

MOUSE AND WEBCAM CONTROLLER

UCS 503 Software Engineering Project Report

END-Semester Evaluation

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BE Second Year, CSE

Group No: 6

Submitted to:

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THAPAR INSTITUTE
OF ENGINEERING & TECHNOLOGY
(Deemed to be University)

Computer Science and Engineering Department

TIET, Patiala

April 2023

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1. Project Selection Phase

1.1 Software Bid

Software Bid/ Project Teams

UCS 503- Software Engineering Lab

Group: CS2 Dated: 31/1/2023

Team Name:
Team ID (will be assigned by Instructor):

Please enter the names of your Preferred Team Members.:

- You are required to form a three to four person teams'
- Choose your team members wisely. You will not be allowed to change teams.

Name	Roll No	Project Experience	Programming Language used	Signature
Chetanveer Singh	102117053	Robotic Arm, Mobile app	C, C++	<i>Chetanveer Singh</i>
Harnmeet Kaur	102117052	Robotic Arm, Mobile App	C, C++	<i>Harnmeet Kaur</i>
Ira Gupta	102117053	Robotic Arm, Mobile App	C, C++, Java	<i>Ira Gupta</i>
Vansh Sandhu	1021170	Robotic Arm, Mobile App.	C, C++	<i>Vansh Sandhu</i>

Programming Language / Environment Experience

List the languages you are most comfortable developing in, as a team, in your order of preference. Many of the projects involve Java or C/C++ programming.

1. C++
2. Python
3. C

Choices of Projects:

Please select 4 projects your team would like to work on, by order of preference: (Write at least one paragraph for each choice (motivation, reason for choice, feasibility analysis, etc.))

	Project Name	Unique Selling Point
First Choice	<u>Mouse and Webcam controllers</u>	<ul style="list-style-type: none">• Improved human computer interaction• Reduces usage of hardware• cost effective
Second Choice	<u>Hangman Game</u>	<ul style="list-style-type: none">• Fun game to develop your vocab• Cost effective & interactive
Third Choice	<u>Heart Disease Prediction</u>	<ul style="list-style-type: none">• targets large audience• provides a virtual doctor at home.

Fourth Choice	Resume Builder	<ul style="list-style-type: none"> No free versions available per se Salient need of every college student
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Additional Remarks/ Inputs

Please tell us about any other factors that we should take into consideration (e.g., if you really would like to work on a project for some particularly convincing reason).

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1.2 Project Overview

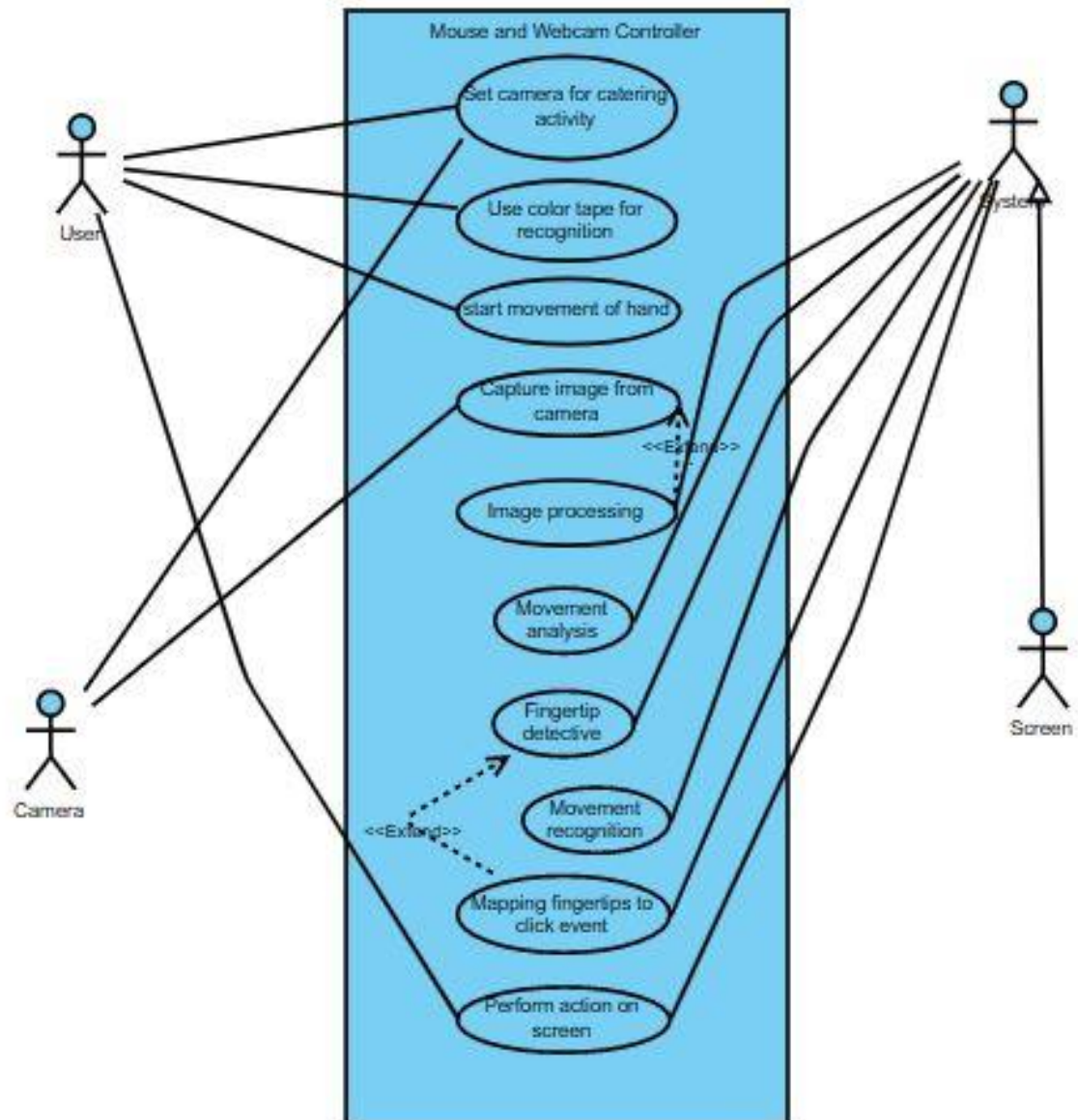
The proposed AI virtual mouse system can be used to overcome problems in the real world such as situations where there is no space to use a physical mouse and also for the persons who have problems in their hands and are not able to control a physical mouse. Also, amidst of the COVID-19 situation, it is not safe to use the devices by touching them because it may result in a possible situation of spread of the virus by touching the devices, so the proposed AI virtual mouse can be used to overcome these problems since hand gesture and hand Tip detection is used to control the PC mouse functions by using a webcam or a built-in camera.

