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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Under the Guidance of

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at

POORNIMA INSTITUTE OF ENGINEERING & TECHNOLOGY

JAIPUR

Rajasthan Technical University, KOTA

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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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CANDIDATE'S DECLARATION

We, Sagar Gyanchandani **(PIET18CS127), Rahul Chhablani (PIET18CS114) & Yash Koolwal (PIET18CS153)** BTech (Semester- VII) of "**Poornima Institute of Engineering & Technology, Jaipur"** hereby declare that the Project Report entitled **"AI Virtual Mouse Controller"** is an original work and data provided in the study is authentic to the best of our knowledge. This report has not been submitted to any other Institute for the award of any otherdegree.

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ABSTRACT

The mouse is one of the most spectacular Human-Computer Interaction (HCI) creations. A wireless mouse or a Bluetooth mouse still requires devices and is not totally device-free because it uses a battery for power and a dongle to connect it to the PC. This issue can be overcome in the proposed AI virtual mouse system by capturing hand motions and detecting hand tips with computer vision utilising a webcam or built-in camera. The machine learning algorithm is used in the system's algorithm. Without the usage of a hardware mouse, the computer may be operated remotely using hand gestures and can perform left click, right-click, drag and drop, and volume control tasks. The method employs deep learning to detect the hands. As a result, by eliminating the requirement for human interaction and device control, the suggested solution will prevent COVID-19 from spreading.

KEYWORDS:

OpenCV, Python, Mouse, Camera, Hand

CHAPTER 1

INTRODUCTION

1.1 Introduction to Project

These devices are becoming increasingly small in the form of Bluetooth or wireless technologies as technology in the fields of augmented reality and daily electronics advances. This study describes an AI virtual mouse system that employs computer vision to perform mouse activities in the computer by recognising hand gestures and tips. The main purpose of the proposed system is to perform computer mouse cursor and scroll operations using a web camera or a computer's built-in camera rather to a traditional mouse device. As an HCI with the computer, computer vision is utilised to recognise hand movements and tip detection.We can utilise a built-in camera or a web camera to monitor the fingertip of a hand motion and perform mouse cursor operations and scrolling activities, as well as move the cursor using the AI virtual mouse system.

When utilising a wireless or Bluetooth mouse, some hardware is needed, such as the mouse, the dongle to connect to the PC, and a battery to power the mouse to work, but in this article, the user utilises his or her built-in camera or webcam and hand gestures to control the computer mouse operations. The recommended system's web camera records and interprets the captured frames, identifies various hand movements and hand tip gestures, and then executes the appropriate mouse action.

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1.2 Project Aim and Objective:

The proposed AI virtual mouse technology can be utilised to solve difficulties in the real world, such as when there isn't enough room to use a physical mouse or for persons who can't use a physical mouse due to hand problems. Furthermore, it is not safe to use devices by touching them in the COVID-19 situation because this could result in the virus spreading, so the proposed AI virtual mouse can be used to overcome these issues because hand gesture and hand Tip detection is used to control the PC mouse functions by using a webcam or a built-in camera.

The primary purpose of the proposed AI virtual mouse system is to provide an alternative to the standard mouse system for performing and controlling mouse activities. This may be performed by employing a web camera to collect hand movements and tips, which are then processed to execute particular mouse tasks like left click, right click, and scrolling.

1.3 Problem Statement:

The computer can be controlled virtually using hand gestures and can perform left click, right click, drag and drop, and volume control functions without the use of a physical mouse. For detecting the hands, the algorithm uses deep learning. As a result, the proposed system will prevent COVID-19 from spreading by removing the need for human intervention and device control.

1.4 Software Requirements: VsCode, OpenCV Python, Pycharm

1.5 Hardware Requirements: PC and Webcam

CHAPTER 2

LITERATURE SURVEY

Seven current research publications on vision-based hand gesture recognition are categorised here. This section lays out the many architectural strategies which used construct Finger gesture apps, with an emphasis on research direction, technology, and theoretical proofs or simulation results.The primary goal of this research is to use two of the most essential modalities of interaction: the head and the hand, to operate any Computer Vision algorithms-based application running on a computer. The video input stream is split into two halves. The correct gesture is recognised given the shape and frequency of movement of the hand. A hidden Markov algorithm is used by the head gesture. Hand and head gesture recognition commonly uses pre-processing. Capture a frame from the camera first. Second, the Viola J.

The fundamental purpose of static hand gesture identification is to divide given hand signal data into a preset set as gesture types using specific criteria. The purpose of this project is to look into the use of two feature based methodologies, namely hand outline and complicated moment, to overcome the issue of hand gesture detection by analyzing the essential advantages and disadvantages of each method. The artificial is created using the pull learning technique.

Pre-processing, feature extraction, and classification are the three stages of processing a hand motion image. In the pre-processing stage, some operations are conducted to remove the finger gesture it from environment and prepares the finger gesture photo for image retrieval. To deal

with scaling and translating issues, the hand form is used as a factor in the first method.

