Contactless Input System

A Minor Project Report Submitted To

Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal

Towards Partial Fulfilment for the Award Of

Bachelor of Technology

In

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

Submitted By

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Under the Supervision of

Ms. Lata Verma

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Department of Artificial Intelligence and Data science,

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Indore (M.P.)

[An Institution Approved By AICTE, New Delhi & Affiliated To RGPV, Bhopal]

PRESTIGE INSTITUTE OF ENGINEERING MANAGEMENTAND RESEARCH

INDORE (M.P.)

DECLARATION

We **Ankita, Chandra shekhar, Prachi, Vinamra** hereby declare that the project entitled "**Contactless Input System**", which is submitted by us for the partial fulfilment of the requirement for the award of "Bachelor of Technology in Artificial Intelligence and Data Science", to the Prestige Institute of Engineering, Management and Research, Indore (M.P.).Rajiv Gandhi Proudhyogiki Vishwavidyalaya, Bhopal, comprises my own work and due acknowledgement has been made in text to all other material used**.**

Signature of Students:

Date:

Place:

PRESTIGE INSTITUTE OF ENGINEERING MANAGEMENTAND RESEARCH

INDORE (M.P.)

DISSERTATION APPROVAL SHEET

This is to certify that the dissertation entitled **"Contactless Input System"** submitted by **Ankita Kurle (0863AD201003), Chandra Shekhar Kushwaha (0863AD201010), Prachi Soni (0863AD201030), and Vinamra Khandelwal (0863AD201056)** to the Prestige Institute of Engineering, Management and Research, Indore (M.P.) is approved as fulfilment for the award of the degree of "Bachelor of Technology in Artificial Intelligence and Data Science" by Rajiv Gandhi Proudhyogiki Vishwavidyalaya, Bhopal, (M.P.).

Internal Examiner

Date:

External Examiner

Date:

HOD, AI & DS

Dr. Dipti Chauhan

PIEMR, INDORE

PRESTIGE INSTITUTE OF ENGINEERING MANAGEMENTAND RESEARCH

INDORE (M.P.)

CERTIFICATE

This is certified that project entitled "**Contactless Input System**" submitted by **Ankita Kurle (0863AD201003),Chandra Shekhar Kushwaha (0863AD201010),Prachi Soni (0863AD201030), and Vinamra Khandelwal (0863AD201056)** is a satisfactory account of the bona fide work done under our supervision and is recommended towards partial fulfilment for the award of the degree Bachelor of Technology in Artificial Intelligence and Data Science to Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal (M.P.)

Date:

Enclosed by:

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PRESTIGE INSTITUTE OF ENGINEERING MANAGEMENTAND RESEARCH

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After the completion of major project work, words are not enough to express my feelings about all these who helped me to reach my goal; feeling above this is my indebtedness to the almighty for providing me this moment in life.

First and foremost, I take this opportunity to express my deep regards and heartfelt gratitude to my project guide **Ms. Monika Verma and Project Coordinator Ms. Lata Verma, Department of Artificial Intelligence and Data Science, PIEMR, Indore** for their inspiring guidance and timely suggestions in carrying out my project successfully. They are also the constant source of inspiration for me. Working under their guidance has been an opportunity for me to learn more and more.

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CHAPTER 1
INTRODUCTION

1.1 Introduction

The uses of computers have become an integral part of our daily life and the human computer interaction are becoming more convenient in every day. While the majority of the people take these facilities for granted, people with physical impairments face many difficulties in properly using these devices.

In this work, we propose a novel multi-modal interactive keyboard and mouse system where we detect and track a colour (yellow in this research) to replace the use of traditional keyboard and mouse using the device's camera. This is achieved by taking inputs from a camera using a vision-based colour recognition technique and hand gesture recognition technique and without any additional hardware requirements.

Our system will allow the user to operate their computer's keyboard and mouse using only their hand bearing a yellow colour cap on their fingertip. The main objective of this research is to build an interactive keyboard and mouse system so that motion impaired people can communicate with the computer through its webcam using their one hand only

1.2 Motivation

In particular, people with severe movement disabilities may have physical impairments which significantly limit their ability to control the fine motor. Therefore, they may not be able to type and communicate with a normal keyboard and mouse. In this situation, it is important to use effective assisted technologies to ensure accessibility for such people. A wide range of eye-tracking devices are currently available commercially on the market, offering many functionalities, accuracy level, and price range. Many research studies require eye-tracking devices of high precision to test a range of eye characteristics, but they are expensive such as infrared

1.3 Objective

To support this aim, secondary objectives are:

- to detect a yellow-coloured cap
- to recognize the key on which the cap is placed
- to track the movement of coloured cap for mouse movement and
- to detect the number of fingers shown to determine left-button or right button click of the mouse
-

