this leads to a drop in the self-reliance of these people. We realized that technology can help reinstate the confidence of motor disabled people by creating a medium through which they can move and communicate at will.

Gaze control is an interaction method that allows people with disabilities to navigate and control computers with their eyes, it only requires the movement of the eye itself. Eye tracking devices can be a powerful alternative for individuals with no control, or limited control, over their hand movements. EyeRoll is a system that uses gaze interaction to enable these people to perform a wide range of tasks through a computer or a tablet which will help them communicate more effectively, move around on our wheelchair and do many other tasks without having to rely on other's help. By using EyeRoll, these disabled people will be able to control their wheelchair, interact with computers for fun activities, communicate with people, browse the internet and perform all the other tasks they can using a tablet or a computer. EyeRoll, with the help of a camera, constantly tracks the user's eye and all eye movement signals are sent to the computer along with the coordinates of where the user is looking. By using this information, it is decided in which direction to move the wheelchair, or which task to perform. EyeRoll will help people control the system with their eyes as they would do so using a mouse, and a built in application will allow them to control their wheelchair. The signals to control the wheelchair will be sent from this application to the Arduino connected to the computer, which will then move the wheelchair in the desired direction. EyeRoll will increase the confidence and help the lives of disabled people by enabling them to move freely and stay connected with the world with the help of our easy to use system.



The Problem

19% of the world's population is disabled.

For 8%, the disability is severe.

Handicapped people face difficulties in realising their potential.

A project by

Haider Mirza

Hufsa Rizwan

M Jameel Baig

Supervised by

Dr. Hisham Zubair

Proposed Solution

Gaze-Controlled tablet/laptop based Communication System mounted on wheelchair.

The system should be:

Affordable

Mobile

+ +

Reliable

Accurate

Working Strategy

Track Eye Movements → Send Eye Coordinates to System → Use coordinates as mouse cursor to use laptop to communicate, browse internet, read news etc.

Send Control signals to wheelchair via Arduino → Move the wheelchair (Forward, Backward, Left or Right)

Project Description:

1. Background and Motivation

Electric wheelchairs are commercially available nowadays. Due to the lack of physical disability, some people cannot drive an electric wheelchair manually. To enable a disabled person to control their wheelchair, researchers have proposed several interaction techniques that include mouse/keyboards, voice controls, gesture based etc. Most of the ways of interaction require the use of physical body movements or the user should be able to give voice commands to the system which might not be possible for the disabled person to do. So in order for these people to communicate with others using their computer and drive their wheelchair safely and easily, our project will use Eye tracking and convert eye movements to generate signals that will inform the system what task to perform.

2. Project Goal

The aim of our project is to develop a system that includes, a wheelchair, an application that controls the wheelchair and also enable users to perform multiple tasks on a computer/tablet using just their eyes. A laptop/tablet will be mounted on our wheelchair. A camera would be used to track the user's eye coordinates. The user would be able to use the built-in application in that to drive the wheelchair, or just control the laptop, using their eyes, for work or entertainment or any other purpose. Our project will eliminate the need for speech input or hand movements to use a laptop or drive a wheelchair, everything could be done using just their eyes.

3. Project Requirements

a. Hardware Requirements

- Unity 2D
- Laptop/Windows Tablet
- Camera
- Image Processing library (OpenCV)
- Arduino Uno R3
- 4x Wheels
- 2x Battery 12v
- Breadboard
- Wires
- Metal Base for wheelchair
- 2x DC Gear Motors
- 1x Servo Motor

b. Constraints

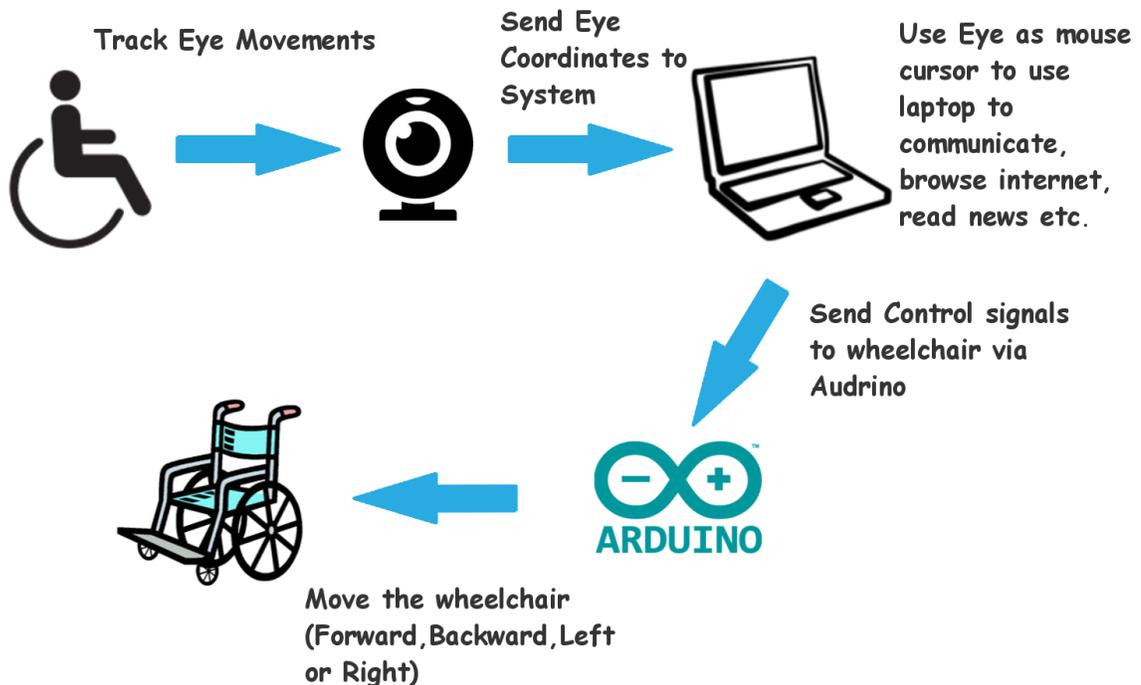
If we use the coordinates of the eye position on the screen to move the chair then the person will not be able to properly see where he is going; on the other hand if we use a camera mounted on the head it will be an added burden on the user and will also increase the cost of the system