Five major steps make up the gesture recognition system. Input image acquisition, pre-processing, feature extraction, gesture classification, and creation of appropriate commandfor the system are the steps involved. Industrial robot control, sign language translation, and rehabilitation devices for those with upper extremity physical limitations could all benefit from vision-based hand gesture detection. In the pre-processing and feature extraction stages of the vision-based Gestural Controllab.

In the feature extraction stages, the SIFT and MBC algorithms are used. Using monogenic signaling modeling, a message image is split into 3 complementary components: velocity, strength, and timing. The statistical characteristics of the retrieved local features are determined after encoding the monogenic variation in each local region and monogenic feature in each pixel. Other methods for extracting local features are substantially more time or space consuming than the suggestedMBC.

The goal of a gesture recognition system is to establish a natural interface for humans to operate or communicate with a technological device. The goal of this project was to create a gesture-based control system for a robotic freight ramp. For the imaging process, they used a generic webcam, and they categorised a gesture words for telerobotic control using an action recognition model called on graphs and motion tracking, making it the perfect for real power, easy to integrate, and efficient in unknown environments.

One of the most typical challenges faced when using a single camera is gesture recognition for motions made from side angles. Affine Convert and Discrete Wavelet Transforms are used to create a finger gesture detection system for many angles with a single camera (DFT). The system

can recognise movements made from a variety of angles, with an average recognition rate of 95.28 % for signs made at +-30 degrees as 91.30 percent for gestures done at 0 degrees.

Motions made at +-44 degrees, respectively, which is regarded excellent in the area of machine learning. By including DFT features, the suggested system becomes invariant under translation, rotation, and scaling.

They create a different at a certain angle is used in this techniques to produce motions entered from various angles look almost equivalent to actions performed on a 0 degree platform. As a result, the proposed scheme for identifying multi-angle motions can be considered effective. The system looks to be simple to operate and financially viable, and the trial findings show that the system's result is good and that it may be used. A vision-based system is given to manage various mouse motions such as left and right dragging using hand gestures, making the connection more efficient. A vision-based interface for operating a clicker with two-dimensional hand signals is described in this work. Hand gestures are detected using camera-based colour detection technology. This method focuses on the building of a digital HCI device utilising a Web Camera at a low cost. The centroid of each input image is determined. Because body motion also affects the location, it can be used to change the pointer on a laptop screen. In this situation, the parent picture is the hand image.

As a result, analyzing the number of fingers in child and mother images reveals information about the hand gesture's functioning. When the lenght of the fingertip in the infant image passes the threshold size, it makes a clicking sound. The efficacy of tracking the hands is increased by using red and blue coloured tips on the fingers to create the location more visible. The author believes that even this innovation has a good future in HCI-based systems after doing studies. It has a wide range of uses in robotics, biomedical devices, computer games, and other fields.

CHAPTER 3

PROJECT MANAGEMENT

Project management has evolved from few simple principles to a wide subject with many complex concepts. To make it easier for people to understand project management, all PMBOK knowledge areas are classified into nine categories by PMBOK Guide. It is one of the most comprehensive model documents for project managers. In this article, we will take a deeper look at each of these knowledge areas to give you a better perspective of project management.

1. Project Integration Management

PMI defines project integration management as, "Processes and activities needed to identify, define, combine, unify and coordinate different processes and activities with project management process groups." In short, project managers will have to keep an eye on every aspect of a project and check if everything is going according to the plan.

Good project integration is not possible without good teamwork. In order to be successful, you should have the resources who know their role and responsibilities. It is the responsibility of project managers to make project objectives clear and manage the inter-dependencies effectively to complete projects successfully. Therefore, project managers should focus on the bigger picture and follow a strategic approach to project management. Keep an eye on the obstacles and address them quickly before the problem gets out of hand.

2. Project Scope Management

Scope creep and lack of proper scope document is one of the main reasons behind project failure. Furthermore, defining and documenting all the work comes under scope management. Project team should know what the deliverables are and what problems your project will solve. All this makes it easier for your team members to achieve the goals and helps clients in knowing what to expect from the projects. Therefore, project scope should also contain milestones related to projects.

There are five sub-processes involved in the project scope management process.

- Collect requirements (Document stakeholder requirements)
- Define scope (Detailed description of project and what it will do)
- Create work breakdown structure (Dividing projects into smaller tasks)
- Verify scope (Getting acceptance of project deliverables from stakeholders)
- Control scope (Difference between actual and approved scope)

3. Project Time Management

One of the biggest challenges for project managers is to complete projects on time. However, most project managers do not understand this knowledge area. Hence, most projects under their supervision fail to complete before the deadline. There are six sub-processes associated with the project time management knowledge area that every project manager should know in order to complete projects on time.

Here are the six sub-processes:

- Define activities
- Sequence activities
- Estimate the resources required
- Estimate the time required
- Develop a schedule
- Control schedule

4. Project Cost Management

Most project managers consider managing costs against their project as their biggest challenge. However, cost management can be a difference maker between a successful project and a project failure. Many projects are abandoned due to budget constraints. If you do not want this to happen to your projects, then you should learn the art of effective project cost management and complete projects within the specified budgets. Latest tools and techniques can help you in this regard.

