# Group NO:3
# AIR TRACKER

B.S. (SE) Final year project proposal

| Sr.no | Name | Roll no | ST/CT No | Sec |
|---|---|---|---|---|
| 1 | Hadiqa Mehdi | 21B-007-SE | ST-21047 | B |
| 2 | Musfira Khalid butt | 21B-027-SE | ST-21107 | B |
| 3 | Saad Ather Ali | 21B-066-SE | ST-21113 | B |
| 4 | Dua Fazil | 21B-140-SE | ST-21039 | B |

Batch 2021

Date:20-september-2024

# DEPARTMENT OF COMPUTER SCIENCE
# USMAN INSTITUTE OF TECHNOLOGY
## Usman Institute of Technology
**Department Of Computer Science**

**FINAL PROJECT APPROVAL FORM**

The Head of Department,
Computer Science Department,
UIT
Karachi.

Date: _____
Batch:_____

Subject: **Bachelor of Science in Computer Science/Software Engineering Final Year Project**

Respect Sir,

We, the below listed students of final Year BS_____class, desire to undertake work on the following project.

_____

We request you to kindly grant approval for undertaking the work on the above-cited project. I abide by all terms and conditions mentioned below.

1. I have selected this project on my own.
2. I have no objection working under the supervision of male/female supervisor, or if my project work is evaluated by male/female externals.
3. I am sure I can complete this project till_____.
4. I am eager to work under the supervision of advisor assigned to this project.
5. I understand that FYP committee can modify the scope of the project as and when required.
6. I know that if do not appear in regular project progress presentations/milestones my project will be disqualified.
7. I know that if I do not appear in mid project presentation, whenever it is scheduled, I will not be eligible for final project viva
8. I fully understand that "***cheating***"***** may lead to cancelation of my project.
9. I understand that the decision of the FYP evaluation committee, for all issues, would be final, and no objections will be accepted.
10. I have no objection presenting my project to external or internal examiner assigned by the Head of the Department.
11. Project and Product deliverables at the time of submission of final year project every group is responsible to submit complete running system along with printed reports, source code, hardware (if any) etc to the project coordinator.
12. It would be the responsibility of Project coordinator to keep record of all projects in a system (in running form) as it would help to continue next project in continuation, depends upon the scope and application of project.
13. Proper dressing and way of presentation should be in English during proposal defend session, milestones and final presentations.
14. Marking of milestones and final presentation should be based on individual evaluation of each faculty members and marks would be granted during session.

15. When we go for proposal defends session a list of all previous projects with their brief introduction must be available during session for our reference. (Introduction, Scope of project, tools and technology and batch must be available).
16. I understand that it is my responsibility to update my advisor and FYP committee members with the status of my project and submit reports on time.
    - Copying code from any resources
    - Using off the shelf components without prior permission
    - Outsourcing your project
    - Hire a resource for the completing the FYP code or any part of the project.

Yours sincerely,

| S.NO. | Roll No | Name | Email | Cell No | signature |
|---|---|---|---|---|---|
| 1 | 21B-007-SE | Hadiqa Mehdi | 21b-007-se@students.uit.edu | 0311-3837022 | |
| 2 | 21B-027-SE | Musfira Khalid butt | 21b-027-se@students.uit.edu | 0333-3517825 | |
| 3 | 21B-066-SE | Saad Ather Ali | 21b-066-se@students.uit.edu | 0335-3948753 | |
| 4 | 21B-140-SE | Dua Fazil | 21b-140-se@students.uit.edu | 0336-2223307 | |

# TABLE OF CONTENT

## Project executive summary

The "Air-Tracker" project seeks to revolutionize the way users interact with presentation slides by developing an advanced gesture-based control tool with advanced real time drawing features that will be a very a very low-cost solution for the problems faced while delivering a interactive presentation. Traditional presentation methods often rely on physical clickers or remote controls, which limit mobility and can lead to technical difficulties. Air-Tracker aims to solve these challenges by incorporating AI and Human-Computer Interaction (HCI) advancements, enabling intuitive and natural gesture-based interactions. The project will involve developing a system that allows users to control slides and annotate in real-time using only hand gestures. The integration of technologies such as OpenCV, TensorFlow, and Media Pipe will be critical in achieving this goal. The project will result in a functional prototype that enhances the user experience, increases engagement during presentations, and provides accessibility features for users with disabilities or for the people who want to increase interactivity while delivering a presentation, Air-Tracker aims to offer a seamless, dynamic, and accessible solution for controlling and enhancing digital presentations.

