

IMMERSIVE MULTISENSORY VR MOTION SYSTEM FOR FULL BODY NAVIGATION

MODULE:
IT4010 RESEARCH PROJECT (FINAL PRESENTATION)

PROJECT ID:
R26-IM-004

PRESENTED BY GROUP R26-IM-004

FINAL PRESENTATION OUTLINE

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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.



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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.

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OUR PROPOSED SOLUTION



A Synchronized Multisensory VR Motion Platform for Embodied Navigation

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

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GUILD IN THE BUILD



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MOTION RENDERING AND CONTROL FOR EMBODIED VR NAVIGATION

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

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IT22082992 | Gunawardena L H



WHERE WE WERE

CORE CONCEPT

Developed the initial control pipeline using a handle-mounted pressure sensor (FSR) for acceleration and head-tilt gyro tracking to steer the broom.

ONBOARDING & EASE OF USE

Built an automated in-game tutorial to help users learn the squeeze-to-fly control scheme upon startup.



PREVIOUS USER TESTING REVEALED

PHYSICAL HAND FATIGUE

Constantly squeezing the un-contoured handle strain users' hands during longer flights.

DIZZINESS & MOTION SICKNESS

Steering by tilting the head created a severe conflict between visual orientation and body movement, causing rotational drift and nausea.



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Banking Angle Refinement

Fine-tuned flight banking angles to smooth out lateral movements and eliminate residual motion sickness.



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Foot-Focused Steering

Completely decoupled head tracking from navigation by introducing footrest directional sensors.

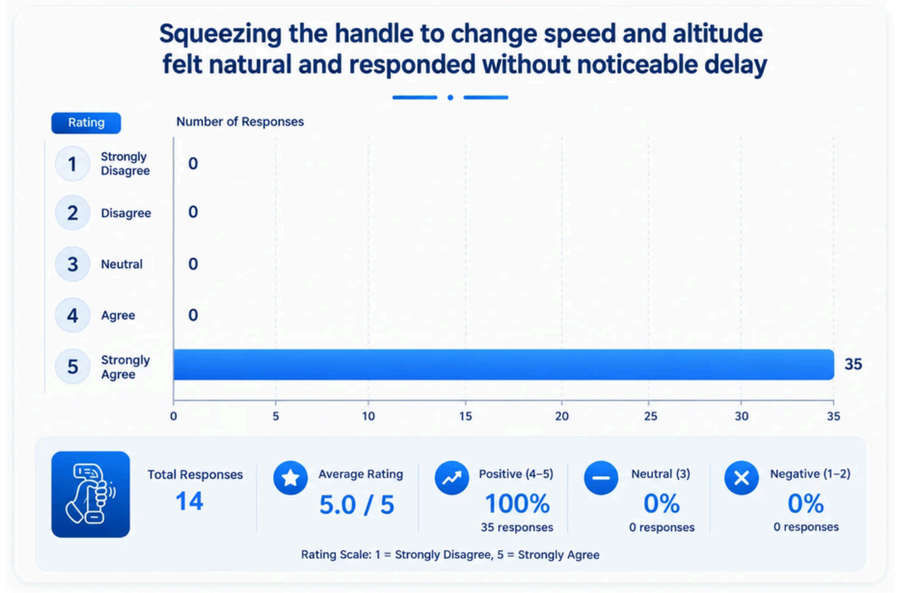
It allows players to freely look around while steering with their lower body.



Ergonomic Handle Contours

Redesigned the physical handle with ergonomic shaping to relieve muscle strain.





ROUND 2 TESTING RESULTS

SEAMLESS FLIGHT

User satisfaction jumped significantly, validating that our changes completely removed hand fatigue and dizziness.



ENVIRONMENTAL INTERACTION AND IMMERSION MODELLING FOR VR AERIAL NAVIGATION

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

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IT22119094 | Botheju W R D



WHERE WE WERE

CORE CONCEPT

Developed the environmental interactions to translate virtual wind speed, turbulence changes into real-time physical vibrations and airflow responses.

HAPTIC JACKET

Designed a static, fixed-size haptic jacket embedded with vibration motors linked directly to Unity virtual zones to simulate aerodynamic drag.



PREVIOUS USER TESTING REVEALED

HIGH TACTILE IMMERSION

Initial testing confirmed that riders strongly felt the direct connection between flight speed and vest vibrations.