Here are three main sub-processes involved in project cost management.

- Estimate costs

- Determine budget
- Control costs

Make sure that you keep an eye on budget and expenditures so that you do not end up exceeding the budget. Unfortunately, most project managers do not pay attention to cost management from the beginning, spends a major chunk initially without any record and struggles to keep the project inside the budget later on. To keep project costs in check, you should track every dollar and where it is spent.

5. Project Quality Management

No matter how you define quality, a high-quality project is one which satisfies the customer needs and does not contain any defects and deficiencies. In order to achieve the highest project quality, project managers and their team should focus on customer requirements they have gathered initially, try to know what the customer wants and which problems your project will solve.

Develop a prototype of the project and give it to the end user to use it. Their feedback will allow you to make necessary adjustments before you deliver the final product to the customer. At the end of it all, the project should completely align with the user requirements in order to be called a high-quality project. Hence, all the requirements should be well documented so that your team can deliver a project that satisfies customer's requirement.

6. Project Human Resource Management

Another knowledge area of project management that usually is ignored is project human resource management. It is the set of processes and activities involved in organizing, leading and managing project teams. It is how you manage the most valuable asset of your company i.e. people. To be successful at it, project managers should have a clear strategy when it comes to hiring and staffing people and inducting them into project teams. Hiring the right people can increase the chances of your success.

Project Human Resource Management process involves following sub-processes:

- Developing a human resource plan
- Hire the project team
- Develop a project team
- Manage project team

7. Project Communication Management

Poor project communications can wreck havoc on your project progress. Moreover, it can take your project towards failure. So, if you want to complete projects successfully, all team members should be on the same page. Moreover, they should work as a team to achieve the common objective. If you want that to happen, then you will have to communicate effectively and regularly. Project managers can enhance collaboration and communication among their team members by using task management software that offers communications and collaboration features. Here are some of the key activities that project managers need to undertake to ensure uninterrupted communications throughout the project:

- Identify stakeholders
- Plan communications
- Distribute information
- Manage stakeholder expectations
- Report performance

8. Project Risk Management

Most project managers consider risk management as the most important factor in completing projects successfully. Therefore, effective risk management plays an important role in preventing your projects from failure. In addition to this, project managers can reduce the risk by following a proactive approach and managing risks at the initial stage. Project managers who ignore minor risks have to suffer from project failure because these minor risks can turn into major risk and can lead to a project disaster if left unattended. Here are some of the activities that project managers will have to undertake in project risk management:

- Plan risk management
- Identify risks
- Perform qualitative and quantitative risk analysis
- Plan risk response
- Monitor and control risks

9. Project Procurement Management

The Project Procurement Management knowledge area covers all the aspects related to purchase and acquiring of products and services needed to complete projects effectively. Although, the procurement process is quite transparent and conducted through a contract or agreement, it important for project managers to ensure that there are no discrepancies. Whether you are a buyer or seller, you need to understand both perspectives to get a better knowledge of the project procurement process. Additionally, cost benefit analysis, cost utility analysis, and risk analysis also comes under project procurement management.

- Plan procurement
- Conduct procurement
- Administer procurement
- Close procurement

Project Management Tools:

Project management required tools to manage the work , time and resources. At present many of the software are available for project management. Some of the popular software tools are as follows.

01. Trello

Trello is an project management tool, instead this app is a free visual way to to glance at the entire project with a single view. With Trello you can organise cards, these cards can be your thoughts, conversations and to-do lists and be placed on a board for everyone to collaborate on.

02. Basecamp

Basecamp is the granddaddy of project management apps. Basecamp is considered the leading project management tool around. It boost a simple and easy to use interface to collaborate with your team and client. It allows you to create multiple projects and setup discussions, write to-do lists, manage files, create and share documents, and organise dates for scheduling.

03. Teamwork Projects

Teamwork Projects is the ultimate productivity tool to manage projects with your team. Teamwork allows you to keep all your projects, tasks and files all in one place and easily collaborate with a team. Teamwork helps you to visualise the entire project through a marked calendar and gantt chart and setup reporting. Teamwork supports file management with Google Drive, Box.com and Dropbox. As well as integration with leading apps such as third party accounting software and customer support apps.

04. Resource Guru

Billed as the "simple way to schedule people, equipment and other resources", Resource Guru is a streamlined resource scheduling and leave management tool that's designed to keep your projects on track. You can plan your team's workloads, receive daily booking reminders, report on KPIs, and more. Apple, Saatchi & Saatchi and Deloitte are among some of the cloud-based team calendar's heavyweight customers.

05. ActiveCollab

ActiveCollab recently released its new version 5.0. The new revamped app is now more powerful and focused project management tool. It offers team collaborating features, task management, time tracking and importing expenses. One of the biggest asset of ActiveCollab is it offers invoicing features. You are able to track payments and expenses and have invoices paid directly within ActiveCollab with PayPal, and other credit card payments.

