e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:04/Issue:05/May-2022 Impact Factor- 6.752 www.irjmets.com

AIR CANVAS USING OPENCV, MEDIAPIPE

Dr. B. Esther Sunanda[*1], M. Bhargavi[*2], M. Tulasi Sree[*3],
M.R.S. Ananya[*4], N. Kavya[*5]
[*1,2,3,4,5]Department of Computer Science and Systems Engineering, Andhra University College of Engineering for Women, Andhra Pradesh, India.

ABSTRACT

With increasing technology each sector need to be modernized. With the improvement of clever gadgets, the system can be now controlled virtually with aid of using human gestures. While using paint , sometimes we feel difficult to draw and feel like drawing our imagination just by waving our hand . The Project Air Canvas makes a speciality of growing a motion-to-textual converter. This project works on hand tracking system development which aims to track the hand which acts as pen and functioning as pen to create or draw different shapes and also as an eraser using Open Computer Vision Library(OpenCV) and Mediapipe. The existing project which allows us to draw just by waving hand uses technology or methodology which takes a lot of process and time. Avoiding or decreasing these limitations we came up with this project that uses new technologies and easy methodologies. System Camera is used to track the hand and create drawings .This also helps to annotate pdf just by waving hands.

Keywords: Air Canvas, Mediapipe, Opencv, Hand Tracking, Pdf Annotator.

I. INTRODUCTION

Earlier painting was done using either a mouse or touch pad which was quite stressful and hectic task . Even though we have touch screen laptops , they are expensive . Hand tracking more specifically finger tracking technique is used as a tool of the computer acting as an external device similar to a keyboard and a mouse. It is used in various fields like Virtual Reality to sign language recognition .

Air Canvas is a hands-free digital drawing canvas which utilizes camera, opencv and mediapipe to recognize and map the hand gestures. The user finger is considered as the brush or the pen used to draw or annotate pdf. The size of brush can be modified , also the pen color can be changed by hovering pointer over built-in buttons. Computer vision techniques are used to draw different shapes. This system uses python language to built the code. Camera and Mediapipe is used to track the finger positions. Computer Vision built in methods are used to draw shapes on the canvas or the area provided. We can annotate or edit pdf of our choice by opening the required pdf and hovering over the area where we need to annotate or underline. We can also save the canvas work as image.

Some of the requirements required for the system are described below:

1. Hardware Requirements

The minimum hardware requirements to execute the system are as follows:

- ✓ Processor – Intel I5
- ✓ RAM – 4GB
- ✓ Storage – 1GB
- ✓ Web Camera

2. Software Requirements

- ✓ Operating system – Windows 10
- ✓ Programming Language – python
- ✓ Front End – Python Tkinter and OpenCV

3. Functional Requirements

- ✓ Using Camera to capture input.
- ✓ Detect Hand positions and finger tips.
- ✓ Choose different shapes, colors, size.
- ✓ Depict shapes on canvas

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:04/Issue:05/May-2022 Impact Factor- 6.752 www.irjmets.com

- ✓ Save the work on canvas as image.
- ✓ Open PDF and edit/annotate it.

4. Non-Functional Requirements

- ✓ Reliability requirements
- ✓ Scalability requirements
- ✓ Maintainability requirements
- ✓ Usability requirements
- ✓ Availability requirements

II. METHODOLOGY

According to the "https://www.irjet.net/archives/V8/i8/IRJET-V8I8258.pdf "published paper, air canvas application is developed by training different images of hands to find out the positions and the fingers opened.

This methodology needs a lot of data to be stored and sometimes it leads to wrong prediction due to background difference or the skin color difference. Some of the existing papers followed the process of image processing using threshold values and database data of different images.

To overcome all these limitations and drawbacks , we proposed the system using mediapipe. In the proposed system hand tracking is done using mediapipe which first detects hand landmarks and then obtain positions according to it.

Figure 1 describes the flow of system or the process of project in which it works. This is the complete work flow that occurs to execute the system and draw images just by waving hands in efficient manner.

