

AIR CANVAS
Mini Project (KCA353)

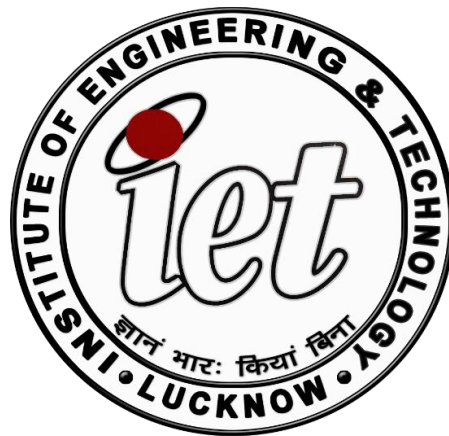
A
Synopsis submitted
In the partial fulfilment of the requirements for the award of the degree of

Master of Computer Applications

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Introduction

In the era of digital world, traditional art of writing is being replaced by digital art. Digital art refers to forms of expression and transmission of art form with digital form. Relying on modern science and technology is the distinctive characteristics of the digital manifestation. Traditional art refers to the art form which is created before the digital art. From the recipient to analyse, it can simply be divided into visual art, audio art, audio-visual art and audio-visual imaginary art, which includes literature, painting, sculpture, architecture, music, dance, drama and other works of art.

In the present circumstances, digital art and traditional art are inclusive of the symbiotic state, so we need to systematically understand the basic knowledge of the form between digital art and traditional art. The traditional way includes pen and paper, chalk and board method of writing. The essential aim of digital art is of building hand gesture recognition system to write digitally. Digital art includes many ways of writing like by using keyboard, touch-screen surface, digital pen, stylus, using electronic hand gloves, etc. But in this system, we are using hand gesture recognition with the use of machine learning algorithm by using python programming, which creates natural interaction between man and machine. With the advancement in technology, the need of development of natural 'human – computer interaction (HCI) systems to replace traditional systems is increasing rapidly.

Problem Statement

Air canvas helps to draw on a screen just by waiving your finger by just capturing the motion of a coloured mark with a camera (Webcam). Here a coloured object at the tip of the finger is used as the marker. The colour marker is detected and a mask is produced.

Related Work

Automatic object tracking has many applications such as; computer vision and human-machine interaction etc. Generally, object could be a text or person which needs to be tracked. In literature, different applications of tracking algorithm are proposed. One group of researchers are used it for translating the Sign Languages , other used it for hand gesture recognition, another group used it for text localization and detection, tracing full body motion of object for virtual reality and finger tracking based character recognition etc.

In a new recognition system for gesture and character input in air is presented. For detecting the finger positions, they used 3D capturing device called Leap Motion controller. In their proposed method they used Dynamic Time Warping Distance (DTW) technique for searching the similar written character from the data base. For character recognition they created a data base of 29000 recordings in which pre-written characters simples are present. Data set have two parts; one is called as candidate characters data set and other is data time series characters. Around 100 people will participate in the instrument for a total of 26000 recordings. Furthermore, they used data time series words of 3000 recordings. In their results, they show that the time series word “new” is recognized in 1.02s with a DTW window of 0 while with larger DWT window size and recordings their proposed system takes longer time in seconds.

Feature Of Air Canvas

Can track any specific-coloured pointer. User can draw in four different colours and even change them without any Hustle.

Able to rub the board with a single location at the top of the screen. No need to touch the computer once the program is run.

Deaf people can use it for effective communication.

It is an effective communication method that reduces mobile and laptop usage by eliminating the need to write.

