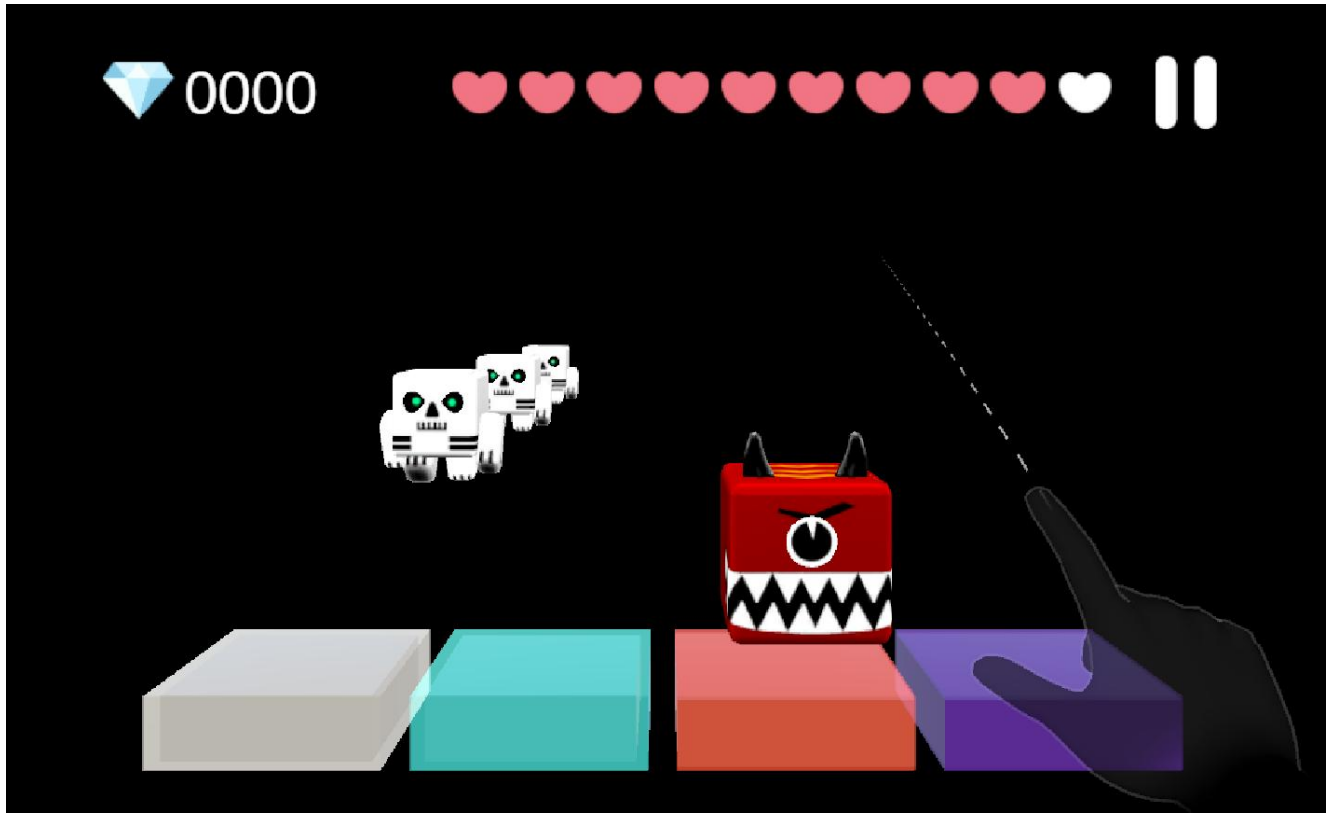
AR Rhythm Game with MRTK3

Haining YU

01 Core Gameplay



4-Lane Note Highway

•**Visuals**: 3D spatial tracks spawned in front of the player.

•**Objective**: Intercept incoming notes at the **Judge Point** in sync with the BGM.

Direct Hand Interaction

•**Input**: Powered by **MRTK Hand Tracking**.

•**Action**: Physical **"Touch & Press"** detection (OnTriggerEnter) replacing traditional button clicks.

Precision Judgement System

•**Timing Windows**: Millisecond-level accuracy.

- ◦**Perfect**: < 50ms (Highest Score)
- ◦**Great**: < 100ms
- ◦**Good**: < 150ms

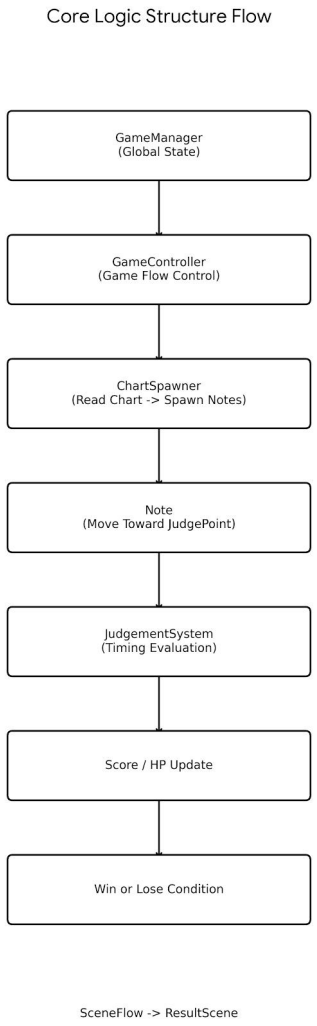
Survival & Progression

•**HP System**: Real-time health tracking; game over if HP hits zero.

•**Feedback**: Instant visual cues (Lane lighting) and dynamic scoring.

02 Technical Architecture

Core Logic Architecture



Global State Machine：

- GameController: Central hub for Lifecycle & Win/Lose logic.

