BUILDING A MOUSE BY EYEBALL MOVEMENT USING MACHINE LEARNING

A Project Report submitted in the partial fulfillment of the requirements for the award of the Degree of

BACHELOR OF TECHNOLOGY

In

COMPUTER SCIENCE & ENGINEERING

Submitted By

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CERTIFICATE

This is to certify that the project report entitled **"BUILDING A MOUSE BY EYEBALL MOVEMENT USING MACHINE LEARNING''** is the bonafied work carried out by **PUJITHA MUPPALLA (20NE1A05A6), JIRRA MERAMMA (20NE1A0566), KOTA SAHITHI (20NE1A0588), JAJJARI SASI KUMAR (20NE1A0563)** in partial fulfillment of the requirements for the award of **"Bachelor of Technology"** degree in the **Department of CSE** from J.N.T.U. KAKINADA during the year 20202024 under our guidance and supervision and worth of acceptance of requirements of the university.

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ABSTRACT

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An individual Human computer interference system is being introduced. In olden times, as an input device the mouse and keyboard were used by human computer interference system. Those people who are suffering from certain disease or illness cannot be able to operate computers. The idea of controlling the computers with the eyes will serve a great use for handicapped and disabled person.

Also this type of control will eliminate the help required by other person to handle the computer. This measure will be the most useful for the person who is without hands through which they can operate with the help of their eye movements. The movement of the cursor is directly associated with the center of the pupil. Implementing a controlling system in it enables them to move without the help of another person is very helpful.

First detect pupil center position of eye. Then the different variation on pupil position different command set for virtual keyboard. The signals pass the driver to interface with virtual keyboard itself. The driver will control both speed and direction to enable virtual keyboard to move forward, left, right and stop.

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INTRODUCTION

1. INTRODUCTION

As the computer technologies are growing rapidly, the importance of human computer interaction becomes highly notable. Some persons who are disabled cannot be able to use the computers. Eye ball movement control mainly used for disabled people. Incorporating this eye controlling system with the computers will make them to work without the help of other individual. Human-Computer Interface (HCI) is focused on use of computer technology to provide interface between the computer and the human.

There is a need for finding the suitable technology that makes the effective communication between human and computer. Human computer interaction plays the important role. Thus there is a need to find a method that spreads an alternate way for making communication between the human and computer to the individuals those who have impairments and give them an equivalent space to be an element of Information Society. In recent years, the human computer interfaces are attracting the attention of various researchers across the globe. Human computer interface is an implementation of the vision-based system for eye movement detection for the disabled people.

This technique will help the paralyzed person, physically challenged people especially person without hands to compute efficiently and with the ease of use. Firstly, camera captures the image and focuses on the eye in the image using OpenCV code for pupil detection.

This results the center position of the human eye (pupil). Then the center position of the pupil is taken as a reference and based on that the human or the user will control the cursor by moving left and right. Some people cannot operate computers because of some diseases. The idea of eye control is very useful not only for the future of natural input but especially for the handicapped and disabled. In addition, the implementation of the control system allows them to control the computers without the help of another person.

This gadget is most useful for a person who can control the cursor by eye movement. In this project, the camera is used to capture the eye movement image. First, it detects the center position of the pupil. Then a different change in the position of the pupil causes a different movement of the cursor. The implementation process for pupil detection is done using the OpenCV library in python, which is an open-source library for computer vision and image processing.

It can be used to process images and videos to identify objects, faces, etc. In this project, we instruct the mouse cursor to change its location based on the movement of the eyeball, connect to the webcam, and then extract each image from the webcam. and pass it to OpenCV to detect the position of the eyeball.

Once the position of the eyeball is detected, we extract the x and y coordinates of the eyeball from OPENCV and then instruct the mouse to change its current position to the given X and Y coordinates of the eyeball.

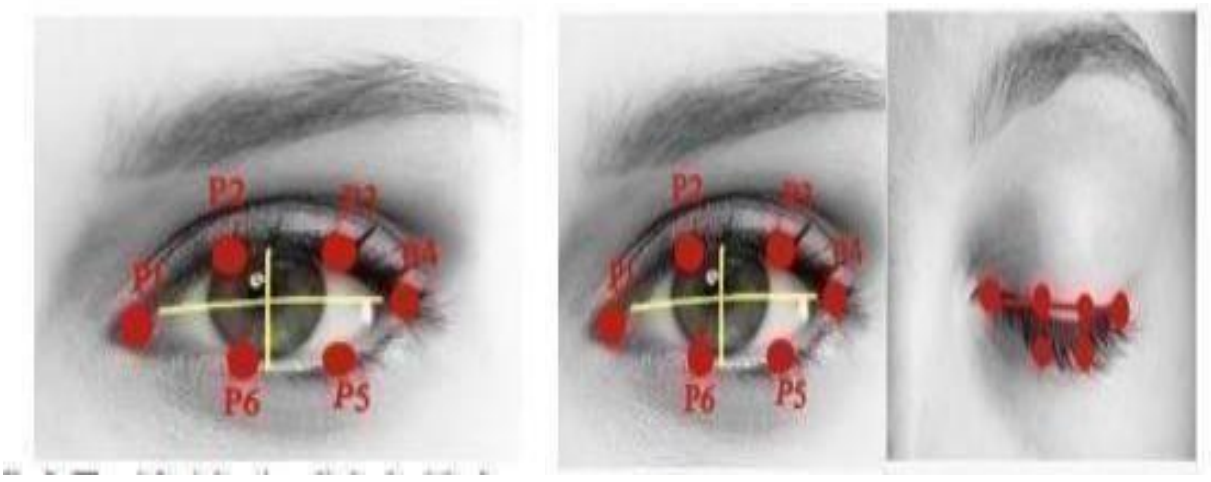


Fig: Eye landmarks

Fig. Physically Challenged Person operate cursor using his eye moment

1.1 METHODS USED

1.1.1 Face Detection

The computer technology which is used for a variety of applications by identifying the human faces in digital images is called as face detection. The proposed method detects features from the face. A simple face tracking system was developed. Face images can be analyzed without ever requiring any interaction with the user/person. Facial recognition can be used as animportant measure of tracking the attendance and time information.

Human face provide facial information that can be used for many applications like emotion recognition and human computer interface. Local binary pattern algorithm can be used for feature extraction.3×3 pixel image can be taken from the web camera. Encoding operation can be performed pixel values and transformed in to binary value 0 or 1. The face image is divided into N blocks.

1.1.2 Eye Region Detection

The exact position of the pupil is known by using vertical integral projection and horizontal projection. These projections divide the whole picture to homogenous subsets. The arbitrary threshold is used in the proposed method. The noise can be removed by using Gaussian filter. The strong pixel value is based on minimum gradient point. The lower threshold protects against splitting edges in the contrast region.

1.1.3 Eye Movement Classification

The different eye-motions are classified with the help of support vector machine classifier. The eye movements are eye open, eye close, eyeball left and eyeball right are captured by web camera.

It can analyze data and used for classification and regression analysis. It is a set of associated supervised learning functions used for classification and regression problems.

It detects the eye pupil movement and hence makes the camera to start capturing the images. Sensor can cover the range up to 5cm.

1.1 INTRODUCTION PROBLEM STATEMENT

Aimed at making a comfortable environment for disabled people that cannot move anything except their eyes. For these people, eye movement and blinks are the sole thanks for communicating with the outside world through the computer. This analysis aims in developing a system that will aid the physically challenged by permitting them to act with a computing system mistreatment solely by their eyes.

Human-Computer interaction has become an associated progressively vital part of our daily lives. There is no universal method to trace the attention movement.

1.2 Scope of the Project

The eye gesture system directly interacts with the vision of the human eyes and then controls the system. Eye Gesture is a real-time gesture assurance program that controls a mouse cursor by using the users eye gestures. Our technique principally focuses on the employment of an online camera to develop a virtual human laptop interaction device in a very cost-effective manner presents hands free interface between computer and human especially for physically disabled persons.

For using this system,users must have to go through the authentication process in which users' faces will be matched with the authenticated users. If the user is authenticated then only, he/she can log into the system.

1.3 Objective of the Project

- To create a interactive device cost-effectively.
- To present a hands free interface between computer and human especially for physically disabled person.
- To reduce human intervention.
- To give 100% comfortable environment for disable people.

LITERATURE SURVEY

2. LITERATURE SURVEY

The system proposed by G. Norris and E. Wilson focuses on eye movement with Electroencephalogram (EEG) which is set up consisting of an instrumentation amplifier and an inverting op amp and the system is set up by wearing it on your head and attaching the EEG specifically to the required points on the head . The EYE Mouse detects the change in EOG from looking up, right, down, left since there is a variation ofpotentialand this is captured accordingly w.r.t the eye movement and it is recorded.

Vandana Khare, S.Gopala Krishna2, Sai Kalyan Sanisetty3, "Cursor Control Using Eye Ball Movement"[1], Because oftheir illness , a few people and groups are unable to use computers. In this case, it makes more sense to provide a computer operating method that is easily accessible, even when taking into account the infirmities of the differently abled. The human eye can be used as a suitable replacement for computer operating hardware. An Internet protocol camera was utilised to capture an image of an eye frame for cursor movement in this paper. In this regard, we must first concentrate on the role of the EYE. We use a Raspberry Pi for pupil identification since it can handle the computer's cursor, and in this task, an Eye Aspect Ratio (EAR) is calculated, which corresponds to the snaps of the eye (left or right) using the Python programming language's Open Source Computer Vision module.

The major purpose of our suggested methodology is to improve the computing experienceof physically challenged people by assisting them in overcoming challenges such as mouse usage Aditya Dave1 and C. Aishwarya Lekshmi ,"Eye-Ball Tracking System for Motor-Free Control of Mouse Pointer"[2], Recent developments in the field of image processing have resulted in a number of high-quality feature detection techniques. While there is a constant need for new algorithms, there is also a need for an equal number of applications of such algorithms in order toachieve their full potential and use by the general public. For building a robust eye ball tacking system for directing the mouse pointer, this work uses a combination of Viola-Jones, Kanade–

Lucas–Tomasi(KLT), and Circular Houghtransformalgorithms. The system's new feature is the ability to represent clicks. A single click is represented by one blink, and a double click is represented by two blinks in a short period of time. Other methods that were tried but failed to track characteristics are also described in the study. Because computer dependence has risen so dramatically in recent years, this technique can help people with motor difficulties browse through their files on the computer more quickly. Different algorithms excel at different things.

So, rather than creating one algorithm extremely complex in order to perform well on all parameters, combining the best features of all three methods greatly simplifies the work and provides a better result than any of the three alone.

The system was tested in a variety of lighting settings and distances from the screen, and it successfully tracked the iris with an accuracy of about 96 percent, which is impressive given that this is a real-time implementation.

The authors' ultimate goal is to create a software package out of this system and make it open source, therefore ease of implementation has been a top priority in order to improve user understanding of the algorithm Sivasangari.A, Deepa.D, Anandhi.T, Anitha Ponraj and Roobini.M.S “Eyeball based Cursor Movement Control”[3],

A human computer interference system is being introduced one at a time. Human computer interference systems used the mouse and keyboard as input devices in the past. Those who are afflicted with a specific ailment or ailment are unable to use computers. For handicapped and impaired people, the idea of controlling computers with their eyes will be extremely useful. This form of control will also eliminate the need for other people to assist with the Vol-7 Issue-3 2021 IJARIIE-ISSN(O)-2395-4396 14512 www.ijariie.com 1921 computer. This approach will be particularly effective for people who are unable to function with their hands and must instead rely on their eyes. The movement of the cursor is directly related to the pupil's centre. As a result, the initial step would be to locate the point pupil's centre. The Raspberry Pi and OpenCV are used to build this pupil detection procedure. The SD card is inserted into the SD/MMC card port of the Raspberry Pi. The operating system that is required to start up the Raspberry Pi is installed on the SD card. Once the application programme is loaded into the Raspberry PI, it will run.

Pierluigi Cigliano, Vincenzo Lippiello, Fabio Ruggiero “Robotic Ball Catching with an Eye-in-Hand Single-Camera System “[4] This study proposes a unified control framework for realising

a robotic ball catching job utilising only a moving single-camera (eye-in-hand) system capable of recording flying, rolling, and bouncing +balls in the same formalism. To visually track the thrown ball, a circle detection approach is used. Following the recognition of the ball, the camera must follow a baseline in the space to capture an initial collection of visual measurements. To obtain an initial estimate of the catching point, a linear technique is applied. Then, using a nonlinear optimization methodology and a more exact ballistic model, new visual measurements are acquired on a regular basis to keep the current estimate up to date. A typical partitioned visual servoing technology is utilised to operate the translational and rotational components of the camera separately. Experiment results on an industrial robotic system indicate the efficacy of the proposed solution. Using a motion-capture system, ground truth is employed to validate the proposed estimating technique.

Osama Mazhar, Muhammad Ahmed Khan, Taimoor Ali Shah, Sameed Tehami "A Real-time webcam based Eye Ball Tracking"[5] The Eye Ball Tracking System is a technology designed to help individuals who are unable to conduct any voluntary duties in their daily lives. Patients who can only control their eyes can use assistive gadgets like the one proposed in this research to communicate with the outside world. This device uses a human-computer interface to make judgments based on the user's eye movements. A webcam captures a real-time data stream that is serially transferred to MATLAB. Then, using a reference axis, a sequential image processing algorithm segments the iris of the eye and determines the centroid, providing a control signal. Using a USB microcontroller interface, the control signals are then used to manipulate the position of a motorised platform R.Rithi1, V.Manjuarasi2, M.Yesodha3, G.Renuka4 "CURSOR control using eyeball Movement with raspberry pi"[6], Some people are unable to use computers due to disease. Not only for the future of natural input, but also for the handicapped and crippled, the concept of eye controllers is extremely useful. Furthermore, by including a control system, they will be able to runthe computer without the assistance of another person.

This device is particularly useful for people who can move their cursor with their eyes. The image of eye movement is captured using a camera in this research. It begins by determining the position of the pupil's centre. Then, depending on the pupil location, the cursor moves in different ways. The Pupil Detection process is carried out on a Raspberry Pi and on the terminal of the Raspier image loaded on the Raspberry Pi. The Raspberry Pi is a single computer or SoC the size

of a credit card that runs on the ARM1176JZF-S core. System on a Chip (SoC) is a method of putting all of the circuitry needed to run a computer on a single chip. To get started, the Raspberry Pi requires an operating system. The Raspberry Pi does not have any on-board non-volatile memory to store boot loaders, Linux kernels, or file systems, as seen in more traditional embedded systems, in order to save money. This in turn is able to click. The system proposed by Bullying, J. A. Ward, contains the eye mouse, and how the EEG system is used with the cursor movement by the simulation of the brain signal and then mapped accordingly to the cursor. The work proposed by V. Khare, Et.al, focuses on tracking the eye movement by capturing the real time video using a microprocessor. The experiment include the use of a webcam which tracks the live video which in turn is broken into frames and a certain threshold is predefined for some certain movement of eyes ,with the help of comparison of the predefined threshold, the cursor will move accordingly with the movement of the eyes.

In a paper by Mohamed Nasor Et.al focuses on how the Iris detection system is functioned using MATLAB. With the help of a webcam, the face is detected first and then iris is detected and extracted using the library of MATLAB which leads in tracking of the eyes and then iris shift is calculated, the shift is then mapped with the help of Graphical user interface and the eye is detected and it is mapped with the cursor and the mouse cursor moves accordingly.

