AI Hardware Project Proposal

1. Project Title

FPGA-Accelerated Real-Time Sign Language Recognition Using the Ztachip Open-Source AI Accelerator

Team Members

Maiva Ndjiakou and Wil Berling

2. Platform Selection

Chosen Platform: Ztachip
Ztachip is an open-source RISC-V FPGA accelerator optimized for CNN inference. It supports Python/C++ APIs, runs efficiently on low-cost FPGA boards, and offers a lightweight workflow suitable for real-time ASL recognition.

3. Problem Definition

The project focuses on creating a real-time ASL alphabet recognition system using Ztachip. The goal is to achieve low-latency gesture recognition suitable for accessibility tools. FPGAs offer parallel computation that significantly reduces inference time compared to CPU-only execution.

4. Technical Objectives

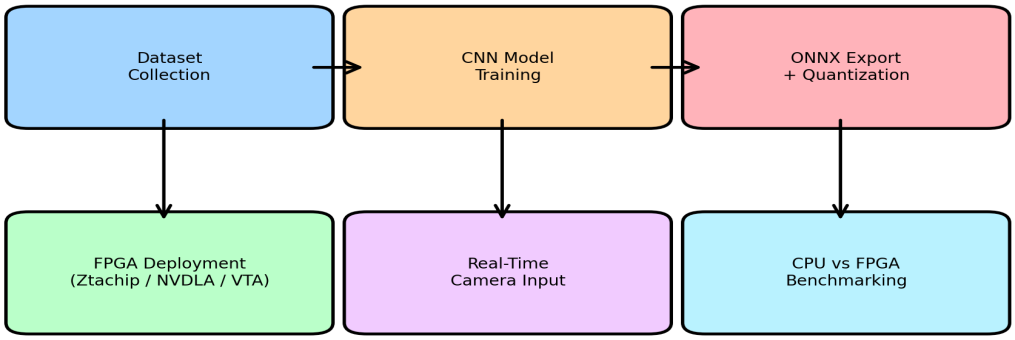
- Achieve ≥95% accuracy on ASL alphabet dataset
- Compile and deploy model on Ztachip FPGA
- Reach ≥30 FPS real-time inference
- Reduce latency by ≥5× vs CPU
- Integrate live camera input pipeline

5. Methodology

Hardware: Ztachip-supported FPGA board
Software: PyTorch/TensorFlow, ONNX, Ztachip toolchain
Pipeline: Train → ONNX export → Ztachip compile → deploy → camera test
Metrics: Accuracy, FPS, latency, resource usage

6. System Workflow Diagram

Below is the flow diagram for the project:



7. Expected Deliverables

- FPGA ASL recognition system
- GitHub repository
- Real-time demo video
- Benchmarking report
- Final slide deck and written report

8. Team Responsibilities

Maiva Ndjiakou: Team Lead, dataset preparation, CNN training
Wil Berling: Hardware Lead, FPGA/Ztachip setup, evaluation

9. Timeline and Milestones

Week 2: Proposal submission
Week 4: Midterm presentation
Week 6: Integration & testing
Dec. 18: Final presentation + demo

10. References

Papers:
1. Chen et al., 'Deep Learning Acceleration on FPGAs'
2. Molchanov et al., 'Real-Time Gesture Recognition'
3. Zhang et al., 'TVM: End-to-End Optimization'

GitHub:
- https://github.com/ztachip/ztachip
- https://github.com/ardamavi/Sign-Language-Digits-Dataset

- https://github.com/onnx/models