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Traffic Security Monitor

Project Background

Waverley road, located in northern Dartmouth, passes through a large residential area but is very narrow and has no sidewalks. Residents are concerned with racers who intentionally speed far above the 50km/hr limit, endangering drivers and pedestrians. When reporting traffic violations to the police, residents are unable to identify perpetrators and traffic laws cannot be enforced.

The project objective is to obtain the license plates of speeding vehicles in order to allow residents to identify traffic violators.

The System Must...

- Measure the speed of passing vehicles and determine when a vehicle is speeding
- Take photos of a speeding vehicle's license plate and save it
- Be able to operate close to the road autonomously in various weather conditions
- Remain hidden to drivers

Design Overview

The **Traffic Security Monitor** has three main modules:

Speed Sensor Module
Detects passing vehicles and calculates speed. If the speed is higher than the limit, it signals the camera to capture

Camera Module
Captures readable license plate image of speeding vehicle, generates a JPEG image.

Memory Module
Saves image file to an SD card which can later be accessed by the user.

Additionally, programing will take place on the Arduino UNO and the system will be powered by a rechargable Li-Po battery, making it autonomous
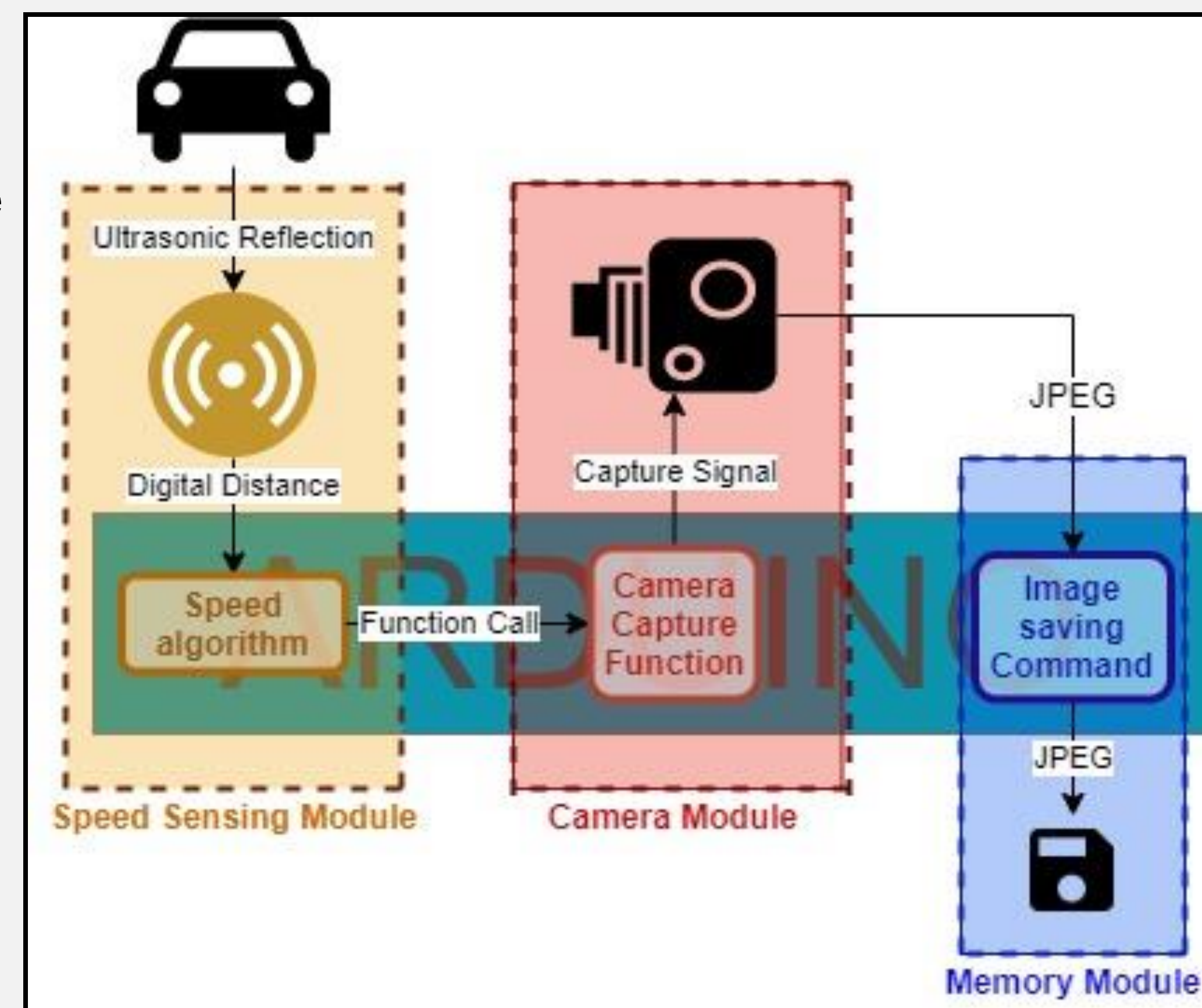