S. Mathew et. a in their proposed paper provides an idea to control home appliances for disabled people . The method here uses an eye tracking method for eye movement for individuals, further following a simple circuitry. In this system, HOG is used to find the Histogram of the image and with the addition of SVM, detection of face takes place and the iris portion is cropped and then there are some points in eye which are targeted and the movements of those points maps the cursor movements, this is a non training based algorithm and it uses Image processing for all the functions.

In a paper proposed by S. R. Fahim, et al, it focus on the uses HOG system and motion vector with python programming and Haar Cascade Algorithm which is a training based algorithm, and it is used mainly with programming in machine learning , eye dataset is given in this, by having multiple dataset of eyes, then the eye data is collected and the following system works accordingly to the eye movement and clicking is done with the help of the eye blinking.

SYSTEM ANALYSIS

3. SYSTEM ANALYSIS

3.1. EXISTING SYSTEM

Mat lab detect the iris and control curser. Eye movement-controlled wheel chair is existing one that controls the wheel chair by monitoring eye movement. In mat lab is difficult to predict the Centroid of eye so we go for OpenCV.

we are instructing mouse cursor to change its location based on eye ball movement, in this application using OPENCV we will connect to webcam and then extract each frame from the webcam and pass to OPENCV to detect eye balls location. Once eye ball location detected then we can extract x and y coordinates of eye balls from OPENCV and then using python pyautogui API we can instruct mouse to change its current location to given eyeballs X and Y Coordinates.

3.1.1 DISADVANTAGES OF EXISTING SYSTEM

- Expensive: Eye-tracking equipment and software can be expensive, which may limit its use in some settings.
- Limited accuracy: Eye-tracking technology is generally accurate, but there are limitations to its precision, and it may not always capture all eye movements.
- Requires special training: Using eye-tracking technology often requires specialized training, which may be time-consuming and costly.
- Potential ethical concerns: Some people may object to the use ofeye-tracking technology, citing concerns about privacy or autonomy.
- The existing system is having Less Accuracy.
- Can’t use a regular camera.

3.2. PROPOSED SYSTEMS

In our proposed system the cursor movement of computer is controlled by eye movement using Open CV.Camera detects the Eye ball movement which can be processed in OpenCV. By this the cursor can be controlled. The user has to sit in front of the display screen of private computer or pc, a specialised video camera established above the screen to studythe user's eyes.

The laptop constantly analysis the video photo of the attention. To "pick out" any key, the user seems at the key for a exact period oftime and to "press" anykey, the user just blink the eye.

This aims to develop a system for controlling the computer cursor using the movement of the user's eyeballs, providing a hands-free alternative to the traditional mouse. We developed a program using image processing techniques and machine learning algorithms in Python to obtain the eyeball movements and blink and translate them respectively into cursor movements and click actions.

Our system was able to achieve a high level of accuracy in tracking the user's eye movements. Users were easily able to adapt to the new input method.

This system has great potential to improve the accessibility and usability of computers for individuals with motor impairments or disabilities. This hands-free control method has great potential in the area of applications in gaming and virtual reality environment etc.

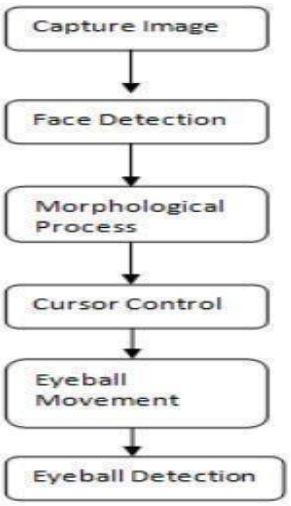


Fig. 1. Flow of Proposed Work

3.2.1 ADVANTAGES OF PROPOSED SYDTEM

- Provides insights into attention and behavior: Eye-tracking technology allows researchers and marketers to gain insights into how people focus their attention and what factors influence their behavior.
- Non-invasive: Eye-tracking technology is generally non-invasive and does not require the use of electrodes or other sensors that come into contact with the skin.
- Real-time data: Eye-tracking technology can provide real-time data on eye movements, allowing researchers and marketers to get immediate feedback on their work.
- High accuracy.
- Physically handicapped people can operate computers.

3.2.2 TECHNOLOGIES USED

1. Eye tracking technology : Utilize specialized hardware such as eye trackers to monitor the movement of the user's eyes. Eye-tracking technology refers to the use of specialized equipment and software to track and measure the movement of a person's eyes. It has a wide range of applications, including research, marketing, and usability testing.

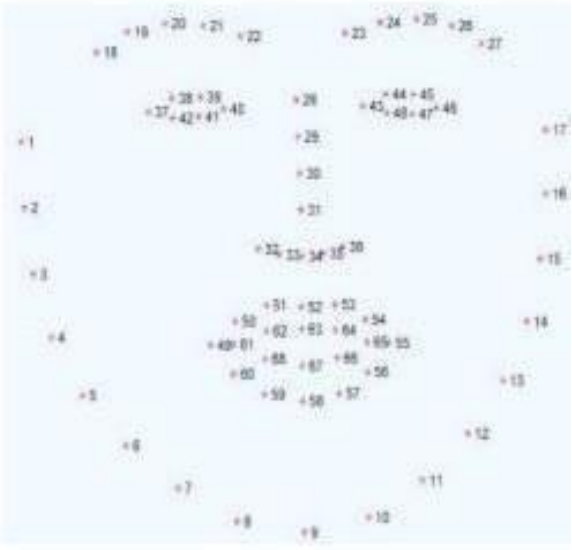


Fig : Landmarks on Human Face.

Benefits Or Advantages Of Eye Tracking Technology

- It increases computing and resource efficiency.
- It helps to assess human conditions and behaviours.
- It helps to learn from experts delivering skills.
- It makes technology more intuitive.
- It helps to communicate with machines in order to automate manual tasks.
- It increases user experience and performance in playing games.

Drawbacks Or Disadvantages Of Eye Tracking Technology

- It is expensive technology due to costly hardware requirements.
- It does not work with few users who wear contact lenses or have long eye lashes.
- It requires some calibration time before it gives satisfactory results. Hence few users deviate themselves from using it.
- Eye movements of some users are often un-intentional. This results into unwanted responses by the system.
- It is difficult to control eye position accurately all the times unlike mouse. Eye tracker provides instable output when it does not get appropriate image of the eye in consecutive frames.

2. **Real-time prediction** : Deploy the trained model to predict cursor movements in real-time based on the user's eye movements.

3. **Feature extraction** : Extract relevant features from the eye movement data, such as gaze direction, velocity, and fixation points.

3.2.3 PROCESS MODEL / ARCHITECTURE

Mouse cursor control can be done by facial movement by moving the face towards left and right, up and down, mouse events are controlled through eye blinks. A high number of people, affected with neuron locomotor disabilities can use this technology in computers for basic tasks such as sending or receiving messages, browsing the internet, watch their favorite TV shows or movies.

This algorithm is used to give the best possible outcomes of the eye position using the decision tree algorithm so that the eye movement is detected and the mouse moves accordingly. It also enables the user to open and close the applications by blinking the eye.

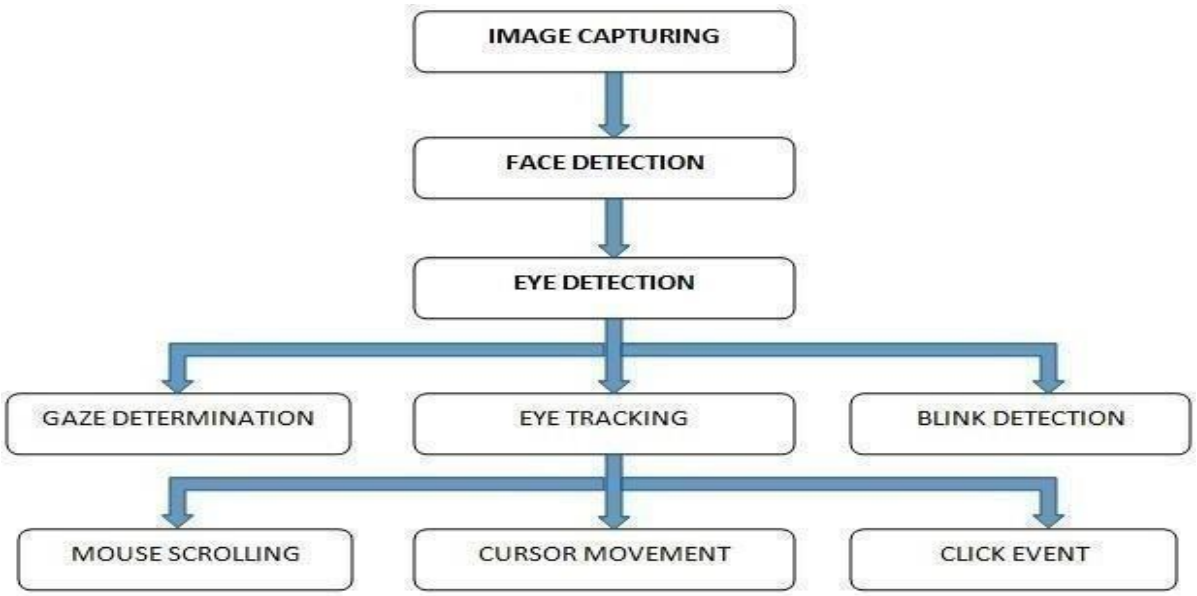


Fig: Architecture ofthe project

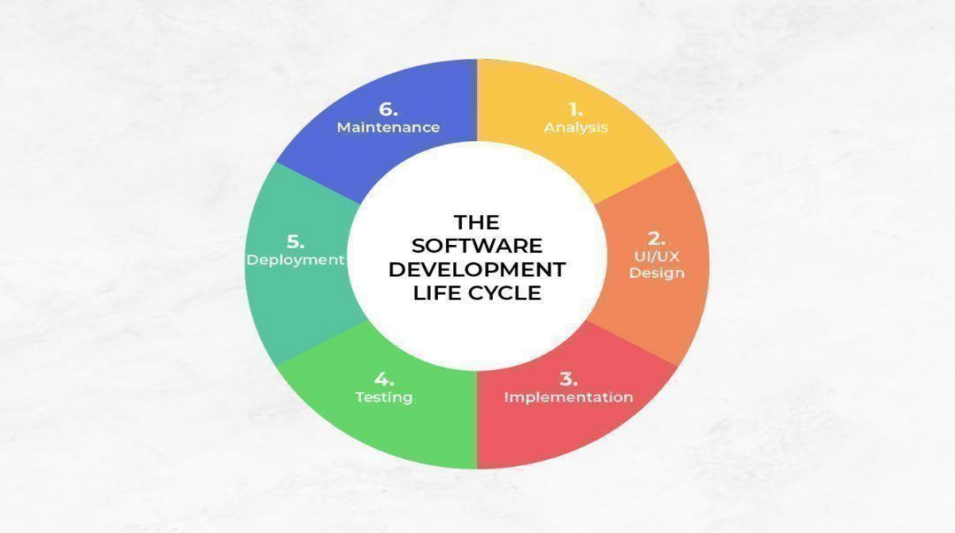
3.3 ANALYSIS

3.3.1 Software Development Life Cycle

SDLC is nothing but Software Development Life Cycle. It is a standard which is used by software industryto develop good software.

The **Systems Development Life Cycle (SDLC)**, or Software Development Life Cycle in systems engineering, information systems and software engineering, is the process of creating or altering systems, and the models and methodologies use to develop these systems.

Software development can be challenging to manage due to changing requirements, technology upgrades, and cross-functional collaboration. The software development lifecycle (SDLC) methodology provides a systematic management framework with specific deliverables at every stage of the software development process. As a result, all stakeholders agree on software development goals and requirements upfront and also have a plan to achieve those goals.



3.3.2 Stages in SDLC

Requirement Analysis and Design

Analysis gathers the requirements for the system. This stage includes a detailed study of the business needs of the organization. Options for changing the business process may be considered. Design focuses on high level design like, what programs are needed and how are they going to interact, low-level design (how the individual programs are going to work), interface design (what are the interfaces going to look like) and data design (what data will be required). During these phases, the software's overall structure is defined. Analysis and Design are very crucial in the whole development cycle.

Implementation

In this phase the designs are translated into code. Computer programs are written using a conventional programming language or an application generator. Programming tools like Compilers, Interpreters, and Debuggers are used to generate the code.

Different high level programming languages like C, C++, Pascal, Java, .Net are used for coding. With respect to the type of application, the right programming language is chosen.

Testing

In this phase the system is tested. Normally programs are written as a series of individual modules, this subject to separate and detailed test. The system is then tested as a whole.

The separate modules are brought together and tested as a complete system. The system is tested to ensure that interfaces between modules work (integration testing), the system works on the intended platform and with the expected volume of data (volume testing) and that the system does what the user requires (acceptance/beta testing).

Maintenance

Inevitably the system will need maintenance. Software will definitely undergo change once it is delivered to the customer. There are many reasons for the change. Change could happen because of some unexpected input values into the system. In addition, the changes in the system could directly affect the software operations. The software should be developed to accommodate changes that could happen during the post implementation period.

3.4 FEASIBILITY STUDY

The feasibility of the project is analyzed in this phase and business proposal is put forth with a very general plan for the project and some cost estimates.During system analysis the feasibility study of the proposed system is to be carried out. This is to ensure that the proposed system is not a burden to the company.For feasibility analysis, some understanding of the major requirements for the system is essential.

Three keyconsiderations involved in the feasibility analysis are,

3.4.1 ECONOMICAL FEASIBILITY

This study is carried out to check the economic impact that the system will have on the organization. The amount of fund that the company can pour into the research and development of the system is limited. The expenditures must be justified. Thus, the developed system as well within the budget and this was achieved because most of the technologies used are freely available. Only the customized products had to be purchased.

3.4.2 TECHNICAL FEASIBILITY

This study is carried out to check the technical feasibility, that is, the technical requirements of the system. Any system developed must not have a high demand on the available technical resources. This will lead to high demands on the available technical resources. This will lead to high demands being placed onthe client. The developed system must have a modest requirement.

3.4.3 SOCIAL FEASIBILITY

The aspect of study is to check the level of acceptance of the system by the user. This includes the process of training the user to use the system efficiently. The user must not feel threatened bythe system, instead must accept it as a necessity.

The level of acceptance by the users solely depends on the methods that are employed to educate the user about the system and to make him familiar with it. His level of confidence must be raised so that he is also able to make some constructive criticism, which is welcomed, as he is the final user of the system.

3.5 REQUIREMENT SPECIFICATION

3.5.1 SOFTWARE REQUIREMENTS

OPERATING SYSTEM	:	Windows 7 or above.
CODING LANGUAGE	:	Python
TOOL	:	Visual Studio Code

3.5.2 HARDWARE REQUIREMENTS

PROCESSOR	:	13/INTEL PROCESSOR
RAM	:	8GB RAM
Hard Disk	:	128 GB

3.6 TOOLS

VISUAL STUDIO CODE

Visual Studio Code combines the simplicity of a source code editor with powerful developer tooling, like IntelliSense code completion and debugging.

First and foremost, it is an editor that gets out of your way. The delightfully frictionless edit-build-debug cycle means less time fiddling with your environment, and more time executing on your ideas. At its heart, Visual Studio Code features a lightning fast source code editor, perfect for day-to-day use. With support for hundreds of languages, VS Code helps you be instantly productive with syntax highlighting, bracket matching, auto-indentation, box-selection, snippets, and more. Intuitive keyboard shortcuts, easy customization and community-contributed keyboard shortcut mappings let you navigate your code with ease.

For serious coding, you'll often benefit from tools with more code understanding than just blocks of text. Visual Studio Code includes built-in support for IntelliSense code completion, rich semantic code understanding and navigation, and code refactoring.

