

IMMERSIVE MULTISENSORY VR MOTION SYSTEM FOR FULL BODY NAVIGATION

MODULE:
IT4010 RESEARCH PROJECT (PP2 PRESENTATION)

PROJECT ID:
R26-IM-004

PRESENTED BY GROUP R26-IM-004

PP2 PRESENTATION OUTLINE

01 INTRODUCTION

02 OUR RESEARCH PROBLEM

03 OUR PROPOSED SOLUTION

04 MOTION RENDERING AND CONTROL FOR EMBODIED VR NAVIGATION

05 ENVIRONMENTAL INTERACTION AND IMMERSION MODELLING FOR VR AERIAL NAVIGATION

06 SYNCHRONIZED EXTERNAL VISUAL FEEDBACK FOR SPECTATOR ENGAGEMENT & PLAYER ATTRACTION

07 MECHANICAL INTEGRATION AND STABILITY DESIGN FOR THE VR MOTION SEAT PLATFORM

08 COMMERCIAL VIABILITY & MARKET FIT

PRESENTED BY GROUP R26-IM-004

INTRODUCTION

Our project builds a multi-sensory VR motion platform where users steer a virtual flying broom by applying pressure and their body.



Project ID: R26-IM-004

PRESENTED BY GROUP R26-IM-004

OUR RESEARCH PROBLEM



Lack of Physical Realism and Embodied Interaction in VR Navigation

Users see fast motion in VR but feel nothing physically.

This clash causes dizziness, nausea, and quick fatigue.

Relying on simple joysticks ruins the feeling of real flight.

Project ID: R26-IM-004

OUR PROPOSED SOLUTION



A Synchronized Multisensory VR Motion Platform for Embodied Navigation

- Pressure-Based Steering
- Wind Simulation
- Environmental Cues
- Spectator Immersion

Project ID: R26-IM-004

USER INSIGHTS AT A GLANCE



Project ID: R26-IM-004

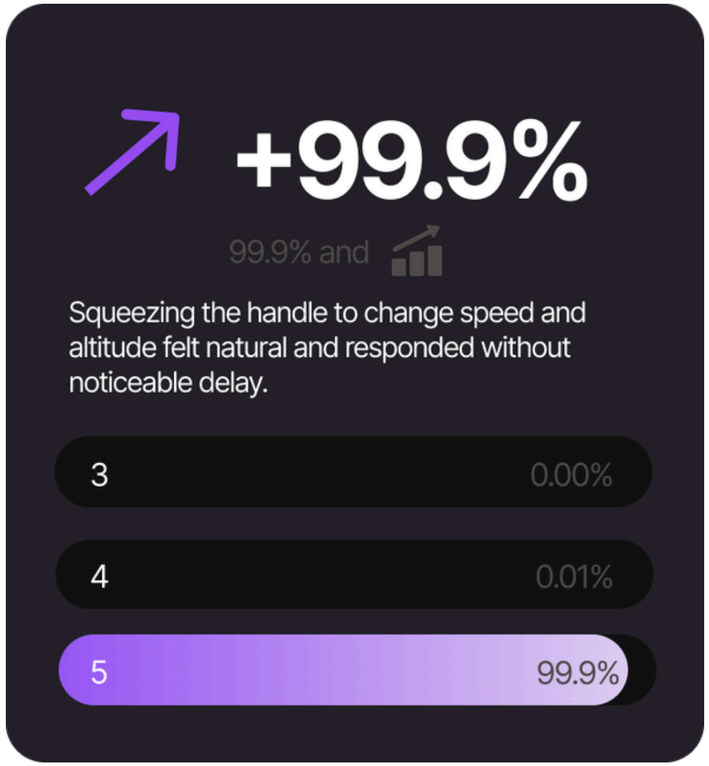


MOTION RENDERING AND CONTROL FOR EMBODIED VR NAVIGATION

Translates pressure & gyroscope data into virtual flight movements and directional motion cues.

Project ID: R26-IM-004

IT22082992 | Gunawardena L H





STRENGTHS & PERFORMANCE EVIDENCE

INTUITIVE ONBOARDING

The learning curve is kept as simple as it gets through an automated UI tutorial that visually displays the flight controls upon startup.



STRENGTHS & PERFORMANCE EVIDENCE

HARDWARE INPUT ACCURACY

Captures precise grip pressure via the FSR and accurate directional flight turns using head-mounted gyro tracking.