Future Recommendations

Camera testing at nighttime showed that the streetlight did not produce enough brightness in the captures. An IR flash integrated camera such as the OV5648 may improve nightvision but is only supported on Raspberry Pi. Therefore, future versions should use the Raspberry Pi as the core processor with the Ov5648 to improve nighttime captures.
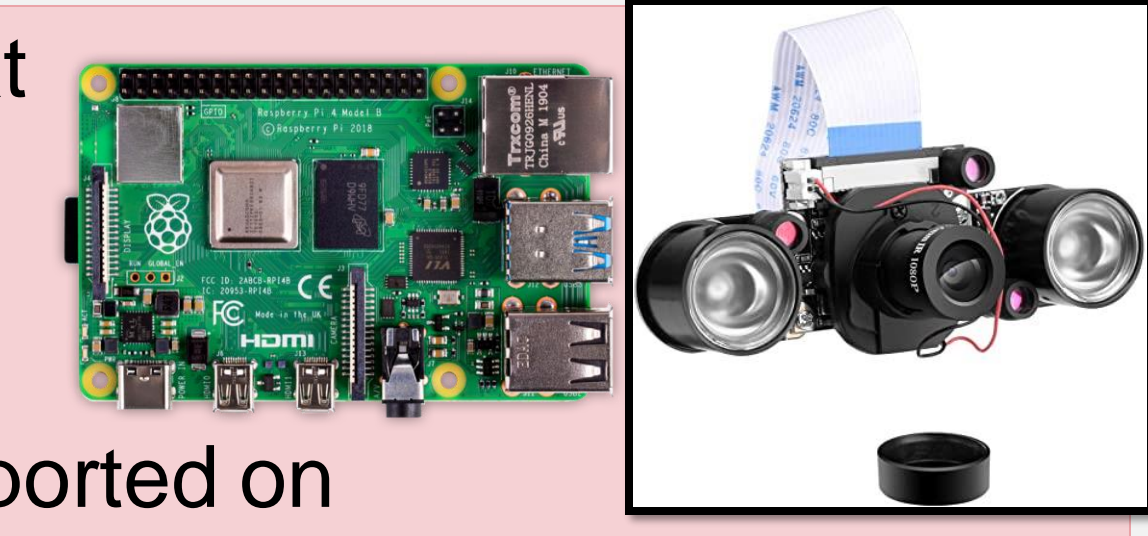
The **ultrasonic sensors** ordered came broken and new ones were unable to be purchased due to the unforseen covid-19 spread and long shipping times. For future versions of the project, a lidar is recommended for speed detection as it uses light and offers higher sampling frequency which allows reliable detection of high speeds.

Upon integration, it was found that the **SD-adaptor** was unable to share the SPI line with the camera as it would not release the MISO line. It is recommended that future versions use bluetooth/wifi to transfer images to a host compter. This would also allow the user to access Images without physically taking the system apart.
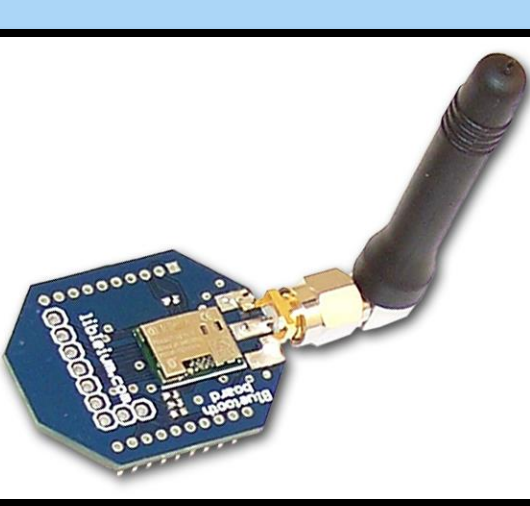
In conclusion, because of complications in integration due to unforseen circumstances, the prototype was never fully installed and tested on Waverly road. The work done by the team can be used as in the future as a refrence in further developing the project.

Refrences

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## Modular Design

Memory

The memory card can be installed on the microcontroller using a micro SD card adaptor. 32 GB SD card is used for saving the captures of license plates. The diagnostic of the SD Card was printed through serial on the Arduino to confirm communication.

