Project Tiresias: A Blind Intersection Advance Warning Device

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Problem Statement and Justification

Problem Statement
59,000 crashes in 2008 occurred at intersections with obstructed views of the road.

Justification
A report from the Nation Highway Traffic Safety Association (NHTSA) said that in total 787,236 crashes in 2008 occurred at intersections, 59,000 occurred at intersections with obstructed views. An additional 5.5% of these accidents at uncontrolled intersections occurred due to drivers' misjudgment of gap or other's speed. These statistics show a clear need for a new solution for blind intersection visibility.

Design Brief and Evaluation Criteria

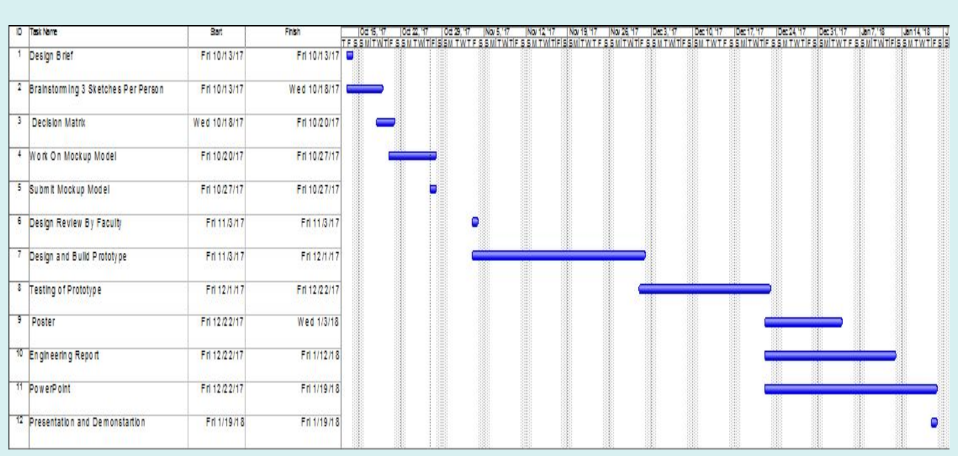
Design Statement
Design, build, and test an advance warning system that notifies if it is unsafe to exit or enter a blind intersection.

Client
Municipalities in which a substantial number of intersection with obstructed views or areas with a high rate of accidents

Constraints/Evaluation Criteria

- Less expensive than current solutions ($500)
- Must be visible to, but not distract the driver
- Must fit all local, state, and federal traffic laws and regulations
- Must withstand wild animals, a variety of weather conditions, and stresses of the outdoors
- Near instantaneous response time
- Components must communicate wirelessly without pairing

Gantt Chart



Prototype Operation

1. Place the traffic signal at the blind intersection and the car speed sensor within 300m along the road into the direction of oncoming traffic.
2. Measure the distance between the two devices. Measure the angle between the direction of the lidar sensor and the length of the road. It is advisable that the distance is between 50m and 300m and that the angle is between 5˚ and 25˚.
3. Open the trapdoor on the car speed sensor and hook up the Arduino inside to a computer.
4. Open the Arduino IDE and open an new serial monitor.
5. Save the angle between the direction of the lidar sensor and the length of the road into the Arduino's EEPROM memory by entering"<aX>" into the terminal, where X is in degrees.
6. Save the distance between the car speed gun and the street signal into the Arduino's EEPROM memory by entering"<dX>" into the terminal, where X is in centimeters and rounded to the nearest meter.
7. Switch on devices and allow cars to drive by the devices.