## Project overview

The Air-Tracker project aims to address a growing need for more dynamic, interactive, and hands-free presentation tools in professional and educational settings. As technology evolves, presenters are seeking innovative ways to engage audiences without the limitations of traditional input devices, such as keyboards, mice, or clickers. The rise of touchless interfaces, gesture recognition, and artificial intelligence (AI) presents an opportunity to develop new tools that allow for more seamless and intuitive control over presentations.

In modern workplaces and classrooms, presentations are a key method of sharing ideas, educating, and influencing decision-making. However, current presentation tools often require physical interaction, which can disrupt the flow of a presentation and limit the presenter’s ability to move freely. This can lead to reduced engagement with the audience, as the presenter must divide attention between the content and the tool used to navigate it. Furthermore, remote work and virtual presentations have become commonplace, making it even more important to create tools that offer ease of use and increased interactivity.

The Air-Tracker project is being undertaken to develop a hands-free presentation tool that leverages gesture-based control and real-time annotation capabilities. By allowing presenters to control slides and annotate content using simple hand movements, the tool aims to enhance the presenter’s ability to engage with the audience, whether in-person or remotely. This project also seeks to integrate artificial intelligence for gesture recognition, ensuring that the tool is both intuitive and responsive.

**Business Value**

The Air-Tracker project offers significant business value by addressing key pain points in current presentation workflows and introducing a more modern, user-friendly solution. Here are the major aspects of its business value:

- **Increase Presenter Mobility:** Allow presenters to move freely around the stage while maintaining control over their slides.

- **Reduce Technical Issues**: Minimize reliance on physical hardware that can malfunction or require batteries.

- **Improve Engagement:** Foster a more dynamic and interactive presentation environment, increasing audience engagement and retention.

- **Enhance Accessibility:** Provide a more accessible solution for individuals with disabilities, improving inclusivity in presentations.

# Project objectives

The Air-Tracker is driven by the following clearly defined objectives that align with the SMART framework, ensuring the project's success is measurable and attainable within the specified timeline. These objectives are tied to specific deliverables and aim to address the core needs of the project while adhering to project goals.

The following objectives are.

**Objective #1:**

- **Develop Gesture-Based Slide Control:** Create a functional prototype that enables presenters to navigate through slides using hand gestures, eliminating the need for traditional clickers or remote controls.

  **Specific:** The project will create a gesture recognition system that allows users to control presentation slides without physical input devices. **Measurable:** The system will be tested with different gestures, ensuring good accuracy in recognizing and executing commands. **Achievable:** By leveraging existing AI and machine learning algorithms, our development team will design a user-friendly system that responds to hand gestures. **Realistic:** The technology is based on established gesture-recognition frameworks and can be adapted to work with current hardware(camera) and software setups. **Time-Based:** This objective will be completed within the first 8 months of the project timeline, following iterative testing phases to ensure accuracy.

**Objective #2:**

- **Implement Real-Time Annotation Capabilities**: Design and integrate a feature that allows presenters to draw, highlight, and annotate slides dynamically based on recognized gestures during the presentation.

**Specific:** The Air-Tracker will be compatible with widely-used presentation software like Microsoft PowerPoint, Canva. **Measurable:** Compatibility tests will be conducted across all major platforms, ensuring full functionality in terms of gesture control, navigation, and annotation features. **Achievable:** The project team will utilize existing material provided by these software platforms to integrate Air-Tracker seamlessly. **Realistic:** integration tools from these software providers will ensure that the Air-Tracker functions as intended. **Time-Based:** Full compatibility will be achieved by month 8, following a period of testing and adjustments to ensure cross-platform support.

