# GESTURE CONTROLLED MOUSE USING PYTHON

**AN INTERNSHIP REPORT**

***Submitted by***

**Prabhas Dunaboyina**

**210303125035**

***In partial fulfillment for the award of the degree of***

**BACHELOR OF ENGINEERING**

***in***

**COMPUTER SCIENCE AND ENGINEERING**

***Under the supervision of***

**AMIT SINGH PATWAL (Faculty Mentor)**

**P. ABHISHEK (Industry Mentor)**

**Parul Institute of Engineering and Technology, Limda.**


**Parul University, Limda**

**March-2025**

## Parul Institute of Engineering & Technology, Limda


# CERTIFICATE

This is to certify that the internship report submitted along with the internship entitled **Gesture Controlled Mouse Using Python** has been carried out by **Prabhas Dunaboyina** under my guidance in partial fulfillment for the degree of Bachelor of Engineering in Computer Science, 8th Semester of Parul University, Vadodara during the Year 2024-25.

Signature

**Amit Singh Patwal**
**Internal Guide**

Signature

**Dr. Amit Barve**
**Head of the Department**

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(Second Amendment) Act, 2015 (Guj. Act No. 7 of 2015)

Parul®
University

Date: 12/04/2024

**To,**
**Slash Mark IT Solutions (OPC) Pvt Ltd**
**Nelson Mandela Road, Vasant Kunj, New Delhi, India -110069**

Subject: NOC for immediate joining of selected student

Dear Sir / Madam,

This is to inform that **Enrollment No** 210303125035,**Prabhas Dunaboyina** 8B15 from our institute is allowed to join from date **01/12/2024** up to **28/02/2025**. This student can join your organisation on full time basis but at the same time, he/she will be required to appear for all Weekly Tests, Mid-Sem Exams, External Semester Exams, vivas, submission and practical exams and must perform satisfactorily in order to become eligible to get degree certificate.

We would request you to kindly consider the same and approve leaves accordingly as per the exam schedule as & when gets finalised.

**Yours Faithfully,**

**Dr. Amit Barve**
Head-Computer Science Engineering Dept.,
Parul Institute of Engineering & Technology,
Parul University, Vadodara.

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Slash Mark

## OFFER LETTER

Dear Prabhas Dunaboyina,
Intern ID: SMI74375
Parul University

Congratulations!

We are delighted to present you with an offer for the position of Python Internship commencing from December 01, 2024 to February 28, 2025.

As an intern, you will have the opportunity to gain valuable experience. As a temporary employee, please be aware that you won't receive the same benefits as our regular staff.

Kindly adhere to our company's policies, including those related to conduct, safety, and confidentiality. We have every confidence that your internship with us will prove to be fulfilling and we extend our best wishes for success in this promising opportunity.

We look forward to welcoming you to our team and witnessing your growth and contributions firsthand.

**P Abhishek**
Human Resources (HR)
Slash Mark IT Solutions (OPC) Pvt Ltd
info@slashmark.cloud

MINISTRY OF CORPORATE AFFAIRS
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Parul® University

# INTERNSHIP COMPLETION CERTIFICATE

This is to certify that

**Prabhas Dunaboyina**

has successfully completed the **Python Internship**
at Slash Mark IT Solutions (OPC) Pvt Ltd (An ISO 9001:2015 certified organization dedicated to excellence in IT solutions)
during the **December 01, 2024 to February 28, 2025**

**Shri P Abhishek**
HR, SLASH MARK

**Shri K Mukesh Raj**
CEO, SLASH MARK

**Intern ID :** SMI74375

# Parul Institute of Engineering & Technology, Limda


# DECLARATION

We hereby declare that the Internship report submitted along with the Internship entitled **Gesture Controlled Mouse Using Python** submitted in partial fulfillment for the degree of Bachelor of Engineering in Computer Science to Parul University, Vadodara, is a bonafide record of original project work carried out by me at Slash Mark under the supervision of **Amit Singh Patwal** and that no part of this report has been directly copied from any students' reports or taken from any other source, without providing due reference.

Name of the student
**Prabhas Dunaboyina**

# Acknowledgment

Behind any major work undertaken by an individual or group there lies the contribution of the people who helped to them to cross all the hurdles to achieve their goal. It gives us the immense pleasure to express our sense of sincere gratitude towards our respected guide **AMIT SINGH PATWAL** sir for their persistent, outstanding, invaluable co- operation and guidance. It was our achievement to be guided under them. They are giving constant source of encouragement and momentum that any intricacy becomes simple. We gained a lot of invaluable guidance and prompt suggestions from them during entire project work. We will be indebted to them forever, and we take pride to work under them. we feel very privileged to have their precious advice, guidance, and leadership. Last but not the least, our humble thanks to the Almighty God Place:

Vadodara

Date: PRABHAS DUNABOYINA- 210303125035

# Abstract

The technique of establishing a process of interaction between human and computer is evolving since the invention of computer technology. In terms of HCI (Human-Computer Interaction) technology, the mouse is a fantastic invention. Even while Bluetooth and wireless mouse technology is still in its infancy, it is not entirely device independent. A Bluetooth mouse needs a connected dongle and batteries to function. When a mouse has additional devices, it becomes harder to use.

The proposed mouse system is beyond this limitation This project proposes a gesture- controlled mouse using Python, where the user can control the movement of the cursor on the computer screen with hand gestures. The system uses a webcam to capture real-time video input and OpenCV, a computer vision library in Python, to detect and recognize hand gestures. The hand gestures are mapped to the movement of the cursor on the screen using PyAutoGUI, a Python library that allows for programmatically controlling the mouse and keyboard. The proposed system aims to provide an intuitive and hands-free approach to computer interaction, especially for users with physical disabilities or for those who prefer a more natural way of controlling their computer. The system will be implemented and tested on a Windows platform using Python 3.x, OpenCV 4.x, and PyAutoGUI. The performance and usability of the system will be evaluated through a user study, where participants will be asked to perform various tasks using the gesture-controlled mouse and provide feedback on their experience. Overall, this project aims to demonstrate the potential of using hand gestures as an alternative input method for controlling a computer mouse and to provide a useful tool for people who have difficulty using traditional input devices.

# Table of Contents

# CHAPTER – 1

# Overview Of the Company

## 1.1 About Company:

At Slash Mark, our mission goes beyond traditional education. We are dedicated to nurturing the next generation of talent through a comprehensive 3-month internship program that includes basic training, mini and major project-based experiences. Upon successful completion of the internship, each intern is required to prepare and submit a presentation. Upon verification of their work, interns will receive a prestigious completion certificate to acknowledge their valuable contributions. But our commitment doesn't end there. We believe in recognizing excellence. For those interns who truly shine during their internship, we take an extra step by providing a coveted letter of recommendation and special gifts as tokens of our appreciation. SLASH MARK is devoted to enhancing engineering education and life skills, and we are unwavering in our commitment to making quality education more affordable and accessible to all.