FLIGHT PHYSICS POLISH

Delivers smooth acceleration and natural momentum using Linear Interpolation.

STEERING STABILITY

Eliminates unintended micro-drifting during flight by applying strict deadzone thresholds to tilt-to-turn inputs.

DRAWBACKS & LIMITATIONS

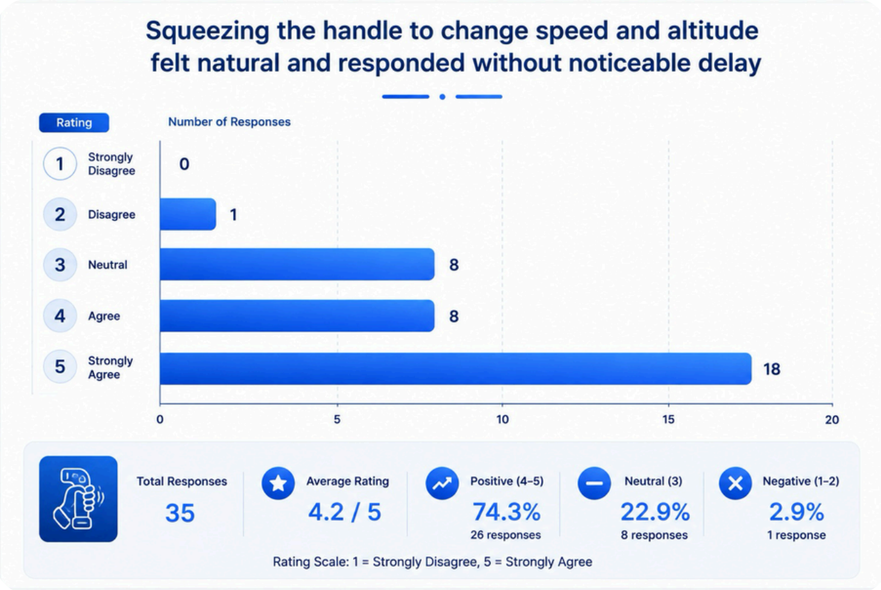
VR LOCOMOTION DISCOMFORT

Translating head roll into horizontal turning causes rotational drift, leading to dizziness during sharp maneuvers.

PHYSICAL GRIP FATIGUE

Constantly squeezing the handle-mounted pressure sensor strains the user's hand during longer flights.





MITIGATION & CORRECTIVE ACTION PLAN

Replacing the head-tilt navigation with dedicated foot sensors to decouple the player's head tracking from the steering mechanics, significantly reducing vestibular mismatch.

Redesigning the physical thrust handle to feature custom hand-comfort contours and advanced ergonomic shaping, supporting a natural grip posture and reducing muscle strain.



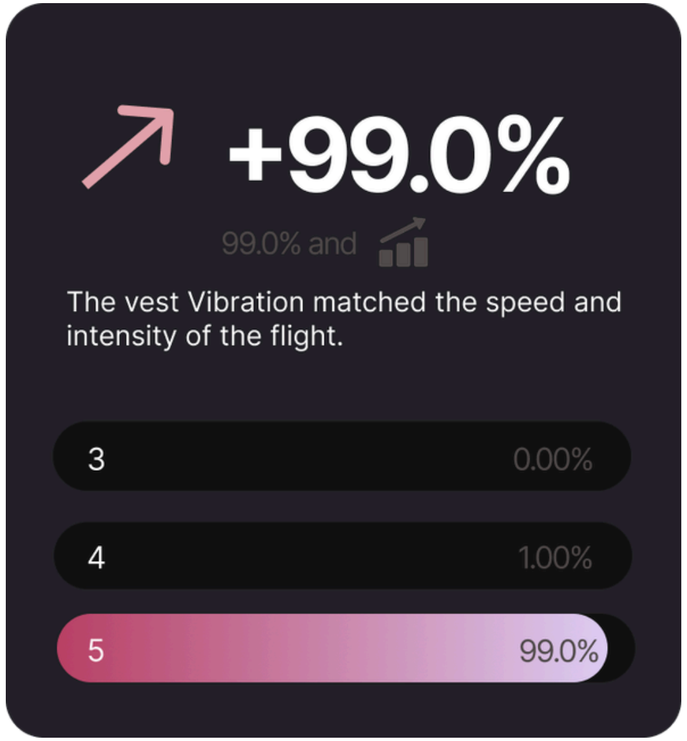


ENVIRONMENTAL INTERACTION AND IMMERSION MODELLING FOR VR AERIAL NAVIGATION

Translates virtual wind, speed, and turbulence into synchronised wearable haptic feedback.

