Kenworth Turn Signal Cancellation System

ELECTRICAL & COMPUTER ENGINEERING
UNIVERSITY of WASHINGTON

KENWORTH

A *PACCAR* COMPANY

Designed for Semi-trucks

Sponsor: Kenworth Trucks
Industry Mentor: Ian OConner

Introduction

Unlike most vehicles, semi-trucks don't have an automatic turn signal canceling mechanism. CDL-licensed drivers are required to turn off the signal when their trailer has realigned with the truck. Our task was to design a turn signal cancellation system based on image processing and internal CAN messages from the truck.

Start

Finish
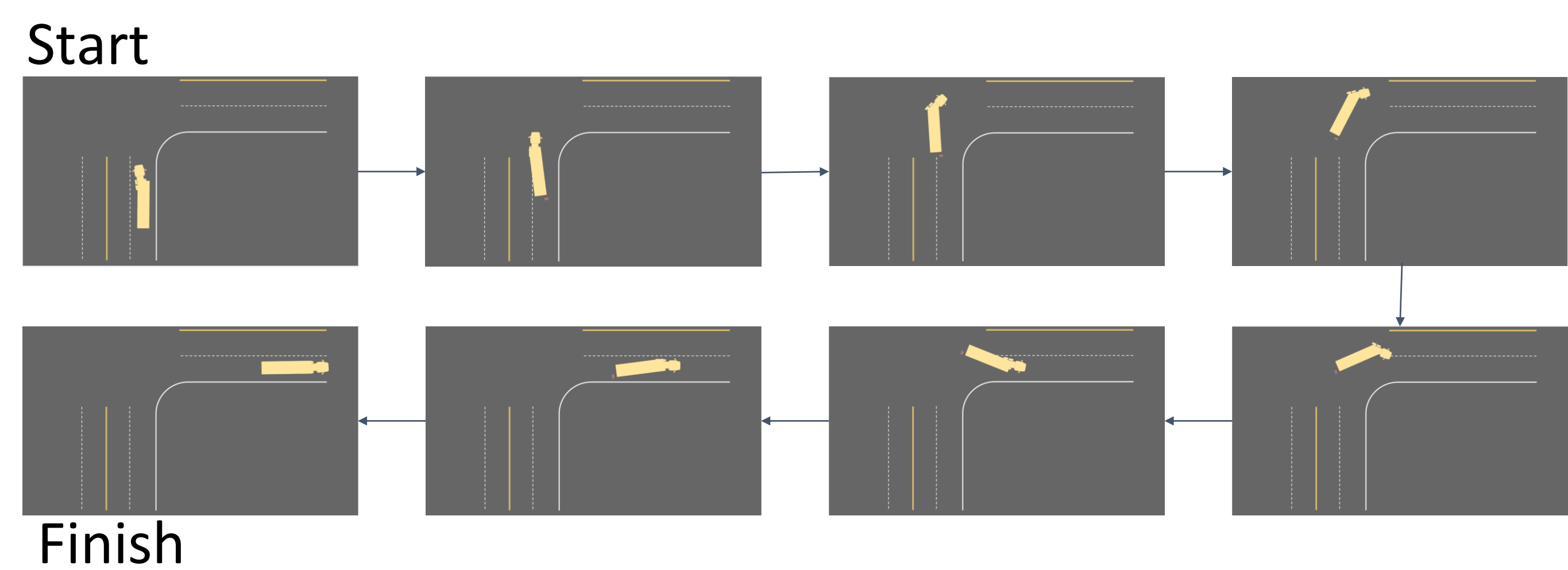
Our Approach

- Use CAN messages to receive turn signal and vehicle speed data to start image processing
- Mount one camera on each on side mirror housing to capture images at one frame/second for image processing using OpenCV
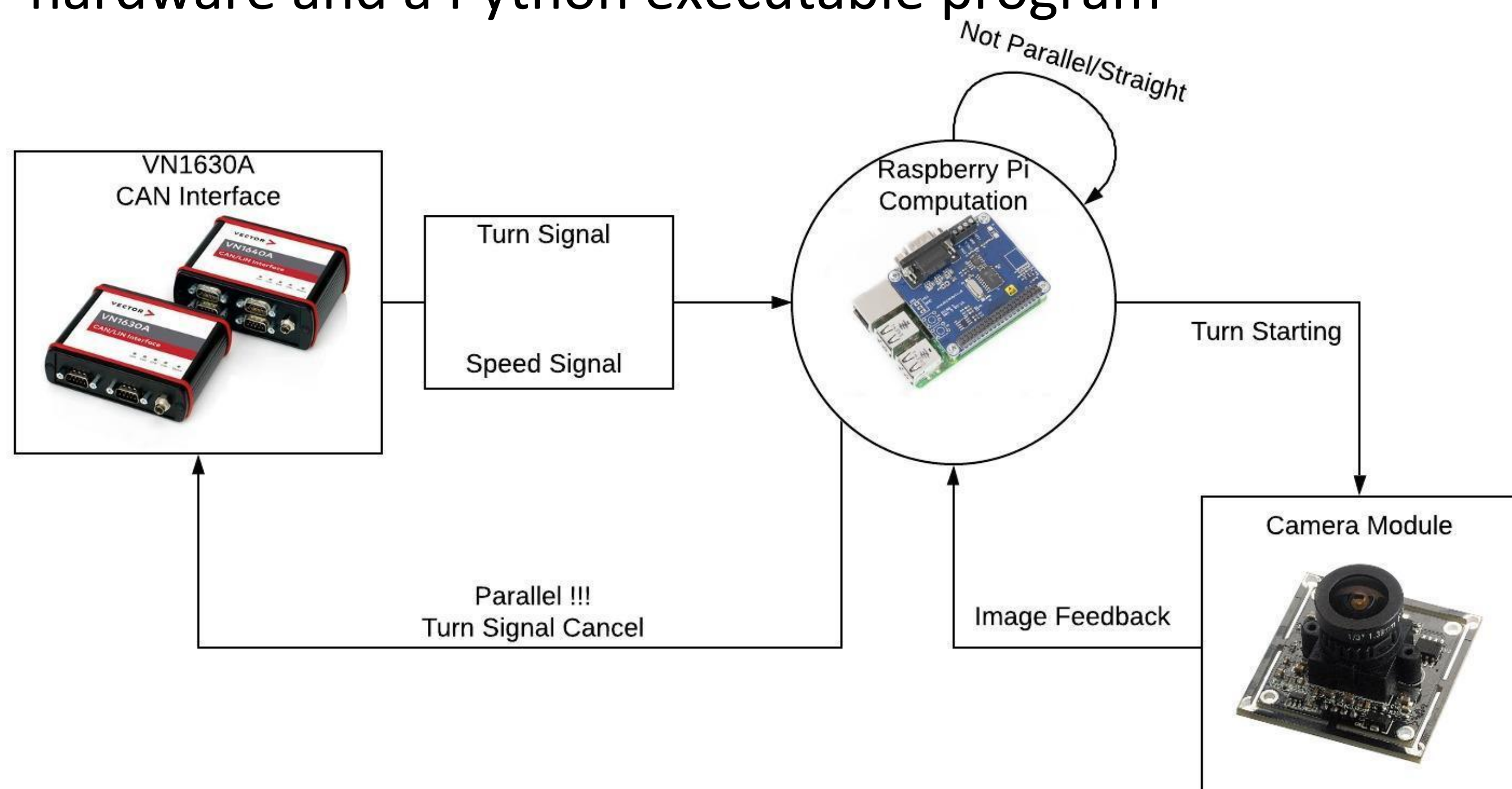- Have program run on start-up using Raspberry Pi hardware and a Python executable program

