A PROJECT REPORT

on

"AI VIRTUAL MOUSE"

Submitted to

KIIT Deemed to be University

In Partial Fulfillment of the Requirement for the Award of

BACHELOR'S DEGREE IN

COMPUTER SCIENCE ENGINEERING

BY

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UNDER THE GUIDANCE OF

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KALINGA INSTITUTE OF INDUSTRIAL TECHNOLOGY

BHUBANESWAR, ODISHA - 751024

May 2023

KIIT Deemed to be University

School of Computer Engineering
Bhubaneswar, ODISHA 751024

CERTIFICATE

This is certify that the project entitled

“AI VIRTUAL MOUSE“

submitted by

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is a record of bonafide work carried out by them, in the partial fulfillment of the requirement for the award of Degree of Bachelor of Engineering (Computer Sci-ence & Engineering OR Information Technology) at KIIT Deemed to be university, Bhubaneswar. This work is done during the year 2022-2023, under our guidance.

Date: 28/04/2023

(Dr. Suchismita Rout)
Project Guide

ACKNOWLEDGEMENTS

We are profoundly grateful to **Dr. Suchismita Rout** of **Affiliation** for her expert guidance and continuous encouragement throughout to see that this project meets its target since its commencement to its completion.

SHIVANSH SINGH

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ABSTRACT

With the development of technologies in the areas of augmented reality and devices that we use in our daily life, AI devices are becoming compact in the form of Bluetooth or wireless technologies. This project develops an AI virtual mouse system that makes use of the hand gestures and hand tip detection for performing mouse functions in the computer using computer vision.This initiative supports a method of human-computer interaction (HCL). We employ a real-time camera to control the mouse function.Our suggested technology is a hand gesture-based system that allows users to control desktop mouse movements with their hands.Our method uses a desktop webcam to identify hand gesture movements. The idea is to utilize a basic camera or webcam to operate mouse cursor operations rather than a typical or standard device. The Virtual Mouse bridges the gap between the user and the machine by utilizing merely a camera. It allows the user to interface with a machine without the need of any mechanical or physical devices, and it even allows the user to control mouse functionalities.The project's domain is AI/ML.Python is used in projects.This artificial intelligence virtual mouse project is built on the notion of computer vision.

KeyWords: Autopy, Mediapipe, Numpy, OpenCV-Python

CONTENTS

Chapter 1

Introduction

The AI Virtual Mouse project is a computer vision-based project that aims to provide an alternative to traditional computer mouse interfaces.It is a cutting-edge technology that utilizes artificial intelligence (AI) algorithms to create a virtual mouse that can be controlled using hand gestures and movements and translate them into computer commands. This technology eliminates the need for a physical mouse, which can be particularly beneficial for individuals who have difficulty using traditional mouse and keyboard interfaces or mobility issues or disabilities.

This project aims to provide a more natural and intuitive way of interacting with computers and other digital devices. The project involves developing a system that can detect hand gestures using a camera and then using AI algorithms to interpret those gestures and translate them into cursor movements on the screen. This technology has the potential to revolutionize the way people interact with computers, making it easier and more accessible for everyone.

In this project report, we will provide a detailed overview of the AI Virtual Mouse project, including its objectives, methodology, and results. We will also discuss the potential applications of this technology, as well as its limitations and future directions for further research and development.

Chapter 2

Basic Concepts/ Literature Review

The main objective of the AI virtual mouse system is to develop alternate to the regular and ancient mouse system to perform and management the mouse functions, and this could be achieved with the help of an interior net camera that captures the hand gestures and hand tip then processes these frames to perform the particular mouse performs like left click, right click, and scrolling perform.
We made this AI virtual mouse using the following tools like autopy, numpy, opencv-python and mediapipe.

2.1 AUTOPY

AutoPy is a simple, cross-platform GUI automation library for python. It includes functions for controlling the keyboard and mouse, finding colors and bitmaps on-screen and displaying alerts.

2.2 NUMPY

NumPy is the fundamental package required for scientific calculation in python. NumPy offers comprehensive mathematical functions, random number generators, linear algebra routines. It is used for performing a wide variety of mathematical operations on arrays.