And when the coding gets tough, the tough get debugging. Debugging is often the one feature that developers miss most in a leaner coding experience, so we made it happen. Visual Studio Code includes an interactive debugger, so you can step through source code, inspect variables, view call stacks, and execute commands in the console.

VS Code also integrates with build and scripting tools to perform common tasks making everyday workflows faster. VS Code has support for Git so you can work with source control without leaving the editor including viewing pending changes diffs.

DESIGN

4. DESIGN

4.1 DATA FLOW DIAGRAM

1. The DFD is also called as bubble chart. It is a simple graphical formalism that can be used to represent a system in terms of input data to the system, various processing carried out on this data, and the output data is generated bythis system.
2. The data flow diagram (DFD) is one of the most important modeling tools. It is used to modelthe system components. These components are the system process, the data used by the process, an external entity that interacts with the system and the information flows in the system.
3. DFD shows how the information moves through the system and how it is modified by a seriesof transformations. It is a graphical technique that depicts information flow and the transformations that are applied as data moves from input to output.
4. DFD is also known as bubble chart. A DFD may be used to represent a system at any level of abstraction. DFD may be partitioned into levels that represent increasing information flow andfunctional detail.

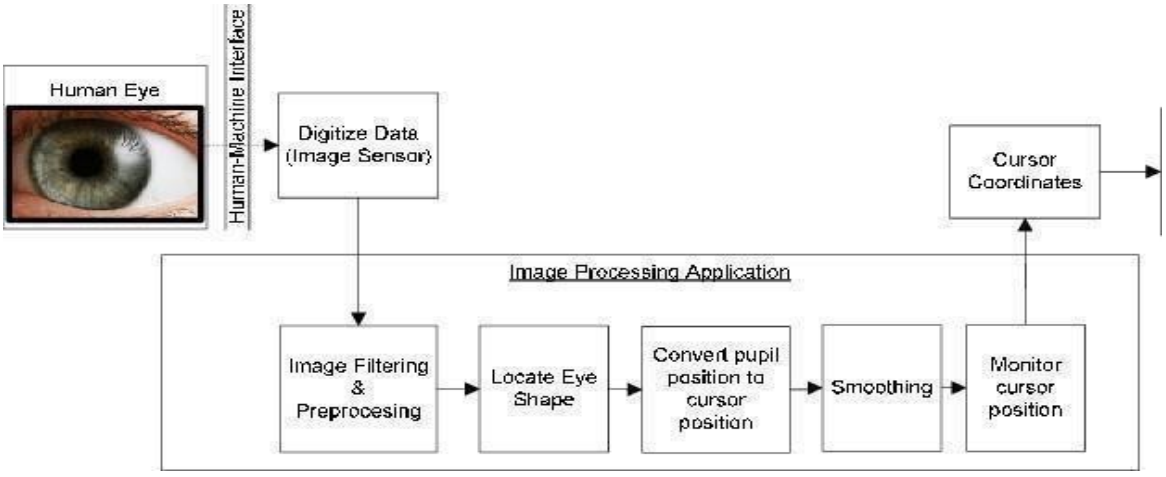


Fig: Process ofappliaction

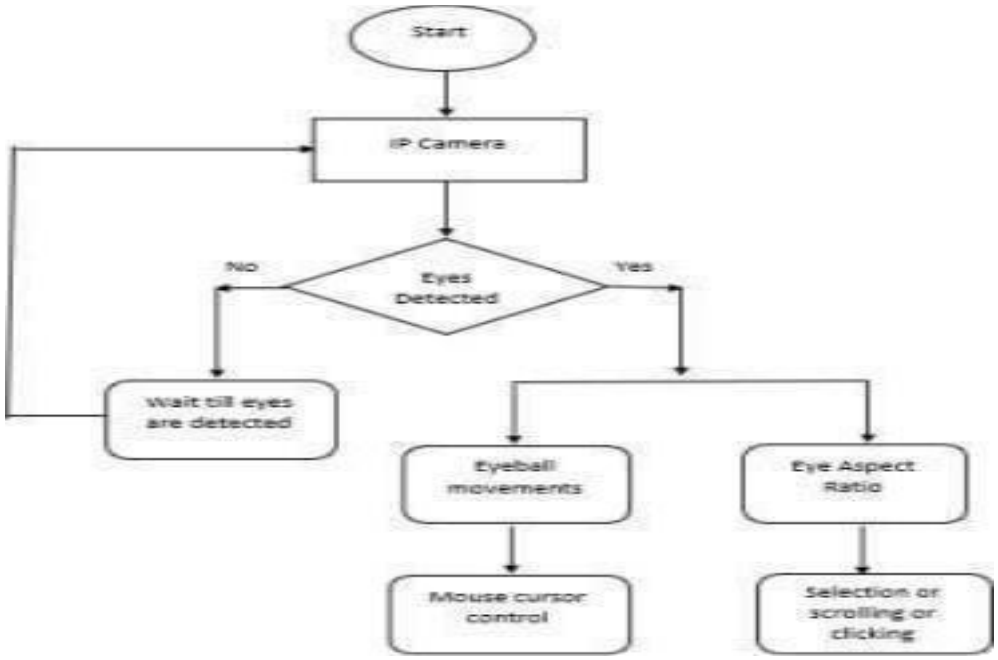


Fig: Flowchart ofoverall process in eyeball movement based cursor control

4.2 UML DIAGRAMS

UML stands for Unified Modeling Language. UML is a standardized general-purpose modeling language in the field of object-oriented software engineering. The standard is managed, and was created by, the Object Management Group. The goal is for UML to become a common language for creating models of object oriented computer software. In its current form UML is comprised of two major components: a Meta-model and a notation. In the future, some form of method or process may also be added to; or associated with, UML.

The Unified Modeling Language is a standard language for specifying, Visualization, Constructing and documenting the artifacts of software system, as well as for business modeling and other non-software systems. The UML represents a collection of best engineering practices that have proven successful in the modeling of large and complex systems. The UML is a very important part of developing objects oriented software and the software development process. The UML uses mostly graphical notations to express the design of software projects.

4.2.1 CLASS DIAGRAMS

In software engineering, a class diagram in the Unified Modeling Language (UML) is a type of static structure diagram that describes the structure of a system by showing the system's classes, their attributes, operations (or methods), and the relationships among the c lasses. It explains which class contains information.

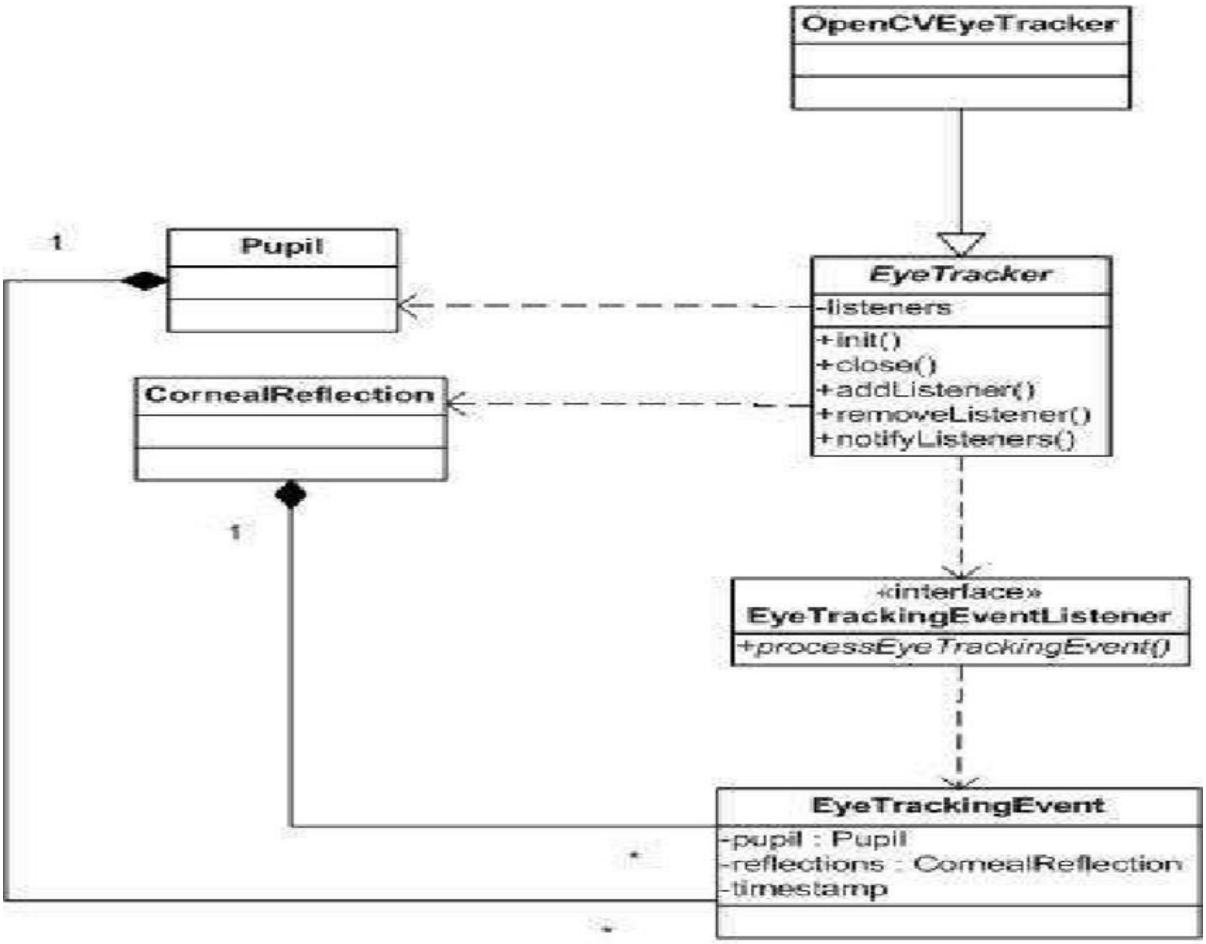


Fig: Class Diagram

4.2.2 USE CASE DIAGRAM

A use case diagram in the Unified Modeling Language (UML) is a type of behavioral diagram defined by and created from a Use-case analysis. Its purpose is to present a graphical overview of the functionality provided by a system in terms of actors, their goals (represented as use cases), and anydependencies betweenthose use cases. The main purpose ofa use case diagram is to show what system functions are performed for which actor. Roles of the actors in the system can be depicted.

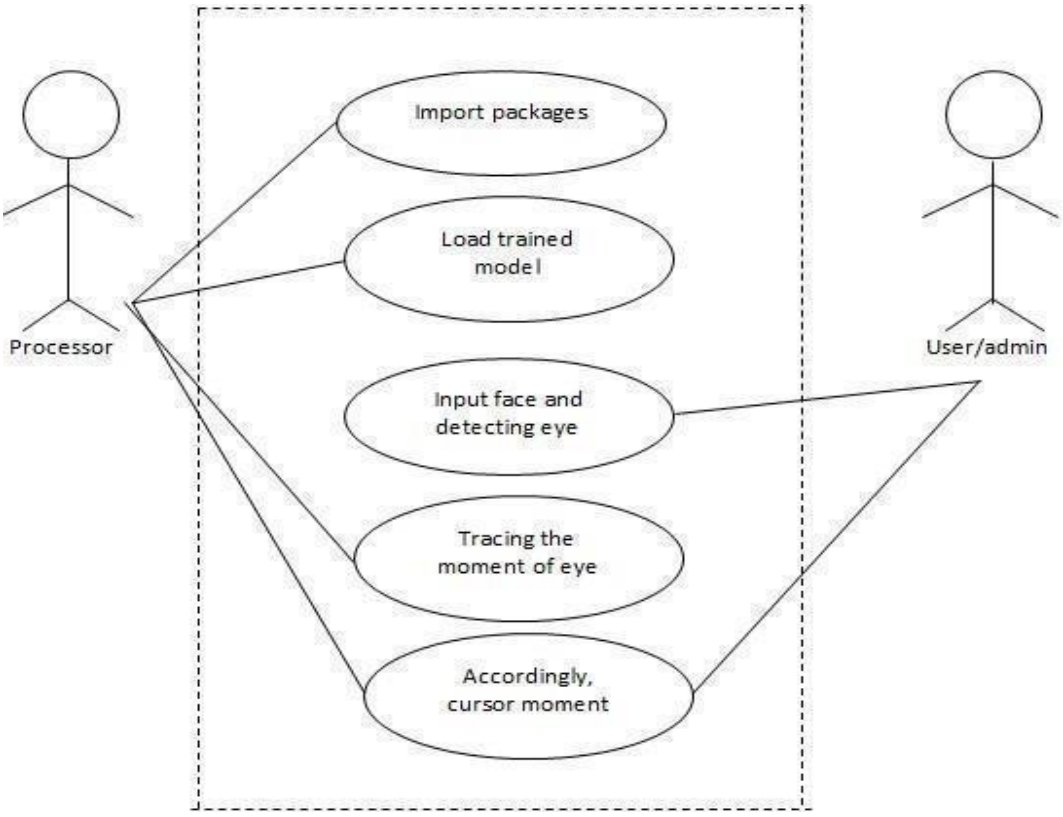


Fig: Usecase Diagrams

4.2.3 SEQUENCE DIAGRAM

A sequence diagram in Unified Modeling Language (UML) is a kind of interaction diagram that shows how processes operate with one another and in what order. It is a construct ofa Message Sequence Chart. Sequence diagrams are sometimes called event diagrams, event scenarios, and timing diagrams.

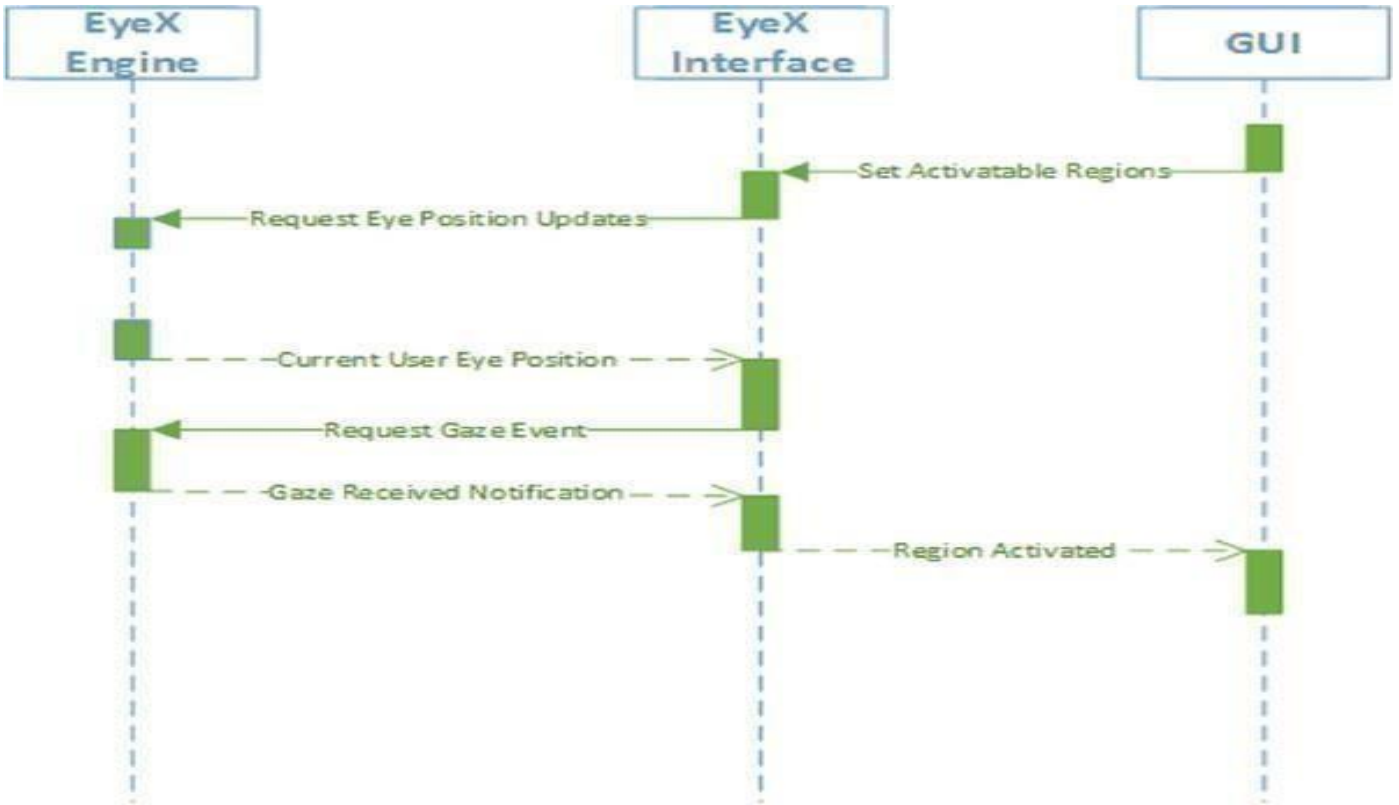


Fig: Sequence Diagram

4.2.4 ACTIVITY DIAGRAM

Activity diagrams are graphical representations of workflows of stepwise activities and actions with support for choice, iteration and concurrency. In the Unified Modeling Language, activity diagrams can be used to describe the business and operational step-by-step workflows of components in a system. An activity diagram shows the overall flow of control.