## 1.2 Scope Of the Company:

1. **Product Expansion:**
   Introducing New Features and Products to Meet Evolving User Needs.
2. **Global Growth:**
   Expanding The User Base Globally and Strategically Entering New Markets.
3. **Tech Advancements:**
   Staying At the Forefront of Technology, Integrating AI, And Enhancing User Experience.4.
4. **Strategic Partnerships:**
   Forming Collaborations to Enrich Product Offerings and Extend Market Reach.
5. **Talent And Development**:
   AttractingTop Talent and Investing in Employee Developmentfor Continuous Innovation.
6. **Customer-CentricFocus:**
   PrioritizingCustomer Support and Utilizing Feedback for Product Refinement.7.
7. **Sustainability And Privacy:**
   Embracing Sustainability and Reinforcing Data Securityand Privacy Measures.

## 1.3 Organization chart:

CEO: KothaMukesh Raj TEAM

LEAD: K Preetham Kumar

HR:P.Abhishek

**1.4 Capacityof plant:** 10 members and 255 associatemembers.

# CHAPTER – 2

# Internship and Project

## 2.1 It includes the details about the work being carried out in each department

During my internship at Slash Mark IT Solutions (OPC) Pvt. Ltd, I had the opportunity to observe and contribute to various departments within the organization. The key departments and their respective functions are outlined below:

1. Business Analysis Department

Conducting requirement gathering sessions with stakeholders.

Analyzing business problems and proposing data-driven solutions.

Creating business process models and documentation.

Developing reports and dashboards using Tableau, Power BI, and Excel.

2. Data Analytics and Reporting

Cleaning and preprocessing raw datasets for meaningful insights.

Performing exploratory data analysis (EDA) using Python, SQL, and R.

Creating visual representations of key performance indicators (KPIs).

Generating automated reports and dashboards for decision-making.

3. Software Development and Implementation

Assisting in the development of data pipelines and workflows.

Collaborating with developers to integrate analytics into business applications.

Testing and debugging various models and algorithms.

4. Human Resource and Administration

Coordinating between teams to manage internship-related operations.

Handling documentation and compliance for interns and employees.

Analyzing HR metrics for workforce planning.

5. Project Management and Client Coordination

Working with project managers to track project timelines and deliverables.

Preparing project reports and presentations for client updates.

Understanding business needs and ensuring alignment with project goals.

Each of these departments played a crucial role in my learning experience, providing me with practical exposure to **real-world business analytics and decision-making processes**.

## 2.2 Sequence of Operations for Manufacturing an End Product

The manufacturing process follows a structured sequence to ensure efficiency, accuracy, and quality control. The steps involved are as follows:

1. Requirement Analysis & Planning
2. Raw Material Procurement & Storage
3. Material Processing & Pre-Production
4. Component Manufacturing & Sub-Assembly
5. Quality Control & Inspection
6. Final Assembly & Integration
7. Finishing & Packaging
8. Dispatch & Logistics

## 2.3 Explain in detail about each stage of production

1. **Requirement Analysis & Planning**
   - This stage involves understanding product specifications, setting production goals, and planning resources, materials, and workforce.
   - A production schedule is developed to optimize efficiency.
2. **Raw Material Procurement & Storage**
   - High-quality raw materials are sourced from reliable suppliers.
   - Quality checks are conducted, and materials are stored under controlled conditions to prevent deterioration.
3. **Material Processing & Pre-Production**
   - Materials are cut, shaped, or moulded into required forms.
   - Heat treatment, chemical processing, or coating is applied to enhance durability and performance.
4. **Component Manufacturing & Sub-Assembly**
   - Individual components are fabricated using CNC machines, molding, or welding.
   - Small assemblies are created before the final product assembly.
5. **Quality Control & Inspection**
   - Rigorous testing is performed to check dimensional accuracy, durability, and functionality.
   - Any defective parts are identified and either reworked or discarded.
6. **Final Assembly & Integration**
   - All components are integrated to form the final product.
   - Electrical, mechanical, and software elements are tested for compatibility.
7. **Finishing & Packaging**
   - Products undergo surface treatments, polishing, and painting for aesthetics and durability.
   - Proper packaging is done to ensure safe transportation.
8. **Dispatch & Logistics**
   - Finished products are stored, tracked, and shipped to customers or distribution centres.

# CHAPTER – 3

# INTRODUCTION TO INTERNSHIP

## Introduction to Internship

I've been given a variety of projects to work on during my internship that cover important facets of Python Programming. Among the major projects are:

## 3.1 Internship Summary

Interning at SLASH mark has been an enriching experience, focusing on vital elements of Python Programming. The internship offers a hands-on approach, providing exposure to diverse projects that cover key facets of these fields.

Engaging with major projects, interns gain practical insights and contribute to the dynamic work environment, fostering skill development and an in-depth understanding of the Python Programming. The internship at SLASH mark is designed to empower interns with real-world experiences, enhancing their capabilities and preparing them for a successful career in the tech industry.

## 3.2 Purpose

The purpose of the internship at SLASH mark is to provide a comprehensive and hands-on learning experience for individuals interested in Python Programming. Through engaging in a variety of projects, interns have the opportunity to apply theoretical knowledge in a practical setting, gaining valuable insights into the intricacies of these fields.

The overarching goal is to empower interns with practical skills, foster their professional development, and prepare them for success in the tech industry by immersing them in real-world projects and challenges. The internship serves as a platform for skill enhancement, experiential learning, and the cultivation of a strong foundation for future careers in Python Programming.

## 3.3 Objective

The essential destinations include:

- Comprehensive Learning: Provide interns with a thorough understanding of Python Programming.
- Practical Application: Enable interns to apply theoretical knowledge through hands-on projects.
- Skill Development: Foster the development of practical skills in a professional setting.
- Real-world Experience: Offer exposure to real-world projects to enhance problem-solving abilities.

## 3.4 Scope (what it can do and can't do)

**The scope encompasses:**

- Gesture Recognition for using mouse movements like up, down, right, left.
- Python programming for Gesture Controlled Mouse.

**It does not include:**

- Backend advancement for any of the projects.

## 3.5 Technology and Literature Review

The Gesture Controlled Mouse system using Python involves the integration of several technologies and libraries to create a functional system. The following are the technologies used in this project: Python, OpenCV, PyAutoGUI, NumPy.

### 3.5.1 Technology Review:

Technologies used in this project:

Python: Python is a high-level programming language used for developing various applications, including machine learning and computer vision.

OpenCV: OpenCV is an open-source computer vision library that is used for image processing, object detection, and recognition.

PyAutoGUI: PyAutoGUI is a Python library used for controlling the mouse and keyboard. NumPy: NumPy is a Python library used for scientific computing, particularly for numerical calculations

## 3.6 Internship Planning

### 3.6.1 Internship Advancement Approach and Justification

The chosen approach for enhancing the Gesture Recognition involves a phased improvement strategy. With a specific focus on the Gestures, The system using Python involves the use of a webcam to capture real-time video input of hand gestures, which are then processed and mapped to the movement of the cursor on the computer screen..