1.4 Analysis

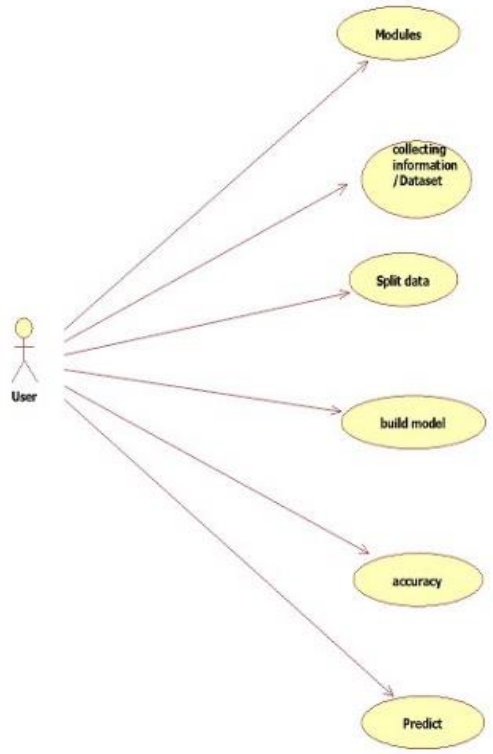
1.3.1. Functional Requirement

Hardware Requirement: a) The following describes the hardware needed in order to execute and develop the Virtual Mouse application: • Computer Desktop or Laptop The computer desktop or a laptop will be utilized to run the visual software in order to display what webcam had captured. A notebook which is International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 08 Issue: 07 | July 2021 www.irjet.net p-ISSN: 2395-0072 © 2021, IRJET | Impact Factor value: 7.529 | ISO 9001:2008 Certified Journal | Page 4040 a small, lightweight and inexpensive laptop computer is proposed to increase mobility of the application. System will be using Processor: Core2Duo Main Memory: 2 GB RAM (Minimum) Hard Disk: 512 GB (Minimum) Display: 14" Monitor (For more comfort)

1.3.2. Non-Functional Requirement

a) The following describes the software needed in-order to develop the Virtual Mouse application: Python: To access camera & tracking all hand motion, python is very easy & accurate to use. Python comes with lots of build in libraries which makes code short and easily understandable. Python version required for building of this application is 3.7 Open CV Library: OpenCV are also included in the making of this program. OpenCV (Open-Source Computer Vision) is a library of programming functions for real time computer vision. OpenCV have the utility that can read image pixels value, it also has the ability to create real time eye tracking and blink detection.

1.3.3. Use Case Diagram



CHAPTER 2
BACKGROUND AND RELATED WORK

2.1 Problem Statement

The aim of this paper is to implement a computer application which uses alternative methods to control keyboard and mouse cursors for rehabilitation of people who are suffered from stroke so that they can recover the side effects. Therefore, we propose a new keyboard and mouse cursor control system based on vision and color recognition technique, utilizing hand gestures recorded from a webcam.

Figure 1 shows the overview of the process of interactive keyboard and mouse controlling system. This work aims at creating a system that recognizes the colors and hand gestures, and controls computer's keyboard and mouse according to those gestures using color detection technique.

Our system will use computer's webcam and will display an onscreen keyboard layout. Users will be able to type through the keyword using a finger cap on his fingertip. User can also turn on mouse controlling system by pressing *Mouse Control Module* button using that finger cap. After that, another live video frame will be shown for tracking the hand movements to recognize mouse functions. Figure 2 represents the system architecture for virtual communication system.

2.2 Background and Related Work

2.2.1 Background Work

There are traditional approaches for virtual keyboard and mouse systems which are usually based on eye gestures. Our literature review focuses on the research works on virtual keyboard and virtual mouse which were published in Elsevier, Springer, ACM Digital Library, IEEE Digital Library etc. We discussed about few related works on virtual keyboard and virtual mouse in the following two subsections.

2.2.2 Literature survey

In 2010, Y. Adajania et. al developed a *Virtual Keyboard Using Shadow Analyss*. This system detects keyboard, hands shadow, finger tips using colour segmentation and sobel technique. Ambient lighting conditions required for this system. This system can analyze 3 frames per second.

In 2011, S. Hernanto et al. built a method for virtual keyboard using webcam . In this approach, two functions are used for finger detection and location detection. This system used two different webcams which are used to detect skin and location separately. The average time per character of this virtual keyboard is 2.92 milliseconds and the average accuracy of this system is 88.61%.

In 2016, S. Shetty et al. constructed a virtual mouse system using color detection They used webcam for detecting mouse cursor movement and click events using OpenCV built-in functions. A mouse driver, written in java, is required as well. This system fails to perform well in rough background.

P. C. Shindhe et al. expanded a method for mouse free cursor control where mouse cursor operations are controlled by using hand fingers They have collected hand gestures via webcam using color detection principles. The built-in function of Image Processing Toolbox in MATLAB and a mouse driver, written in java, used in this approach. The pointer was not too efficient on the air as the cursor was very sensitive to the motion

