Hogwarts: Spellstorm

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1. Project Description

Hogwarts: Spellstorm is a virtual reality game set in a magical, immersive world inspired by Harry Potter. Players perform spellcasting using motion-based wand gestures and voice commands, interpreted by machine learning models for enhanced precision. The game emphasizes strategic gameplay in environments such as the Forbidden Forest and Hogwarts Castle, with waves of enemies culminating in intense boss battles. Players can unlock new spells and wands, enhancing replayability and personalization.

Key Technical Highlights:
- **Gesture Recognition:** Trained machine learning models analyze wand motion captured by the VR controller to match predefined spell gestures.
- **Voice Command Recognition:** Speech-to-text systems integrated into the gameplay interpret incantations for spellcasting.
- **Customizable Gameplay:** Players can create a custom motion gesture and verbal command to cast predefined effects.

2. Problem and Added Benefit

Problem:

Existing VR games often focus on either immersive environments or engaging gameplay, but rarely both. Additionally, many lack innovative interaction mechanics, leaving players craving unique, magical experiences.

Innovative Spellcasting Mechanics

- **Wand Gestures:** Players perform predefined wand movements for each spell. Motion tracking captures these gestures, which are then analyzed by our gesture recognition model.
- **Voice Commands:** Players vocalize spell incantations. Our voice recognition system processes these commands, even accommodating variations in pronunciation.
- **Combined Input:** Successful spellcasting requires the correct combination of gesture and voice command, adding depth and realism to the gameplay.
- **Custom Spell Casting:** Players can record a custom motion gesture and verbal pronunciation to cast a pre-defined spell.

Machine Learning Integration

- **Gesture Recognition Model:** Utilizes ML models to accurately identify simple hand motion patterns.
- **Voice Command Model:** Employs cloud speech recognition APIs to interpret incantations.
- **Creating a Custom Spell:** Training custom spellcasting involves repeating the pronunciation and hand gesture multiple times, alongside fine-tuning motion gesture recognition to adapt to the player's abilities during gameplay.

Immersive Environments

- **Iconic Locations:** Detailed recreations of the Forbidden Forest, Hogwarts Castle, and other familiar settings enhance player immersion.
- **Dynamic Interactions:** Environmental elements respond to player actions, such as spells that bring potions to the player to restore health or provide power ups. Additionally, environmental elements can serve as traps to harm enemies, such as falling chandeliers or collapsing trees.

Strategic Gameplay

- **Enemy Weaknesses:** Different enemies are vulnerable to specific spells, requiring players to strategize their approach.

- **Resource Management:** Players collect potions and items that aid in combat, adding a layer of tactical planning.

Customization and Progression

- **Unlockable Content:** Players earn points to unlock new spells and wands.
- **Personalization:** Customizable avatars and wands allow players to create a unique identity within the game.

Global Leaderboards and Social Integration

- **Competitive Play:** Players can compare scores on global leaderboards, encouraging replayability.

3. Competitors/Alternatives

Similarities:

- **Hogwarts Legacy:** Both games immerse players in the magical Harry Potter universe, offering detailed environments and spellcasting as central gameplay mechanics.
- **Waltz of the Wizard VR:** Both games emphasize the use of magic and spellcasting in VR. Players engage in interactive, motion-based gameplay, creating an immersive magical experience.
- **Call of Duty Zombies:** Both games promote intense survival gameplay and the need for strategic resource management.

Differences:

- **Hogwarts Legacy:** Primarily a story-driven and exploration-focused game with traditional console/PC mechanics, whereas Hogwarts: Spellstorm centers on VR's interactive capabilities, such as wand gestures and voice commands, to deliver a more tactile and immersive magical experience.
- **Waltz of the Wizard VR:** While both games offer VR magic, Hogwarts: Spellstorm takes it further by combining motion gestures with voice commands for a more comprehensive spellcasting system. Additionally, Hogwarts: Spellstorm features structured levels, waves of enemies, and strategic gameplay elements like resource management, which are less prominent in Waltz of the Wizard.
- **Call of Duty Zombies:** Despite its strong focus on survival, Call of Duty Zombies does not feature magical elements or a whimsical atmosphere. Moreover, it does not provide the same level of immersive and interactive gameplay enabled by VR, which is a key differentiator for our game.

