# AI Virtual Mouse

## A Report For
## Design Engineering II A (3150001)

**Submitted By**


**Odedara Jagdish (210640107001)**

**Patel Mayur (210640107010)**

**Agarwal Dev (210640107013)**

**Solanki Tushar (210640107005)**


**Guided by**

**Mrs. Hiral Patel**
**Department of Computer Engineering**



**K J INSTITUTE OF ENGINEERING AND TECHNOLOGY, SAVLI**

**Gujarat Technological University, Ahmedabad**

**K J INSTITUTE OF ENGINEERING AND TECHNOLOGY, SAVLI**

**Department of Computer Engineering**

# CERTIFICATE

*Date:*

This is to certify that **Odedara Jagdish** with Enrollment No **210640107001** of Semester 5th, **Department of Computer Engineering** has satisfactorily completed the work under the "**AI Virtual Mouse**" in Design Engineering II A (3150001) course within the four walls of the Institute.

Internal Guide
Prof. Hiral Patel
Department of Computer Engineering

Head of Department
Prof. Pranavi Patel
Department of Computer Engineering

**K J INSTITUTE OF ENGINEERING AND TECHNOLOGY, SAVLI**

**Department of Computer Engineering**

# CERTIFICATE

*Date:*

This is to certify that **Mayur Patel** with Enrollment No **210640107010** of Semester 5th, **Department of Computer Engineering** has satisfactorily completed the work under the "**AI Virtual Mouse**" in Design Engineering II A (3150001) course with in the four walls of the Institute.

Internal Guide
Prof. Hiral Patel
Department of Computer Engineering

Head of Department
Prof. Pranavi Patel
Department of Computer Engineering

**K J INSTITUTE OF ENGINEERING AND TECHNOLOGY, SAVLI**

**Department of Computer Engineering**

# CERTIFICATE

*Date:*

This is to certify that **Agarwal Dev** with Enrollment No **210640107013** of Semester 5th, **Department of Computer Engineering** has satisfactorily completed the work under the "**AI Virtual Mouse**" in Design Engineering II A (3150001) course within the four walls of the Institute.

Internal Guide
Prof. Hiral Patel
Department of Computer Engineering

Head of Department
Prof. Pranavi Patel
Department of Computer Engineering

**K J INSTITUTE OF ENGINEERING AND TECHNOLOGY, SAVLI**

**Department of Computer Engineering**

# CERTIFICATE

*Date:*

This is to certify that **Solanki Tushar** with Enrollment No **210640107005** of Semester 5th, **Department of Computer Engineering** has satisfactorily completed the work under the "**AI Virtual Mouse**" in Design Engineering II A (3150001) course within the four walls of the Institute.

Internal Guide
Prof. Hiral Patel
Department of Computer Engineering

Head of Department
Prof. Pranavi Patel
Department of Computer Engineering

**K J INSTITUTE OF ENGINEERING AND TECHNOLOGY, SAVLI**

**Department of Computer Engineering**

# CERTIFICATE

*Date:*

This is to certify that **Mayur Patel** with Enrollment No **210640107010** of Semester 5th, **Department of Computer Engineering** has satisfactorily completed the work under the "**AI Virtual Mouse**" in Design Engineering II A (3150001) course with in the four walls of the Institute.

Internal Guide
Prof. Hiral Patel
Department of Computer Engineering

Head of Department
Prof. Pranavi Patel
Department of Computer Engineering

# ABSTRACT

In today's world we see lots of development happening in the field of Technology. Today's technology is combined with the technique called Artificial Intelligence. This project is also based on a small part of AI. This project presents finger movement gesture detection on our computer's window using a camera & handling the whole system by just moving your one finger.

Using finger detection methods for instant camera access and user-friendly user interface makes it more easily accessible. The system is used to implement motion tracking mouse, a signature input device and an application selector. This system reduces the use of any physical mouse which saves time and also reduces effort.

# INDEX

# CHAPTER-1

## 1.1) PROJECT INRODUCTION & OVERVIEW

In the new present day progresses at extends the areas of exaggerated reality and contraptions that we will generally will as a rule use in our existence, these devices have gotten diminished at ranges the sort of Bluetooth or far off advancements. AI virtual mouse system that produces use of the hand signals and hand tip acknowledgment for performing articulations mouse limits at ranges the advantageous PC cheating adaptable PC vision. The most impartial of the projected system is to perform device pointer works and material performs using a web camera or a characteristic camera at extends the smaller PC rather than using an obsolete mouse contraption.

Also, hand tip area by misuse helpful PC vision is used as a HCI with the PC. With the usage of the AI virtual mouse system, we will follow the tip of the hand signal by using an intrinsic camera or net camera and play out the mouse pointer assignments and investigating work and together move the pointer with it.

We are developing such an application which is combination of AI & Web. Implement such code where camera can recognize each and every finger movement & respond according to it. After completing this project, users can access their system with the help of their finger by using.

## 1.2) PURPOSE OF SOFTWARE

Motion Tracker Application is the application software where after clicking on TRACK option, which is given after just opening of application, instead of using physical mouse user can use their finger as a mouse & whatever the direction we give to our finger according to that cursor on the system move & user can do their work.

## 1.3) PROJECT GOAL AND SCOPE

Virtual Mouse will soon to be introduced to replace the physical computer mouse to promote convenience while still able to accurately interact and control the computer system. To do that, the software requires to be fast enough to capture and process every image, in order to successfully track the user's gesture.

- The Scope of The Project Is as Below:

  I. Realtime Application
  II. User friendly Application
  III. Removes the requirement of having a physical mouse.

# CHAPTER:2

## 2.1) Software Requirements

- Microsoft office 2022
- Operating System: Window 8 or higher or MACOS
- PyCharm CE editor 2022.2

## 2.2) Hardware Requirements

- Processor:X32 or X64
- RAM :2GB or higher
- Storage: 5GB (Approx.)
- Camera

## 2.3) Functional Requirements

- After developing this application, the user should be able to access their system through Motion Tracker Application. Calculations required for this application are all related to motion detect operations & Data processing is done by using different python libraries like NumPy & media-pipe.

## 2.4) Interface Requirements

- This application communicates with UI & Python code with the help of Autopy of python. Autopy is a Python binding to the Tk GUI toolkit. It is the standard Python interface to the Tk GUI toolkit and is Python's de facto standard GUI. Autopy is included with standard Linux, Microsoft Windows and Mac OS X installations of Python.

# CHAPTER:3

## 3.1) Summary Of Prior Art Search (PAR):

- Here unit a few associated works allotted on virtual mouse exploitation hand motion location by wearing among the hand and likewise exploitation shading tips among the hands for motion acknowledgment, however they are presently further right in mouse capacities. The acknowledgment isn't in this way right as aftereffect of wearing gloves; also, the gloves don't appear to be fitted to certain clients, and at times, the acknowledgment isn't subsequently right as consequences of the mistake of area of concealing tips. In1991, Quam presented partner early equipment-based structure; all through this strategy, the client got to wear a data Glove. The extended structure by Quamtho' gives consequences of higher exactness; assemble d's strong to perform assortment of the signal controls exploitation the framework. Manure "the premier constraint of this model is further unpretentious hand signals. Neha, Parul Gandhi and AshwiniM.2014 extended a concentrate on "Cursorsystem abuse Hand Gesture Recognition."