Figure 1: System Overview

Hardware

- Raspberry Pi 3 Model B+ with Raspbian Headless OS
- SanDisk 32GB microSD card
- PiCAN2 CANbus interface shield
  - Using the SocketCAN driver to receive messages from trucks internal speed and turn signals
- Spinel 2MP full HD USB Camera Module OV2710
- OBDII to DB9 cable
- 3D printed camera housing
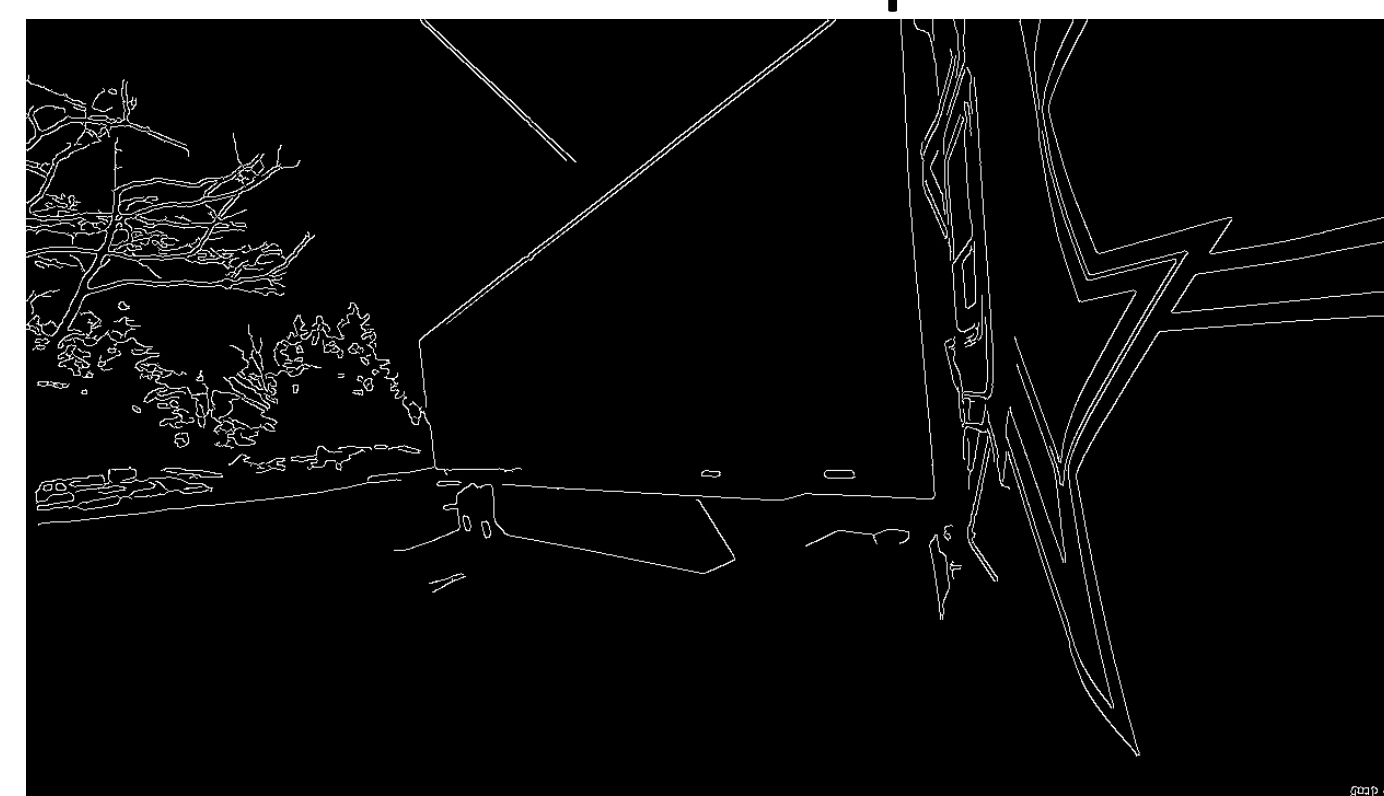
Mounted truck camera
PiCAN Setup
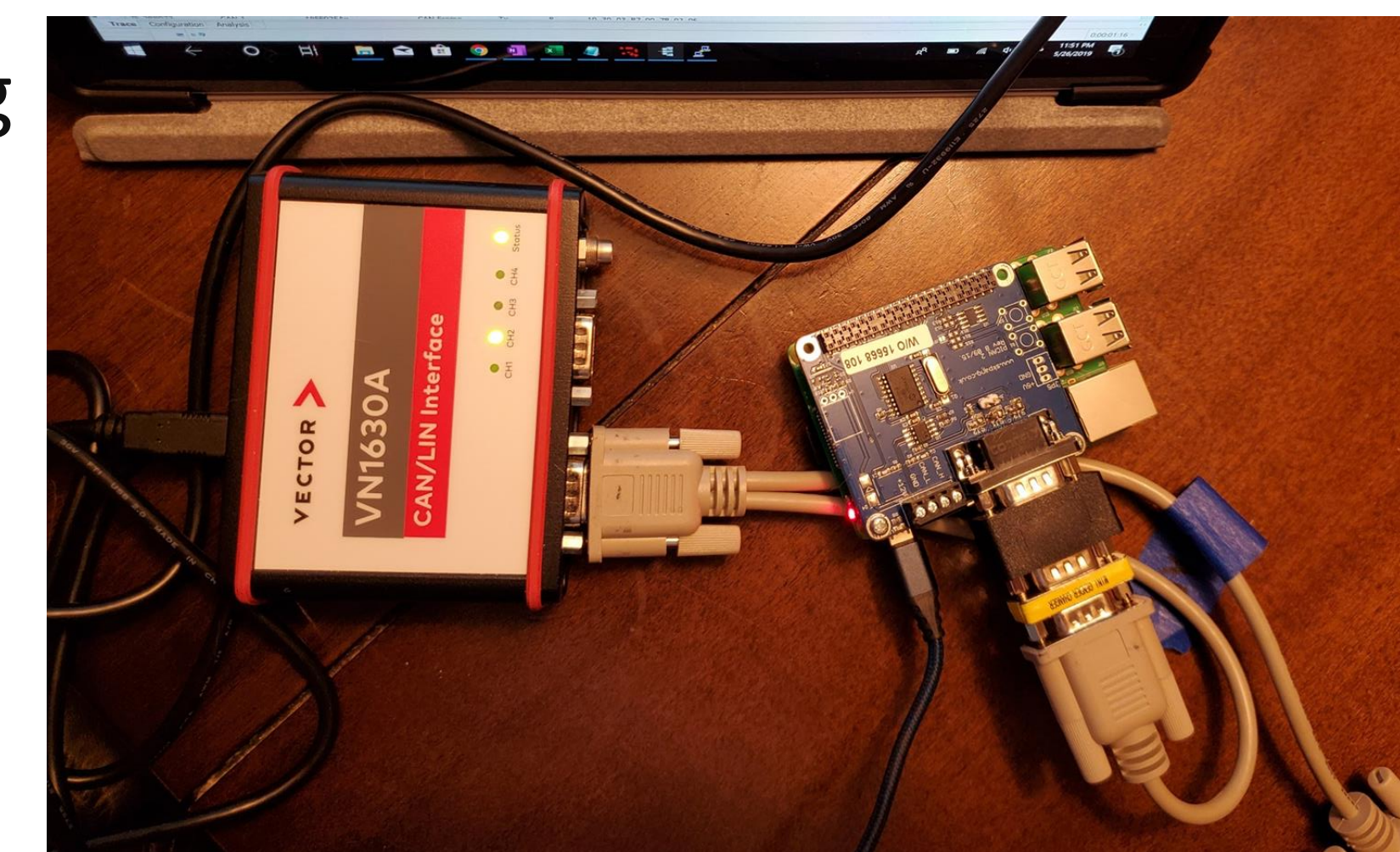
CANalyzer and

