ELECTRONICS DEPARTMENT
Faculty of Electrical & Electronics Engineering
Ho Chi Minh City University of Technology

TRAFFIC LIGHTS WITH TRAFFIC JAM DETECTION AT INTERSECTIONS USING MACHINE LEARNING MODEL ON FPGA

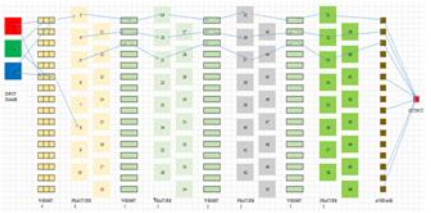
(Nguyen Thanh Toan, Faculty of Electrical & Electronic Engineering) @ toan.nguyenpsc@hcmut.edu.vn

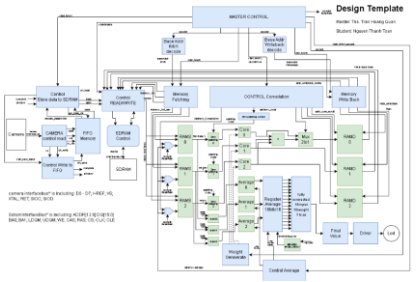
Abstract

This project presents a smart traffic light system that detects traffic jams at intersections using the MobileNet CNN model implemented on an FPGA. The system classifies camera images into "traffic jam" or "no traffic jam" and adjusts light durations accordingly. MobileNet is optimized for FPGA by processing layer-by-layer with BRAM and SDRAM to save hardware resources. The solution achieves real-time performance and shows high potential for practical use in urban traffic management.

Method

❑ MobileNet model:
Model is built by python (computer vision): Model have 6 layer with 1 input layer, 1 output layer and 4 hidden layer
❑ Block diagram of system:
System get image of traffic by Camera OV7670, main memory element is SDRAM on kit DE0, Using BRAM on FPGA to store feature and result feature on processing, data width is 10 bit Q3.6 for feature map and Q0.9 for weights.





Conclusions

The model was trained in software and partially tested on FPGA, with the top-level design completed but not fully verified. Using deep learning on FPGA offers fast processing and lower energy consumption, making it a promising solution for efficient urban traffic control. Further work will focus on complete hardware testing and system integration. Although the project is not yet fully completed, it still proves the feasibility of implementing machine learning models on FPGA

Introduction

Traffic congestion at intersections is a common urban issue, often made worse by fixed-timing traffic lights. To address this, the project proposes a smart system that uses the MobileNet deep learning model to detect traffic jams through live camera images. The model is deployed on an FPGA to ensure real-time processing with low energy consumption. Based on the detection results, the system can dynamically adjust traffic light durations to improve overall traffic flow

Result

❑ Project has been verified function of some main module of system.
❑Convolution computing with error about 2% with computer vision.

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