ERGONOMIC CONSTRAINT

The static jacket design proved restrictive, failing to adjust comfortably for users with broader physiques.



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The Ergonomic Upgrade

Replaced the rigid, fixed-size haptic jacket with a flexible, modular padded harness.



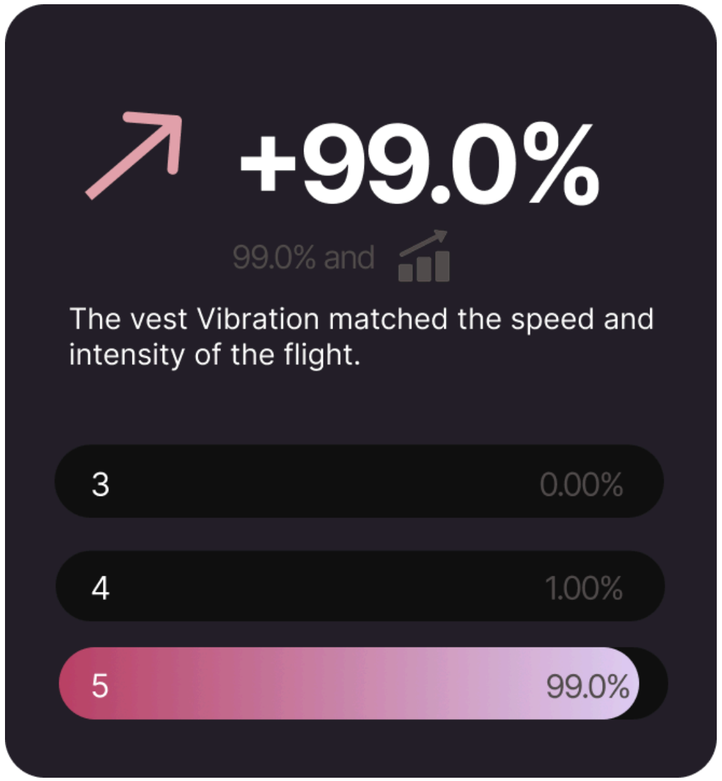


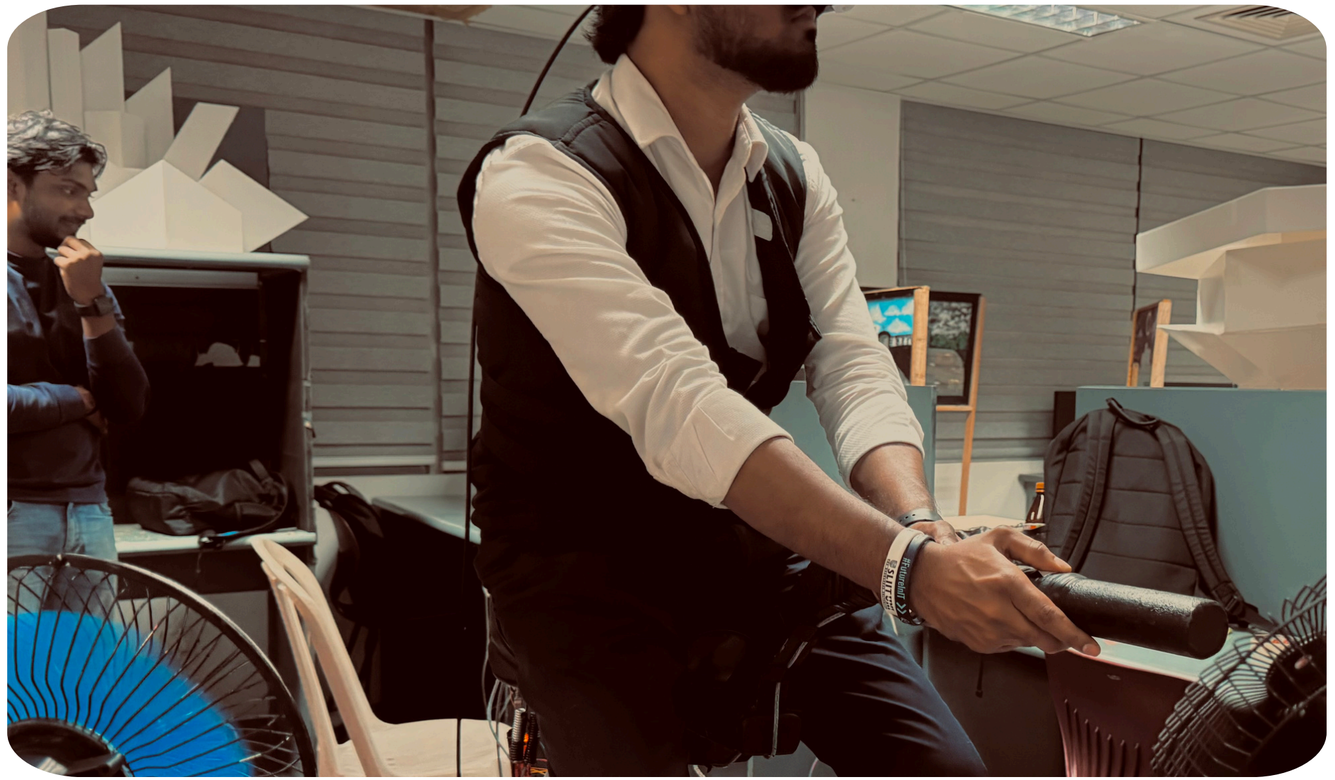
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Dynamic Conformity