The main objective of the proposed AI virtual mouse system is to develop an alternative to the regular and traditional mouse system to perform and control the mouse functions, and this can be achieved with the help of a web camera that captures the hand gestures and hand tip and then processes these frames to perform the particular mouse function such as left click, right click, and scrolling function.

2. Analysis Phase

2.1 Use Cases

2.1.1 Use Case Diagram



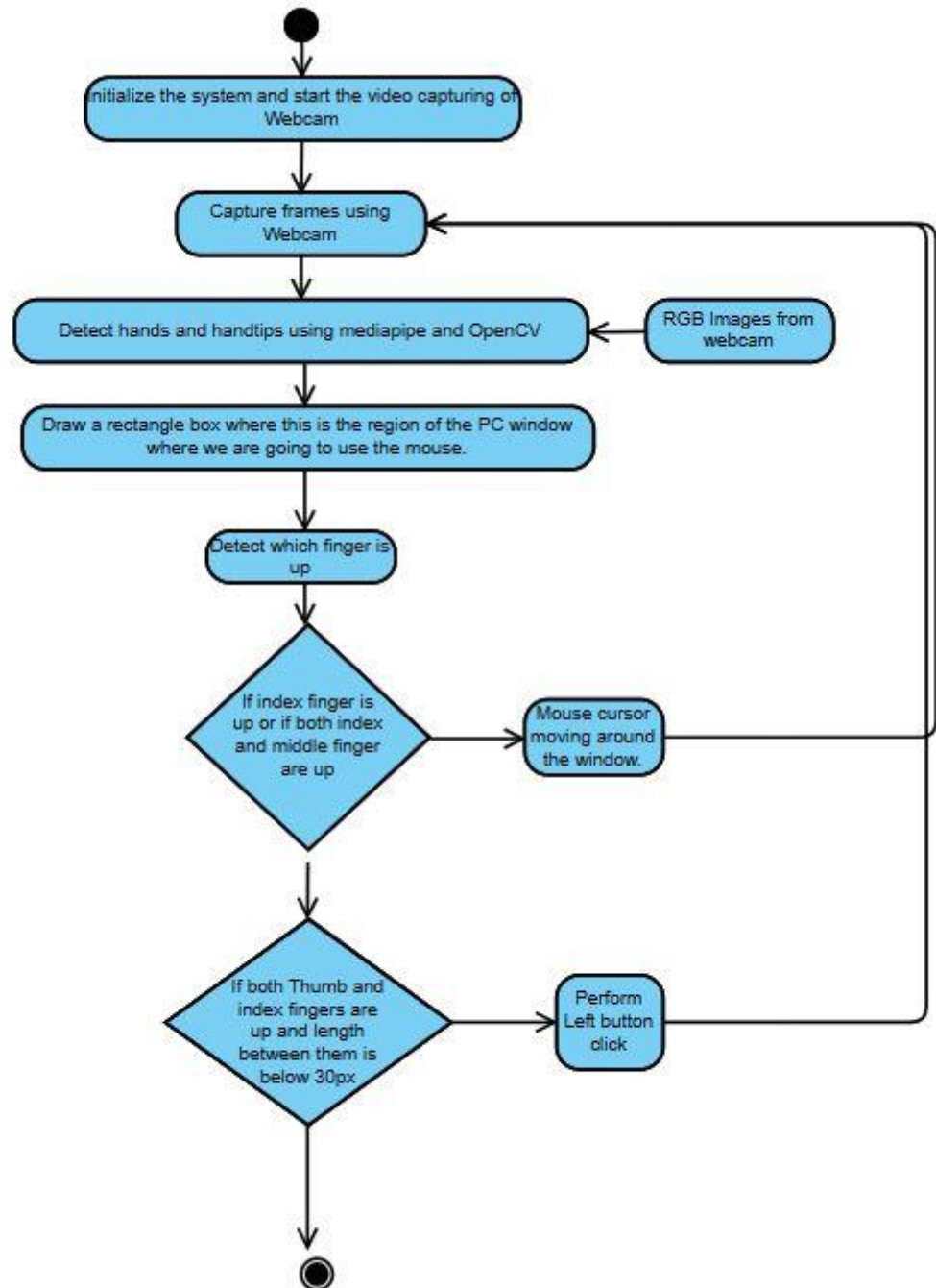
2.1.2 Use Case Templates

1.Use Case ID	1
2.Use Case Name	Use color tapes for recognition
3.Created By	Chetanveer Singh,Vansh Sandhir
4.Actors	User, Camera, Screen, System
5.Description	It is the utility that would help to detect colours using grayscale and color tapes.
6.Pre Conditions	Webcam and active system
7.Post Conditions	Monitor or Display
8.Special Requirements	Uninterrupted environment, Bare hands ,Human face or any other object
9.Modification History	28 Feb 2023, Tuesday

1.Use Case ID	2
2.Use Case Name	Clicking operations
3.Created By	Harneet kaur ,Ira Gupta
4.Actors	User,Camera , Screen , System
5.Description	It is the utility that would perform the major function of our proposed model.It would help to replace the traditional mouse by introducing a virtual technology.
6.Pre Conditions	Webcam and an active system
7.Post Conditions	Monitor or Display
8.Special Requirements	Uninterrupted environment, Bare hands
9.Modification History	28 Feb 2023, Tuesday