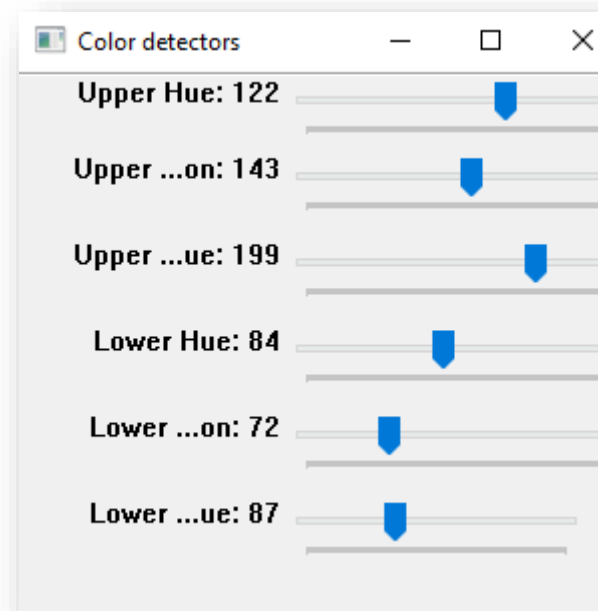
Methodology

Ever wanted to draw your imagination by just waiving your finger in air. Here we will learn to build an Air Canvas which can draw anything on it by just capturing the motion of a coloured marker with camera. Here a coloured object at tip of finger is used as the marker. We will be using the computer vision techniques of OpenCV to build this project. The preferred language is python due to its exhaustive libraries and easy to use syntax but understanding the basics it can be implemented in any OpenCV supported language. Here Colour Detection and tracking is used in order to achieve the objective. The colour marker is detected and a mask is produced. It includes the further steps of morphological operations on the mask produced which are Erosion and Dilation. Erosion reduces the impurities present in the mask and dilation further restores the eroded main mask.

STEPS IN DETAIL : -

1. Colour Tracking Of Object At Fingertip

First of all, the incoming image from the webcam is to be converted to the HSV colour space for detecting the coloured object at the tip of finger. The below code snippet converts the incoming image to the HSV space, which is very suitable and perfect colour space for Colour tracking. Now, we will make the Trackbars to arrange the HSV values to the required range of colour of the coloured object that we have placed at our finger. When the trackbars are setup, we will get the Realtime value from the trackbars and create range. This range is a NumPy structure which is used to be passed in the function `cv2.inrange()`. This function returns the Mask on the coloured object. This Mask is a black and white image with white pixels at the position of the desired colour.



Trackbars: To arrange HSV value

2. Contour Detection Of The Mask Of Colour Object

Now, after detecting the Mask in Air Canvas, Now is the time to locate its centre position for drawing the Line. Here, In the below Snippet of Code, we are performing some morphological operations on the Mask, to make it free of impurities and to detect contour easily.



3. Drawing The Line Using The Position Of Contour

Now comes the real logic behind this Computer Vision project, we will form a python deque (A Data Structure). The deque will store the position of the contour on each successive frame and we will use these stored points to make a line using OpenCV drawing functions. Now, we will use the position of the contour to make decision, if we want to click on a button or we want to draw on the sheet. We have arranged some of the buttons on the top of Canvas, if the pointer comes into their area, we will trigger their method. We have four buttons on the canvas, drawn using OpenCV.

Clear: Which clears the screen by emptying the deques.

Red: Changes the marker to red colour using colour array.

Green: Changes the marker to Green colour using colour array.