### 3.6.2 Internship Exertion and Time, Taken a toll Estimation

Exertion and time estimation will be based on the complexity of each extend component. Fetched estimation will incorporate potential costs related to plan instruments and resources.

### 3.6.3 Roles and Responsibilities

Parts are clearly characterized:

- OpenCV to capture and preprocess the video input from the webcam for Gesture.
- PyAutoGUI is a Python library used for controlling the mouse and keyboard
- Gesture Recognition for using mouse movements like up, down, right, left.

## 3.7 Internship Scheduling

The internship program will implement a structured scheduling approach using a Gantt Chart. This visual tool will provide a clear representation of project timelines, key milestones, and critical dependencies. The Gantt Chart will serve as a dynamic and accessible resource for effective planning, monitoring, and communication throughout the internship duration. By employing this visual aid, interns and supervisors can collaboratively track progress, identify potential bottlenecks, and ensure a streamlined and successful execution of internship tasks and objectives.

# CHAPTER – 4

# SYSTEM ANALYSIS

## 4.1 Study of Current System

The current system involves traditional interaction with a computer using a mouse and keyboard. The mouse is highlighted as a significant invention in Human-Computer Interaction (HCI) technology. Bluetooth and wireless mouse technology are mentioned, but it's noted that they still require a connected dongle and batteries. The limitations of the current system are emphasized, indicating the need for a more device-independent and intuitiveapproach.

## 4.2 Problem and weaknesses of Current System

Dependency on physical devices like a connected dongle and batteries for Bluetooth and wireless mouse technology. Difficulty in use when a mouse has additional devices, making it less user- friendly. Challenges for users, especially those with physical disabilities, in using traditional input devices like a mouse and keyboard. Lack of a hands-free and intuitive approach to computer interaction in the current system. The proposed system aims to address these issues by introducing a gesture-controlled mouse using Python.

## 4.3 RequirementsofNew System

**Gesture-Controlled Mouse:**

- The new system should allow users to control the computer mouse using hand gestures.
- It should be intuitive and provide a hands-free approach to computer interaction.

**Technological Requirements:**

- Utilization of a webcam for real-time video input.
- Implementation in Python, specifically using Python 3.x
- Integration of OpenCV (computer vision library) for hand gesture detection and recognition.
- Integration of PyAutoGUI for programmatic control of the mouse and keyboard.

**Platform and Compatibility:**

- Implementation and testing on the Windows platform.
- Compatibility with Windows operating system (Python 3.x, OpenCV 4.x, PyAutoGUI)

## 4.4 System Feasibility

### 4.4.1 Does the system contribute to overall objectives of the organization?

- The gesture-controlled mouse system aligns with organizational objectives by enhancing accessibility, promoting innovation, and focusing on user-centric design, contributing positively to the overall goals.

### 4.4.2 Can the system be implemented using the current technology and with in the given cost and schedule constrains

- The system's feasibility depends on the current technology; however, successful implementation within cost and schedule constraints is feasible, given the use of Python,

OpenCV, and PyAutoGUI.

#### 4.4.3 Can the system be integrated with other systems which are already in place?

- The system's integration with existing systems is contingent on compatibility, but with Python-based implementation, integration with other systems is likely achievable with proper considerations.

## 4.5 Action / Prepare in New system

**1. Gesture Recognition:**

- OpenCV captures real-time video for hand gesture detection.

**2. Cursor Control Mapping:**

- PyAutoGUI maps recognized gestures to cursor movement.

**3. User Interaction:**

- A user study evaluates system performance and usability.

**4. Implementation:**

- Using Python, OpenCV, and PyAutoGUI on Windows for testing.

**5. Documentation:**

- Comprehensive documentation details hardware, software, and processes.

## 4.6 Feature of New System

**Gesture Recognition:**

- Utilizes OpenCV for real-time video input and hand gesture detection.
- Implements efficient algorithms for accurate and responsive gesture recognition.

**Cursor Control Mapping:**

- PyAutoGUI enables the mapping of recognized gestures to cursor movement on the computer screen.
- Offers customizable settings for users to tailor gesture-to-cursor mapping based on preferences.

**User Study and Feedback:**

- Conducts a user study to evaluate system performance and usability.
- Incorporates iterative user feedback for continuous system improvement.

**Platform and Technology:**

- Implemented on the Windows platform using Python 3.x, OpenCV 4.x, and PyAutoGUI.
- Ensures seamless integration with the latest advancements in Python and computer vision technologies.

**Inclusivity and Accessibility:**

- Provides a natural and hands-free approach to computer interaction, particularly beneficial for users with physical disabilities.
- Incorporates accessibility features, such as customizable gesture commands, to cater to diverse user needs.

**Documentation:**

- Comprehensive documentation outlines hardware, software, and the testing/implementation processes.
- Includes user-friendly guides and troubleshooting resources for easy system comprehension.

# CHAPTER – 5

# SYSTEM DESIGN

## 5.1 System Design & Methodology

The project aims to setup for gesture-controlled mouse navigation using a landmark approach typically includes the following components:

1. Camera:The user's hand motions are recorded on video by a high-resolution camera. The camera should be placed such that it can clearly see the user's hand and should be able to take excellent pictures even in dim lighting.
2. Computer: A computer with a fast processor and dedicated graphics card is needed to process the video feed from the camera and perform the necessary computer vision algorithms in real-time. The computer should also have appropriate software installed to analyze the video feed and interpret the hand gestures.
3. Software: Software is required to perform the necessary computer vision algorithms and interpret the hand gestures. This software typically includes modules for image processing, landmark detection, and gesture recognition. Some systems also use machine learning algorithms to improve the accuracy of gesture recognition.
4. Calibration Setup: Before using the system, a calibration setup is required to establish the mapping between hand gestures and cursor movements on the computer screen. The calibration process typically involves having the user perform a series of gestures while the system records their hand movements, allowing the software to learn how to map specific hand gestures to cursor movements.
5. Feedback mechanism: Some systems may provide visual or audio feedback to the user to confirm that their gestures have been correctly interpreted by the system. Overall, the experimental setup for gesture-controlled mouse navigation using a landmark approach requires careful calibration and tuning to ensure accurate and reliable performance. However, with the right hardware and software, this technology offers an exciting new way for users to interact with their computers.

