# MOUSE-CURSOR MOVEMENT AND CONTROL USING EYE GAZE-A HUMAN COMPUTER INTERACTION

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Computer Science and Engineering

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# APPROVAL

This Research titled **"Mouse-Cursor Movement and Control using Eye Gaze-A Human Computer Interaction"**, submitted by Payel Miah, ID No: 191-15-12654 and Mirza Raina Gulshan, ID No: 191-15-12602 Student ID to the Department of Computer Science and Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfilment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on *26th January 2023*.

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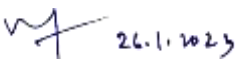


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# DECLARATION

We hereby declare that, this project has been done by us under the supervision of **Raja Tariqul Hasan Tusher**, **Assistant Professor, Department of CSE** Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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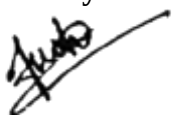

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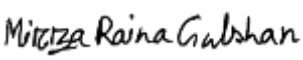

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# ABSTRACT

An emerging technology is human computer interaction (HCI).It is the technique that provide the ways to the human interact with the computers. Gaze interaction is one kind of human computer interaction(HCI). One of the most important HCI strategies is the eye gazing method, which enables the user to operate the display without using their hands. Direct eye movement detection, template, appearance, form, feature, hybrid, regression, clustering 3D methods et cetera. are all ways to categorize eye gaze detection techniques. Deep learning, a technology that mimics human behavior and behaviors like speech recognition, image recognition, language translation, and other things, can make this possible. Gaze interaction is the process of making interconnection between the human body part and the smart device. Devices takes input from the human on the real time.

An web camera was employed in this study to capture an frame of an eye frame for mouse-cursor movement. In connection with the point previously mentioned, we must first concentrate on the function of our eye. We are employing a web camera for pupil identification, which can manage the computer's cursor. For this paper, an Aspect Ratio Eye (EAR) is determined that corresponds to the blinks of eye's (right or left) applying the library of Mediapipe which is Open Source and acts as a computer vision library. You can provide smart people with crippled limbs who are having trouble using computers a chance to express their opinions. Our method's primary objective is improving the experience of using computer for physically disabled people by assisting them in overcoming challenges like using a mouse.

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# CHAPTER 1

# INTRODUCTION

## 1.1 Introduction

Moving a computer mouse or finger has become a typical method of moving the computer cursor currently moving around the computer screen technology. To align it with the motions of the system notices any movement of the cursor The human finger or computer mouse. This using present technology will not be possible referred to by some as "amputees" since they do not the ability to use their hands. As a result, the amputee and other people with physical disabilities can if their eyeball movement can be controlled, they will be to the cursor, mapped. Depending on how the movement and direction of the eyes are seen tracking the direction an eye is looking, the physically mapped cursor will be used. disabled individuals will be able to move the cursor. From past hand disabled person are deprived to use computer or laptop for this reason they took themselves too far from the new technologies. Though having enough knowledge on modern technology, they cannot utilize their knowledge because of their disability. We have thought about these intelligent disabled persons and proposed the system that can play a great role for these persons and they can utilize their knowledge and can do something.

This technology has been the subject of extensive development in recent years with the goal of making it accessible to the general population. First, three different technologies were used to construct eye trackers, which monitor eye movement. These three methods include optical tracking, which uses light to measure the motion of eye, and potential electric measurement, which is being used to calculate eye's moment of dipole to determine motion of eye. Eye attached tracking involves attaching a device to the eye, such as a contact lens.

Then, using the information gathered by the tracker, several methodologies were created in order to identifying the x, y coordinates of the screen region the user is viewing. This information was then used to carry out a variety of generic activities in human computer conversation, including object selection, object movement, text scrolling, etc. [1]. The proposed technology is a hand free communication system between human and computer on the concept of Human-machine-interaction (HMI). External webcam is being used to take input from human and control the cursor

based on this input. Taking input is a real time process [2]. Also, the technology will exchange traditional screen pointing method to a smarter and new process. [3].

In this paper, we propose for a multimodal camera-face human machine interface architecture, this includes acknowledging eye tracking has completed. Constant eye input has traditionally been employed for individuals who are unable to move their eyes but can use them for input.

The interaction depends on uses eyeball size, eye movement speed distance of view point, intensity distribution of the pupils and iris and cornea's shape. For implementing the project, it also refers high resolution cameras, different types of sensors for detecting eye movement, near-infrared light sources and algorithms. Algorithms translate the eye movement into real time data stream. The process explore data identify pattern and involves minimal human intervention. Deep learning machine learning and Artificial intelligence will work to train the computers. These algorithms combinedly make a interconnection with human eyes and computer screen. To take instruction, computer analyze various features like distance between eye and screen, contour of the visible eyeball region, Iris and cornea's shapes, intensity distribution of the pupils, power of eyesight etc.it also depends on users I color, texture light conditions, blink combination, shutting of eyes and visual angle.to take inputs first of all data related to the position of the eye is acquired using a system that illuminates the eye of the subject with an IR source. it takes a video image of that eye locates the corneal reflection of the IR source. Eid processed dynamically to calculate or record the eye gaze. the corneal reflection is determined from the dark pupil when the pupil has detected. the reflection is then used to estimate user’s point of gaze in terms of the screen coordinates where the user is looking at. There are various types of methods in the I gaze technics. This method works bases on user's eye detection, appearance, template shape and feature method etc. We have used Mediapipe to track eye movement which control the cursor movement. Also, we have used PyAutoGUI which is a automation library for python support keyboard and mouse control. We trying to introduce a new and smart method to the users and also a significant way for disabled users.

## 1.2 Objective

We are living at time of technological revolution. New techniques and new technologies are appearing day by day. And also, those technologies are updating with time. There is a saying that "Modern problem has smarter solution". We find a problem that hand disables people are unable to use mouse that's why they do not operate computer. Our main objective is to introduce our proposed model to the hand disabled people. So, we can describe these goals in a list like this:

- Our goal is to provide a solution to the hand-disabled and amputee people who want to operate computer or who have knowledge on computing but cannot do anything because of their disability**.**
- We want to introduce a very smart and efficient technology to the modern world.
- Trying to minimize physical devices with smart way.
- Traditional mouse pointing system will be replace into modern gaze pointing system.

