

Faculty of Engineering & Applied Science



ENGR-4941U Capstone II

Smart Traffic Signals

Group#: 8

Section CRN#:73459

Advisor: Dr. Hossam Gaber

Coordinator: Dr. Vijay Sood

Due Date: N/A

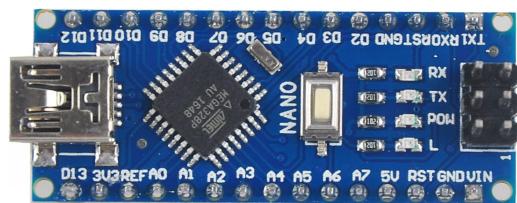
First Name	Last Name	Student Number
Tirth	Patel	100751761
Vatsal	Patel	100728903
Saro	Karimi	100755079

For the design of this project in the real world we came up with a radio-based plan. So, in this system, we have an RF transmitter and receiver modules with 433MHz receiving frequency. This module has the capability to transmit and receive data within the range of 20 to 200 meters. This module will be connected to an Arduino Mini Nano so we can send and receive the data. Also, the Arduino will help us to process the data and connect them to our car computers. So, we don't have real cars so we are just going with a simple design of small cars with speed, range, GPS sensors and etc. All of these will be connected to the Arduino and the data will be sent to other cars. Instead of having traffic lights, we will have a stationary device at each intersection with sensors, cameras, and a radio transmitter to communicate with the other cars. The cars will show the status of the traffic light inside the infotainment system so for us since we have a smaller version of the cars we just put three color LEDs inside the cars.

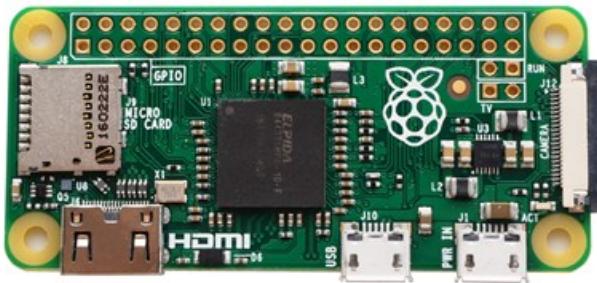
So here is what it will look like. The below are the components that we are going to use for the project. It includes everything we need to make the connection between the vehicles to traffic signals



