Virtual Mouse

AI Model Development

Time: 60 mins

Introduction

In this class, the student/s will learn to control the movements of the mouse pointer on your screen using hand gestures.

New Commands Introduced

- pyautogui.size()   Finds the screen size

- np.interp()   Estimates data points between two data points

- pyautogui.moveTo(x, y)   Moves the cursor to a coordinate

- cv2.circle(img, x, y, radius, color, width)   Draws a circle at (x, y) coordinates of specified radius, color and width

- cv2.line(img, starting coordinate, ending coordinate, color, thickness)   Finds the hands in the given frame

- pyautogui.scroll()   Adds a mouse scroll upwards for positive value and scrolls downwards for negative value

Vocabulary

- **Virtual mouse** allows users to interface with machines without the use of mechanical or physical devices, and even control mouse functionalities.
- **Interpolation** is the estimation of unknown data points between two known data points is known as interpolation.

Learning Objectives

Student/s should be able to:
- ***Recall*** how to detect hands and fingers in a camera feed.
- ***Demonstrate*** how to use hands and fingers detection to create a virtual mouse.
- ***Explain*** the concepts of integrating the features to create a virtual mouse.
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Activities

1. **Class Narrative:** *(2 mins)*
   - Brief the student/s about using the hands and fingers detection to create a virtual mouse.

2. **Concept Introduction Activity:** *(5 mins)*
   - Let the student/s play the explore-activity to control the movement of the mouse pointer on your screen using a hand gesture.
   - Using the slides, explain that the student/s will learn:
     - To move the cursor.
     - To click the cursor.
     - To scroll up and down the cursor.

3. **Activity 1: Move the Cursor :** *(12 mins)*

   Teacher Activity: *(6 mins)*.
   - Explain the process of storing the 3D coordinates of specific hand points.
   - Explain how to get the set the camera size using variables and get the screen size using pyautogui.size().
   - Explain the process of mapping the coordinates of virtual mouse pointer to those of mouse pointer using an interpolator.
   - Demonstrate to the student/s how to draw the circle at the current position of the mouse pointer.
   Note: Install the pyautogui library using 'pip install pyautogui'

   Student Activity: *(6 mins)*
   - Guide the student/s to move the cursor with the index finger tip.

4. **Activity 2: Click the Cursor:** *(12 mins)*

   Teacher Activity: *(6 mins)*
   - Explain to the students how to define the finger gesture to depict clicking mouse by bringing the index and middle finger close.
   - Demonstrate detecting the distance between the two fingers if less than 20 then draw the green circle and perform click operation.

   Student Activity: *(6 mins)*
   - Guide the student/s to detect the distance between index and middle finger and perform a click.
     Probing question: How do you find the midpoint of any object?
     Expected answer: We can find the midpoint of any object by dividing it's length by 2.

5. **Activity 3: Scroll Up and Down the cursor:** *(12 mins)*

   Teacher Activity: *(6 mins)*
   - Demonstrate the student/s how to scroll updown by defining the gesture control and using pyautogui.scroll().

   - Demonstrate to the student/s how to take screenshot by defining the gesture control and using pyautogui.screenshot()

   Student Activity: *(6 mins)*

   - Guide the student/s to scroll down the page, and to take screenshots.

6. **Introduce the Post class project:** *(2 min)*
   ● Show the messages on the basis of different hand gestures.

7. **Test and Summarize the class learnings:** *(5 mins)*
   ● Check for understanding through quizzes and summarize learning after respective missions.
   ● Summarize the overall class learning towards the end of the class.

8. **Additional activities:**
   ● Encourage the student/s to perform a right click using a virtual mouse.
   ● Encourage the student/s to move the cursor using hand gestures.

9. **State the Next Class Objective:** *(1 min)*

   ● In the next class, student/s will place different face filters at the top of the camera screen.

U.S. Standards:

CSTA: 2-AP-11, 2-AP-12, 2-AP-13, 2-AP-14, 2-AP-19

Links Table		
Activity	**Activity Name**	**Link**
Class Presentation	Virtual Mouse	https://s3-whjr-curriculum-uploads.whjr.online/0d068ea9-9419-405c-9d9a-04dbfb6f7840.html
Explore Activity	Virtual Mouse	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C70-SAS-BP
Teacher Activity 1	Move the Cursor	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C70-TAS-BP
Teacher Activity 1 Solution	Move the Cursor	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C70-TAS
Student Activity 1	Move the Cursor	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C70-SAS-BP
Teacher Reference: Student Activity 1 Solution	Move the Cursor	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C70-SAS
Teacher Activity 2	Click the Cursor	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C70-TAS-BP
Teacher Activity 2 Solution	Click the Cursor	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C70-TAS
Student Activity 2	Click the Cursor	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C70-SAS-BP

Teacher Reference: Student Activity 2 Solution	Click the Cursor	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C70-SAS
Teacher Activity 3	Scroll Up the Cursor	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C70-TAS-BP
Teacher Activity 3 Solution	Scroll Up the Cursor	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C70-TAS
Student Activity 3	Scroll Down the Cursor	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C70-SAS-BP
Teacher Reference: Student Activity 3 Solution	Scroll Down the Cursor	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C70-SAS
Student's Additional Activity 1	Perform Right Click	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C70-SAS-BP
Teacher Reference: Student's Additional Activity 1 Solution	Perform Right Click	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C70-SAS
Student's Additional Activity 2	Move the Cursor using Hand Gesture	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C70-SAS-BP
Teacher Reference: Student's Additional Activity 2 Solution	Move the Cursor using Hand Gesture	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C70-SAS
Post Class Project	Sign Language App	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C70-PCP-BP
Teacher Reference: Post Class Project Solution	Sign Language App	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C70-PCP