Project ID: R26-IM-004

IT22119094 | Botheju W R D





STRENGTHS & PERFORMANCE EVIDENCE

SPATIAL SYNCHRONIZATION

Virtual zones in Unity reliably trigger the jacket haptics, achieving for instant visual-to-physical response.



STRENGTHS & PERFORMANCE EVIDENCE

WIND COLLABORATOR IMMERSION

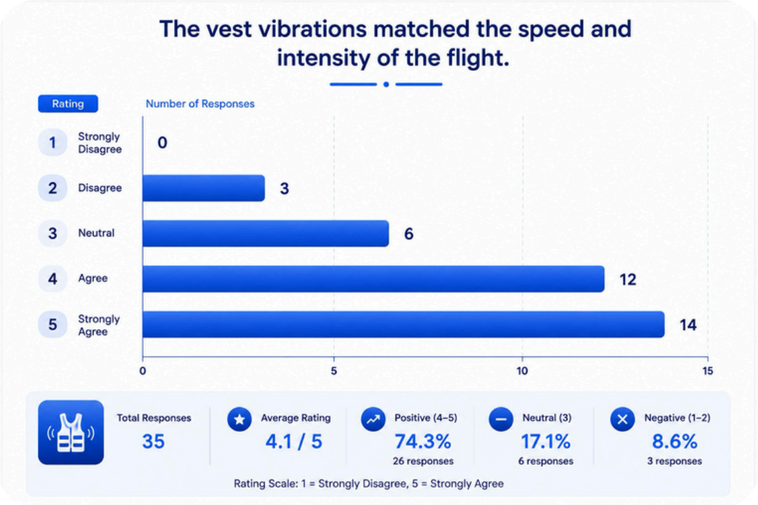
Reliable implementation and firing of vibration motors within the haptic feedback jacket to enhance the immersion of the user.

DRAWBACKS & LIMITATIONS

RESTRICTED FIT & ERGONOMICS

The fixed-size jacket restricts physical movement and causes discomfort for users with broader physiques during flight.