06. Zoho Projects

Zoho offers a wide range of business software including Projects. Zoho Projects is an proficient tool to project plan and project coordinator from start to finish. It boost all the features you need for project management with some advance features including reporting, integration with Google Apps and Dropbox, bug tracking, setup Wiki Pages to build a repository of information, forums and more.

07. Jira

Jira is specifically targeted for software development teams. Jira offers abilities to raise issues and bugs. Jira makes it real easy to track bugs and see which issues are still outstanding and how much time was spent on each task. Jira offer other products including Confluence a document collaboration tool, and HipChat a team chat and video and file sharing platform and other products.

08. Asana

Asana is the easiest way for teams to track their work so everyone knows who's doing what, by when. With tasks, projects, conversations and dashboards, Asana keeps your work organized, and teammates accountable so you can move work forward faster. Asana also lets you keep track of your work wherever you are with mobile apps for both iOS and Android.

09. Podio

Podio is a ever growing tool to organise and communication tool for any business. Podio allows you to personalise this platform to fit your business needs. Besides being able to communicate with a team, setup task management, use as a file storage system, like a traditional project management app, Podio can be an internal intranet for all your colleagues and departments to interact.

10. Freedcamp

Whatever your project may be, either setting up an event, a web project or organising a wedding, Freedcamp helps you organise and plan effectively. Freedcamp has an organised dashboard to view the entire project at a glance. You can easily setup tasks, use sticky notes to visually setup tasks and organise them into the calendar. Freedcamp provides advance add-ons for high level business use including CRM, invoicing, issue tracking and setting up wiki pages.

11. Wrike

Wrike is advance application to help you work smarter. By making sure you are always staying on track and ensure you have the adequate resources to finish on time and on budget.Setting up

tasks, engage your team and integrate with your business tools including Google Apps, Microsoft Excel, Dropbox and many more is so easy with Wrike.

CHAPTER 4

TECHNOLOGY APPLIED

Technologies applied in the Project:

Python:

Python is a high-level, general-purpose programming language that is interpreted.

Its design philosophy emphasises code readability through extensive indentation.

Its language components and object-oriented strategy are intended to assist programmers in writing concise, reasonable code for both large and small applications.

OpenCV:

OpenCV is a programming library that focuses on real-time computer vision.

It's great for computer vision applications like video and CCTV footage analysis, as well as image analysis.

We can use this library to focus on real-world problems when developing computer vision applications that we don't want to build from scratch.

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 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 it 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 5

PRODUCT BACKLOG DESIGN

2.1 Product Backlog

It consists of a collection of User stories divided into a number of Sprint Backlogs.

A product agenda is a list of innovative features, modifications to current products, bug repairs, new infrastructure, and other activity that a crew can complete in order to achieve a given objective.

For whatever a team works on, the work package is the reality. In other words, nothing got completed it's not on the product backlog. The appearance of a product backlog item on a software product, from the other end, does not always something. Rather than a guarantee, it is an alternative for the company to produce a specified result.

Adding a product backlog article to the deliverable, as well as removing a sprint backlog item that would not result in direct advance toward the successful objectives or enable movement toward the purpose, should be straightforward and inexpensive.

This deliverable consists of four spring backlogs, each with its own set of features.

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

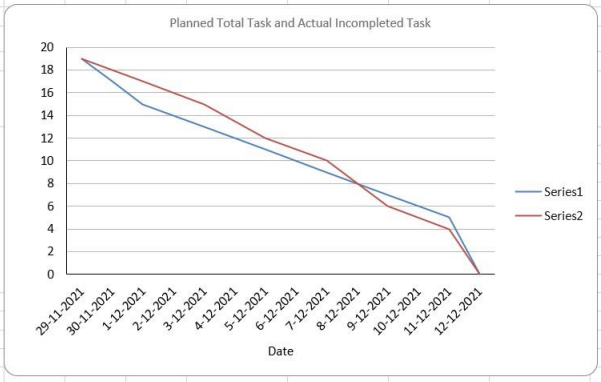
2.2 Sprint Backlog-1

Sprint Backlog is a collection of User stories and their associated tasks. This spring backlog consists of cursor moving functionality using our index finger.

