# TRAIL CROSSWALK SAFETY AUTOMATION

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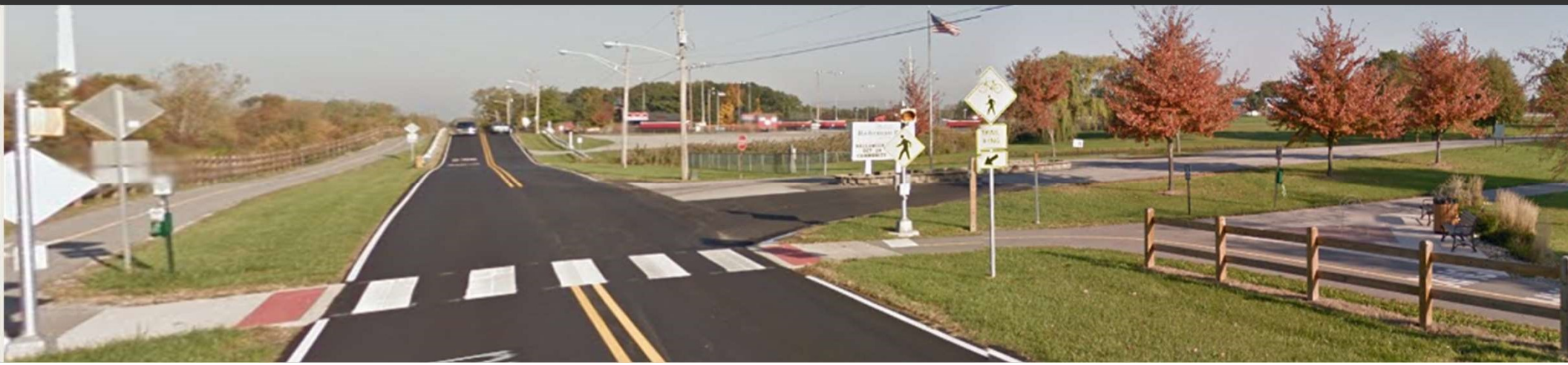
# PROJECT DESCRIPTION

- Pennsy trail at Rhorman Park, Schererville, IN
- Motivation - Increase convenience and safety
- Design Objectives – Utilize sensors to create automated detection system



# CROSSWALK CURRENT SETUP


- Current system is a simple push button
- Activates the flashing yellow beacon to warn drivers of pedestrians
- Motivation for automation
  - Only 4% button usage
  - Cars assume no pedestrians
- External Constraints
  - Complex bike path routing
  - Cost
  - Vandalism proof

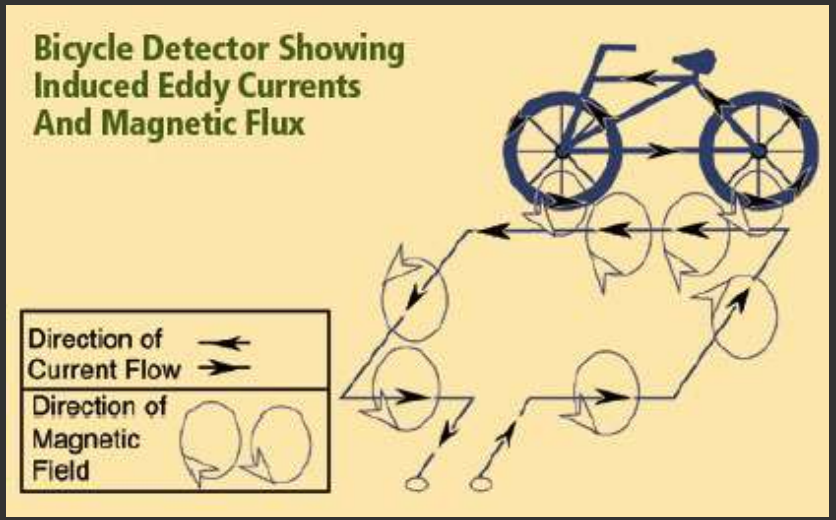
# CONSTRAINTS


- Complex Routing of the trail on Right Side
  - If pre-emptive, how do you tell who's crossing or not?
- Does it Interface with the Current setup to reduce cost?
- Is it Protected against Vandalism
- Pedestrian Traffic vs Car Traffic
  - Is the intersection worth the a larger investment

# BACKGROUND

# FEDERAL HIGHWAY ADMINISTRATION

- Induction Loop
- Many automobile intersections use induction loop sensors.
- FHWA engineers found high sensitivity can detect bicyclists.
- detection along the edge of the sensor loop.
- middle results in no detection.
- cannot detect carbon fiber bicycle frames or pedestrians.