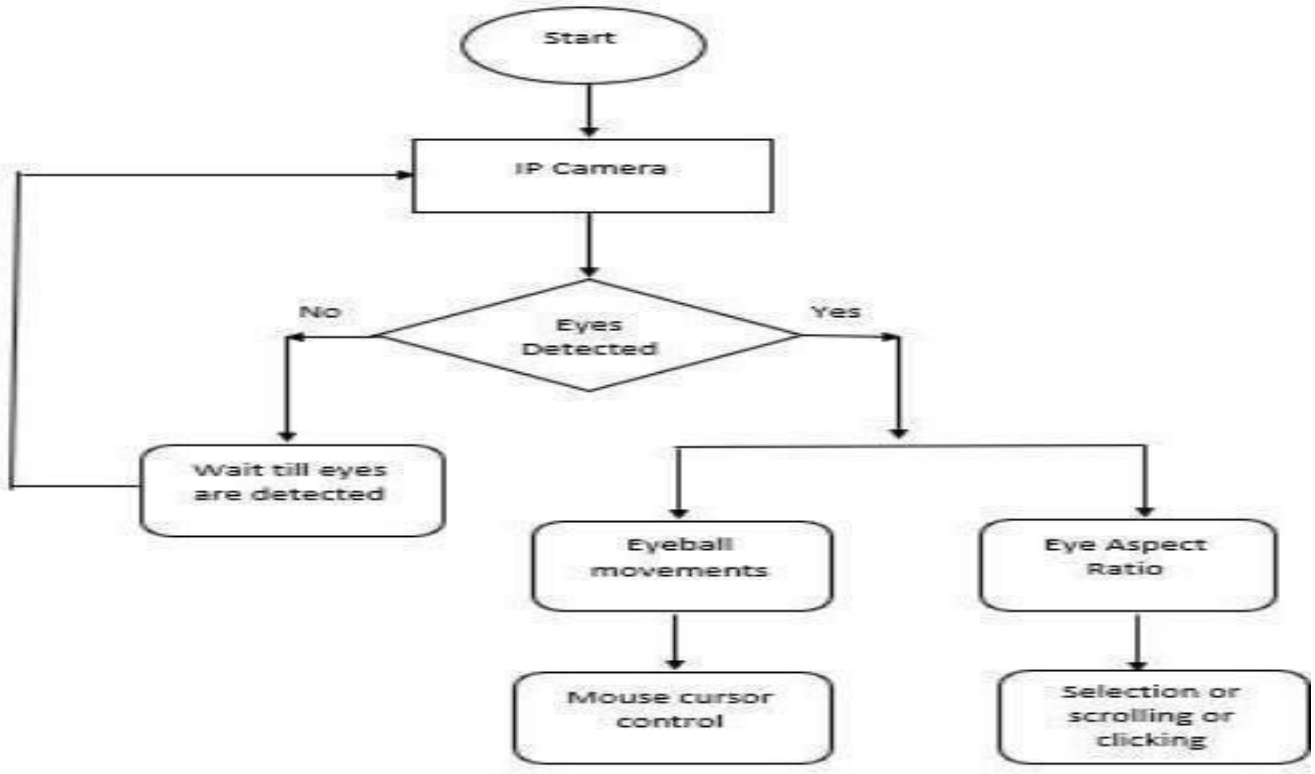
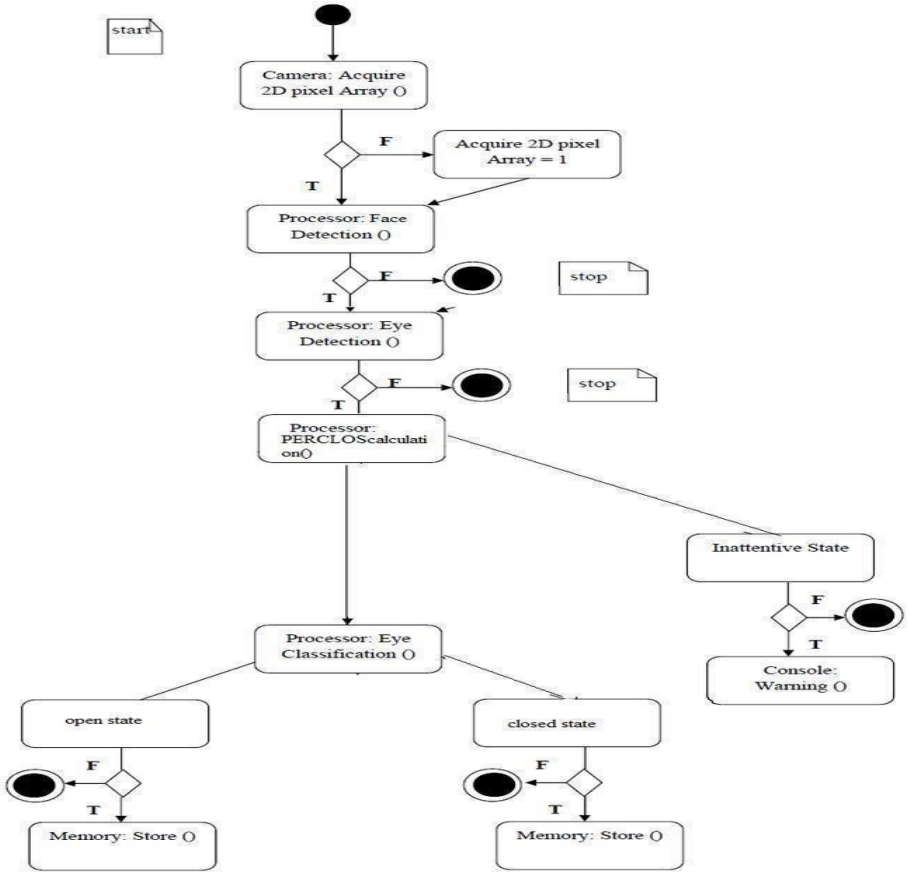


Fig: Activity Diagram

4.2.5 STATE CHART DIAGRAM

A state machine is any device that stores the status of an object at a given time and can change status or cause other actions based on the input it receives. States refer to the different combinations of information that an object can hold, not how the object behaves. In order to understand the different states of an object, you might want to visualize all of the possible states and show how an object getsto each state, and you can do so with a UML state diagram.



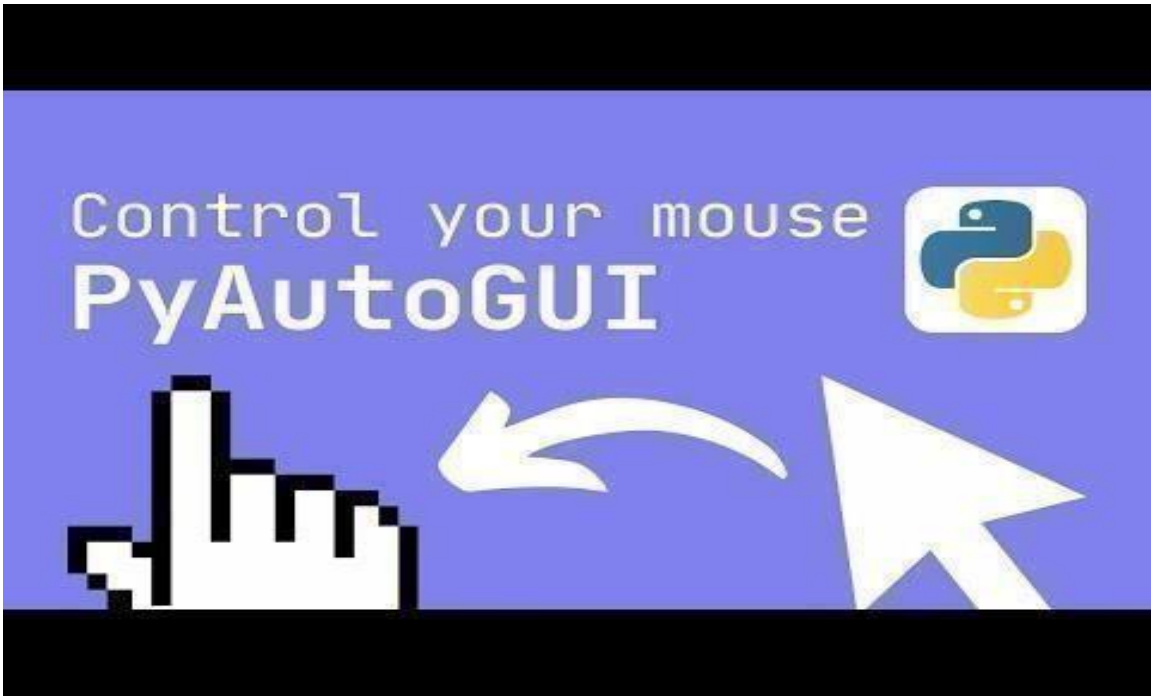
IMPLEMENTATION

5. IMPLEMENTATION

5.1 ABOUT PYTHON

Python is an interpreted high-level programming language for general-purpose programming. Created by Guido van Rossum and first released in 1991, Python has a design philosophy that emphasizes code readability, notably using significant whitespace. It provides constructs that enable clear programming on both small and large scales.

Python features a dynamic type system and automatic memory management. It supports multiple programming paradigms, including object oriented, imperative, functional and procedural, and has a large and comprehensive standard library.

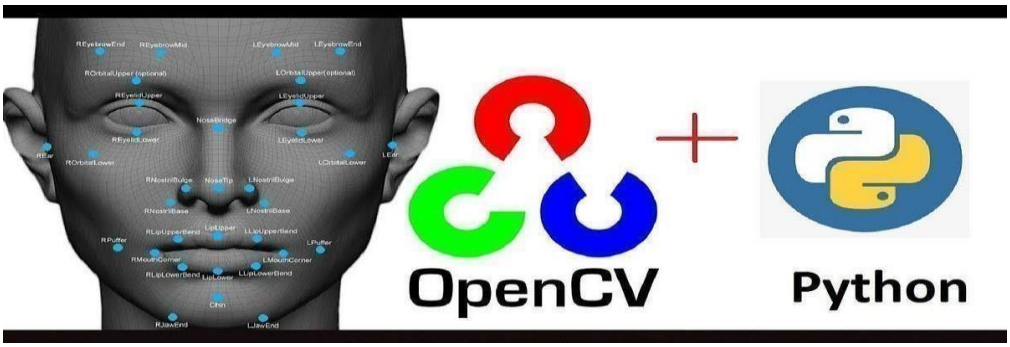


OpenCV-Python

OpenCV-Python is a library of Python bindings designed to solve computer vision problems. Python is a general purpose programming language started by **Guido van Rossum** that

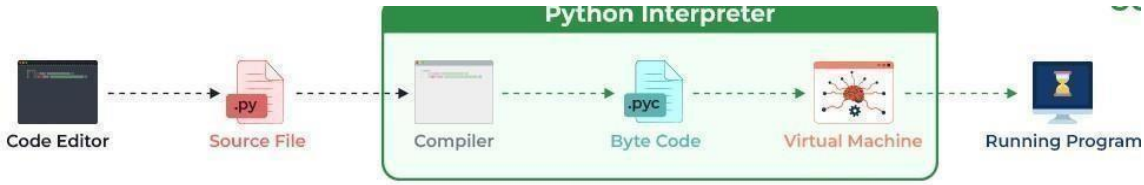
became very popular very quickly, mainly because of its simplicity and code readability. It enables the programmer to express ideas in fewer lines of code without reducing readability.

Compared to languages like C/C++, Python is slower. That said, Python can be easily extended with C/C++, which allows us to write computationally intensive code in C/C++ and create Python wrappers that can be used as Python modules. This gives us two advantages: first, the code is as fast as the original C/C++ code (since it is the actual C++ code working in background) and second, it is easier to code in Python than C/C++. OpenCV-Python is a Python wrapper for the original OpenCV C++ implementation.



OpenCV-Python makes use of **Numpy**, which is a highly optimized library for numerical operations with a MATLAB-style syntax. All the OpenCV array structures are converted to and from Numpy arrays. This also makes it easier to integrate with other libraries that use Numpy such as SciPy and Matplotlib.

ARCHITECTURE OF PYTHON



5.1 LIBRARIESUSED

- OPENCV
- MEDIAPIPE
- PYAUTOGUI

5.2.1 OPENCV

Open CV (Open Source Computer Vision Library) is an open source computer vision and learning software library. Open CV was built to provide a common infrastructure for computer vision applications and to accelerate the use of machine perception in the commercial products. Being a BSD-licensed product, Open CV makes it easy for businesses to utilize and modify the code.

The library has more than 2500 optimized algorithms, which includes a comprehensive set of both classic and state-of-the-art computer vision and machine learning algorithms. These algorithms can be used to detect and recognize faces, identify objects, classify human actions in videos, track camera movements, track moving objects, extract 3D models of objects, produce 3D point clouds from stereo cameras, stitch images together to produce a high resolution image of an entire scene, find similar images from an image database, remove red 42 eyes from images taken using flash, follow eye movements, recognize scenery and establish markers to overlay it with augmented reality, etc.

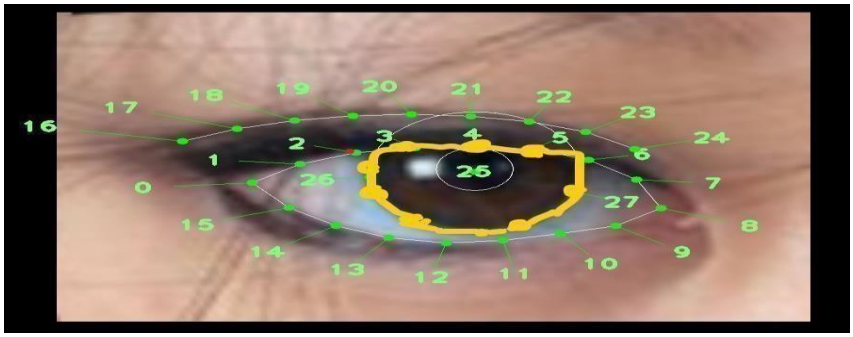
Open CV has more than 47 thousand people of user community and estimated number of downloads exceeding 14 million. The library is used extensively in companies, research groups and by governmental bodies.