Software

OpenCV
- Grayscale filter and Gaussian blur to reduce noise
- Houghline to detect straight lines in filtered picture
- Separate perimeter of the top of the trailer
- Calculate the slope to determine alignment

Edge-detected
Line-highlighted

CANAlyzer
- Using a logged data file for validating turn signal and vehicle speed received in Python program

Software Architecture

- Multiprocessing, or parallel processing, to capture and translate CAN messages
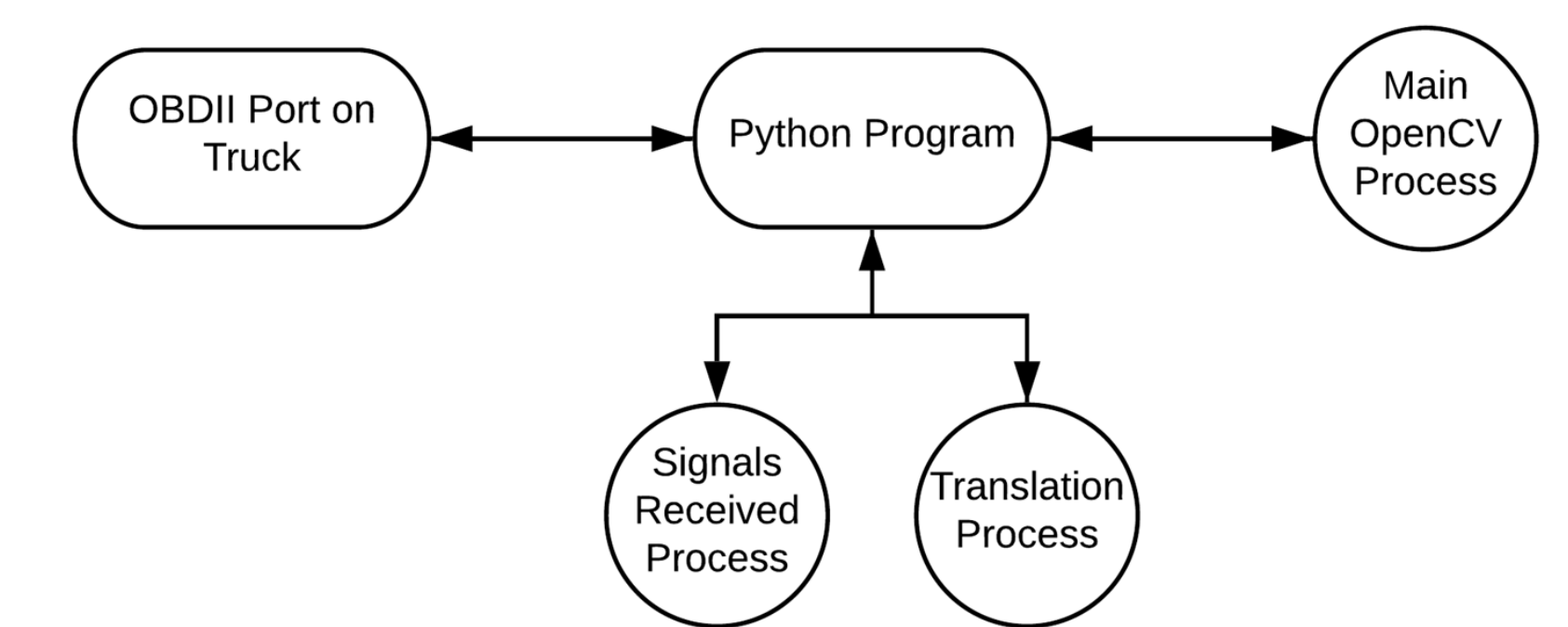
Figure 2: Python program architecture

Results

- Assembled the camera & computing modules
- Received and translated turn signal data accurately in Python program and while testing on truck
- Vehicle speed data didn't come through while testing on truck, resulting in incorrect implementation of image processing algorithm