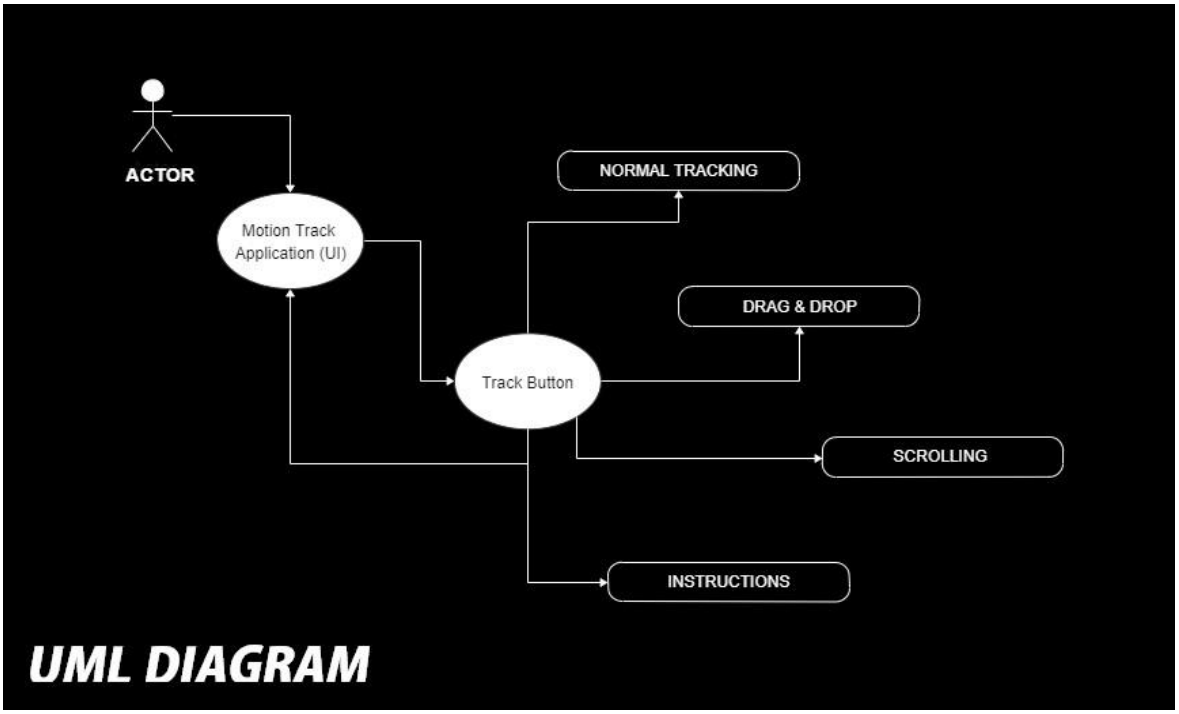
2.3 Solution Approach

As the technology increase everything becomes virtualized. Such as speech recognition, Speech Recognition is used for recognition and translation of the spoken language into text. Thus, Speech Recognition can replace keyboards in the future, Similarly Eye Tracking which is used to control the mouse pointer with the help of our eye. Eye Tracking can replace mouse in the future. Gestures can be in any form like hand image or pixel image or any human given pose that require less computational difficulty or power for making the © 2020 JETIR June 2020, Volume 7, Issue 6 www.jetir.org (ISSN-2349-5162) JETIR2006455 Journal of Emerging Technologies and Innovative Research (JETIR) www.jetir.org 827 devices required for the recognitions to make work. Different techniques are being proposed by the companies for gaining necessary information/data for recognition handmade gestures recognition models. Some models work with special devices such as data glove devices and color caps to develop a complex information about gesture provided by the user/human.

CHAPTER 3

DESIGN (UML AND DATA MODELING)

3.1 UML Modelling

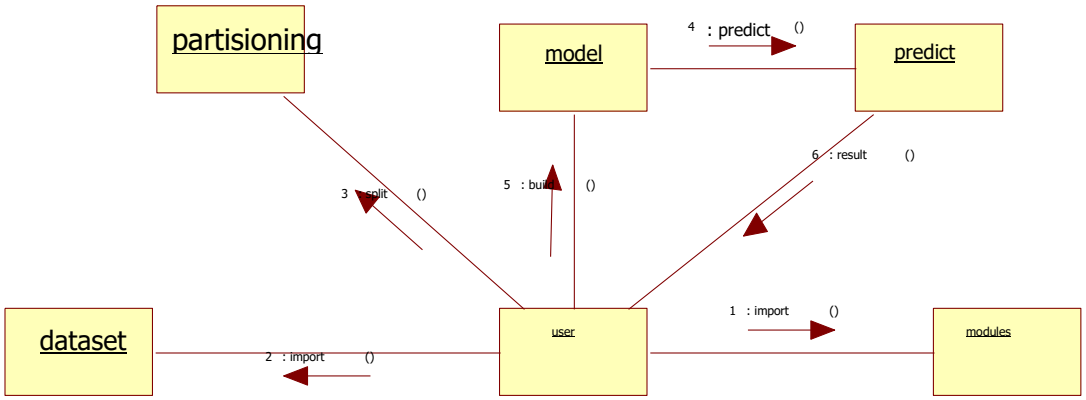


3.1.2 Modules Specification

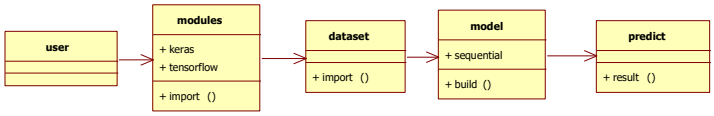
There are following modules used in the completion of this project which are as follows:

- Python
- Opencv
- Mediapipe
- Pyautogui
- Cvzone

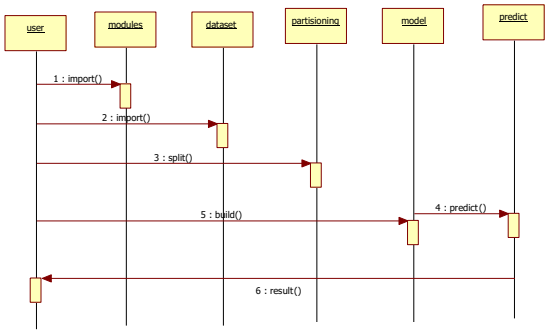
3.1.3 Collaboration Diagram



3.1.4 Class Diagram\



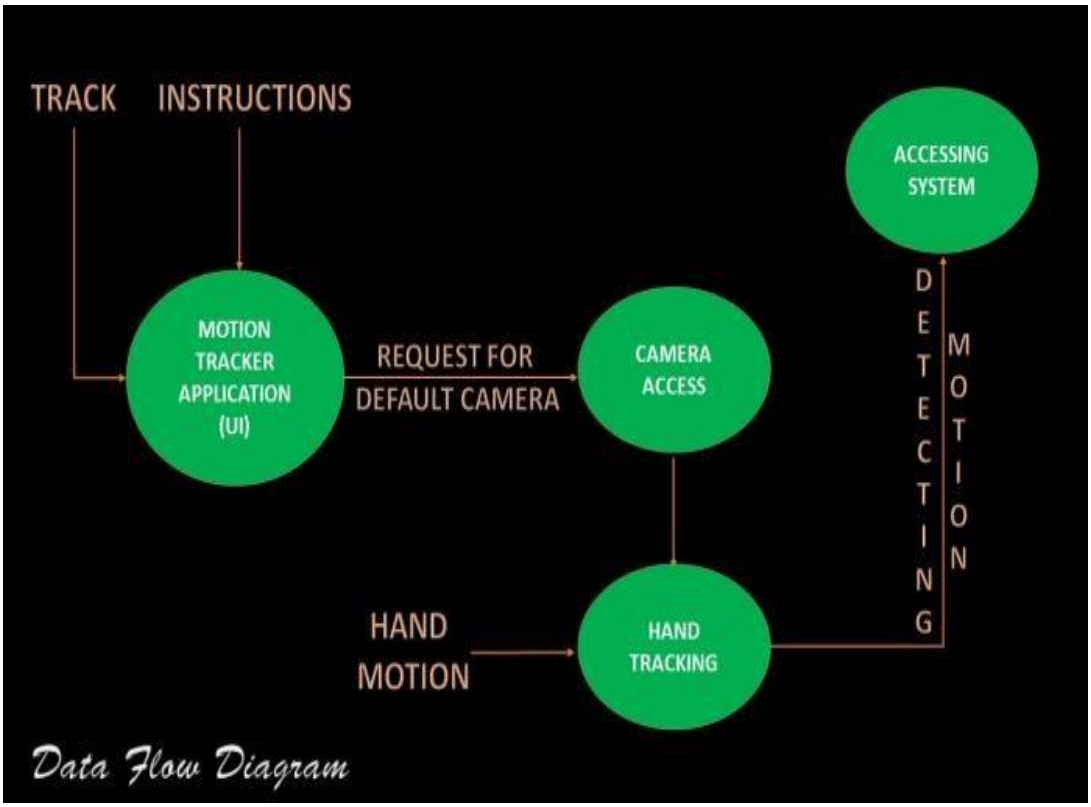
3.1.5 Sequence Diagram



3.1.6 Activity Diagram

3.2 Data Modelling

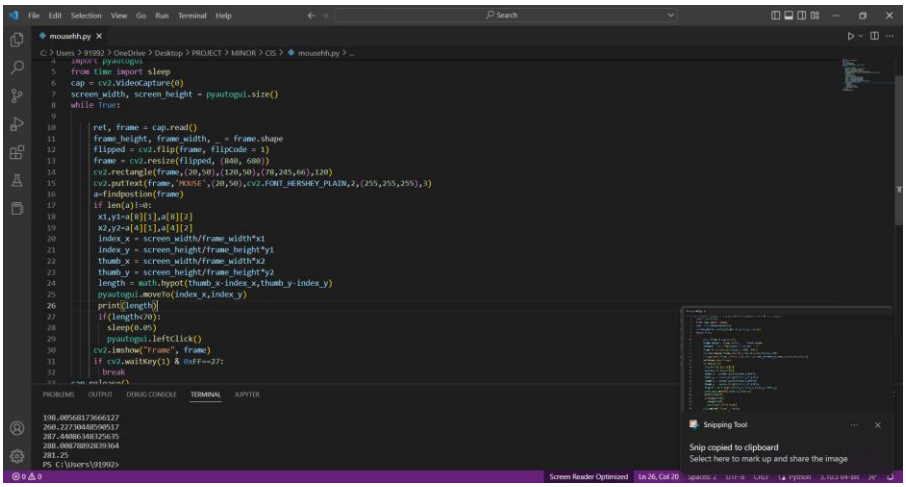
3.2.1 Data Flow Diagram



CHAPTER 4
IMPLEMENTATION

4.1 Tools Used

- **VS Code**



Visual Studio Code, also commonly referred to as VS Code is a source-code editor made by Microsoft with the Electron Framework, for Windows, Linux and macOS. Features include support for debugging, syntax highlighting, intelligent code completion, snippets, code refactoring, and embedded Git. Users can change the theme, keyboard shortcuts, preferences, and install extensions that add additional functionality.