It has C++, Python, Java and MATLAB interfaces and supports Windows, Linux, Android and Mac OS. Open CV leans mostly towards real-time vision applications and takes advantage of MMX and SSE instructions when available.

The OpenCV library contains over 2500 algorithms, extensive documentation, source code, and sample code for real-time computer vision. Developers using the Python package, along with other Python libraries, can seamlessly integrate OpenCV into their projects using commands like "python opencv." This integration is made even more convenient through package managers, which provide a simple process for installation and control.

5.2.2 MEDIAPIPE

MediaPipe is an open-source framework for building pipelines to perform computer vision inference over arbitrary sensory data such as video or audio. Using MediaPipe, such a perception pipeline can be built as a graph of modular components. MediaPipe is currently in alpha at v0.7, and there may still be breaking API changes.



The MediaPipe Face Landmarker task lets you detect face landmarks and facial expressions in images and videos. You can use this task to identify human facial expressions, apply facial filters and effects, and create virtual avatars. This task uses machine learning (ML) models that can work with single images or a continuous stream of images.

The task outputs 3-dimensional face landmarks, blendshape scores (coefficients representing facial expression) to infer detailed facial surfaces in real-time, and transformation matrices to perform the transformations required for effects rendering.

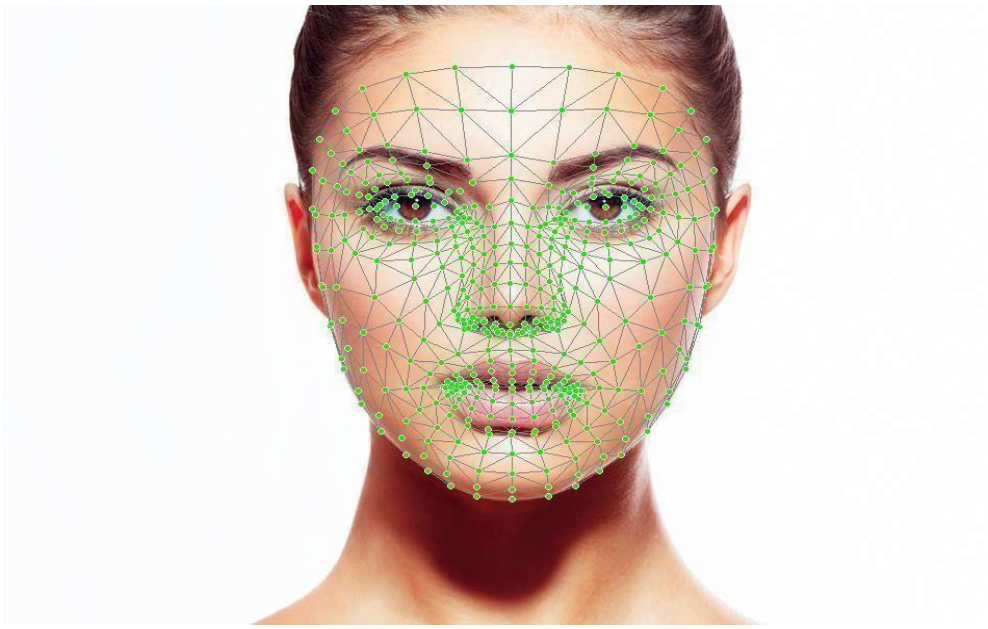
Models In MediaPipe

The Face Landmarker uses a series of models to predict face landmarks. The first model detects faces, a second model locates landmarks on the detected faces, and a third model uses those landmarks to identify facial features and expressions.

The following models are packaged together into a downloadable model bundle:

Face detection model: detects the presence of faces with a few key facial landmarks.

Face mesh model: adds a complete mapping ofthe face. The model outputs an estimate of 478 3-dimensional face landmarks.



Blendshape prediction model: receives output from the face mesh model predicts 52 blendshape scores, which are coefficients representing facial different expressions.

5.2.3 PYAUTOGUI

Python's pyautogui is a package that allows users to create scripts that can simulate mouse movements, click on objects, send text, and even use hotkeys. While not as elegant a solution as Selenium, pyautogui can be used to bypass systems that put up blocks against automated browser use It is third-party library so we need to install in it before using it. We can install it using the pip command. You can create a virtual environment or install it globally

Installation Command : pip install pyautogui

Python’s pyautogui is a package that allows users to create scripts that can simulate mouse movements, click on objects, send text, and even use hotkeys. While not as elegant a solution as Selenium, pyautogui can be used to bypass systems that put up blocks against automated browser use. In this article, I will show you the basics of pyautogui through a web scraping example.

We will be using pyautogui to create a Python script that will open a web browser, navigate to a specific Wikipedia article, and copy and paste the data from a table on that web page.

5.3 Code

```
 //IMPORTING THE LIBRARIES REQUIRED
import cv2
import mediapipe as mp
import pyautogui
cam= cv2.VideoCapture(0)
face_mesh = mp.solutions.face_mesh.FaceMesh(refine_landmarks=True)
screen_w, screen_h = pyautogui.size()
while True:
    _, frame = cam.read()
    frame = cv2.flip(frame, 1)
//TO CONVERT THE COLOR TO RGB
    rgb_frame =cv2.cvtColor(frame,cv2.COLOR_BGR2RGB)
    output = face_mesh.process(rgb_frame)
    landmark_points = output.multi_face_landmarks
    frame_h, frame_w, _ = frame.shape
```

```
if landmark_points:
        landmarks = landmark_points[0].landmark
   //RIGHT EYE POSITIONS
        for id, landmark in enumerate(landmarks[474:478]):
            x = int(landmark.x *  frame_w)
            y = int(landmark.y * frame_h)
            cv2.circle(frame, (x, y), 3, (0, 255, 0))
 //FIXING THE SCREEN SIZE
            if id == 1:
                screen_x = screen_w * landmark.x
                screen_y = screen_h * landmark.y
                pyautogui.moveTo(screen_x, screen_y)
        left = [landmarks[145], landmarks[159]]
 //TO ACCESS THE LEFT EYE
         for landmark in left:
            x = int(landmark.x * frame_w)
            y=  int(landmark.y *  frame_h)
            cv2.circle(frame, (x, y), 3, (0, 255, 255)
```

```
 if (left[0].y - left[1].y) < 0.004:
        //TO PERFORM ACTION
        pyautogui.click()
        pyautogui.sleep(1)
   cv2.imshow('Eye Controlled Mouse', frame)
cv2.waitKey(1)
```

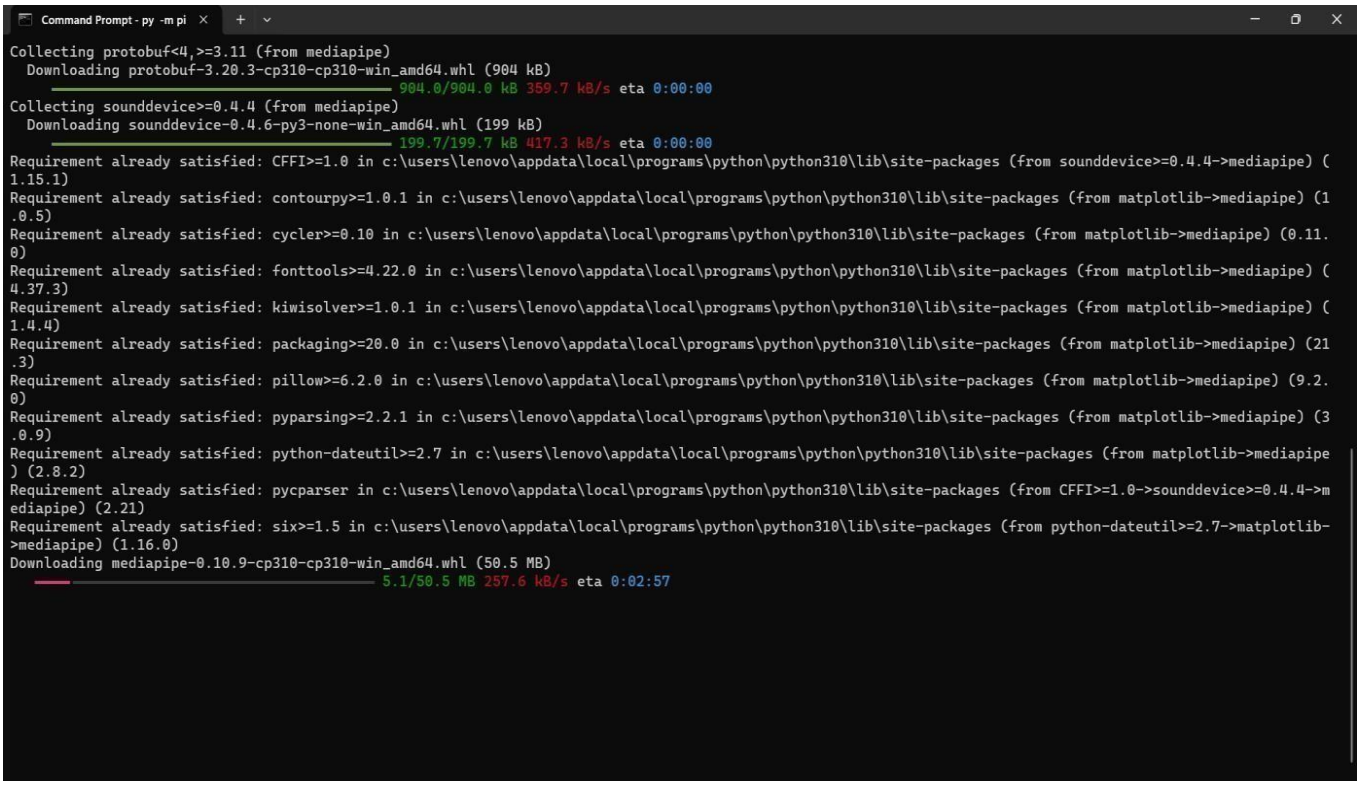


Fig : Installation of Mediapipe in to our system

Functionality of mediapipe

5.4 OUTPUT SCREENS

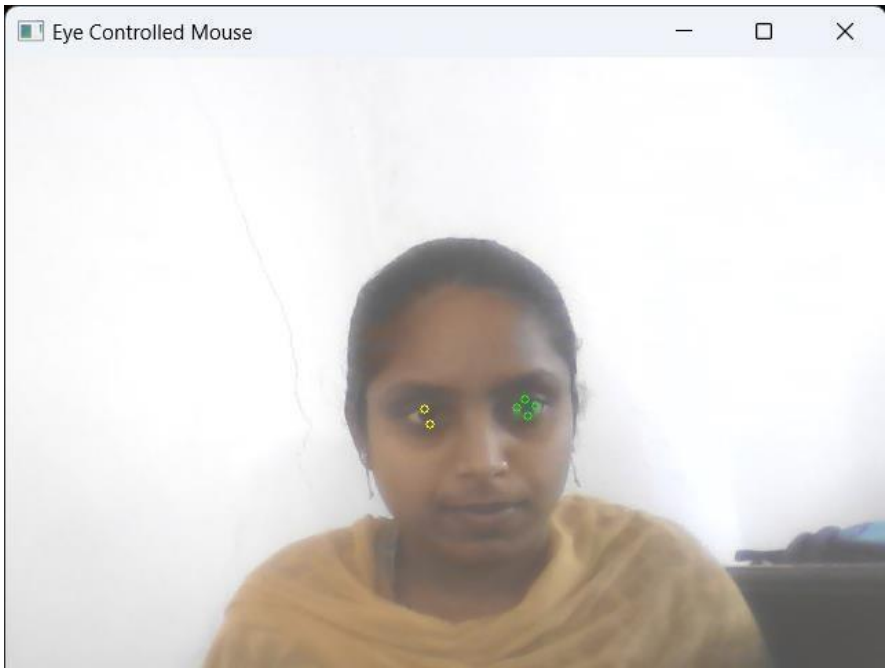
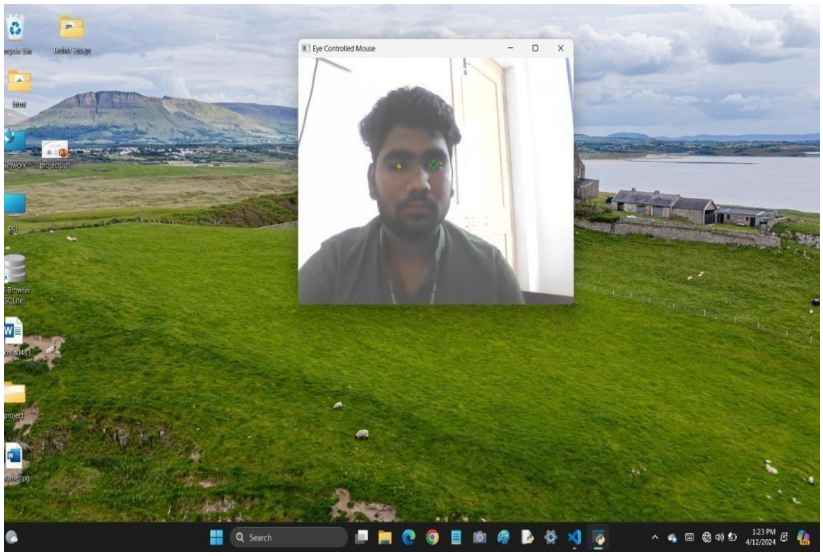


Fig: Right and left eyes identification .



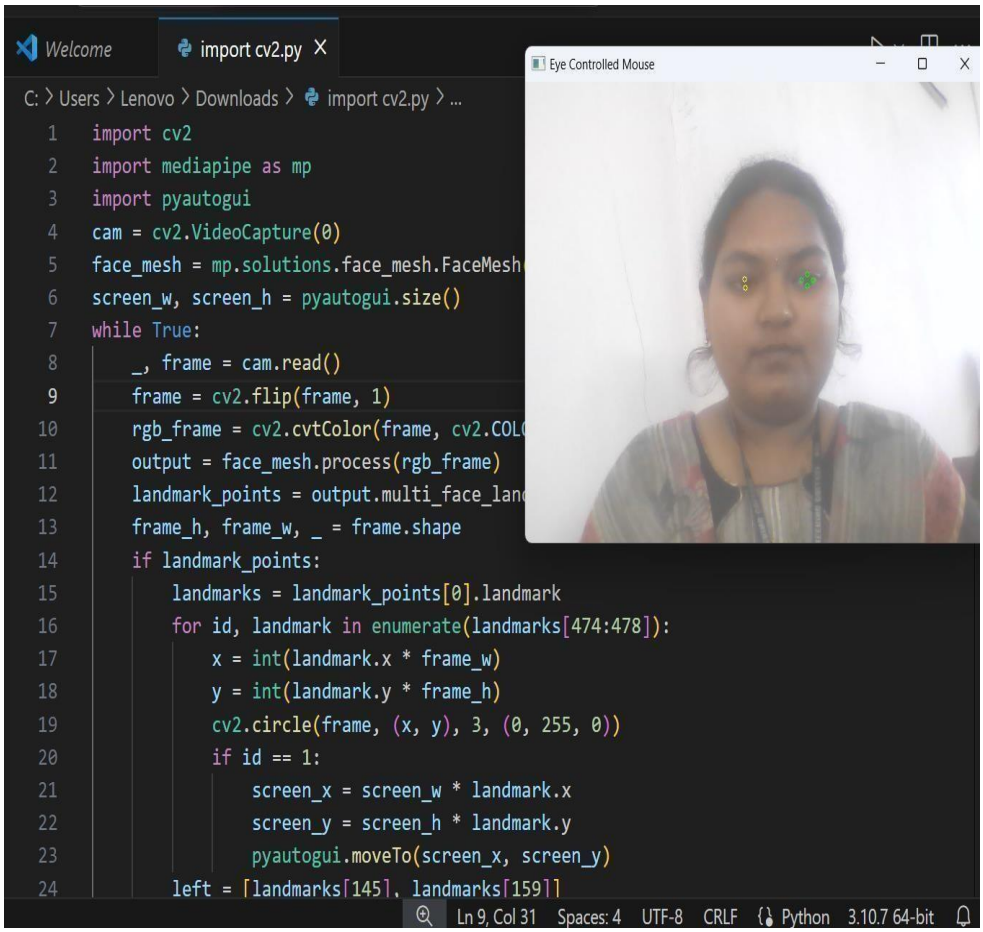


Fig: Code with output window.