2.3 OPENCV-PYTHON

OpenCv library built in python programming language aids in the creation of computer vision applications. It is utilized in the processing of images and videos as well as in analysis tasks like hand gesture detection, face recognition and object detection.

2.4 MEDIAPIPE

The MediaPipe framework is used by the developer to create and analyze systems using graphs as well as to create systems for application related purposes. It helps to detect the landmarks of the hands in an image using the Hand Landmakrer task to localize the key points of the hands and render visual effects over the hands

Chapter 3

Problem Statement / Requirement Specifications

With the development of technologies in the areas of augmented reality and devices that we use in our daily life, these devices are becoming compact in the form of Bluetooth or wireless technologies. This project develops an AI virtual mouse system that makes use of the hand gestures and hand tip detection for performing mouse functions in the computer
using computer vision.

3.1 Project Planning

1. **Define the objective:** The primary objective of AI virtual mouse is to help people with physical disabilities to use computers or to provide an alternative to traditional computer mouse

2. **Research existing solutions:** Conduct research on existing AI virtual mouse solutions to understand the technology and identify any potential gaps or shortcomings.

3. **Determine the features and functionalities:** identification of different features and functionalities of the mouse like hand tracking,cursor movement,simulation according to hand gestures.

4. **Select the technology:** The technology used in this project is libraries of python like autopy, mediapy, numpy, cv2, OpenCV

5. Develop the prototype: Develop a basic prototype of your AI virtual mouse to test and evaluate its performance.Like getting camera access using openCV,hand tracking methods.

6. **Test and iterate**: Test your prototype, collect feedback, and iterate to improve the functionality and performance of your AI virtual mouse.

7. **Design the user interface:** Create an intuitive and easy-to-use user interface for your AI virtual mouse.

8. **Design the user interface:** Create an intuitive and easy-to-use user interface for your AI virtual mouse.

9. **Develop the final product:** Based on the feedback and testing, develop the final version of your AI virtual mouse and ensure its compatibility with various operating systems.

10. **Deploy the product:** Launch your AI virtual mouse, deploy it so that many other users can get access to it.

3.2 Project Analysis

The project's scope involves the creation of an artificial intelligence virtual mouse that employs natural language processing, machine learning, and computer vision to give accurate and precise control of the computer cursor.

Project deliverables include a functioning prototype of the AI virtual mouse, an intuitive and easy-to-use user interface, and documentation of the development process.