**Objective #3:**

- **Enhance Accessibility for Users with Disabilities**: Develop an intuitive interface that caters to users with disabilities, ensuring that the tool is easy to use and accessible to a wider audience.

  **Specific:** Ensure the tool is accessible to users with disabilities through feature of customizable gestures. **Measurable:** Achieve 90% positive feedback on accessibility from user testing. **Achievable:** Leverage existing assistive technologies to implement accessibility features. **Realistic:** Focus on integrating well-known accessibility tools within the existing project framework. **Time-Based:** Complete and test accessibility features by month 9.

# Project scope

## In scope:

- **Data Collection and Preprocessing:** Gather and prepare a diverse dataset of hand gestures and video annotations to train gesture recognition models. This includes data labeling, cleaning, and augmentation to ensure high-quality inputs for model training.

- **Gesture Recognition System:** Develop and implement machine learning models using TensorFlow and Media Pipe to accurately detect and interpret hand gestures in real-time. This will involve training Convolutional Neural Networks (CNNs) and potentially exploring Long Short-Term Memory (LSTM) networks for future enhancements.

- **Real-Time Annotation:** Create a feature that allows for real-time drawing and annotation on presentation slides with pointers. This will enable presenters to make immediate adjustments and highlights during their presentations.

- **Gesture Recognition with AI:** Using machine learning models to accurately detect hand movements for controlling presentations and annotating content.

- **User Interface Design:** Develop an intuitive and user-friendly interface that integrates seamlessly with popular presentation software. The interface will facilitate ease of use and accessibility for all users.

- **Testing and Evaluation:** Conduct comprehensive testing of the gesture recognition and annotation features to ensure accuracy, reliability, and user satisfaction. This will involve usability testing, performance evaluation, and iterative refinements based on feedback.

# Out of scope:

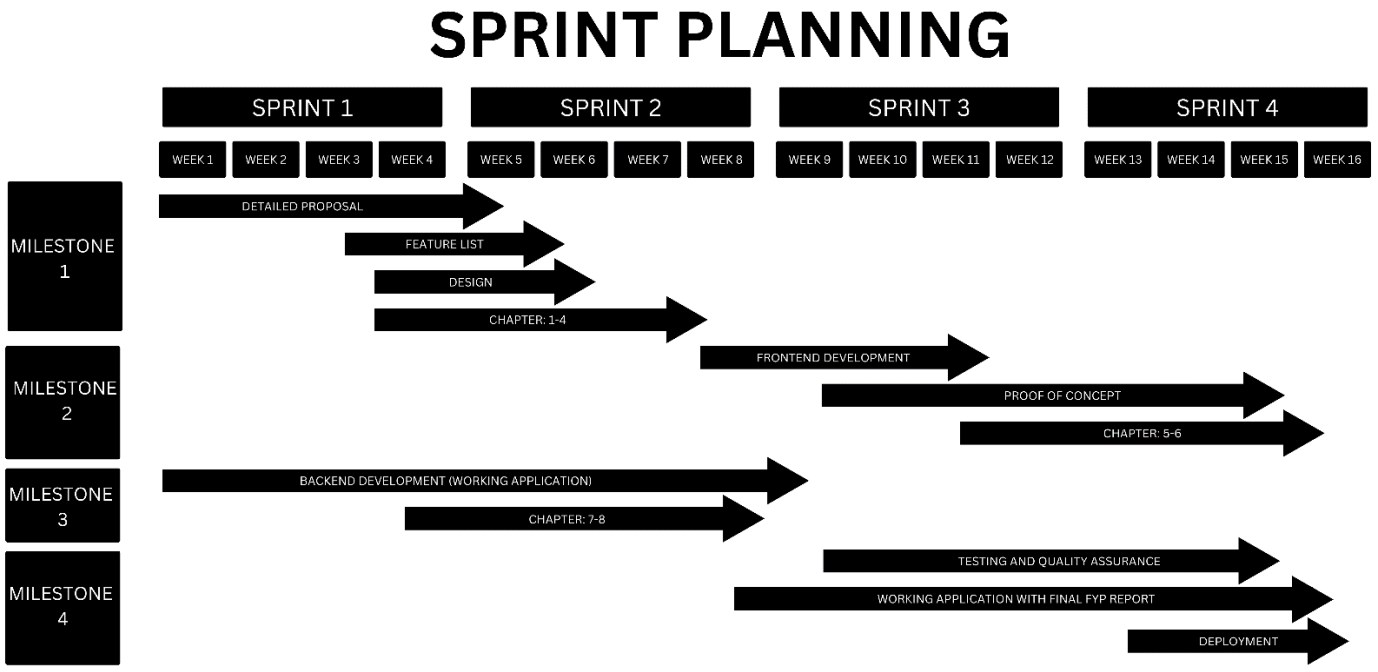
- **Custom Hardware Development:** The project will not involve the creation of custom hardware. It will utilize existing standard computer systems and cameras.