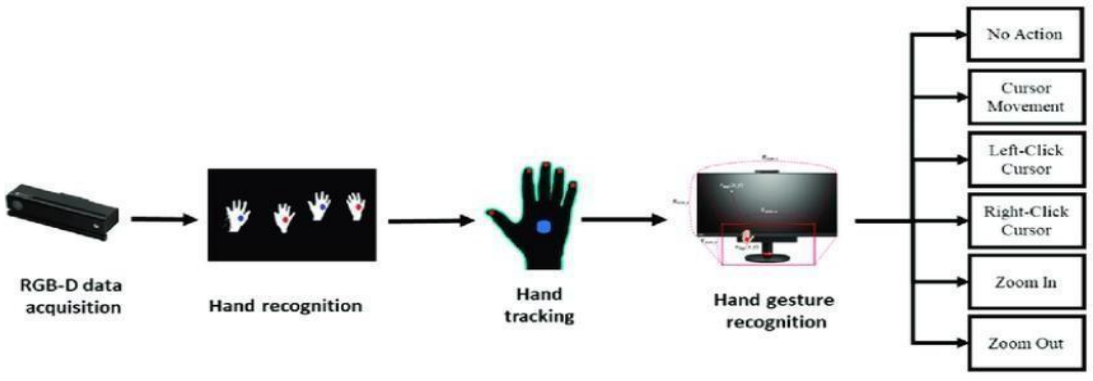



Figure 5.1: Implementation Diagram

## 5.2 Process Design

The algorithm for implementing gesture-controlled mouse navigation using Python typically involves the following steps:

The K-Nearest Neighbor (KNN) algorithm is a supervised machine-learning algorithm for gesture recognition. KNN is utilized for classification, and each data point's categorization is influenced by the classification of its neighbors. Hand gesture recognition algorithms using machine learning. Decision Trees (DT), K Nearest Neighbors (KNN), and Support Vector Machines (SVM)

1. Preprocessing :

• Capture video feed from the camera

• Apply image processing techniques to extract the user's hand

• Pre-process the hand image to improve landmark detection

2. Landmark Detection :

• Use machine learning algorithms to detect landmarks on the hand

• Extract the position of each landmark on the hand

3. Gesture Recognition :

• Use machine learning algorithms to recognize the gestures made by the user's hand

• Train the algorithm on a dataset of labelled gestures

• Classify the current gesture based on the landmarks detected in step 2

4. Cursor Movement :

• Map specific gestures to specific cursor movements on the computer screen

• Move the cursor on the screen based on the recognized gesture

5. Calibration :

• Prompt the user to perform specific gestures

• Record the user's hand movements and learn how to map specific hand gestures to cursor movements

• Fine-tune the gesture recognition algorithm based on the calibration results Overall, the algorithm for implementing gesture-controlled mouse navigation using Python involves a combination of image processing, machine learning, and calibration techniques to accurately interpret the user's hand gestures and translate them into cursor movements on the computer screen

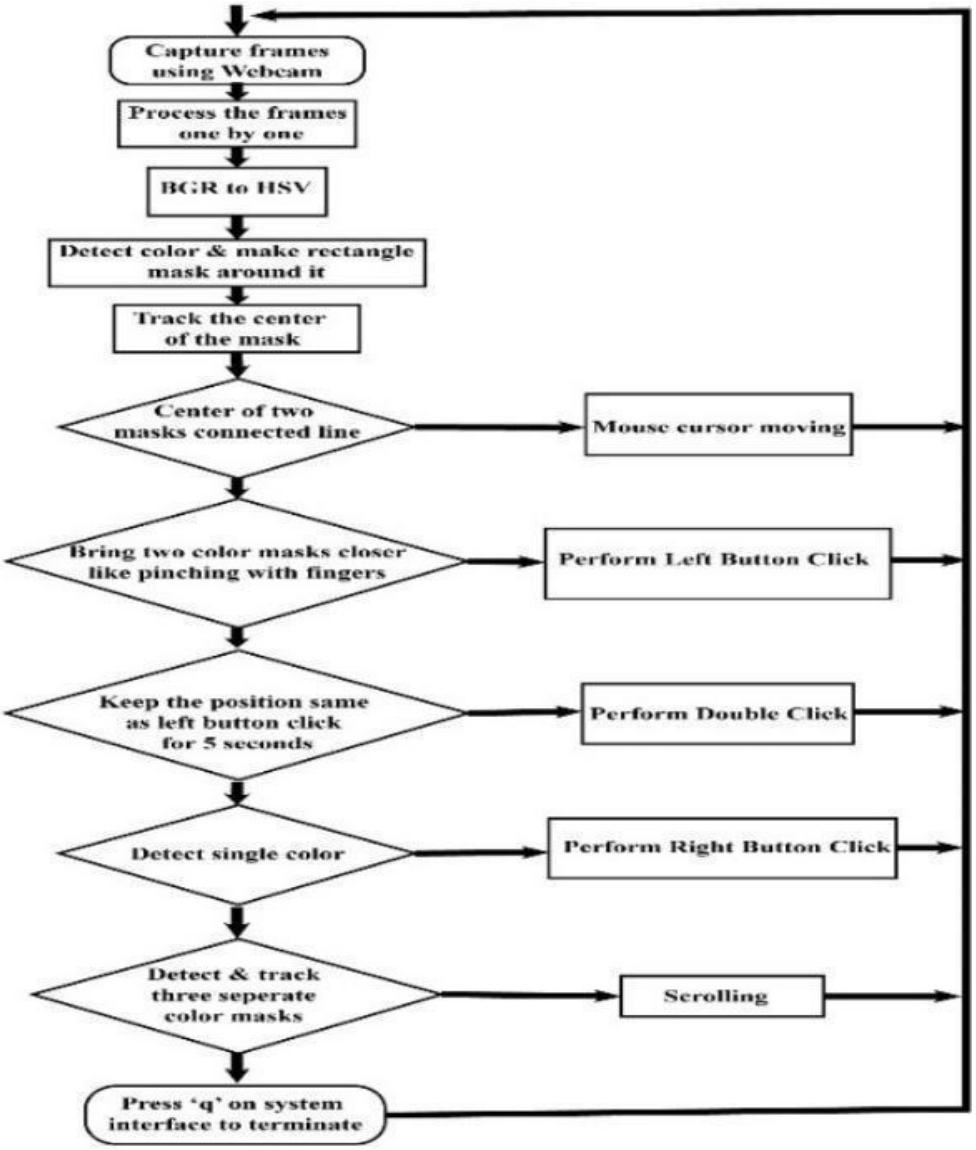



Figure 5.2: Process Design Diagram

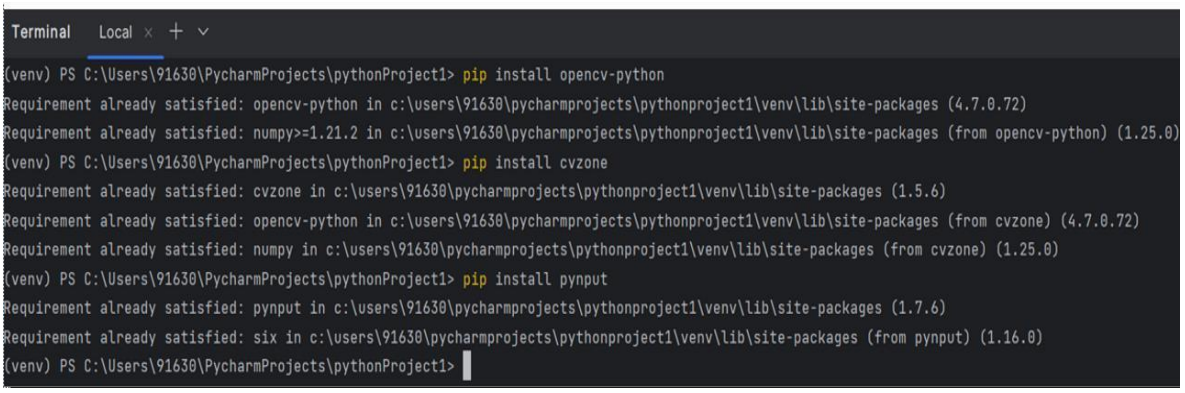
# CHAPTER – 6

# IMPLEMENTATION

## 6.1 Implementation Platform

PyCharm is primarily an integrated development environment (IDE) for Python development, providing a wide range of features to support various Python-related tasks, including video capturing and gesture recognition.