- **Web Cam**

A webcam is a video camera which is designed to record or stream to a computer or computer network. They are primarily used in videotelephony, livestreaming and social media, and security. Webcams can be built-in computer hardware or peripheral devices, and are commonly connected to a device using USB or wireless protocols.

4.2 Technology

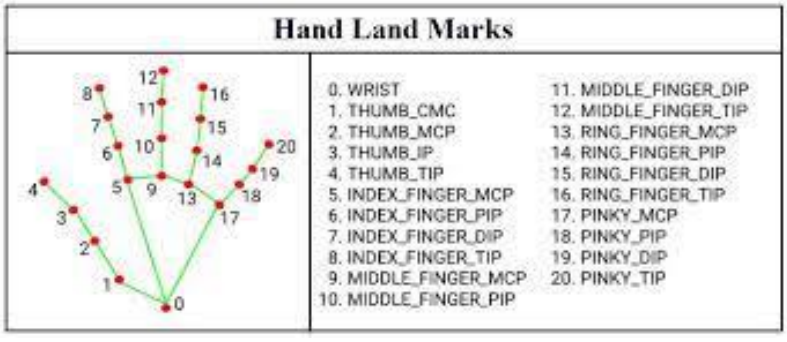
- **Python 3.10**

  • Python is a high-level, general-purpose programming language. Its design philosophy emphasizes code readability with the use of significant indentation.

  • Python is dynamically-typed and garbage-collected. It supports multiple programming paradigms, including structured (particularly procedural), object-oriented and functional programming. It is often described as a "batteries included" language due to its comprehensive standard library.

- **Mediapipe 0.8.1**

MediaPipe offers cross-platform, customizable ML solutions for live and streaming media. End-to-End acceleration: Built-in fast ML inference and processing accelerated even on common hardware. Build once, deploy anywhere: Unified solution works across Android, iOS, desktop/cloud, web and IoT.



4.3 Testing

4.3.2 Test Cases

Keyboard

We have considered a stroke patient for our testing who has lost control of his left side. After doing some exercises, he was able to use our system and performed keyboard and mouse operations for five times. We have performed our experiment in a normal lighted room condition.

The summary of our experiment's parameters is given below:

- Considered text: A Brown Fox Jumps Over The Lazy Crocodile 1 2 3 4 5 6

7 8 9 0
- Number of characters(without space): 44
- Number of tests: 5
- Tested by: A 52 years old stroke patient who has very little control of his left side

Mouse

Virtual Mouse module in our system performs mouse functions by recognizing hand and counting the finger numbers. It can perform six different functions: left click, right click, left movement, right movement, up movement and down movement. We considered the same lighting and room condition which was used in virtual keyboard experiment. The distance between the camera and object is maximum 10 m and the objects are set in a fixed environment.