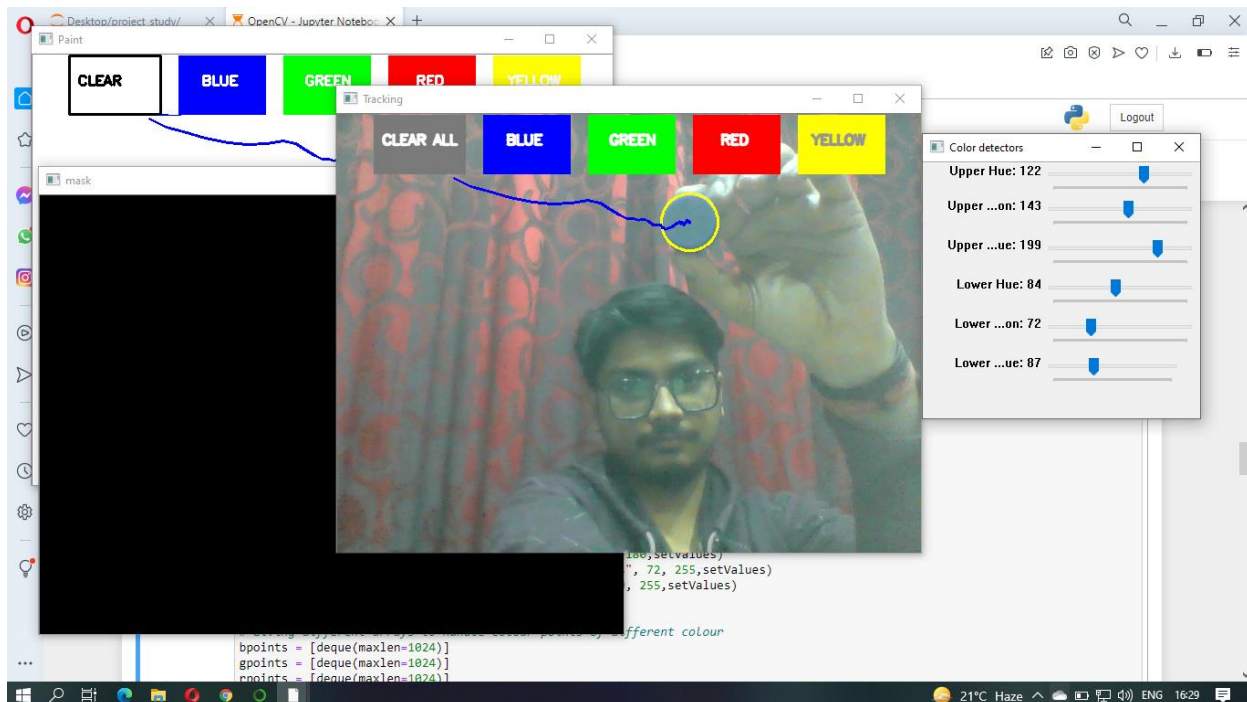
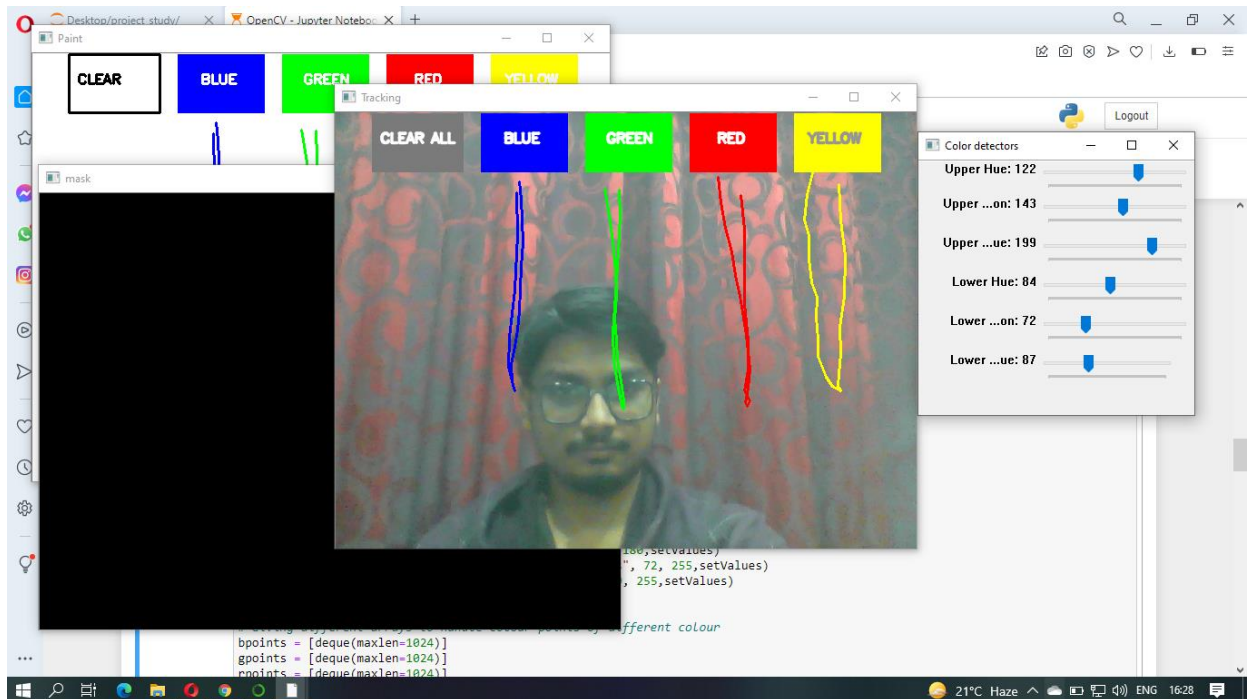
Yellow: Changes the marker to Yellow colour using colour array.

Blue: Changes the marker to Blue colour using colour array.



Also, to avoid drawing when contour is not present, we will Put an else condition which will capture that instant.

4. Now we will draw all the points on the positions stored in the dequeues, with respective colour.



Proposed Solution

In this computer vision project that is an Air Canvas which helps to draw on a screen just by waiving your finger fitted with a colourful point or a simple coloured cap. It was OpenCV which came to the rescue for these computer vision projects. The proposed method provides a natural human-system interaction in such way that it does not require keypad, stylus, pen or glove etc. for character input. Although we take hearing and listening for granted, deaf people communicate using sign languages. Most of the world can't understand their feeling, their emotions without a translator in between.