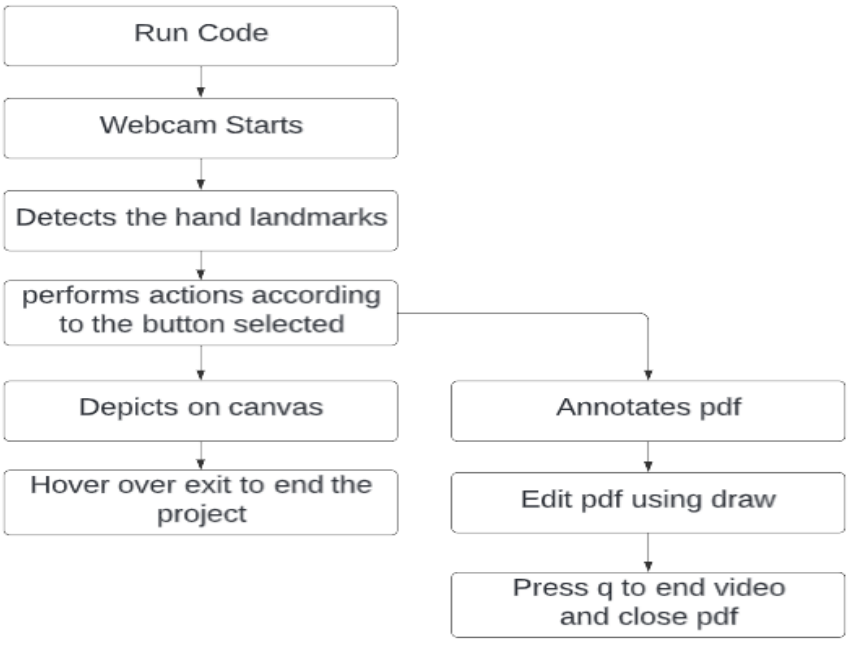

Figure 1: Flowchart of Project.

III. CASE STUDY: AIR CANVAS USING MEDIAPIPE, OPENCV

Air Canvas using Mediapipe, Opencv is the proposed system that improves the efficiency for the existing system. Each stage of the flowchart and its methodologies are explained in detailed below.

The methodologies or the stages of the proposed system are discussed below:

1. Run Or Execute the Code

Execute the code once all the libraries are installed , this leads to turning the camera on automatically and the opencv frame with buttons displaying various shapes, colors, size, save, clear, erase etc.

2. Webcam Starts

Webcam starts recording and converts the video each frame and sends the frame to hand tracker class to track or detect the positions of finger. Figure 2 displays the buttons and frame which records video.

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:04/Issue:05/May-2022 Impact Factor- 6.752 www.irjmets.com

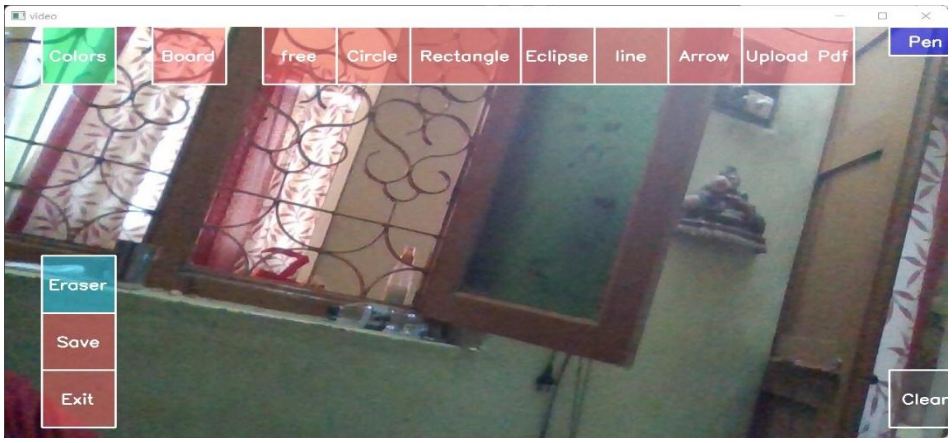

Figure 2: Opencv Frame with Buttons.

3. Detects Hand Landmarks

Each frame received is compared with mediapipe hand landmarks i.e, the Figure 3 and positions of finger are found using getPositions() and which finger is opened using getUpFingers() functions of handtracker class. These 2 functions are part of the Handtracker class.

