

# **PROJECT REPORT**

*Phase-I*

**On**

## **AI Virtual Mouse Controller**

Submitted to Rajasthan Technical University

in partial fulfillment of the requirement for the award of the degree of

**B.TECH.**

**in**

**COMPUTER ENGINEERING**

**Submitted By**

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**at**

**POORNIMA INSTITUTE OF ENGINEERING & TECHNOLOGY**

**JAIPUR**

**Rajasthan Technical University, KOTA**

**DECEMBER, 2021**

## **CERTIFICATE**

This is to be certified that the project entitled “AI Virtual Mouse Controller” has been submitted for the Bachelor of Computer Science and Engineering, Poornima Institute of Engineering & Technology, Jaipur during the academic year 2021-2022 is a bonafide piece of project work carried out by “Sagar Gyanchandani, Yash Koolwal & Rahul Chhablani” towards the partial fulfillment for the award of the Degree (B.Tech.) under the guidance of “Mr. Deepak Moud” and supervision and no part of thereof has been submitted by them for any degree or diploma.

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**Date: 21-12-21**

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We are thankful to ***Mr. Deepak Moud*** for his/her support, cooperation, and motivation provided to us during the training for constant inspiration, presence and blessings.

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## **ABSTRACT**

The mouse is one of the wonderful inventions of Human-Computer Interaction (HCI) technology. Currently, wireless mouse or a Bluetooth mouse still uses devices and is not free of devices completely since it uses a battery for power and a dongle to connect it to the PC. In the proposed AI virtual mouse system, this limitation can be overcome by employing webcam or a built-in camera for capturing of hand gestures and hand tip detection using computer vision. The algorithm used in the system makes use of the machine learning algorithm. Based on the hand gestures, the computer can be controlled virtually and can perform left click, right click, drag and drop functions, and volume control function without the use of the physical mouse. The algorithm is based on deep learning for detecting the hands. Hence, the proposed system will avoid COVID-19 spread by eliminating the human intervention and dependency of devices to control the computer.

### **KEYWORDS:**

OpenCV, Python, Mouse, Camera, Hand

# **CHAPTER 1**

## **INTRODUCTION TO PROJECT**

### **1.1 Introduction**

With the development technologies in the areas of augmented reality and devices that we use in our daily life, these devices are becoming compact in the form of Bluetooth or wireless technologies. This proposes an AI virtual mouse system that makes use of the hand gestures and hand tip detection for performing mouse functions in the computer using computer vision. The main objective of the proposed system is to perform computer mouse cursor functions and scroll function using a web camera or a built-in camera in the computer instead of using a traditional mouse device. Hand gesture and hand tip detection by using computer vision is used as a HCI with the computer. With the use of the AI virtual mouse system, we can track the fingertip of the hand gesture by using a built-in camera or web camera and perform the mouse cursor operations and scrolling function and also move the cursor with it.

While using a wireless or a Bluetooth mouse, some devices such as the mouse, the dongle to connect to the PC, and also, a battery to power the mouse to operate are used, but in this paper, the user uses his/her built-in camera or a webcam and uses his/her hand gestures to control the computer mouse operations. In the proposed system, the web camera captures and then processes the frames that have been captured and then recognizes the various hand gestures and hand tip gestures and then performs the particular mouse function.

Python programming language is used for developing the AI virtual mouse system, and also, OpenCV which is the library for computer vision is used in the AI virtual mouse system. In the proposed AI virtual mouse system, the model makes use of the MediaPipe package for the tracking of the hands and for tracking of the tip of the hands, and also, Pynput, Autopy, and PyAutoGUI packages were used for moving around the window screen of the computer for performing functions such as left click, right click, and scrolling functions. The results of the proposed model



showed very high accuracy level, and the proposed model can work very well in real-world application with the use of a CPU without the use of a GPU.

## **1.2 Project Aim and Objective:**

The proposed AI virtual mouse system can be used to overcome problems in the real world such as situations where there is no space to use a physical mouse and also for the persons who have problems in their hands and are not able to control a physical mouse. Also, amidst of the COVID-19 situation, it is not safe to use the devices by touching them because it may result in a possible situation of spread of the virus by touching the devices, so the proposed AI virtual mouse can be used to overcome these problems since hand gesture and hand Tip detection is used to control the PC mouse functions by using a webcam or a built-in camera.

The main objective of the proposed AI virtual mouse system is to develop an alternative to the regular and traditional mouse system to perform and control the mouse functions, and this can be achieved with the help of a web camera that captures the hand gestures and hand tip and then processes these frames to perform the particular mouse function such as left click, right click, and scrolling function.

## **1.3 Problem Statement:**

Based on the hand gestures, the computer can be controlled virtually and can perform left click, right click, drag and drop functions, and volume control function without the use of the physical mouse. The algorithm is based on deep learning for detecting the hands. Hence, the proposed system will avoid COVID-19 spread by eliminating the human intervention and dependency of devices to control the computer.