It is also our goal to produce a time-consuming screen controlling system to the user.

### 1.3 Motivation

We wanted to implement something which is not available in the modern technology. Besides our main thinking was to implement something which will be very effective to the users. That's why we sat together and discussed about it. We started to research. On that time, we found out that some hand disabled people and amputee people who wants to operate computer and they have enough knowledge on it. After knowing this we made an idea that we would do something to replace traditional mouse pointing system into a modern system. So, we started to find some solution on it and we have known about Human computer interaction. After studying about HCI we came to know about gaze pointing system. So, we decided to implement a system that will do everything which a mouse can do by following users eyeball movement. We decided to remove mouse and establish gaze pointing system and this system will be very helpful for hand disabled and amputees. Also, general will be helpful by using these techniques. And our main goal will be kept up that this system will be new and effective to the users. Then we started to read some research paper on it. In maximum paper we have known about a device which name is 'RasberryPi'. This device take input from human eyes and operate with human eye movement. But we decided to implement this technology in the laptop. So we have taken knowledge from those paper and started to learn machine learning. We started to learn various type of algorithms and also share our idea with our professors. They encouraged us and gave some instruction. Getting their encouragement word, we get motivated and started to implement it. We started to learn Mediapipe and PyAutoGUI which we have use to implement our system. Mainly after getting knowledge on Gaze Estimation, we got inspiration to implement this system. Amputee's disability also motivated us that we have to do something for them. And our motivation and hard work help us to reach our goal. We finally implement this system on the laptop and we find out that our implemented system is working. That's means we can now control the cursor on our laptop with moving our eye ball and this system can use anyone like general people and also hand disabled people. Our motivation helps us to reach our goal. So, we think that motivation is the most important thing that can help a person to do something. Motivation makes a person mentally strong to take decision and work on it. Some of our friends tried to divert our mind saying that it is very hard to implement and will not be effective to the users. But we did not listen to them and continued our work to implement this system. And now we enable to operate our laptop with our eye movement.

## 1.4 Rational of the Study

Giving instruction to the computer by human eyes movement and control the cursor without any physical input device it is out of imagination of many people. So this system will make people surprised and introduce them with latest technology. This is the main reason behind the implementation. It brings the gaze estimation in a new level. There are a lot of work on gaze estimation but our implement system is new and no one work like us. We research a lot on gaze estimation but did not find any work same as us. So we studied on this topic. We are very much happy for studying on it. Really, we lean a lot when we started to study on it. Utilizing gaze estimation and providing something latest that made us interested to study on it.

## 1.5 Expected Outcome

Expectation makes a man interested to do something. Every implemented technology had an expectation to fulfil some required tasks. There is no work which is created without any expected result. When we make decision to implement this system, we expected that we could be able to control the all mechanism that mouse can do. We planned that computer would detect our eyes first and then follow the movement of our head and eyeballs. Keeping hope in our mind that we would be operate any work on computer without any mouse, we started to implement this technology. Also our expectation was that the implemented system would be make hand disabled people enable to use computer. To get expected result we trained laptop to detect users eyes and follow the movement. After lunching the technology we expect that:

- Our proposed model will be used everywhere in the world.
- This system will be much popular to the general people and amputees.
- Use of physical input device will minimize.
- This technology will make us smarter and will reach a new level in modern world.
- This system will consume time while giving instruction.

In near future this technology motivate people to insert this method in all autonomous devices.

## 1.6 Research Questions

When we finally made decision to work on this purpose, It was so challenging for us to complete this. We had to face a lot of difficulties on the time on working. Some of people do not encourage

us on doing this. They told us it is not possible to implement this project also we are not able to work on it because lake of knowledge and resources. On that time we became confused and some questions arise in our mind. In order to have a realistic, efficient and accurate result we had to solve all of questions. The questions was like this:

- Can we collect enough resourches on this topic?
- Can we gain enough knowledge to implement this proposed model?
- Can we will be able to bear the cost?
- Can we learn enough to complete this implementation?
- Is it possible to train the devices to detect human's eyes and take input from eyes?
- Do our implemented system will be efficient and do our system will perform the required task?
- Is it possible to get the expected result?

### 1.7 Layout of the Report

**Chapter one** provide a general idea on our project. Which is our research topic, how we found this topic why we work on this topic are explained on this chapter. Chapter one have described with objective, motivation, expected outcome and research Questions.

**Chapter two** is mainly illustrated on the background study to this research paper. We read some papers on gaze interaction and we found some work on eyeball movement tracking which is closely similar with our work. In this chapter we have described about some related work. Here we said the resources from where we got knowledges on it and the way of learning to implement this system. Also in this chapter we have shown a comparison between our proposed system and related work . Also we have talk about scope of problem and challenges which we have faced at the time of working on this system.

**Chapter three** we have talk about methodology of the research topic. Here we have talk about out implementation and have described about necessary instruments. In this chapter we have shown the workflow of our proposed system. Those workflow express the working mechanism of the

system that how does the system work to get desire result. Here we have shown tow types of working mechanism one for hand disabled people and other for general people. Besides we have described the data collection procedure and our proposed model. Moreover we have explain that how can we train the system. In chapter three we also talk about our implementation requirements.

**Chapter four** we have described about our system's performance. We have talk about the evaluation of the system that the system is working or not. Have shown a persentage of the accuracy of the system. Also we have analyzed the result of the implemented system.

**Chapter five** described the impact that will be created in our society and our environment by launching our system. Will the system be effective for our society or not this chapter have expressed it. Besides what type of impact will be faced our environment we have explained.

**Chapter six** we have talk about the conclusion of the research. Also we have discussed about the future work that we are planning to do on future to make a addition with this project that will be update version of our proposed system.

# CHAPTER 2

# BACKGROUND

## 2.1 Introduction

This section will cover relevant works, a research summary, and this study's problems. In the section on related works, we'll talk about other research papers' findings, methodologies, and accuracy as they pertain to our work. We shall summarize our connected efforts under the section on research summaries. We will go over how we boosted the accuracy level in the challenges section.

## 2.2 Related Works

Before starting our work we read some papers on gaze interaction. On those paper we came to know a large number of things and got a lot of ideas on eye gaze tracking.

