

Use of Imaging Devices to Assist Autonomous Vehicles



Advisor: Dr. Joseph Zambreno

Members: Souparni Agnihorti, Ashley Dvorsky, Eric Himmelblau, Fahmida Joyti, John Orefice, Bowen Zhang

Senior Design May 2018

EE/CPR E/SE 492 

Problem Statement:

An autonomous tractor using GPS to view its world can be given greater intelligence by using a vision system to realize potential obstacles in its environment.



Functional Requirements:

- Detect fences, ditches, and combines in real-time
- Calculate distance to objects from stereo cameras

Non-Functional Requirements:

- Speed of real-time object detection system ≥ 15 FPS
- Fit into a late tractor model
- Will not prevent manual driving
- Powered by the tractor electrical system

Technologies:

Object Detection:

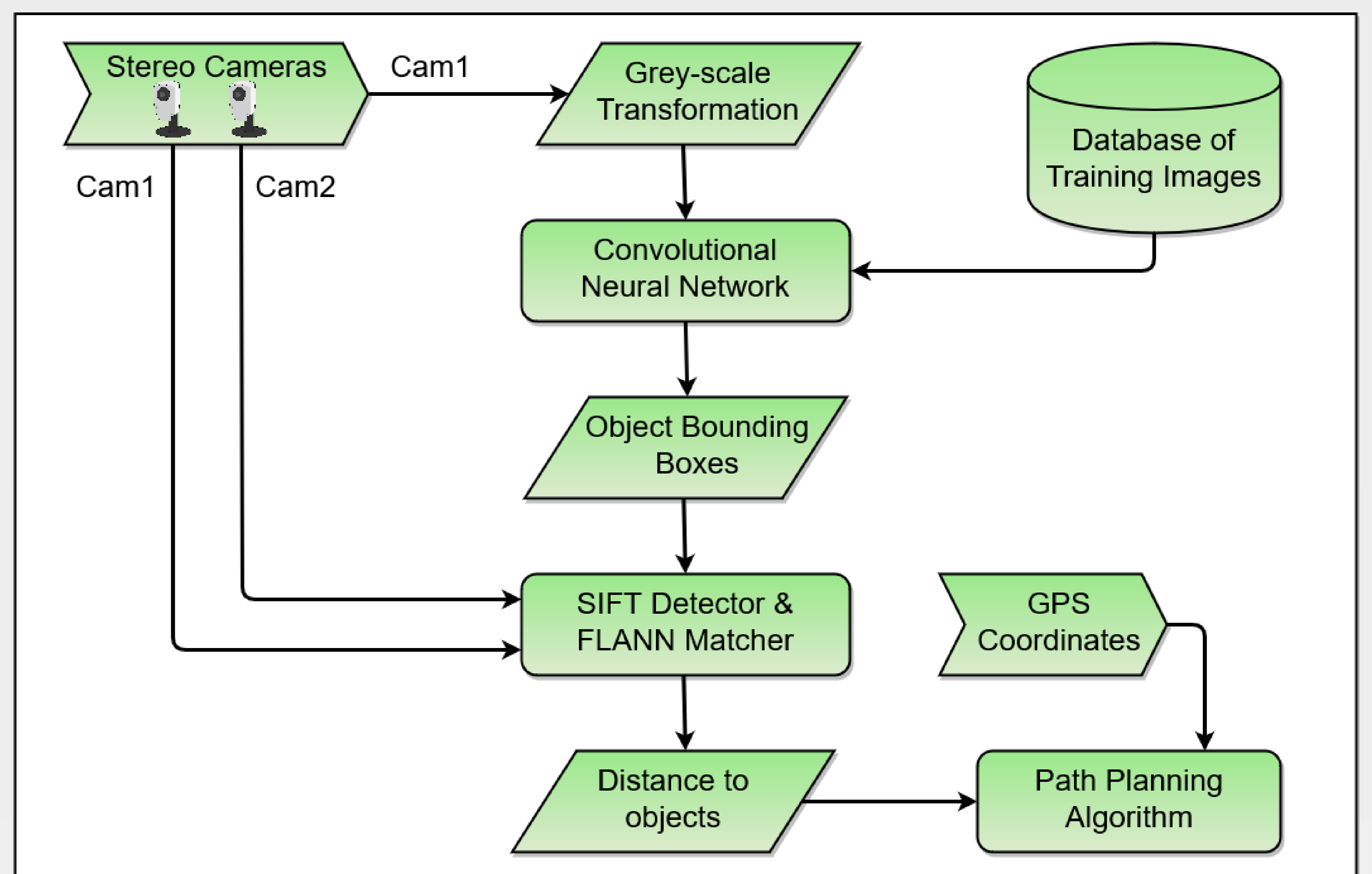
Language: Python, MATLAB
Model of Neural Network used: MobileNetSSD on TensorFlow

Distance Measurement:

Language: Python, MATLAB
Libraries: OpenCV

Engineering Constraints:

- Limited to using OpenSource Software
- System needs to run on embedded hardware



Testing:

Testing environment:

SmartAg's local test field with a modifiable tractor and test obstacles.

Testing Strategy:

Object Detection

- Test NN with static objects
- Test NN with real-time video feed
- Test NN with video feed from stereo cameras.

Distance measurement

- Test object matching with static images and manually identified objects
- Calculate distance to objects which has been manually measured

Relevant Standards:

- IEEE standard – Ethically aligned design: A vision for prioritizing human well being with artificial intelligence and autonomous systems.