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 smoothning to random value	SG	In Progress	8/12/2021
		SB1/US7/T2	For smoothning 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

Spring Backlog 01 burn down chart

Date	Planned Total Task	Actual Incompleted Task
29-11-2021	19	19
30-11-2021	17	18
1-12-2021	15	17
3-12-2021	13	15
5-12-2021	11	12
7-12-2021	9	10
9-12-2021	7	6
11-12-2021	5	4
12-12-2021	0	0

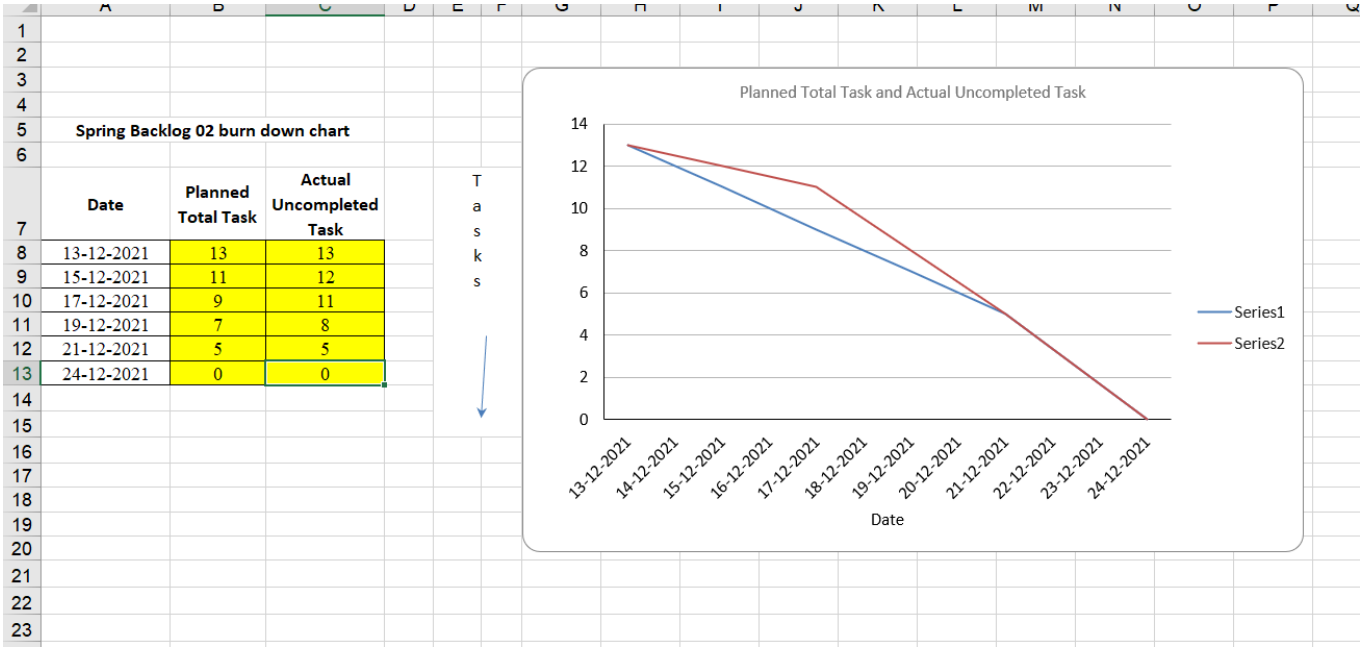


2.3 Sprint Backlog-2

This spring backlog consists of clicking functionality using our index finger and middle finger, as we join the tips of our index and middle finger, clicking functionality will be implemented.

SPRINT BACKLOG 2

US ID	USER STORY	TASK ID	TASKS	TM	STATUS (NOT STARTED / IN PROGRESS / COMPLETED)	ESTIMATED DATE OF TASK COMPLETION
			SPRINT 2 - AI Virtual Mouse			
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
		SB2/US1/T2	Detect the middle finger	RC	In Progress	14/12/2021
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
		SB2/US2/T2	Locate the middle finger	YK	In Progress	16/12/2021
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
		SB2/US3/T2	Detect the middle finger	RC	In Progress	18/12/2021
		SB2/US3/T3	Finding tip of middle finger	RC	In Progress	19/12/2021
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
		SB2/US4/T2	Find landmarks coordinates	YK	In Progress	21/12/2021
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
		SB2/US5/T2	Compare the distance of the tip of both fingers	SG	In Progress	23/12/2021
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
		SB2/US6/T2	Add clicking gesture if distance is less than a particular value	SG	In Progress	24/12/2021



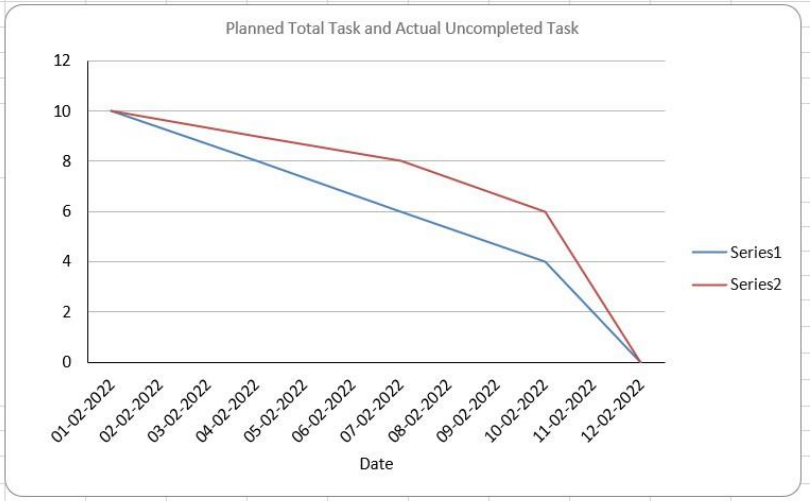
2.4 Sprint Backlog-3

This sprint backlog consists of volume control functionality using our index finger and thumb, as we increase the distance between the tips of the fingers, volume increases and volume decreases as we decrease the distance.

