ESS-NW/CAR

Leon Fernandez, Jonas Ekman, Fredrik Hyyrynen, Jacob Kimblad, Yini Gao and Yifan Ruan

MF2063

December 10, 2018

Overview

Introduction and background

JACK STEWART TRANSPORTATION 08.04.18 07:00 AM

TESLA SAYS ITS NEW SEL DRIVING CHIP IS FINALL BAKED

Move over Tesla, this self-drivi you sleep or watch a movie du highway commute

Tom Huddleston Jr. | 5:00 PM ET Tue, 26 June 2018

46 Corporations Working On Autono

September 4, 2018

Autotech

Scania self-driving trucks to be tested Finnish roads

How Intel Plans to Win Self-Driving Cars

Inside Intel's compelling self-driving car strategy.

Ashraf Eassa (TMFChipFool)
Jul 9, 2018 at 6:06PM

Waymo's driverless cars hit a new milestone: 10 million miles on public roads

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The UK firm hoping to take on G driverless cars

By Will Smale
Business reporter, BBC News

8 October 2018

+ A –

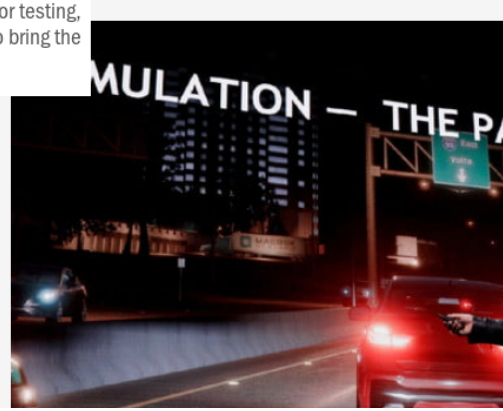
onaoina challenaes

Apple self-driving car fleet grows to 66 vehicles in California

By Malcolm Owen
Wednesday, July 18, 2018, 12:14 pm PT (03:14 pm ET)

Apple is continuing to increase the number of autonomous vehicles it has on the roads for testing, reportedly registering more vehicles with the Californian Department of Motor Vehicles to bring the fleet up to 66 self-driving cars operating in the state.

Nvidia is helping au
ulate their way to sc



Article

Development of self-dr vehicles in the United I

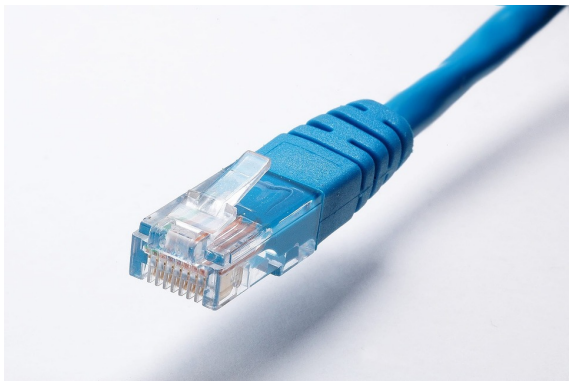
Where science fiction meets sc

Autonomous vehicles

- Autonomous Driving (AD) and Advandced Driving Assistance Systems (ADAS)
- Common services:
  - Object detection
  - Speedometer
  - Distance meter
  - Cruise control
  - Steering control
  - Central decision making
- Intelligent system monitoring:
  - Startup
  - Fault detection
  - Communication surveilance
- Dynamic adaptation:
  - Failsafe behaviour
  - Adaptive communication

The problem with existing communication technologies

- Existing communication technologies between internal computers in cars:
  - CAN (1 Megabit/s)
  - LIN (19.2 Kilobit/s)
  - FlexRay (10 Megabit/s)
- Increased demand of bandwidth because of increased number of services in autnomous vehicles puts high demands on communication technologies.
- An interesting area of research is to use regular **ethernet** to replace existing communication technologies for cars.
  - Current ethernet speeds reach into the Gigabit/s range.

