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AI Based Video Processing using OO

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Abstract: *The increase in digital video material has increased the requirement for efficient video processing methods. Conventional techniques of video processing are sometimes time-consuming and reliant on substantial user intervention, resulting in decreased efficiency and precision. Video processing based on Artificial Intelligence (AI) is developing as a feasible alternative to conventional approaches. In this study, we investigate the application of Object-Oriented AI concepts to video processing. Our method utilizes object identification and recognition algorithms based on deep learning to recognize and track objects in video streams. In addition, we illustrate the efficacy of our method by applying it to a variety of actual video processing settings*

Keywords: Artificial Intelligence

I. INTRODUCTION

AI-based video processing uses object-oriented programming (OOP) to analyze and manipulate video data. OOP represents real-world items as software objects with properties and actions, and AI algorithms identify, recognize, and track video objects using computer vision and machine learning. Developers can design faster and more accurate video processing apps using AI and OOP, such as video surveillance, editing, and VR. AI systems can spot suspicious activity or persons in a crowd, detect, and eliminate cables and microphone booms in video editing, and generate lifelike avatars and settings in virtual reality. AI-based video processing allows developers to design complex video processing programmes that automatically discover, recognize, and track objects in video data.

Case Study:

In this we are taking the application called an AI-based virtual mouse that lets users move the cursor on their computer by making hand gestures. It is a technology for recognizing hand gestures. It uses computer vision algorithms to track and understand how the user's hand moves. In this, we will talk about how object-oriented programming (OOP) principles were used to design and build an AI-based virtual mouse.

Design of application:

- For designing the AI Based Virtual mouse the modules are;
- Hand tracking module
- Gesture recognition module
- Cursor control module
- User interface module

Hand tracking module: This module uses computer vision algorithms to follow the user's hand as it moves. It can track the hand's position, orientation, and speed in real time.

Gesture recognition module: This module looks at the hand movements that have been tracked and figures out what the user meant to do. It uses algorithms for machine learning to classify the gestures and map them to movements of the cursor.

Cursor control module: This module takes the information from the gesture recognition module and turns it into movements for the cursor. It makes clicks and drags look like they came from the mouse.

User interface module: This module gives the user a way to interact with the virtual mouse through a graphical user interface (GUI). It shows how the cursor moves and lets the user set preferences and calibrate the system.

Implementation:

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To implement this application, we are using the concept of object-oriented principles like,
Define classes for each module: For each module, we make a class that holds the data and functions of that module. Every class has ways to talk to the other classes.
Implement inheritance: We set up relationships between classes by letting them inherit from each other.
Example, the gesture recognition module is based on the hand tracking module because it needs to know where the hand is.
Encapsulation: We use encapsulation to hide the details of how each module is put together. This makes sure that each module can be changed separately from the others.
Polymorphism: Polymorphism is used, so that each module can act differently based on the data it receives.
For example, the cursor control module can act like a left-click or a right-click depending on what the gesture recognition module sees.
Set up the user interface: To make a user interface for the virtual mouse, we use a GUI library. The user interface has a canvas to show where the cursor is moving and buttons to set preferences and calibrate the system.

CLASSES

Here are some possible classes that could be involved in a virtual mouse using artificial intelligence:
User class: user profiles such as "beginner," "intermediate," or "advanced" which could adjust the sensitivity or other features of the mouse to better suit the user's abilities or preferences.
Algorithm Class: This class would define a machine learning algorithm that is used to train the virtual mouse to perform certain actions, such as moving the cursor or clicking a button. The class would have methods for initializing the network, propagating signals through the network, and adjusting the weights based on training data.
Sensor Class: This class would represent the input sensors used by the virtual mouse, such as a camera or touchpad, and would have methods for reading and interpreting the sensor data.
Action Class: This class would represent the output actions performed by the virtual mouse, such as moving the cursor or clicking a button, and would have methods for executing the action and reporting its success or failure.