Interest in creating a method for studying eye movements has grown recently. Numerous algorithms, models, and strategies have been examined in this research survey. The findings of the survey have helped identify certain crucial factors and aspects that have a significant impact on the accuracy and efficiency of eye gazing processes. In order to conduct additional research and analysis, a variety of eye gaze-based HCI models and algorithms have been examined. Below is a discussion of the advantages and disadvantages of eye gaze-based models.

A Visual Analytic in Deep Learning Approach to Eye Movement for Human-Machine Interaction Based on Inertia Measurement, 2020 paper [2]. This method uses the user's eye gaze to control the computer cursor. A user can type, run computer software, use a computer mouse, access the internet, and create voice syntheses by staring at the control keys that are visible on the screen. The sole requirements for using the Eye gaze are the ability to maintain a relatively stable head position and control of at least one eye with decent vision. The technology employs an external speech device and outputs fair results.

Eye gaze estimation is a process that use in human computer intersection (HCI). Gaze pointing method bring a new process which control cursor in screen with eyeball rotation instead of traditional mouse. Eye gaze pointing and eye gaze direction both were done in 2021 estimated by

Yong Huang and his team [4]. They constructed local sharing network for feature extraction and propose Multiview Multitasking Learning(MML) for gaze direction. Information were taken from eyes as input in real time. Neural light method is a kind of method that use infrared light source to implement a gaze estimation. Some limitation was faced like changing in the visible light spectrum and low contrast images, but it is less sensitive to infrared light.

A strategy for human-computer interaction based on eye movement was put forth by Ramsha and Usmani in an IEEE 2016 paper [5]. Our paper is dedicated to outlining also implementing a human-machine interfaced framework which traces the movements of the user's eye while using EAR equation to move the mouse cursor while using eye pupil implementation, and Eye squints, an eye movement, are used while closing and opening a certain sign.

The sixth sense technology, developed by a team at MIT [6], promises to improve HCI by using palm and eye motions. The complete system may be mounted on the person's helmet in order to be operated anywhere around the globe and displayed onto flat surfaces. The issue is that it does not offer a good solution that really can communicate with some other suitable devices or ensure access and support for the impaired.

Mr. Yushou Tang and Jianhuan Su proposed a model that predict human emotion based on eye movement. They thought that eye movement can express human emotion and so they use backpropagation (BP) algorithm to gaze eye movement signal. Analysing eye movement signal human emotion can be predicted [7].

Sidrah liaqat and some of his friends proposed a model on predicting ASD diagnosis in children based on eye gaze process. They tried to predict autism spectrum disorder on young children at a very early age. They proposed two machine learning method for implementation. The first method is synthetic saccade pattern which is used to represent the baseline scan-path and the other method is image based which adopts a more holistic image based approach by feeding the input image and a sequence of fixation maps into a state-of-the-art convolutional neural network [8].

Using gaze estimation, a model was proposed to predict driver's eye fixation to ensure safe driving in autonomous vehicles. Convolution neural network predict the potential saliency regions in the driving environment and then use the probability of the driver gaze direction, given head pose as a top-down factor [9]. Tracking the driver's eye movement, gaze direction and gaze movement

with real time the driver's next action is being predicted and can make a judgment on safety and risk level.

Mohd Khalel published a work [10] which concentrates on the usage of MATLAB to operate the pupil detection mechanism. Using a web camera, the head will be first identified, followed by the eye, which is then extracted using the MATLAB library, leading towards the monitoring of gaze. The iris transition would then be determined by calculating, and the transition would then be plotted using a graphical interface. The eye is then identified, and this is plotted with cursor, and thus the mouse pointer moves in accordance.

Eye gaze estimation taking a great contribution on eye blinking prediction. Nowadays eye blinking prediction method is used in various platforms like drowsiness detection, face recognition application, unlocking phones, etc. In raspberry pi 3 gazing eye blink is estimated in 2021. Dlib library was utilized to detect facial features. Eye aspect ratio (EAR) was built to detect the blink. It provides an accurate calculation using the ratio of distance among the eye landmarks [11],[14].

Pupil center movement was being tracked dynamically. Gaze estimation expresses feelings, desires, emotions, and in tension. A person-dependent calibration-free system could deal with the illumination [12].

Examining and establishing the variables that capture the changes caused by blinking in this article study. Face detection is performed using the Mediapipe technique, while eye extraction is performed via template matching. The eye part is removed using specific geometric dependencies. Eye tracking is carried out in its first stages via template matching. For cursor movement, face classifiers were utilized (such as up, down, left, and right). The major steps of this system are: first, it recognizes faces in videos; second, it extracts eyes; third, it extracts features; and finally, it recognizes cursor movement and mouse events.

## 2.3 Research Summary

Following the reading of the paper, we discovered a variety of gaze interactive work that operated on smart devices and gained a lot of information that was apparent to us conceptually. We had to study from several academics' publications about their extremely complicated procedures, and we had to gather information that would help us focus on writing when we implemented our system. As opposed to that, we put our system into place fully informed. After examining the prior article, we realized some of the elements that were lacking before implementation and went about implementing them correctly and with the necessary expertise. Prior to implementation, we thought erratically. As part of our process, we employed a variety of automation packages, including Mediapipe, PyautoGui, and OpenCV, which are more suitable for automation. However, we made an effort to make life simpler for those with disabilities who cannot use current smart gadgets like laptops, desktop computers, or mobile phones. They will therefore be able to work in any setting and at any level, including corporate, academic, and freelance.

## 2.4 Challenges

Nothing is gain without struggle. There is nothing done without facing any challenges and difficulties. But the main spirit is that to gain something challenges should be overcome. After begging of our work we had to face some challenges. On that time, we felt confusion on decision making. Some challenges like:

- A number of people told us that it is not easy to implement and do not find enough resources and knowledges. They deceased our spirit.
- We did not find paper where we can get similarities with our project.
- We had not any knowledges on Mediapipe library. It was new to us.
- We face some difficulties while going to train the laptop. First time it did not tacking input from the eyes

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# CHAPTER 3

# RESEARCH METHODOLOGY

## 3.1 Introduction

In our suggested method, Mediapipe is used to track eye movement to control computer mouse pointer movement. The movement of the eyeball is identified by the camera and analyzed by MediaPipe. Real-time computer vision is the main emphasis of a suite of programming interfaces called MediaPipe. In this paper we used PyAutoGUI library. The automation library PyAutogui for Python supports keyboard and mouse control. Alternately, we could say that it makes it easier for us to automate keyboard and mouse clicks in order to establish interaction with another program using a Python script. This allows for cursor control. The user is required to stand in front of the personal computer screen. a dedicated video camera mounted above a computer or laptop's screen to record the user's gaze. The laptop continuously analyzes the attention's video image to determine where the A user is addressing the monitor. There is nothing fastened to the customer's head or body.