Future Implementation

- Stereo depth camera (Intel® RealSense™ Depth Camera D435i)
  - Generates depth map
  - More accurate
  - Higher cost

- More powerful computation
  - Stereo camera requires higher transmission speed (USB3.0)
  - Nvidia Jetson
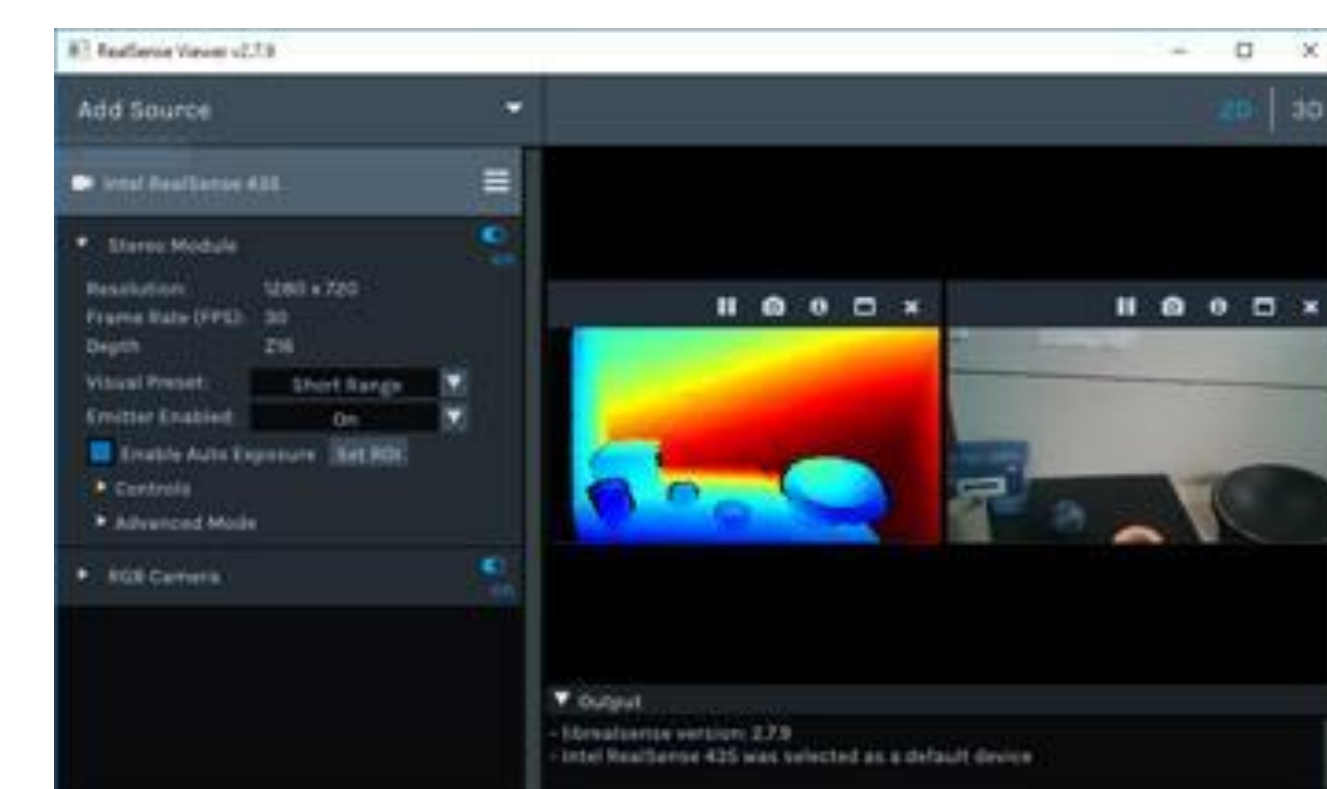
*Figure 3: Depth camera sample image

*Admin. "Get Started with the Intel® RealSense™ Software Development Kit (SDK)." Intel® Software, Intel, 20 Sept. 2017, software.intel.com/en-us/realsense/d400/get-started