## **1.4 Background of the Project (Literature Survey):**

### **1.4.1 HCL Technology:**

Human-computer interaction (HCI) is an area of research and practice that emerged in the early 1980's

#### **1.4.2 Gesture Recognition:**

Gesture Recognition is the mathematical interpretation of a human motion by a computer device

#### **1.5 Software Requirements:**

VsCode, OpenCV Python

#### **1.6 Hardware Requirements:**

PC and Webcam

## CHAPTER 2

### PRODUCT BACKLOG

#### 2.1 Product Backlog

It is a collection of User stories and it is divided into number of Sprint Backlogs. A product backlog is a list of the new features, changes to existing features, bug fixes, infrastructure changes or other activities that a team may deliver in order to achieve a specific outcome.

The product backlog is the single authoritative source for things that a team works on. That means that nothing gets done that isn't on the product backlog. Conversely, the presence of a product backlog item on a product backlog does not guarantee that it will be delivered. It represents an option the team has for delivering a specific outcome rather than a commitment.

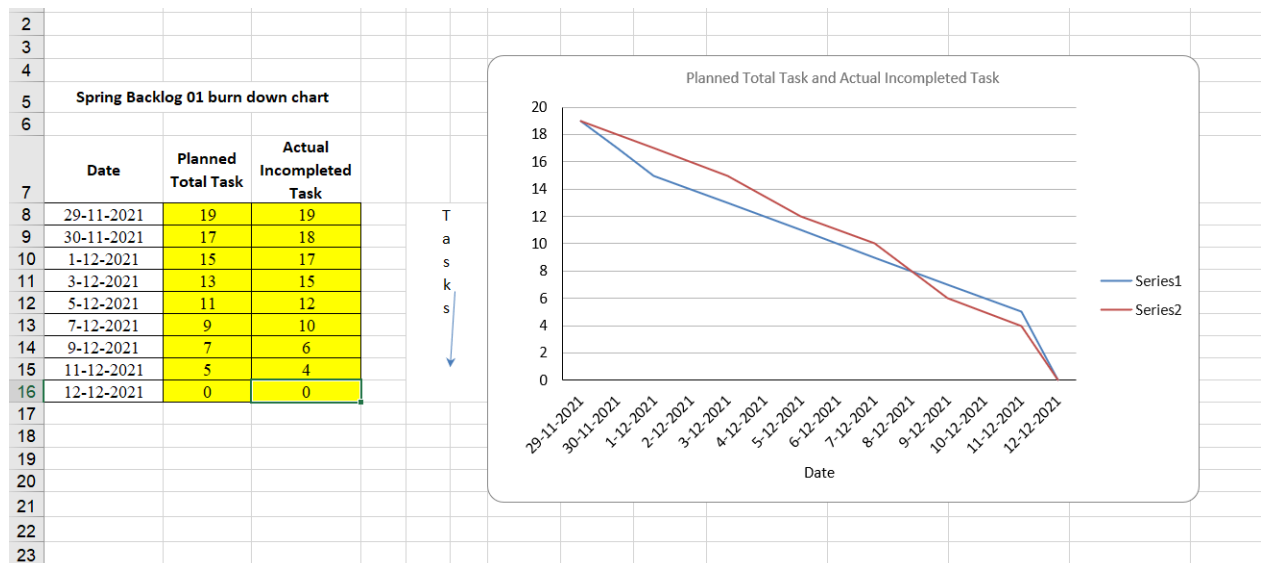
It should be cheap and fast to add a product backlog item to the product backlog, and it should be equally as easy to remove a product backlog item that does not result in direct progress to achieving the desired outcome or enable progress toward the outcome.

PRODUCT BACKLOG							
SPRINT BACKLOG	US ID	BACKLOG ITEM			PRIORITY	RESPONSIBLE	ESTIMATE DATE
		AS A/AN	I WANT TO	SO THAT			
1	SB1/US1	User	Capture the video	I can capture my hand	1	RC	29/11/2021
1	SB1/US2	User	Detect my hand	I can use my hand for mouse gestures	1	RC	30/11/2021
1	SB1/US3	User	Recognize my hand	I can use my fingers for mouse gestures	1	RC	1/12/2021
1	SB1/US4	User	Detect my index finger	I can move cursor	1	SG	3/12/2021
1	SB1/US5	User	Use coordinates system	I can control finger movement	1	YK	5/12/2021
1	SB1/US6	User	Detect mouse movements in frame rate	I can work in specific range	1	YK	7/12/2021
1	SB1/US7	User	Add smoothening effects	I can move cursor smoothly	1	SG	9/12/2021
1	SB1/US8	User	Add a feature when a finger other than index finger is up	I can stop cursor movement	1	SG	11/12/2021
1	SB1/US9	User	Add fps text on screen	I can see my fps while moving mouse	1	YK	12/12/2021
2	SB2/US1	User	Detect my middle finger	I can use that finger to add click gesture	2	RC	13/12/2021
2	SB2/US2	User	Find the coordinates of middle finger	I can compare them with the coordinates of index finger	2	YK	15/12/2021
2	SB2/US3	User	Find the tip of middle finger	I can add the click gesture	2	RC	17/12/2021
2	SB2/US4	User	Find the distance between the tips of index and middle finger	I can use clicking gesture	2	YK	19/12/2021
2	SB2/US5	User	Compare the distance with particular value	I can click when distance is less than a particular value	2	SG	21/12/2021
2	SB2/US6	User	Add of feature of joining the tips of middle and index finger	I can use the click gesture	2	SG	24/12/2021
3	SB3/US1	User	Detect my thumb	I can use volume control gesture	3	RC	01/02/2022
3	SB3/US2	User	Recognize my thumb	I can find the landmarks of the tip of thumb	3	RC	04/02/2022
3	SB3/US3	User	Recognize the tip of thumb landmark	I can use it with the tip of index finger for controlling volume	3	SG	07/02/2022
3	SB3/US4	User	Find the coordinates of the tip of thumb	I can compare them with the coordinates of index finger	3	YK	10/02/2022
3	SB3/US5	User	Adjust the distance between the tips of thumb and index finger	I can adjust volume accordingly	3	SG	12/02/2022
4	SB4/US1	User	Detect my ring finger	I can create drag and drop gesture	4	RC	15/02/2022
4	SB4/US2	User	Detect the land mark of the tip of ring finger	I can find coordinates of ring finger	4	SG	18/02/2022
4	SB4/US3	User	Find the distance between the tips of middle and ring finger	I can create single click gesture event	4	YK	21/02/2022
4	SB4/US4	User	Add a feature of joining the tips of both the fingers	I can drag and drop an object	4	SG	24/02/2022
4	SB4/US5	User	Create an executable file	I can use that on any system	4	RC + SG + YK	26/02/2022

