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INTERACTION THROUGH AIR CANVAS USING OPENCV

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ABSTRACT
Smart user interfaces that are able to identify the content of what we are drawing in the middle of the air can provide for interesting new sketching applications and more creative designs and interesting content creation to sketch your imagination by merely waving your finger in the air that indeed employs computer vision methods here in this project we establish an air canvas upon which anything can be drawn by merely tracing the trajectory of a colored marker using the respective installed camera color tracking and detection is the aim here interaction through the computer vision air canvas includes the content and could be displaying it on the screen using the application by having the different colors included the different colors enable the user for identification and more clarity this is done by accessing the web camera of the laptop itself or the separate web camera installed this helps for better understanding and give the user the brief detail on the air this is also used for sketching and text visualizing to the audience this steppingstone for more creative stream and engaging content in the future draw your creativeness via just waving your finger in air that indeed includes computer vision techniques in the respective project we make a screen through which the content or text we draw by waiving is displayed accordingly on the screen for which is done by using shooting the motion of finger via internet digital camera the objective here in this project include detection of the colors and tracking of the marker and setting the coordinate

Keywords:
Open cv,Numpy, Conections, Air canvas

INTRODUCTION

Air canvas is a hand-free digital drawing canvas that uses open cv to scan text written in the air to render it visible on the screen to develop a basic prototype for a drawing program that uses finger waiving recognition to paint or write on a screen but really writes or draws in the air we can enhance the interaction through interfaces using computer vision the marker direction is entirely managed using open source open cv software and altered to project the pointer finger onto the screen the concept for air canvas came from our fascination with digital drawing and smart photo recognition software there are many ways to visualize the data in order to learn and understand through various techniques like traditional teaching using marker and white board due to advancement of technology we moved traditional teaching to online mode where we use interface to deliver the topics even during this pandemic situations online classes have been the basic roots for the education using computer vision we can improve the interaction through interfaces here we implement intelligent user interface where we can draw different sketches using different colored markers so that everyone can understand and visualize data easily this project enables the user to sketch or write using the air canvas that is without any contact with the computer and just by waiving your finger in the air this simplifies the process and any individual can grasp and implement with complete ease free-air gestural interaction is a topic in interaction development with the release of consumer grade hard-wares and other motion tracking technologies new sensing technologies allow for free-air gestural sensing at low cost the color 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 in the era of digital world traditional art of writing is being replaced by digital art digital art refers to forms of

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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 digital art and traditional art are interrelated and interdependent social development is not a peoples will but the needs of human life are the main driving force anyway the same situation happens in 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

RELATED WORK

computer canvas it is able to process video and images to recognize objects faces or even humans handwriting when combined with other libraries such as numpy python is able to process the open cv computer vision is a process by which we can understand the images and videos how they are stored and how we can manipulate and retrieve data from them computer vision is the base or mostly used for artificial intelligence computer-vision is playing a major role in self-driving cars robotics as well as in photo correction apps open cv is the huge open-source library for the computer vision machine learning and image processing and now it plays a major role in real-time operation which is very important in todays systems by using it one array structure for analysis to identify image pattern and its various features we use vector space and perform mathematical operations on these features the first release of open cv was 10 open cv is free as its open-source so its free for commercial use as well as for academic use it has a c c python and java interface and it supports windows linux mac os ios and android during the design of opencv the general idea was for real-time use so that computational power could be provided all the codes are in optimized tcc for taking full advantage of multi-core processing uses of open cv numpy is a general-purpose array package it provides a high-performance multidimensional array object and a wide range of high-level mathematical functions to manipulate these arrays it is the core package for scientific computing with python python numpy is a cross-platform general-purpose library of array operations that offers tools for dealing with the n-dimensional arrays it offers a variety of computing utilities like extensive mathematical operations linear algebra operations numpy gives the convenience of python combined with the performance of highly optimized compiled c code its simple and easy syntax makes it extremely approachable and productive for developers of any sort this numpy tutorial helps you learn the fundamentals of numpy from basics to advance like operations on numpy array matrices using a huge dataset of numpy programs and project