- opencv-python(cv2) - For Video Capturing
- pynput - For monitoring and controlling mouse actions
- cvzone - For detecting hands from captured video




## 6.2 Process

The implementation process involved several stages,

- Importing Required Modules
  - import cv2
  - from cvzone.HandTrackingModule import
  - from pynput.mouse import Button, Controller
- For capturing and resizing Video
  - width, height = 1280, 720
  - cap.set(3,width)
  - cv2.VideoCapture(0)
  - set cap.(4,height)
- For Monitoring & Controlling Mouse
  - mouse = Controller() #creating an object for controlling mouse from pynput package
- For detecting hands from captured video:
- detector = HandDetector(detectionCon=0.8,maxHands=1) #object to detect hands in video

- To display the captured video: while True:
  - ret, frame = cap.read()
  - img = cv2.flip(frame,1) # To display video in original format
  - cv2.imshow('Video',img)

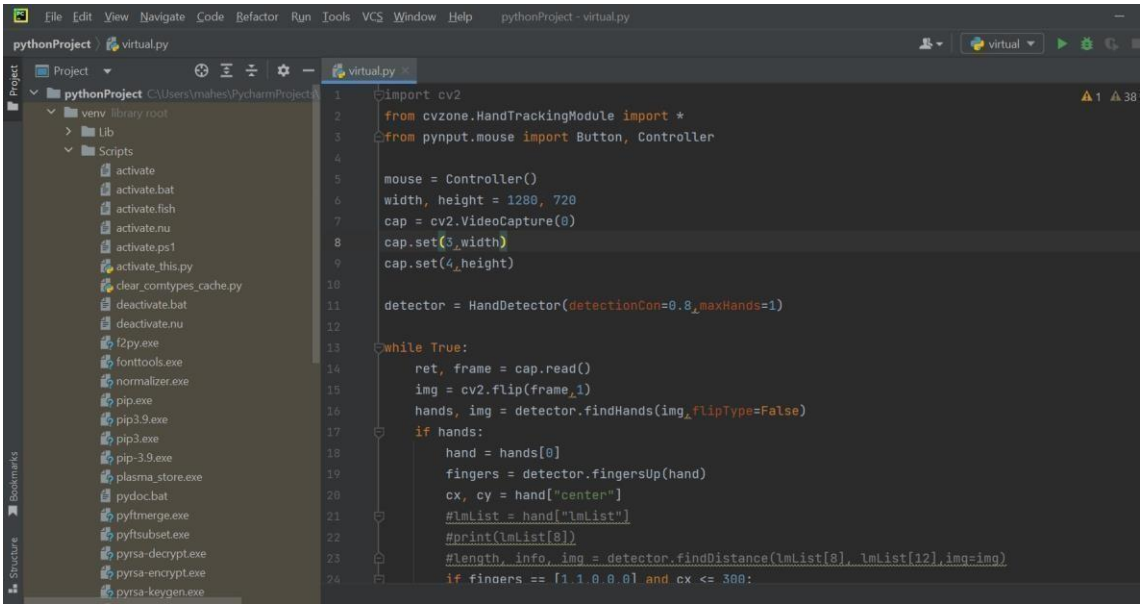



Figure 6.2.1: implementation code

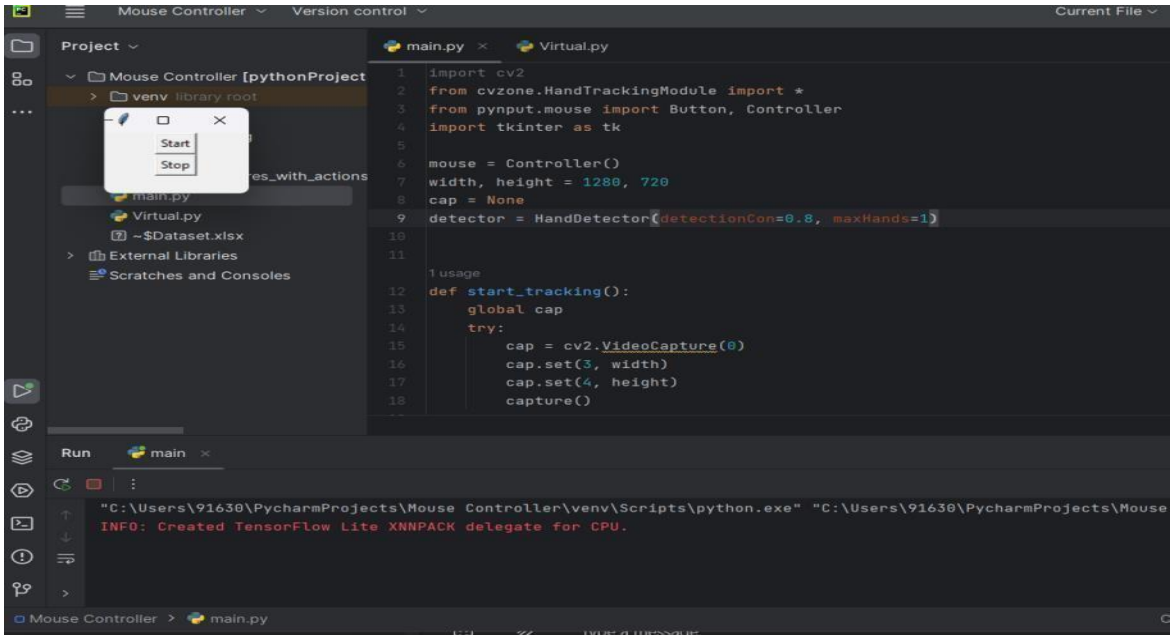



Figure 6.2.2: Start and Stop Option

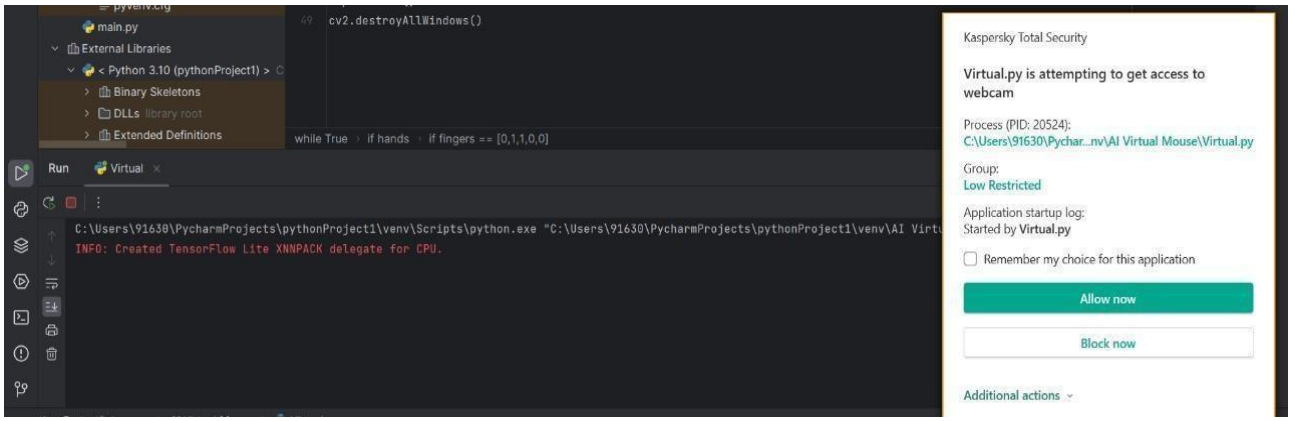



Figure 6.2.3: Granting Permission

