**Project proposal**

1. **Title –** Air canvas using computer vision.
2. **Problem Statement -** Hand gesture recognition is incredibly challenging task in the computer vision field. In this field you required detection and explanation of certain movements and poses of the hands. The goal of this research is to develop a healthy and accurate system for hand gesture recognition using computer vision techniques. In this research, the system should be able to detect and classify accurately for different hand movements in real phase of time. Also, system should be performed in various condition and in different viewpoints. In this research we aim to improve the performance for hand recognition system and try to make them more universally applicable in fields such as gaming, sign language reorganization.
3. **Solution Outline –** The Air Canvas project using computer vision is allows users to draw on a virtual canvas in the air using their fingers. Here are some of the solution outlines to develop this project using computer vision:

1. Install the necessary software and libraries: The first step is to install the required software and libraries. This includes Python, OpenCV, and NumPy. OpenCV is a computer vision library that provides various algorithms for image processing and computer vision applications.

2. Capture video frames from camera: The next step is to capture the video frames from the camera. This can be done using OpenCV's Video Capture function.

3. Apply image processing techniques: Once the video frames are captured, the next step is to apply image processing techniques to isolate the hand from the background. This can be done using background subtraction or skin color segmentation.

4. Detect fingertips: Once the hand is isolated, the next step is to detect the fingertips. This can be done using techniques such as contour detection or convex hull.

5. Calculate finger positions: After detecting the fingertips, the next step is to calculate the positions of the fingers in 3D space using the camera's intrinsic and extrinsic parameters.

6. Draw on the canvas: Finally, once the positions of the fingers are calculated, the next step is to draw on the canvas using the positions of the fingertips as input. This can be done using a graphics library like PyCharm or OpenCV.

7. Implement UI/UX features: Additional features like color selection, eraser, undo and redo can be added to improve the user experience of the application.

8. Testing and debugging: Once the application is developed, testing and debugging can be done to ensure that the application is working correctly.

# Tools/Technology Required -

Python

OpenCV and NumPy

Internet

Camera

Hand Tracking

Machine Learning

# Ethical Concerns -

Fairness and bias: The algorithms used for detecting hand movements and fingers may be biased towards certain skin colors, hand shapes, or genders, leading to unfair or discriminatory outcomes. To ensure fairness and mitigate bias, the algorithms must be developed and tested on diverse datasets that represent the user population.

Transparency: Users of the Air Canvas project must be informed about the data that is being collected, how it will be used, and who will have access to it. The development team must ensure transparency by providing clear explanations about the data collection and use process.

Privacy: The Air Canvas project using computer vision requires the use of a camera to capture user's hand movements, which raises privacy concerns. Users must be informed about how the data is collected, stored, and used. The development team must also take steps to ensure the data is secured from unauthorized access.

Accountability: The development team must be accountable for the technology they create. They must ensure that the technology is used only for its intended purpose and that the users' data is not used for unintended purposes.

Informed consent: Users of the Air Canvas project must provide informed consent before their data is collected and used. The development team must ensure that the users understand the technology's capabilities, how their data is collected and used, and any potential risks.

In summary, the ethical concerns for the Air Canvas project using computer vision include fairness and bias, transparency, privacy, accountability, and informed consent. Addressing these concerns will help ensure that the technology is developed and used in a responsible and ethical manner.

# Data Sources –

Real-world data: Real-world data can be collected using cameras and sensors, which can capture video and image data of users' hand movements. Real-world data can be used for training and testing the algorithms in different lighting conditions and with different users.

Public datasets: There are several publicly available datasets that can be used for training and testing computer vision algorithms, such as the MNIST dataset, the CIFAR dataset, and the ImageNet dataset. These datasets can be used to train the algorithms for detecting hand movements and fingers.

In summary, the data sources for the Air Canvas project using computer vision include synthetic data, real-world data, public datasets, crowdsourced data, and simulation data. The use of a diverse range of data sources will help ensure that the algorithms used for detecting hand movements and fingers are robust and accurate.

# Reference –

‘’<https://ijsret.com/wp-content/uploads/2022/03/IJSRET_V8_issue2_290.pdf>”

‘’ <https://www.ijraset.com/research-paper/computer-vision-based-virtual-sketch>’’

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