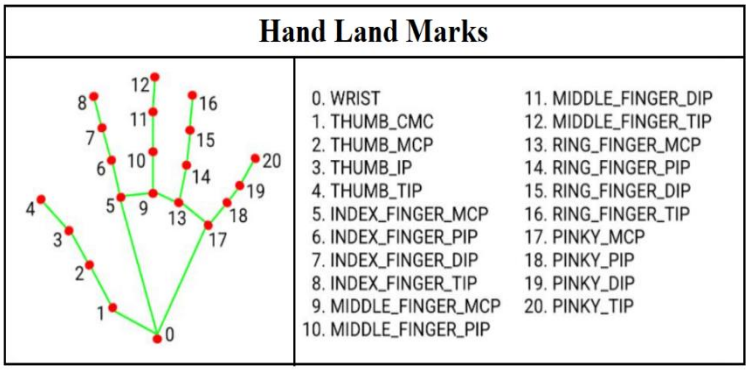

Figure 3: Mediapipe Hand Land Marks.

4. Perform actions according to button

Different buttons are choosed with the help of index finger hover over those buttons. In this way different shapes and pdf are chosen. Each button has its own functionality to perform over .If shapes or colors or size are choosed then functionalities are performed on the canvas . The shapes are resized according to the distance between the thumb and the index finger. If pdf is choosed then it gets opened in ms edge and editing is done. Figure 4 shows the hand landmarks ,colors and sizes options.

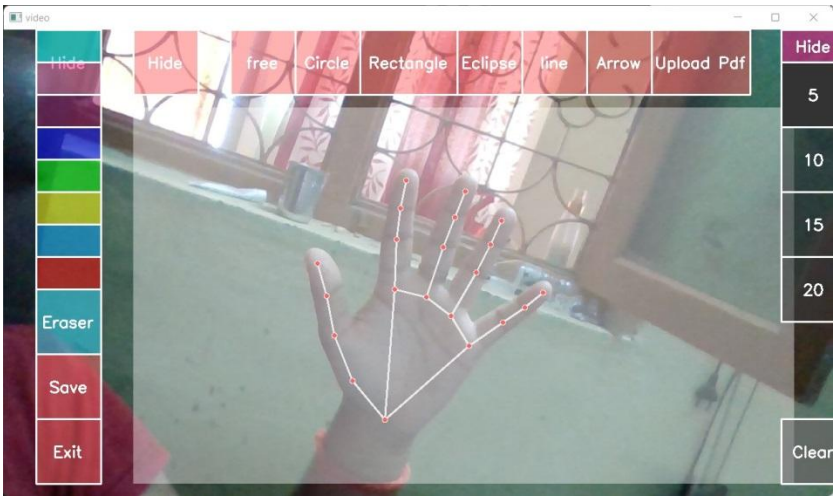

Figure 4: Hand Landmarks and buttons.

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:04/Issue:05/May-2022 Impact Factor- 6.752 www.irjmets.com

5. Depict on canvas

Shapes like rectangle, circle, ellipse, arrow head line, line, free style are depicted on canvas. We can also clear or erase the content on the canvas. Saving of work on canvas is also done. Shapes are drawn by considering the distance between the thumb and index finger as the diagonal length for rectangle, radius for circle, length for line and arrowhead line. Figure 5 explains how a circle is being depicted on the canvas.

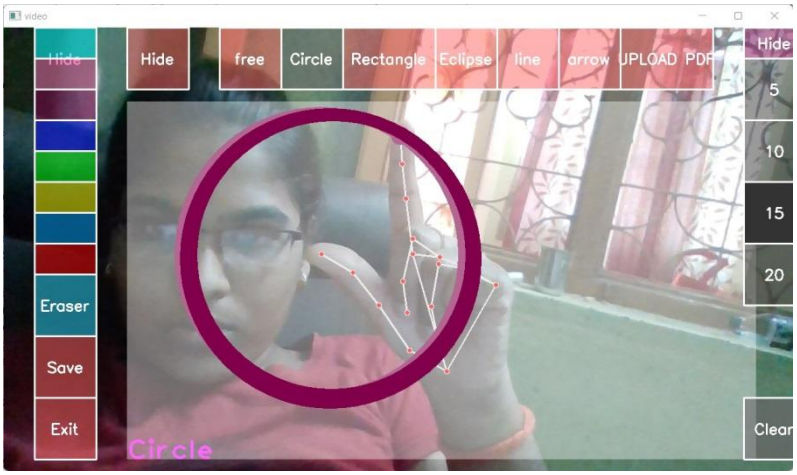

Figure 5: Depicting Circle on Canvas.

6. Annotate PDF

If pdf option is selected then a Tkinter window opens asking to choose the pdf needed to open. On opening pdf select draw and use finger to edit or draw over the pdf at required areas. Figure 6 depicts the annotation of the pdf.