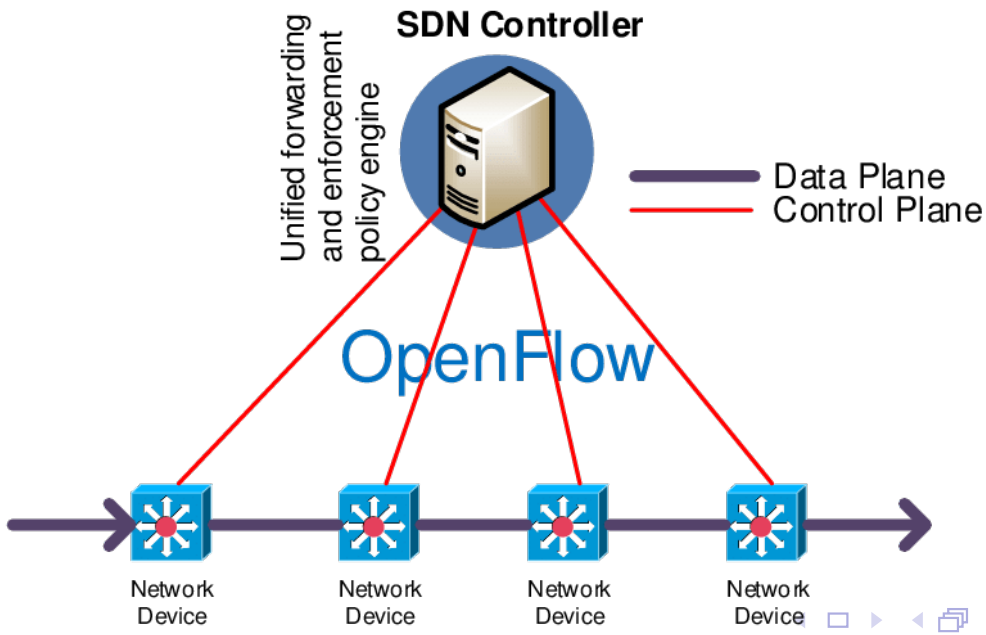


The problem with ethernet

- Ethernet is not developed for time-critical applications.
  - Messages can take any road through the network.
  - There is no way to give precedence for certain messages.
  - Ethernet has no way to control for message congestion in the network.
  - Worst-case latencies for messages can be to long because of congestion.
  - Messaging is usually implemented using the client-server model.
  - Ethernet is unadaptive to real-time events.
- An interesting area of research to tackle these problems is to use **Software Defined Networking** (SDN).

Software defined networking

- Builds onto the theory of regular ethernet.
- Move the intelligence from the switches to a central controller.
- The controller gather information from the switches.
- The controller decides how the traffic should be directed in the network.
- The SDN-controller allows for more adaptation in the network based on real-time events.