Integrated adjustable tension straps and elastic side panels.

Allowing the hardware to dynamically expand and fit any body type comfortably.

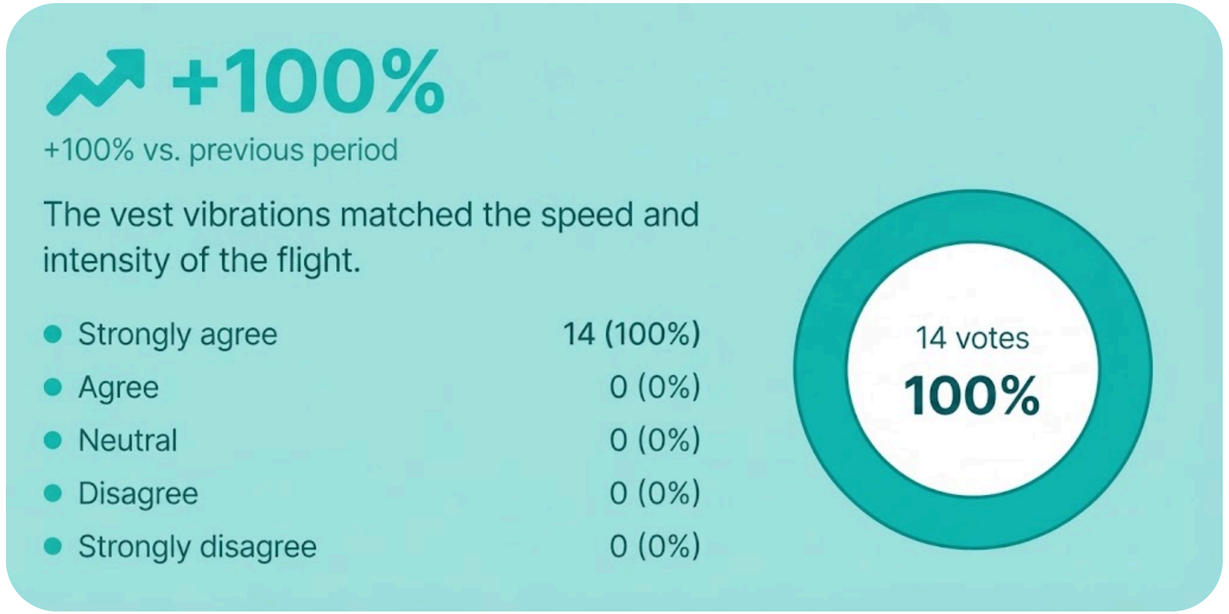




ROUND 2 TESTING RESULTS

UNIVERSAL FIT & COMFORT

Eliminated all sizing constraints, ensuring vibration motors stayed snugly pressed against users of any physique without restricting movement.





ROUND 2 TESTING RESULTS

Post-mitigation testing showed overwhelming positive approval , confirming that our wearable haptic feedback achieved seamless realism.