4.3.3 Test Reports

Fig.9. Experimental result of virtual mouse

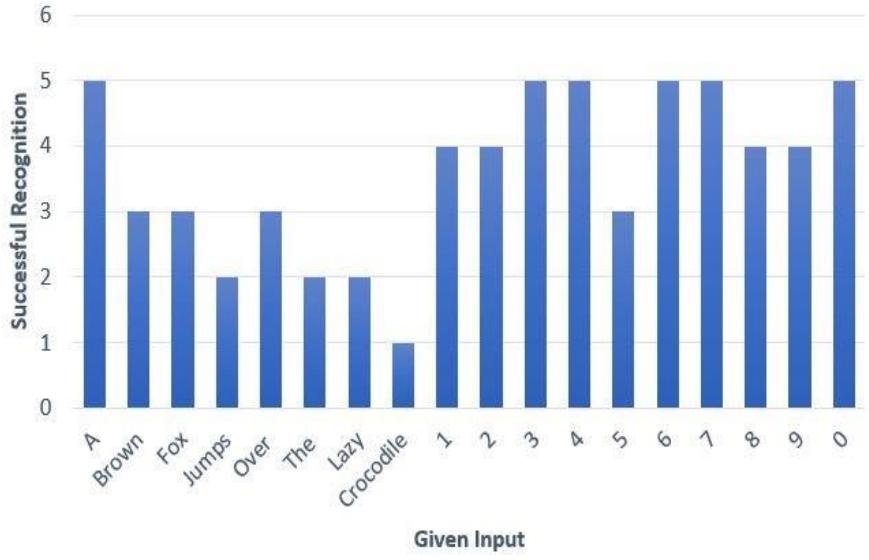


Fig.8. Experimental result of virtual keyboard

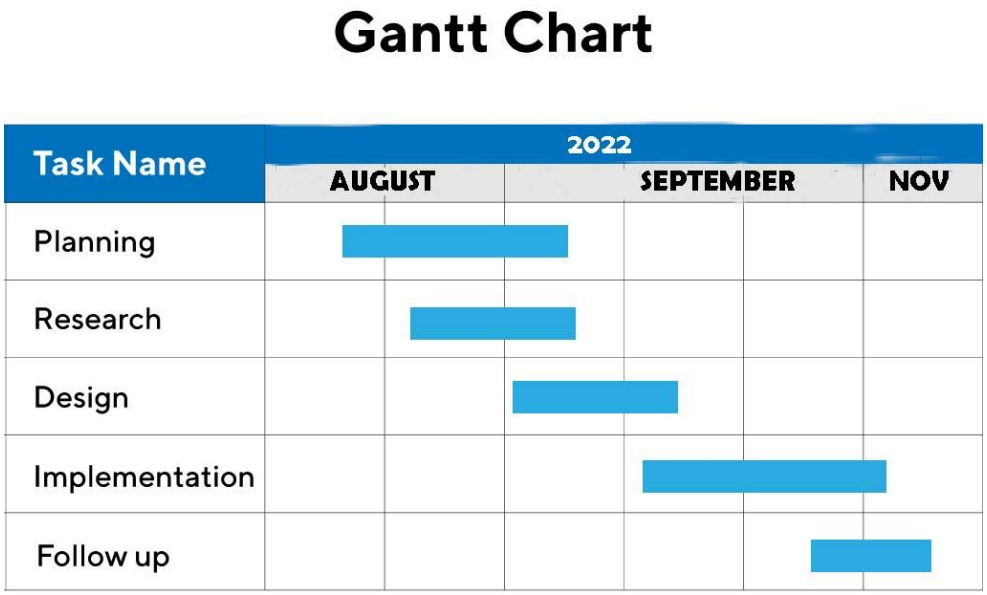
4.3 User manual

- Display the frame The imShow() is a function of HighGui and it is required to call the waitKey regulerly. The processing of the event loop of the imshow() function is done by calling waitKey. The function waitKey() waits for key event for a “delay” (here, 5 milliseconds). Windows events like redraw, resizing, input event etc. are processed by HighGui. So we call the waitKey function, even with a 1ms delay.
- Mouse Movement We have to first calculate the center of both detected red object which we can easily do by taking the average of the bounding boxes maximum and minimum points. now we got 2 co-ordinate from the center of the 2 objects we will find the average of that and we will get the red point shown in the image. We are converting the detected coordinate from camera resolution to the actual screen resolution. After that we set the location as the mouse_position. but to move the mouse pointer it will take time. So we have to wait till the mouse pointer reaches that point. So we started a loop and we are not doing anything there we are just waiting will the current mouse location is same as assigned mouse location. That is for the open gesture.
- Clicking The next step is to implement the close gesture. The operation is performed by clicking the object and dragging it. It is similar to the open gesture, but the difference is we only have one object here so we only need to calculate the center of it. And that will be placed on the location where we will position our mouse pointer. Instead of mouse release