## 3.2 Research Subject and Instrumentation

We work on human computer interaction(HCI). Consider the subject of your query as a study area that has been looked at to help you understand some ideas. We cover the technology and methods we used under the heading of instrumentation. We utilized the Windows operating system together with a number of Python modules, such as Mediaipipe, PyautoGUI, OpenCV, etc. PyCharm, a Python programming language distribution designed for use in information science and artificial intelligence applications, was used for all of the training and testing.

## 3.3 Workflow

Workflow is the series of activities that are necessary to complete a task. Each step in a workflow has a specific step before it and a specific step after it, with the exception of the first and last steps**.** Every steps has a specific activity. A workflow shows the working mechanism of a system step

by step. A workflow helps to understand a system's working process within a very short time. The whole working process cab be define in a workflow. And every system should have its own work flow. Our system also have its workflow. We divided our system's workflow into two part. One part describes the workflow of hand disabled person and the other part the for general users. But both workflow is almost same and both workflows work together in our system.

### 3.3.1 Flow Of Execution For Limbless User:

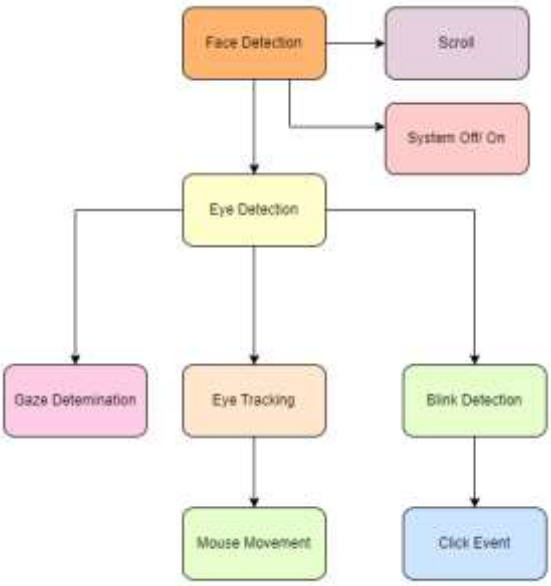



Fig 3.3.1**:** Flowchart(disabled)

In figure 1, MediaPipe Facemesh will detect the face and divide it into se of landmarks to identify facial movement. From mediapipe detected face we will measure head movement to determine scroll event. When user will open and close their mouth system will turn itself off/on. By extracting eye placement from MediaPipe we will determine where to place the cursor. From the detected landmark for both eye we will detect distance between upper eyelid and lower eyelid. If we detect that the distance between the eyelids is very low we will execute following click event.

### 3.3.2 Flow Of Execution For Normal User:

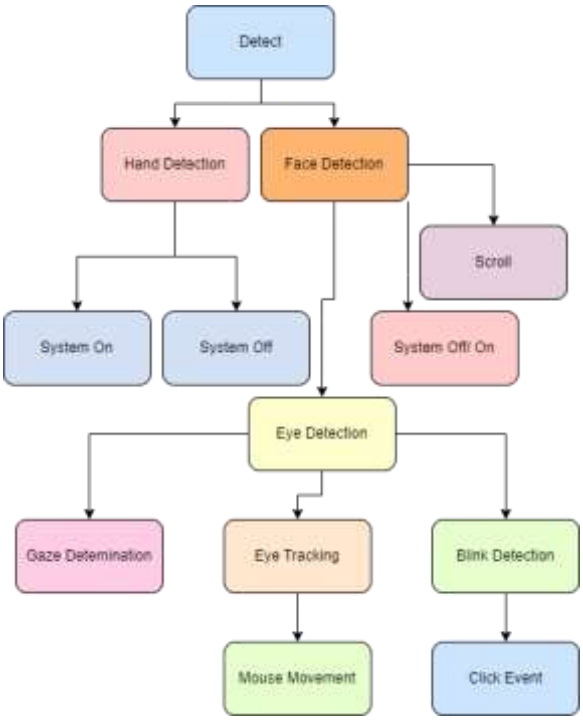



Fig 3.3.2: Flowchart (not disabled)

In the given figure number tow this flowchart is for a user who is not disabled our system will follow same set of execution order as we saw for disabled user but this user will also be able to use his hands to turn the system off and on.

### 3.4 Data Collection Procedure

Our proposed system will work with real time data collection procedure. No dataset is used in this system. When a user open the laptop the web cam detect the users face landmarks. And follow all the instruction which is given by the users. Also the cursor will move one place to another place with following the eyeball movement with real time. When the eyes will blink the clicking procedure will be done. This system will not save any instruction for later uses. This system will collect data while a user will be using computer time to time. So this system will be called e

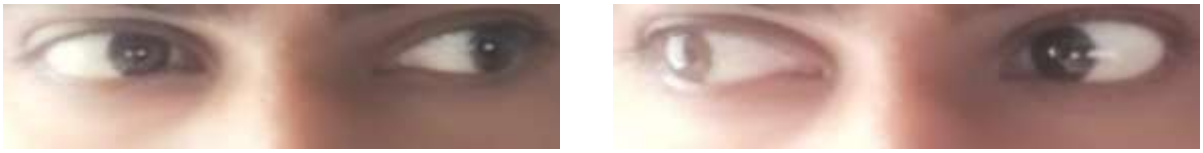
dynamic system. All process will be done with real time. And when the user shut the system off the data collection procedure will be stop and do not save any data by it's own. This system will work with users interaction and also there will be a fixed range of collecting data from the users. If the users will go out from the range the system will be paused. And if the users shut their eyes off the system also will be paused. So it is also necessary to being in range of detection level.