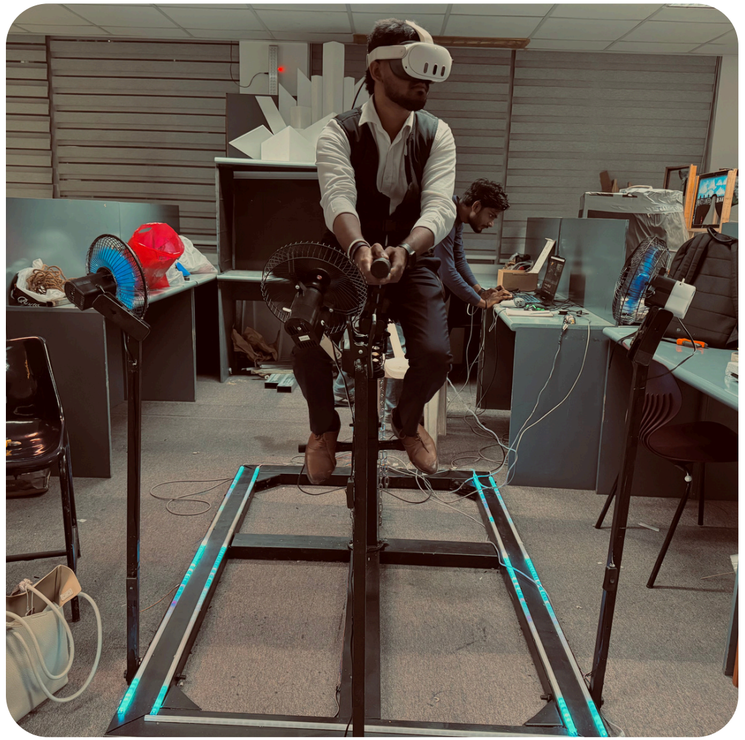


SYNCHRONIZED EXTERNAL VISUAL FEEDBACK FOR SPECTATOR ENGAGEMENT & PLAYER ATTRACTION

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

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IT22191724 | Nimsara L G S K



WHERE WE WERE

INITIAL SYSTEM PROTOTYPE

Established the Unity-to-Arduino communication pipeline and developed initial LED animations for flight speed, ring passing, and countdown events.

SYSTEM REFINEMENT REQUIREMENTS

Further optimization was required for multi-strip LED control, animation priority, and reliable operation during actual gameplay.



PREVIOUS USER TESTING REVEALED

POSITIVE AUDIENCE RESPONSE

Initial campus feedback indicated strong interest in the combined physical VR installation and lighting, with 30 of 33 survey respondents providing positive ratings.

NEED FOR FURTHER VALIDATION

The initial survey evaluated the physical setup and lighting together, highlighting the need for further evaluation of the completed integrated experience.