## 2.2 Sprint Backlog-1

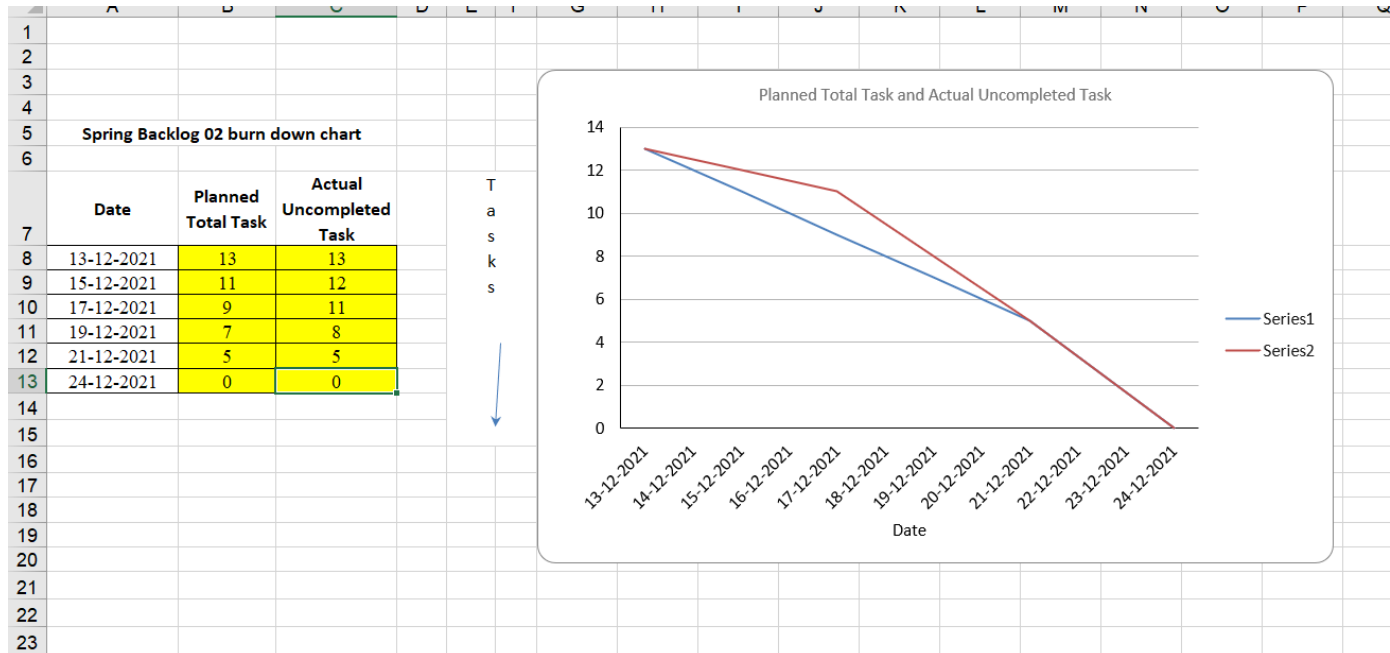
Sprint Backlog is a collection of User stories and their associated tasks.