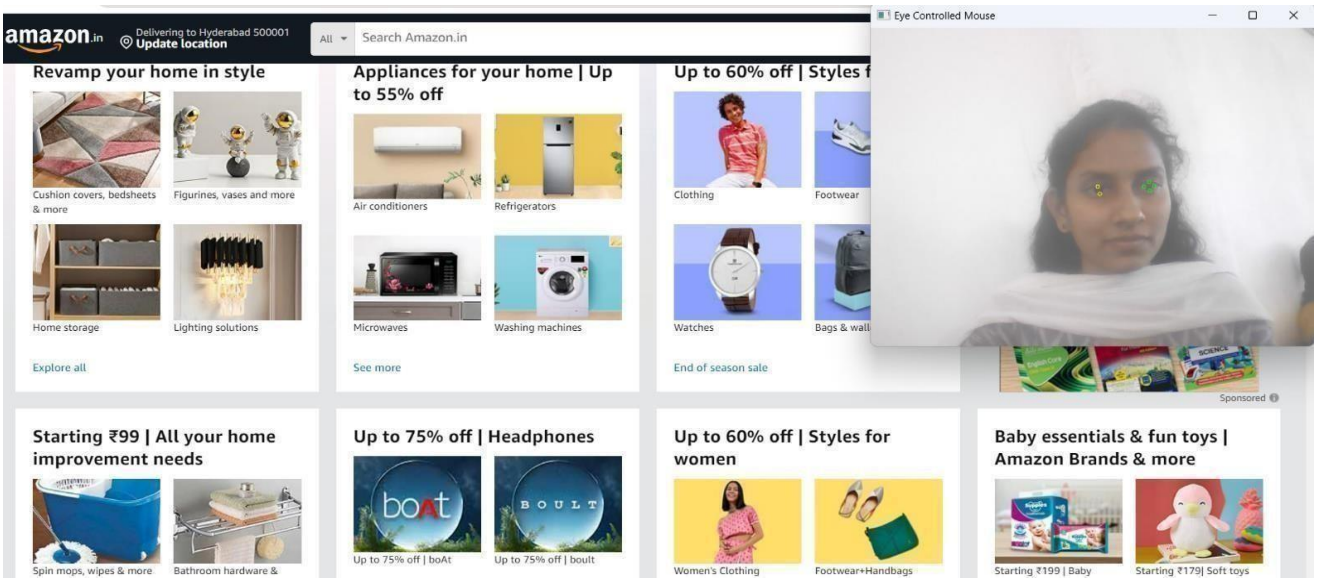


Fig: Accessing entire system through eyes

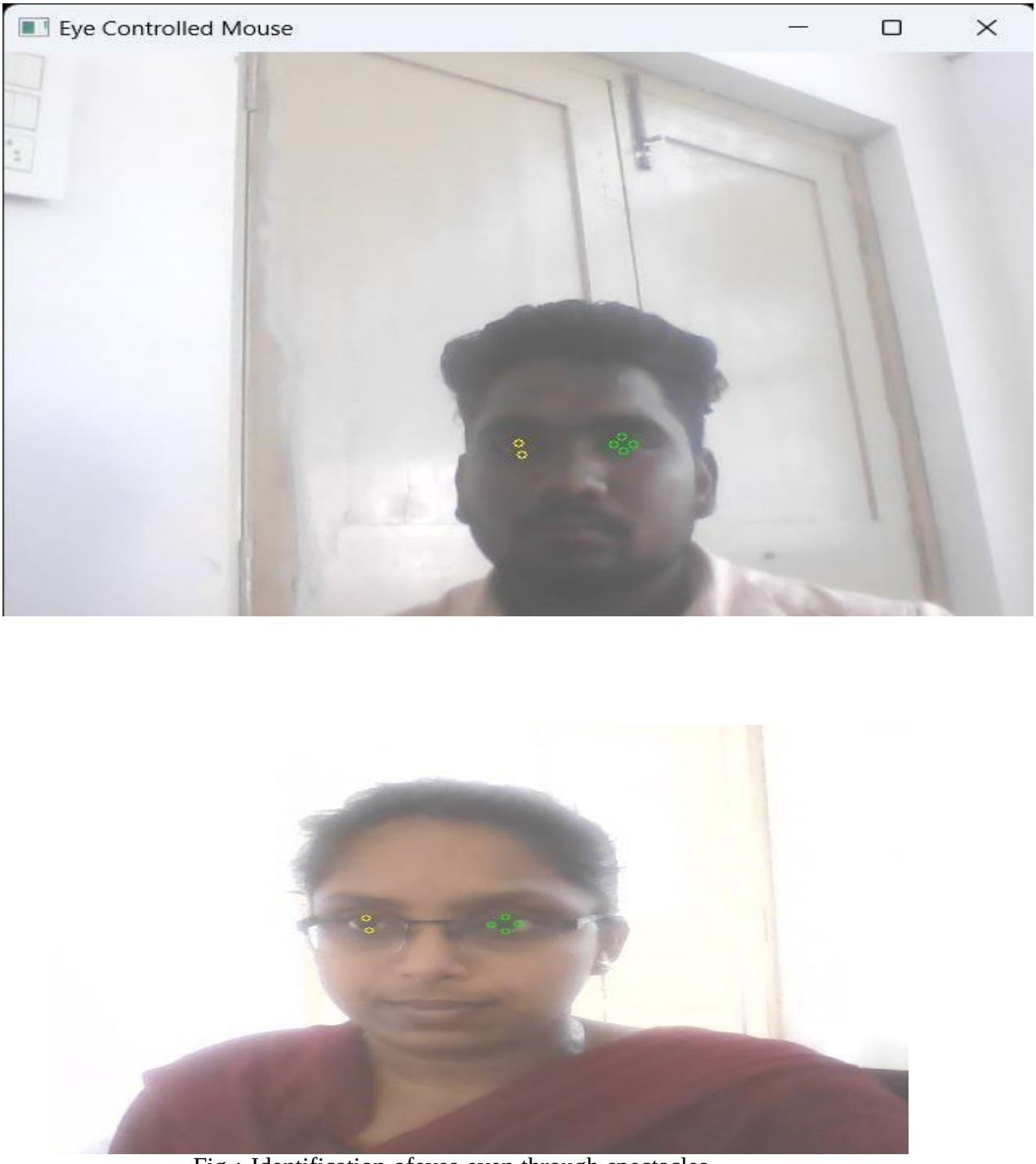


Fig : Identification ofeyes even through spectacles

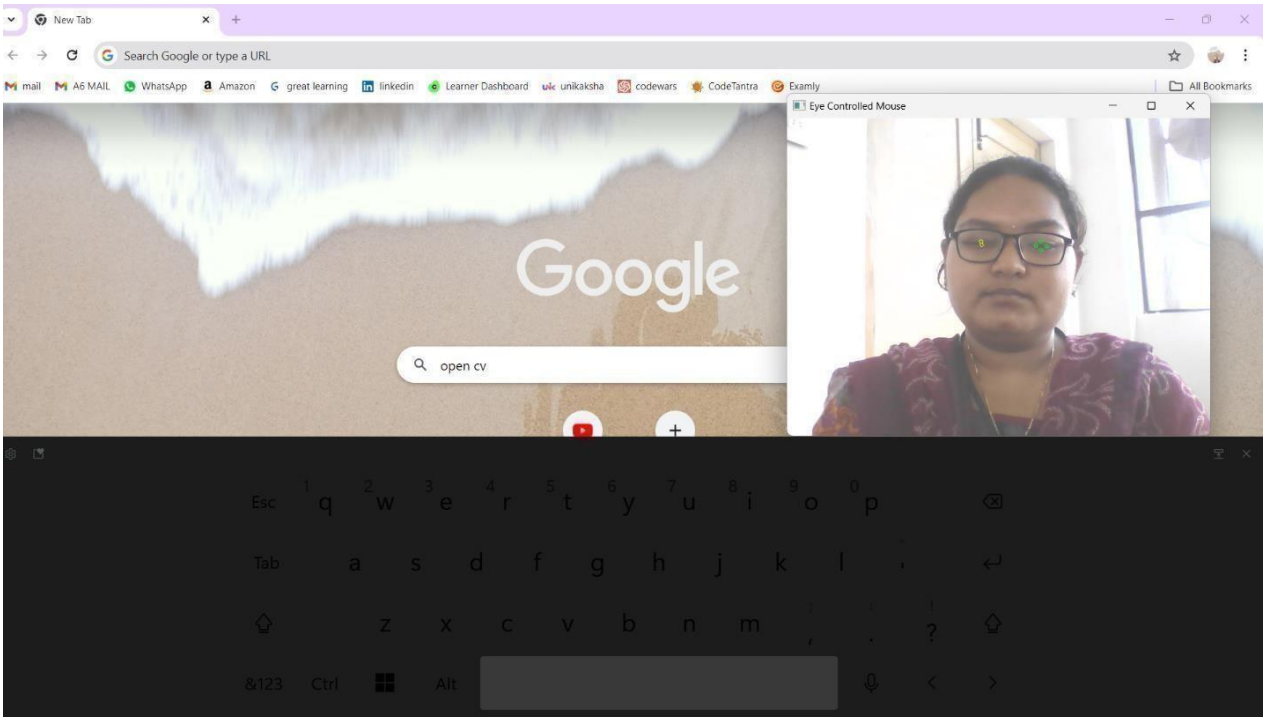


Fig: Accessing keyboard through eyes

SYSTEM TESTING

6. SYSTEM TESTING

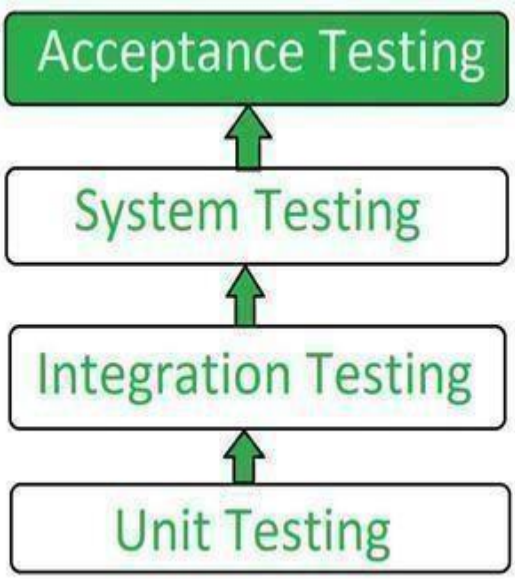
6.1 TESTING OBJECTIVE

The purpose oftesting is to discover errors. Testing is the process oftrying to discover every conceivable fault or weakness in a work product. It provides a way to check the functionality of components, sub assemblies, assemblies and/or a finished product.

It is the process of exercising software with the intent of ensuring that the Software system meets its requirements and user expectations and does not fail in an unacceptable manner. There are various types oftest. Each test type addresses a specific testing requirement.

Software testing is a process used to help identify the correctness, completeness and qualityofdeveloped computer software.

Software testing is the process used to measure the quality of developed software. Testing is the process of executing a program with the intent of finding errors. Software testing is often referred to as verification & validation.



Initialization testing is the first level of dynamic testing and is the first responsibility of developers and then that ofthetest engineers. Unit testing is performed after the expected test results are met or differences are explainable/acceptable.

Unit testing helps tester and developersto understand the base of code that makes themable change defect causing code quickly. Unit testing helps in the documentation. Unit testing fixes defects very early in the development phase that's why there is a possibility to occur a smaller number of defects in upcoming testing levels. It helps with code reusability by migrating code and test cases.

Test strategy and approach

Field testing will be performed manuallyand functional tests will be written in detail.

Test objectives

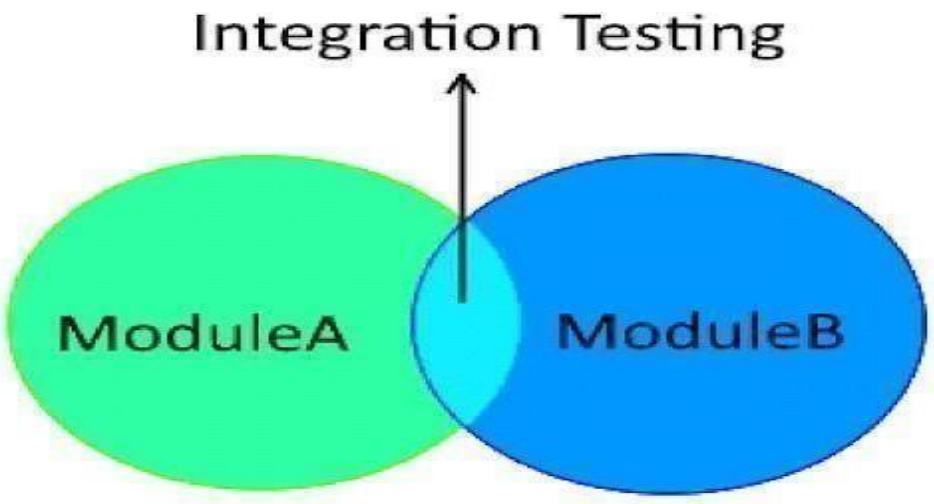
- All field entries must work properly.
- Pages must be activated fromthe identified link.
- The entryscreen, messages and responses must not be delayed.

Features to be tested

- Verify that the entries are ofthe correct format
- No duplicate entries should be allowed
- All links should take the user to the correct page.

6.1.1 Integration Testing

Software integration testing is the incremental integration testing of two or more integrated software components on a single platform to produce failures caused by interface defects.The task of the integration test is to check that components or software applications, e.g. components in a software system or – one step up – software applications at the company level – interact without error.



6.1.2 Acceptance Testing

User Acceptance Testing is a critical phase of any project and requires significant participation by the end user. It also ensures that the system meets the functionalrequirements.

6.2 Test Results

Allthe test cases mentioned above passed successfully. No defects encountered.