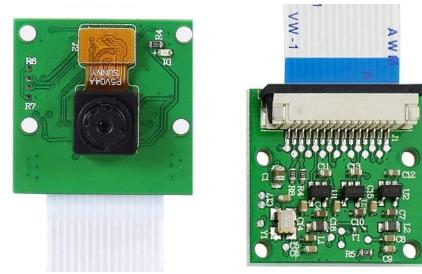
(Fig 1.1) RF transmitter and receiver



(Fig 1.2) Arduino Nano Mini



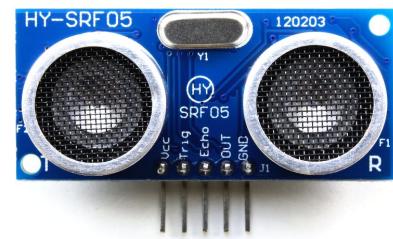
(Fig 1.3) Raspberry PI Zero



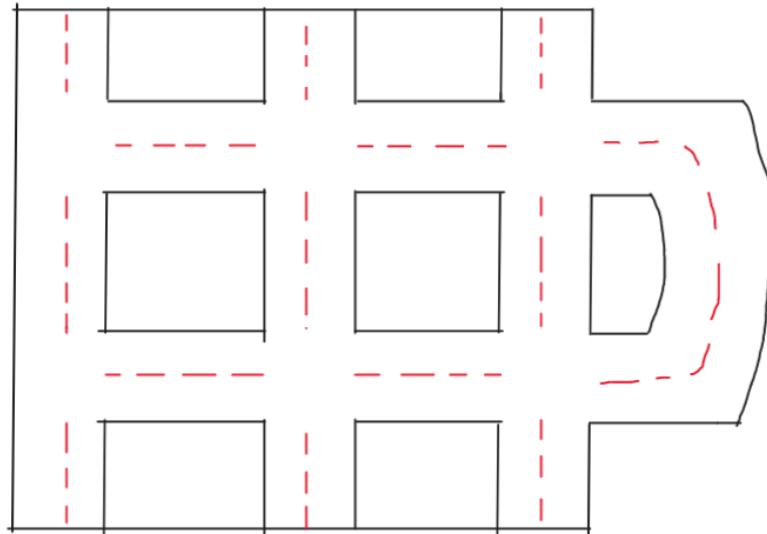
(Fig 1.4) Raspberry PI Camera



(Fig 1.6) XYZ Angular Analog Accelerometer

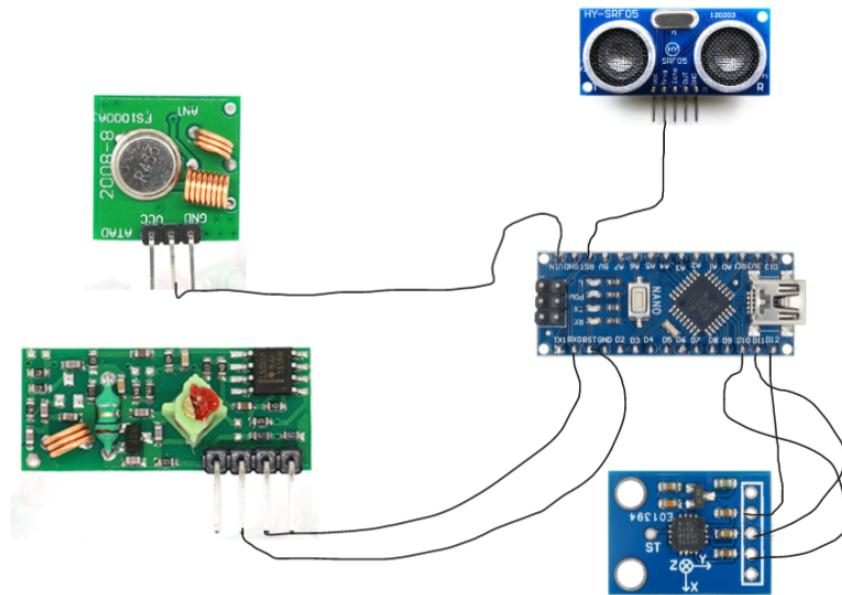


(Fig 1.7) Ultrasonic



(Fig 1.8) Intersection Simulation Map

These are just what we need to create a beta version of the smart traffic signal. As shown in figure 1.9, by combining the RF transmitter and receiver with the ultrasonic and the XYZ module, we can create the computer block needed on the car. So, this system will be able to communicate with other systems with similar structures and transfer the data of the ultrasonic and the XYZ module.



(Fig 1.9) STS System on the cars

The data sets include:

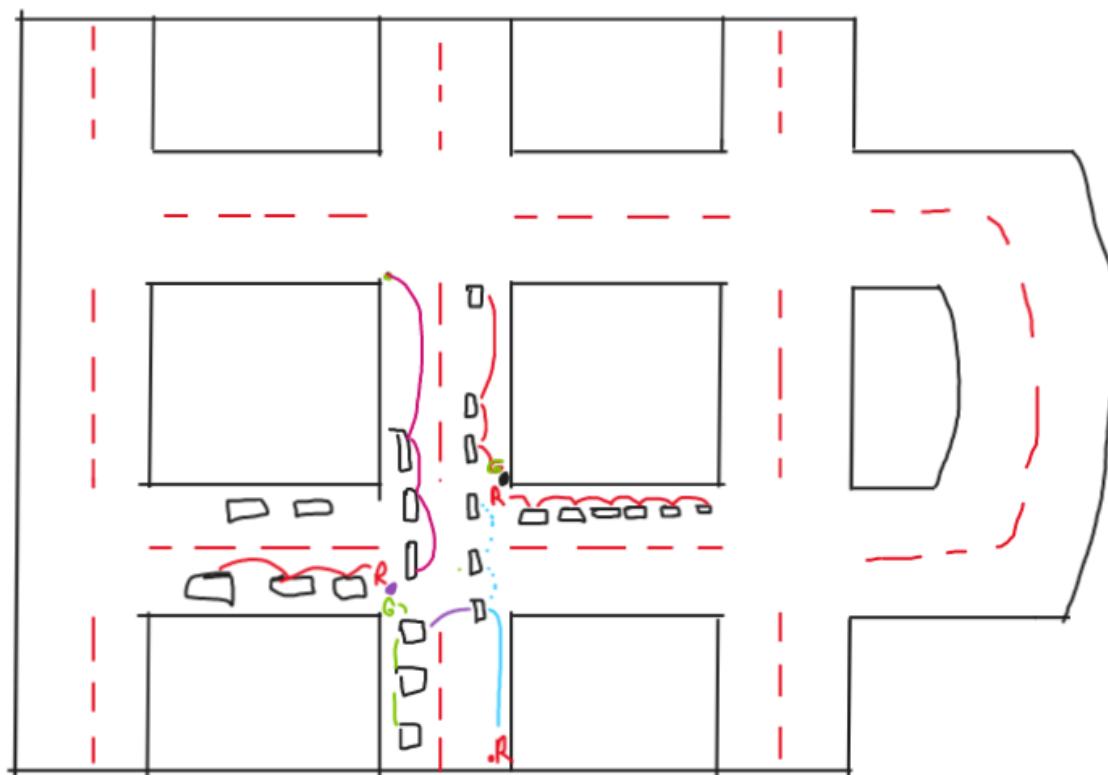
1. [X, Y, Z]
2. Speed of the car
3. Distance between the cars with reading the ultrasonic data.
4. The status of the light
5. The ID of the car.