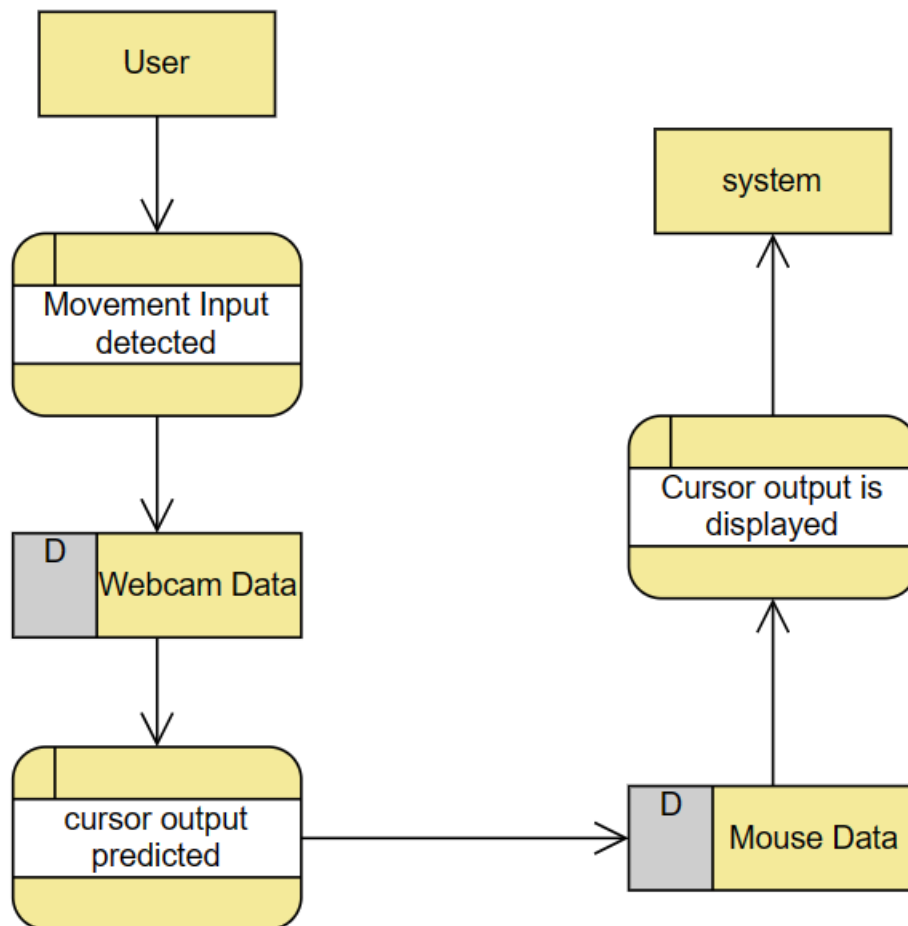
1.Use Case ID	3
2.Use Case Name	Scrolling and Screenshot
3.Created By	Ira Gupta , Harneet Kaur
4.Actors	User, Camera, Screen, System
5.Description	It is the utility that would take the previous function as consideration but with an advancement .It would be able to take screenshots and perform basic scrolling with system coordinates provided.
6.Pre Conditions	Webcam and active system
7.Post Conditions	Monitor or Display
8.Special Requirements	Uninterrupted environment, Bare hands
9.Modification History	28 Feb 2023, Tuesday