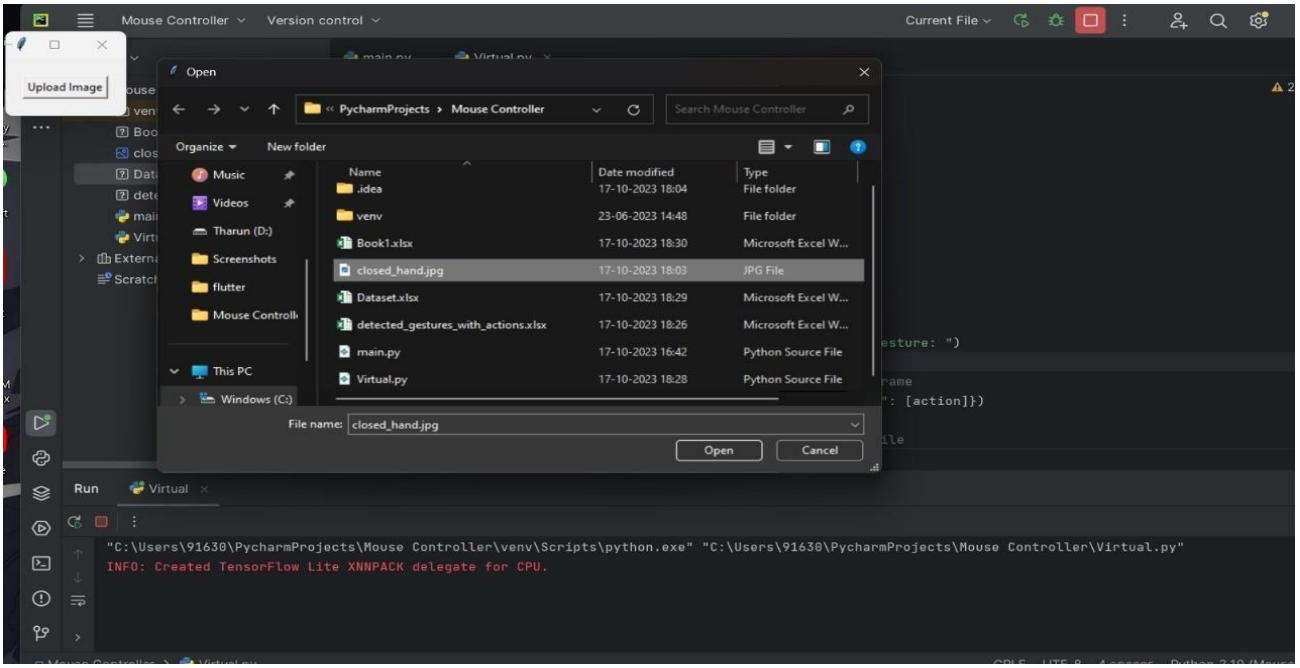



Figure 6.2.4: Uploading The Image

## 6.3 Result

By creating a gesture-controlled mouse system, the project aims to completely transform computer interaction by doing away with the requirement for conventional input devices like cable or wireless peripherals. With the use of webcams as hardware, Python, and computer vision libraries—specifically OpenCV—the system was able to precisely recognize and transform hand motions into equivalent mouse movements. By carefully mapping gestures and optimizing for different illumination, users could easily explore the interface of the system, allowing for natural engagement even in situations when physical touch is not necessary.

The project's success was largely due to ongoing testing and improvement, which guaranteed reliable performance and a positive user experience. Thorough documentation

aided in additional improvements and fostered comprehension, highlighting the project's dedication to accessibility and community participation. In the end, the gesture-controlled mouse system is evidence of the revolutionary possibilities