3.3 System Design

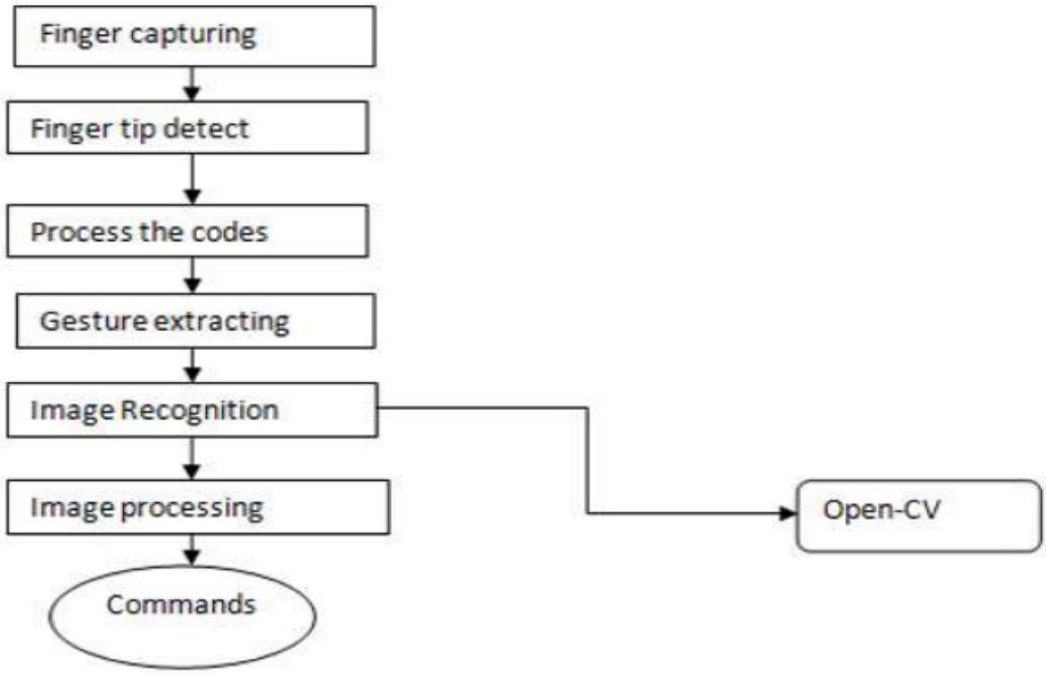
3.3.1 Design Constraints

- **Compatibility:** The AI virtual mouse should work with a variety of operating systems and computer hardware combinations.
- **Ease of use:** The AI virtual mouse's user interface should be intuitive and simple to operate, especially for persons with physical limitations.
- **Accuracy and precision:** To guarantee that users can accomplish activities effectively, the AI virtual mouse must enable accurate and exact control of the computer pointer.
- **Response time:** The AI virtual mouse's response time should be swift and constant to avoid delays or lag in pointer movements.
- **Accessibility:** The AI virtual mouse should be built to accommodate users of varying physical abilities and limitations.
- **Security:** The AI virtual mouse must be secure in order to keep user data safe,that is only authenticated users should have access to the ai mouse

Chapter 4

Implementation

4.1 Methodology OR Proposal

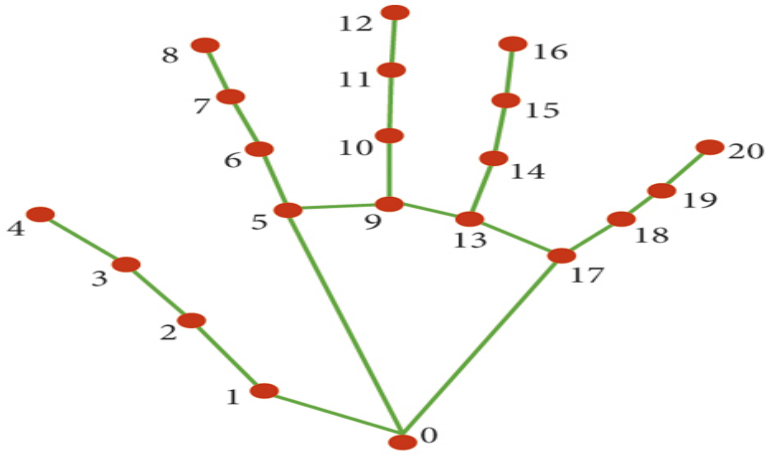


- Open-CV is a python vision library that contains Associate in the organized AI virtual mouse system depending upon the edges that are gotten by the camera in Associate in nursing passing PC. Pictures can be conveyed in Vol-9 Issue-1 2023 IJARIIE-ISSN(O)-2395-4396 19200 ijariie.com 1340 concealing layered with 3 channels , Grayscale with pixel values fluctuating from 0 (dull) to 255 (white), and twofold portraying dim or white characteristics (0 or 1) specifically.

- Initializing the VideoCapture object by passing in the camera index. In this case, 0 is passed as the camera index, which is the default camera on most systems.

- The while loop runs continuously, and in each iteration, it reads the next frame from the camera using the read() method of the VideoCapture object. This method returns two values: a boolean success that indicates whether the frame was successfully captured, and the img object which represents the captured frame.

- The AI virtual mouse framework utilizes the instructive algorithmic rule, and it changes over the coordinates of tip from the camera screen to the pc window full screen for the mouse. Whenever the hands unit saw and keeping in mind that we've missing to see that finger is up for topic the specific mouse perform, Associate in Nursing rectangular box is attracted concerning the pc window at ranges the camera locale any spot we've a penchant to will every now and again move all through the window plan the mouse pointer.