Inspiration

We took inspiration from the rich magical environments and narrative elements of Hogwarts Legacy, the interactive VR spellcasting mechanics of Waltz of the Wizard VR, and the intense survival gameplay and strategic resource management of Call of Duty Zombies. By integrating these aspects with innovative features like gesture and voice recognition, we created a uniquely immersive and action-packed VR experience in Hogwarts: Spellstorm, blending magical exploration, dynamic survival challenges, and deeply interactive gameplay.
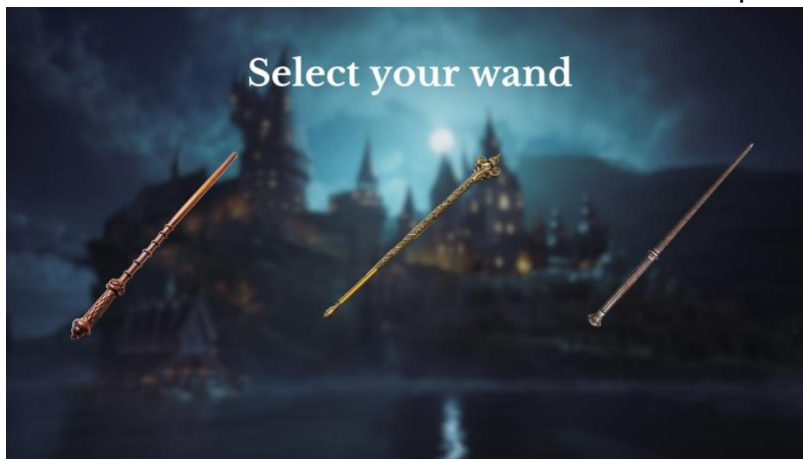
4. Game Flow

Main Menu
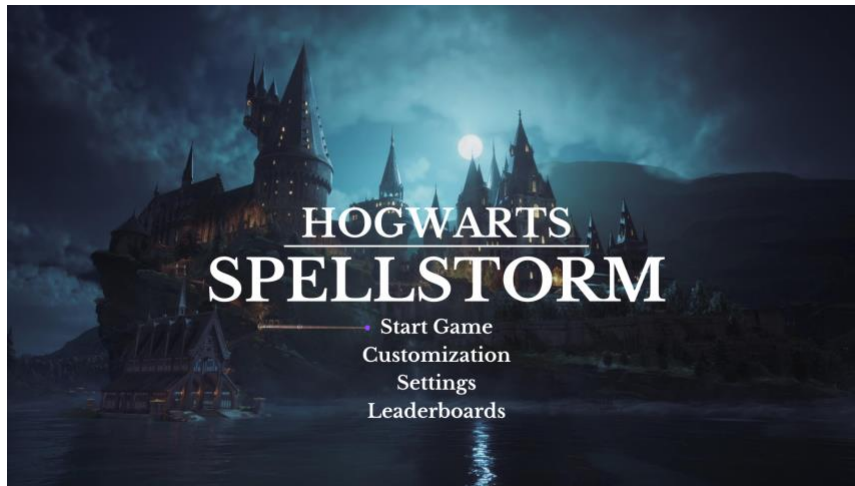
A central screen for players to navigate game options:
- **Start Game:** Begin a new game or resume from the last checkpoint.
- **Customization:** Select and customize wands and spells.

- **Settings:** Adjust audio, graphics, and controls.
- **Leaderboards:** Check global rankings and personal stats.