			SPRINT 3 - AI Virtual Mouse			
SB3/US1	As an User I want to detect my thumb so that I can use volume control gesture	SB3/US1/T1	Check if fingers are up	RC	Not Started	1-1-2022
		SB3/US1/T2	Detecting thumb	RC	Not Started	5-1-2022
SB3/US2	As an User I want to recognize my thumb so that I can find the landmarks of the tip of thumb	SB3/US2/T1	Recognize Thumb	RC	Not Started	8-1-2022
		SB3/US2/T2	Find the landmark of the thumb	RC	Not Started	10-1-2022
SB3/US3	As an User I want to recognize the tip of thumb landmark so that I can use it with the tip of index finger for controlling volume	SB3/US3/T1	Study of Hand detector	SG	Not Started	11-1-2022
		SB3/US3/T2	Mark the tip of the thumb	SG	Not Started	12-1-2022
SB3/US4	As an User I want to find the coordinates of the tip of thumb so that I can compare them with the coordinates of index finger	SB3/US4/T1	Find the coordinates of the thumb	YK	Not Started	20-1-2022
		SB3/US4/T2	Check the distance between the coordinates of index finger and thumb	YK	Not Started	22-1-2022
SB3/US5	As an User I want to adjust the distance between the tips of thumb and index finger so that I can adjust volume accordingly	SB3/US5/T1	Study of AudioUtilities and IAudioEndpointVolume library	SG	Not Started	24-1-2022
		SB3/US5/T2	Adjust volume with the distance of fingers	SG	Not Started	25-1-2022

Spring backlog 3 Burnt Down chart

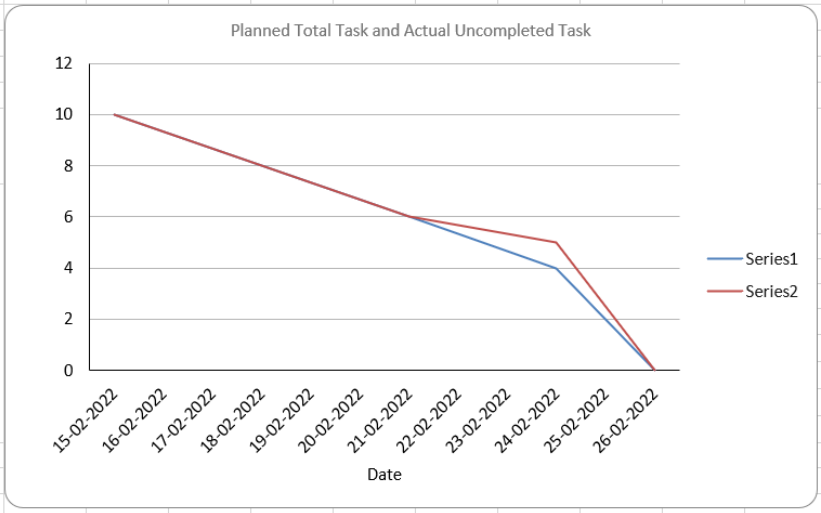
Date	Planned Total Task	Actual Uncompleted Task
01-02-2022	10	10
04-02-2022	8	9
07-02-2022	6	8
10-02-2022	4	6
12-02-2022	0	0



2.5 Sprint Backlog-4

This sprint backlog consists of scrolling functionality using our pinky finger and thumb, as we raise our pinky finger, page scrolls down and page scrolls up as we raise our thumb.

Date	Planned Total Task	Actual Uncompleted Task
15-02-2022	10	10
18-02-2022	8	8
21-02-2022	6	6
24-02-2022	4	5
26-02-2022	0	0