2.2 Activity Diagrams and Swimlane Diagram

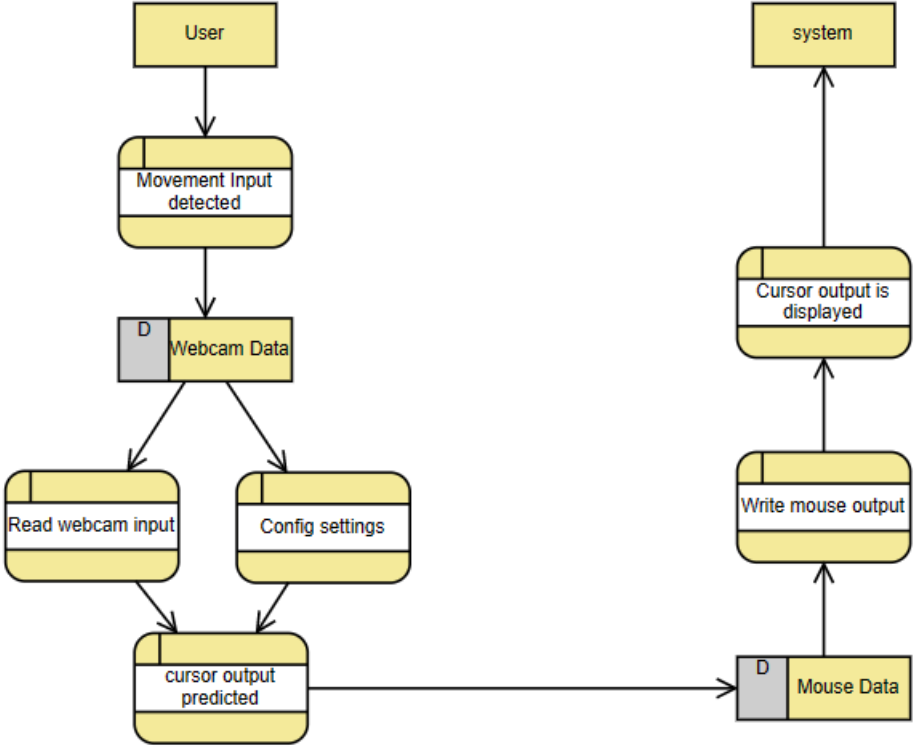


2.3 Data Flow Diagrams (DFD)

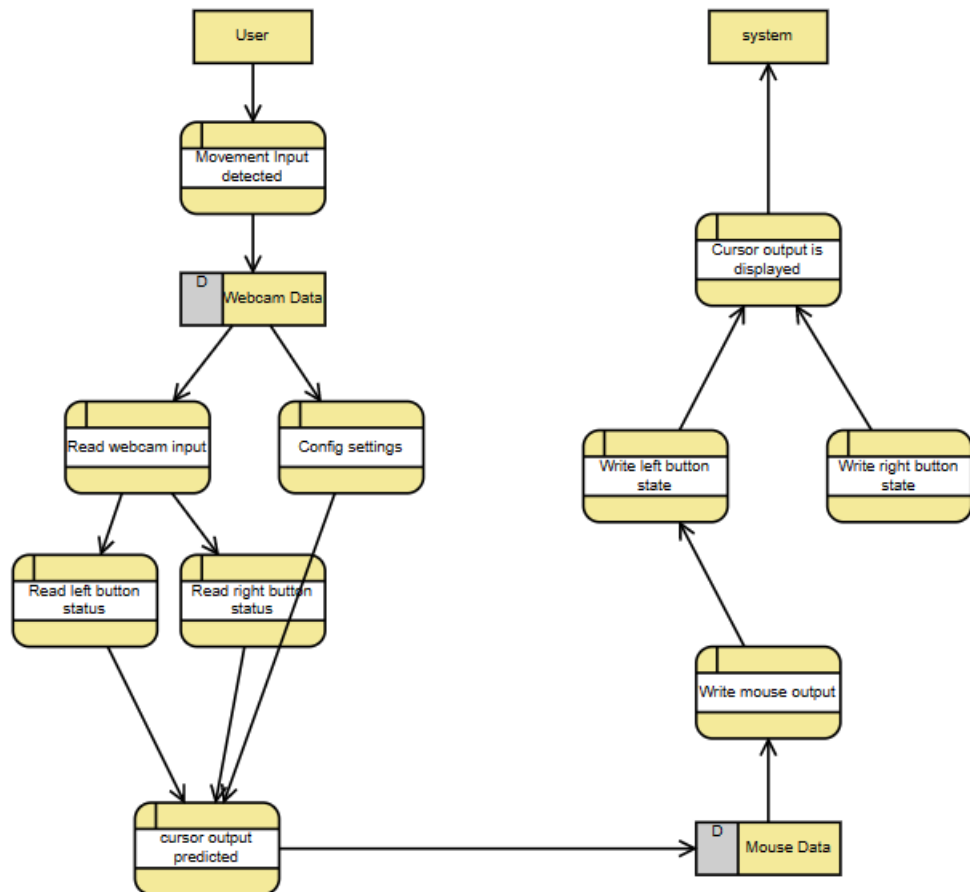
2.3.1 DFD Level 0



2.3.2 DFD Level 1



2.3.2 DFD Level 2



2.4 Software Requirement Specification in IEEE Format

[Drive link to open SRS document of the Project](#)

2.5 User Story and User Story Cards

User Story:

As a user, I want to be able to use an AI virtual mouse system so that I can interact with my computer without the need for a physical mouse.

User Story Card: (Front of Card)

#0001	Title: Mouse and Webcam Controller	Fibonacci size #3
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As a user, I want to be able to use an AI virtual mouse system so that I can interact with my computer without the need for a physical mouse.

User Login

Username: _____

Password: _____

Login

(Back of Card)

1. Acceptance Criteria:

- The AI virtual mouse system accurately tracks my hand movements and translates them into mouse movements on the screen.
- The controls for the virtual mouse system are intuitive and easy to use, allowing me to quickly learn how to use it.
- The sensitivity of the virtual mouse system is customizable to suit my preferences and needs.
- The AI virtual mouse system is able to respond to my voice commands, allowing me to control the mouse without the need for hand movements.
- The virtual mouse system is compatible with a wide range of operating systems and applications.
- The virtual mouse system is designed with accessibility in mind, and is able to cater to the needs of users with disabilities or mobility issues.
- The virtual mouse system is robust and reliable, able to operate smoothly and without glitches even under heavy usage.

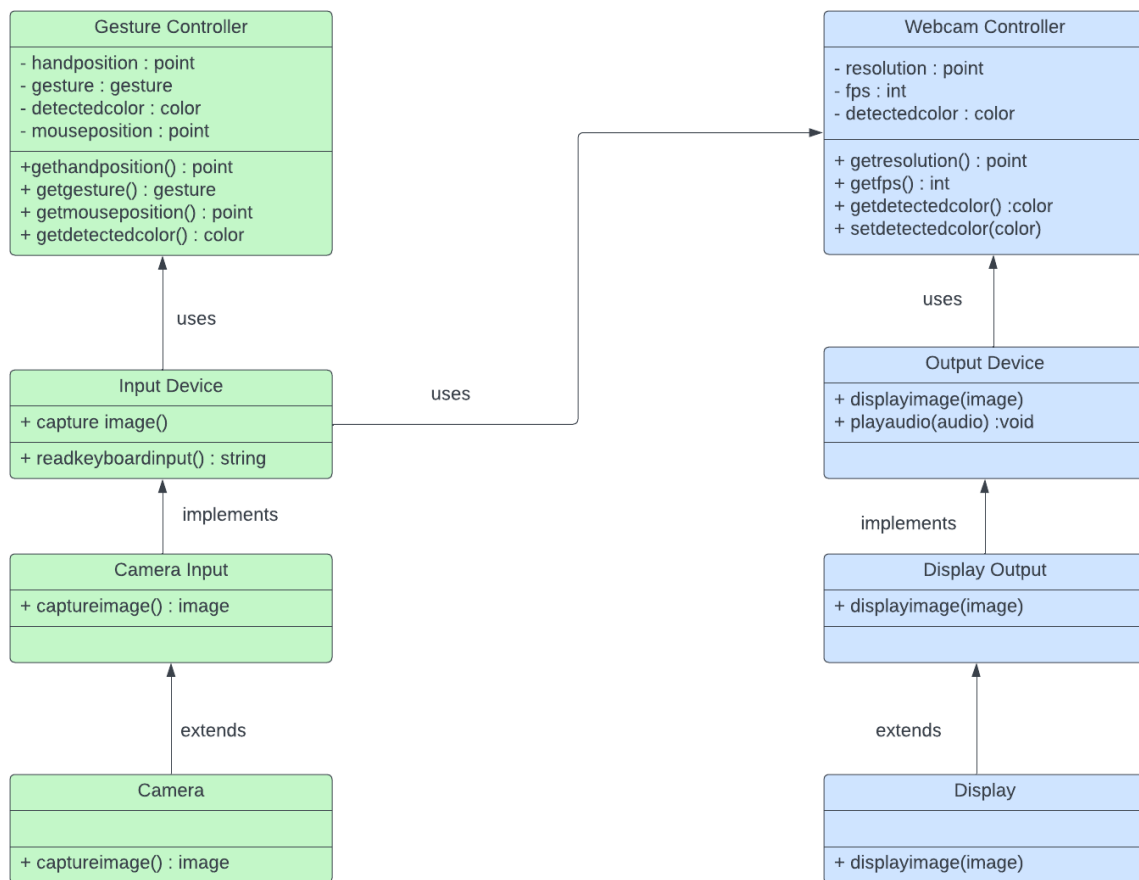
2. Tasks:

- Develop the AI algorithms and software to accurately track hand movements and translate them into mouse movements.