0. WRIST
1. THUMB_CMC
2. THUMB_MCP
3. THUMB_IP
4. THUMB_TIP
5. INDEX_FINGER_MCP
6. INDEX_FINGER_PIP
7. INDEX_FINGER_DIP
8. INDEX_FINGER_TIP
9. MIDDLE_FINGER_MCP
10. MIDDLE_FINGER_PIP
11. MIDDLE_FINGER_DIP
12. MIDDLE_FINGER_TIP
13. RING_FINGER_MCP
14. RING_FINGER_PIP
15. RING_FINGER_DIP
16. RING_FINGER_TIP
17. PINKY_MCP
18. PINKY_PIP
19. PINKY_DIP
20. PINKY_TIP

- The imshow() method is used to display the captured image in a window titled "Image". The waitKey() method waits for a key event for a specified amount of time (in milliseconds). In this case, it waits for 1 millisecond. The loop then continues to the next iteration and reads the next frame. The loop runs indefinitely until the user closes the window or the program is terminated manually.
- The code mpHands = mp.solutions.hands imports the hands module from the mediapipe library, which is a popular computer vision library used for various tasks such as object detection, facial

recognition, and hand tracking. The code hands = mpHands.Hands()creates an instance of the Hands class from the mpHand module.The Hands class is a pre-trained machine learning model for detecting and tracking hand landmarks in images and videos. The model uses a set of 21 key points to represent the hand and fingers, which can be used for various applications such as gesture recognition and virtual reality hand tracking.By creating an instance of the Hands class, we can use the pre-trained hand detection model to process image frames and obtain the landmarks of hands present

