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THE UNIVERSITY OF THE WEST INDIES
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INDIVIDUAL PLAGIARISM DECLARATION

STUDENT ID: 814005475

COURSE TITLE: HUMAN-COMPUTER INTERACTION

COURSE CODE: COMP 3603

TITLE OF ASSIGNMENT: ASSIGNMENT 1

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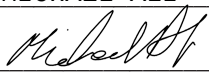
SIGNATURE 

DATE 18/09/18

COMP 3603 Assignment #1

COURSE CODE: *COMP 3603*

COURSE TITLE: *Human Computer Interaction*

NAME: *Michael Ali*

STUDENT ID NO.: *814005475*

Part A. Project Topic Brainstorming

Project Ideas –

1. *Emotionally Intelligent Robot Assistant (EIRA)–*
   EIRA is designed to be a therapy robot to help those suffering from mental and mood disorders, such as anxiety and depression, since the majority of sufferers do not seek help out of shame and finances. EIRA will be a private, and affordable, companion that can interact verbally with, and respond to the user's emotions.

2. ***Human-Computer Interaction Using Eye Movement Tracking-***
   Voice Recognition is a powerful tool to the physically disabled. However, it cannot assist those who also are speech impaired. Stephen Hawking was one such individual. Individuals like him, are in danger of becoming "locked-in," that is, being fully aware but completely paralysed and trapped in their bodies. I propose a system that tracks movement of the eye using a simple camera and allows for blinks to be used as mouse clicks, to allow full utilization of computer systems.

3. *Haptic Feedback for Use in VR Environments-*
   Virtual Reality offers an exciting and immersive experience through sight and sound. However, to truly have the world brought to life, the user should be able to feel their virtual surroundings, in the form of gloves that contain an array of springs and actuators that provide resistance to their fingers. This will give the impression of touching or holding objects, and can also simulate material hardness or sponginess.

Part B. Preliminary User and Task Analysis

Justification for Idea –

While EIRA will be extremely useful to socially anxious individuals and help them deal overcome their issues, and Haptic Feedback will greatly improve the VR experience, I have encountered many individuals who suffer from cerebral palsy or Parkinson's who have been unable to use computer systems. Many may see this as a luxury, but they do not experience the benefit of being able to Skype with family, perform in a workplace or simply stream a fun video. I very much hope to help these individuals with my skills in Computer Science.

References to support Idea –

While systems like this exist, they are extremely pricey, inaccurate with particular facial types and focused toward gaming, rather than helping the disabled. As such, they operate on estimated rather than accurate calculation. Dagnew and Kaur performed research on tracking eye movements to assist those who are hand disabled. Their paper describes an algorithm that can accurately determine the point where a

user's eye is pointing at based on either still images, or streaming video. Furthermore, it is effective in poor lighting conditions. (Dagnew, Kaur 2016)

Kim and Park, in addition, evaluated the effectiveness of neural network-based classification of a user's eyes in determining eye movement. They used their system to allow a user to control simple interfaces, such as a television, telephone and lights, and designed it to work when the user's face is "cluttered," such as with glasses and facial hair. They present a much more thorough method, as compared to Dagnew and Kaur. (Kim, Park 2006)

Therefore, it is highly possible to create a cheap and accurate system that will work with a wide variety of web cameras, while also accounting for various facial types and if the user wears eyeglasses.

Problem Description –

> Eye Tracking is aimed at increasing the quality of life and the possible level of communication in individuals who have lost use of their arms. Methods using images or video streams from standard webcams have been proven highly accurate, and systems adapted from them will be extremely affordable. This system will allow the users to interact fully with a computer system, and enable them to type, operate programs and even browse the web from simply looking at the screen and blinking. In addition, due to the health condition the users may be in, it is also important for the system to allow them to call for emergency help.

Scenarios

1.1 Scenario 1: *Call for Emergency*

Primary Actor: *Patient*

Starting Situation: *User is suffering from a medical emergency and requires assistance.*

Scenario:

a. The Patient places their gaze at a particular section of the screen, dedicated for emergency calls.
b. Using their blinks as clicks, the Patient can quickly send an emergency notification to Emergency Services and nearby family.
c. Emergency Services and caretakers will be notified to tend to the patient.

1.2 Scenario 2: *Open Netflix to Stream Video*

Primary Actor: *Patient*

Starting Situation: *The patient would like to view a television show on the popular Netflix application on their computer.*

Scenario:

a. The system tracks the patient's eyes as they look at the Netflix app.
b. A long blink is interpreted as a click, so the user commands the system to open the app.
c. An onscreen keyboard appears, allowing the user to enter the name of the show they would like the view.
d. Following the same process, the patient looks at the letters and "clicks."
e. When the required show appears in the suggestions, then the user can stop typing and simple view the suggestion and "click" once more, allowing them to watch it.

1.3 Scenario 3: *Browse Internet for News*

Primary Actor: *Patient*

Starting Situation: The Patient wishes to view the most recent news articles. A Quick Start shortcut already exists in their default browser. The patient's "clicks" are simply long blinks with their eyes. Eye Gestures exist, allowing the patient to "scroll" vertically and horizontally in webpages.

Scenario:

a. The patient glances at the Internet application and "clicks." This opens the default browser.
b. From the preexisting shortcuts, the patient "clicks" the news icon.
c. After the webpage loads, the patient can use the vertical scroll gesture to scroll down and view more news reports.

Following the same process as with applications, "clicks" will allow the patient to view further links and explore.

Part C. Design Direction

How does the system work? (High Level Description)

The system comprises of a self-contained software package, that can be adapted to any existing webcam. As such, the only requirement from the user is a webcam of reasonable quality. While systems similar to this exist, like the Tobii Eye Tracker, they are not suited for disabled individuals and are geared toward improving game experience, sacrificing accuracy for responsiveness. However, using mathematical calculations based on the dimensions of the user's face and position of the sclera, the user's gaze can be accurately pinpointed.

What makes it work?

The main programming language used will be Python due to the availability of facial recognition libraries, such as *OpenCV* and *dlib*. OpenCV will allow pinpointing of features in the eyes, as it's a library of common facial recognition algorithms. The video stream will be analysed, frame-by-frame, calculating the eye position with reasonable response time.

No additional software will be required, since all required libraries are Open Source, and most code, written from scratch personally.

References

Dagnew, Gebremaryam, and Gagandeep Kaur. "Human Computer Interaction Using Eye Movements for Hand Disabled People." *International Journal of Engineering Trends and Technology* 33, no. 3 (2016): 142-50. Accessed September 10, 2018. doi:10.14445/22315381/ijett-v33p227.

Kim, Eun Yi, and Se Hyun Park. "Computer Interface Using Eye Tracking for Handicapped People." *Intelligent Data Engineering and Automated Learning – IDEAL 2006 Lecture Notes in Computer Science* 4224 (2006): 562-69. Accessed September 10, 2018. doi:10.1007/11875581_68.