When an image file is produced by the camera, it is saved to the SD-card

Speed sensor

Two Maxsonar EZ4 ultrasonic sensors are installed parallel to the road and at an angle to each other to avoid the signals from interfering.
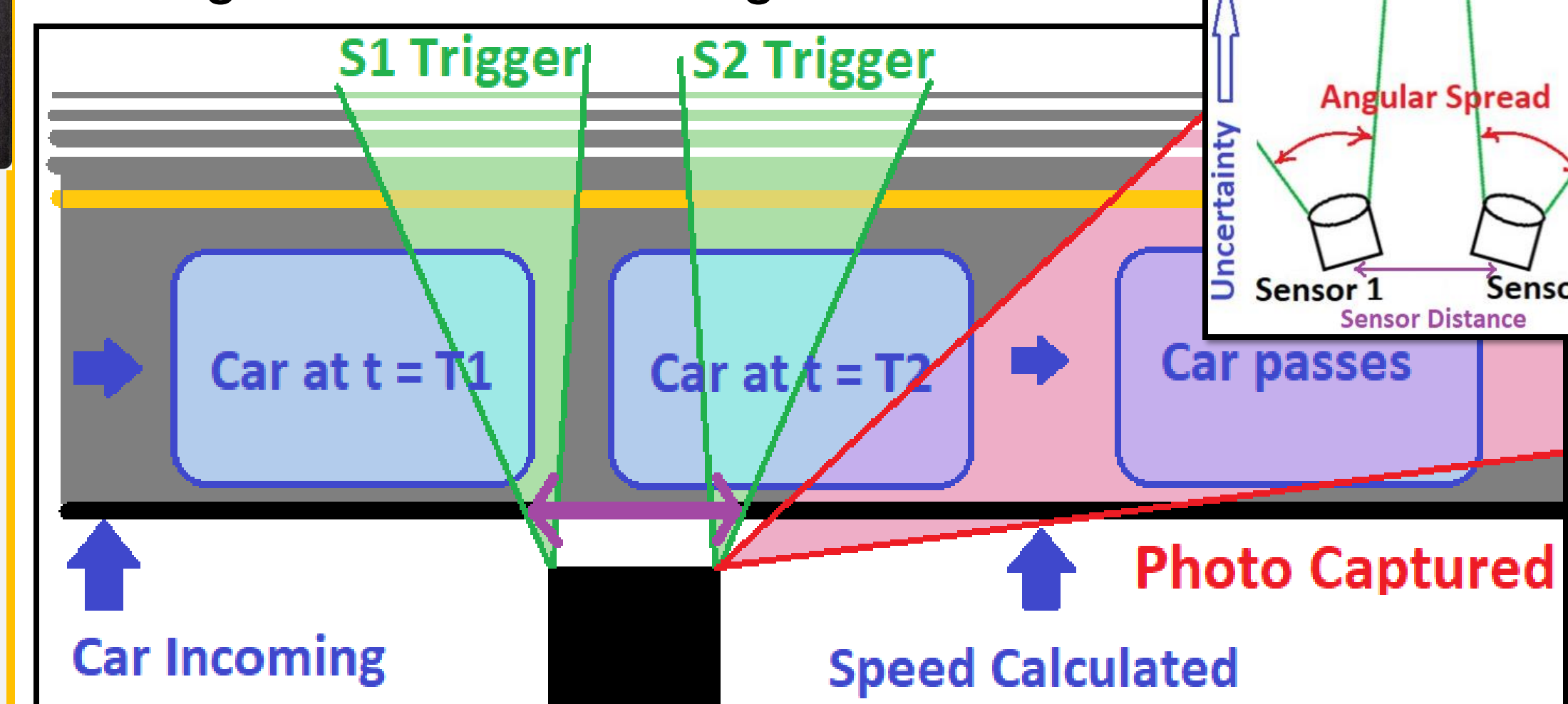
Additionally, only one sensor is activated at a time to further reduce overlap. When S1 is triggered, the timer starts and S2 turns on. The timer stops when S2 detects a vehicle and the speed is calculated by:

$$V_{vehicle} = \Delta D_{sensor} / \Delta T_{sensor}$$

Camera

Module Requirement	Positive Effects	Negative Effects
Fast Shutter Speed	Captures movement	Darkens Photos
Light Source	Brightens photo	Visible to Drivers
High Resolution	Readable License Plates	Higher chance of image corruption

In order to remain invisible to drivers, the streetlight was utilized as a light source. Additionally, the Arducam OV5642 was selected for its 5MP resolution and its programable shutter speed.

Daytime Captures

Photos taken on Waverly Rd. Automatic exposure used, license plates are readable.

Nighttime Captures

Photos taken on Waverly Rd under a streetlight. Programed with Manual shutter speed, license plates not completely readable