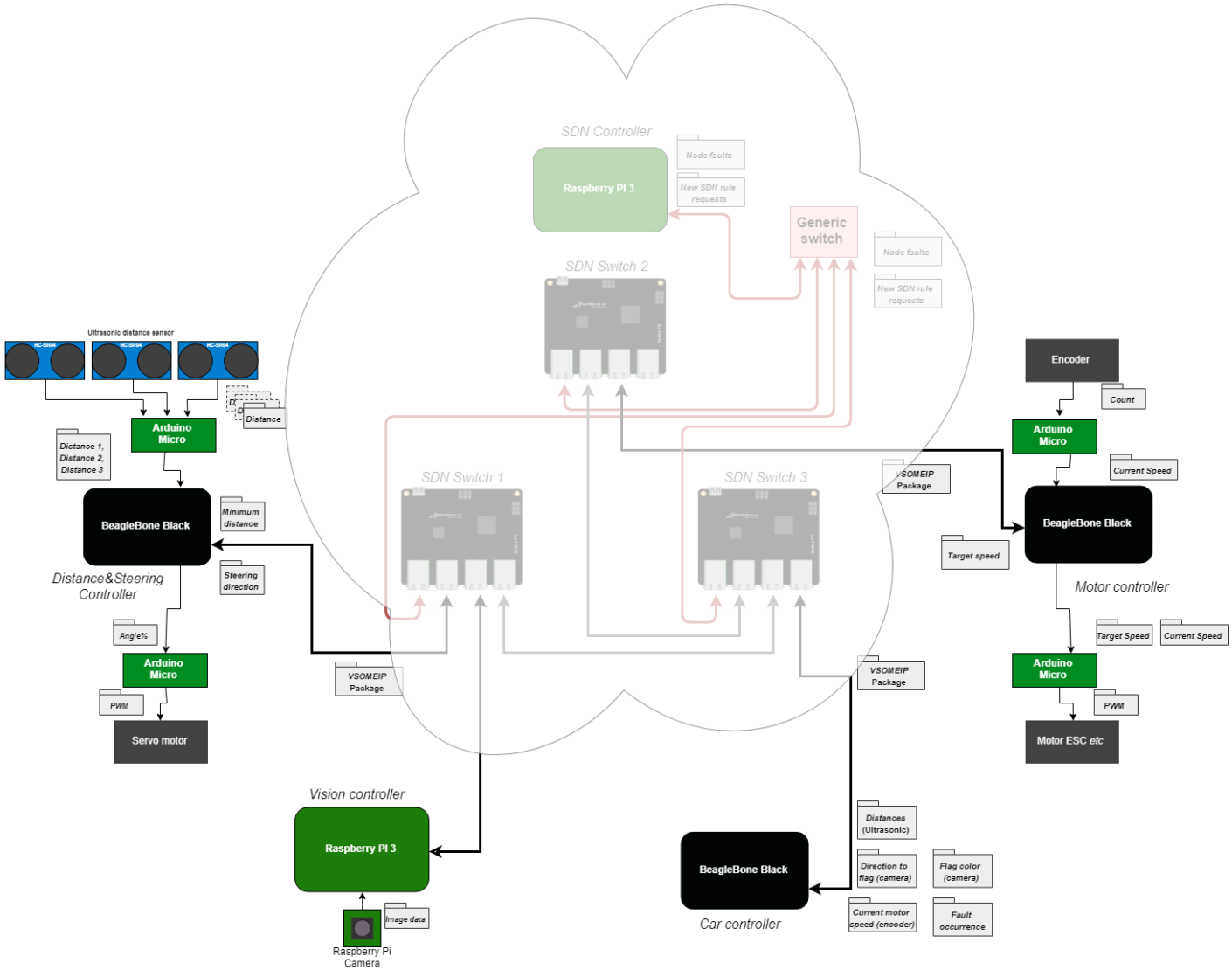
Our project

Goals of the project

- Produce a prototype of an SDN-based communication infrastructure for automotive vehicles.
- Produce a prototype of intelligent system monitoring and adaptation service for automotive vehicles.

