University of Virginia

Department of Electrical and Computer Engineering

Course: ECE 4332 / ECE 6332 — AI Hardware Design and Implementation

Semester: Fall 2025

Proposal Deadline: November 5, 2025 — 11:59 PM

Submission: Upload to Canvas (PDF) and to GitHub (/docs folder)

AI Hardware Project Proposal

1. Project Title

Hand Gesture Recognition on an Embedded Vision System

Student: Yi Deng (edh4su)

2. Platform Selection

OpenMV H7 — Tiny AI embedded vision hardware

3. Problem Definition

Gesture-based human interaction is becoming increasingly important in devices that must operate hands-free or in situations where microphones are not ideal. Running vision-based gesture recognition normally requires GPUs or powerful processors, but those systems consume more energy and rely on network connectivity.

This project explores how a small embedded processor can recognize a few common hand gestures using minimal compute and memory. The main focus is to examine how well a microcontroller-class device can perform useful AI-based perception under strict hardware constraints.

4. Technical Objectives

- Recognize at least three gestures (e.g., open palm, closed fist, pointing).

- Maintain real-time responsiveness with ≥10 FPS on the OpenMV H7.

- Keep model size small enough to run on the board's memory (<500 KB after quantization).

- Demonstrate reliable classification with ≥85% test accuracy.

5. Methodology

Hardware Setup: OpenMV H7 MCU with built-in image sensor.

Model Training: Data collection and model generation using Edge Impulse; quantized neural network optimized for TFLite Micro.

Deployment & Integration: Convert the trained model for MCU deployment and run inference through OpenMV IDE.

Performance Evaluation: Measure latency, frame rate, memory usage, and classification accuracy using real-world tests under different lighting conditions.

Validation: Demonstrate live interaction where detected gestures control local outputs (e.g., LED behavior).

6. Expected Deliverables

Working demo, GitHub repository, documentation, presentation slides, and final report.

7. Team Responsibilities

- Yi Deng: documentation, setup, model training, inference, testing, benchmarking

8. Timeline and Milestones

Week 2: Proposal — PDF + GitHub submission

Week 4: Midterm presentation — Slides, preliminary results

Week 6: System integration — Working prototype

Dec. 18: Final presentation — Report, demo, GitHub archive

9. Resources Required

OpenMV H7 development board

Edge Impulse training platform

Standard computer for model development

LED / buzzer for output demonstration

10. References

OpenMV H7 documentation: https://docs.openmv.io/

Relevant TinyML embedded vision research publications