	SPRINT BACKLOG 1						
	US ID	USER STORY	TASK ID	TASKS	TM	STATUS (NOT STARTED / IN PROGRESS / COMPLETED)	ESTIMATED DATE OF TASK COMPLETION
	SPRINT 1 - AI Virtual Mouse						
	SB1/US1	As an User I want to capture the video so that I can capture my hand	SB1/US1/T1	Capture the video frame	RC	In Progress	29/11/2021
			SB1/US1/T2	Capture my hand	RC	In Progress	29/11/2021
			SB1/US1/T3	Display the resulting frame	RC	In Progress	29/11/2021
	SB1/US2	As an User I want to detect my hand so that I can use my hand for mouse gestures	SB1/US2/T1	Study of Hand Tracking Module	RC	In Progress	30/11/2021
			SB1/US2/T2	After studying we use hand detector class object	RC	In Progress	30/11/2021
	SB1/US3	As an User I want to recognize my hand so that I can use my fingers for mouse gestures	SB1/US3/T1	Hand placement in front of camera	RC	In Progress	1/12/2021
			SB1/US3/T2	To move mouse show hand with one index finger up	RC	In Progress	2/12/2021
	SB1/US4	As an User I want to detect my index finger so that I can move cursor	SB1/US4/T1	Detect when index finger is up	SG	In Progress	3/12/2021
			SB1/US4/T2	Show landmarks of the index finger	SG	In Progress	4/12/2021
	SB1/US5	As an User I want to use coordinate system so that I can control finger movement	SB1/US5/T1	Study of hand detector object for coordinates	YK	In Progress	5/12/2021
			SB1/US5/T2	Find Position of the index finger	YK	In Progress	5/12/2021
	SB1/US6	As an User I want to detect mouse movements in frame rate so that I can work in specific range	SB1/US6/T1	Make a boundry for movements	YK	In Progress	6/12/2021
			SB1/US6/T2	Mouse will not work in out of the boundry	YK	In Progress	7/12/2021
	SB1/US7	As an User I want to add smoothening effects so that I can move cursor smoothly	SB1/US7/T1	Set smoothening to random value	SG	In Progress	8/12/2021
			SB1/US7/T2	For smoothening we take the help of coordinates	SG	In Progress	9/12/2021
	SB1/US8	As a User I want to add a feature when a finger other than index finger is up so that I can stop cursor movement	SB1/US8/T1	To check if only one finger(index) is up	SG	In Progress	10/12/2021
			SB1/US8/T2	Stop movement when other finger detected	SG	In Progress	11/12/2021
	SB1/US9	As an User I want to add fps text on screen so that I can see my fps while moving mouse	SB1/US9/T1	Study of cv2 library	YK	In Progress	12/12/2021
			SB1/US9/T2	Use of cv2 library to put text on screen	YK	In Progress	12/12/2021



## 2.3 Sprint Backlog-2

1	SPRINT BACKLOG 2						
2							
3	US ID	USER STORY	TASK ID	TASKS	TM	STATUS (NOT STARTED / IN PROGRESS / COMPLETED)	ESTIMATED DATE OF TASK COMPLETION
4							
5	SPRINT 2 - AI Virtual Mouse						
6	SB2/US1	As an User I want to detect my middle finger so that I can use that finger to add click gesture	SB2/US1/T1	Create the object of hand detector class	RC	In Progress	13/12/2021
7			SB2/US1/T2	Detect the middle finger	RC	In Progress	14/12/2021
8	SB2/US2	As an User I want to find the coordinates of middle finger so that I can compare them with the coordinates of index finger	SB2/US2/T1	Create the object of the hand detector class	YK	In Progress	15/12/2021
9			SB2/US2/T2	Locate the middle finger	YK	In Progress	16/12/2021
10	SB2/US3	As an User I want to find the tip of middle finger so that I can add the click gesture	SB2/US3/T1	Study the indices of all finger	RC	In Progress	17/12/2021
11			SB2/US3/T2	Detect the middle finger	RC	In Progress	18/12/2021
12			SB2/US3/T3	Finding tip of middle finger	RC	In Progress	19/12/2021
13	SB2/US4	As an User I want to find the distance between the tips of index and middle finger so that I can use clicking gesture	SB2/US4/T1	Find the landmarks of the tip of the middle finger	YK	In Progress	20/12/2021
14			SB2/US4/T2	Find landmarks coordinates	YK	In Progress	21/12/2021
15	SB2/US5	As an User I want to compare the distance with particular value so that I can click when distance is less than a particular value	SB2/US5/T1	Study of math library	SG	In Progress	22/12/2021
16			SB2/US5/T2	Compare the distance of the tip of both fingers	SG	In Progress	23/12/2021
17	SB2/US6	As an User I want to add of feature of joining the tips of middle and index finger so that I can use the click gesture	SB2/US6/T1	Check the distance between the tips of middle and index finger	SG	In Progress	24/12/2021
18			SB2/US6/T2	Add clicking gesture if distance is less than a particular value	SG	In Progress	24/12/2021
19							



## CHAPTER 3

### TECHNOLOGY APPLIED AND PROJECT MANAGEMENT

#### **Technologies applied in the Project:**

##### Python:

Python is an interpreted high-level general-purpose programming language.

Its design concept emphasises readability of code by the use of extensive indentation.

Its language components and object-oriented strategy are meant to help developers write concise, reasonable code for larger and smaller applications.

##### OpenCV:

OpenCV is a library of programming functions mainly aimed at real-time computer vision.

It is very useful for computer vision applications such as video analysis, CCTV footage analysis and image analysis.

When we create applications for computer vision that we don't want to build from scratch we can use this library to start focusing on real world problems.