c. Objectives

The main objective of our project is to build a system that eases the lives of motor disabled people by providing them with an all-in-one solution which mobilizes them and allows them to communicate as well.

Technical Design:

1. System Level Overview



Users eyes will be tracked through a camera/eye tracking device and a model will be drawn of the user's eyes which will be used to determine where the user is looking. Once this is determined accurately the user will be able to perform all the functions they can using a physical mouse/keyboard or any other pointing device, by using just their eyes. Then by using the built-in application, user will be able to drive the wheelchair.

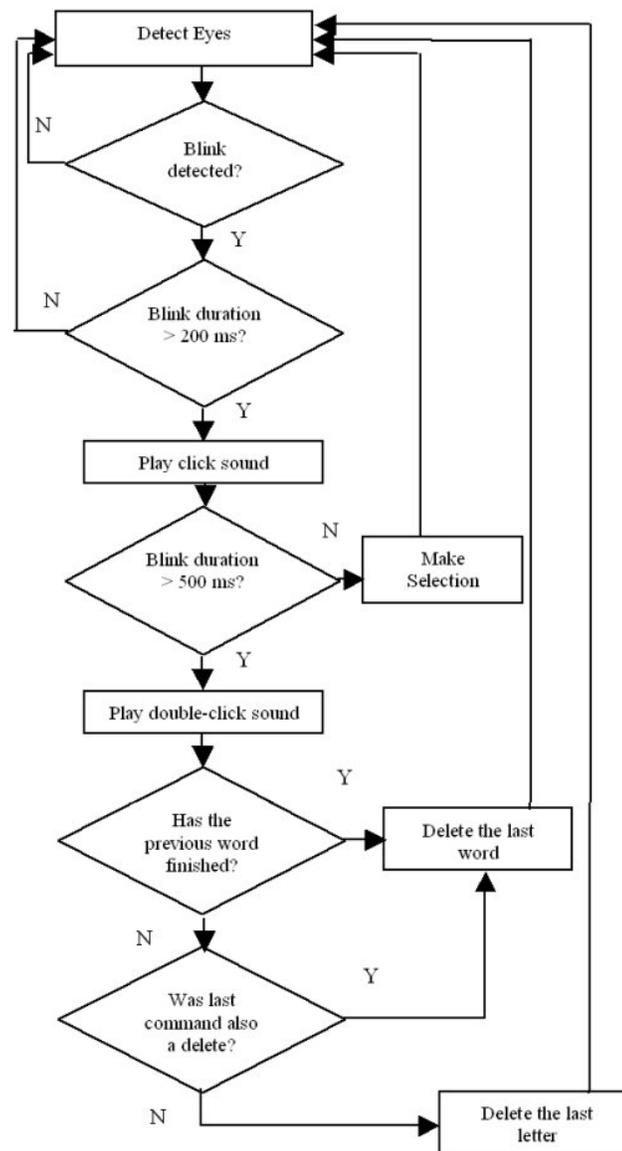
Enabling the user to type using just their eyes is one of the function that could be performed by the users using our system. The user can perform this task by the help of on screen keyboards already available in windows. The user will focus on the letters they want to type. By looking at the desired letter and blinking, that letter will be typed.

This process is nicely explained in a flowchart below:

On-Screen Keyboard:



Process Diagram:



Work Plan:

1. Feasibility Assessment

a. Skill and Resources

This project requires us to have some knowledge about hardware and circuitry design and application development. In this project, we will build an electric wheelchair from scratch by attaching 4 wheels to a metal base and a chair would be fixed on that. DC Motors will be attached on the rear wheels for forward and backward movements while a steering system is designed for the front wheels which will make the wheelchair turn left or right whenever required, using servo motor. The input to these motors would be controlled using a circuit of our design and an Arduino. The power would be supplied from 2 12v Batteries, and control signals would be sent via Bluetooth or USB from our application running on any windows system. Knowledge of C++, .Net Framework, Matlab and Microsoft Visual Studio is also required.

b. Risk Assessment

	Low	Medium	High
• Technical risk	<input type="checkbox"/>	✓	<input type="checkbox"/>
• Timing risk	<input type="checkbox"/>	<input type="checkbox"/>	✓
• Budget risk	✓	<input type="checkbox"/>	<input type="checkbox"/>

Comments:

Time is the major risk to the project because our goal is to develop a working system, including the wheelchair. Any unforeseen technical problem would have a high impact on the progress of the project.