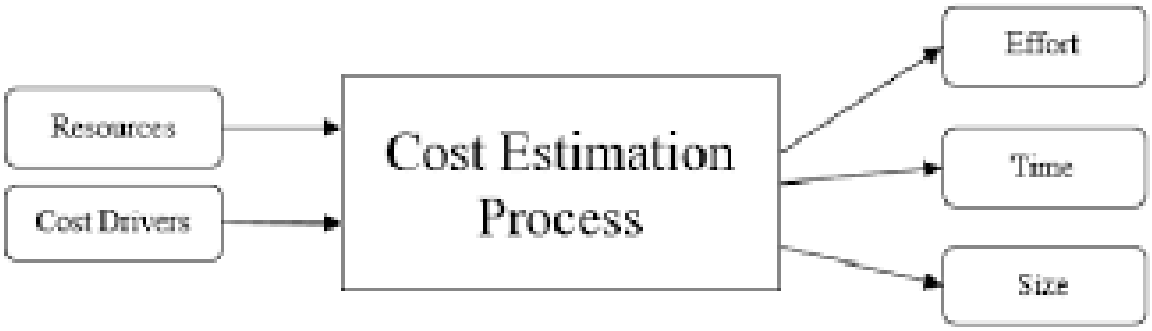
CHAPTER 5

PROJECT PLAN

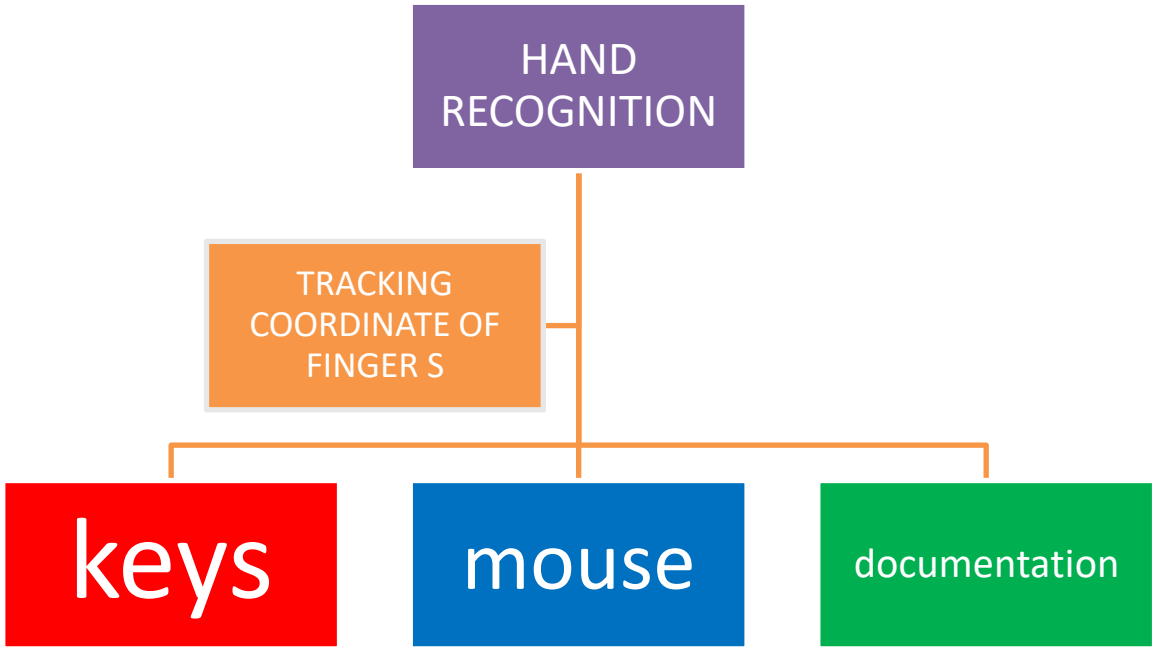
5.1 Gantt Chart



5.2 Effort Schedule &Cost estimation



5.3 Work Breakdown Structure



5.4 Deviation from original plan and correction applied

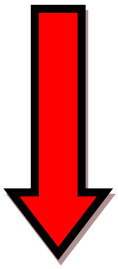
First we tried to create program in which we would integrate the interaction of mouse and Keyboard simuntaneously but due to limitation of resources and pre requisted knowledge we come to an idea to develop the project indivisualy hence, developed different script for the keyboard and mouse but used a same module to catch the hand gestures. Moreover , we tried to develop the multi-hand gesture control but due to incoming deadline we decided to stick to limited fuctionality of the mouse and Keyboard.