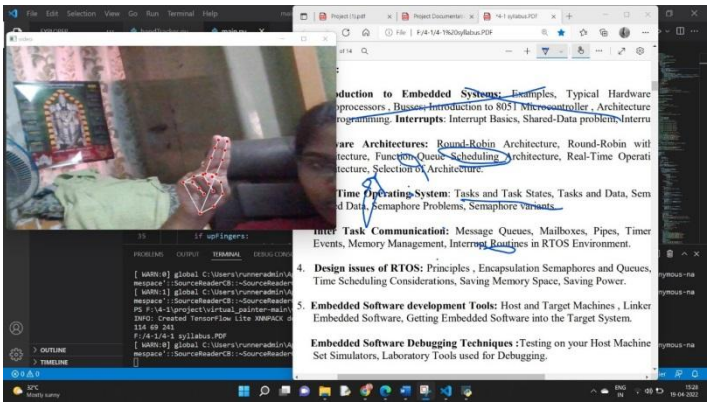

Figure 6: Annotating PDF.

7. Exit

By hovering index finger over exit closes the frame.

IV. TESTING

Software testing is an investigation conducted to provide stakeholders with information about the quality of the product or service under test. Software testing can also provide an objective, independent view of the software to allow the business to appreciate and understand the risks of software implementation. Table 1 describes the various test cases for the system . Test cases outputs can be seen in the output section. The sample test cases we designed for our system are as follows:

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:04/Issue:05/May-2022 Impact Factor- 6.752 www.irjmets.com

Table 1: Test Cases

S.No	Description	Input	Expected Value	Actual Value	Result
1	To draw a circle shape virtually through Hand on a board.	Hand Tracking through webcam	Circle is obtained with the help of little and index finger	Circle is obtained with the help of little and index finger	PASS
2	To draw free style of required colour on the board with the help of hand	Hand Tracking through webcam	Line of required colour is obtained from set of available colours	Line of required colour is obtained from set of available colours	PASS
3	To draw a ellipse virtually through Hand on a board	Hand Tracking through webcam	Ellipse is obtained with the help of little and index finger	Ellipse is obtained with the help of little and index finger	PASS
4	To clear the board with the help of hand tracking through clear button	Hand Tracking through webcam	Board gets cleared i.e, all the shapes drawn are erased	Board gets cleared i.e, all the shapes drawn are erased	PASS
5	A text file is selected and can highlight few important texts virtually	Hand Tracking through webcam	High lighting of important ones is done	High lighting of important ones is done	PASS
6	To select the exit button to terminate through hand	Hand Tracking through webcam	We will be Terminated from the screen to source code	We will be Terminated from the screen to source code	PASS
7	To erase the unwanted parts on canvas	Hand Tracking through webcam	The pixels on canvas at index fingertip gets erased	The pixels on canvas at index fingertip gets erased	PASS
8	Trying to draw on canvas using middle finger	Hand Tracking through webcam	Drawing is not possible i.e, no changes will be depicted on canvas	Drawing is not possible i.e, no changes will be depicted on canvas	PASS
9	Saving the work done on canvas	Placing cursor on save button using index finger	The work gets saved in images folder	The work gets saved in images folder	PASS

V. RESULTS AND DISCUSSION

The output screen of the system are as follows:

FREESTYLE-

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:04/Issue:05/May-2022 Impact Factor- 6.752 www.irjmets.com

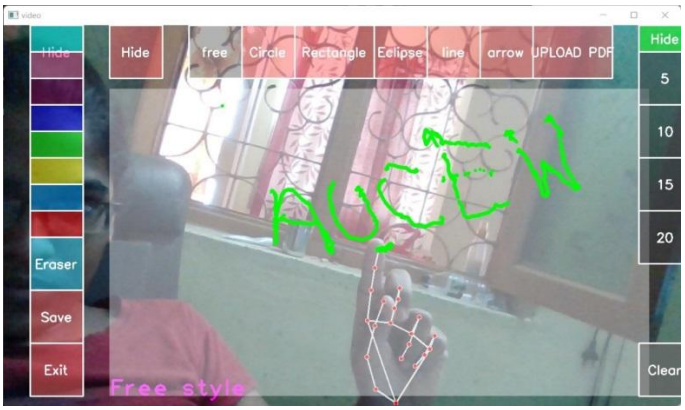

Figure 7: Freestyle drawing.