TEST CASES

Test case_ID	Pre-condition	Post condition	Output
TC-1	Invoking camera and check whether we are able to capture live video	Camera detected and live video capturing	Pass
TC-2	Camera detecting the hand	Hand detected	Pass
TC-3	Detection of multiple hands	Multiple hands detected	pass
TC-4	Moment of cursor	Cursor moves	pass
TC-5	Selecting a file	At times selected file is not opened properly	Fail

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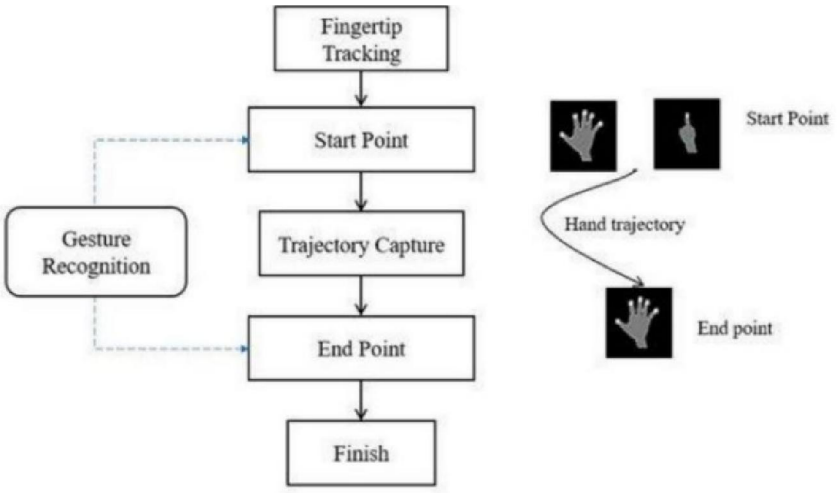

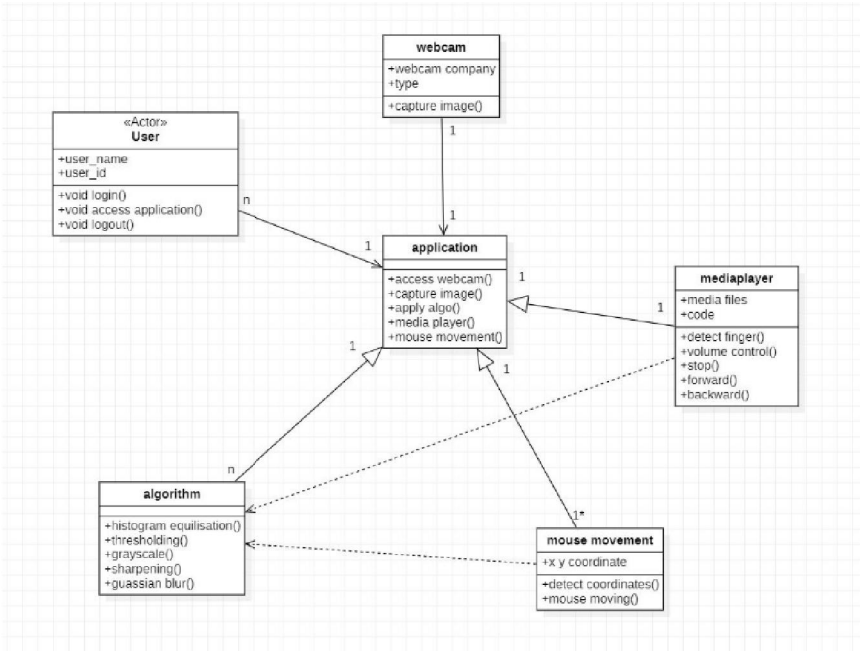

II. FINDINGS AND DISCUSSIONS

There is a connection between the user class, the algorithm class, the sensor class, and the action class in a virtual mouse.

The user class gives information about the user, such as their level of experience or any special needs they may have. With this info, the user can choose an algorithm and sensor class that will work best for them.

The algorithm class is made up of the mathematical algorithms that the virtual mouse uses to figure out what the user wants and to move the mouse. Users can choose between different algorithm classes based on their needs and skills.

The sensor class is the type of sensor technology that is used to track what the user does. Optical sensors, laser sensors, and touchpads are all examples of different types of sensors. The user can choose the sensor class based on the type of device the virtual mouse is running on and their own needs.

The action class describes the different things that the virtual mouse can do, like left-click, right-click, scroll, and so on. Different action classes can be given to different user actions, like moving the mouse or pressing a button.

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III. CONCLUSION

In this research, we describe a framework for AI-based video processing that employs object-oriented programming to detect and identify objects in video streams. Our method utilizes object identification and recognition algorithms based on deep learning to recognize and track objects in video streams. We showed the efficacy of our strategy by applying it to a variety of actual video processing settings. Our technology offers various advantages over conventional methods of video processing, including enhanced efficiency and precision. Future research may investigate the application of our system to additional video processing applications, such as action identification and event detection.

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