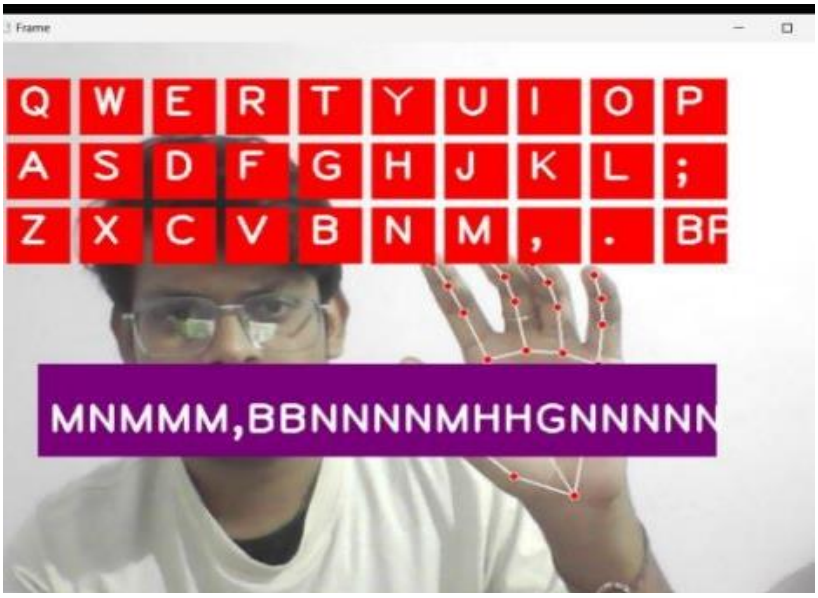
CHAPTER 6

PROJECT SCREENSHOT

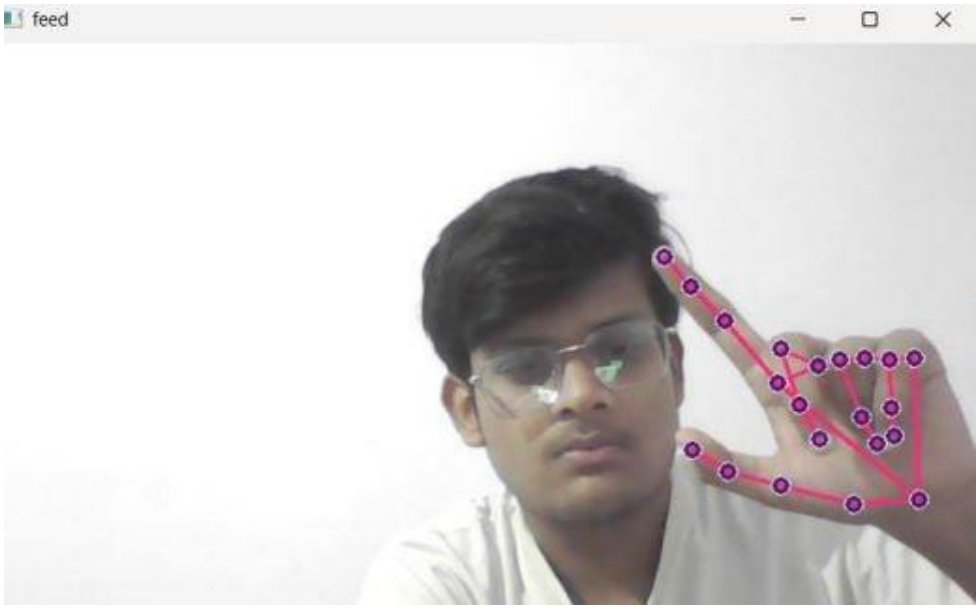
6.1 Keyboard

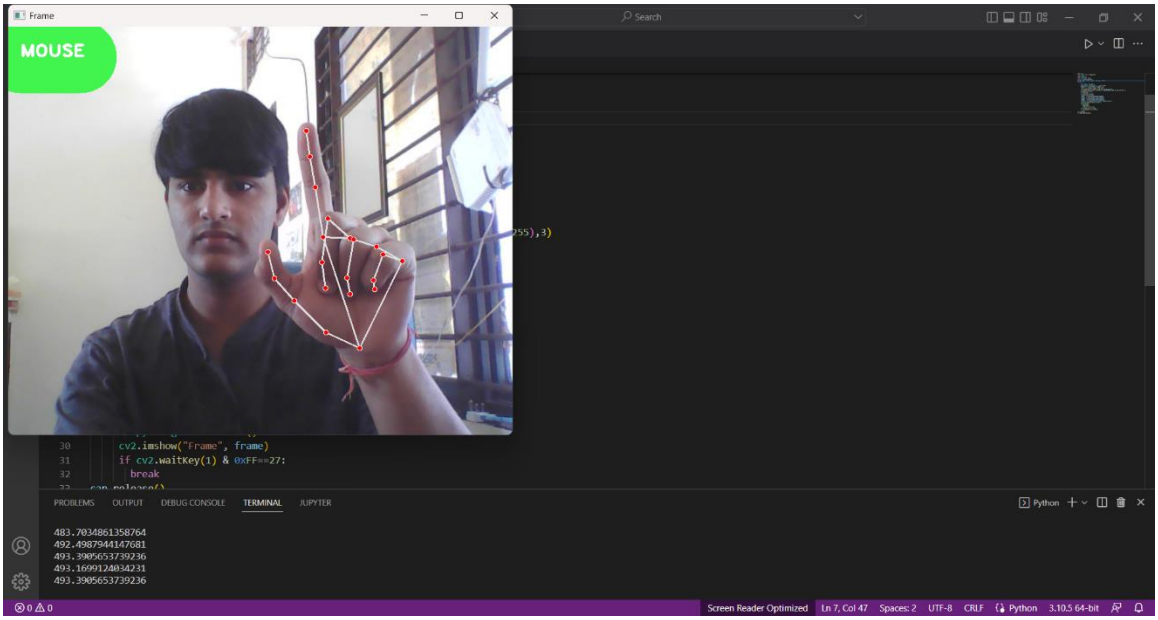

Frame
Q W E R T Y U I O P
A S D F G H J K L ;
Z X C V B N M , .




Frame
Q W E R T Y U I O P
A S D F G H J K L ;
Z X C V B N M , .
MNMMM,BBNNNNMHHGNNNNN

6.2 Mouse


feed


Frame
MOUSE
cv2.imshow("Frame", frame)
if cv2.waitKey(1) & 0xFF==27:
break
PROBLEMS
OUTPUT
DEBUG CONSOLE
TERMINAL
JUPYTER
483.7034861358764
492.4987944147681
493.3905653739236
493.1699124034231
493.3905653739236

CHAPTER 7

CONCLUSION/ FUTURE SCOPE

7.1 Conclusion

Keyboard and mouse actually form an integral part of the computer system. Our system architecture can facilitate the use of computer for the paralyzed people. We have developed a virtual system where people can communicate with the computer without using any physical keyboard and mouse. This could lead to a new age of Human Computer Interaction in which physical contact with the computer would not be necessary at all. The use of object detection and image processing in OpenCV for the implementation of our work has proved to be practically successful and the task of keyboard and mouse is achieved with good precision. This system can be beneficial to certain people who have no control over their limbs.

Most of the applications require additional hardware which are often very expensive. The motive of this work is to create this technology as cheaply as possible and to create it under a standardized operating system as well. Though, our system can be used as an alternative for physical keyboard and mouse, it still may perform less accurately in a low light condition. This is a concern for further research. Moreover, the work can be extended for a wide variety of environments and can be tested using the sophisticated existing models

7.2 Application Domain &Future Scope

There are several features and improvements needed in order for the program to be more user friendly, accurate, and flexible in various environments. The following describes the improvements and the features required:

a) Smart Movement: Due to the current recognition process are limited within 25cm radius, an adaptive zoom in/out functions are required to improve the covered distance, where it can automatically

adjust the focus rate based on the distance between the users and the webcam.

b) Better Accuracy & Performance: The response time are heavily relying on the hardware of the machine, this includes the processing speed of the processor, the size of the available RAM, and the available features of webcam. Therefore, the program may have better performance when it's running on a decent machine with a webcam that performs better in different types of lightings.

c) Mobile Application: In future this web application also able to use on Android devices, where touchscreen concept is replaced by hand gestures.

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