This Figure 7 is depicting the free style drawing over the canvas. The index finger is hovered over freestyle and is hovered over canvas to draw required text.

RECTANGLE-

Figure 8: Depicting Rectangle.

This Figure 8 is depicting the Rectangle over the canvas. The index finger is hovered over freestyle and is hovered over canvas to draw required text.

ERASE-

Figure 9: Erasing unwanted part on canvas.

This Figure 9 is depicting the erasing mode of the content over the canvas. Index finger is hovered over canvas to erase the part of canvas.

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:04/Issue:05/May-2022 Impact Factor- 6.752 www.irjmets.com

TKINTER WINDOW-

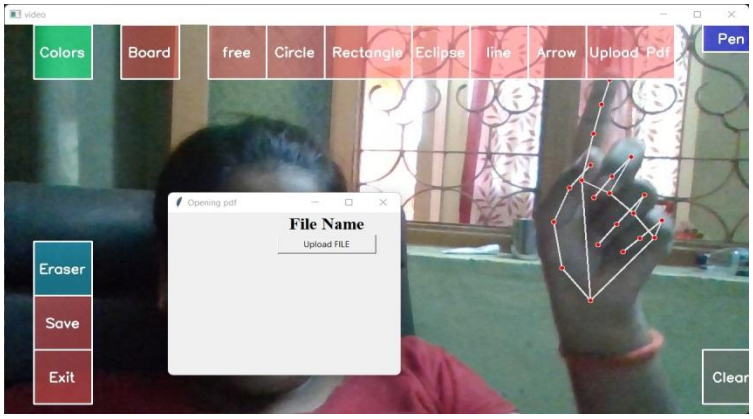

Figure 10: Uploading pdf.

This Figure 10 is showing a Tkinter window asking to upload pdf. We need to choose the required PDF needed to edit or annotate.

PDF ANNOTATION-

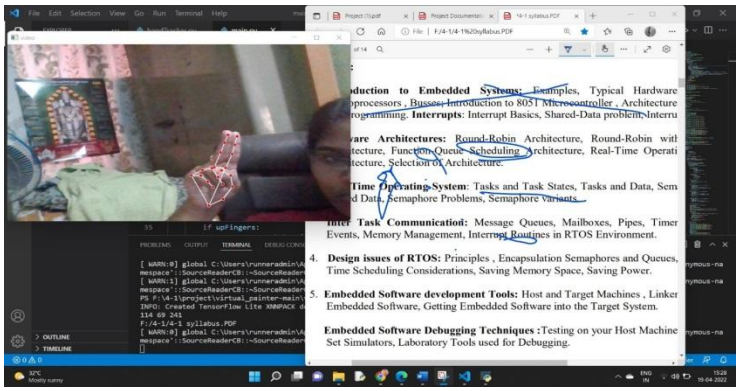

Figure 11: Annotating PDF.

This Figure 11 is depicting the pdf annotations by fingers. Index and Middle finger helps to move cursor and index finger to edit pdf.

VI. CONCLUSION

To avoid the use of mouse and difficulty to draw using it in the existing systems , this project Air Canvas helps us a lot. We can easily draw or present our imagination just by waving our hand . This uses the easy methods or libraries like mediapipe making the project efficient than existing one. In this system we have implemented an air canvas system using mediapipe which is efficient way to track hand positions . Mediapipe also helps us to reduce the process of image processing to detect the positions of fingers . This can be used in different aspects like teaching, drawing etc. This helps us to reduce the use of hardware components like mouse, touch screen etc. This can also be used as base project for various system that require hand tracking. The project discussed in this paper also helps to improve creativity in people. This helps us to teach and draw easily than earlier. In future, we can also use this project as base project for many other hand tracking projects. we can also use this in sign language detection , virtual mouse etc.

VII. REFERENCES

[1] Google AI Blog: On-Device, Real-Time Hand Tracking with MediaPipe (googleblog.com)
[2] http://ai.googleblog.com/2019/08/on-device-real-time-hand-tracking-with.html
[3] https://mediapipe.dev/
[4] https://ieeexplore.ieee.org/abstract/document/9753939
[5] A Practical Introduction to Computer Vision with OpenCV-WILEY
[6] https://opencv.org/
[7] https://ieeexplore.ieee.org/abstract/document/9731873