

# Implementation of The Space Writer using Motion Detection

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**Abstract**— *The software that recognizes writing in space without any physical touch with the device is known as the Space Writer. It's a method of generating digital artwork with the help of modern human-computer interface technology. The goal of this project is to propose a solution that tracks the user's hand gestures and draw the motion on the screen. Writing in space helps to develop automated processes and can improve the interface between man and machine in a variety of applications.*

**Index Terms**— *Computer Vision, Vision- based gesture recognition, Object Tracking, character detection, character recognition*

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## I. INTRODUCTION

The Space Writer aims to construct a model that recognizes the movement written in the air as text using a combination of computer vision and hand tracking. Models would be able to write words or draw various shapes in front of a webcam in real time or in advance. Movements that are transformed into letters or numbers are put on the screen.

Space writing is an intriguing topic to explore because it lends itself to a variety of future applications Space writing is the most intuitive field. The analysis enables people with special needs to communicate in new ways. This concept might be expanded to include motions as a more universal input method for technology that are incompatible with the standard keyboard and mouse. Pen and paper, chalk, and a board are all examples of classic writing methods. The main goal of digital artwork is to construct a hand gesture-detecting machine that can be used to digitally write. Digital artwork includes a variety of unique writing methods, such as using a keyboard, touch-screen surface, a mouse, stylus, and so on. However, in this machine, we're using hand gesture detection implemented in Python, to result in a natural interaction between man and machine. The need for improved Human-Computer Interface (HCI) systems to upgrade traditional systems is rapidly expanding as technology advances. A customer can be served without any physical contact or verbal commands.

## II. LITERATURE SURVEY

Various methods of non-physical writings have been suggested in the literatures. Paper [1] uses deep learning algorithms such as Single Shot Detector (SSD) and RCNN pre-trained models to create a fingertip recognition model. Paper [2] builds the recognition model is using 2 Convolutional Neural Network (CNN) and 2 Gated Recurrent Unit (GRU) and merges the results to recognise the characters

written with higher accuracy levels. OCRs are used in paper [3] to understand the plotted picture on the screen without using external hardware. Paper [4] develops a motion to textual content developer which can be employed as software for intelligent wearable electronics that allows writing in space. It also suggests using AI to trace the finger's path. Paper [6] uses 3D hand models for complex modelling of hand gestures and appearance based models for instantaneous gesture recognitions. Papers [7] and [8] propose to recognise the written text in steps. Characters are recognized by statistical models for each letter along with the extra linking movements. HMM models are created for each phrase in dictionary and all words are recognized individually. Impulse Radar Ultra-WideBand (IR-UWB) sensors are used in paper [9] for continuous writing on air. All these various literatures aim to improve the user experience by developing a more advanced method of user interaction with the system.

## III. PROPOSED SYSTEM ARCHITECTURE

The basic architecture of our proposed system is shown in the figure below. The basic architecture of the software on the user's device from the start of the software till the application is closed will perform the following functions. The webcam will be read and the position of the fingertip will be detected. Based on the position of the fingertip, the application will either do the button operations or draw the motion done by the user and output it on the screen. The flowchart explains how our proposed system works in step by step manner.

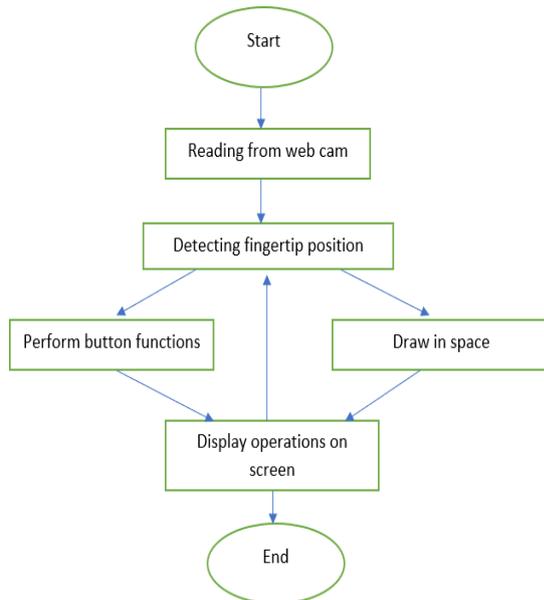


Fig. flowchart of proposed system

#### IV. PROPOSED METHODOLOGY

This methodology talks about how we can write in space which will be recognized and displayed on the machine's screen. This is possible with the help of the image processing technology. By using python language along with NumPy and OpenCV libraries we can achieve this idea. Fingertip is detected and tracked using pixel coordinates. Further, the coordinates are analysed. If the coordinates lie on any of the button regions, then the button operations are performed. If the coordinates lie on the drawing region, then those coordinates are stored and put on the screen.

Tracked pixel coordinates get inserted into queues according to the colors selected by the user and the user can also clear the screen, this happens as all the queues get emptied. All the activities of the user are actually being displayed on the screen so that creates a feel of writing in air without touching anything.

#### V. ALGORITHM

1. Set the application screen and put the various buttons necessary for the users to access.
2. Start reading the user's webcam and capture the video.
3. Detect and trace the user's movements to analyse the coordinates position based on which further functioning is performed.
4. If the coordinate position is in the button region, then perform the button operation; else draw on these coordinates on the screen digitally.
5. Repeat the process from step 3 till the application is closed. This continuous process of writing the detected text on the screen creates the feeling of writing in the space as the writing gets displayed on the screen.

#### VI. RESULTS

According to the proposed methodology and algorithm, we get to understand the pattern, and a code is written that takes the input through a webcam, button operations can be done depending on the user's need, and the drawn figure is recognized and displayed on the screen. The noise from the obtained input is again removed to obtain the required outcome.

#### VII. CONCLUSION

Space writing is a computer vision technique to detect hand-written text in the air, which is an essential step for many applications. In this paper, we present an efficient method for space writing detection. Our method detects the motion of written characters or figures in space by analysing the coordinates of the image, which is robust against changes and can work in real time on a webcam. Our goal is to aid the teachers in their classroom to be able to have undivided attention to the students during lectures and to help hospitalized patients to write or convey without burdening themselves. This project also aims to help dyslexic patients to write and learn without worrying and by making it fun and understandable.

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