Figure: RC-car model kit used for the prototype

System architecture



Implemented services

- Speedometer
- Cruise control
- Steering
- Object recognition
-

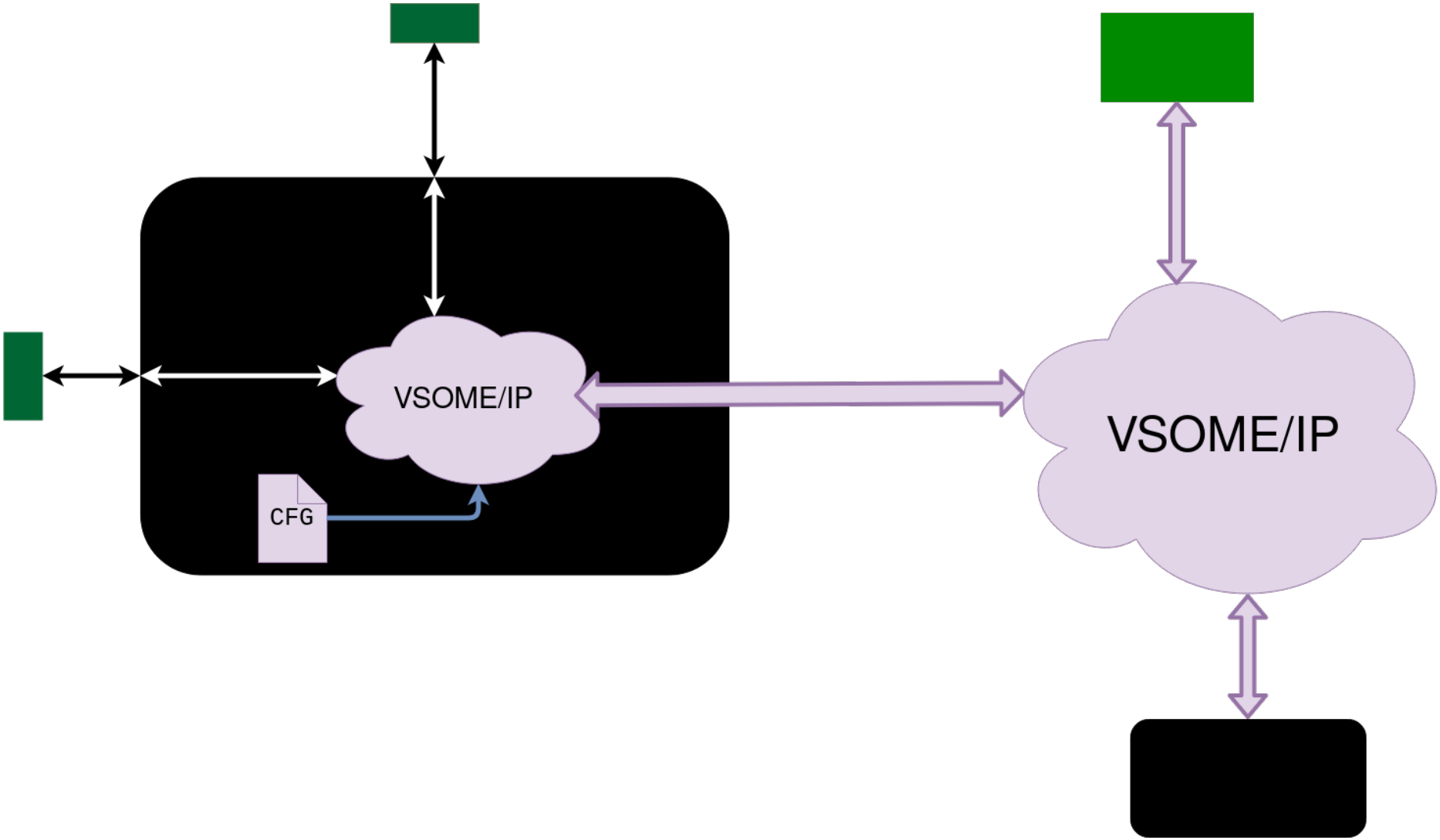
Conclusion

Conclusion

- Ethernet is a promising candidate for increasing demand on bandwidth for communication in autonomous cars
- Ethernet is not without problems, many of which a SDN can help to solve.
- SDN networks allow for safe communications on autonomous vehicles by being fast, adaptive and customisable
- Fault detection and failsafe behaviour is a **must** in autonomous vehicles.