#### **Agile Methodology:**

Agile is one form of software development methodology. Its main focus is on client satisfaction through continuous delivery. The focus of Agile is more on limiting the project scope. An agile project sets a minimum number of requirements and turns them into a deliverable product.

Agile development methodology provides opportunities to assess the direction of a project throughout the development lifecycle. By focusing on the repetition of abbreviated work cycles as well as the functional product they yield, agile methodology is described as “iterative” and

“incremental”. In waterfall, development teams only have one chance to get each aspect of a project right. Various key terms associated with it are as follows-

**Scrum:** Scrum is a process framework used to manage product development and other knowledge work. Scrum is empirical in that it provides a means for teams to establish a hypothesis of how they think something works, try it out, reflect on the experience, and make the appropriate adjustments. That is, when the framework is used properly. Scrum is structured in a way that allows teams to incorporate practices from other frameworks where they make sense for the team’s context.

**Scrum master:** The scrum master is the team role responsible for ensuring the team lives agile values and principles and follows the processes and practices that the team agreed they would use.

The responsibilities of this role include:

- Clearing obstacles
- Establishing an environment where the team can be effective
- Addressing team dynamics
- Ensuring a good relationship between the team and product owner as well as others outside the team
- Protecting the team from outside interruptions and distractions.

The scrum master role was created as part of the Scrum framework. The name was initially intended to indicate someone who is an expert at Scrum and can therefore coach others.

The role does not generally have any actual authority. People filling this role have to lead from a position of influence, often taking a servant-leadership stance.

**Product Owner:** The product owner is a role on a product development team responsible for managing the product backlog in order to achieve the desired outcome that a product development team seeks to accomplish. Key activities to accomplish this include:

- Clearly identify and describe product backlog items in order to build a shared understanding of the problem and solution with the product development team

- Make decisions regarding the priority of product backlog items in order to deliver maximum outcome with minimum output
- Determine whether a product backlog item was satisfactorily delivered
- Ensure transparency into the upcoming work of the product development team.

The product owner role was created as part of the Scrum framework in order to address challenges that product development teams had with multiple, conflicting direction, or no direction at all with respect to what to build.

Many infer that a product owner is someone who can spend a considerable amount of time with the product development team providing clarification on product backlog items, and making decisions about which product backlog items to do and regarding the specifics of those particular product backlog items.

**Product Backlog:** A product backlog is a list of the new features, changes to existing features, bug fixes, infrastructure changes or other activities that a team may deliver in order to achieve a specific outcome.

The product backlog is the single authoritative source for things that a team works on. That means that nothing gets done that isn't on the product backlog. Conversely, the presence of a product backlog item on a product backlog does not guarantee that it will be delivered. It represents an option the team has for delivering a specific outcome rather than a commitment.

It should be cheap and fast to add a product backlog item to the product backlog, and it should be equally as easy to remove a product backlog item that does not result in direct progress to achieving the desired outcome or enable progress toward the outcome.

Product backlog items take a variety of formats, with user stories being the most common. The team using the product backlog determines the format they chose to use and look to the backlog items as reminders of the aspects of a solution they may work on.

Product backlog items vary in size and extent of detail based in large part in how soon a team will work on them. Those that a team will work on soon should be small in size and contain sufficient



detail for the team to start work. The team may establish a definition of ready to indicate their agreement on the information they'd like to have available in order to start working on a product backlog item. Product backlog items that are not slated for work may be fairly broad and have little detail.

The sequence of product backlog items on a product backlog changes as a team gains a better understanding of the outcome and the identified solution. This reordering of existing product backlog items, the ongoing addition and removal of product backlog items, and the continuous refinement of product backlog items gives a product backlog its dynamic characteristic.

A team owns its product backlog and may have a specific role – product owner – with the primary responsibility for maintaining the product backlog. The key activities in maintaining the product backlog include prioritizing product backlog items, deciding which product backlog items should be removed from the product backlog, and facilitating product backlog refinement.

A product backlog can be an effective way for a team to communicate what they are working on and what they plan to work on next. Story Maps and information radiators can provide a clear picture of your backlog for the team and stakeholders.

The product backlog can be represented in physical form using index cards or sticky notes, or it may be represented in electronic form such as a text file, spreadsheet, or one of the many backlog management tools that exist. Electronic boards are the better option for a team that has remote members or collects a great deal of supplementary information about product backlog items. Physical boards offer the advantage of making the product backlog continuously visible and concrete during discussions around the product backlog.

**Sprint Backlog:** A sprint backlog is the subset of product backlog that a team targets to deliver during a sprint in order to accomplish the sprint goal and make progress toward a desired outcome.

The sprint backlog consists of product backlog items that the team agreed with their product owner to include during sprint planning. The team owns the sprint backlog and can determine whether new items are added or existing items are removed. This allows the team to focus on a clear scope for the length of the sprint. Some teams may allow the inclusion of a new product

backlog item if it replaces a product backlog item of equal or greater size that already exists on the sprint backlog.

If a team identifies tasks needed to deliver the select product backlog item, those tasks also become part of the sprint backlog. The team can add or remove tasks to the sprint backlog throughout the course of the sprint. The sprint backlog also includes any action items the team identified from the previous retrospective meeting.