So, the solution will let the user to write on the screen by waving their finger. Then that word is compared with the words in the database and the resultant word will be written in a separate file. This will let people write everything without the use of keyboard.

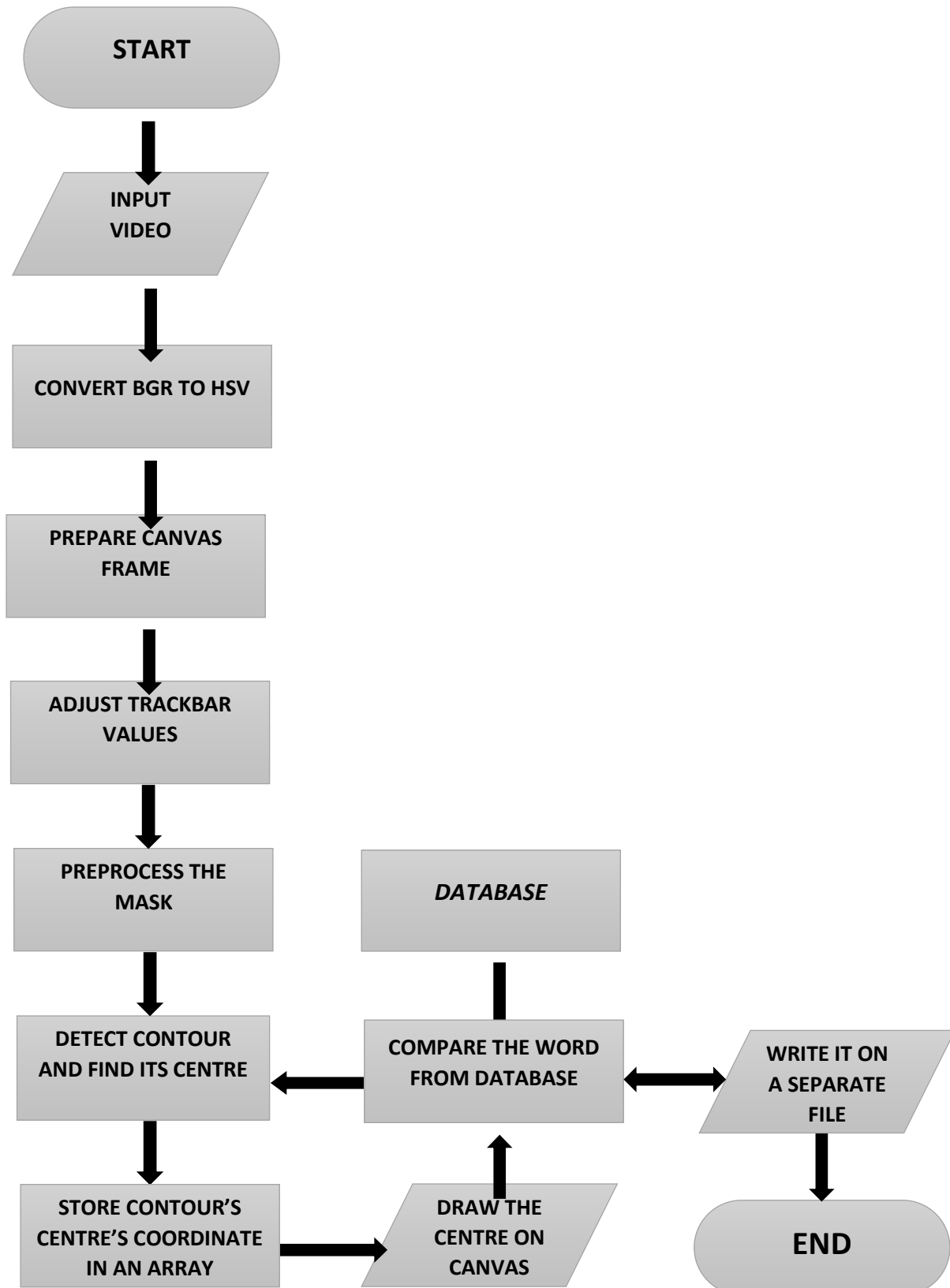
Algorithm

1. Start reading the frames and convert the captured frames to HSV colour space. (Easy for colour detection).
2. Prepare the canvas frame and put the respective ink buttons on it.
3. Adjust the track bar values for finding the mask of coloured marker.
4. Pre-process the mask with morphological operations.
5. Detect the contours, find the centre coordinates of largest contour and keep storing them in the array for successive frames (Arrays for drawing points on canvas).
6. Draw the points stored in array on the frames and canvas.
7. Compare the written word from the database.
8. Write the resultant word in a separate text file.