S.NO	TEST CASE NAME	INPUT	EXPECTED RESULT	ACTUAL RESULT	PASS OR NOT EXECUTED
1	TC1	cursor movement within bounds of the screen	Initial position: (0,0), move right 5 units	Initial position: (0,0), move right 5 units	PASS
2	TC2	cursor movement diagonally	Initial position: (5,5), move up-right 3 units	Initial position: (5,5), move up-right 3 units	PASS
3	TC3	cursor movement with zero coordinates	Initial position: (0,0), move down-right 2 units	Initial position: (0,0), move down-right 2 units	PASS
4	TC4	cursor movement with maximum screen coordinates	Initial position: (79,23), move up-left 3 units	Initial position: (79,23), move up-left 3 units	PASS
5	TC5	cursor movement with mixed positive and negative coordinates	Initial position: (20,20), move left 10 units, move up 5 units	Initial position: (20,20), move left 10 units, move up 5 units	PASS

6.3 TYPES IN TESTING

Software testing can be broken down into three main types:

- **black box,**
- **white box,**
- **gray box testing.**

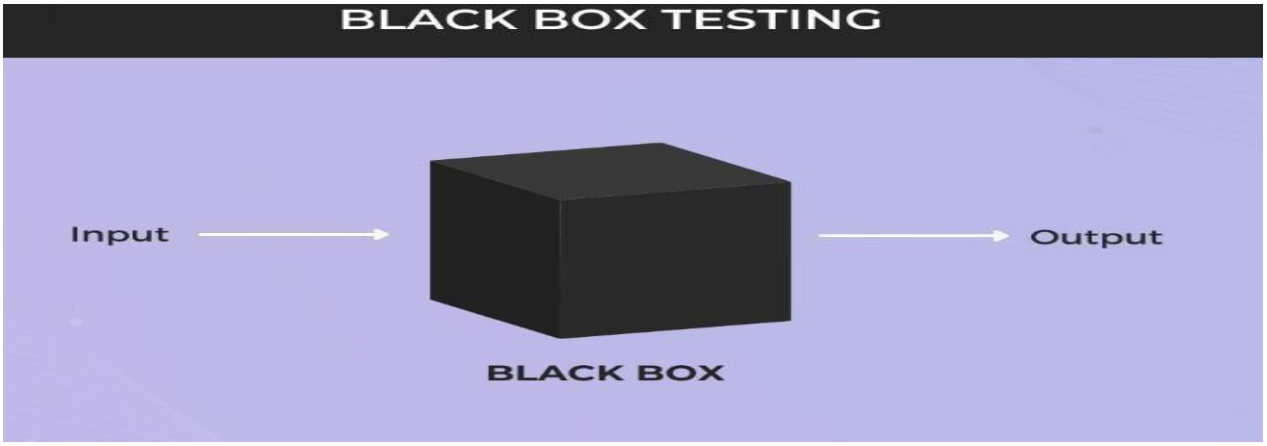
While they all have the same goal of finding and fixing defects in the app, each approach uses different methods to achieve this, focusing on different aspects of the app.

6.3.1 BLACK BOX TESTING

Black box testing zeros in on the behavior the software exhibits on the outside, on the interface level, and therefore requires no knowledge of its inner workings.

This means that testers don't have to handle anycode, algorithms, or other technical details. They approach the software purely from a user's perspective, without concerning themselves with what's going on under the surface.

Along the way, a black boxtest evaluates all relevant subsystems, including UI/UX, web server or application server, database, dependencies, and integrated systems.



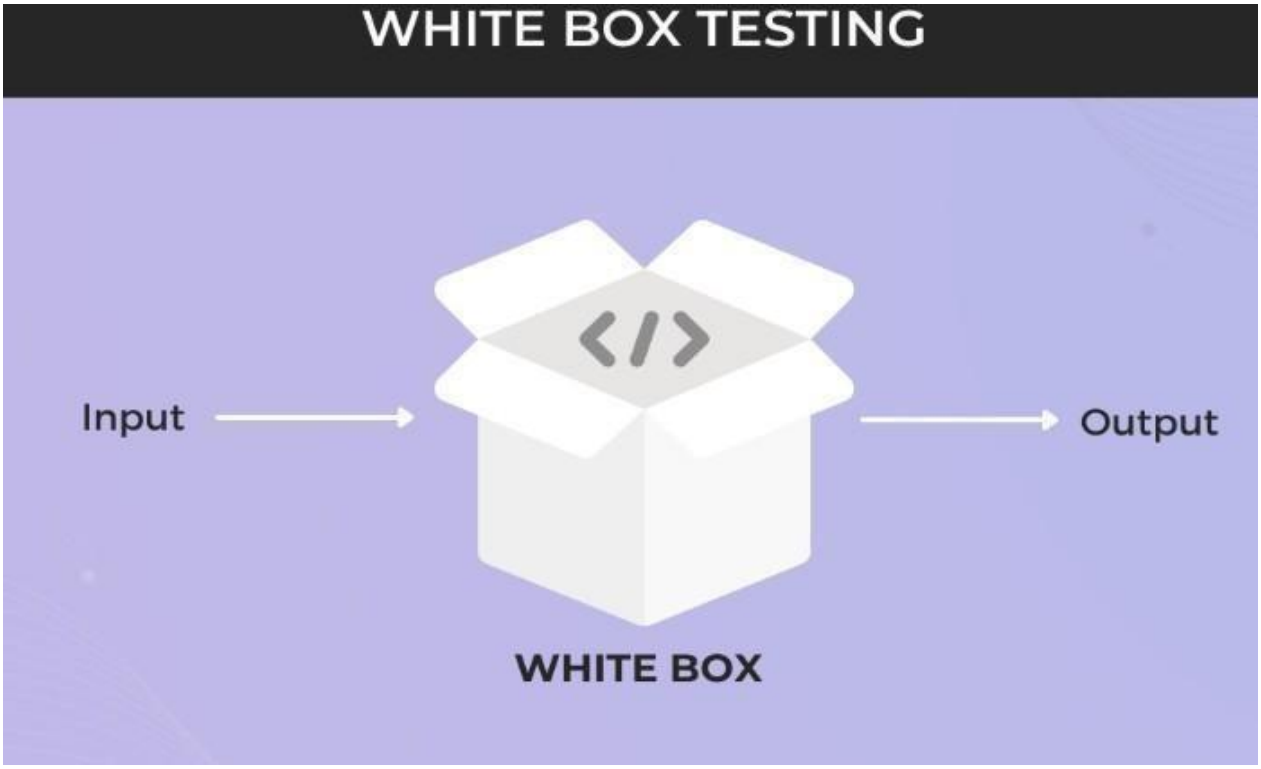
Black box testing is a powerful testing technique because it exercises a system end-to-end. Just like end-users "don't care" how a system is coded or architected, and expect to receive an appropriate response to their requests, a tester can simulate user activity and see if the system delivers on its promises.

6.3.2 WHITE BOX TESTING

While black box testing may give testers a broad view of a software system, it offers no insight into its internal code structure.

That's where white box testing comes in.

With this approach, testers can see inside the white box and scrutinize every aspect ofthe software system, from its code and infrastructure to its integrations.



White box testing is an approach that allows testers to inspect and verify the inner workings of a software system—its code, infrastructure, and integrations with external systems.

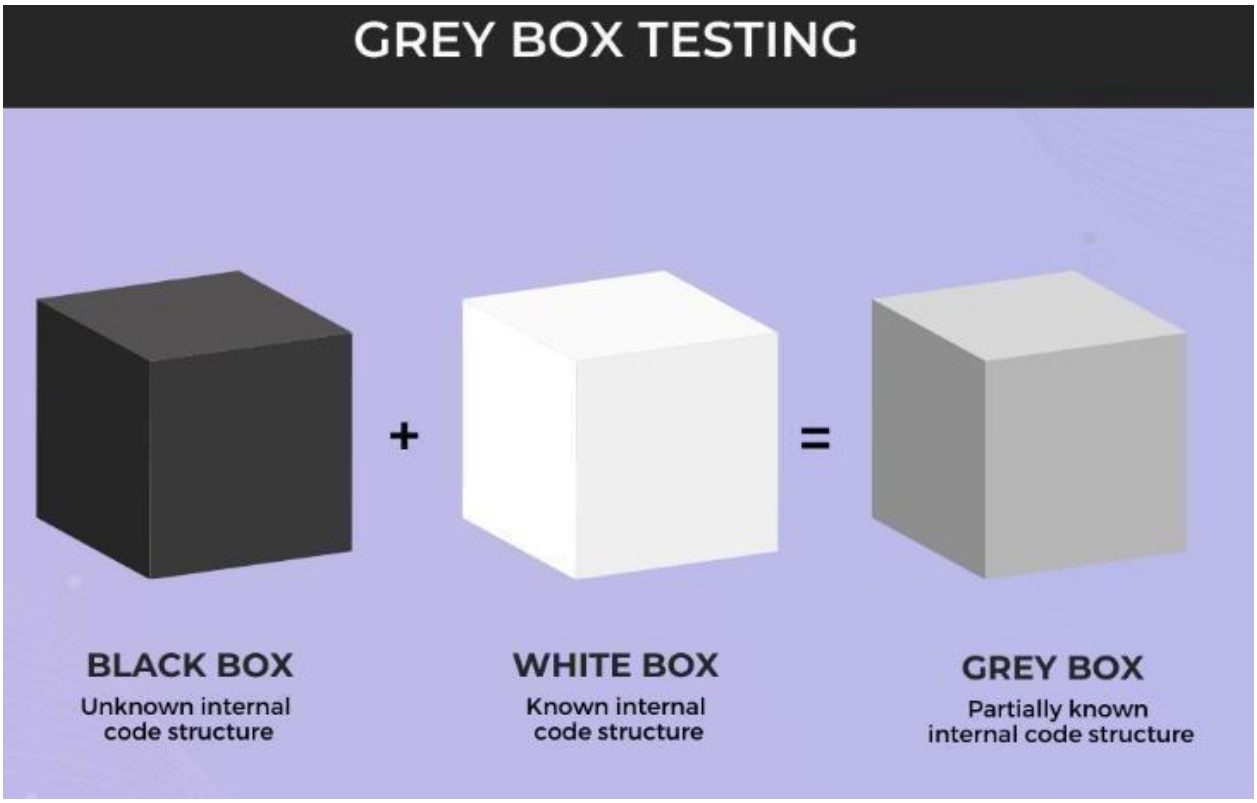
White box testing is an essential part ofautomated build processes in a modern Continuous Integration/Continuous Delivery (CI/CD) development pipeline.

6.3.3 GRAY BOX TESTING

Gray box testing is a great amalgamation of both black box and white box testing. It allows testers to approach a software product from the point of view of a user, while also allowing them to access its internal code.

Therefore, with this type oftesting, testers need to have some understanding of the system's internal mechanisms, but not as much as white box testing would require.

In addition to this, theyalso test end-to-end features and user scenarios.



Gray box testing takes a page from both white box and black box approaches. In gray box testing, testers may have a partial understanding of the internal structure of the application, enabling them to design more targeted test scenarios.

CONCLUSION

7. CONCLUSION

The project "Eye Ball Cursor Movement using OPENCV" is developed. The results show that we can effectively control cursor functions without using a mouse. This system is a possible solution to all the problems we face with the existing mouse cursor control manual, which is not possible for people with disabilities. In this research, the experimental results provide objective eye-tracking evidence that confirms the hypotheses made based on the findings of existing research.

Most students recognize beacons and pay more attention to these areas when debugging. Only significant statistical results have been reported in the conclusions, guaranteeing the conclusion validity.

Previous research has revealed a relationship between working memory capacity and the cognitive activities related to debugging with regard to mental arithmetic, short-term memory, logical thinking, and problem solving. Thus, the eye ball movement tracking is applied to physically challenged peoples to obtain various results

FUTURE ENHANCEMENT

8. FUTURE ENHANCEMENT

Most of us control our technology using our fingers and hands, whether that's through touch screens or a mouse. But for years, individuals with disabilities have used their eyes as a wayto control digital interfaces.

Controlling the proposed system using eye movements mainly concentrates on the development of handsfree computing. The study of various movement–based human computer interaction techniques are implemented. The mouse cursor is operated by the eye movement. The paper presented above has a very wide future scope as the human-computer interaction- based software can be very useful in the field of modern technology. Various different scope of this project could be driving cars with the eye movements and operating other digital appliances with the body movements.

The use of eye tracking in the simulated setting can help improve our understanding of what sources of information users are and are not using as they deliver routine processes. In particular, data derived fromeye tracking can be used to evaluate common, error-prone processes. Information on the eye behavior of experts can lead to the development of training protocols to guide the education of the students.

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BUILDING AMOUSE BY EYEBALL MOVEMENT USING MACHINE LEARNING

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Abstract - An individual Human computer interference system is being introduced. In oldentimes, as an input device the mouse and keyboard were used by human computer interference system. Those people who are suffering from certain disease or illness cannot be able to operate computers. The idea of controlling the computers with the eyes will serve a great use for handicapped and disabled person.

Also this type of control will eliminate the help required by other person to handle the computer. This measure will be the most useful for the person who is without hands through which they can operate with the help of their eye movements. The movement of the cursor is directly associated with the center of the pupil. Implementing a controllingsystem in it enables them to move without the help of another person is very helpful.

First detect pupil center position of eye. Then the different variation on pupil positiondifferent command set for virtual keyboard. The signals pass the driver to interface with virtual keyboard itself. The driver will control both speed and direction to enable virtual keyboard to move forward, left, right and stop.

Key Words: Human computer interference, Keyboard, Mouse, Eye, Cursor, pupil.

1. INTRODUCTION

As the computer technologies are growing rapidly, the importance of human computer interaction becomes highly notable. Some persons who are disabled cannot be able to use the computers. Eye ball movement control mainly used for disabled people. Incorporating this eye controlling system with the computers will make them to work without the help of other individual. Human-Computer Interface (HCI) is focused on use of computer technology to provide interface between the computer and the human.

There is a need for finding the suitable technology that makes the effective communicationbetween human and computer. Human computer interaction plays the important role. Thus there is a need to find a method that spreads an alternate way for making communication between the human and computer to the individuals those who have impairments and give them an equivalent space to be an element of Information Society. In recent years, the human computer interfaces are attracting the attention of various researchers across the globe. Humancomputer interface is an implementation of the vision-based system for eye movement detection for the disabled people.

This results the center position of the human eye (pupil). Then the center position of the pupil is taken as a reference and based on that the human or the user will control the cursor by moving left and right. Some people cannot operate computers because of some diseases. The idea of eye control is very useful not only for the future of natural input but especially for the handicapped and disabled. In addition, the implementation of the control system allows them to control the computers without the help of another person.

This gadget is most useful for a person who can control the cursor by eye movement. In this project, the camera is used to capture the eye movement image. First, it detects the center position of the pupil. Then a different change in the position of the pupil causes a different movement of the cursor. The implementation process for pupil detection is done using the OpenCV library in python, which is an open-source library for computer vision and image processing.

It can be used to process images and videos to identify objects, faces, etc. In this project, we instruct the mouse cursor to change its location based on the movement of the eyeball, connect to the webcam, and then extract each image from the webcam. and pass it to OpenCVto detect the position of the eyeball.

Once the position of the eyeball is detected, we extract the x and y coordinates of the eyeball from OPENCV and then instruct the mouse to change its current position to the givenX and Y coordinates of the eyeball.

2. LITERATURE REVIEW

The system proposed by G. Norris and E. Wilson focuses on eye movement with Electroencephalogram (EEG) which is set up consisting of an instrumentation amplifier and an inverting op amp and the system is set up by wearing it on your head and attaching the EEG specifically to the required points on the head . The EYE Mouse detects the change in EOG from looking up, right, down, left since there is a variation of potential and this is captured accordingly w.r.t the eye movement and it is recorded.

Vandana Khare, S.Gopala Krishna2, Sai Kalyan Sanisetty3, "Cursor Control Using Eye Ball Movement"[1], Because of their illness , a few people and groups are unable to use computers. In this case, it makes more sense to provide a computer operating method that is easily accessible, even when taking into account the infirmities of the differently abled. The human eye can be usedas a suitable replacement for computer operating hardware. An Internet protocol camera was utilised to capture an image of an eye frame for cursor movement in this paper. In this regard, we must first concentrate on the role of the EYE. We use a Raspberry Pi for pupil identification sinceit can handle the computer's cursor, and in this task, an Eye Aspect Ratio (EAR) is calculated, which corresponds to the snaps of the eye (left or right) using the Python programming language's Open Source Computer Vision module.