- Design an intuitive user interface with customizable settings.
- Implement voice command recognition and integration.
- Test the virtual mouse system on a variety of operating systems and applications for compatibility.
- Incorporate accessibility features, such as compatibility with assistive technologies and customizable input methods.
- Conduct extensive testing to ensure the virtual mouse system is robust and reliable under heavy usage.

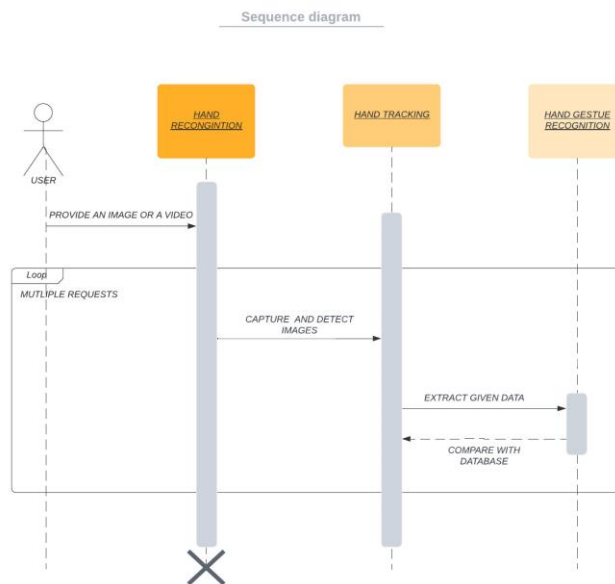
3. Design Phase

3.1 Class Diagram

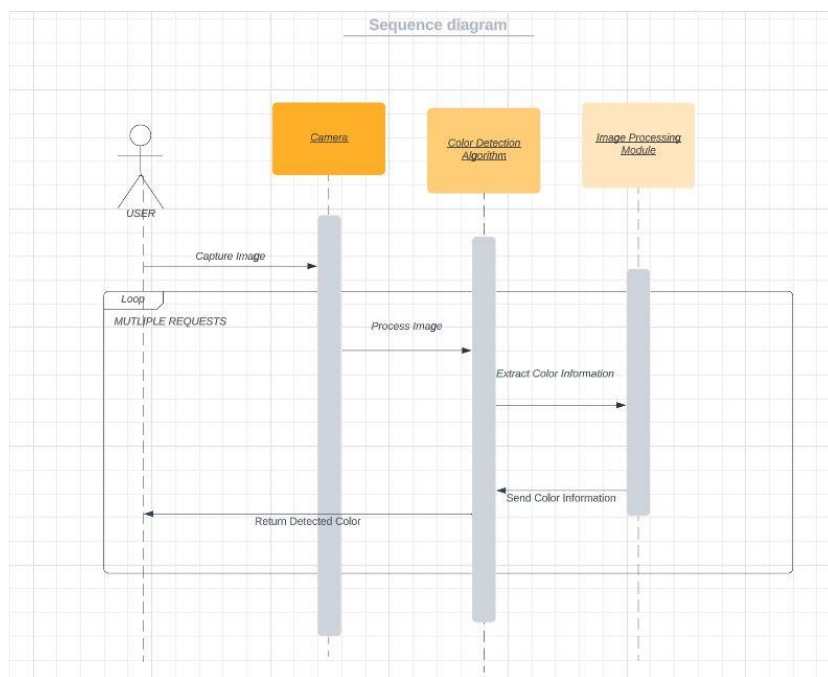


3.2 Sequence Diagram

(i) Hand Gesture Detection

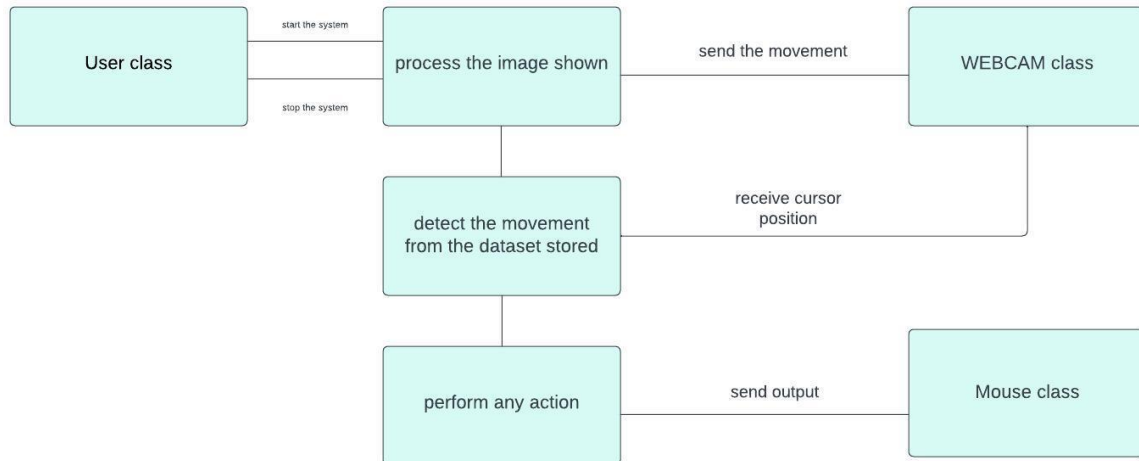


(ii) Color Detection

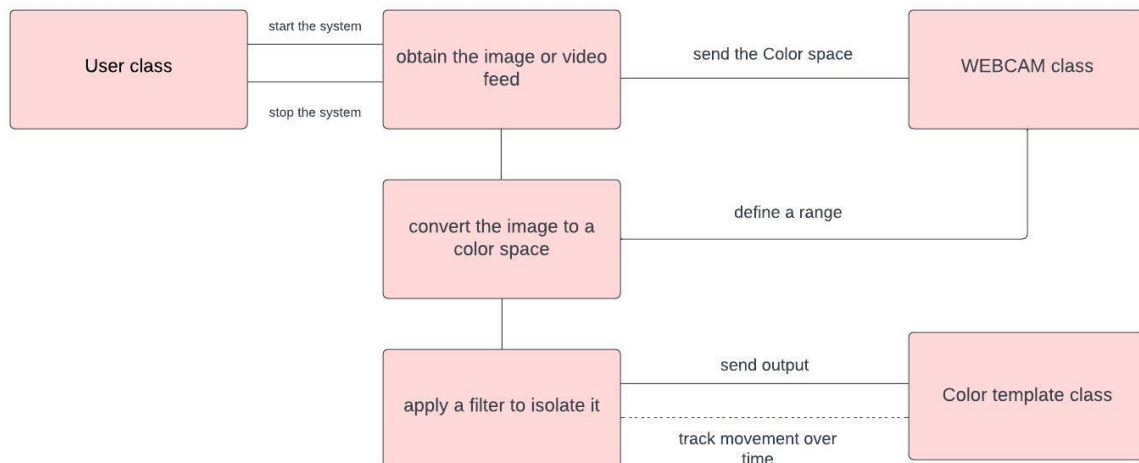


3.3 Collaboration Diagrams

(iii) Hand gesture Detection

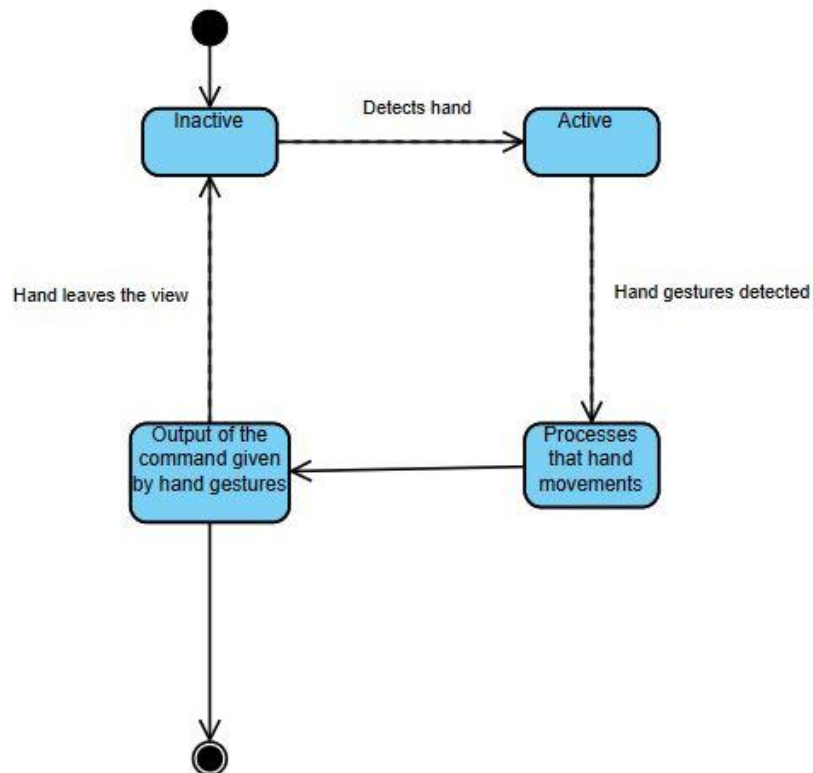