- Chaitanya Thomas, Naveen kr, and Abhilash Seth in 2019 expected "Virtual Mouse double-dealing Hand Gesture" where the model area relies upon colors. In any case, alone barely any mouse limits square measure performed.

- *D. Ligature Survey*

  The current construction is contained a nonexclusive mouse and trackpad screen control framework, as well as the mishap of a hand development control structure. The utilization of a hand development to get to the screen from a nice way is unimaginable.

  No matter what how it is basically attempting to execute, the degree is just restricted in the virtual mouse field.

- The current virtual mouse control structure contains direct mouse tasks utilizing a hand attestation framework, in which we have some control over the mouse pointer, left click, right snap, and drag, etc. The utilization of hand confirmation in the future won't be utilized. Despite how there are a gathering of frameworks for hand certification, the construction they utilized is static hand attestation, withies just a confirmation of the shape made by the hand and the meaning of activity for each shape made, which is restricted to a few depicted activities and makes a great deal of unsettling influence.
- As progression drives, there are something else and more decisions rather than utilizing a mouse.

⇒Coming up next are a piece of the techniques that were used: -

1. Camera Used in the Virtual Gesture Mouse project: Open- CV is python vision library that contains Associate in the organized AI virtual mouse structure depends upon the edges that are gotten by the camera in associate in nursing passing computer.
2. Providing Input: Pictures in Computer Vision are portrayed as associations of numbers watching out for the discrete eclipsing or power values present in each picture pixel. Each picture is considered as information displayable in various ways, whether as collections of pixel values or either complex plot keeping an eye on the course of pixel powers.
3. Moving hand through the Window using rectangular area: The AI virtual mouse structure uses the informative algorithmic rule, and it changes over the co-ordinates of tip from the camera screen to the pc window full screen for the mouse.
4. Detect the Fingertips and do the Mouse Cursor improvements.
5. In this construction, AI mouse is police evaluation that finger is up deceiving the spot co-ordinate of the particular finger that it'll found abuse the Media-Pipe and along these lines the specific bits of the fingers that region unit up, and according to that, the authentic mouse perform is played out its assignments.

## 3.2) Algorithm Analysis of A.I.:

- **Gesture Tracking**

  For the characteristic of area of hand signals and hand development, the Media Pipe system is utilized, and Open-CV library is utilized for PC machine vision the standard purposes the AI contemplations to keep and see the hand developments and fingertip.

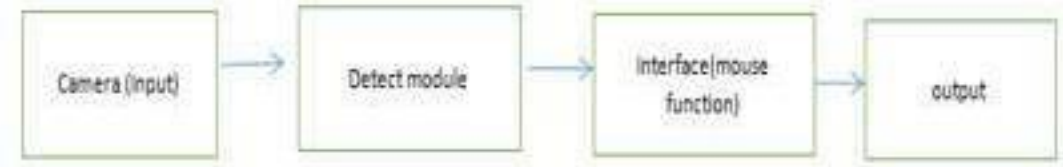



Fig1: Block Diagram of system

- **What is Media-Pipe?**

  Media-Pipe is a system that is utilized for applying in a different AI pipeline, partnered with an open-source structure of Google. The Media-Pipe system is useful for across stage improvement since the edge work is made abuse the measurement data. The Media-Pipe structure is multi-modular, any place this system is frequently applied to differed sounds and recordings. The Media-Pipe structure is utilized by the engineer for building and breaking down the frameworks through diagrams, and it conjointly been utilized for fostering the frameworks for the machine reason.

  The means worried inside the framework that utilizes Media- Pipe square measure administrated inside the line setup. The pipeline made will run in various stages allowing quantity friability in portable and work areas. The Media-Pipe structure is predicated on three rudimentary parts, they're execution investigation, system for recovering identifier data, and a gathering of parts.

The number cruncher and streams joined produce an information stream outline; the diagram is made with Media- Pipe any place each hub might be an adding machine and thus the hubs square measure associated by stream.

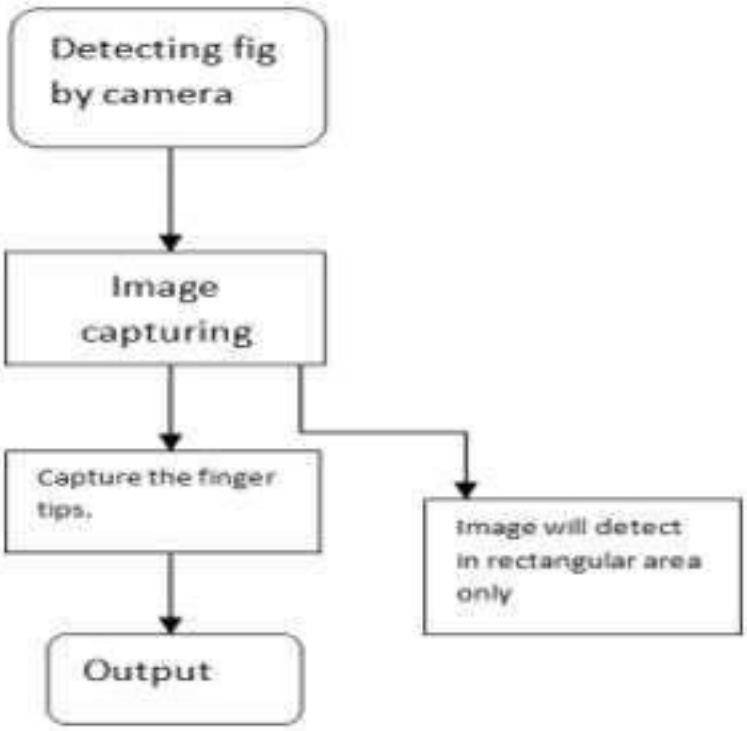



Fig 2: Media-Pipe hand tip recognition layout.

Single shot is utilized for location and perceiving a finger and palm progressively exploitation journal PC net cam. Finder framework is utilized by the Media Pipe, in the Hand discovery module of python, its style for a finger and hand recognition model because of it's easy to mentor hand. The planned model of hand reason mark comprises of 21 joint reason and co-ordinates inside the hand, as displayed in Fig3.

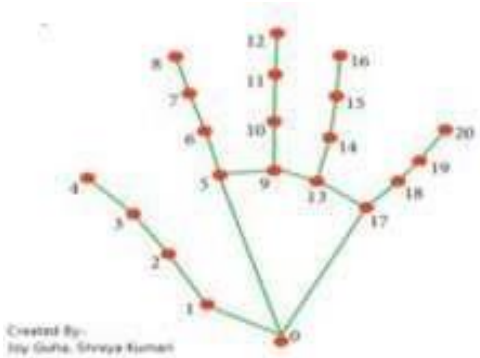


Fig3: Co-ordinates of hand dots.

- **Open-CV MODULE**

  PC vision is an interaction by which we can comprehend the pictures and recordings, how they are put away and how we can control and recover information from them. PC Vision is the base or generally utilized for Artificial Intelligence. The primary Open- CV form was 1.0. Open-CV is delivered under a BSD permit and thus it's free for both scholar and business use. It has C++, C, Python and Java connection points and supports Windows, Linux, Mac OS, iOS and Android. At the point when Open-CV was planned the fundamental Centre was continuous applications for computational productivity.

1. **Pseudo code algorithm for edge-detection:** -

   Step-1) Start

   Step-2) Import python OpenCV 3- input section

   define the normal value for ‘A’ ‘A’ value to be divided by 500

   define the edge algorithm parameters - picture and intensity

   define height X and width Y of a picture define the edge.

