MICHIGAN STATE UNIVERSITY

Project Plan Presentation

Aviation Maintenance & Ground Ops Simulation

The Capstone Experience

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From Students…
…to Professionals

Project Sponsor Overview

- Founded in 1964 as a small private jet business in Columbus, Ohio
  - World's largest private aviation provider today
- Mission: To deliver safe, accessible private jet experiences with exceptional service
- Outstanding safety culture
  - Only private aviation company to surpass Federal Aviation Administration (FAA) requirements



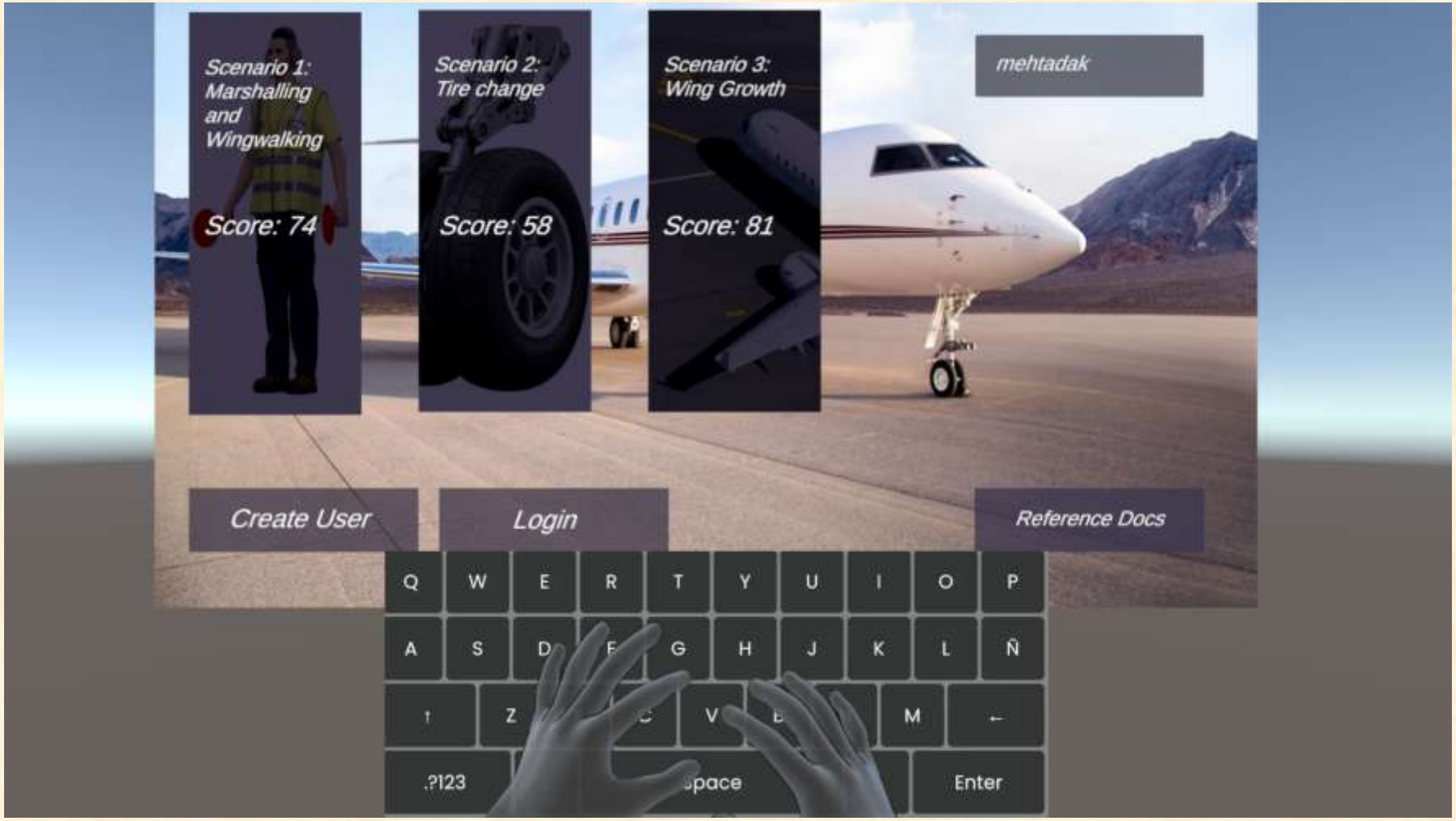
Project Functional Specifications

- **Problem:** With a large operational scope, it generates considerable exposure to risk during ground handling and maintenance events
  - "Learning by mistake" is not an option
- **Solution:** An immersive, modular VR simulation that allows users to practice maintenance and ground handling tasks in a consequence-free environment
  - Reduces training risks and costs
- For new crew members to train on correct maintenance and ground handling procedures