Hardware And Software Requirements

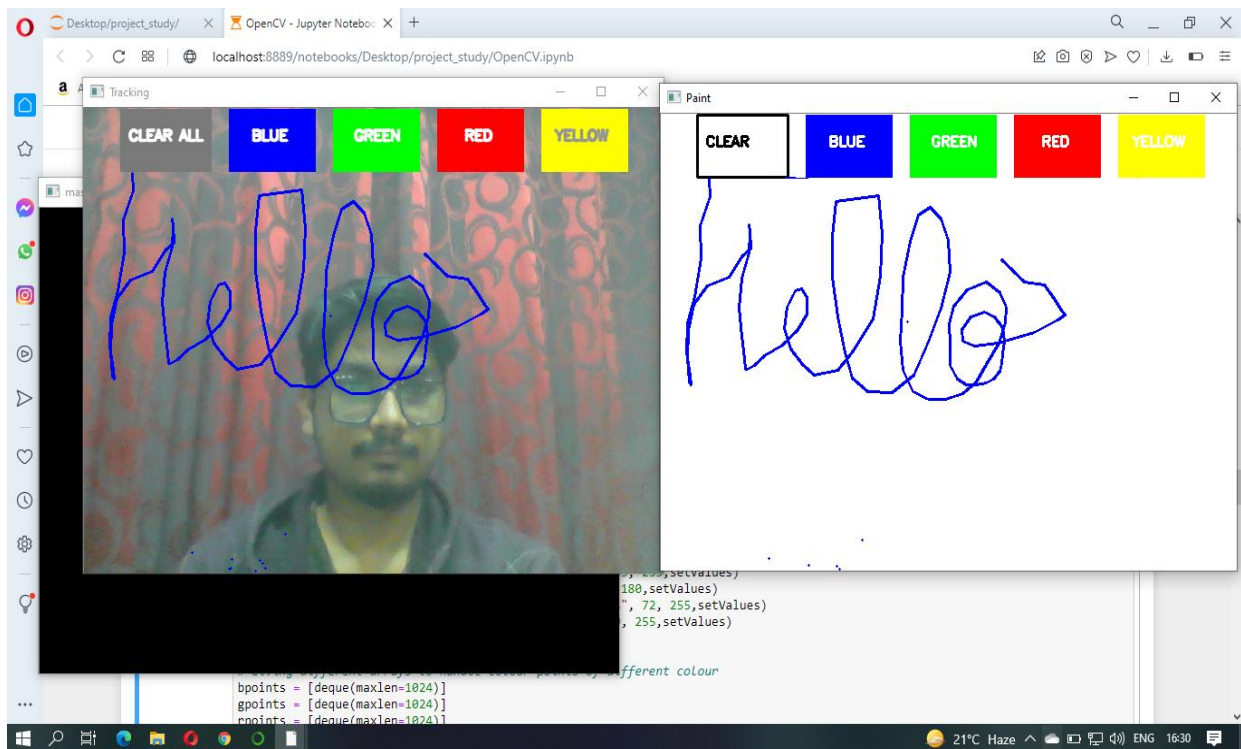
- Operating System: Any Operating System
- Supporting software: Python, NumPy, OpenCV
- Processor: Intel Core i3 3rd Gen
- RAM: 2GB
- Monitor: Any colour monitor
- Webcam