The sprint backlog is generally tracked on an information radiator to provide a visual signal of the progress of the team as well as indicate the scope of the current sprint. If the team does not identify tasks, the product backlog items are tracked through different stages of the workflow in a format sometimes referred to as a delivery board. If the team breaks their product backlog items into tasks, they will often use a task board to track those tasks.

The majority of product backlog items included on a sprint backlog are user stories that are appropriately described according to the team's definition of ready. Other product backlog items could represent bugs that need to be addressed, research that needs to be done (typically in the form of spikes), or changes needed to the products architecture or infrastructure.

The sprint backlog only lasts for the duration of a sprint. Each new sprint starts with a new sprint backlog, although the team may choose to add items from the previous sprint's sprint backlog to the new sprint backlog if those items contribute to completing the new sprint's sprint goal.

**User story:** In consultation with the customer or product owner, the team divides up the work to be done into functional increments called “user stories.”

Each user story is expected to yield, once implemented, a contribution to the value of the overall product, irrespective of the order of implementation; these and other assumptions as to the nature of user stories are captured by the INVEST formula.

To make these assumptions tangible, user stories are reified into a physical form: an index card or sticky note, on which a brief descriptive sentence is written to serve as a reminder of its value. This emphasizes the “atomic” nature of user stories and encourages direct physical manipulation:

for instance, decisions about scheduling are made by physically moving around these “story cards”.

**Daily Meeting:** Each day at the same time, the team meets so as to bring everyone up to date on the information that is vital for coordination: each team members briefly describes any “completed” contributions and any obstacles that stand in their way. Usually, Scrum’s Three Questions are used to structure discussion. The meeting is normally held in front of the task board.

This meeting is normally timeboxed to a maximum duration of 15 minutes, though this may need adjusting for larger teams. To keep the meeting short, any topic that starts a discussion is cut short, added to a “parking lot” list, and discussed in greater depth after the meeting, between the people affected by the issue.

**Burn Down Chart:** The team displays, somewhere on a wall of the project room, a large graph relating the quantity of work remaining (on the vertical axis) and the time elapsed since the start of the project (on the horizontal, showing future as well as past). This constitutes an “information radiator“, provided it is updated regularly. Two variants exist, depending on whether the amount graphed is for the work remaining in the iteration (“sprint burndown”) or more commonly the entire project (“product burndown”).

## **PO and Their Relevance to project**

**PO1: Engineering knowledge:**Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

In this project creation process engineering knowledge of the software engineering and Electronics engineering have been applied. we have used software engineering , HTML,xml, java , android , java script , php , j2ee, data base , oracle , my sql , mango and other programming language and database to the project. We have applied all above engineering subjects in our projects.

**PO2: Problem analysis:**Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

In our projects we have identified an problem , once verified by the client we have worked to identify the solution using all of our theoretical and practical knowledge.

**PO3: Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**PO4: Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**PO5: Modern tool usage:**Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

In the project development we have applied Integrated Development Environment IDE for the rapid development of the code, used web server for the software development.

**PO6: The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

In 1961 , the Conference of Engineering Societies of Western Europe and the United States of America defined "professional engineer" as follows.

A professional engineer is competent by virtue of his/her fundamental education and training to apply the scientific method and outlook to the analysis and solution of engineering problems. He/she is able to assume personal responsibility for the development and application of engineering science and knowledge, notably in research, design, construction, manufacturing, superintending, managing and in the education of the engineer. His/her work is predominantly intellectual and varied and not of a routine mental or physical character. It requires the exercise of original thought and judgement and the ability to supervise the technical and administrative work of others. His/her education will have been such as to make him/her capable of closely and continuously following progress in his/her branch of engineering science by consulting newly published works on a worldwide basis, assimilating such information and applying it independently. He/she is thus placed in a position to make contributions to the development of engineering science or its applications. His/her education and training will have been such that he/she will have acquired a broad and general appreciation of the engineering sciences as well as thorough insight into the special features of his/her own branch. In due time he/she will be able to give authoritative technical advice and to assume responsibility for the direction of important tasks in his/her branch.

**PO7: Environment and sustainability:** Understand the impact of the professional engineering solutions in and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Sustainability is the ability to continue a defined behaviour indefinitely. Sometimes environmental, social and economic are termed to be the three pillars of sustainability.

**PO8: Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice

The ethics of engineers and the fundamental principles for Engineers are as follows.

Engineers uphold and advance the integrity, honor and dignity of the engineering profession by:

- I. using their knowledge and skill for the enhancement of human welfare;
- II. being honest and impartial, and servicing with fidelity the public, their employers and clients;
- III. Striving to increase the competence and prestige of the engineering profession; and
- IV. Supporting the professional and technical societies of their disciplines.

**PO9. Individual and team work:** Function effectively as an individual and as a member or leader in diverse teams, and in multidisciplinary settings.

To work successful in team a team member must have following capabilities.