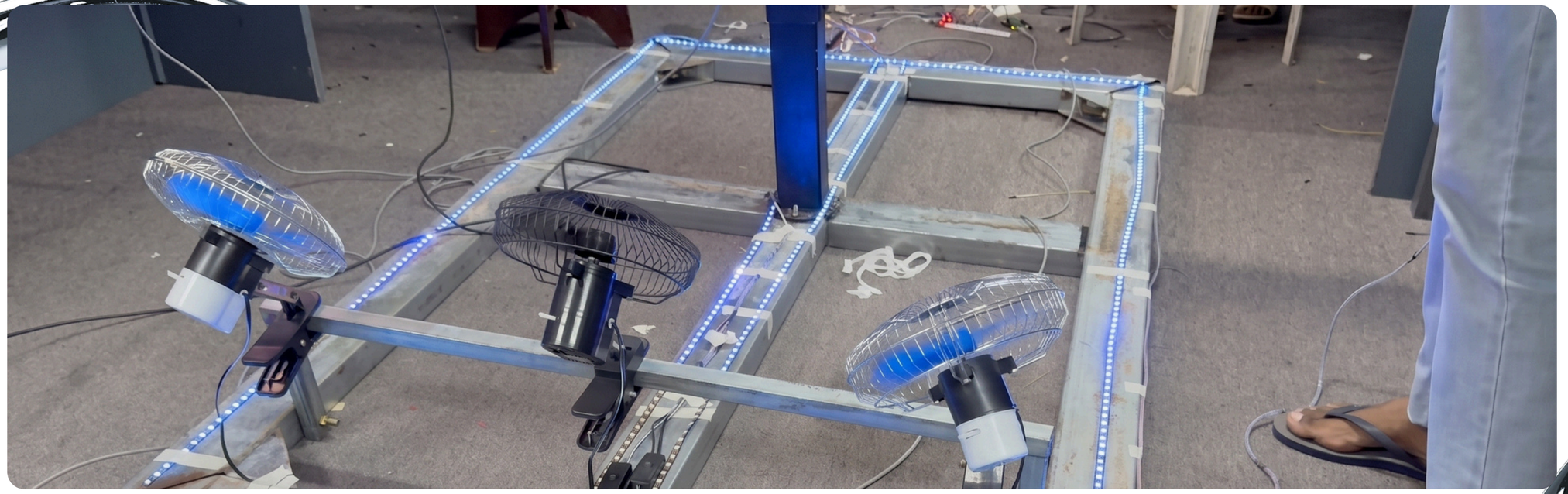


MITIGATION & CORRECTIVE ACTION PLAN

Transition the haptic garment from a static jacket to a highly adjustable modular vest or harness.

Integrating adjustable tension straps and elastic side panels will allow the hardware to dynamically expand and conform to a wider range of body types, ensuring the vibration motors remain comfortably but securely pressed against the user for accurate spatial feedback.



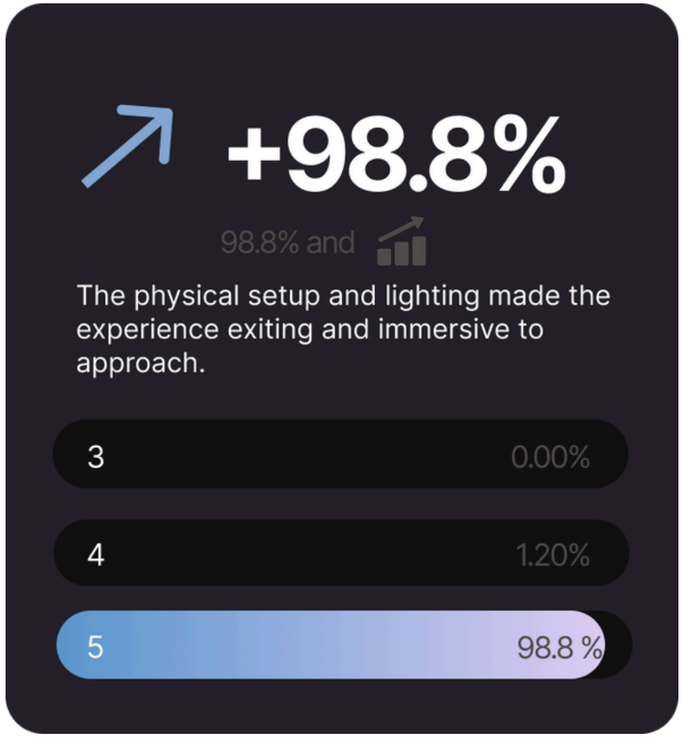


SYNCHRONIZED EXTERNAL VISUAL FEEDBACK FOR SPECTATOR ENGAGEMENT & PLAYER ATTRACTION

Synchronised in-headset VR events dynamically in order to enhance audience engagement and spectator psychology

Project ID: R26-IM-004

IT22191724 | Shehan Nimsara





STRENGTHS & PERFORMANCE EVIDENCE

SPATIAL SYNCHRONIZATION

Evaluate whether visual feedback makes the VR experience more interesting, immersive, and engaging for people watching outside the headset.



STRENGTHS & PERFORMANCE EVIDENCE

INTENTION TO PARTICIPATE

Enhanced spectator experience increases spectators' curiosity and willingness to try the VR experience themselves, in commercial VR environments.

EVENT COMPREHENSION

Measure how effectively spectators can recognise and understand important hidden VR gameplay information.

SYSTEM RESPONSIVENESS

Evaluate whether VR gameplay states are translated into the correct physical visual feedback accurately and with minimal noticeable delay.