4.2 Result Analysis OR Screenshots

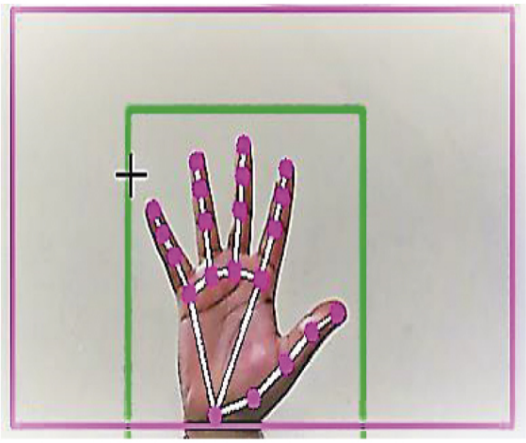


Fig1: Hand tracking module detecting human hand

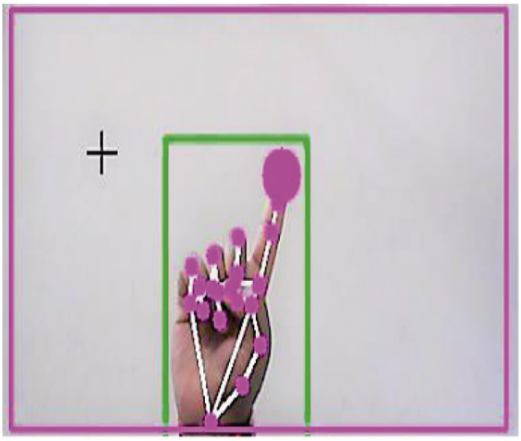


Fig2: Hand tracking module detecting how many fingers are up

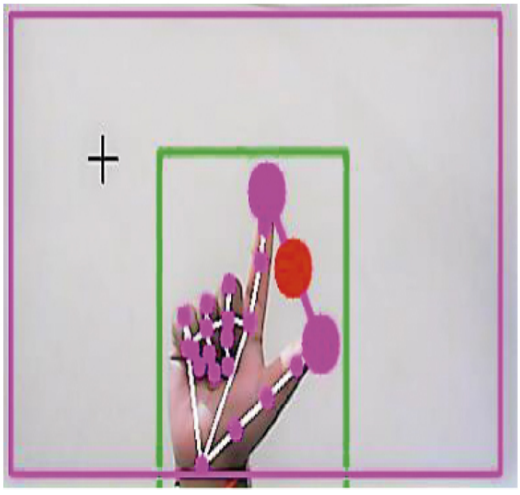


Fig3: Hand tracking module measuring distance between two hands

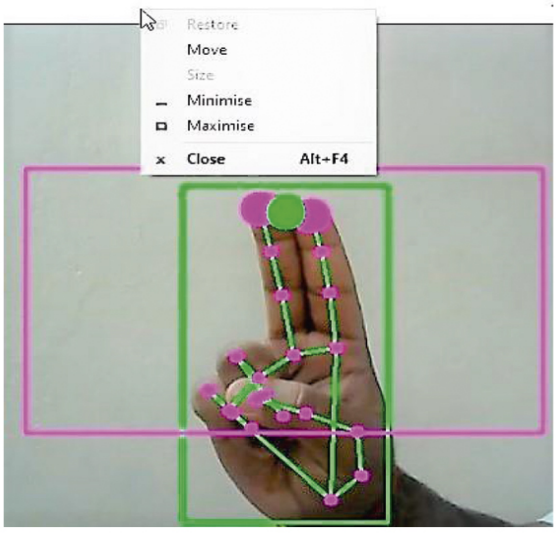


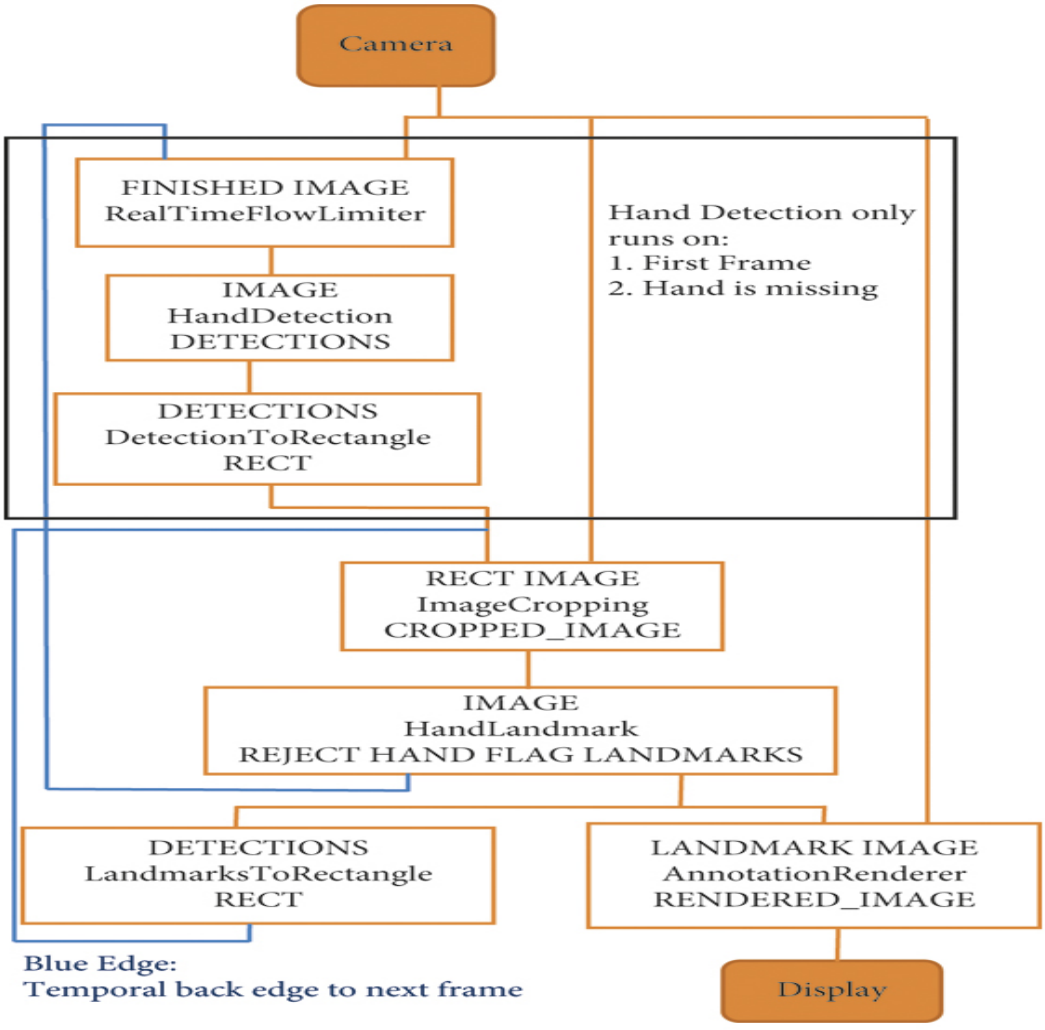
Fig4: AI virtual mouse performing click operation

Chapter 5

Standards Adopted

5.1 Design Standards

This project does not use any kind of database to store the data as it works with a real time environment.



