Project Proposal for Smart Traffic Light

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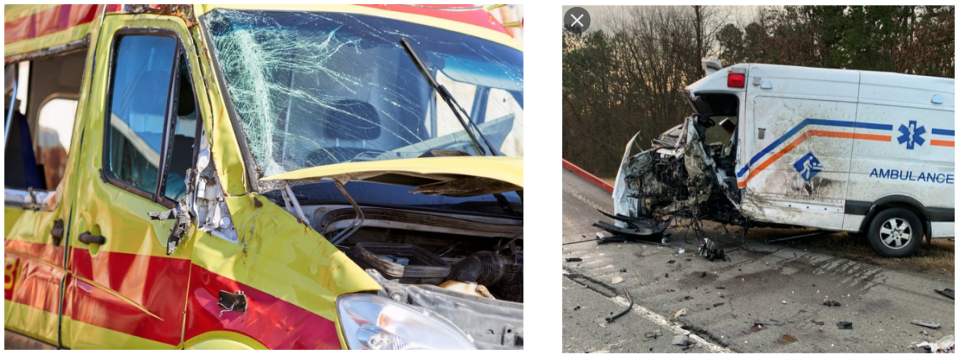
1 Summary

- Research question: Ambulance, police car, fire engine, or other emergency vehicles that use a siren and flashing lights have the right of way. Vehicles not in emergency service should pull to the right side of the road and stop till the emergency vehicles have passed. However, as these vehicles routinely speed to saving countless lives, they also put themselves in a dangerous condition. Especially at the crossroad, vehicle drivers might not be aware of the siren and choose to continue driving through the intersection when they see the green light. Emergency vehicle who drives through a red light is more likely to hit or hit by the moving cars at the crossroad, shown in Figure 1. It is urgent to save the hero's lives by stopping the vehicles driving into the intersection of the road before emergency vehicles pass by.

- Expect to Achieve: We plan to utilize the civilian cameras and sound detectors at the crossroads to detect emergency vehicles. When the sound detector detects the siren, the traffic light begins to flash. When the camera captured the emergency vehicles, and at the same time, the sound detector detects the siren, the traffic lights in its moving direction will turn green.



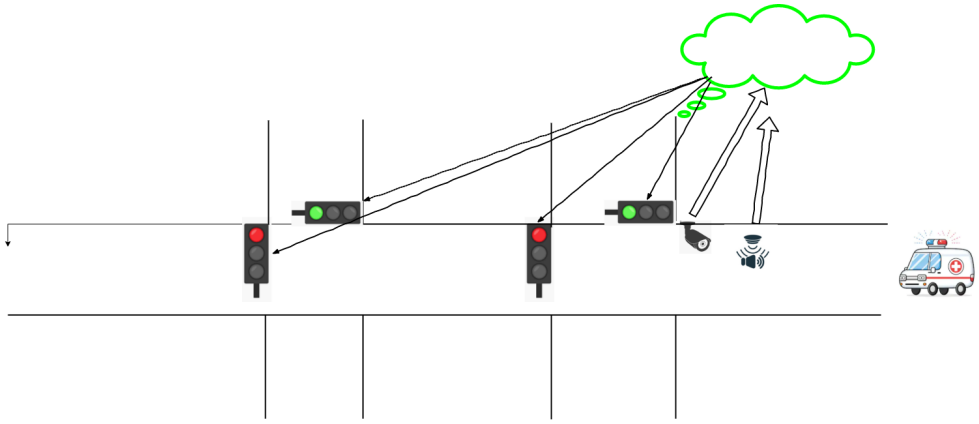
(a) **(b)**

Figure 1: Emergency vehicle accidents.

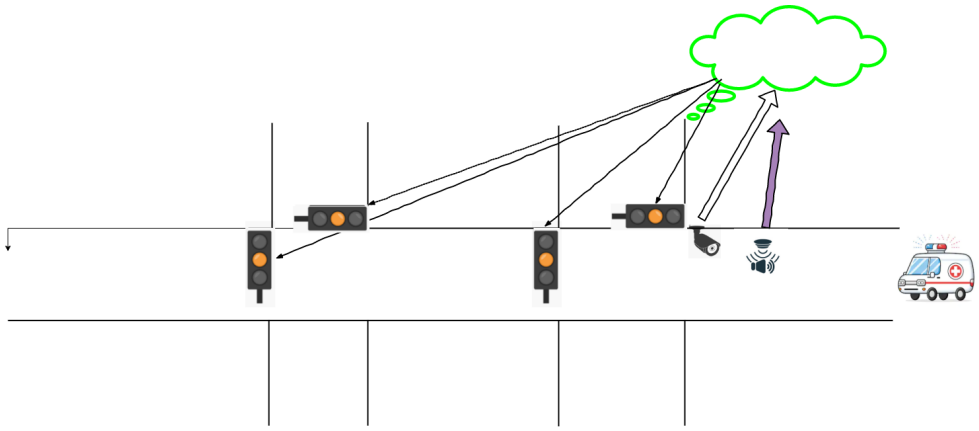
2 Introduction

IIn this project, we were planning to integrate a GPS module with the emergency vehicle. GPS sends information to the cloud and then control the traffic light. The GPS can provide the knowledge of the vehicle's moving direction, and the location of the traffic lights are all recorded in the cloud. However, due to the accuracy of the GPS is low, the one we plan to purchase has an accuracy of 5 meters, it will be tough for us to demo at the SEH basement. We move the sensors from the emergency car to the traffic light and remove the GPS part. We decide to use a sound detector to detect the siren and a camera to capture the emergency vehicle. The camera should cooperate with the sound detector. If the emergency vehicle is not on duty, the sound detector will not detect the siren. The signal from the camera itself will not work. The sound detector has a larger detection area compare with the camera, so when the siren is detected, the traffic light