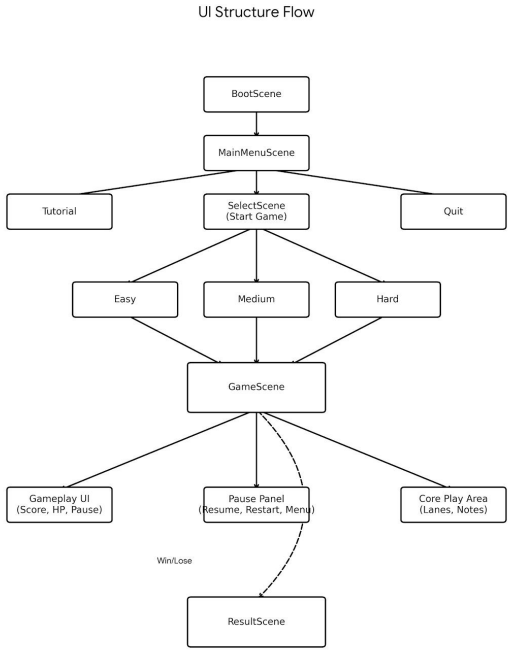
Precision Synchronization：

- DSP Time: Millisecond-level audio-visual sync (No Time.time).
- JSON Parsing: Automated chart generation from data.

Bidirectional Judgement：

- Self-Driving Notes: Real-time trajectory calculation.
- Validation: System checks input against Perfect/Good/Miss windows.

UI Flow & Scene Management



Hierarchical Scene Flow

- Structure: Boot → Menu → Game.
- Dynamic Difficulty: Data-driven level selection.

Modular UI System

- Decoupled HUD: Event-based Score & HP updates.
- Zero Latency: UI logic separated from core game loop.

Robust State Control

- Independent Pause: Freeze state without data loss.
- Game Loop: Seamless transition to Result & Retry.

03 Key Challenges

Precision Timing in AR

- *Challenge*: 3D spatial movement lacks a traditional 2D timeline.
- *Solution*: **Spatial-Temporal Mapping** (Time = Distance / Speed) for 50ms accuracy.

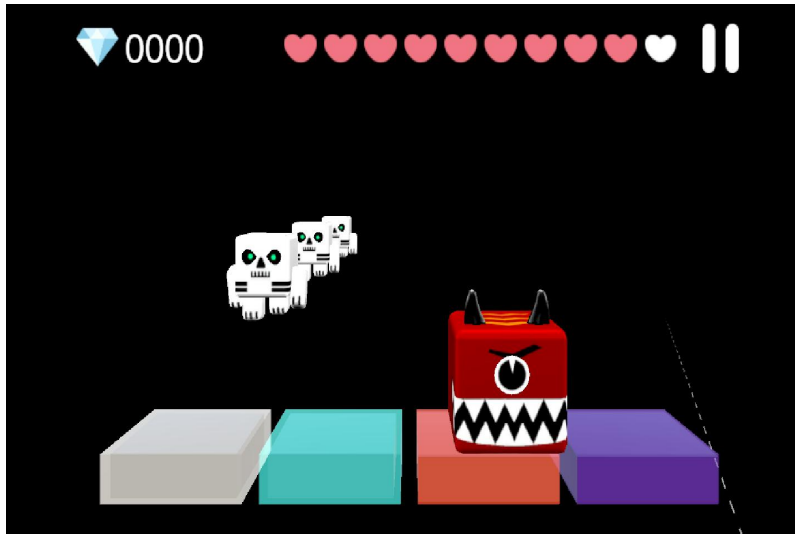
Input Noise Cancellation

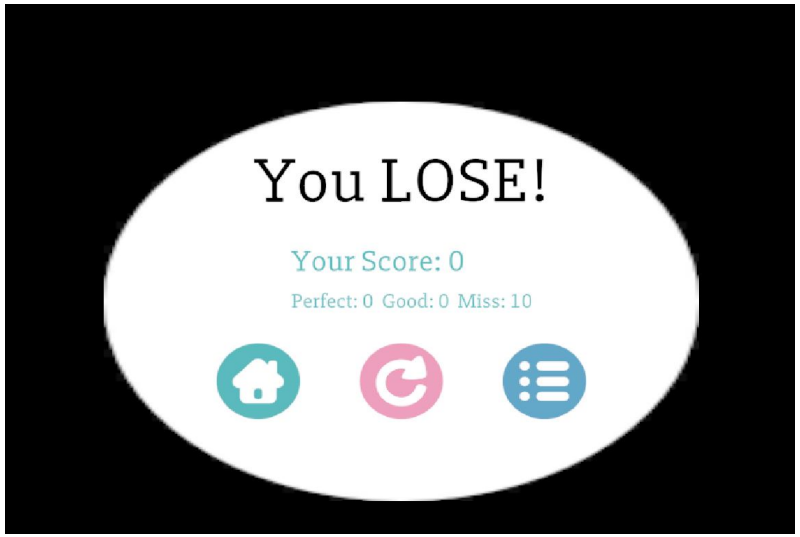
- *Challenge*: Physics colliders cause "ghost inputs" and double-triggers.
- *Solution*: **Cooldown Mechanism (0.08s)** & Input Locking.

Cross-Scene Persistence

- *Challenge*: Data loss (Score/HP) during scene transitions.
- *Solution*: **Singleton Architecture** with DontDestroyOnLoad.

04 Final Results





05 Future & Conclusion

Future Improvements:

- More songs
- Better VFX
- Sound feedback improvement

Conclusion:

- Successfully developed an AR rhythm game
- Demonstrates immersive AR interaction design

That’s All, Thank You!