Tutorial

An interactive onboarding experience led by a mentor character:
1. **Spellcasting Training:**
    - **Gesture Practice:** Visual cues guide wand movements with real-time accuracy feedback.
    - **Voice Commands:** Players practice incantations, receiving feedback on clarity and timing.
    - **Combined Casting:** Players integrate gestures and voice commands to cast spells.
2. **Basic Combat:** Practice skills against simple enemies.

Level Selection
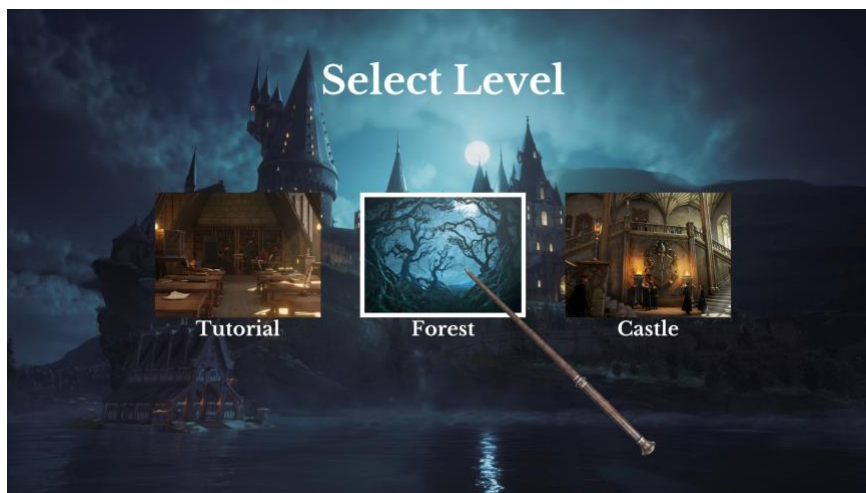
- **Map Overview:** Displays available locations with descriptions and difficulty ratings.
- **Unlocking Progression:** Completing levels unlocks new areas.

Gameplay

In a wave, multiple enemies approach the player, aiming to harm them through attacks. The player must actively destroy these enemies by casting spells using a combination of voice and hand gestures, creating an immersive and dynamic combat experience. To evade or reposition, the player can fly across the map on a broomstick. Enemies drop potions that can restore vitality or power-up and enhance spell effectiveness. A wave concludes when either the player is defeated or all the enemies are destroyed, rewarding the player with points.

- **Environment Exploration:** Players are restricted to a small area of movement within each level. This confined space enhances the intensity of combat and encourages players to focus on utilizing their spells effectively within the designated area.

  At certain moments during gameplay, players can summon a broomstick to fly to a different area of the map to escape an overrun area or moving to a better location.

- **Combat Mechanics:**
  - Enemy Waves: Enemies attack in increasingly challenging waves.
  - Spell Selection: Players cast spells based on enemy type and situation.
  - Resource Collection: Potions and power-ups are obtained by defeating enemies.

- **Boss Battles:** Each level ends with a unique boss that requires strategic use of spells and the environment to defeat.

Post-Level Summary

- **Performance Metrics:** Displays stats such as accuracy, damage taken, and time completed.
- **Rewards:** Earn points based on performance.
- **Leaderboards Update:** Scores are uploaded to global rankings.

5. Tools and Dependencies

Languages and Frameworks:
- Unity and C# for VR development.
- Python for developing and integrating machine learning models.

Hardware:
- VR headsets (Oculus Quest).
- Motion controllers for precise wand tracking.

Software Dependencies:
- Speech-to-text libraries for incantation recognition (e.g., Google Speech API, Local Speech Recognition SDK such as PocketSphinx/TensorFlow Lite + Custom Models).
  - We will decide later whether to recognize speech locally or through an API, based on performance considerations
- ML libraries for gesture recognition (e.g., TensorFlow, PyTorch).
- Asset libraries for environments and character models.

Backend: Cloud-based leaderboard and user data storage (e.g., Firebase or AWS). Real-time data processing for gesture and voice inputs.