PROJECT PROGRESS AND STATUS PLAN #3 – <FPGA BASED ML EDGE>

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MEETING SUMMARY

Date & summary of latest meeting with your advisor.

May 2nd, 2024 (Thursday) – The Team had a meeting with Prof Eli bozorgzadeh at 10 AM. Multiple points were discussed.

- Setting up new server in the department to get access for Vitis AI as the previous server was not working.
- Demonstrated the working of Lane Detection using Deep Learning to understand calculations for lane detection on curved roads.
- Determining the comparison metrics to be conducted for FPGA vs Multicore processors. For now decided on : Power consumption, Time, Load, FPS, Overall efficiency, Temperature, Throughput, Latency, Cost.
- Discussed the possibility of using Openlane Datasets for further testing.
- Discussed about the number of image sensors to be used.

SHORT-TERM GOALS

How is your overall and individual status of your short-term goals?

Short term goals to be achieved: (Decided and Discussed with our Mentor)

- Develop a working ML application for lane detection in Vitis environment using a finalized dataset (accelerators may change)
- Pass all checkpoints on Vitis for running the above application
- Implement the entire process flow on the board.

What has been achieved:

- Working on Xilinx Kria KV-260 Board by running in-built smart camera applications using accelerators for FPGA.
- Lane detection using deep learning and camera calibrations for testing on curved roads.
- Tutorials for understanding working of AMD Vitis and Vivado.
- Explorations of various datasets for our model.

Yet to be implemented:

- Testing and deploying of models on AMD Vitis and implementation on Xiling Kria KV-260 Board as still waiting for access of server.
- Finalizing of deep learning model, number of layers and accelerators to be used for ideal comparison of FPGA Performance vs Multicore processors performance.

LONG-TERM GOALS

What is your current end of Spring goal based on your current progress w/ short-term goals? What are your current prototype goals for December? Are your current goals/tasks reasonable and sufficient toward meeting your December goals?

Current prototype goals for December:

- Implementing machine learning (ML) applications for lane detection:
    - Utilizing multiple models and datasets for experimentation.
    - Conducting comprehensive comparisons between FPGA, multicore processors, and potentially GPUs.
    - Understanding the trade-offs associated with each hardware platform in terms of power consumption, processing time, load distribution, frames per second (FPS), overall efficiency, and temperature.
- Testing out a hybrid system:
    - Exploring the combination of FPGA hardware accelerators and traditional processing units.
    - Evaluating the performance of the hybrid system in terms of speed, accuracy, and resource utilization.
- Developing a real-time system:
    - Focusing on processing videos in real-time for timely and accurate lane detection.
    - Optimizing algorithms and hardware configurations to meet real-time processing requirements.

Current goals/tasks are being done at a reasonable pace towards our Spring and December goals but more work can be done if server access can be given for Vitis AI implementation.

The new server should arrive within a week or 10 days so further work can be finished within the deadline to expand the scope of the project.

We wish to implement a real-time system for our December goal for demonstration purposes. But to expand the scope of our project, the above models can be tested out on a hybrid system as well to understand the performance trade-offs in an ideal scenario if time permits.