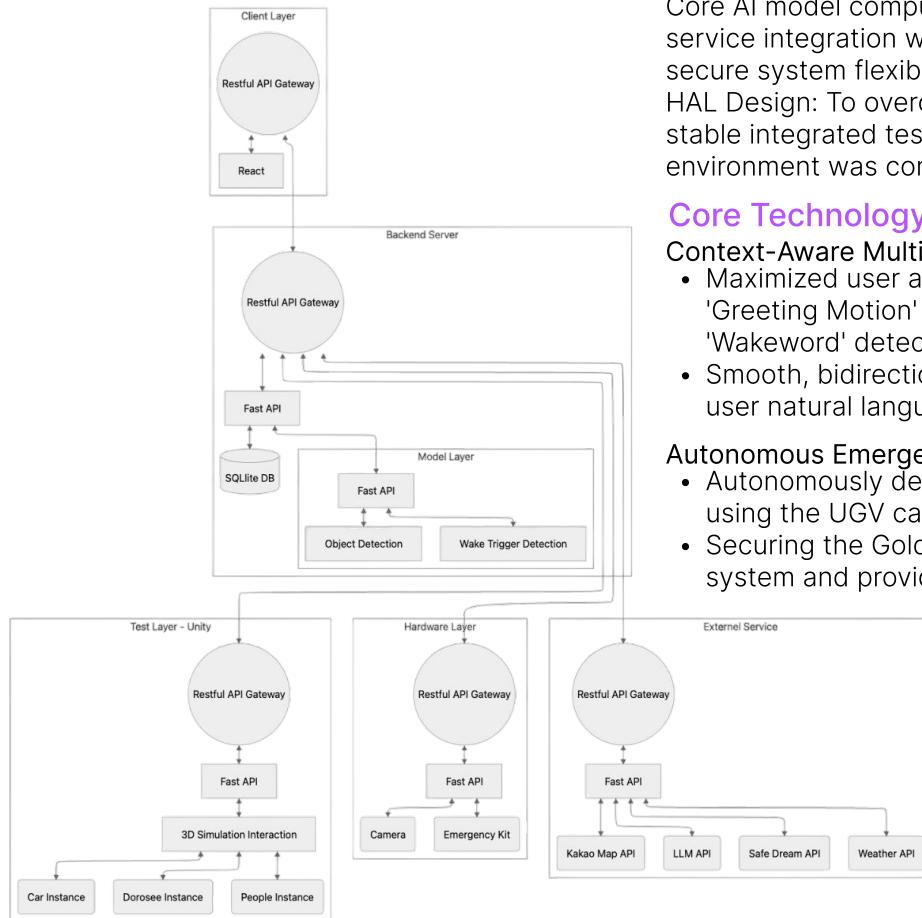


# Dorosee

## AI System for Digitally Underserved and Securing the Emergency Situations (2025 UWC AI & Unmanned Mobility Hackathon Grand Prize)



### System Architecture

Core AI model computation, hardware control, and external service integration were decoupled into independent services to secure system flexibility, scalability, and maintainability. HAL Design: To overcome UGV hardware constraints and ensure stable integrated testing, a Unity-based 3D simulation environment was constructed as a Virtual Hardware Layer.

### Core Technology

#### Context-Aware Multimodal Conversational AI Interface

- Maximized user accessibility by designing multiple triggers: 'Greeting Motion' detection using Mediapipe-based and 'Wakeword' detection using STT (Keyword Spotting).
- Smooth, bidirectional communication pipeline that understands user natural language via LLM API and responds via TTS.

#### Autonomous Emergency Detection and Response System

- Autonomously detected surrounding situations in real-time using the UGV camera feed and CV models.
- Securing the Golden Hour by integrating automated reporting system and providing an onboard emergency kit (e.g., AED).

### Problem Solving

#### Metrics-Driven Inception

Over 30 ideas generated during the initial ideation phase were categorized by three core metrics: Theme Suitability, Technical Feasibility, and Social Utility. This idea, which achieved the highest quantitative score through team scoring (excluding individual preferences), was objectively selected as the development basis.

**Resource Constraint Mitigation Virtual**  
Addressed the constraints of using actual UGV hardware and high-performance computing resources by utilizing the Unity 3D Simulation environment as the system's HAL (Hardware Abstraction Layer). This minimized the gap between the development and real operational environments, completing the integrated testing and verification of the AI model.

### Verification

#### High-Reliability Emergency Object Detection Model

Secured a high-performance object detection model (Recall 92% / Precision 85%) by fine-tuning the YOLOv8 model with 3,000 emergency situation (fall) data points.

- Stabilization Logic: Applied the False Alarm Prevention Logic (Collapse lasting > 10 seconds) to enhance system stability and practical usability. This logic is a core factor in ensuring service Reliability.

### Retrospective

#### Project Management and Planning Insight

The confusion experienced during the initial planning phase led to the realization that "Accurate Problem Definition is the foundation of robust System Engineering." This experience fostered a deeper understanding of the importance of High-Level Design for improving efficiency and quality during development.

#### Technical Challenge and System Construction

Undertook the technical challenge of constructing the Unity 3D simulation environment as the system's integrated test environment to overcome UGV hardware constraints. This secured technical competencies in establishing virtualization and integrated test environments from a System Engineering perspective and effectively managing the communication complexity among Model/Hardware/Service components.