   Step-3) Recognizing section.

   for all height X and width Y pixels in range extract pixel values

   top and bottom

   left and right.

   top_left and top_right bottom_left and bottom_right extract differences

   difference I = top minus bottom difference II = left minus right

   extract total diff.

   total diff. = diff. I + diff. II

   total diff. = normal (total diff.) * intensity extract pixels of the image

   picture_pix = image [X, Y] extract edge_image

edge_picture [ X, Y] = picture_pix * total diff

Step-4) Output

Display input picture

Display input picture converted to

gray scale Display edge.

Step-5) End

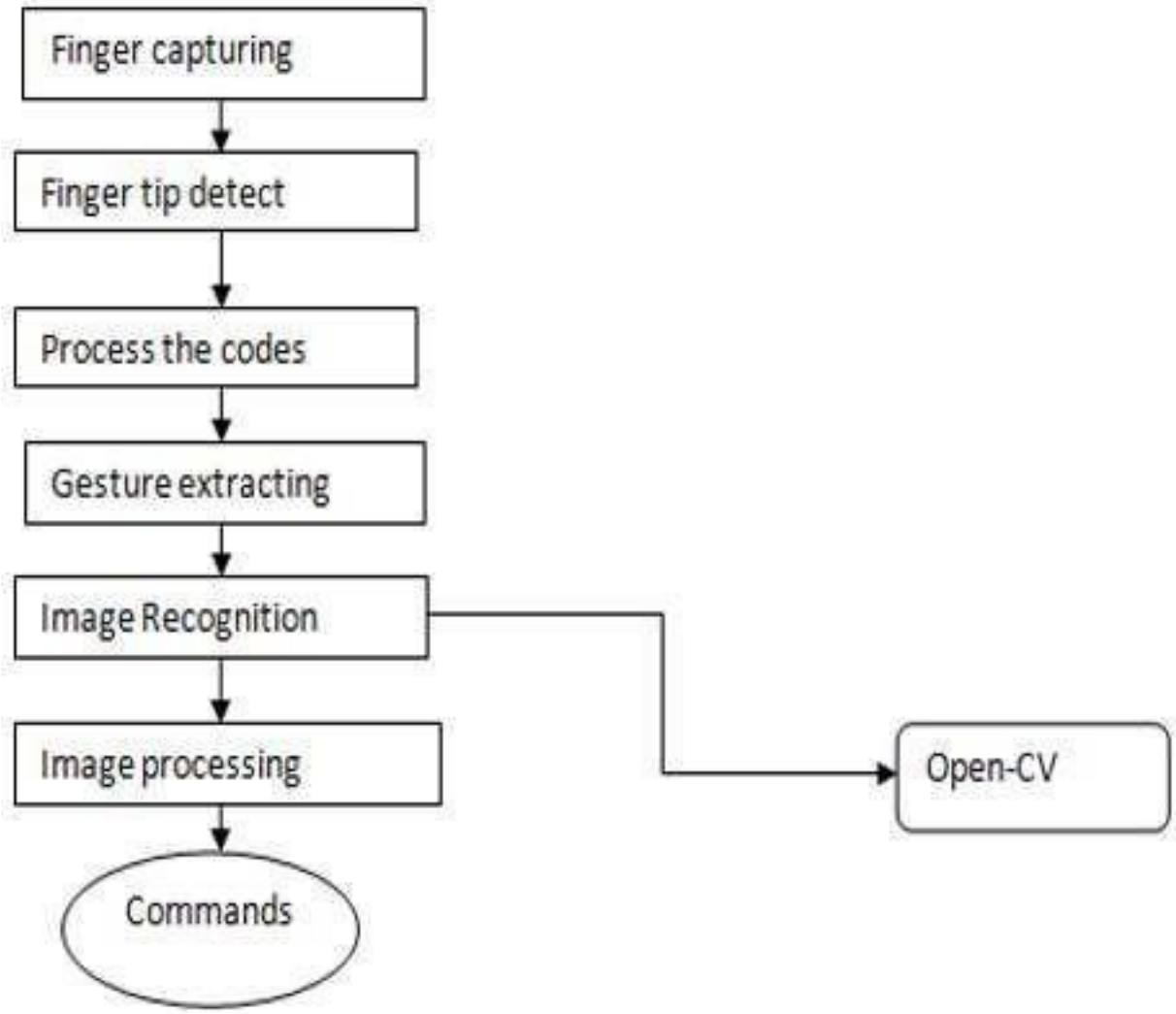



Fig 4: flow chart

## 3.3) Testing Model

- For this project we'll be using the agile software development methodology approach in developing the application. The stated approach is an alternative to the traditional waterfall model that helps the project team respond to unpredictability through incremental and iterative work. It promotes adaptive planning, evolutionary development, early delivery, continuous improvement, and encourages rapid and flexible respond to change.

- When to use this model??

  1) Requirement clear and fix and may not change.

  2) There are no ambiguous requirements and confusion.

  3) It’s a good to use this model when technology is well Understood

  4) Project is short and cost is low.

  5) Risk is minimum.


*Fig. Agile Model*

## PLANNING

Thorough planning will be conducted in this phase where the existing Systems/product, for this case, physical computer mouse will be reviewed and studied to identify the problems that existed, a comparison of problems will be Made to compare which problems are more crucial and requires improvement. An outline objective and the scope will be identified to provide an alternative solution to the problem.

## REQUIREMENT ANALYSIS

The phase that gathers and interpreting the facts, diagnosing problems and recommending improvements to the system. In this phase, the collected problem statements will be extensively studied in order to find a proper solution or at least an improvement to the proposed system.

## DESIGNING

The requirement specification from the previous phase will be studied and prioritized to determine which requirements are more important and where the requirement with the highest priority will be delivered first. After the study, the system design will be prepared as it helps in defining the overall system architecture and specifying the hardware and the software requirements.

## BUILDING

The phase where the actual coding implementation takes place. By referring to the inputs from the system design, the system will be developed based on the prioritized requirements. However, because we're using the agile Methodology approach, the developed system will be considered as a Prototype system where it will be integrated and tested by the users.

## TESTING

The phase where the prototype system goes through a series of tests. The Prototype system will first undergo integration where the features from the Previous iteration cycle are added to the latest cycle. After the integration, the Prototype system will be thoroughly tested by the users to determine whether They are satisfied with the latest deliverables, the completion of the project depends on whether they've accepted.