Flowchart Of The Proposed Model

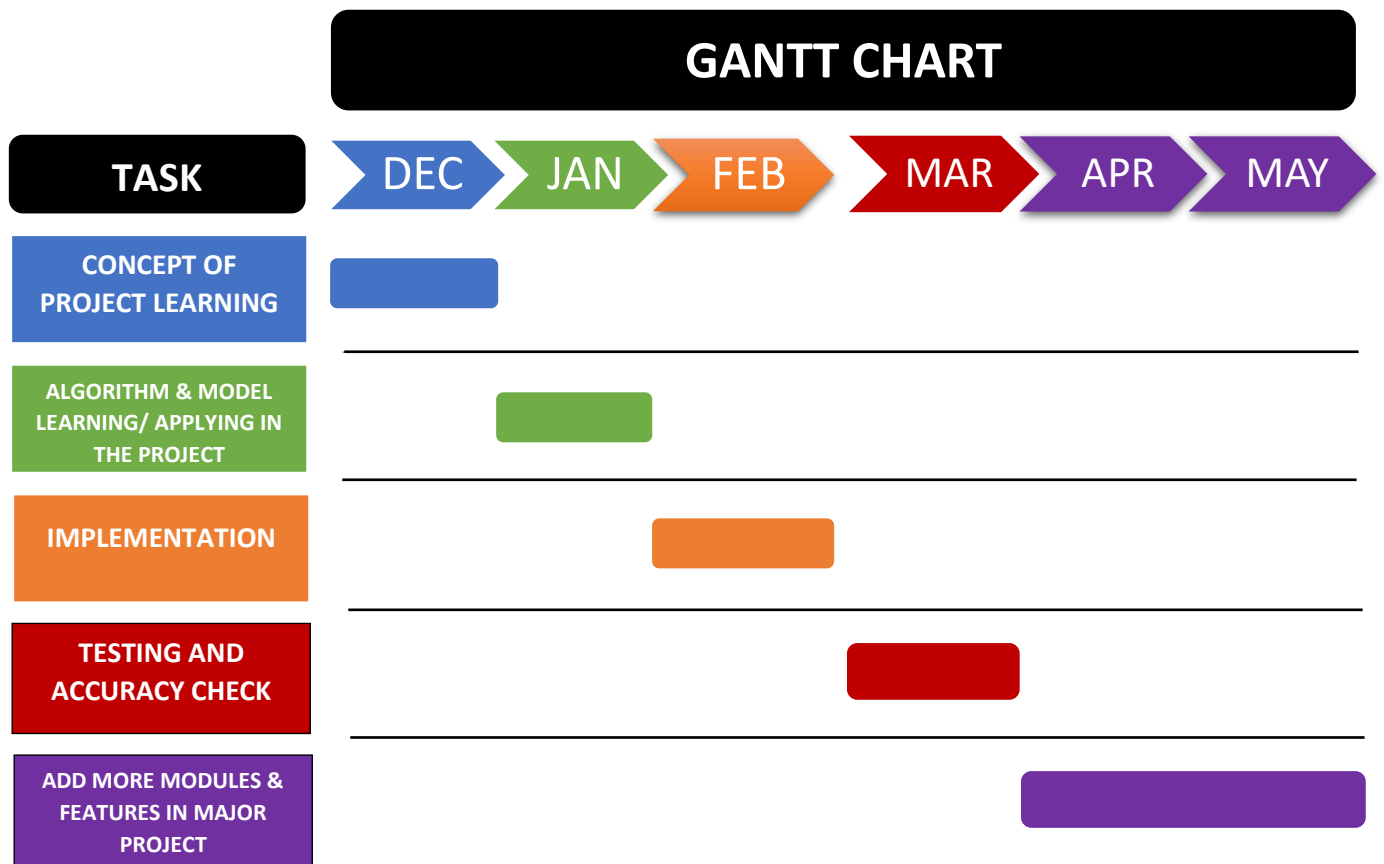


Result

This project presents a video based pointing method which allows writing of English text in air using camera. Proposed method provides a natural human-system interaction in such way that it does not require Keypad, Pen or Glove etc. for character input. It just requires a camera and any colour for reorganization a fingertip. But it has one serious issue that is colour sensitivity. If there is anything in the background related to the colour which is being used as the mask, can lead to false results.



Plan of Work



Conclusion

The system has the potential to challenge traditional writing methods. It eradicates the need to carry a mobile phone in hand to jot down notes, providing a simple on-the-job way to do the same. It will also serve a great purpose in helping especially abled people communicate easily. Even senior citizens or people who find it difficult to use keyboards will be able to use the system effortlessly. Extending the functionality, the system can also be used to control IoT devices shortly. Drawing in the air can also be made possible. The system will be an excellent software for smart wearables using which people could better interact with the digital world. Augmented Reality can make text come alive. There are some limitations of the system which can be improved in the future. Firstly, using a handwriting recognizer in place of a character recognizer will allow the user to write word by word, making writing faster. Secondly, hand-gestures with a pause can be used to control the real-time system. Thirdly, our system sometimes recognizes fingertips in the background and changes their state. Air-writing systems should only obey their master's control gestures and should not be misled by people around.

Reference

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