Project RoboFuel
Senior Design Project Fall 2020 - Spring 2021

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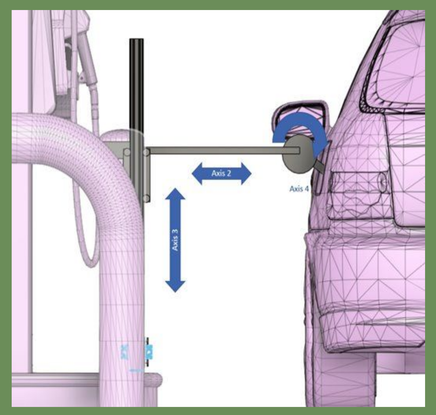
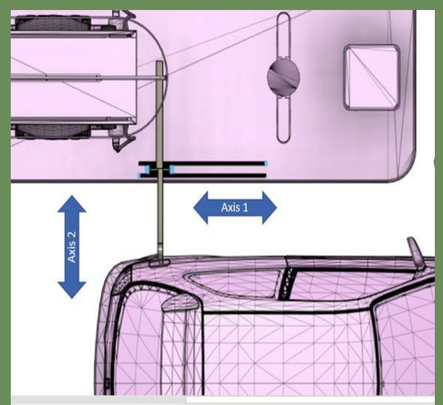
Problem Statement

An automated robotic vehicle fueling system can increase accessibility, safety, and eliminate fomite viral transmission.



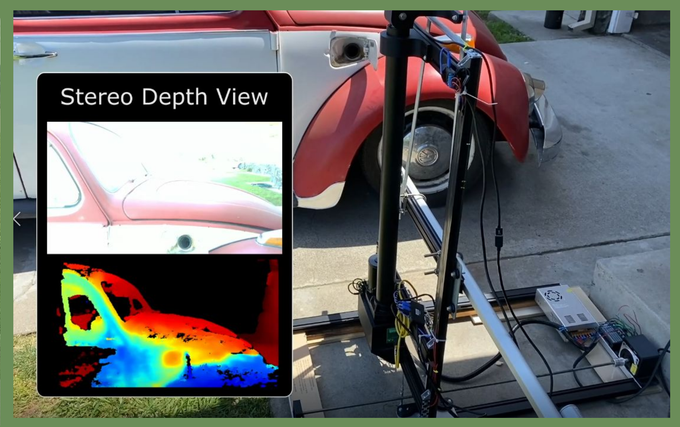


Background

In light of a global pandemic, affecting more than 20 million people and lasting longer than 6 months, there is an ever growing need to solve how traditional gas pumps are operated today. The spread of COVID-19, accessibility, identity fraud, human operating error, and pollution are all issues with contemporary designs. The current infrastructure of gas stations is exclusively catered toward gas operating vehicles. This can be solved by creating an automated system that can be easily integrated with all types of refueling mediums. The payment method for most gas stations is by swiping a credit card.This creates a vector for immoral actors to “skim” vital information from customers and perpetrate fraud. An automated system would mitigate this issue by utilizing a secure app payment system that prevents theft. The human operating component results in fuel spills, absorption of hazardous chemicals such as Benzene and hydrocarbonpollutants being released into the atmosphere. By eliminating the human component completely, these issues can be greatly reduced and promote a more sustainable, convenient and safe means of refueling one’s vehicle.

Summary of Work

The implementation of this design required both hardware and software design components. Custom software was written to interact with our Intel Realsense camera via the Realsense SDK. We captured frames from a video stream which were processed by an object detection algorithm, generating a bounding box for the object that the algorithm had been trained to detect (in this case, a fuelport). The software then deprojects the location of the center of the bounding box from 2D pixel space to 3D coordinate space, and feeds that coordinate information to the motor controller. This will all be tied together in a custom embedded Linux solution running on a SOC FPGA. Custom motor controller IP is implemented in Verilog for higher stability kinematics. Simplified software kinematic control is implemented in conjunction with hardware IP.



Impact On Community

- Immediately reduce surface transmission of COVID-19 at high traffic public spaces such as gas stations
- Increase accessibility to gas stations for disabled customers
- Reduce credit card fraud due to pump skimming
- Reduce pollution due to “topping off” and other user error