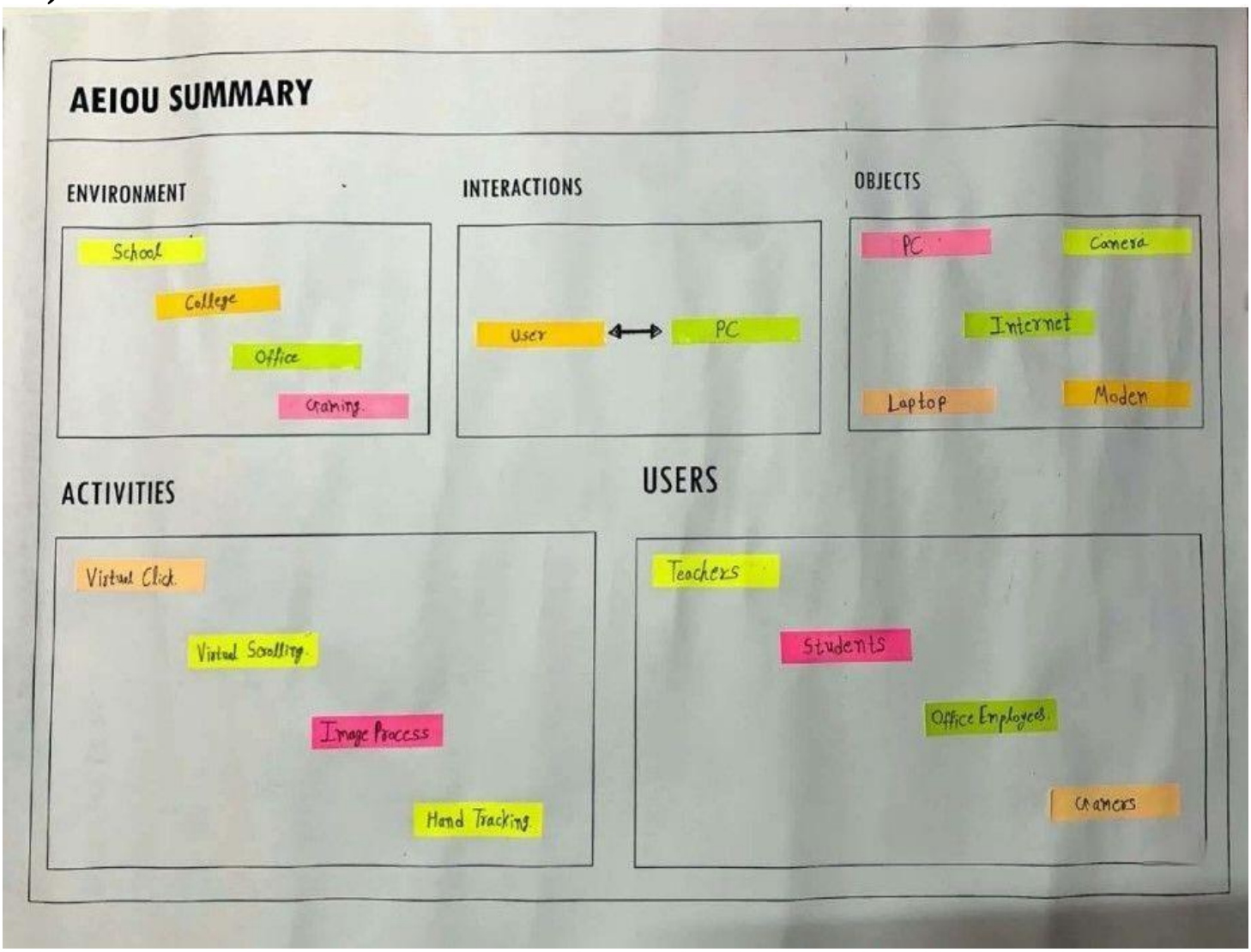
### 3.4) How application works?

- This application is a combination of UI & AI. First of all, the user opens the application which is .exe file. After opening the file, the user interface appears after thatuser has option of TRACK, after clicking on that button our backend program gets executed where that code contains accessing of camera to finger tracking motions.
- Following would be the languages I would use to develop my application within the stipulated period:

    1) Python 3.8
    2) PyCharm CE editor 2022.2

# CHAPTER-4

## 4.1) AEIOU Canvas




### Activity Framework

- In A-E-I-O-U, A stands for Activity. That means various activities being performed related to AI virtual mouse.
- Some basic activities that we observed are virtual click, virtual scrolling, image processing, hand tracking etc.

### Environment Framework

- in A-E-I-O-U, E stands for Environment. That means various environmental conditions being experienced by people related to AI virtual mouse domain. Examples are Schools, Colleges, Office, Gaming, etc.

**Interaction Framework**

- In A-E-I-O-U, I stand for Interaction. Examples of interactions, user → pc.

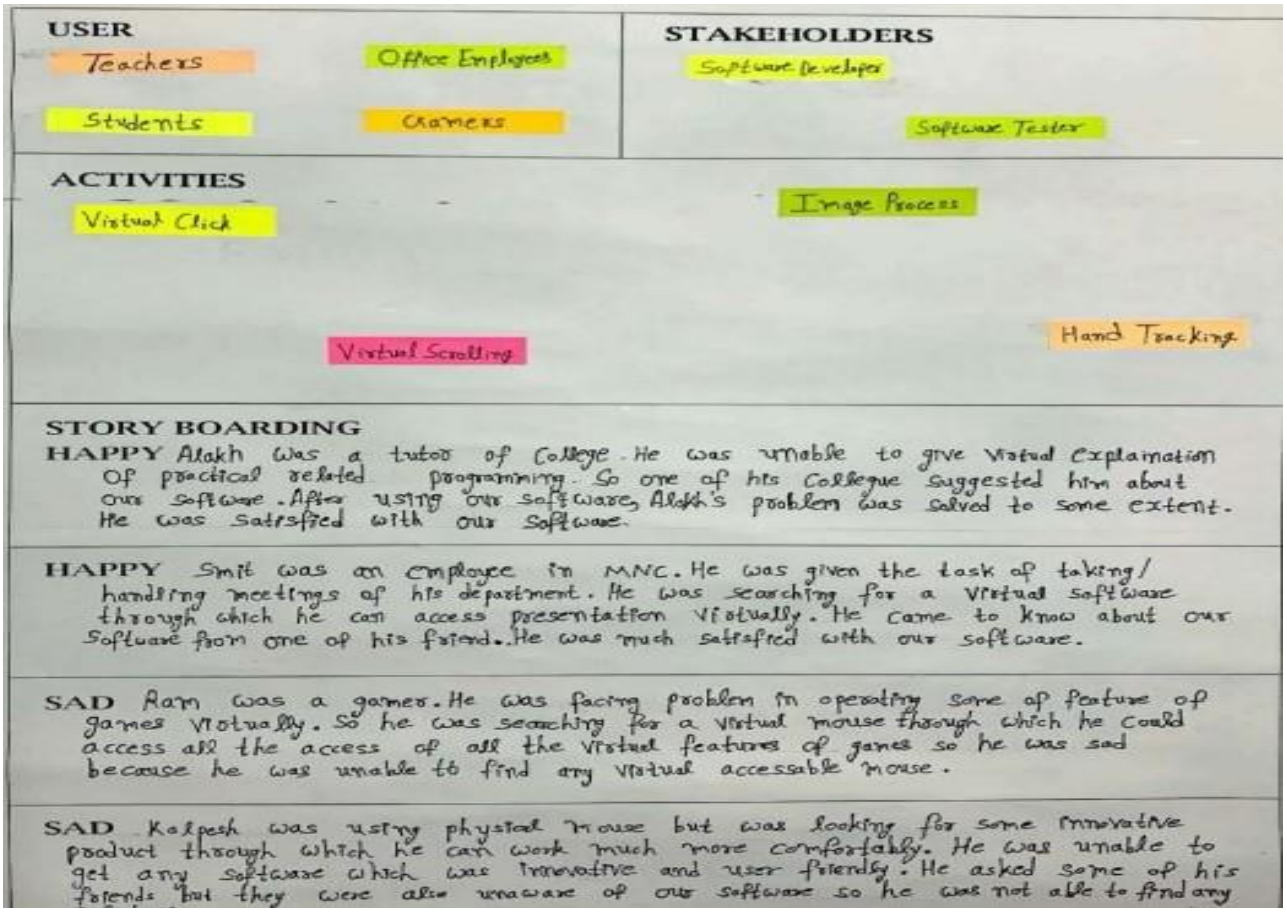
**Object Framework**

- In A-E-I-O-U, O stands for Objects. There are many objects that we have observed like camera, laptop, p.c., modems, the internet, etc.