### 3.5 Data Processing

Data processing is the method of data being processed. When the data is given as input, the data is being started to be processed. Data is being processed in many steps and many ways. Our system also takes some steps to process the data.

#### 3.5.1 The pupil's movement to the left and right:

Circular artifacts can be used to move the eye's pupil horizontally. The mouse pointer moves in lockstep with the pupil, so if the pupil moves to the left, it will also move to the left if it moves to the right.



(a) (b)

Fig 3.5.1: left (a) and right (b)

Figure number 3 shows the left and right movement.

#### 3.5.2 Movement of the pupil up and down:

A pupil scale can be used to move the eyes' pupils vertically. When looking downward, the eyes are slightly half-closed. These phenomena can be exploited to direct the mouse pointer's movement from top to bottom.

(a)

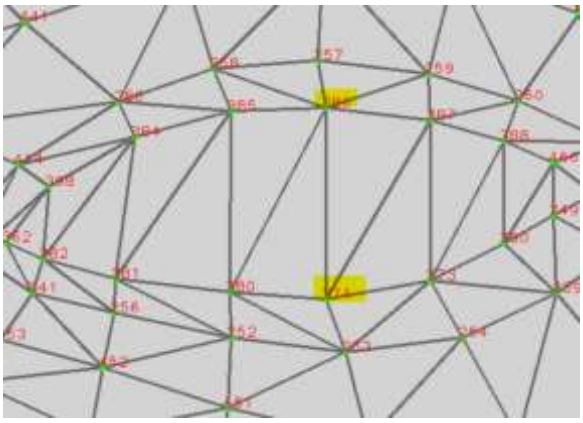
(b)

Fig 3.5.2: pupil upwards (a) and pupil downwards (b)

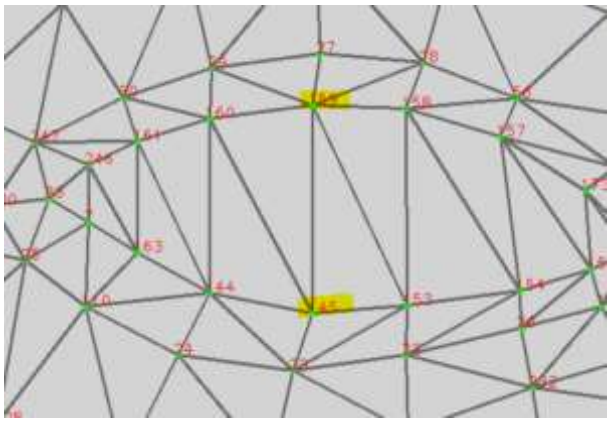
Figure number 4 shows the pupil movement of upwards and downwards.

### 3.5.3 Mouse right click and left click:

The functionalities of the right click and left click will be accessed through right eye winking and left eye winking Fig. 6(a, b). For the left eye wink detection landmark, 145,159 was used in Fig. 5 (b), and for the right eye wink detection landmark, 386,374 was used in Fig. 5 (a).



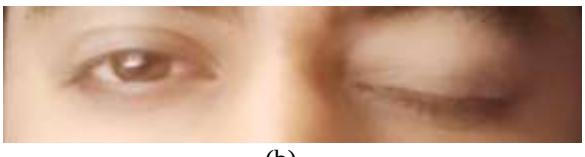
(a)



(b)

Fig 3.5.3: Right eye landmarks (a) and Left eye landmarks (b)

(a)



(b)

Fig 3.5.4: Right eye wink (a) and Left eye wink (b)

### 3.5.4 Mouse Scrolling:

Most of the time it will be a must to scroll a page, without scrolling we can't actually provide a good usage. For scrolling, users need to move their head (Fig. 7). Move up and down will scroll up and downwards. In the same manner, moving the head right and left will scroll right and leftwards.

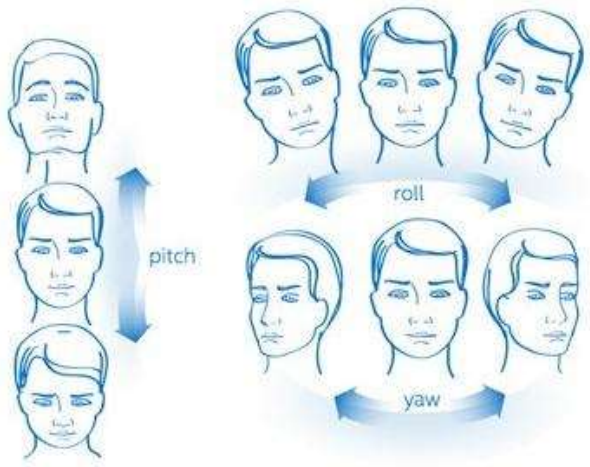
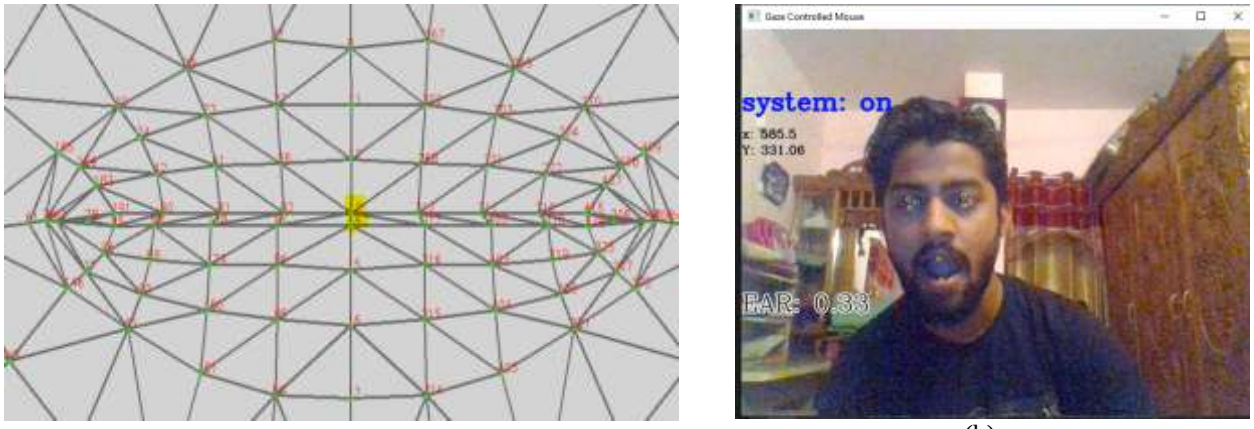



Fig 3.5.5: Scrolling

### 3.5.5 System Of/On (mouth):

User will be able to turn the system on when turned off by opening their mouth. When the system is turned on users will be able to turn it off by simply opening their mouth. Here we calculated the distance of landmarks 13,14 to determine the distance between lip in Fig. 8 (a).