(iv) Color Detection

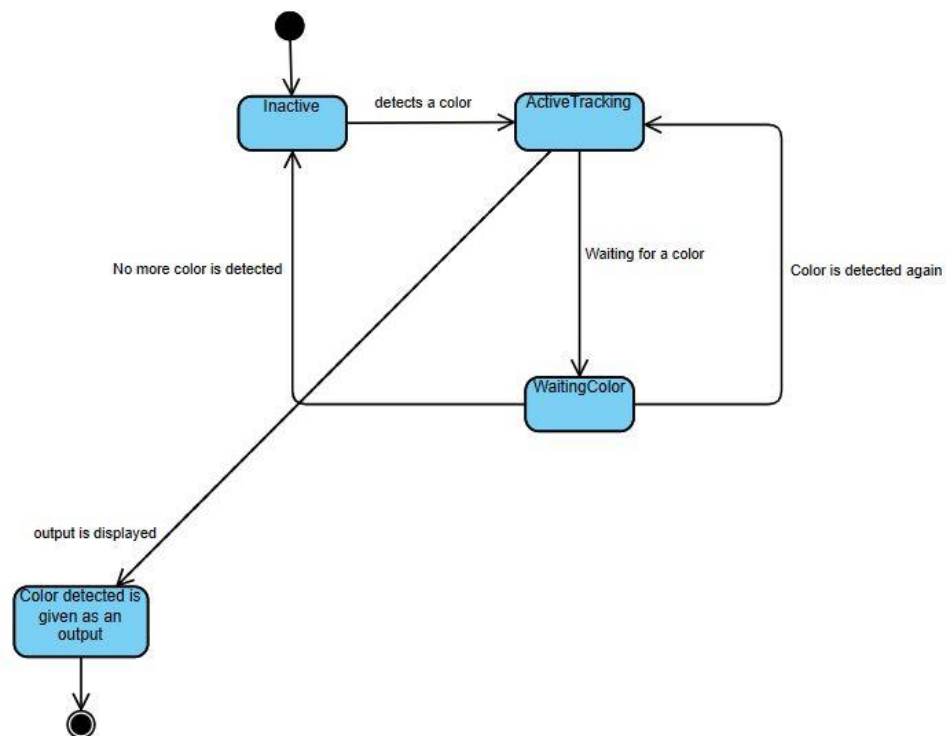


3.4 State Chart Diagrams

(v) Hand gesture Detection

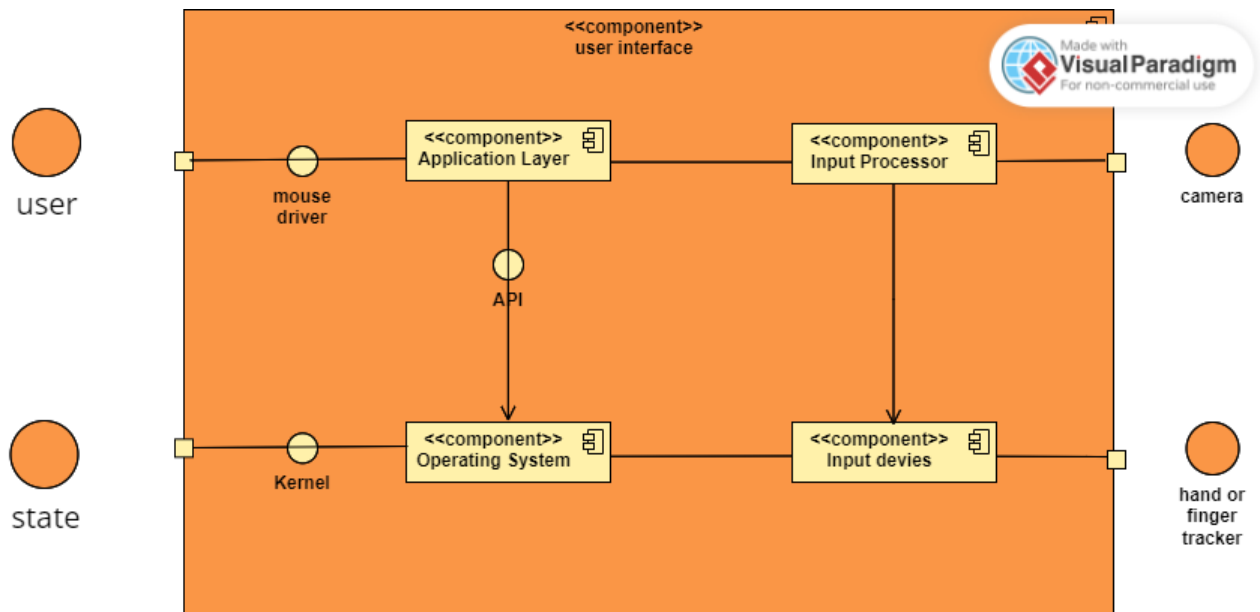


(vi) Color Detection

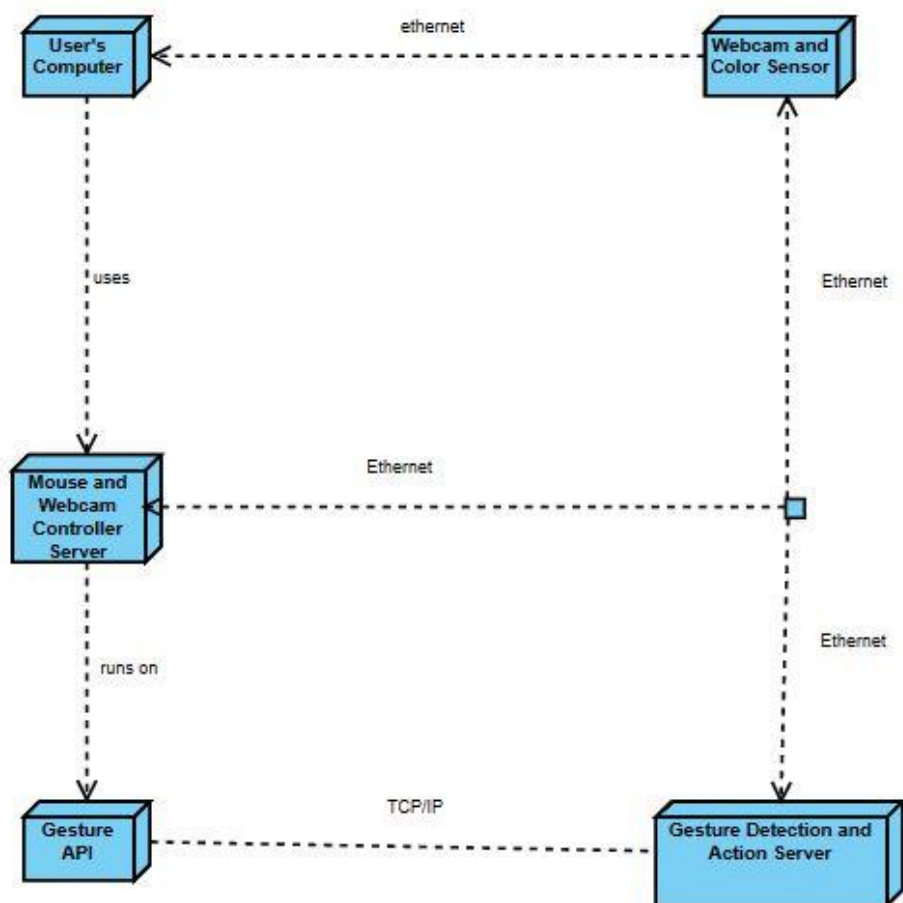


4. Implementation

4.1 Component Diagram



4.2 Deployment diagram



5. Testing

5.1 Test Plan

1. Objectives:

- To ensure that the hand gesture detection and color recognition system works accurately and reliably.
- To ensure that the software performs well under different conditions and scenarios.

2. Test Cases:

- Test case 1: Hand gesture detection accuracy test
 - Objective: To test the accuracy of the hand gesture detection algorithm.
 - Procedure:
 1. Perform various hand gestures in front of the camera and check if they are accurately recognized by the system.
 2. Record the accuracy rate and compare it against the expected accuracy rate.
 - Pass criteria: Accuracy rate of at least 90%.
- Test case 2: Color recognition accuracy test
 - Objective: To test the accuracy of the color recognition algorithm.
 - Procedure:
 1. Show different colors to the system and check if they are accurately recognized.
 2. Record the accuracy rate and compare it against the expected accuracy rate.
 - Pass criteria: Accuracy rate of at least 90%.
- Test case 3: Performance test
 - Objective: To test the performance of the system under different conditions.
 - Procedure:
 1. Test the system with different lighting conditions and camera angles.
 2. Record the time taken to recognize the hand gestures and colors.
 - Pass criteria: The system should perform well under different conditions with response times of less than 1 second.