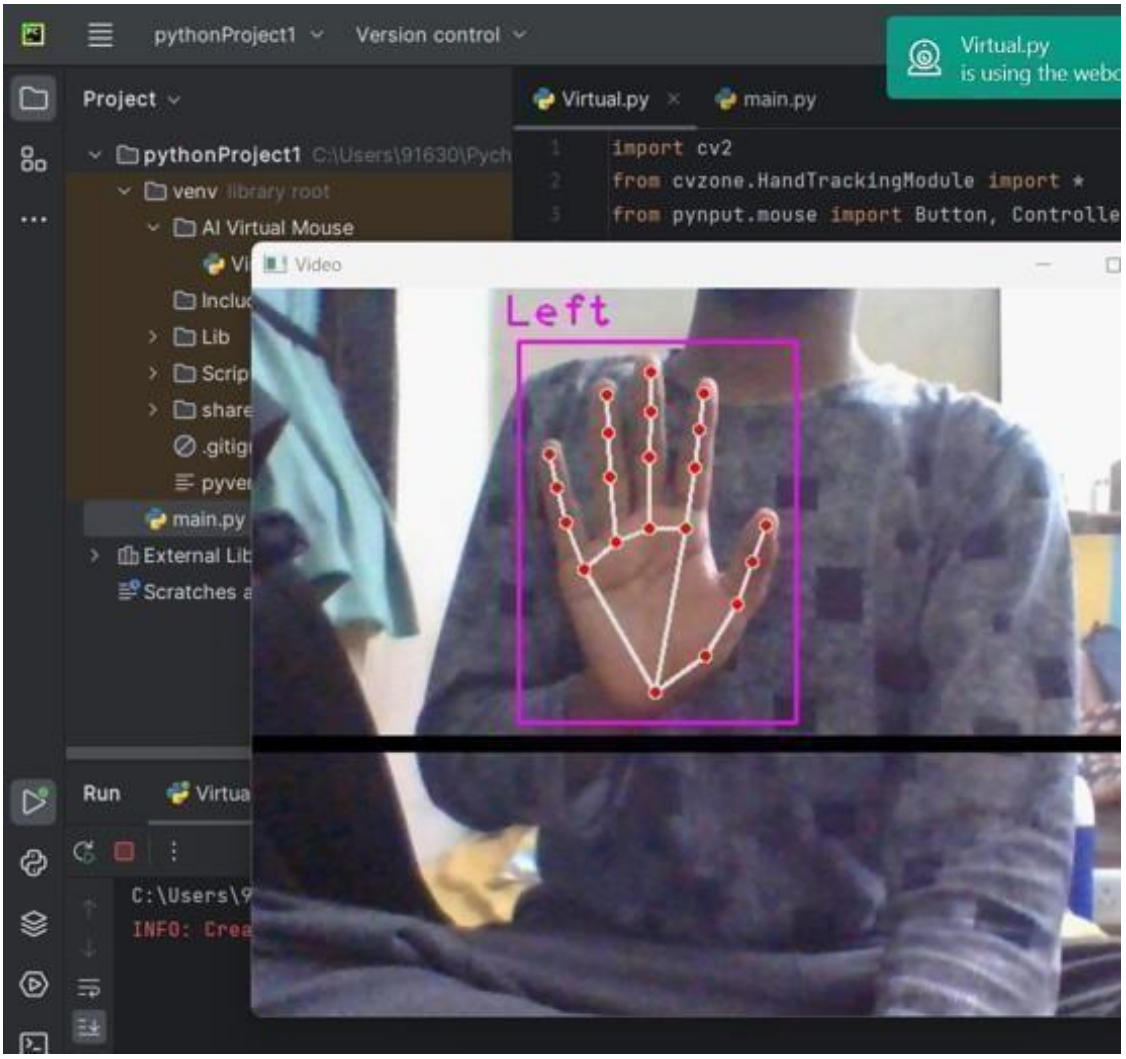



Figure 6.2: Result

# CHAPTER – 7

# TESTING

## 7.1 Test Results and Analysis

The system underwent extensive testing and iteration before it was able to accurately identify and convert hand motions recorded by integrated webcams into equivalent mouse actions. This allowed users to interact with the system's interface without the need for traditional input devices.

Important tests carried out for the project included responses of mapped movements to mouse actions, usability testing to guarantee a seamless user experience, and accuracy assessments of gesture detection in different lighting circumstances. According to these parameters, the system continuously showed strong performance, proving its dependability and efficiency in practical situations. With regard to the future of computing interfaces, the gesture-controlled mouse system, as demonstrated by its revolutionary potential to shape computer vision and Python, is a noteworthy milestone in the field of human-computer interaction search

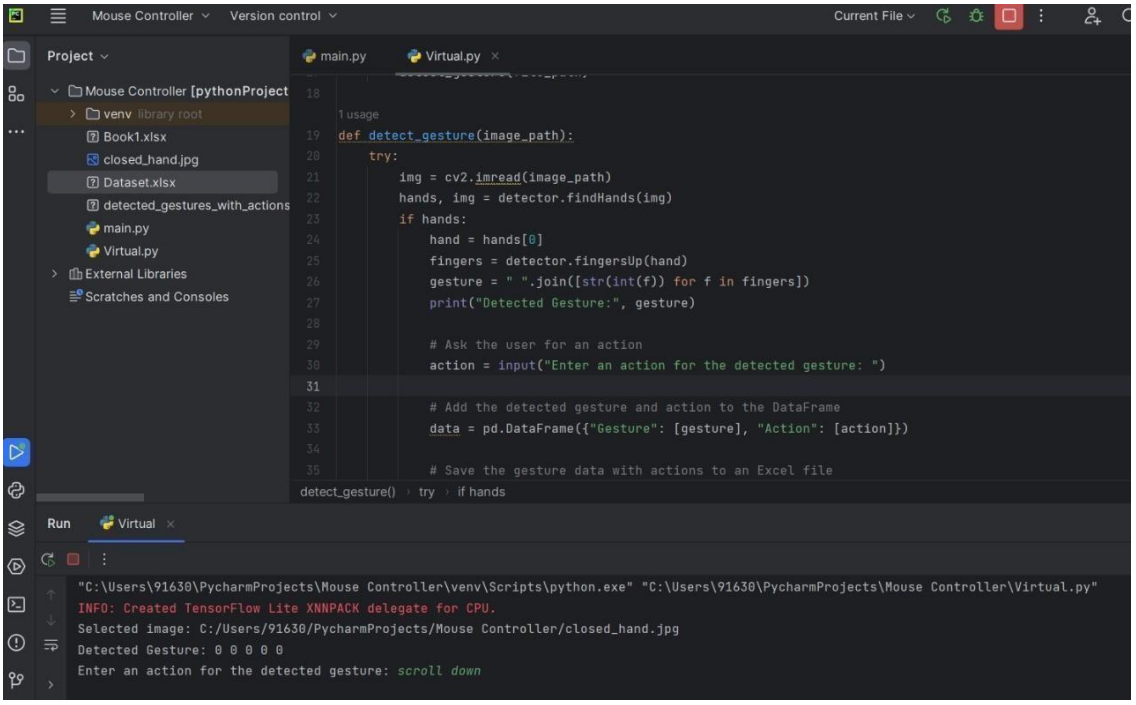
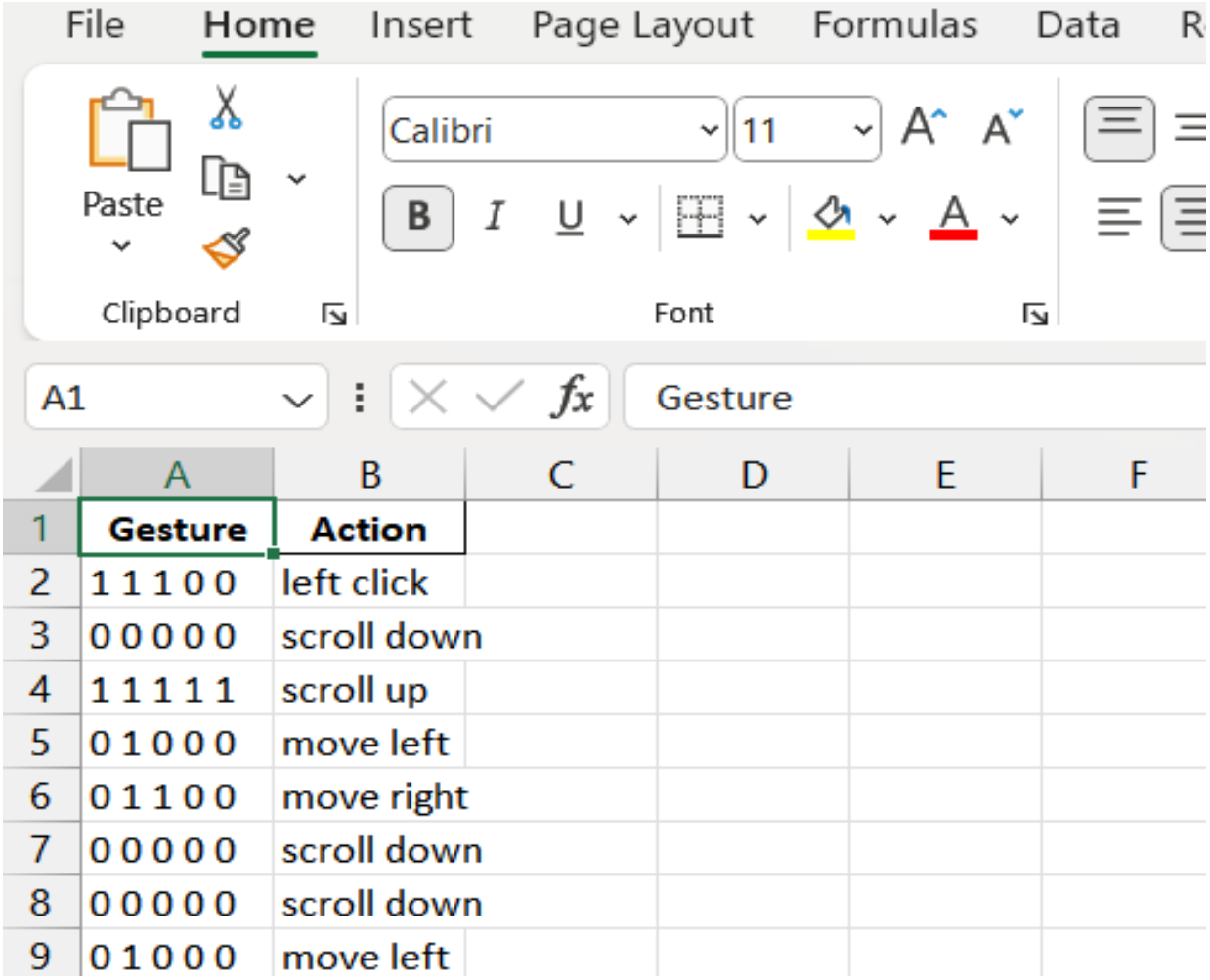