old-slides

VSOME/IP

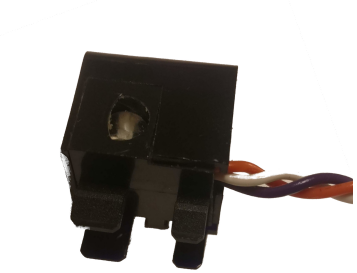


Control and sensors

Services

- Ultrasonic sensor

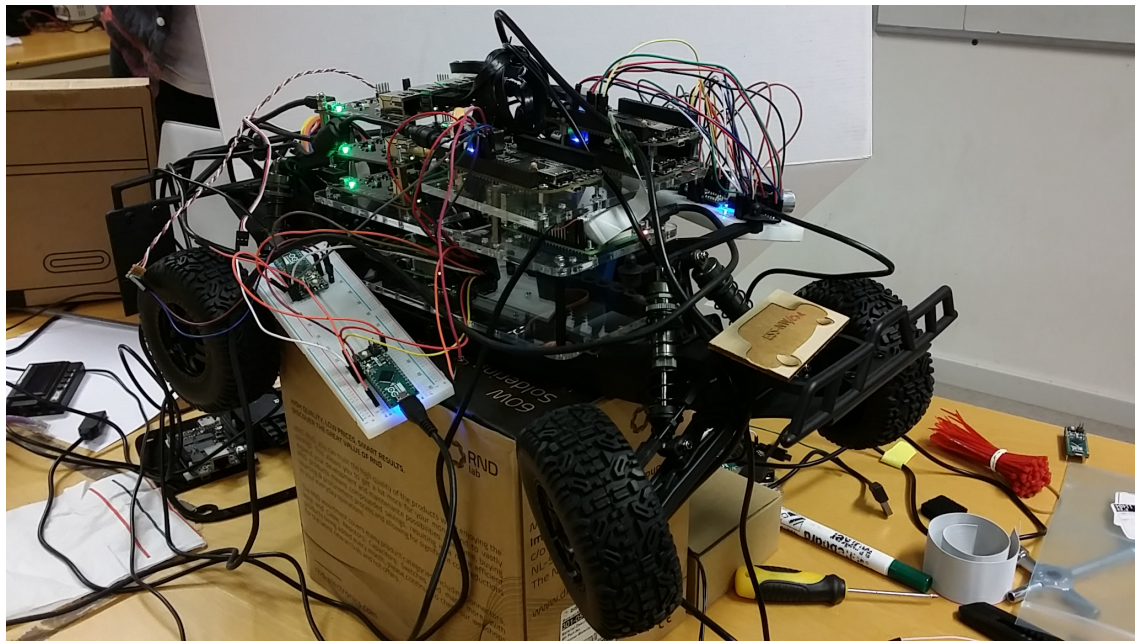
- Reflective object sensor



- Camera

Actuators

- Motor controller
- Steering controller



Autonomous behaviour

- Services
- State machine

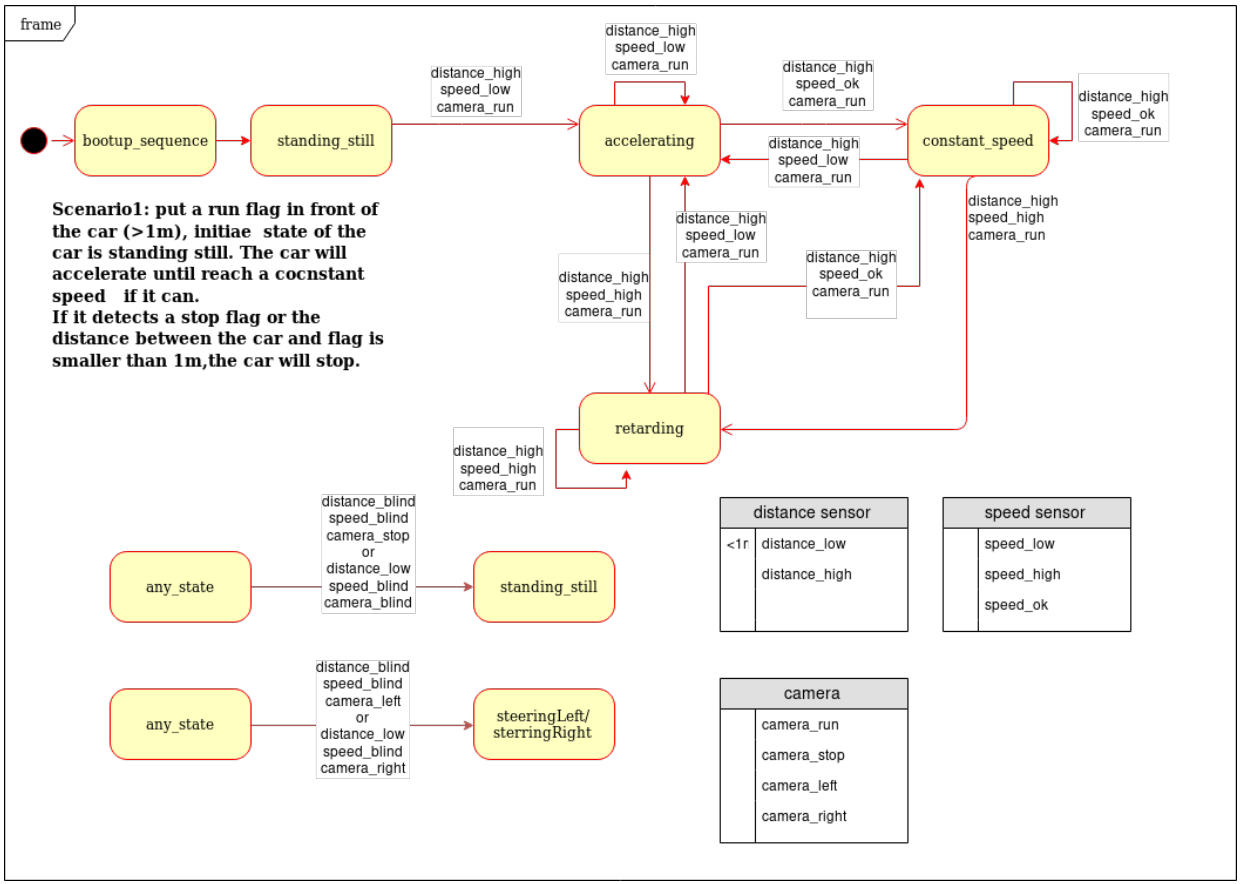
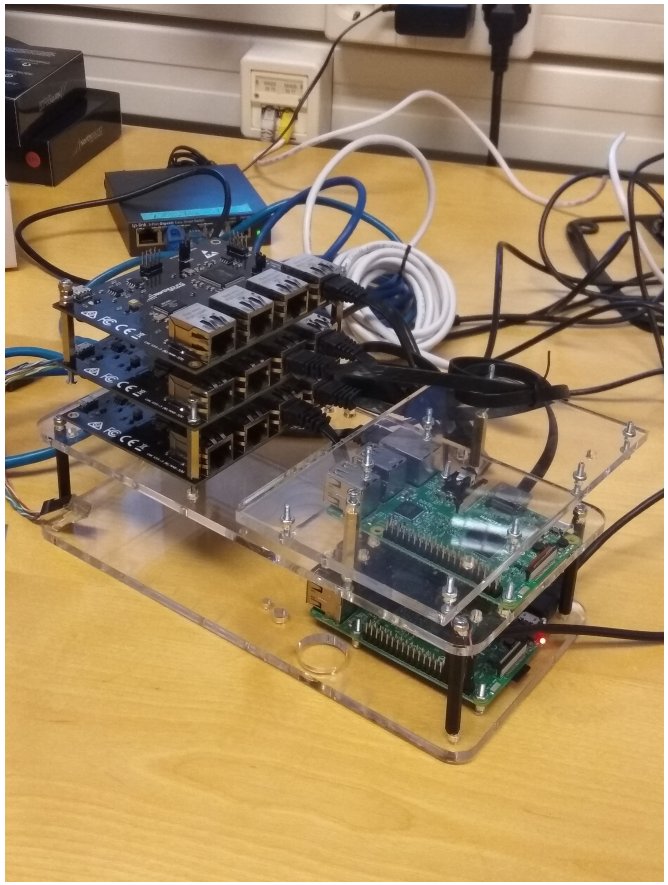


Figure: State machine

Assembly

The platform

- Designed in Fusion 360
- Cut out in the laser cutter
- The idea of the design was to build up to get access to everything and to be modular
- Mounted on the car via two holes



Power

- We hade designed PCBs to mount the Arduinos on and to power the other devices
- Could not order PCB
- The machine PCB mill was broken both the one Mentorspace and proto Prototype Center
- Had to use breadboard

Come check out our DEMO in the prototyping lab on floor 3!