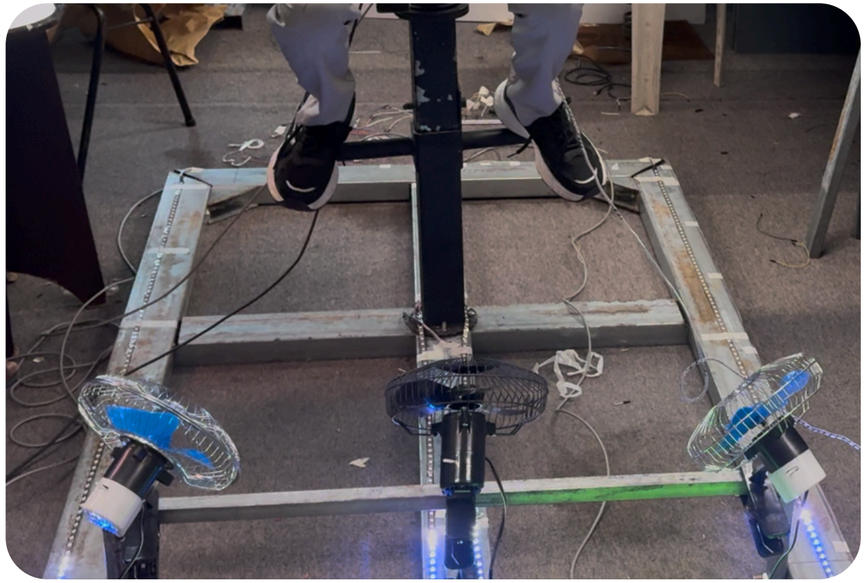
DRAWBACKS & LIMITATIONS

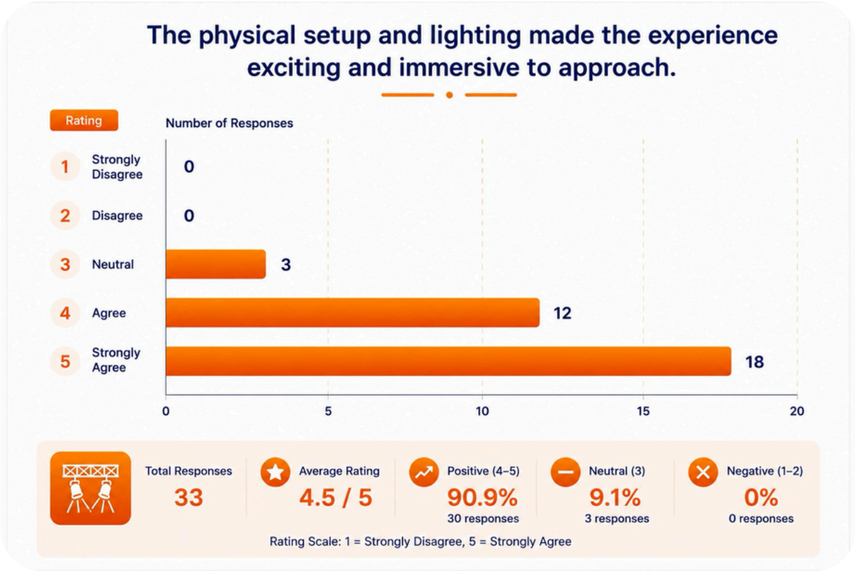
VISUAL DISTRACTION

Too many simultaneous lighting effects could confuse or distract spectators.

DIFFERENT SPECTATOR PERCEPTIONS

Spectators may initially misunderstand what a particular colour, movement, or pattern represents.





MITIGATION & CORRECTIVE ACTION PLAN

Use a structured visual hierarchy with limited, event-specific patterns rather than random decorative lighting.

Conduct spectator user testing, collect feedback, and refine the mappings based on the results.