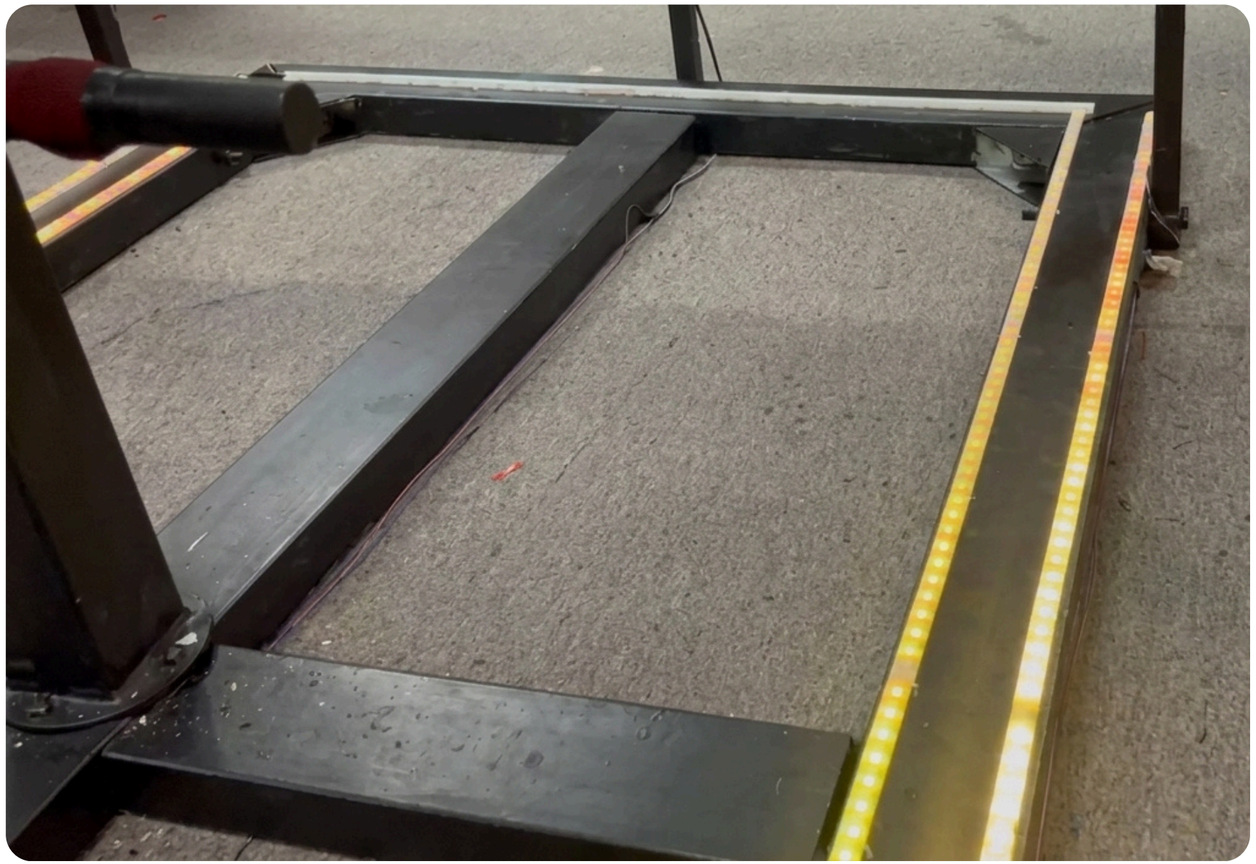


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Real-Time Unity Integration

Integrated gameplay events with the Arduino-controlled LED system.

Enables automatic speed-responsive lighting, gold ring-passing animations, and an independent 60-sec countdown.



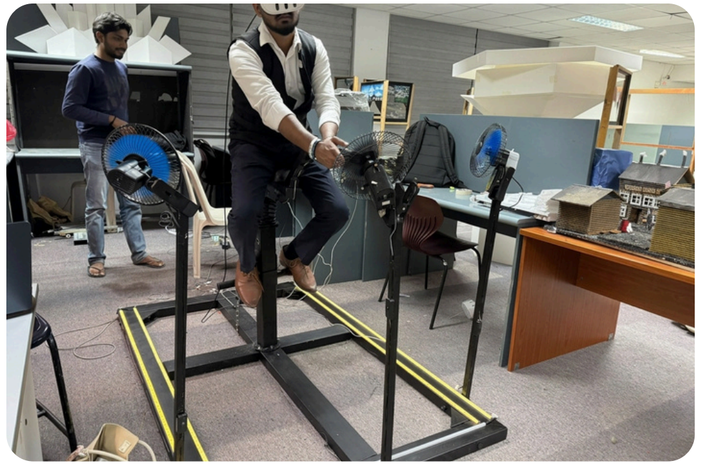


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Optimized LED Architecture

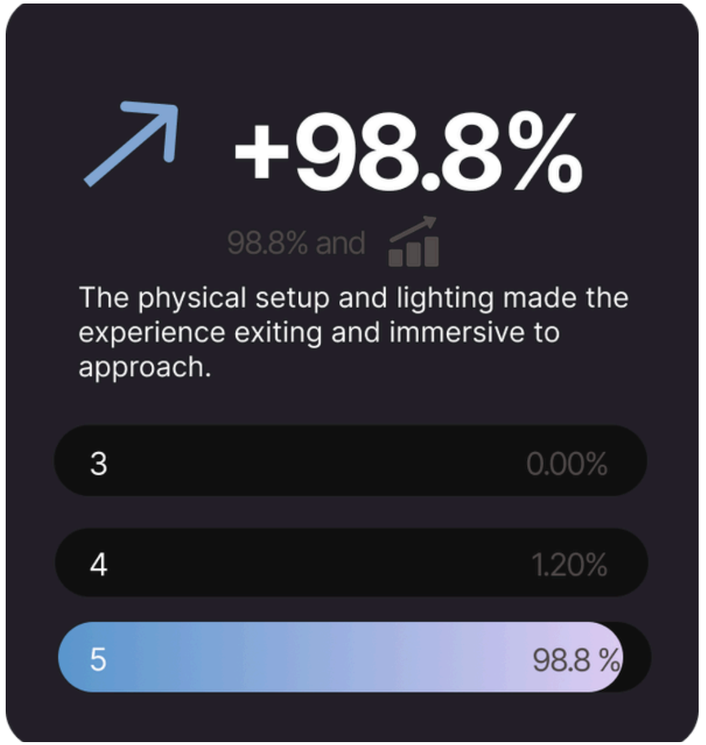
Refined the 460-LED configuration by connecting four 100-LED strips to a shared data output.