Project Design Specifications

- Standalone first-person VR training simulation
  - Immersive, intuitive, easy-to-use
- Realistic environments with interactive tools, aircrafts, and NPCs
- Three gamified scenarios:
  - Wheel & Brake Change – procedural accuracy and safety
  - Marshalling & Wing Walking – communication and spatial awareness
  - Wing Growth – precision and clearance awareness
- Two modes for each scenario:
  - Guided training – pop-ups, visual cues, instructions
  - Test – no guidance, performance-based scoring
- Failure modes and feedback to reinforce safety, accuracy, and situational awareness

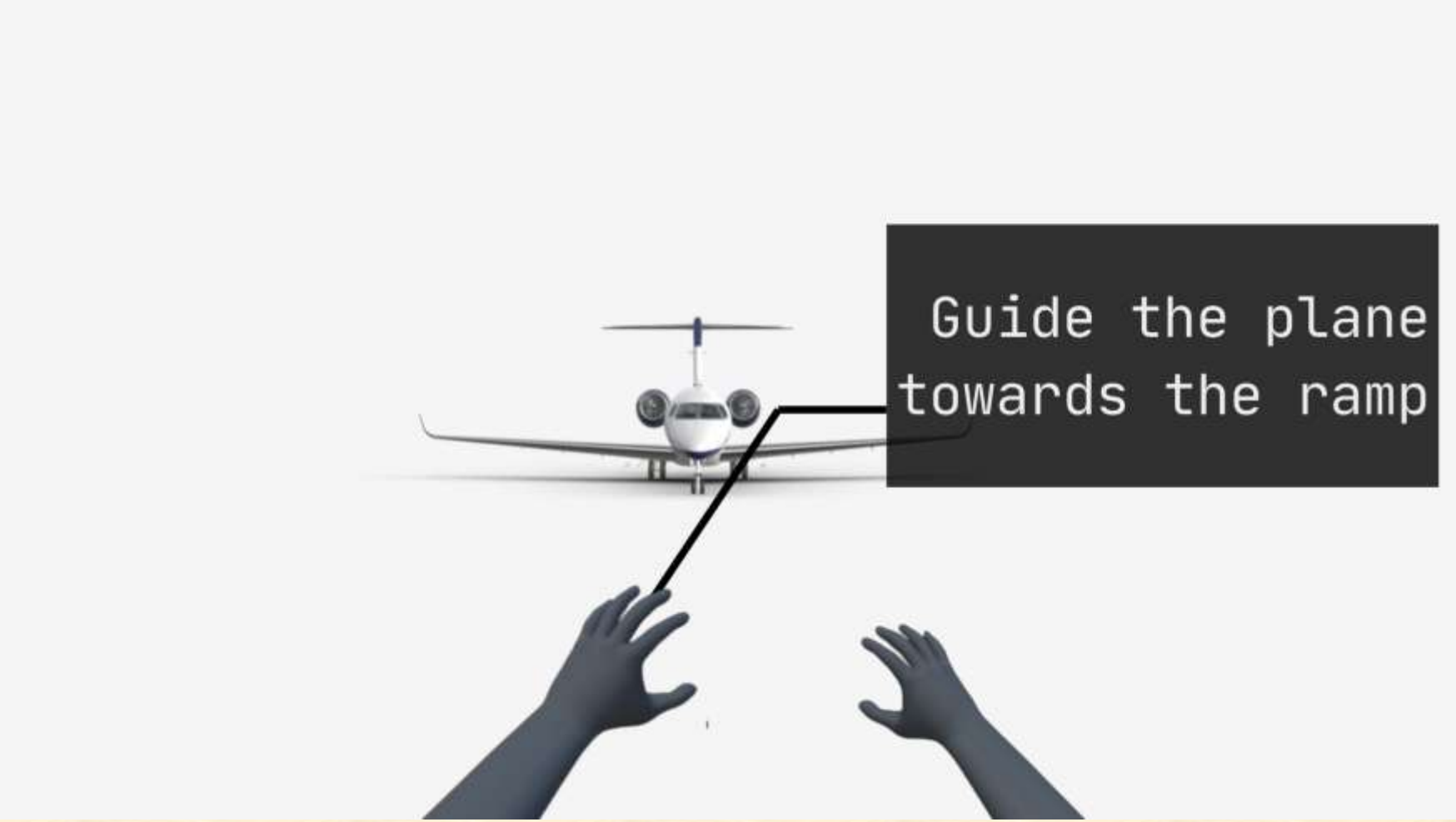
Screen Mockup: Main Menu Screen



Screen Mockup: Work Order Board



Screen Mockup: Marshalling Game



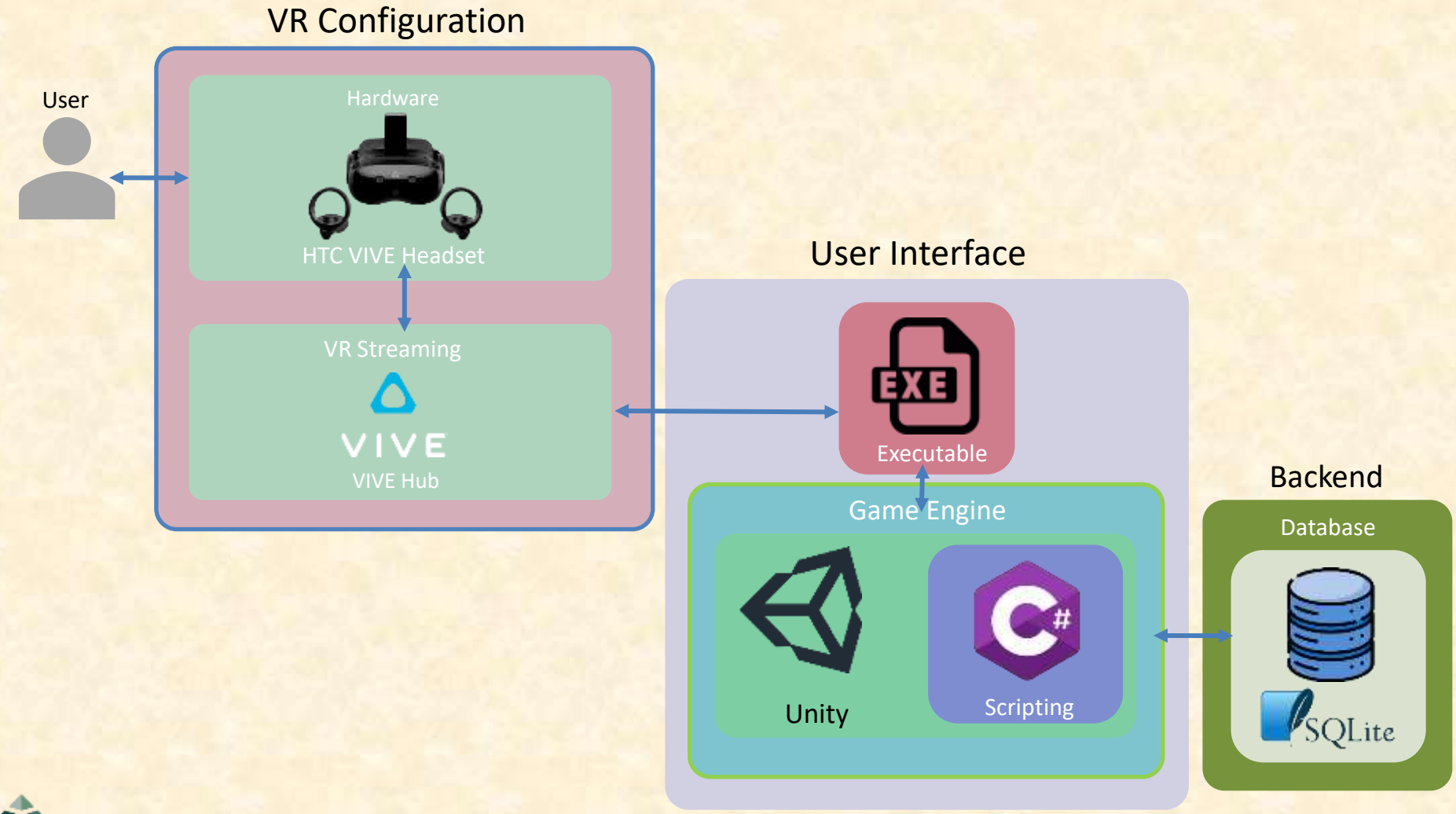
Screen Mockup: Wing Growth Game



Project Technical Specifications

- Room-scale boundary and play area handling
- User authentication and profile management system
  - Local data storage using a user database for profiles and scores
- User interface and menu system
  - Scenario selection and state management system
  - VR interaction and input handling layer
- Performance tracking and high-score management

Project System Architecture



Project System Components

- Hardware Platforms
  - HTC VIVE Focus Vision
  - Handheld controllers
- Software Platforms / Technologies
  - VIVE Hub
  - SQLite
  - Unity
  - Visual Studio Community 2022
  - C#

Project Risks

- Risk 1: Virtual Asset Acquisition
  - Description: Difficult to find high quality, affordable 3-D models of specific aircrafts
  - Mitigation: Discussing 3-D model options early with our sponsor and communicating information to determine what is needed and find the optimal budget necessary to obtain the desired virtual assets
- Risk 2: Field of View (FOV) Management
  - Description: The simulation requires the user to keep many hazards within their FOV at once. It is difficult to achieve because the headset has a limited field of view, significantly less than real life
  - Mitigation: Use iterative user testing to determine problems that arise from the limited FOV while using the simulation and making design decisions to accommodate and fix the identified issues
- Risk 3: Motion Sickness Reduction
  - Description: When using VR headsets, some people can get motion sickness with varying amounts of severity
  - Mitigation: Utilize VR software-based motion sickness reduction techniques like teleportation-based locomotion, snap turning, vignette tunneling
- Risk 4: Realistic Simulation Environment Design
  - Description: Being able to create a high-fidelity, true-to-scale VR environment to replicate real-world aircraft maintenance environments
  - Mitigation: Continuous communication with our sponsor to obtain accurate dimensions and provide iterative prototypes for feedback and critque

Questions?