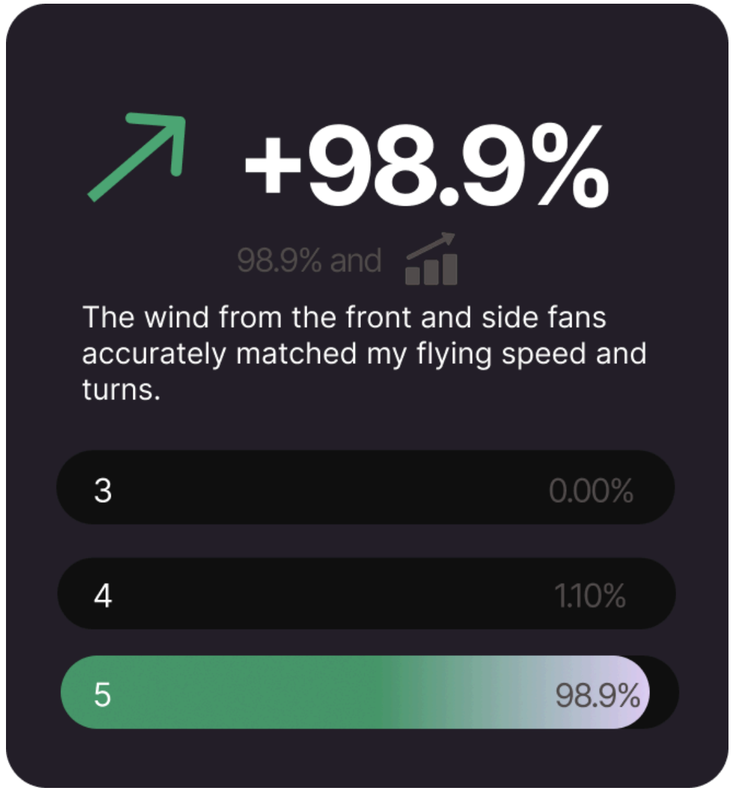


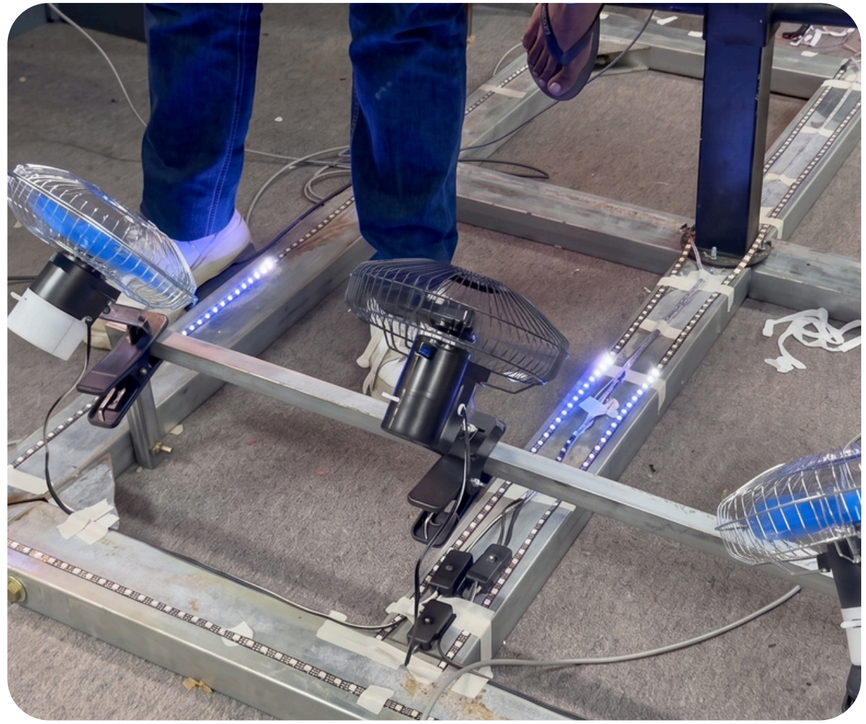
MECHANICAL INTEGRATION AND STABILITY DESIGN FOR THE VR MOTION SEAT PLATFORM

Synchronizes physical airflow with virtual velocity on a stabilized, counter-weighted platform.

Project ID: R26-IM-004

IT22129208 | Sashik Silva





STRENGTHS & PERFORMANCE EVIDENCE

DYNAMIC WIND SIMULATION

Successfully engineered physical wind-force feedback that enhances VR immersion by scaling a physical fan's RPM dynamically in direct proportion to the player's virtual flight velocity.



STRENGTHS & PERFORMANCE EVIDENCE

VIRTUAL-PHYSICAL SYNCHRONIZATION

Achieved real-time hardware synchronization between the in-game momentum coasting, driven by Mathf.Lerp flight physics, and the external physical fan motor