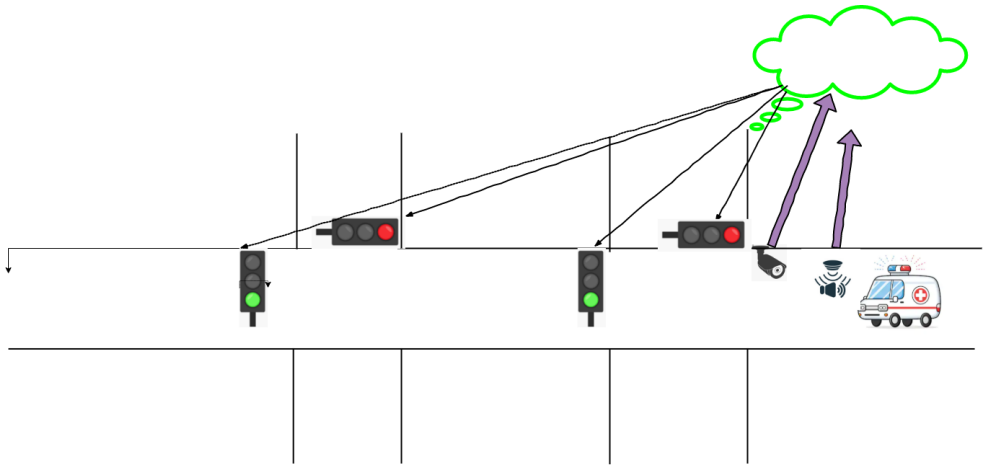
will turn to yellow or flash to warn the vehicles as a stop sign. While keep sending the signals to the cloud, the emergency vehicle moving close to the camera, the camera can detect the emergency vehicle and predict its moving direction and send the message to the cloud. At this time, the cloud has received the signal from both the camera and the sound detector. Then the cloud will turn the traffic light to green according to the moving direction and set the traffic lights to red for other routes. Figure 2 shows the detailed design.



(a)



(b)



(c)

Figure 2: Smart traffic light. (a) Before sound detector and camera detect the emergency vehicle. (2) The sound detector detects the siren, and the traffic light turn yellow and flash. (c) When the camera capture the movement of the emergency vehicle, the lights on its moving direction will turn green while other directions will trun red.

3 Approach

3.1 Component Breakdown

- Camera part (Huachuan)
- Sound detection part (Cuidi)
- Cloud control part (Cuidi and Huachuan)
- Traffic light part (Andrew)

3.2 Purchase plans

- Siren police car with remote control (option 1) around 16 dollars.
  https://www.amazon.com/RC-Concept-Police-Car-Function/dp/B015YLHWSC/ref=cm_cr_arp_d_product_sims?ie=UTF8
- Siren police car move use fraction (option 2) below 10 dollars.
  https://www.amazon.com/Toy-Enjoy-Ambulance-Light-Effects/dp/B07KT8WXXW/ref=sr_1_7?keywords=siren+light+toy&qid=1581288992&sr=8-7
- Raspberry Pi Mini Camera Video Module 5 Megapixels 1080p Sensor OV5647 Webcam for Raspberry Pi Model A/B/A+/B+, Pi 2B and Raspberry Pi 3B, Pi 3 B+, Raspberry Pi 4 B
  https://www.amazon.com/Raspberry-Camera-Module-Megapixels-Sensor/dp/B07L82XBNM/ref=asc_df_B07L82XBNM/?tag=hyprod-20&linkCode=df0&hvadid=343234125040&hvpos=1o1&hvnetw=g&hvrand=8909236505216670 37&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9053018&hvtargid=pla-717544328579&psc=1&tag=&ref=&adgrpid=68968886317&hvpone=&hvptwo=&hvadid=343234125040&

hvpos=1o1&hvnetw=g&hvrand=8909236505216670 37&hvqmt=&hvdev=c&hvdvcmdl=
&hvlocint=&hvlocphy=9053018&hvtargid=pla-717544328579

- Raspberry Pi 4 Model B 2019 Quad Core 64 Bit WiFi Bluetooth (4GB)
  https://www.amazon.com/Raspberry-Model-2019-Quad-Bluetooth/dp/B07TD43PDZ/
  ref=asc_df_B07TD43PDZ/?tag=hyprod-20&linkCode=df0&hvadid=380013417597&
  hvpos=1o3&hvnetw=g&hvrand=9435810075559801611&hvpone=&hvptwo=&hvqmt=
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  hvpos=1o3&hvnetw=g&hvrand=9435810075559801611&hvqmt=&hvdev=c&hvdvcmdl=
  &hvlocint=&hvlocphy=9053018&hvtargid=pla-781430589105
- Traffic lights
  https://www.amazon.com/Pi-Traffic-Light-Raspberry-pack/dp/B00RIIGD30/
  ref=sr_1_2?keywords=raspberry+pi+traffic+light&qid=1581290784&s=electronics&
  sr=1-2