Event Priority Management

Implemented ring-passing animation priority over flight-speed effects.

ROUND 2 TESTING RESULTS

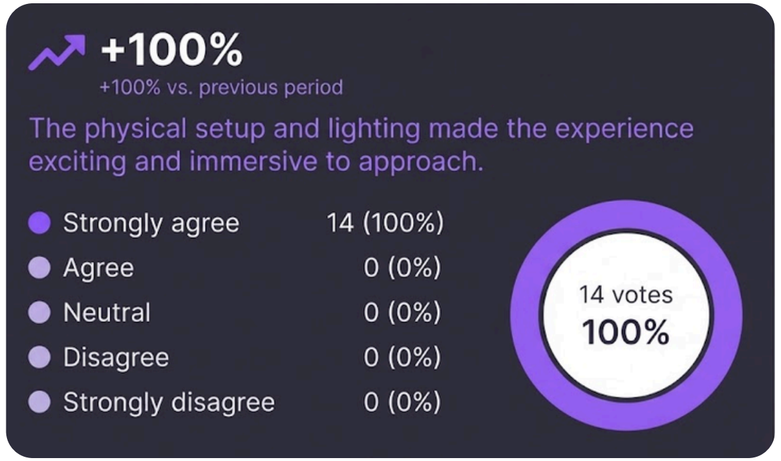


SPECTATOR ATTRACTION

All 14 students strongly agreed that the physical setup and synchronized lighting made the VR experience exciting and immersive to approach.

CONSISTENT POSITIVE FEEDBACK

The second-round evaluation achieved an average rating of 5.0/5, with 100% strongly positive responses and no neutral or negative ratings.





MECHANICAL INTEGRATION AND STABILITY DESIGN FOR THE VR MOTION SEAT PLATFORM

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

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IT22129208 | Silva H S N



WHERE WE WERE

CORE CONCEPT

Design a broom rig structure and motion-seat support system. Ensures user safety, ergonomic support, and structural stability

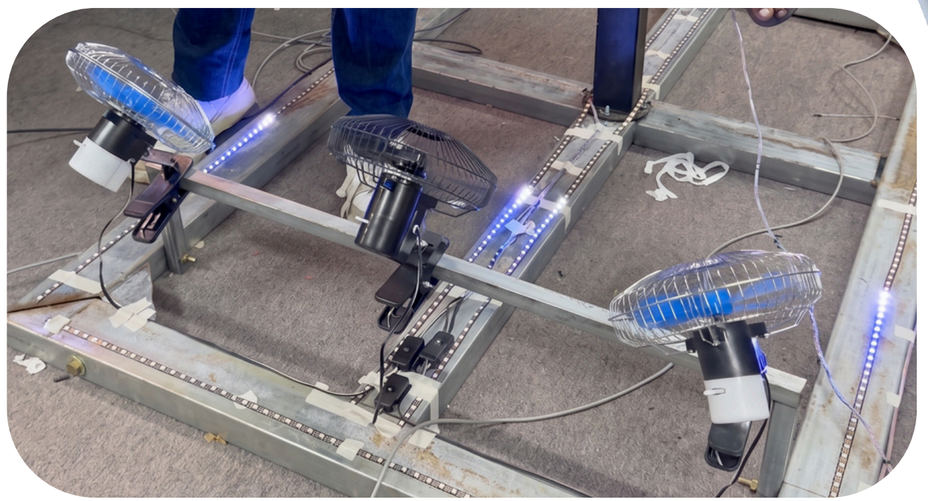
WIND STIMIULATION WITH SYNCHRONIZATION

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

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

PREVIOUS USER TESTING REVEALED



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.