### **1. The Ability to Listen**

it is important to listen to one another's ideas. Too often in a business setting, you have a group of people simply waiting for their turn to speak, not paying one iota of attention to the persons on their left or right. So it is a good teamwork skill to have the ability to listen

### **2. Check Your Ego**

This isn't saying abandon your ego all together, because that isn't healthy. But leaving your ego at the door temporarily is a very important team work skill. The reason this is so essential is because there is always someone better than you at something, no matter how brilliant you are.

### **3. Critique**

By critique, I mean constructive criticism. Be able to give others constructive criticism and be able to listen to others critique your ideas and work. There shouldn't be any offense taken to constructive criticism. You all want to succeed, and this is a vital step in doing so.

#### **4. Delegation**

The mentality must be applied to teamwork. Delegate roles to those who do them best.

#### **5. Show Respect**

If you and another person happen to be paired up and can't stand each other, you can still put that aside for a couple of hours, treat each other civilly, and complete the tasks at hand. You may even overcome the dislike toward one another.

#### **6. Be Helpful**

This is simple. If one of your teammates does not understand an idea, discussion, or task that is being completed, take the necessary time to explain it to them and work with them. There are no weak links when everyone helps one another. Some take longer to learn than others, but that doesn't mean that they are of less intelligence. If in a meeting someone asks a question because they don't understand, don't frown at them. Just answer the questions patiently and concisely.

#### **7. Question One Another**

If someone brings up a topic of discussion and a solution to this topic, question them. Respectfully question, don't badger. Rather, ask them how it will work, why it will work over the long-run, and how everyone else can implement the idea.

#### **8. Participation**

Have the entire team encourage shy people to engage in the topics of discussion. Don't demand it, but make them realize that you really want to hear their ideas.

#### **9. Rational Debate**

Bad ideas are bad for teams. Spirited, friendly, rational debate is where facts come forward, ideas are born, and quality rises to the top.

## 10. Set The Right Environment

Try to make the space in which your team is assembled as comfortable, relaxing, and inviting as possible. You do not want your team to be tense and with frayed nerves.

**PO 10: Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**PO11: Project management and finance:** Demonstrate knowledge and understanding of the engineering management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

Project management is the application of processes, methods, knowledge, skills and experience to achieve the project objectives. In general project is a unique, transient endeavour, undertaken to achieve planned objectives, which could be defined in terms of outputs, outcomes or benefits.

**PO12: Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

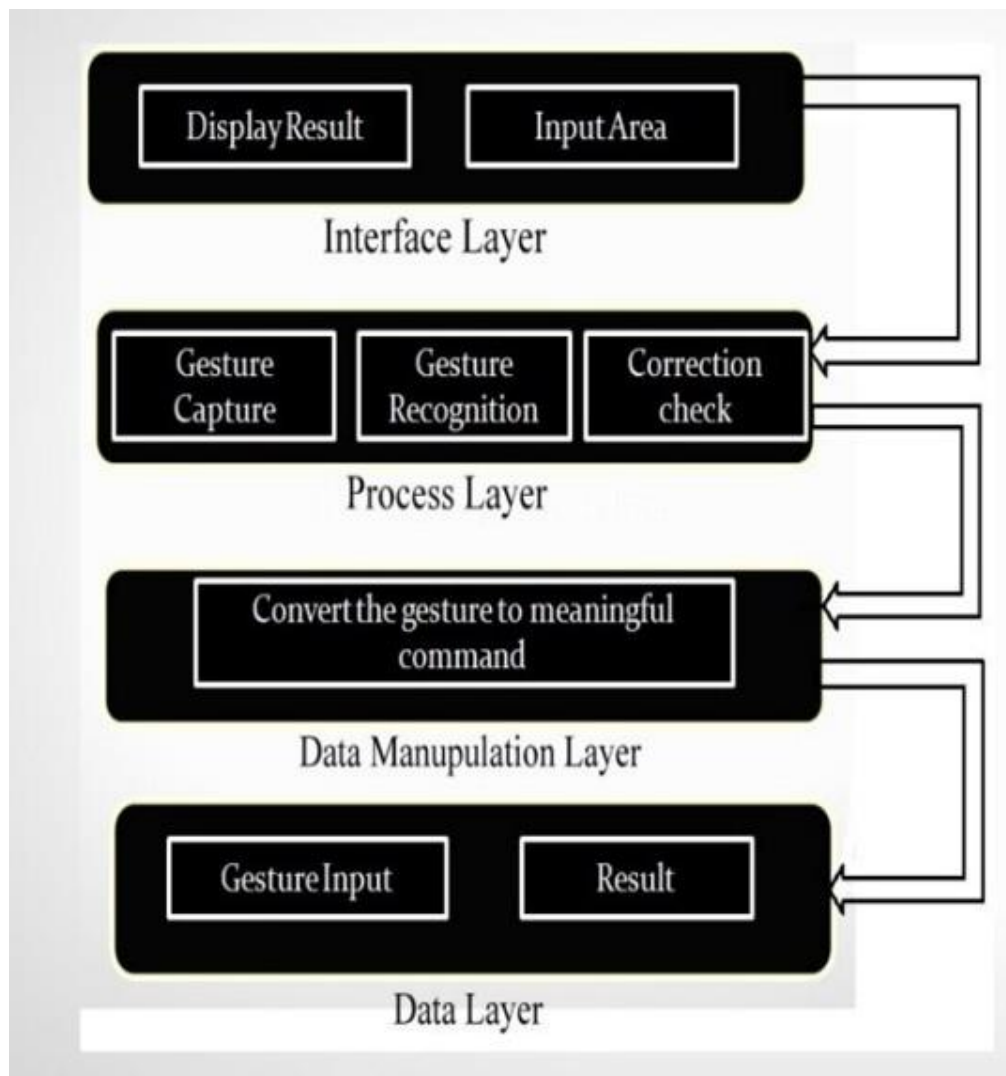
Life Long Learning means is the provision or use of both formal and informal learning opportunities throughout people's lives in order to foster the continuous development and improvement of the knowledge and skills needed for employment and personal fulfillment