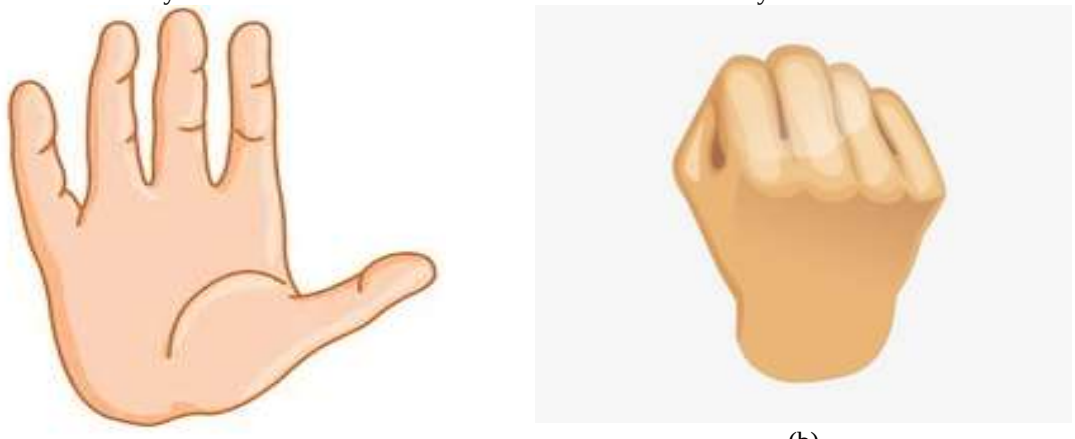

(a) (b)

Fig 3.5.6: Mouth landmarks (a) and System Off/On (b)

### 3.5.6 System Of/On (hand):

Users will be able to turn the system on by opening their fist Fig. 9(a). When the system is turned on users will be able to turn it off by simply closing their fist Fig. 9S(b).

System On System Off



(a) (b)

Fig 3.5.7: System On (a) and System Off (b)

### 3.6 Proposed Methodology

In our suggested method, Mediapipe is used to track eye movement to control computer mouse pointer movement. The movement of the eyeball is identified by the camera and analyzed by MediaPipe. Real-time computer vision is the main emphasis of a suite of programming interfaces called MediaPipe. In this paper we used PyAutoGUI library. The automation library PyAutogui for Python supports keyboard and mouse control. Alternately, we could say that it makes it easier for us to automate keyboard and mouse clicks in order to establish interaction with another program using a Python script. This allows for cursor control. The user is required to stand in front of the personal computer screen. a dedicated video camera mounted above a computer or laptop's screen to record the user's gaze. The laptop continuously analyzes the attention's video image to determine where the A user is addressing the monitor. There is nothing fastened to the customer's head or body.

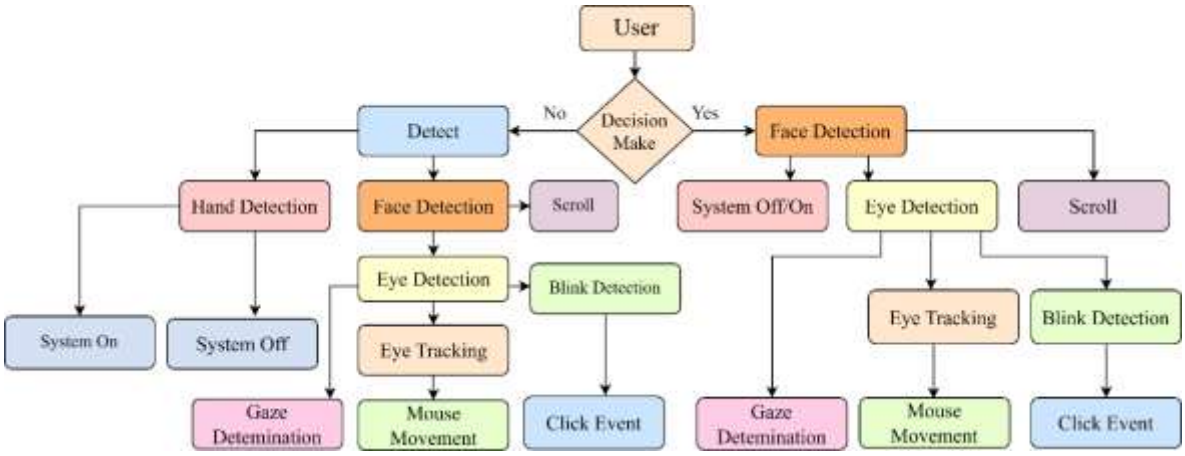



Fig. 3.6.1. Overall Work Process of Proposed System

MediaPipe Facemesh will detect the face and divide it into se of landmarks to identify facial movement. From mediapipe detected face we will measure head movement to determine scroll event. When user will open and close their mouth system will turn itself off/on. By extracting eye pacement from MediaPipe we will determine where to place the cursor. From the detected

landmark for both eye we will detect distance between upper eyelid and lower eyelid. If we detect that the distance between the eyelids is very low, we will execute following click event. For a user who is not disabled our system will follow same set of execution order as we saw for disabled user but this user will also be able to use his hands to turn the system off and on.3.6.1 Convolutional Layer

### 3.7 Training the Model

Following detection, we collected data from face landmarks with images of those who used a laptop or computer. The system's backend features several detection levels that will use human-provided information, such as photographs, bodily landmarks, and so forth, to train identification algorithms.

### 3.8 Implementation Requirements

A list of requirements has been established that must be completed in order to use the gaze interactive computer after adequate study of the relevant statistics or theoretical ideas and procedures.