**Users Framework**

In A-E-I-O-U, U stands for Users. Users related to admission are Students, Office Employee, Teachers, Gamers etc.

## 4.2) EMPATHY MAPPING Canvas




- Empathy mapping canvas is collaborative tool which helps learners to gain deeper information about problems in particular domain. Learners can find more problems. It also helps to develop a better understanding of the personfor whom you are designing solutions.

Users ➔ Students, Office Employee, Teachers, Gamers

Stakeholders ➔ software Developer, Software Tester

Activities ➔ virtual click, virtual scrolling, image processing, hand tracking etc.

**STORY BOARDING**

**HAPPY** Alakh was a tutor of College. He was unable to give virtual explaination of practical related programming. So one of his collegue suggested him about our software. After using our software, Alakh's problem was solved to some extent. He was satisfied with our software.

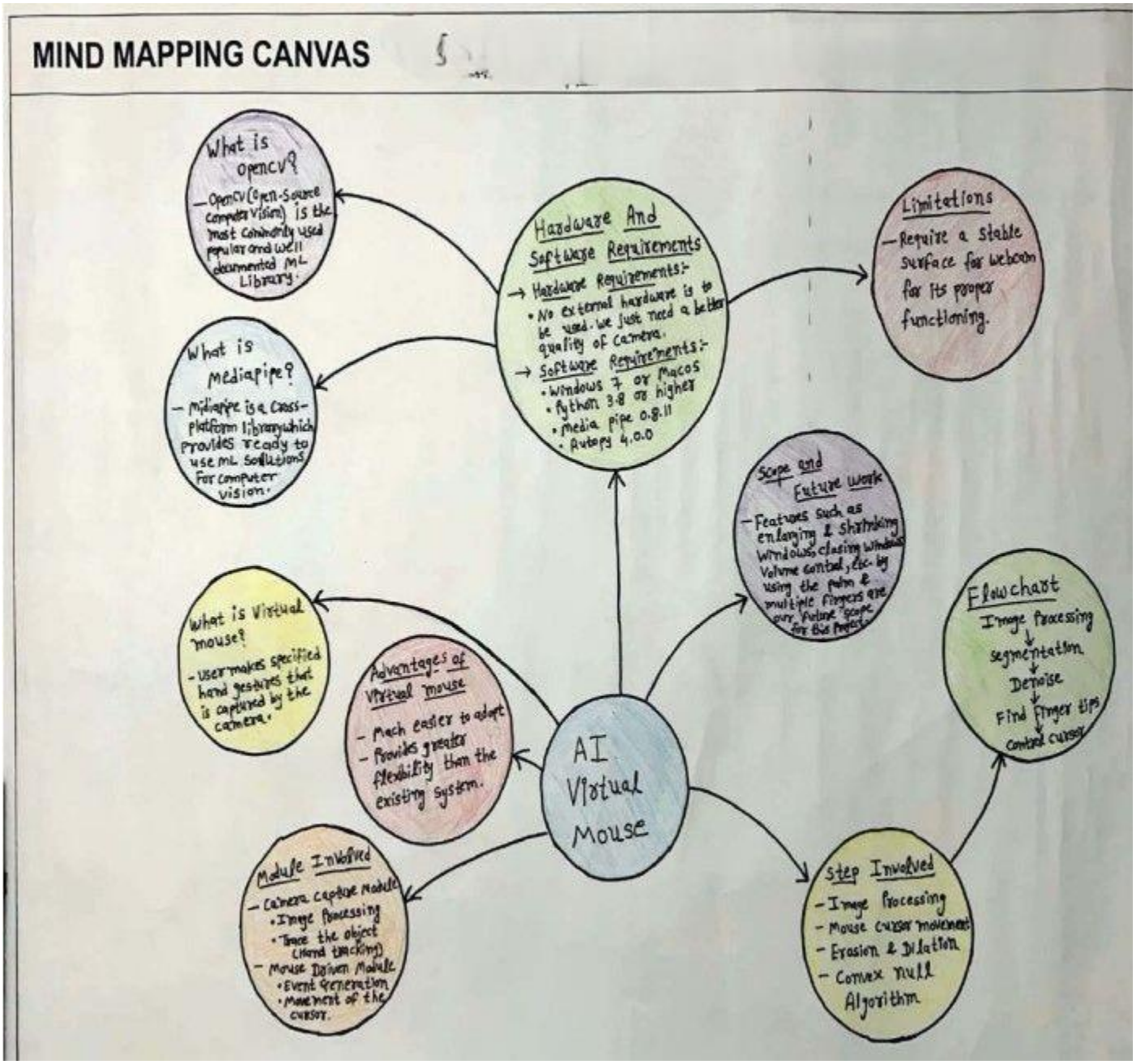
**HAPPY** Smit was an employee in MNC. He was given the task of taking/handling meetings of his department. He was searching for a virtual software through which he can access presentation virtually. He came to know about our software from one of his friend. He was much satisfied with our software.

**SAD** Ram was a gamer. He was facing problem in operating some of feature of games virtually. So he was searching for a virtual mouse through which he could access all the access of all the virtual features of games so he was sad because he was unable to find any virtual accessable mouse.

**SAD** Kalpesh was using physical mouse but was looking for some innovative product through which he can work much more comfortably. He was unable to get any software which was innovative and user friendly. He asked some of his friends but they were also unaware of our software so he was not able to find any solution.

## 4.3) Mind-Map Canvas

- A mind map is a visual representation of hierarchical information that includes a central idea surrounded by connected branches of associated topics.
- Mind mapping is the best way to brainstorm, plan, or turn ideas into the steps needed to make it real. It is a technique of visual representation between various ideas, concepts or other information. It helps in project planning, collecting data, brainstorming, and presentation.



## 4.4) Ideation Canvas

- Ideation is the process where you generate ideas and solutions through sessions such as Sketching, Prototyping, Brainstorming, Brainwriting, Worst Possible Idea, and a wealth of other ideation techniques.


## PEOPLE

- It includes users and stakeholders and other entities that is connected with the system. Students, Office Employee, Teachers, Gamers, etc.

## ACTIVITIES

- In this part, all the activities which are done by virtual click, virtual scrolling, image processing, hand tracking etc.

## SITUATION/CONTEXT/LOCATION

- It includes the situation in which it can be used or in which location it can be held.