# SRF CONSULTING GROUP, INC.

## Bicycle results

| Sensor | Technology | Baseline | Sensor Count | % Difference |
|---|---|---|---|---|
| Induction loop | Magnetic | 100 | 100 | 0% |
| Autoscope-Solo | Video | 100 | 101 | 1% |
| SmartWalk | Microwave | 100 | 96 | 4% |
| ASIM-DT272 | Passive infrared/ Ultrasonic | 100 | 101 | 1% |
| Diamond Traffic counter | Active Infrared | 100 | 96 | 4% |

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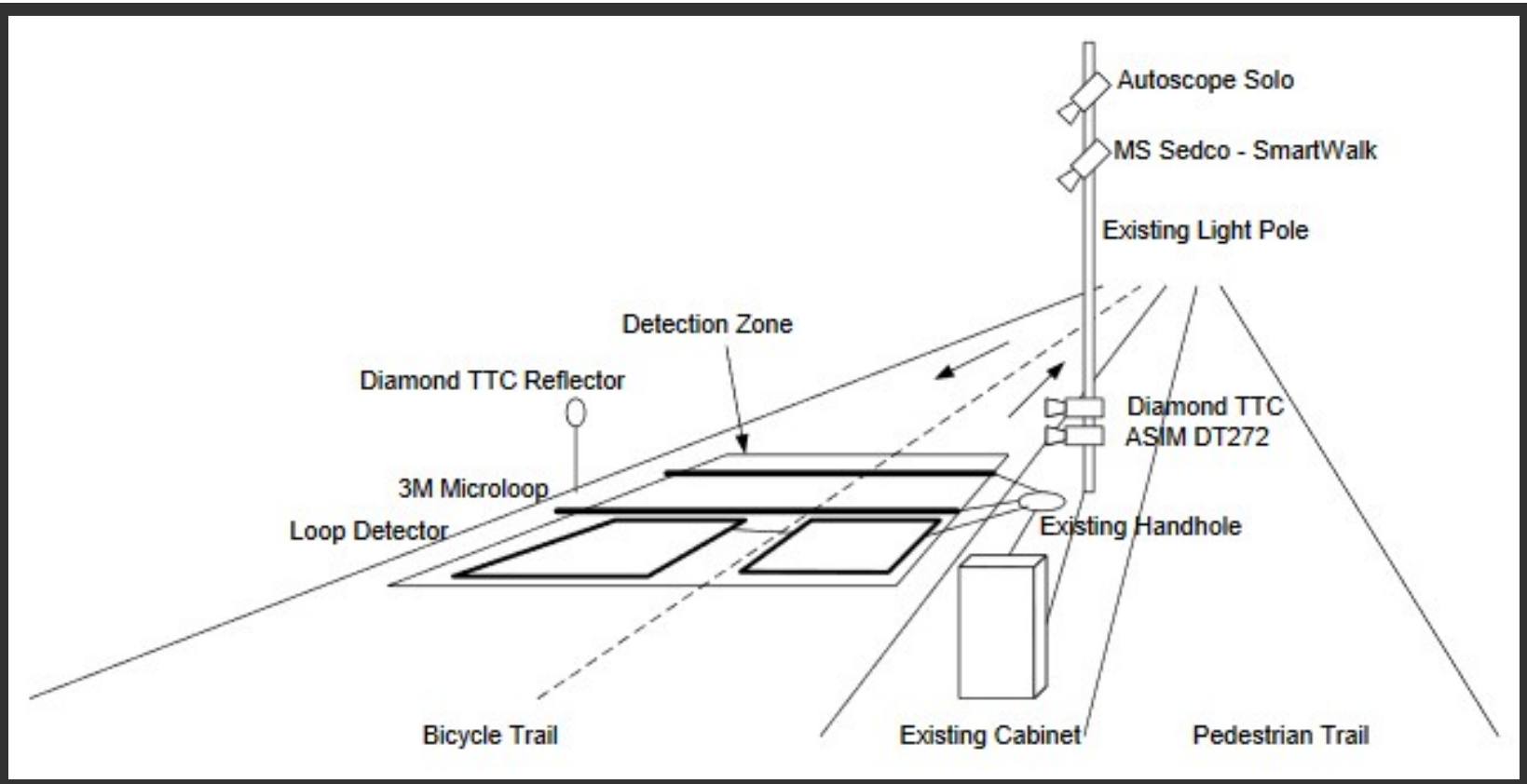
## Pedestrian results