The following are likely prerequisites:

**Hardware/Software Requirements**

Operating System (Windows 7 or above)
Hard Disk (minimum 500 GB)
Ram (Minimum 4 GB)

**Developing Tools**

Python Environment
PyCharm

# CHAPTER 4

# EXPERIMENTAL RESULTS AND DISCUSSION

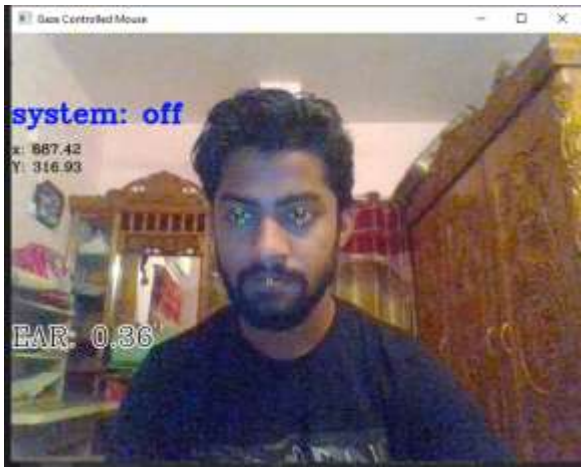
## 4.1 Introduction

Real-time data collecting will be used by our proposed system. This system makes no use of any dataset. The webcam recognizes the user's face landmarks when the user opens the laptop. And adhere to every instruction that is provided by users. Additionally, the cursor will move from one location to another while simultaneously tracking the eyeball's movement.

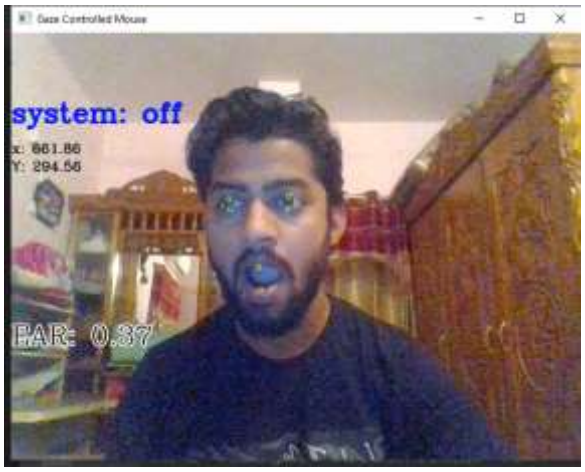
## 4.2 Performance Evaluation

After completing any work it is mandatory **to** evaluate its performance. Evaluation is a systematic method to study a program, practice, intervention, or initiative to understand how well it achieves its goals. Evaluations help to determine which part works well and which part could be improved in a program or initiative. Evaluation helps to mark the origin of the error. Every system is being implemented to perform some required task. If a system can able to done it's required task than it can called a good system but if it does not done it's required task than it is an useless system. Every system should be evaluated before launching it. Otherwise users have to face a lot of problem and the systems performance rating will be decreased. Programmers also have to modify his system many times and also launching cost will be increased. So it is not a good practice to launch any system without evaluation. We evaluated our system when we finished it's implementation. Fist time we faced some difficulties. The laptop was not perfectly detected our eyes movement. But after adding some modification we noticed that the system is working. After every modification we test our system's performance. Evaluating process helps us to figure out which part working perfectly and which parts have some errors. Than we found out the origin of the error and tried to understand the reason behind the errors. Than we discussed together and also discussed with our supervisor. She also gave us some guidelines. Besides we searched to find the solutions of the errors. After getting the solution we updated our system. Now the system can detect users eyes and can take inputs that the eyes give to the laptop. Also the cursor is moving with following the eyeball movement. It is a great achievement for us. We test our system again and again to find out errors if their any have. We modified our system every time when we found any error. We work

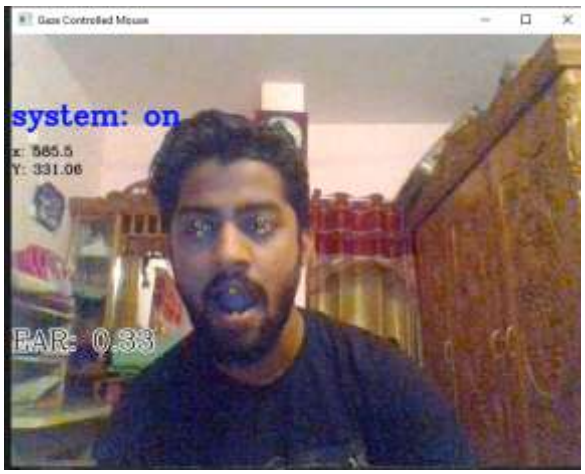
hard and gave our best to reach our goal. After adding all modification we find our required system. We are very happy because the system fulfilled our expectation. Now we are able to operate our laptop without using any mouse. Our eyes gives instruction to the laptop and following those instruction laptop provides us the output. All task are perfectly doing that mouse can do. No need to use traditional mouse to give instruction. After considering various input forms, such as eye detection situation, system on-off process using mouth, left click and right click using eyes. We prepared the visual results to observe proposed system's performances.