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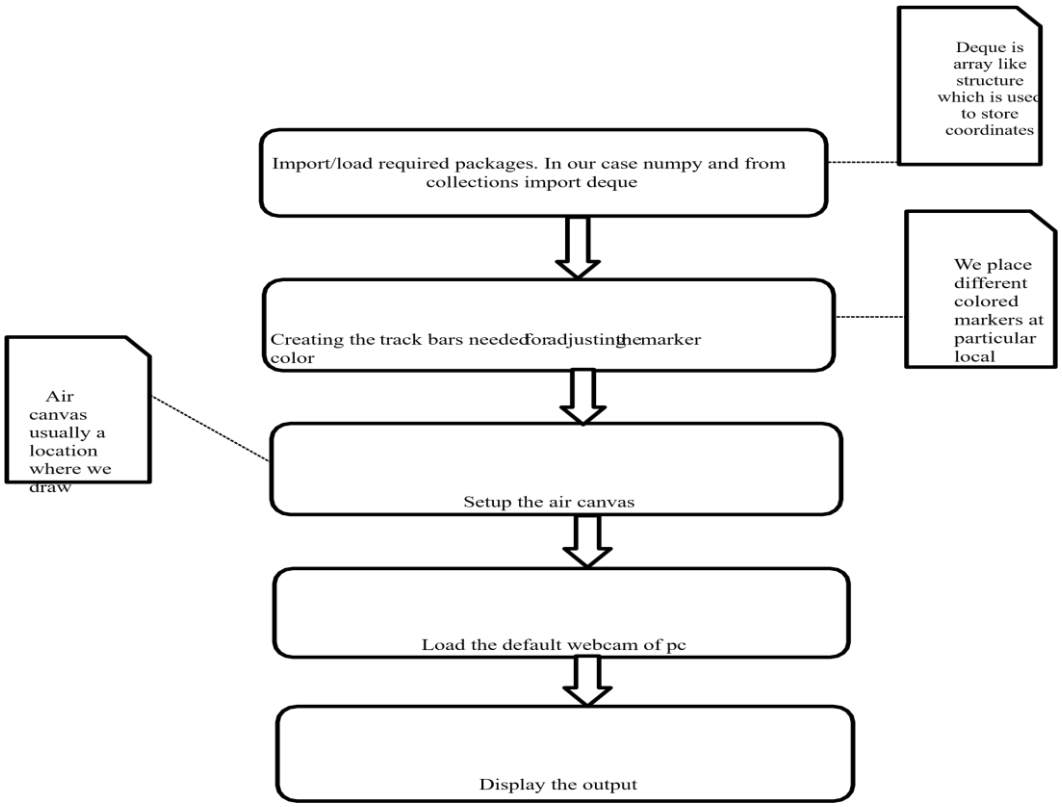
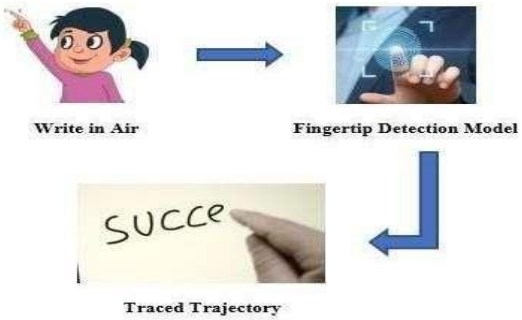
SYSTEM DESIGN



UML DIAGRAM

METHODOLOGY

this system needs a dataset for the fingertip detection model the fingertip models primary purpose is used to record the motion ie the air character a fingertip detection model air writing can be merely achieved using a stylus or air pens that have a unique color the system though makes use of fingertip we believe people should be able to write in the air without the pain of carrying a stylus we have used deep learning algorithms to detect fingertip in every frame generating a list of coordinate this system needs a dataset for the fingertip detection model the fingertip



Workflow of system

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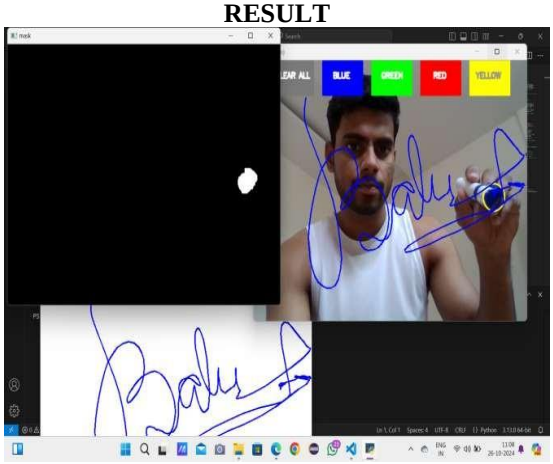
models primary purpose is used to record the motion ie the air character a fingertip detection model air writing can be simply done with a stylus or air-pens with a special color the system does utilize fingertip though we feel that people should be able to write in the air without having to deal with holding a stylus we have employed deep learning algorithms to recognize fingertip in each frame creating a list of coordinates b fingertip recognition dataset generation methods a video to images two-second hand movement videos of an individual were recorded in different environments in this scenario the videos were segmented into 30 individual images as shown in figure 2 we harvested a total of 2000 images the dataset was manually annotated with fig 62 video to images b capture images in different backgrounds to overcome the drawback caused by the absence of diversity in the first approach we created a new dataset here we were aware that we would require some gestures to implement the system hence we captured the four different hand postures as shown in figure 4 the idea was to allow the model to effectively recognize the fingertips of all four fingers this would allow the user to use the system based on the number of fingers he shows he or she could now write quickly by showing one index finger convert this writing hand to e-text by showing two fingers insert space by showing three fingers strike backspace by showing five fingers inter prediction mode by showing four fingers and then the show 123 fingers to select the 1st 2nd or 3rd prediction respectively to come out of prediction mode show five fingers this dataset contained 1800 images using a script the previously trained model was applied to auto-label this dataset then we cleaned up the wrongly labeled images and included another model a 94 accuracy was achieved this model worked well in diverse backgrounds unlike the previous one c training fingertip recognition model after we had our dataset ready and labeled its divided into train and dev sets 85-15 single shot detector ssd and faster rcnn pre-trained models were used to train our dataset faster rcnn was much more accurate than ssd refer results section for details.

RESULT



CONCLUSION

In this project, with Air Canvas, we have achieved a hands-free drawing program that uses
OpenCV to detect the user's pointer finger. With Air Canvas, Colorful lines can be drawn wherever the user desires and the brush can even be modified. It is truly like drawing in the air. Of course, Air Canvas has many flaws that may be interesting areas of research in the future.

The first is the issue of frame rate: image processing slowed down the camera feed on the usability of the program. It would be best optimized with multicore functionality, which we attempted in this project. Moreover, we relied on open source OpenCV code for hand recognition, which had its own issues that we worked hard to circumvent. This is a simple demonstration of the image processing capabilities of OpenCV. We designed different colored markers for creative design and for multicore functionality content.

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-go 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 able to use system effortlessly. Extending the functionality, system can also be used to control IoT devices shortly. Drawing in the air can also be made possible. The system will be an

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excellent software for smart wearable 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 as done by [1] instead of using the number of fingertips. 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.

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