This all will be sent in one 2D array looking like below:

Data [16][64] = [ID][LOCX, LOCY, LOCZ, Speed, Ultrasonic1, Ultrasonic2, Ultrasonic3, Ultrasonic4, Light Status]

The traffic light will have the Raspberry PI, XYZ module, camera, and the RF receiver and transmitter. The data on the cars will be received by the raspberry pi and then the system will determine how to behave. We are still working on the algorithm and trying to find the best way to solve the problem with the given car data and the camera installed at the intersection.

First Scenario:



Meeting summary:

Label each intersection (i.e A,B,C ...).

Assign each car a unique ID.

Edge-server.

Cameras should be assigned to each lane.

We need to simulate the intersections and the traffic singal on a floor matt with bars installed with RGY lights.

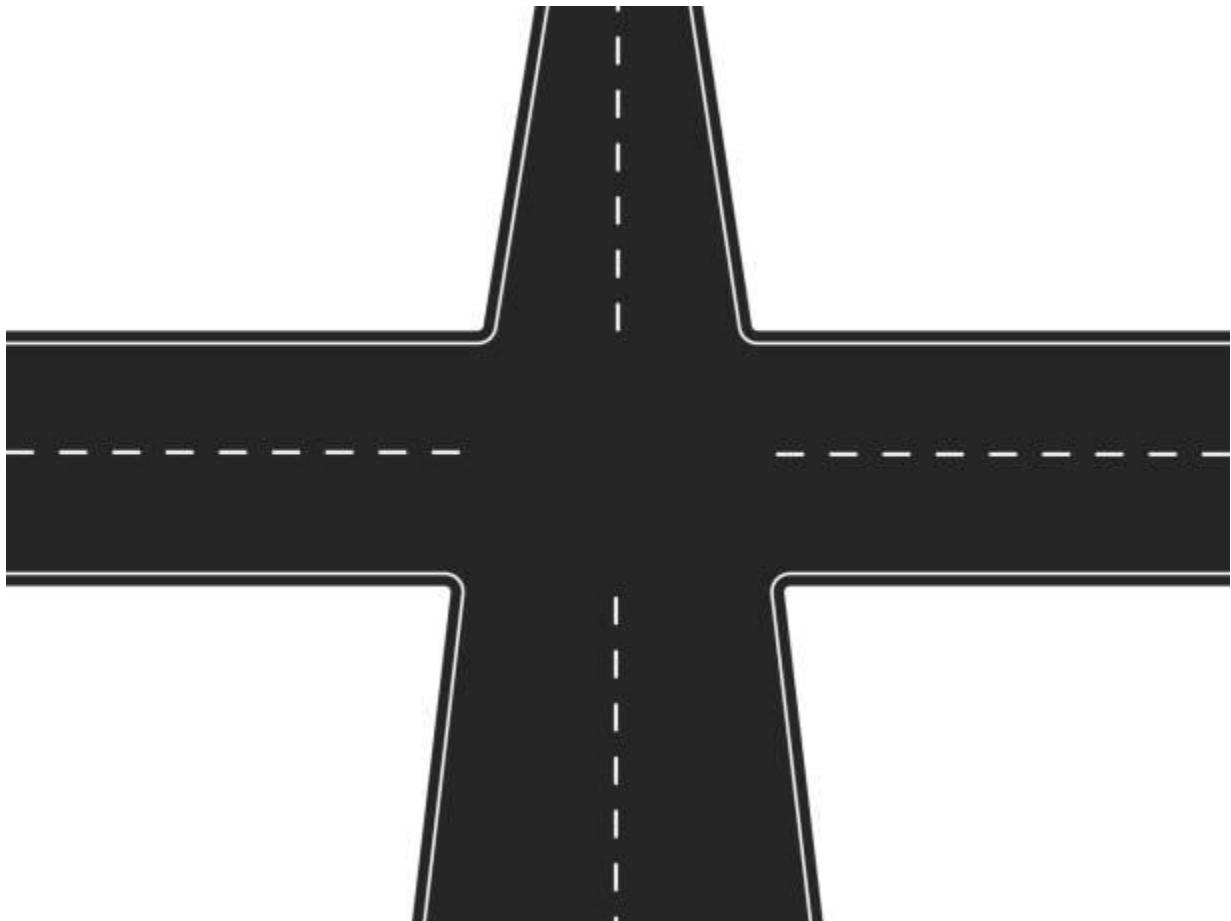
We should make scenarios about the communication between the cars and the lights with how the planning for the status of the lights work.

We should make a list of advantages and disadvantages for both connection we want to use. One is connecting all of the cars and then send the data to the server and the other one is about making the connection directly with the edge servers which are the lights on each intersection.

The scenarios:

Scenario number UNO:

In this scenario, we assume that the intersection has two sides and there is no turn left route. On one side of the intersection is the major street which does not have any left turns. As you can see in the diagram, in the major street, each side has two sides. On the right side of each lane, there are cars parked since it is the parking law for a curtain out of the road.



So, if one car we arrange the cars like bellow,