PREVIOUS USER TESTING REVEALED

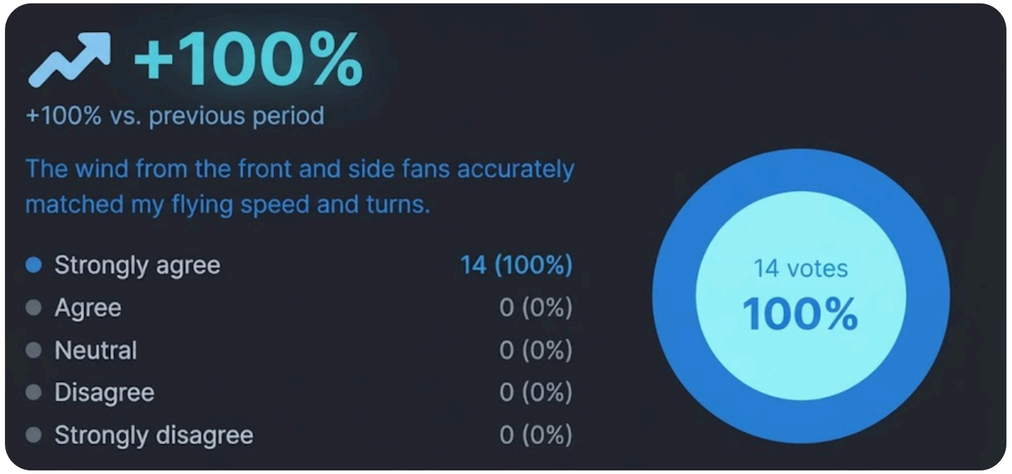
PLATFORM INSTABILITY

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





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Airflow Trajectory

Elevated and repositioned fan assembly to align airflow with upper body.



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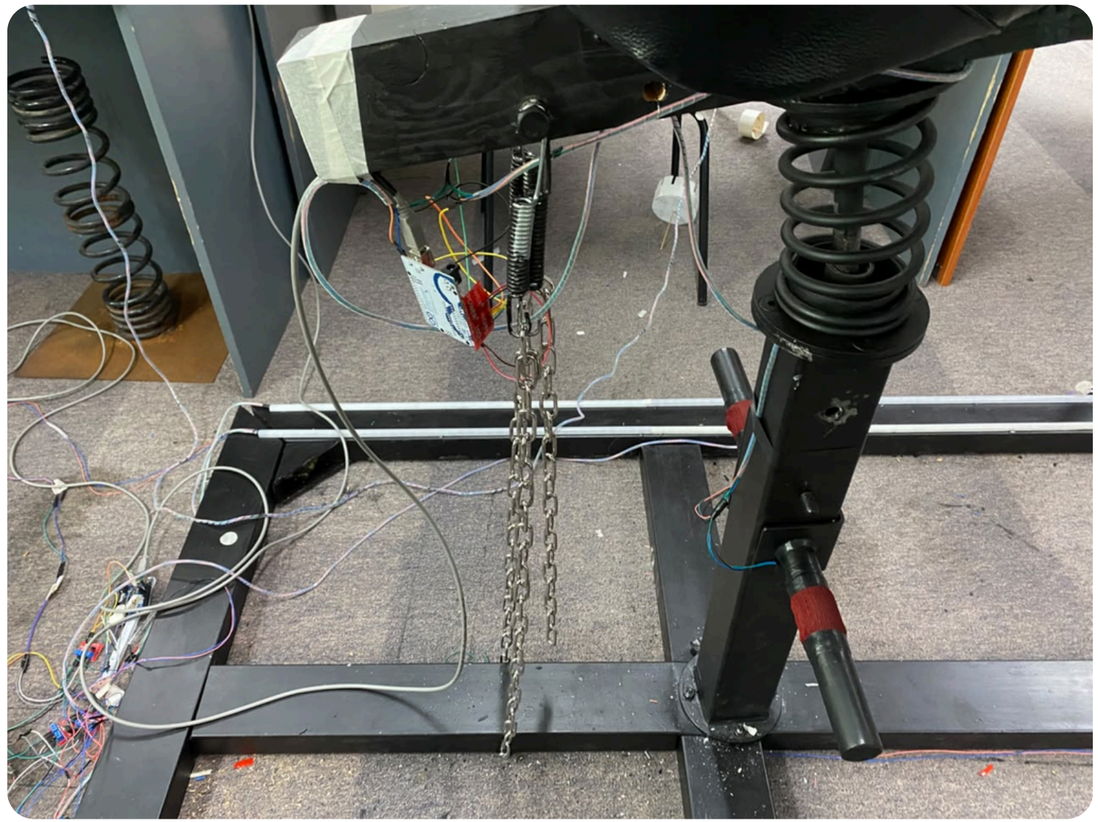