However the design module and the steps may be formulated as below : The hand is recognised using the background subtraction approach, and the outcome is converted to a binary image. Then, to make it easier to recognise the fingers, the palm and fingers are segmented. The fingers are additionally recognised and detected. Lastly, a straightforward rule classifier is used to identify hand gestures.

Following are the main modules in the system design:

Camera component: The built-in camera on a laptop or the webcam on a computer are the frames that the system uses to operate. The system will capture webcam video in real-time by establishing the video capture object. The device index for this system would be "0" in order to employ a single camera.Additional camera device indexes could be added with 1, 2, and so forth. The system will get frame-by-frame data from this camera.

Module for Capturing: Using an infinite loop, the webcam records every frame up until the program's end. The real-time video's frames are converted from BGR to HSV color space.

Module for color detection and masking: In the suggested approach, color detection is carried out by identifying color pixels on the user's fingertips using color caps from webcam frames. This is the first and most important stage in the suggested system. A grayscale image will result from this step, with the color cap's intensity being different from the remainder of the image's intensity.

5.2 Coding Standards

5.2.1 Naming Conventions: In this project, we followed the standard naming conventions recommended by the Python community. All variables. functions. and modules were named using lowercase letters,separated by underscores, with descriptive names that reflect their purpose. Class names were written in CamelCase.

***5*.2.2 Comments:** To ensure that the code is readable and understandable,comments were added to the code. Comments were used to explain the purpose of the code. the logic behind it, and any limitation or assumption made.Commenting is important to help other developers understand the code and make modifications if necessary.

5.2.3 **Error Handling:**Proper error handling was implemented in the code to ensure that the program doesn't crash in case of unexpected inputs or errors.

5.2.4 Modularity : Modularity is a key aspect of software development that allows developers to create reusable code

Chapter 6

Conclusion and Future Scope

6.1 Conclusion

The primary goal of the AI virtual mouse system is to operate mouse cursor functionalities with hand gestures rather than a hardware mouse. The suggested system may be realized by employing a webcam or an in-built camera that recognises hand motions and hand tips and analyses these frames to perform the specific mouse tasks. Based on the model's findings, we can conclude that the suggested AI virtual mouse system worked extremely well and has more accuracy than current models, and that the model solves most of the constraints of existing systems. Because the suggested model is more accurate, the AI virtual mouse may be employed in real-world applications.Because the suggested mouse technology may be operated remotely using hand gestures rather than the typical physical mouse, it can be utilized to minimize the spread of COVID-19. The model has various limitations, such as a little loss in precision in the right click mouse function and some issues in selecting text by clicking and dragging. As a result, we will aim to solve these restrictions in the near future by upgrading the fingertip identification algorithm to give more accurate results.

6.2 Future Scope

- **Improving accuracy and responsiveness**: Virtual mouse are expected to become more accurate and responsive, making them more user-friendly for individuals with disabilities or those who prefer a more natural way of interacting with computers.

- **Integration with other devices:** Virtual mouse could be integrated with other devices, such as smartphones or smart home devices, making them even convenient to use.

- **Virtual and augmented reality :** Technologies become more widely available, virtual mice could be used to interact with virtual environments and objects, creating a more immersive experience.

- **Healthcare:** Virtual mouse could be used in healthcare settings to improve accessibility and usability for people with disabilities or limited mobility, allowing them to interact more easily with medical equipment and devices.

- **Ergonomics** : Some people may choose to use a virtual mouse to alleviate hand or wrist strain caused by prolonged usage of traditional physical mice.