3. Test Environment:

- Hardware:
 - Computer with a webcam and color sensor
- Software:
 - Operating system: Windows or Linux
 - Web browser: Chrome, Firefox or Edge

4. Test Execution:

- The tests will be executed by the project team.
- The results of each test case will be recorded and compared against the pass criteria.
- Any issues or bugs found during the testing will be logged in a bug tracking system and fixed by the development team.

5. Test Schedule:

- Test case 1: Hand gesture detection accuracy test - 2 days
- Test case 2: Color recognition accuracy test - 2 days
- Test case 3: Performance test - 1 week

6. Test Deliverables:

- Test plan document
- Test results report
- Bug tracking report

7. Risks:

- Hardware failure
- Software compatibility issues
- Time constraints

8. Contingency Plan:

- Backup hardware and software will be available in case of failure.
- Extra time will be allocated in case of any unforeseen issues or delays.

5.2 Test Cases

- **Test Case 1:**

Test Case #: 1.1	Test Case Name: Clicking
System: Virtual Mouse System	SubSystem: Mouse
Designed by: Chetanveer Singh	Design Date: 20 March 2023
Executed by: Chetanveer Singh	Execution Date: 23 March 2023
Short Description : To check the clicking operations on our system	

Step	Action	Expected System Response	Pass/ Fail	Comment
1	Move your index finger to bring the virtual cursor to a desired location on the screen.	The expected action is performed when the clickable object is clicked.	Pass	Ensure it's functioning correctly
2	Extend the index finger and the middle finger to perform the clicking action.			
3	Verify that the clicking action is performed.			
4	Move the virtual cursor to a different location using your index finger.			

Post-Conditions: The system should return to its original state, and any changes resulting from the clicking operation should be reflected in the user interface.

- **Test Case 2:**

Test Case #: 1.2	Test Case Name: Scrolling
System: Virtual Mouse System	SubSystem: Mouse
Designed by: Vansh Sandhir	Design Date: 29 March 2023
Executed by: Vansh Sandhir	Execution Date: 3 April 2023
Short Description : To check the scrolling operation	
Pre- Conditions: The page or the document opened should be long enough to be able to scrolled up or down.	

Step	Action	Expected System Response	Pass/ Fail	Comment
1	Move the virtual cursor to a scrollable area on the screen, such as a webpage or document.	The expected content should be visible after scrolling, and the scrolling direction should be correct	Pass	The expected content should be visible after scrolling, and the scrolling direction should be correct.
2	Perform a scrolling gesture, using the three fingers depending upon your choice of direction of scroll.			
3	Verify that the expected content is visible after scrolling, such as the appearance of new text or images.			
4	Reverse the scrolling gesture to ensure that scrolling direction is correct and content returns to its previous position.			

Post-Conditions: The system should return to its original state, and any changes resulting from the scrolling operation should be reflected in the user interface.

• **Test Case 3:**

Test Case #: 1.3	Test Case Name: Screenshot
System: Virtual Mouse System	SubSystem: Mouse
Designed by: Ira Gupta	Design Date : 31 March 2023
Executed by: Ira Gupta	Execution Date: 5 April 2023
Short Description : To take the screenshot using two fingers	
Pre- Conditions: Set up the virtual mouse system and ensure it is functioning correctly.	

Step	Action	Expected System Response	Pass/ Fail	Comment
1	Navigate to the area on the screen that you want to capture in the screenshot.	The expected area of the screen should be captured in the screenshot image and saved in the correct location.	Pass	A certain amount of glitch is observed during the screenshot operation.
2	Perform the screenshot gesture, which involves the gesture of extending the index finger and the little finger.			
3	Verify that the expected image is captured and saved in the correct location on the computer.			
4	Open the saved image file to ensure that it matches the area of the screen that was intended to be captured.			

Post-Conditions: The system should return to its original state, and any changes resulting from taking the screenshot should be reflected in the user interface.

• **Test Case 4:**

Test Case #: 1.4 System: Virtual Mouse System Designed by: Harneet Kaur Executed by: Harneet Kaur Short Description : To detect the color of the finger tip	Test Case Name: Color Detection SubSystem: Detector Design Date: 7 April 2023 Execution Date: 18 April 2023
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Pre- Conditions: Set up the virtual mouse system and ensure it is functioning correctly.

Step	Action	Expected System Response	Pass/ Fail	Comment
1	Move the virtual cursor to an area of the screen where a specific color is present.	The expected color should be detected and displayed accurately in the virtual mouse system.	Fail	Only the color across the fingertips are detected.
2	Perform the color detection gesture, i.e Extend all the four fingers.			
3	Verify that the expected color is detected and displayed in the virtual mouse system's color picker or other color-related feature.			
4	Test the color detection operation on different colors, including variations in brightness, hue, and saturation, to ensure the system is capable of detecting a wide range of colors accurately.			

Post-Conditions: The system should return to its original state, and any changes resulting from the color detection operation should be reflected in the user interface

5.3 Test Reports

1. Summary

- Total number of test cases = 4
- Number of passed test cases = 3
- Number of failed test cases = 1

2. Test Results

Test Case ID	1.1	1.2	1.3	1.4
Test Case Description	To check the clicking operations on our system	To check the scrolling operation	To take the screenshot using two fingers	To detect the color of objects
Test status	Pass	Pass	Pass	Fail
Defects found (if any)	N/A	N/A	N/A	Yes, the colour of the object is not detected but only that of the fingertip is detected.

3. Defect Tracking

Defect ID	1
Defect description	The color of the object cannot be detected but only that of the fingertip is detected.
Severity	It is mild, as some of the working is performed by the current version of the software.
Priority	The priority would be to increase the area to be considered for detecting the color.
Status	Under progress.
Assigned to	Harneet Kaur, Ira Gupta
Target date	30-May-2023.

4. Conclusion

Our current version of the software is able to perform the basic mouse operations as promised. The color detection operation is lacking at certain points. Only a smaller area of the object is considered for the color detection as of now. We intend to increase this area of observation in the next version. We also intend to increase the smoothness of the working of our software and reduce the glitches as much possible.