Advantages

- The solution is less expensive than a traffic mirror, which is the traditional solution to blind intersections.
- Drivers are able to know when a car is approaching from a greater range (up to 300m).
- The bright warning LED will make it harder for a driver to miss an approaching car
- During sunrise and sunset, the blind intersection system is more likely to identify an oncoming car compared to a mirror especially when the headlights of an oncoming car are not turned on.
- A driver will be less distracted checking for the presence of a light than if they have to scan their surroundings and mirrors for cars.
- A driver will spend less time determining if there is an approaching car, which allows them to spend less time at the intersection.
- Drivers will not need to pull out into the intersection to see the mirror from different angles or see around the bend.
- The device will calculate the time it takes for a car to reach the intersection, allowing you to know exactly when it is safe to continue driving.

Testing Method and Criteria

1. Set up the devices, following the operation instructions.
2. Drive a car past the sensor towards the blind intersection at a constant 30 mph.
3. Observe and record whether the street sign successfully turns on the moment the car passes the car speed sensor, and turns off at a reasonable time after the car passes (around the same time it takes to arrive at the blind intersection)
4. Repeat steps 8-9 three more times.
5. Repeat step 10 for 35 mph and 40 mph
6. Record if the LED successfully turns on due to the car.

Results and Conclusions

The device effectively signaled an oncoming car to a driver stopped at an intersection about 50% of the time. The initial failures were caused by a broken lidar sensor, which was later replaced. For redesign, higher quality materials such as plastic are suggested, as well as further weather- and tamper-proofing.

Trial	Result	Speed
1	Failure	30
2	Failure	30
3	Failure	35
4	Failure	35
5	Failure	40
6	Failure	40
7	Success	30
8	Success	30
9	Success	35
10	Success	35
11	Success	40
12	Success	40