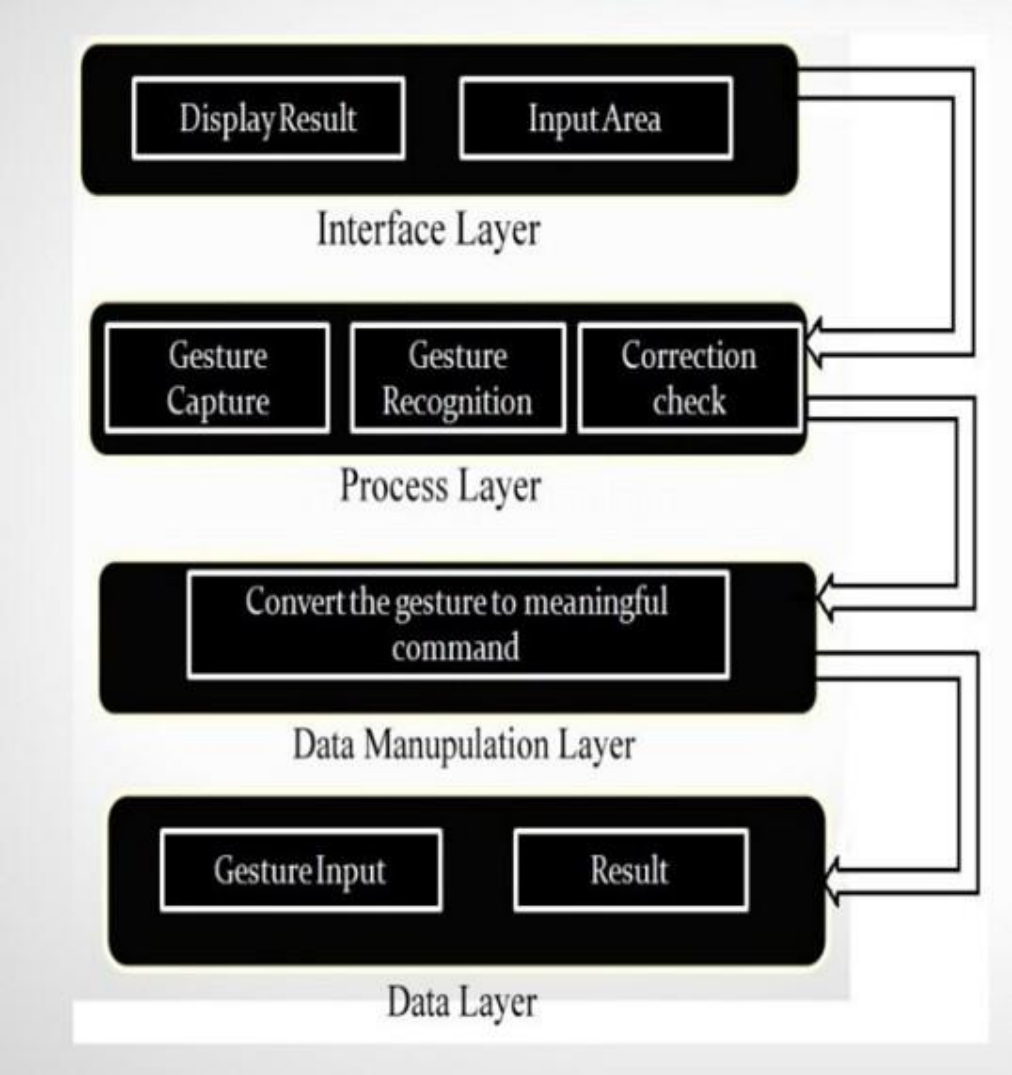
SPRINT BACKLOG 4

US ID	USER STORY	TASK ID	TASKS	TM	STATUS (NOT STARTED / IN PROGRESS / COMPLETED)	ESTIMATED DATE OF TASK COMPLETION
			SPRINT 4 - AI Virtual Mouse			
SB4/US1	As an User I want to detect my ring finger so that I can create drag and drop gesture	SB4/US1/T1	Study the indexes of all finger	RC	Not Started	15-2-2022
		SB4/US1/T2	Detect ring finger	RC	Not Started	16-2-2022
SB4/US2	As an User I want to detect the landmark of the tip of ring finger so that I can find coordinates of ring finger	SB4/US2/T1	Find landmark of the ring finger	SG	Not Started	18-2-2022
		SB4/US2/T2	Find the coordinates of ring finger	SG	Not Started	20-2-2022
SB4/US3	As an User I want to find the distance between the tips of middle and ring finger so that I can create single click gesture event	SB4/US3/T1	Find distance between middle and ring finger	YK	Not Started	21-2-2022
		SB4/US3/T2	Compare the tip distance of middle and ring finger	YK	Not Started	22-2-2022
SB4/US4	As an User I want to add a feature of joining the tips of both the fingers so that I can drag and drop an object	SB4/US4/T1	Select the object or icon	SG	Not Started	24-2-2022
		SB4/US4/T2	If distance is less activate the gesture	SG	Not Started	25-2-2022
SB4/US5	As an User I want to create an executable file so that I can use that on any system	SB4/US5/T1	Study of how to make executable file	RC+YK+SG	Not Started	26-2-2022
		SB4/US5/T2	Make an executable file	RC+YK+SG	Not Started	27-2-2022