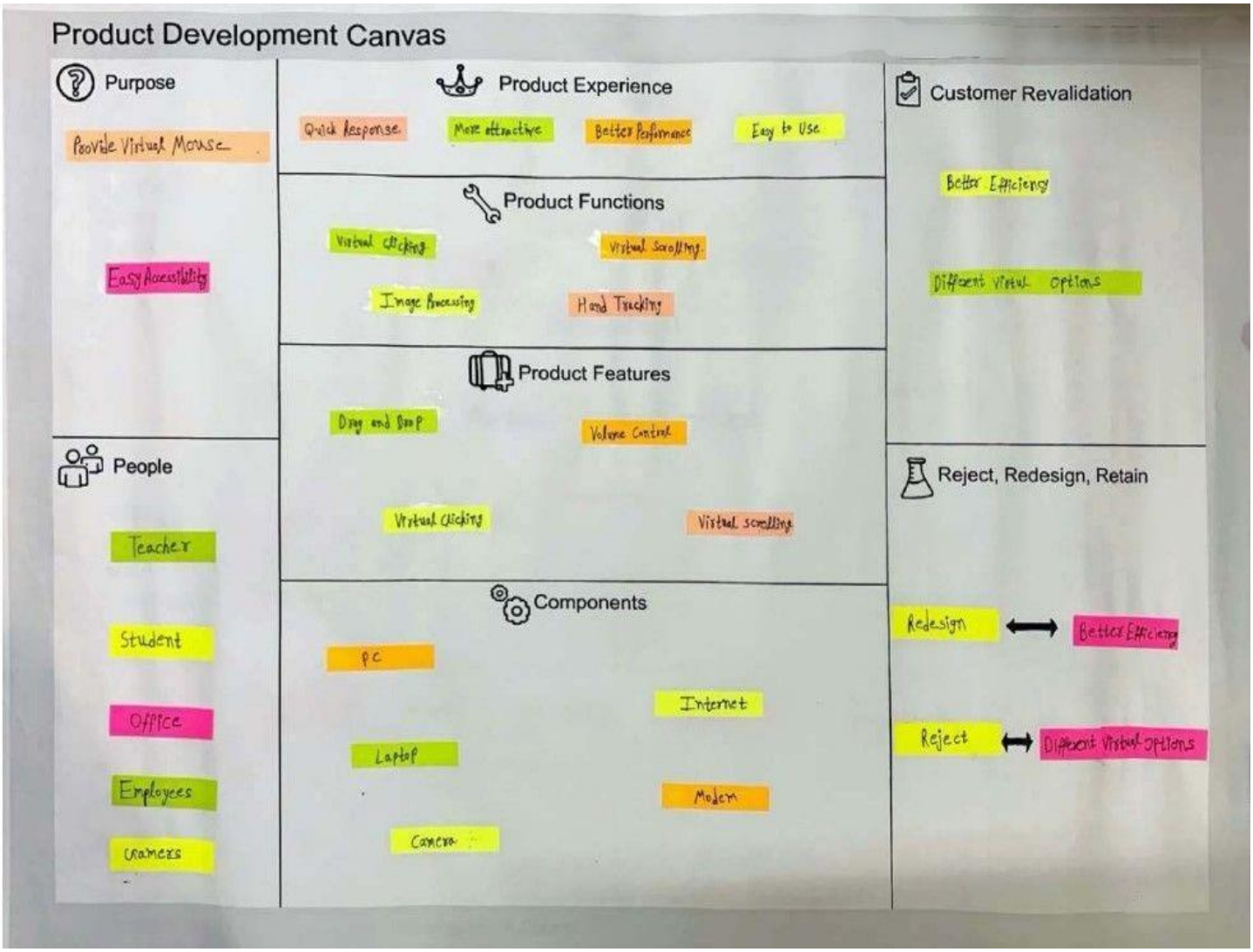
    I. Schools
    II. Collages
    III. Offices

## PROPS/POSSIBLE SOLUTION

- This task shows which different components will be used for the best possiblesolution and which is the possible solution for defined problems.
- Some pops like laptop, p.c., modem, A.I., python, internet, python libraries, camera etc.

## 4.5) Product Development Canvas (PDC)

- A product development canvas is the ground where in the best possible ideas after ideation phase we can solve defined problems and develop solution.




Purpose:

- To provide virtual mouse
- To provide easy accessibility

People:

- teacher
- Student
- Office employees
- Gamers

Product experience:

- Better performance
- Quick responsive
- More attractive
- Easy to use.

Product functions:

- Image processing
- Hand tracking
- Virtual clicking
- Virtual scrolling

Product features:

- Drag and drop.
- Volume control
- Virtual clicking
- Virtual scrolling

Components:

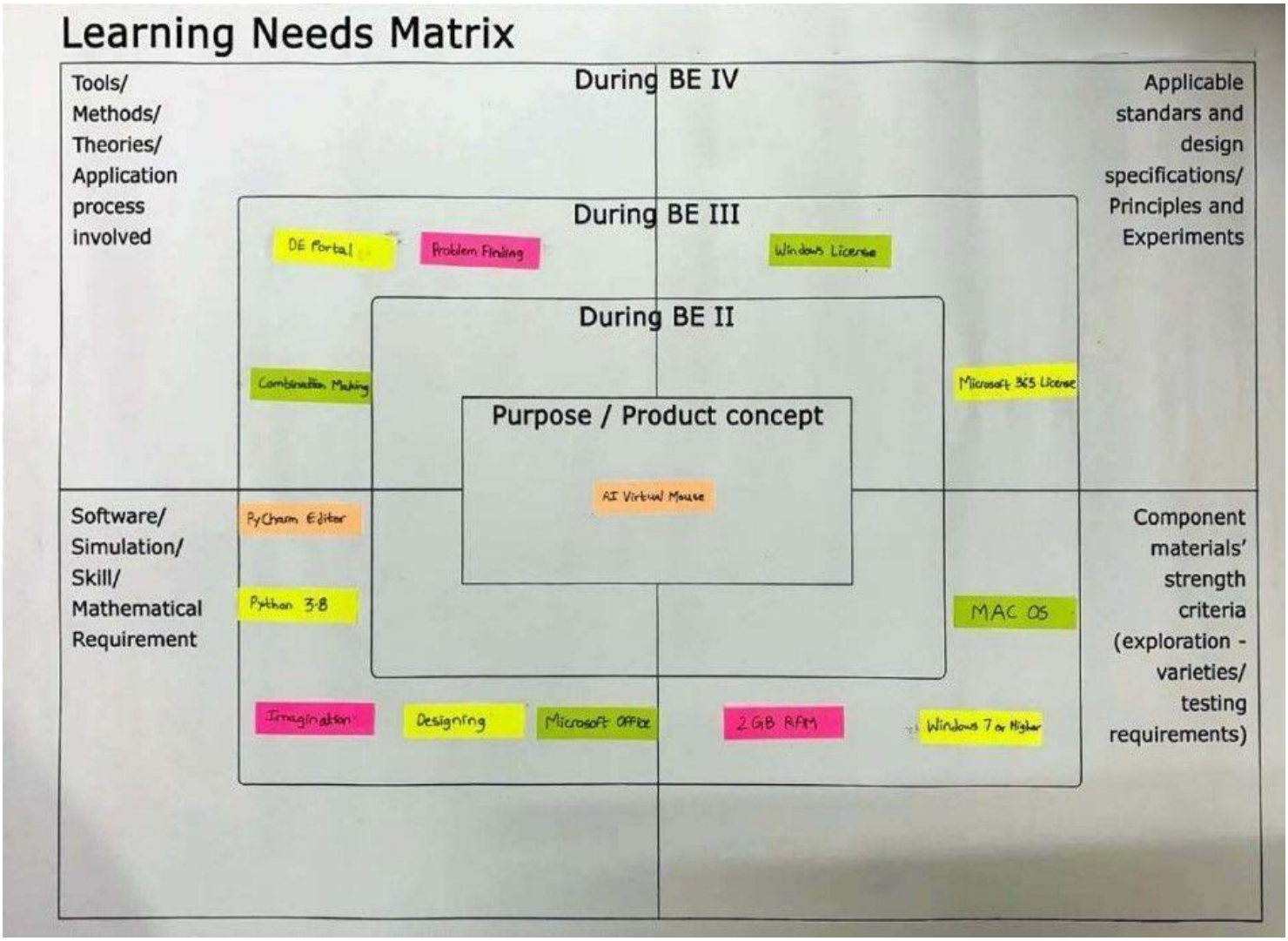
- Camera
- laptop
- p.c.
- modem
- internet