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INDIVIDUAL CONTRIBUTION REPORT

AI VIRTUAL MOUSE USING MACHINE LEARNING

ANUDARSHI DUTTA
2005789

Abstract: An AI virtual mouse is a software programme that simulates the behavior of a computer mouse using artificial intelligence algorithms. It allows users to interact with a computer without the need of physical input devices like a mouse or a touchpad. Using a camera or other sensors, the AI virtual mouse can monitor hand movements and gestures, interpret them as mouse movements, and translate them into computer commands. This technology has the potential to change the way people interact with computers, especially for individuals who have disabilities or mobility issues.

Individual contribution and findings: In this project I contributed in coding as well as in the documentation. My task was to code the AI virtual mouse module along with installing the dependencies involved in it such as media-pipe,also to find references explaining the throughout process of all the functions like implementation of tensorflow, mapping hand coordinates with that of mouse pointers.

Individual contribution to project report preparation: In report contributing I helped in documenting the problem statement requirement analysis and implementation module.

Individual contribution for project presentation and demonstration: In project presentation I explained about the future scope and applications of our project and also helped in running the modules in the environment to showcase the working of smooth movements of the mouse cursor with respect to the hand gestures.

Full Signature of Supervisor

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Full signature of the student:

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INDIVIDUAL CONTRIBUTION REPORT

AI VIRTUAL MOUSE USING MACHINE LEARNING

ADITI SINHA
20051123

Abstract: An AI virtual mouse is a software programme that simulates the behavior of a computer mouse using artificial intelligence algorithms. It allows users to interact with a computer without the need of physical input devices like a mouse or a touchpad. Using a camera or other sensors, the AI virtual mouse can monitor hand movements and gestures, interpret them as mouse movements, and translate them into computer commands. This technology has the potential to change the way people interact with computers, especially for individuals who have disabilities or mobility issues.

Individual contribution and findings: In this project my contribution is in the coding as well as in the documentation. My work was in the coding part of the hand tracking module, and looking after the hand detection, finding coordinates, click operations,smooth working of the code.I also found references related to the processes in the project.

Individual contribution to project report preparation: In report contribution I helped in documenting the Introduction, basic concepts, literature review along with the result analysis and screenshots.

Individual contribution for project presentation and demonstration: In project presentation I explained the introduction and the concept of our project, along with a brief description on its potential uses and needs in today's world and gave a quick look through the benefits and limitations.I also helped in understanding the details of the hand tracking module, and how it detects and tracks our hands gestures and work accordingly.

Full Signature of Supervisor

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Full signature of the student:

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INDIVIDUAL CONTRIBUTION REPORT

AI VIRTUAL MOUSE USING MACHINE LEARNING

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Individual contribution and findings: In this project, I contributed in both the coding and documentation part. In the coding part, I helped in designing the hand tracking module. It captures the image of the hand gestures, finds the coordinates, and moves the cursor according to the gestures captured. Also, I helped in the installation of all the required tools for the smooth running of this project.

Individual contribution to project report preparation: In the project report preparation, I helped in editing the overall report which includes the proper fonts, sizes and also the literature review part and the design coding standards.

Individual contribution for project presentation and demonstration: In project presentation I explained about the benefits and applicable areas of our project and also helped in explaining the report, how things are implemented in our project.

Full Signature of Supervisor

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Full signature of the student:

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INDIVIDUAL CONTRIBUTION REPORT

AI VIRTUAL MOUSE USING MACHINE LEARNING

SHIVANSH SINGH
20051170

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Individual contribution and findings: In this project I contributed in coding as well as in the documentation of the Working of the algorithm, different libraries, literature review along with the result analysis and screenshots and overall idea of the project including the working of the code , and my task was to code the HandTracking Module along with installing the dependencies .

Individual contribution to project report preparation: In report contributing I helped in documenting the Working of the modules and implementation of modules and future scopes.

Individual contribution for project presentation and demonstration: In project presentation I explained working and applications of our project and also helped in running the modules in the environment to showcase the working of smooth movements of the mouse cursor with respect to the hand gestures.

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AI VIRTUAL MOUSE

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