CAD Drawings and Device Operation

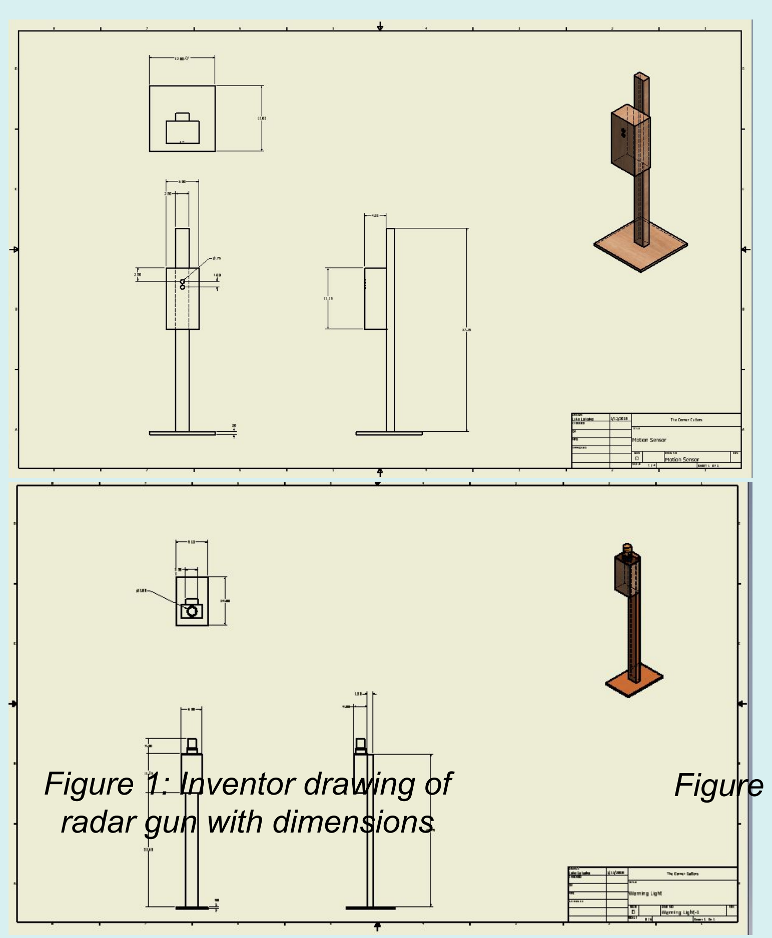


Figure 1: Inventor drawing of radar gun with dimensions

Figure 2: Inventor drawing of LED post with dimensions

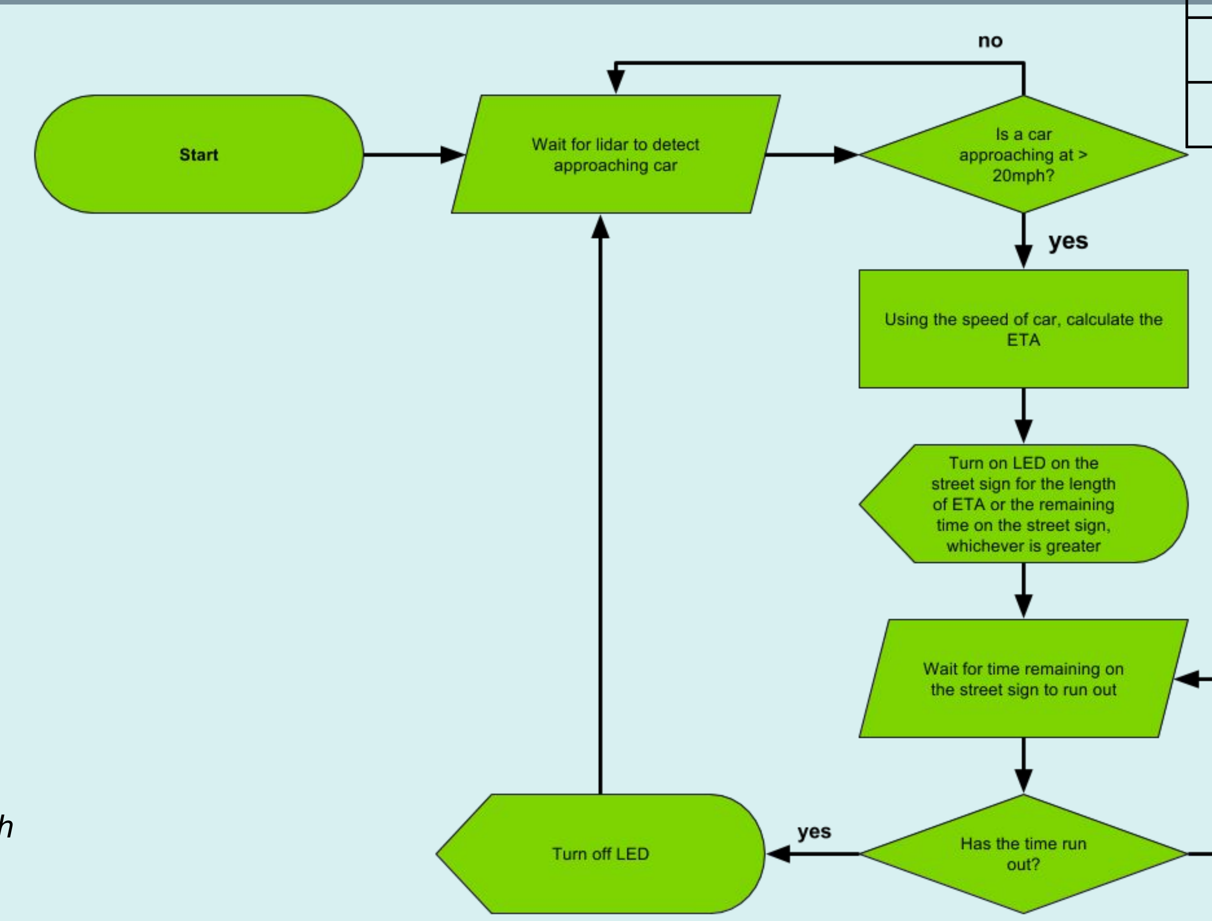


Figure 3: Software Flowchart

Figures 4 and 5: Final prototype and prototype in operation