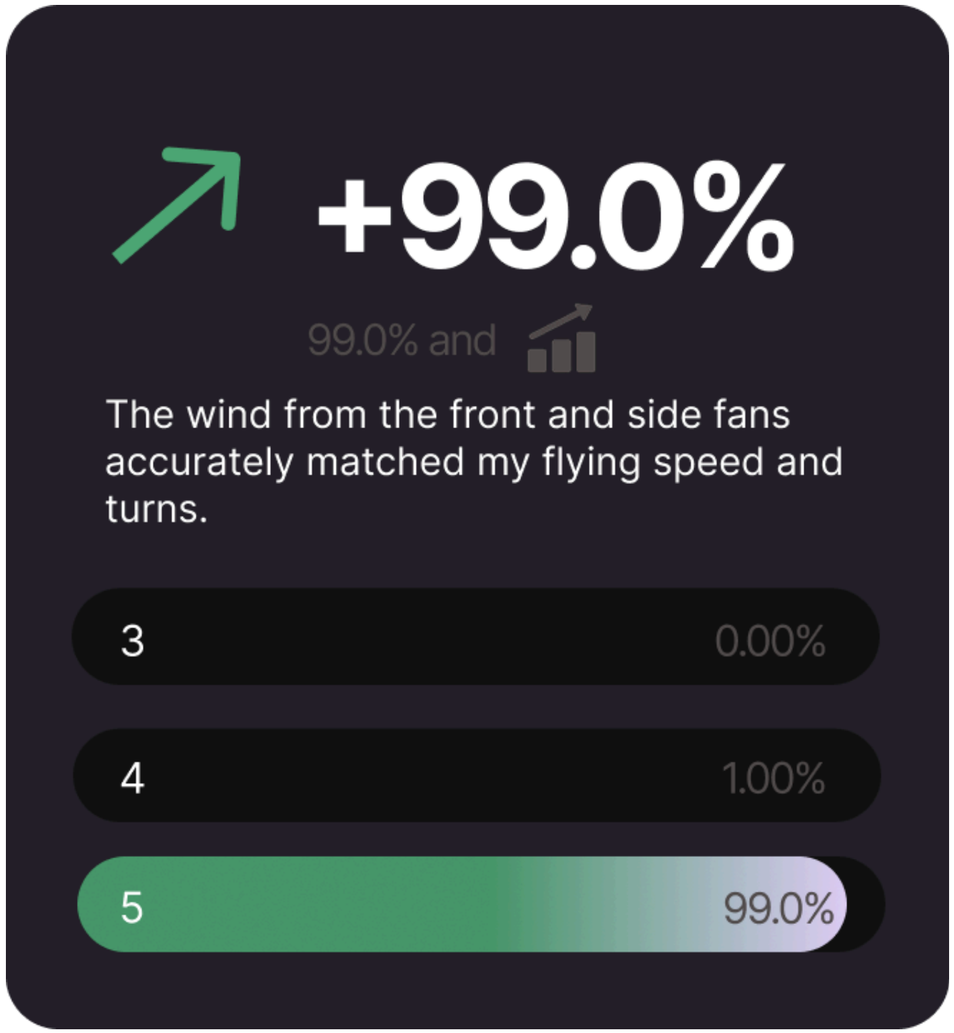
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Structural Weight Distribution

Integrated a rear-mounted counterweight to stabilize the physical broom rig under high-maneuvers.







ROUND 2 TESTING RESULTS

STEADY CONTROL WITH THE RIG & NATURAL WIND FEEL

User satisfaction jumped significantly, validating that our changes completely removed the discomfort for the user riding the rig, and a natural wind feel during stimiulation.



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.





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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.





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DEMO VIDEO



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IN GAME UI



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OUR RESEARCH TEAM









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THIS IS HOW INTERACTIVITY WORKS WITH MEDIA
&
WE ARE FROM INTERACTIVE MEDIA

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THANK YOU!

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