- **Extensive Compatibility Testing:** While the tool will be tested with major presentation platforms, comprehensive compatibility with all available platforms is not included in the initial scope.

- **Virtual/Augmented Reality Integration**: The project will focus on traditional presentation environments and will not include VR/AR functionalities at this stage.

- **Advanced AI Features**: Advanced AI capabilities such as facial expression recognition will not be part of the initial development. Future iterations may explore these features.

- **Offline Functionality:** The tool will primarily be developed for online use and won't focus on fully offline operations.




## Deliverables produced

**Deliverables produced.**

- **Project Deliverable 1:** Initial Proposal
- **Project Deliverable 2:** System diagram
- **Project Deliverable 3:** Feature List
- **Project Deliverable 4:** Detailed Proposal
- **Project Deliverable 5:** Non-working prototype of the Project
- **Project Deliverable 6:** Video presentation of the non-working prototype
- **Project Deliverable 7:** Actor use case diagram
- **Project Deliverable 8:** Activity Diagram
- **Project Deliverable 9:** Class Diagram
- **Project Deliverable 10:** Front-end (GUI)
- **Project Deliverable 11:** Sequence Diagram
- **Project Deliverable 12:** Object Diagram
- **Project Deliverable 13:** Entity Relation Diagram
- **Project Deliverable 14:** Algorithm Analysis
- **Project Deliverable 15:** Working Project in executable form
- **Project Deliverable 16:** Deployment Architecture & Strategy
- **Project Deliverable 17:** Data for Project Directory
- **Project Deliverable 18:** Final FYP Report

**Product Deliverables**

**Product Deliverable 1:**
**Functional Prototype:**

Functional Prototype is the core product of the Air-Tracker project, demonstrating the tool's primary features and capabilities. This prototype will include the gesture-based slide control and real-time annotation functionalities. It will be tested internally and used to gather feedback from stakeholders and potential users. The prototype will showcase the ability to navigate through slides using hand gestures, as well as draw and annotate on slides in real-time during presentations. This deliverable is crucial for validating the tool's functionality and effectiveness before final deployment.

**Product Deliverable 2:**
**User Documentation:**

User Documentation is a detailed manual that provides instructions on how to set up, use, and troubleshoot the Air-Tracker tool. It will include a user guide with step-by-step instructions, FAQs, and troubleshooting tips. This documentation is designed to help users understand and effectively utilize the tool, ensuring a smooth and efficient experience. It will be an essential resource for end-users, providing them with the necessary information to maximize the benefits of the Air-Tracker tool.

**Product Deliverable 3:**
**Test Reports:**

Test Reports document the outcomes of the comprehensive testing process for the Air-Tracker tool. These reports will include methodologies, results, user feedback, and recommendations for improvements. The Test Reports will provide insight into the tool's performance, reliability, and user satisfaction, and will help identify any issues or areas for enhancement. This deliverable is important for ensuring that the final product meets quality and performance standards before its official release.