Customer revalidation:

- Better efficiency
- Different virtual options

## 4.6) Learning Need Matrix Canvas (LNM)

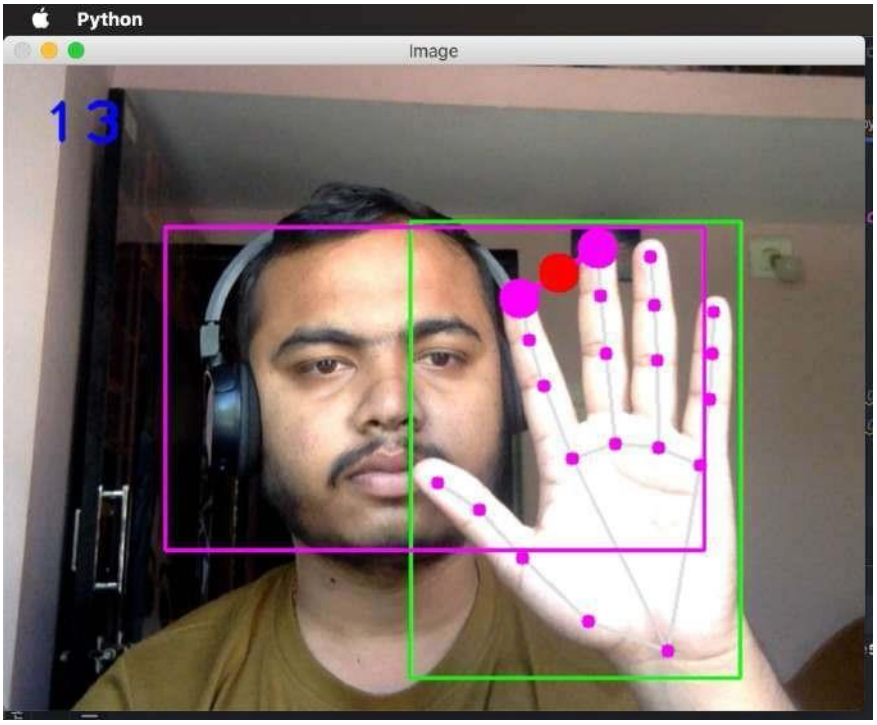
- Learning Needs Matrix will help to identify the learning requirements that are much needed in industry or in their career at an early stage along with prioritization of specific learning.