**(a)**

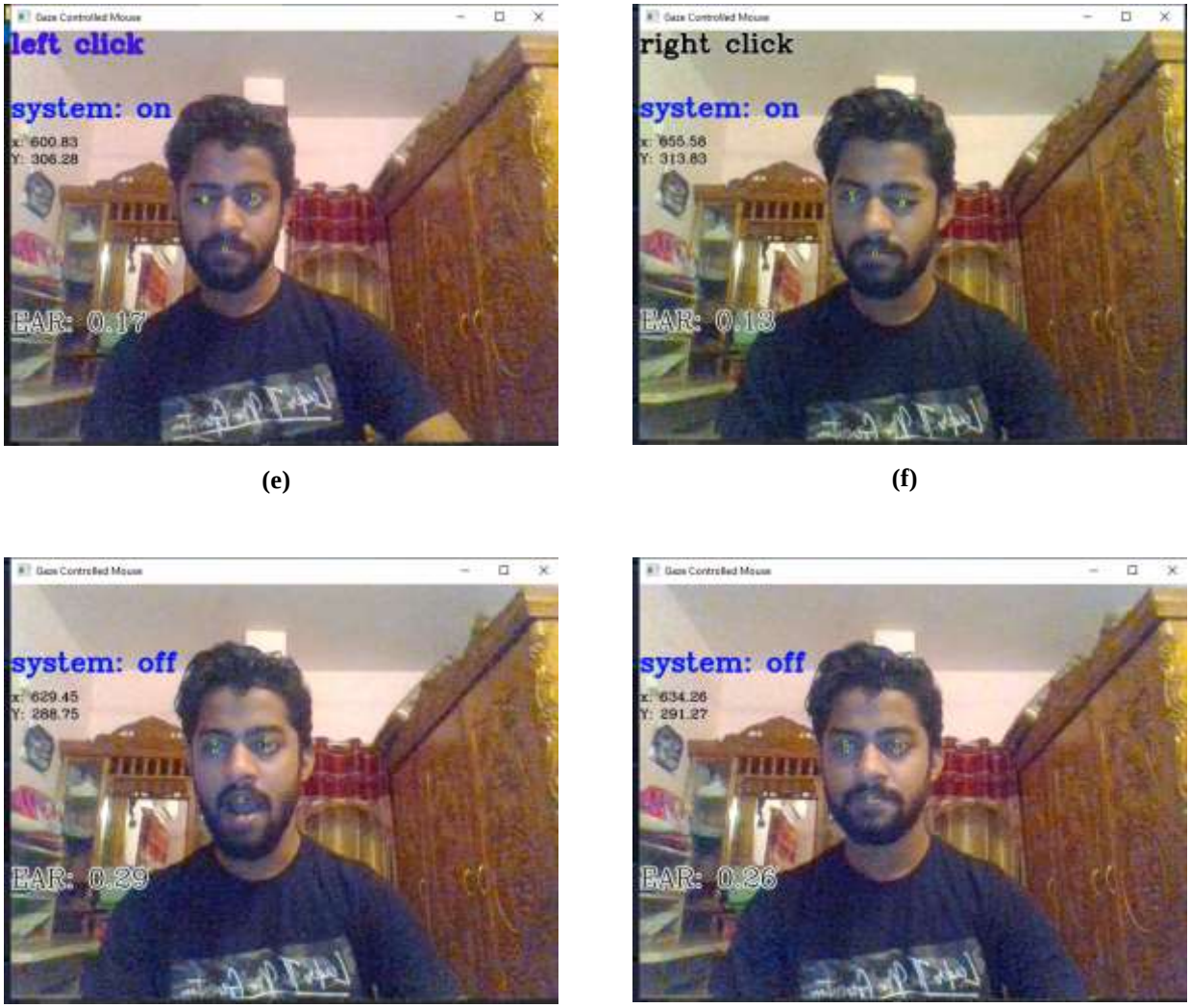



**(b)**




**(c)**


**(d)**




**(e)** **(f)**

**(g)** **(h)**

Fig.4.2.1. (a) Eye detected, (b) System Off to On, (c) Turning system Off to On, (d) System turned On (e) Left Eye Wink detected, (f) Right Eye Wink detected, (g)

The accuracy of the system should have been 100 percent, but external factors like light intensity, an average camera, and others caused it to be a little low. After much trial and error, the accuracy is now between 80 and 95 percent, with the maximum average accuracy occurring in bright sunlight and a decrease to 85 percent at night. If the illumination is good, the device will provide a 100 percent accurate reading.

### 4.3 Result Discussion

Table 1 prepared for mention the eye movement taking ration. To understand the outcome of this work several results are visualized in Fig. 6. After considering various input forms, such as eye detection situation, system on-off process using mouth, left click and right click using eyes. We prepared the visual results to observe proposed system's performances.

**Table 4.3.1:** Eye Aspect Ratio (EAR) values when eyes are opened, closed, and clicked.

| Eye features | Ratio |
|---|---|
| open fully | 0.36-0.44 |
| open partially | 0.31-0.37 |
| closed fully | <0.15 |
| Right wink | 0.12-0.18 |
| Left wink | 0.12-0.18 |

# CHAPTER 5

# CONCLUSION, RECOMMENDATION AND FUTURE WORKS

## 5.1 Summary of the Study

Finally, our system uses amputee people for this reason disable people work in modern world any place such as corporate field, educational, organization etc. They will able to work anywhere for use our system that's why hopefully the corporator will hired them for work. We want to implement a feature that is not offered by contemporary technology. In addition, we focused on implementing solutions that will benefit users greatly. We sat down and talked about it as a result. We began our inquiry. At that time, we learned that several hand impaired and amputee people wanted to use computers and had sufficient computer expertise. Knowing this, we decided to take action to replace the conventional mouse pointing mechanism with a more contemporary one. As a result, we started looking for a solution and learned about human-computer interaction.

## 5.2 Conclusion

This research proposes a novel HMI system for manipulating a pointer on the computer screen while tracking the user's eyes. It uses computer vision and pattern recognition techniques. The following solution, which uses PyAutoGUI, will give physically disabled users an alternative method of interacting with real-world programs in a better and more effective way. This particular technology allows physically challenged individuals greater adaptability by allowing them to simulate mouse pointer action just using facial recognition. Additionally, even non-disabled users will be able to use this system and thus it can be concluded that further utilization of this system while updating the framework and graphical user interface will revolutionize the IT world for the better and take gesture base computing to a new milestone.

### 5.3 Future Works

Our system is now totally dependent on a laptop but it will be great if you could work with that without implementing it in the computer rather than running it using raspberry pi. Making cursor movement faster and slower will also give a lot of application.

For gaming, we may introduce multiple control systems which will revolutionize the gaming experience. Implementing the whole thing alongside virtual reality (VR) will provide an experience never experienced before.

In near future we will try to implement this system on personal computers, mobile phones and other digital devices. We hope that most of the device which controls by a mouse and screen touch system will replace into eye movement controlling technology in upcoming new generation.

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# APPENDIX

After finishing this project, which describes the whole procedure utilized in ocular movement-based cursor control using machine learning, automation libraries such as Mediapipe, PyautoGUI, and OpenCV, among others, were employed. Here, Mediapipe will be employed for that purpose to collect real-time data from people while also recognizing face landmarks. The PyautoGUI module, on the other hand, is utilized for mouse movement while clicking. Also built with real-time data is the OpenCV library, which is used to record video from the camera. When our system is active, it functions work properly.

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