## Project estimated effort/cost/duration

**GANTT chart/ Increments/ sprints:**

**Estimated effort hours:**

| Members | Estimated hrs per Week |
|---|---|
| Hadiqa Mehdi | 17 hrs |
| Musfira Khalid butt | 17 hrs |
| Saad Ather Ali | 17 hrs |
| Dua Fazil | 17 hrs |
| Discussion/Meeting with Supervisor | 2 hrs |

**Estimated duration:**
According to the FYP planner (2024-2025)

| Milestone | Date completed | Deliverable(s) completed |
|---|---|---|
| Project planning | 25/july/2024 | • Project Deliverable 1<br>• Project Deliverable 2<br>• Project Deliverable 3 |
| Milestone 1 | 20/sep/2024 | • Project Deliverable 4<br>• Project Deliverable 5<br>• Project Deliverable 6<br>• Project Deliverable 7<br>• Project Deliverable 8 |
| Milestone 2 | 13th week of spring 2024 | • Project Deliverable 9<br>• Project Deliverable 10<br>• Project Deliverable 11<br>• Project Deliverable 12<br>• Project Deliverable 13<br>• Project Deliverable 14 |
| Milestone 3 | 6th week of fall 2025 | • Project Deliverable 15 |
| Milestone 4 | 13th week of fall 2025 | • Project Deliverable 16<br>• Project Deliverable 17<br>• Project Deliverable 18 |
| Project conclusion | 14th week of fall 2025 | |

## Project assumptions

To ensure the success of the project, the following assumptions are made:

**Assumption #1:**

- **Stable Internet Access:** All team members will have reliable internet access to facilitate collaboration, development, and data sharing.

**Assumption #2:**

- **Availability of Required Hardware:** Necessary hardware, including computers and cameras, will be available and operational throughout the project duration.

**Assumption #3:**

- **Access to Presentation Software:** The project will have access to popular presentation platforms for integration and testing purposes.

**Assumption #4:**

- **Team Expertise:** Team members possess the required skills and expertise in AI, HCI, and software development to execute the project effectively.

## Project risks

The following risks have been identified and will be managed to minimize their impact on the project:

| Risk Area | Level (H/M/L) | Risk Plan |
|---|---|---|
| Hardware Availability | Medium | Ensure backup systems are available and functional. Regularly check hardware performance. |
| Gesture Recognition Accuracy | High | Continuously refine models with diverse data.<br>Implement rigorous testing and validate procedures. |
| Integration with Presentation Software | Medium | Prioritize compatibility with major platforms. Extend compatibility as needed and conduct thorough testing. |
| Real-Time Performance | High | Optimize code and algorithms for efficiency. Conduct performance testing and address bottlenecks promptly. |
| User Acceptance | Medium | Gather user feedback early and often. Incorporate feedback into iterative improvements. |

## Project approach

The Air-Tracker project will follow an Agile development approach, characterized by iterative cycles and regular feedback. This methodology allows for flexibility and continuous improvement throughout the project. Key phases include:

- **Planning:** Define project goals, scope, and deliverables. Develop a detailed work plan and schedule.

- **Data Collection and Preprocessing:** Gather and prepare data for model training. Implement preprocessing pipelines to ensure data quality.

- **Model Development:** Train and test gesture recognition models using TensorFlow and Media Pipe. Incorporate feedback and refine models.

- **Feature Development:** Implement real-time annotation and gesture-based control features. Integrate these features into the Air-Tracker tool.

- **User Interface Design:** Develop a user-friendly interface that integrates with presentation software. Focus on usability and accessibility.

- **Testing and Validation:** Conduct comprehensive testing of all features. Gather user feedback and make necessary adjustments.

- **Deployment and Documentation:** Finalize the prototype, prepare user documentation, and ensure readiness for demonstration and deployment.

## Tools and technologies

**Hardware:**

- **Computer System:** A laptop or desktop with a camera (minimum specifications: Intel i5 processor, 8GB RAM). The system should be capable of running machine learning models and processing video data in real-time.