DRAWBACKS & LIMITATIONS

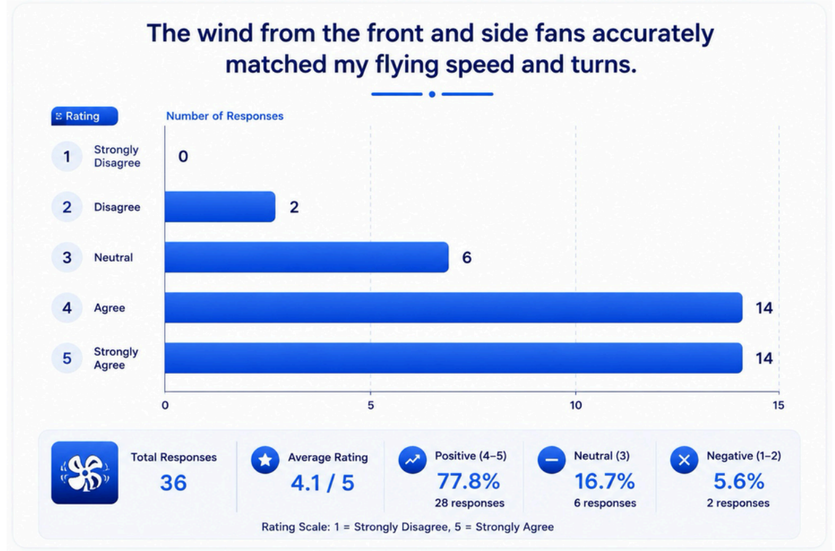
SUBOPTIMAL AIRFLOW TRAJECTORY

The current mechanical mounting brackets direct the fan angles too low toward the lower body, failing to simulate aerodynamic resistance on the chest and face where players naturally expect wind during forward flight



ASYMMETRICAL FORCE OUTPUT

Inconsistencies between the physical fan motors result in uneven wind distribution, breaking the illusion of uniform atmospheric drag when flying at top speeds.

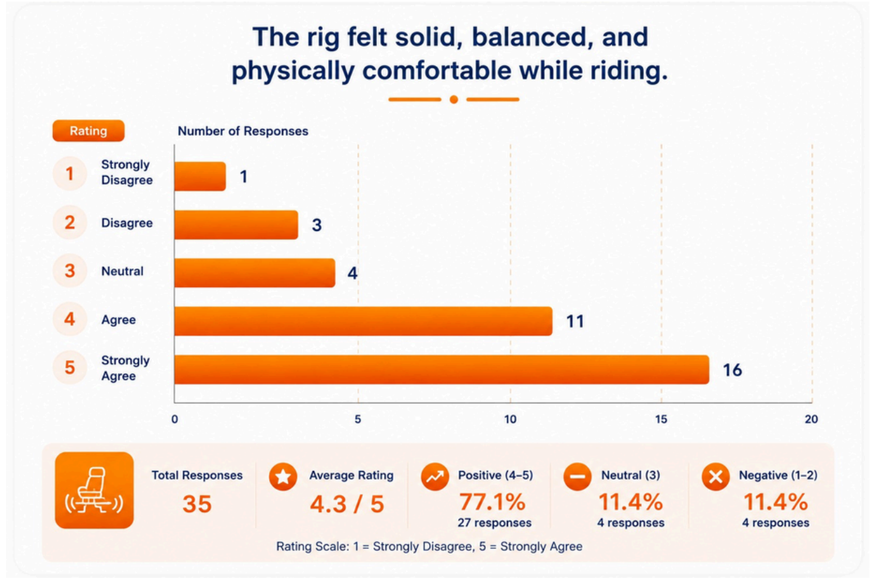


DRAWBACKS & LIMITATIONS

PLATFORM INSTABILITY

The physical broom rig lacks the necessary structural weight distribution to remain anchored and stable when players execute aggressive tilt-to-turn steering maneuvers.





MITIGATION & CORRECTIVE ACTION PLAN



ELEVATED FAN PLATFORM

Increase the overall fan elevation by designing an elevated mounting platform, ensuring the airflow accurately targets the user's upper torso to simulate forward flight.



CURVED SPATIAL PLACEMENT

Reposition the fans along an equal curved distance around the front of the rider, establishing a perfectly symmetrical and uniform wind field regardless of motor variance.



COUNTER-WEIGHT ANCHORING

Implement counter-weight cabling into the base of the design to establish a lower center of gravity, drastically enhancing the rig's structural stability when players physically lean

COMMERCIAL VIABILITY & MARKET FIT

TARGET VENUES

Location-based VR arcades, theme parks, and entertainment hubs looking for high-throughput attraction rigs.

HIGH REPLAY VALUE

Majority of users recommended this setup over standard controller-based VR games.





Project ID: R26-IM-004

COMMERCIAL VIABILITY & MARKET FIT

COMMERCIAL SCALABILITY

Low footprint and rapid throughput make the hardware ideal for mall activations, cinema lobbies, and high-traffic entertainment venues.

