HawkEye

Image Processing Vision System for Manned and Unmanned Aircraft

Project Description

To determine if single board computers can be used to replace FPGAs for vision processing, we developed a real time video processing application on the NVIDIA Jetson TX1.

Our application processes video from three USB 3.0 cameras and displays the results on a monitor. To measure the latency of our system, we used a high speed camera.

Project Features

Hardware

- NVIDIA Jetson TX1 Single board computer with 256 core integrated GPU using less than 15 Watts
- 3 Point Grey high resolution cameras with various lenses and filters
- 1080p input and output resolution

Software

- CUDA GPU accelerated real time video processing modules
- Edge and feature detection algorithms
- Support for different camera modules including zoom, daytime, and low light cameras

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Project Background

Rockwell Collins, our project sponsor, designs video systems to help pilots see better in tough weather conditions. These systems assist during flight operations, such as landing.

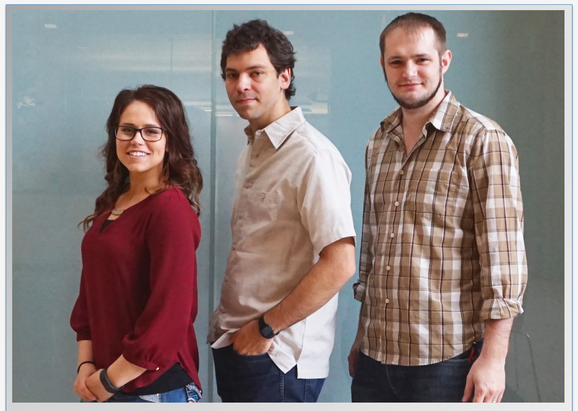
Some of these systems overlay images with graphics to help pilots locate important features like runways. Vision systems can also detect when cameras are not needed and turn them off to save power.

In order to provide pilots with this enhanced imaging, Rockwell Collins develops Field Programmable Gate Arrays (FPGAs) to perform image processing. This development process is very complex and costly. New vision enhancements can take weeks or months to develop using FPGAs. The FPGAs are currently Rockwell Collins' only option that uses low power and produces high quality video that pilots can use effectively.

Project Solution

Our goal is to provide an alternative to Rockwell Collins' FPGAs that has the needed performance metrics and meets the power requirements while providing faster implementation time and reducing the cost of production.

We believe the best candidate for this is to use a single board computer, such as the Jetson TX1. Our goal was to fully test this board's ability to see if it met Rockwell Collins' requirements.



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Results and Conclusions

Our proof of concept was able to meet the required performance metrics using the NVIDIA Jetson TX1.

Our performance metrics results are as follows:

- ~90 frames per second for three cameras
- 24 ms latency
- 1080p output resolution
- Video streams combined into one image output after GPU processing

Oregon State UNIVERSITY