CHAPTER 6

PROJECT IMPLEMENTAION

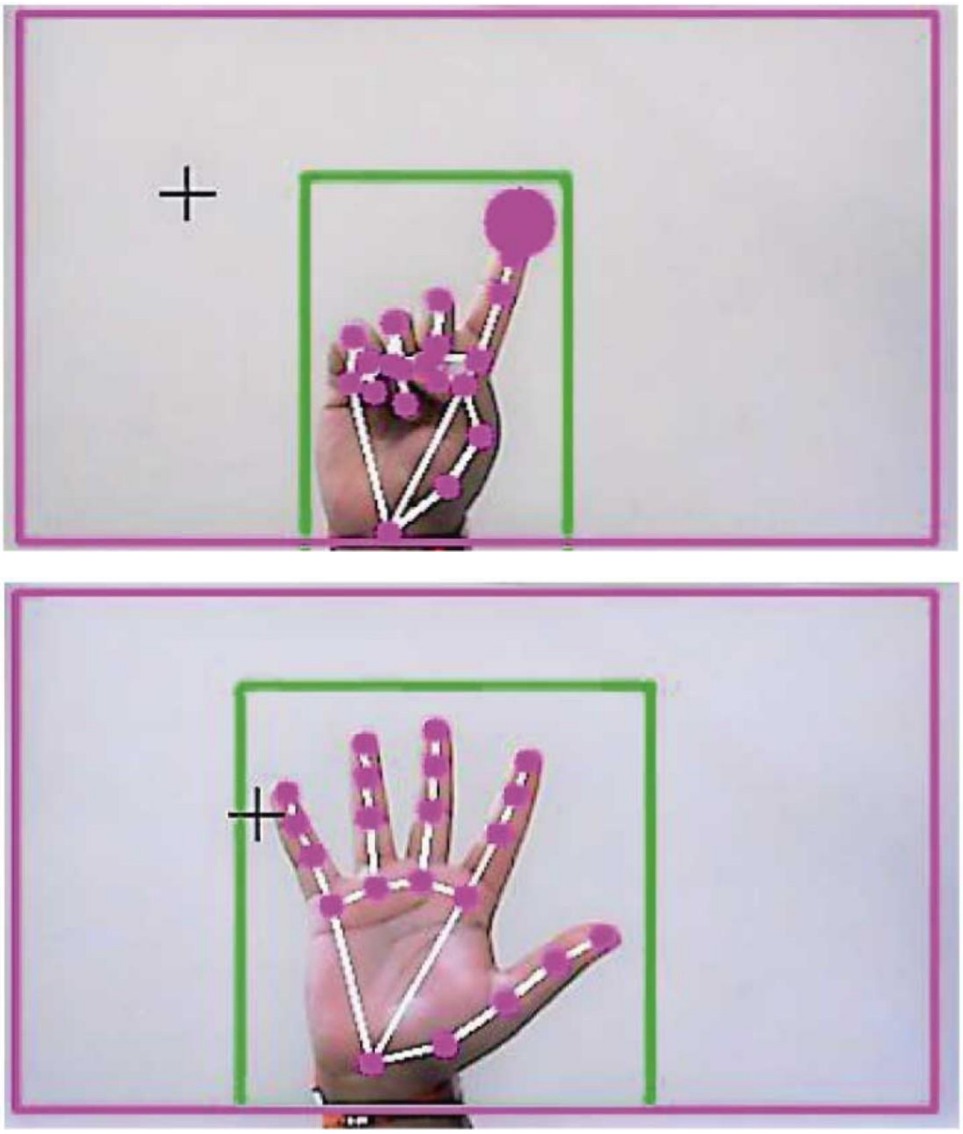
ARCHITECTURE



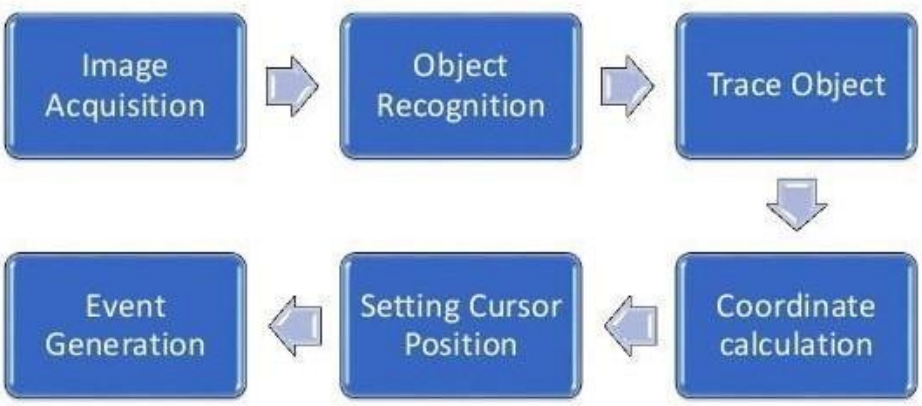
There are types of layer:

- 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
smoothening = 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)
```

```python
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 7

RESULTS

Conclusion

- We're working on a system that uses a real-time camera to operate the mouse.
- This system uses computer vision techniques to perform all mouse functions.
- However, because of the wide range in lighting and skin hues among human ethnicities, it is difficult to obtain consistent results.
- This technique might be handy in presentations and for saving space at work.

Future Scope

The suggested AI virtual mouse has various problems, including a modest loss of precision when utilising the right click mouse function and issues picking text by clicking and dragging. These are some of the suggested AI virtual mouse system's limitations, which will be addressed in future study.

In addition, the suggested system may be developed to handle virtual keyboard and mouse functions, which is another prospective Human-Computer Interaction application (HCI).

REFERENCES

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