Figure 7.1: Result of Uploading Image




| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| 1 | **Gesture** | **Action** | | | | |
| 2 | 1 1 1 0 0 | left click | | | | |
| 3 | 0 0 0 0 0 | scroll down | | | | |
| 4 | 1 1 1 1 1 | scroll up | | | | |
| 5 | 0 1 0 0 0 | move left | | | | |
| 6 | 0 1 1 0 0 | move right | | | | |
| 7 | 0 0 0 0 0 | scroll down | | | | |
| 8 | 0 0 0 0 0 | scroll down | | | | |
| 9 | 0 1 0 0 0 | move left | | | | |

Figure 7.1: Excel sheet of data Analysis

# CHAPTER – 8

# CONCLUSION AND DISCUSSION

## 8.1 Overall Analysis of Internship

The analysis of internship project reveals several positive aspects. Firstly, the project tackles human- computer interaction (HCI) in a fresh way by exploring hand gestures as an alternative control method. This approach has the potential to enhance accessibility and create a more intuitive user experience.

Secondly, the project demonstrates a practical approach by utilizing well-established Python libraries like OpenCV and Pynput and cvzone. These tools offer readily available functionalities, making the development process more efficient.

Thirdly, the project prioritizes user-centered design. It focuses on usability for both individuals with disabilities and those seeking a more natural interaction with their computers. This demonstrates a commendable commitment to inclusivity and user experience.

Finally, the inclusion of a user study in the project plan showcases a dedication to continuous improvement. By gathering user feedback on performance and usability, the system can be refined to better meet user needs.

However, there's room for further exploration in a few areas. For instance, specifying the hand gestures used for different commands (move, click, scroll) would add clarity to the project. Additionally, mentioning if the system requires calibration for varying hand sizes or lighting conditions would provide valuable insight. Finally, discussing potential future advancements, such as incorporating multi-touch gestures or integrating the system with other applications, could highlight the project's long-term value and possibilities for further development.

In conclusion, this internship project appears to be well-structured with a clear objective of exploring gesture-based computer interaction. The use of established tools and the planned user study suggest a strong foundation for successful development and evaluation. While the abstract doesn't provide details about specific achievements or challenges encountered during the internship, the overall analysis highlights the project's strengths and areas for further exploration.

## 8.2 Summary of Internship / Project work

**Project Summary:** The suggested system’s aim and goal is to take control of the system without utilizing wired or wireless control methods. With the help of hand gestures, this technology enables us to operate the mouse, which in turn can control the system. This is accomplished by giving the user access to a camera that is integrated into the system and which manipulates hand movements and carries out associated tasks.

Creating a gesture-controlled mouse using Python involves leveraging computer vision libraries, selecting appropriate hardware like webcams, defining and mapping gestures, ensuring a smooth user experience, and addressing challenges like lighting conditions. Continuous testing and documentation are crucial for refining the system and making it user-friendly and shareable

**References:**

1. D.L. Quam, “Gesture recognition with a Data Glove,” 10.1109/NAECON.1990.

2. Abhik Banerjee, Abhirup Ghosh, Koustuvmoni Bharadwaj,” Mouse Control using a Web Camera based on Color Detection”,IJCTT, Mar 2014.

3. Angel, Neethu.P.S,”Real Time Static Dynamic Hand Gesture Recognition”, International Journal of Scientific Engineering Research March-2013.

4. Game P. M., Mahajan A.R,”A gestural user interface to Interact with computer system ”, International Journal on Science and Technology (IJSAT) (Jan.- Mar.) 2011.

5. Oudah, Munir, Ali Al-Naji, and Javaan Chahl. ”Hand gesture recognition based on computer vision: a review of techniques.” journal of Imaging 6, no. 8 (2020): 73.

6. Munir Oudah, Ali Al-Naji, and Javaan Chahl (2020) – "Hand Gesture Recognition Based on Computer Vision: A Review of Techniques." Journal of Imaging 6, no. 8 (2020): 73.

7. Bala Krishnan, M. Sridhar, and D. Gopal (2021) – "Hand Gesture-Based Virtual Mouse Using OpenCV." International Journal of Interactive Multimedia and Artificial Intelligence.

8. M. Arulprakash and N. Babu (2022) – "Vision-Based Hand Gesture Recognition for Human-Computer Interaction." International Journal of Advanced Research in Computer Science.

9. P. M. Game and A. R. Mahajan (2017) – "A Gestural User Interface to Interact with Computer Systems." International Journal on Science and Technology (IJSAT).

10. Pavlovic, V. I., Sharma, R., & Huang, T. S. (1997). Visual Interpretation of Hand Gestures for Human-Computer Interaction: A Review. IEEE Transactions on Pattern Analysis and Machine Intelligence, 19(7), 677–695.

11. Abhik Banerjee, Abhirup Ghosh, and Koustuvmoni Bharadwaj (2016) – "Mouse Control Using a Web Camera Based on Color Detection." International Journal of Computer Trends and Technology (IJCTT).

12. D. L. Quam (1990) – "Gesture Recognition with a Data Glove." NAECON Conference Proceedings.