The major purpose of our suggested methodology is to improve the computing experienceof physically challenged people by assisting them in overcoming challenges such as mouse usage Aditya Dave1 and C. Aishwarya Lekshmi ,"Eye-Ball Tracking System for Motor- Free Control of Mouse Pointer"[2], Recent developments in the field of image processing have resulted in a number of high-quality feature detection techniques. While there is a constant need for new algorithms, there is also a need for an equal number of applications of such algorithms in order toachieve their full potential and use by the general public. For building a robust eye ball tacking system for directing the mouse pointer, this work uses a combination of Viola-Jones, Kanade–Lucas–Tomasi (KLT), and Circular Hough transform algorithms. The system's new featureis the ability to represent clicks. A single click is represented by one blink, and a double click is represented by two blinks in a short period of time. Other methods that were tried but failed to track characteristics are also described in the study. Because computer dependence has risen so dramatically in recent years, this technique can help people with motor difficulties browse throughtheir files on the computer more quickly. Different algorithms excel at different things.

So, rather than creating one algorithm extremely complex in order to perform well on all parameters, combining the best features of all three methods greatly simplifies the work and provides a better result than any of the three alone.

The system was tested in a variety of lighting settings and distances from the screen, and itsuccessfully tracked the iris with an accuracy of about 96 percent, which is impressive given thatthis is a real-time implementation.

The authors' ultimate goal is to create a software package out of this system and make it open source, therefore ease of implementation has been a top priority in order to improve user understanding of the algorithm Sivasangari.A, Deepa.D, Anandhi.T, Anitha Ponraj and Roobini.M.S "Eyeball based Cursor Movement Control"[3],

A human computer interference system is being introduced one at a time. Human computer interference systems used the mouse and keyboard as input devices in the past. Those who are afflicted with a specific ailment or ailment are unable to use computers. For handicapped and impaired people, the idea of controlling computers with their eyes will be extremely useful. This form of control will also eliminate the need for other people to assist with the Vol-7 Issue-3 2021 IJARIIE-ISSN(O)-2395-4396 14512 www.ijariie.com 1921 computer. This approach will be particularly effective for people who are unable to function with their hands and must instead rely on their eyes. The movement of the cursor is directly related to the pupil's centre. As a result, the initial step would be to locate the point pupil's centre. The Raspberry Pi and OpenCV are used to build this pupil detection procedure. The SD card is inserted into the SD/MMC card port of the Raspberry Pi. The operating system that is required to start up the Raspberry Pi is installed on theSD card. Once the application programme is loaded into the Raspberry PI, it will run. Pierluigi Cigliano, Vincenzo Lippiello, Fabio Ruggiero "Robotic Ball Catching with an Eye- in-Hand Single-Camera System "[4] This study proposes a unified control framework for realizing a robotic ball catching job utilising only a moving single-camera (eye-in-hand) system capable of recording flying, rolling, and bouncing +balls in the same formalism. To visually track the thrownball, a circle detection approach is used. Following the recognition of the ball, the camera must follow a baseline in the space to capture an initial collection of visual measurements. To obtain an initial estimate of the catching point, a linear technique is applied. Then, using a nonlinear optimization methodology and a more exact ballistic model, new visual measurements are acquired on a regular basis to keep the current estimate up to date. A typical partitioned visual servoing technology is utilised to operate the translational and rotational components of the camera separately. Experiment results on an industrial robotic system indicate the efficacy of the proposedsolution. Using a motion-capture system, ground truth is employed to validate the proposed estimating technique.

In a paper proposed by S. R. Fahim, et al, it focus on the uses HOG system and motion vector with python programming and Haar Cascade Algorithm which is a training based algorithm, and it is used mainly with programming in machine learning , eye dataset is given in this, by having multiple dataset of eyes, then the eye data is collected and the following system works accordingly to the eye movement and clicking is done with the help of the eye blinking.

3. SYSTEM ANALYSIS

3.1 EXISTING SYSTEM

Mat lab detect the iris and control curser. Eye movement-controlled wheel chair is existing one that controls the wheel chair by monitoring eye movement. In mat lab is difficult topredict the Centroid of eye so we go for OpenCV.

We are instructing mouse cursor to change its location based on eye ball movement, in this application using

OPENCV we will connect to webcam and then extract each frame from thewebcam and pass to OPENCV to detect eye balls location. Once eye ball location detected then we can extract x and y coordinates of eye balls from OPENCV and then using python pyautogui API we can instruct mouse to change its current location to given eyeballs X and Y Coordinates.

3.2. PROPOSED SYSTEMS

In our proposed system the cursor movement of computer is controlled by eye movement using Open CV.Camera detects the Eye ball movement which can be processed in OpenCV.By thisthe cursor can be controlled. The user has to sit in front of the display screen of private computer or pc, a specialised video camera established above the screen to study the user's eyes.

The laptop constantly analysis the video photo of the attention. To "pick out" any key, theuser seems at the key for a exact period of time and to "press" any key, the user just blink the eye.

This aims to develop a system for controlling the computer cursor using the movement of the user's eyeballs, providing a hands-free alternative to the traditional mouse. We developed a program using image processing techniques and machine learning algorithms in Python to obtain the eyeball movements and blink and translate them respectively into cursor movements and clickactions.

Our system was able to achieve a high level of accuracy in tracking the user's eye movements. Users were easily able to adapt to the new input method.

This system has great potential to improve the accessibility and usability of computers for individuals with motor impairments or disabilities. This hands-free control method has great potential in the area of applications in gaming and virtual reality environment etc.

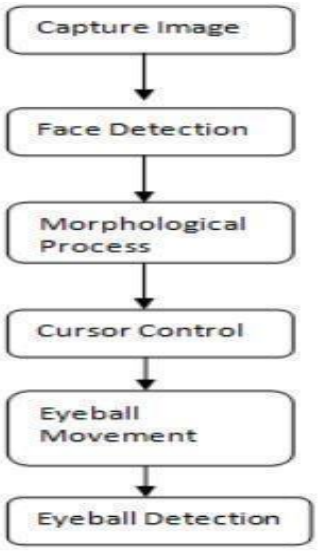


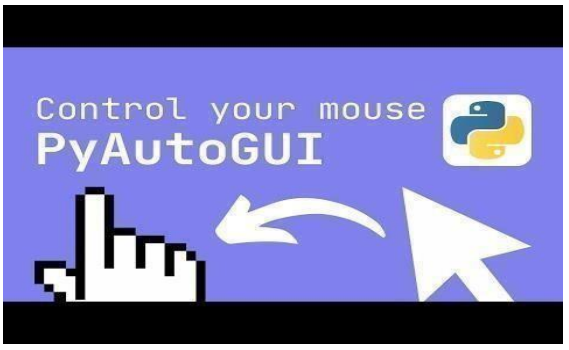
Fig. 1. Flow of Proposed Work

4. IMPLEMENTATION

ABOUTPYTHON

Python is an interpreted high-level programming language for general-purpose programming. Created by Guido van Rossum and first released in 1991, Python has a design philosophy that emphasizes code readability, notably using significant whitespace. It provides constructs that enable clear programming on both small and large scales.

Python features a dynamic type system and automatic memory management. It supports multiple programming paradigms, including object oriented, imperative, functional and procedural, and has a large and comprehensive standard library.

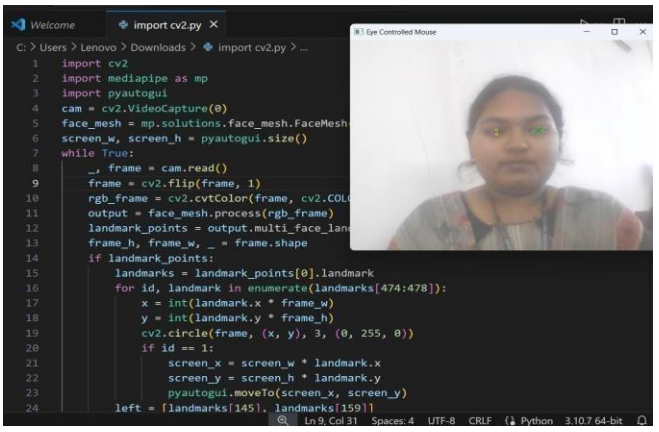


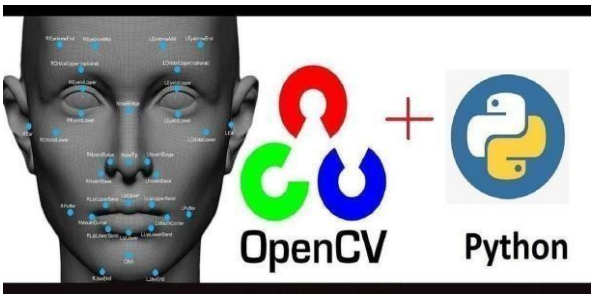
OpenCV-Python

OpenCV-Python is a library of Python bindings designed to solve computer vision problems. Python is a general purpose programming language started by **Guido van Rossum** that became very popular very quickly, mainly because of its simplicity and code readability. It enables the programmer to express ideas in fewer lines of code without

reducing readability.

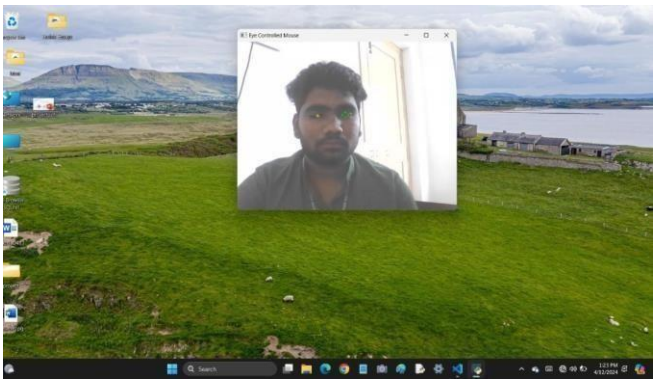
Compared to languages like C/C++, Python is slower. That said, Python can be easily extended with C/C++, which allows us to write computationally intensive code in C/C++ and create Python wrappers that can be used as Python modules. This gives us two advantages: first, the code is as fast as the original C/C++ code (since it is the actual C++ code working in background) and second, it is easier to code in Python than C/C++. OpenCV-Python is a Python wrapper for the original OpenCV C++ implementation.

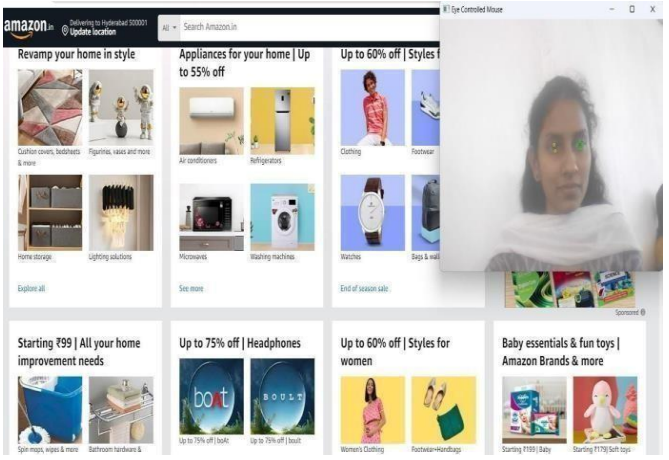




OpenCV-Python makes use of **Numpy**, which is a highly optimized library for numericaloperations with a MATLAB-style syntax. All the OpenCV array structures are converted to and from Numpy arrays. This also makes it easier to integrate with other libraries that use Numpy such as SciPy and Matplotlib.

5. Output Screens





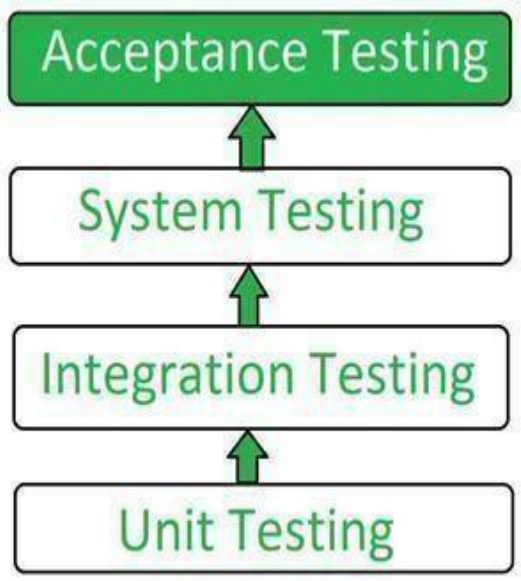
6. SYSTEM TESTING

The purpose of testing is to discover errors. Testing is the process of trying to discover every conceivable fault or weakness in a work product. It provides a way to check the functionality of components, sub assemblies, assemblies and/or a finished product.

It is the process of exercising software with the intent of ensuring that the Software system meets its requirements and user expectations and does not fail in an unacceptable manner.There are various types of test. Each test type addresses a specific testing requirement.

Software testing is a process used to help identify the correctness, completeness and qualityofdeveloped computer software.

Software testing is the process used to measure the quality of developed software. Testing is the process of executing a program with the intent of finding errors. Software testing is often referred to as verification & validation.



Initialization testing is the first level of dynamic testing and is the first responsibility of developers and then that ofthe test engineers. Unit testing is performed after the expected test resultsare met or differences are explainable/acceptable.

Unit testing helps tester and developers to understand the base of code that makes them able change defect causing code quickly. Unit testing helps in the documentation. Unit testing fixes defects very early in the development phase that's why there is a possibility to occur a smaller number ofdefects in upcoming testing levels. It helps with code reusability by migrating code and test cases.

Test strategy and approach

Field testing will be performed manually and functional tests will be written in detail.

6.1 Integration Testing

Software integration testing is the incremental integration testing of two or more integrated software components on a single platform to produce failures caused by interface defects.The taskof the integration test is to check that components or software applications, e.g. components in a software system or – one step up – software applications at the company level – interact without error.

6.2 Acceptance Testing

User Acceptance Testing is a critical phase of any project and requires significant participation bythe end user. It also ensures that the system meets the functional requirements.

6.3 TYPES IN TESTING

Software testing can be broken down into three main types:

- **black box,**
- ***white box,***
- **gray box testing.**

While they all have the same goal of finding and fixing defects in the app, each approach uses different methods to achieve this, focusing on different aspects of the app.

6.3.1 BLACK BOX TESTING

Black box testing zeros in on the behavior the software exhibits on the outside, on the interface level, and therefore requires no knowledge of its inner workings.

This means that testers don't have to handle any code, algorithms, or other technical details. They approach the software purely from a user's perspective, without concerning themselves withwhat's going on under the surface.

Along the way, a black box test evaluates all relevant subsystems, including UI/UX,web server or application server, database, dependencies, and integrated systems.

6.3.2 WHITE BOXTESTING

While black box testing may give testers a broad view of a software system, it offers no insight into its internal code structure.

That's where white box testing comes in. With this approach, testers can see inside the white box and scrutinize every aspect of the software system, from its code and infrastructure to its integrations.

6.3.3 GRAY BOXTESTING

Gray box testing is a great amalgamation of both black box and white box testing. It allows testers to approach a software product from the point of view of a user, while also allowing them to access its internal code.

Therefore, with this type of testing, testers need to have some understanding of the system'sinternal mechanisms, but not as much as white box testing would require.

In addition to this, they also test end-to-end features and user scenarios.

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