**Software(s):**

- **Python:** Primary language for backend development, including machine learning model implementation and data processing.
- **OpenCV:** Used for real-time image and video processing, essential for detecting and interpreting gestures.
- **TensorFlow:** A framework for building and training machine learning models, including Convolutional Neural Networks (CNNs) for gesture recognition.
- **Media Pipe:** Provides pre-built solutions for hand tracking and gesture detection, facilitating accurate and efficient gesture recognition.
- **NumPy:** A library for numerical operations and data manipulation, supporting model training and evaluation.

**Libraries:**

- **OpenCV:** Offers a range of functions for image and video processing, crucial for gesture recognition and tracking.
- **TensorFlow:** Facilitates the development and deployment of deep learning models for gesture detection.
- **Media Pipe:** Provides hand tracking and gesture recognition capabilities, reducing development time and complexity.
- **NumPy:** Supports various numerical operations required for processing data and training models.

**Algorithm:**

- **Convolutional Neural Network (CNN):** Utilized for feature extraction and classification in gesture recognition. CNNs are effective in identifying patterns in image data.
- **Long Short-Term Memory (LSTM) Networks (Future Iterations):** Explored for handling temporal sequences and improving gesture recognition accuracy over time.

## Expected Final product

The final product will be a comprehensive tool that enhances presentation experiences through gesture-based controls and real-time annotation features. The demonstration of the final product will include:

- **Gesture-Based Control:** Showcase the ability to navigate slides using hand gestures, including advancing, reversing, and pausing slides.

- **Real-Time Annotation:** Demonstrate dynamic drawing and annotation capabilities, allowing presenters to highlight and annotate slides during the presentation.

The product will be demonstrated using a standard computer setup with a camera, and will be available as a standalone application. The final deliverables will include user documentation, test reports, and a fully functional prototype.

## Similar products available

Several existing products offer similar functionalities, though they may have different approaches or limitations:

**Leap Motion:** Leap Motion offers a gesture control system that enables interaction with computers using hand and finger motions. It provides a different approach to gesture-based interaction but requires dedicated hardware.
Leap Motion **URL:** https://www.ultraleap.com/leap-motion-controller-overview/ (Accessed August 2024)
**Similarity Factor**: Both Air-Tracker and Leap Motion focus on gesture-based interaction, though Leap Motion necessitates additional hardware.

**Microsoft Kinect**: Originally designed for gaming, Kinect has been adapted for gesture control in presentations and other applications. It uses depth sensing and motion tracking but requires specific hardware setup.
Microsoft Kinect **URL:** https://learn.microsoft.com/en-us/windows/apps/design/devices/kinect-for-windows (Accessed August 2024)
**Similarity Factor:** Kinect and Air-Tracker both aim for gesture-based control but Kinect's application is more hardware-dependent.

**Touchless Presentation Tools:** Various touchless presentation tools utilize computer vision for gesture-based interaction without physical touch. These tools offer an alternative to traditional clickers but may lack advanced features like real-time annotation.
Touchless Presentation Tools: https://slidedog.com/ (Accessed August 2024)
**Similarity Factor:** Similar in providing touchless interaction, though Air-Tracker's real-time annotation feature sets it apart.

**Gesture Tek:** Specializes in 3D gesture control technology used in interactive displays and kiosks. The system uses computer vision to interpret user gestures and control various applications.**URL**: https://www.gesturetek.com/ (Accessed August 2024)
**Similarity Factor**: Gesture Tek and Air-Tracker both employ gesture-based controls, though Gesture Tek's primary use is in interactive displays and public installations, whereas Air-Tracker focuses on presentation environments.

**UBI Interactive:** Converts any surface into an interactive touchscreen using a depth-sensing camera. It supports touchless gestures for controlling presentations and other applications.
**URL**: https://www.ubi-interactive.com/ (Accessed August 2024)
**Similarity Factor**: Ubi Interactive provides touchless control similar to Air-Tracker, with an emphasis on transforming standard surfaces into interactive displays.

## Project approvals:

*Add any signatures that are important for the approval of the project. (Remove this comment section from final document.)*

| | |
|---|---|
| Name:<br>Project Supervisor | Signature |
| Member, FYP Committee, UIT | Signature |