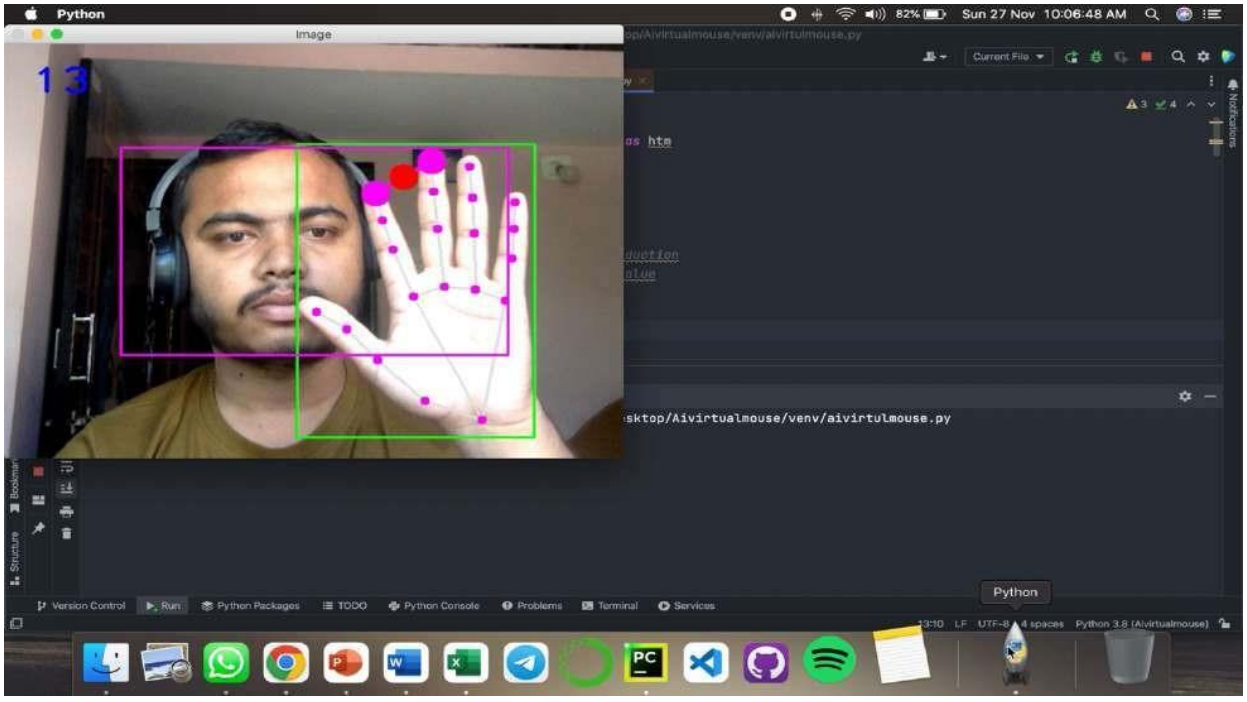
# CHAPTER-5

## 5.1) Prototype Snapshot

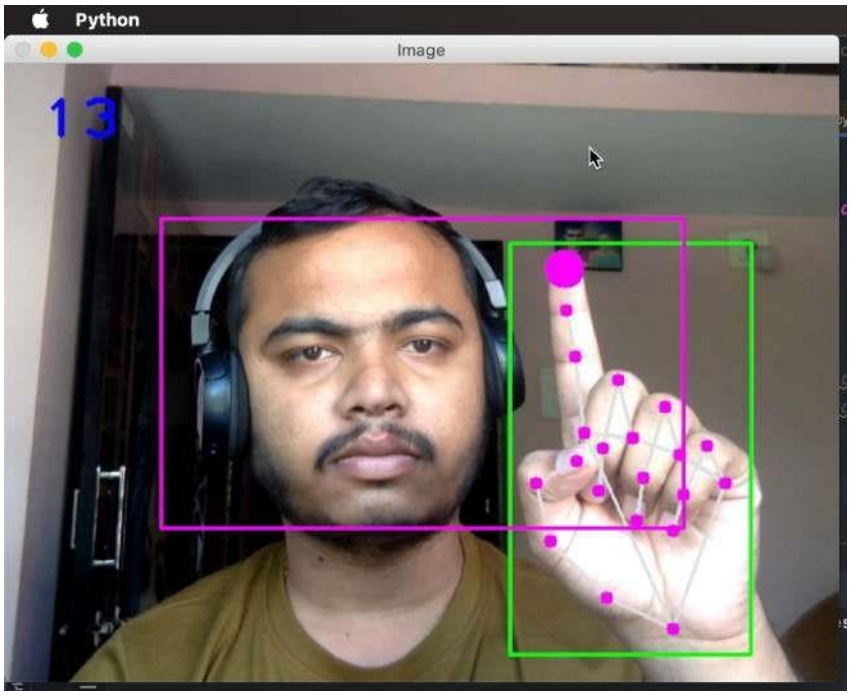
Snap-1: Hand Detection



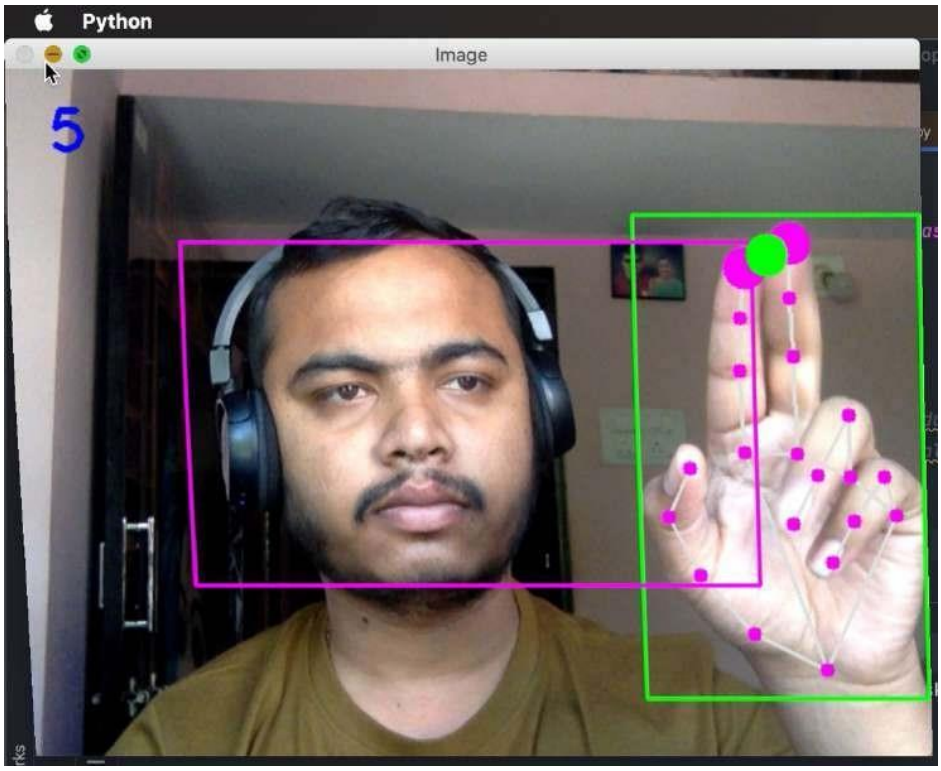

Snap-2 Fingertips Detections



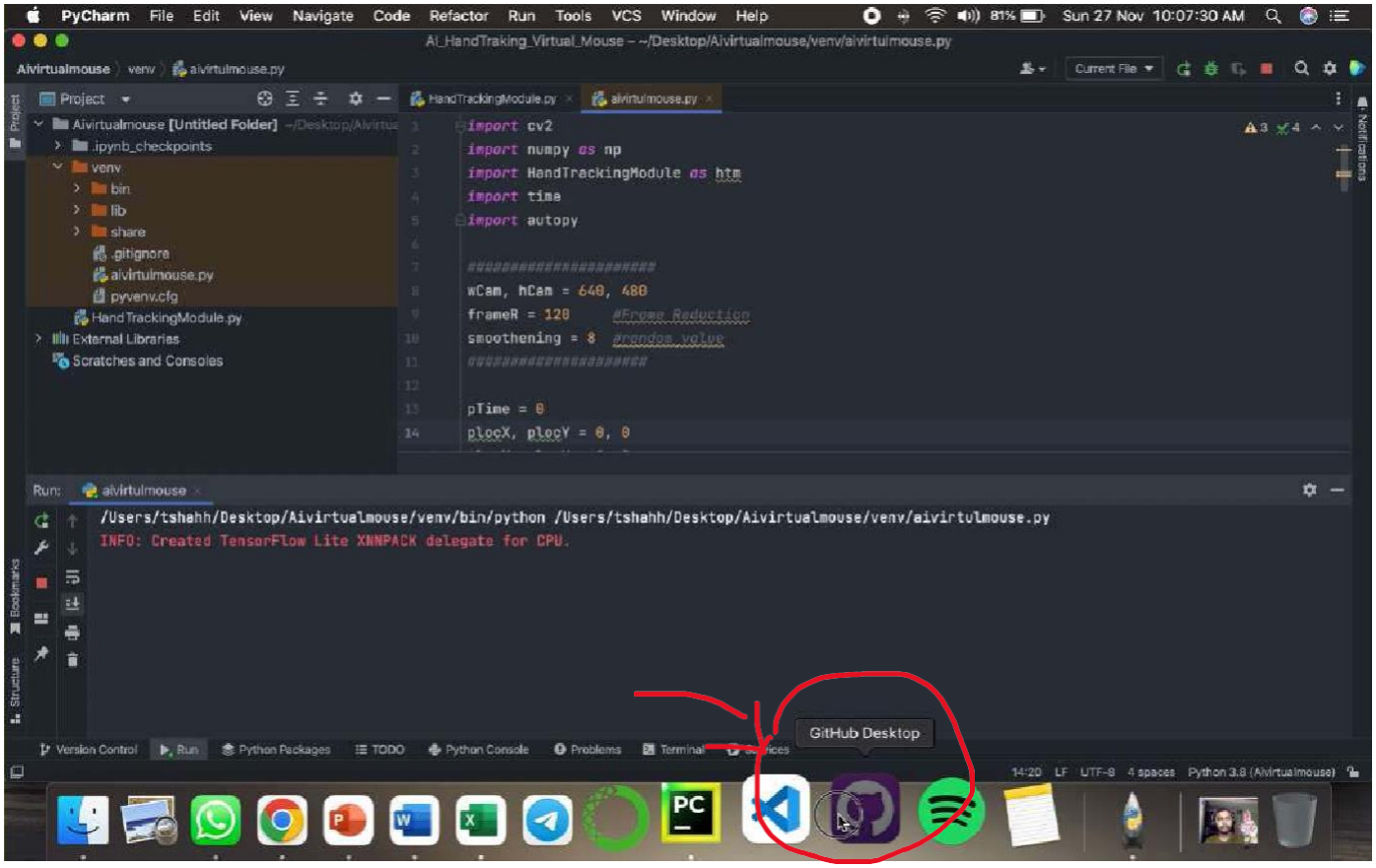
Snap-3 Cursor movement.




Snap-4 virtual clicking



Snap-5 virtual click  in p.c.



# CHAPTER-6

## 6.1) Future Work

- The work is to make PC understanding projects that can deal with continuous issues and to achieve targets of the affiliations and regular daily existence as well as individuals. There is a degree in encouraging the machines games, talk affirmation machine, language revelation, PC vision, ace systems, progressed mechanics, etc. The more you learn about AI sciences, for instance material science or science, the better. For the normal ways of managing Artificial Intelligence, the out about mind science and the tangible framework. Get to know some Machine vernaculars. It is savvy to focus on one crucial machine language. Occupations are commonly to depend after getting the programming vernaculars. Calling decisions in AI where student can land positions at Occupation will be offered like: Game Programmer, Robotic, Scientist, Computer Scientist and data analyst.

## 6.2) Conclusion

- The main objective of the AI virtual mouse system is to control the mouse cursor functions by using hand gestures instead of using a physical mouse.