## CHAPTER 4

### PROJECT IMPLEMENTATION

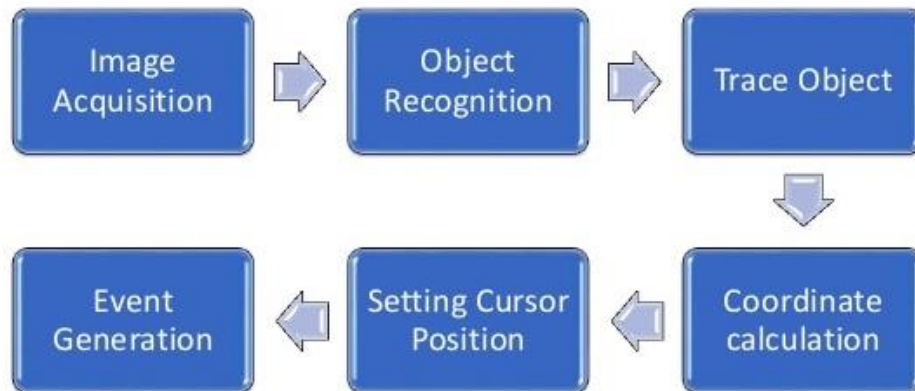
#### ARCHITECTURE



There are following layer:

- Interface Layer
- Process Layer
- Data Manipulation Layer
- Data Layer

## Flow Chart



## Screenshot

```
import cv2
import numpy as np
import HandTrackingModule as htm
import time
import autopy

#####
wCam, hCam = 800, 600
frameR = 100 #Frame Reduction
smoothing = 7 #random value
#####

pTime = 0
plocX, plocY = 0, 0
clocX, clocY = 0, 0
cap = cv2.VideoCapture(0)
cap.set(3, wCam)
cap.set(4, hCam)

detector = htm.handDetector(maxHands=1)
wScr, hScr = autopy.screen.size()

# print(wScr, hScr)

while True:
    # Step1: Find the landmarks
    success, img = cap.read()
    img = detector.findHands(img)
    lmList, bbox = detector.findPosition(img)

    # Step2: Get the tip of the index and middle finger
    if len(lmList) != 0:
        x1, y1 = lmList[8][1:]
        x2, y2 = lmList[12][1:]

        # Step3: Check which fingers are up
        fingers = detector.fingersUp()
        cv2.rectangle(img, (frameR, frameR), (wCam - frameR, hCam - frameR),
                      (255, 0, 255), 2)
```

```

import cv2
import mediapipe as mp
import time
import math
import numpy as np

class handDetector():
    def __init__(self, mode=False, maxHands=2, detectionCon=0.5, trackCon=0.5):
        self.mode = mode
        self.maxHands = maxHands
        self.detectionCon = detectionCon
        self.trackCon = trackCon

        self.mpHands = mp.solutions.hands
        self.hands = self.mpHands.Hands(self.mode, self.maxHands, self.detectionCon, self.trackCon)
        self.mpDraw = mp.solutions.drawing_utils
        self.tipIds = [4, 8, 12, 16, 20]

    def findHands(self, img, draw=True):
        imgRGB = cv2.cvtColor(img, cv2.COLOR_BGR2RGB)
        self.results = self.hands.process(imgRGB)
        # print(results.multi_hand_landmarks)

        if self.results.multi_hand_landmarks:
            for handLms in self.results.multi_hand_landmarks:
                if draw:
                    self.mpDraw.draw_landmarks(img, handLms, self.mpHands.HAND_CONNECTIONS)
            return img

    def findPosition(self, img, handNo=0, draw=True):
        xList = []
        yList = []
        bbox = []
        self.lmList = []
        if self.results.multi_hand_landmarks:
            myHand = self.results.multi_hand_landmarks[handNo]
            for id, lm in enumerate(myHand.landmark):
                # print(id, lm)

```

## CHAPTER 5

### CONCLUSION

#### Conclusion

- We are developing a system to control the mouse using a real-time camera.
- This system is based on computer vision algorithms and can do all mouse tasks.
- However, it is difficult to get stable results because of the variety of lighting and skin colors of human races.
- This system could be useful in presentations and to reduce work space.

#### Future Scope

In future, we plan to add more features such as Drag and Drop and Volume controller, etc by using index and thumb finger.



## REFERENCES

- <https://www.computervision.zone/>
- <https://www.slideshare.net/>
- <https://www.youtube.com/>