HIGH-IMPACT MARKET WINDOW

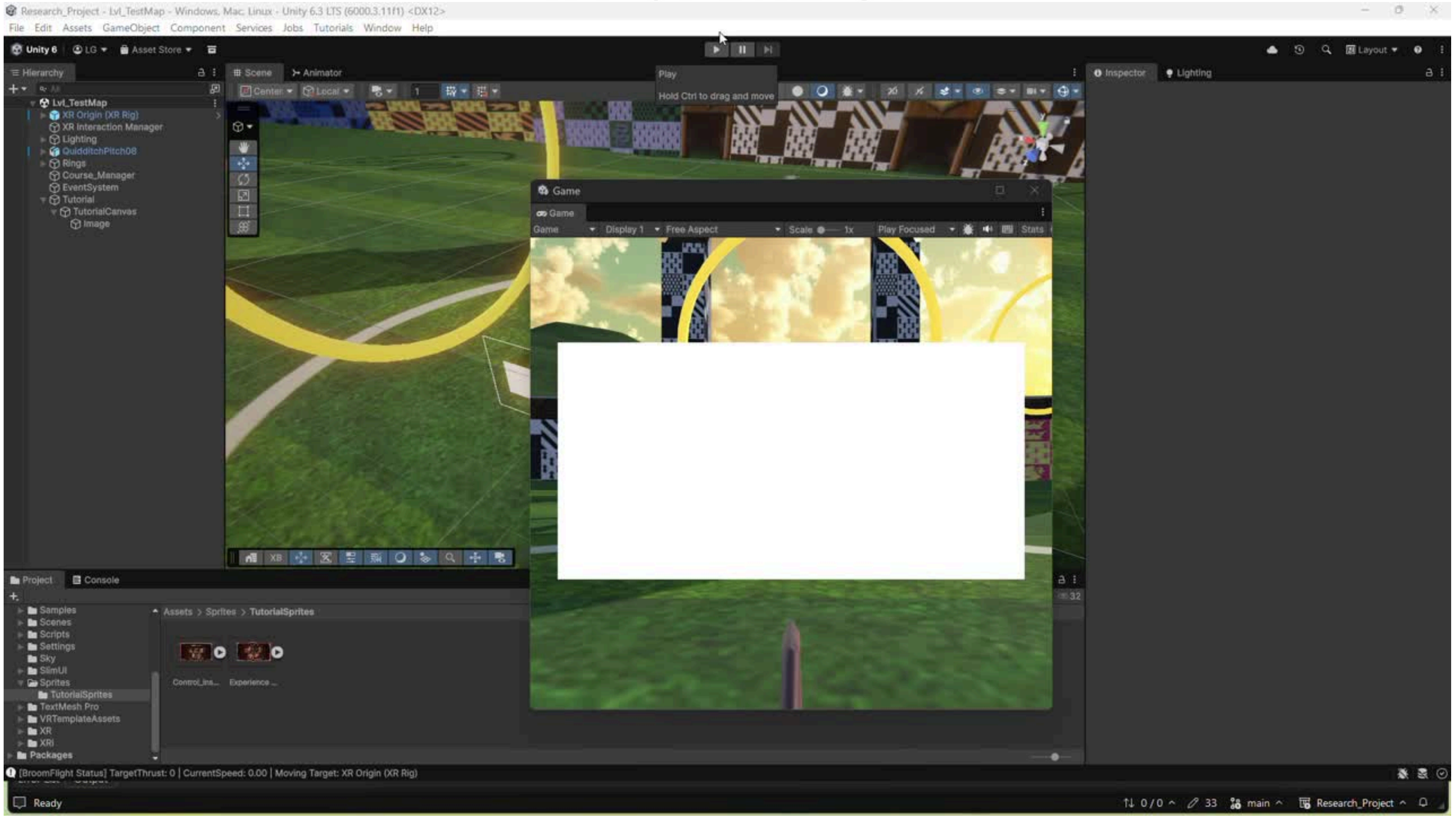
Capitalizing on the resurgence of wizarding world hype with upcoming Harry Potter releases to capture mainstream fan engagement.





Project ID: R26-IM-004

IN GAME UI



Project ID: R26-IM-004

OUR RESEARCH TEAM









Project ID: R26-IM-004



THANK YOU!

MODULE:
IT4010 RESEARCH PROJECT (PP2 PRESENTATION)

PROJECT ID:
R26-IM-004