| Sensor | Technology | Baseline | Sensor Count | % Difference |
|---|---|---|---|---|
| Autoscope-Solo | Video | 100 | 100 | 0% |
| SmartWalk | Microwave | 100 | 100 | 0% |
| ASIM-DT272 | Passive infrared/ Ultrasonic | 100 | 100 | 0% |
| Diamond Traffic counter | Active Infrared | 100 | 93 | 7% |

# SRF SENSOR MOUNTING



# SENSORS

**FLIR TrafiOne: Thermal Imaging**

**MS Sedco SmartWalk: Microwave**

**Autoscope Solo Terra: Video**

# LOW COST SENSORS

## Laser Beam Break

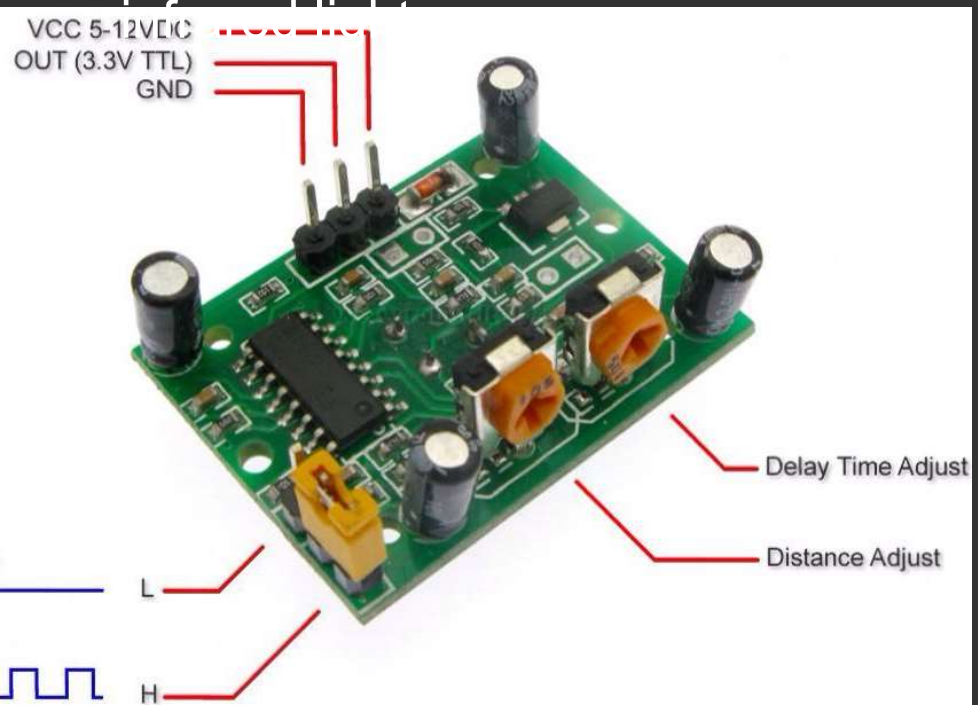
- Photoresistor senses light from a laser transmitter
- Triggers flashing light when it no longer detects laser light
- **Pros:**
  - Easy to place
- **Cons:**
  - Laser is harmful to vision
  - Difficult to align
  - Easily misaligned

## Active Infrared Beam Break

- LED sends pulses of IR light
- Used in garage door sensors
- Triggers at gaps in the signal
- **Pros:**
  - Not harmful to vision
  - Easy to align
- **Cons:**
  - Frequency must match
  - Light can bounce around object

# PASSIVE INFRARED MOTION DETECTION

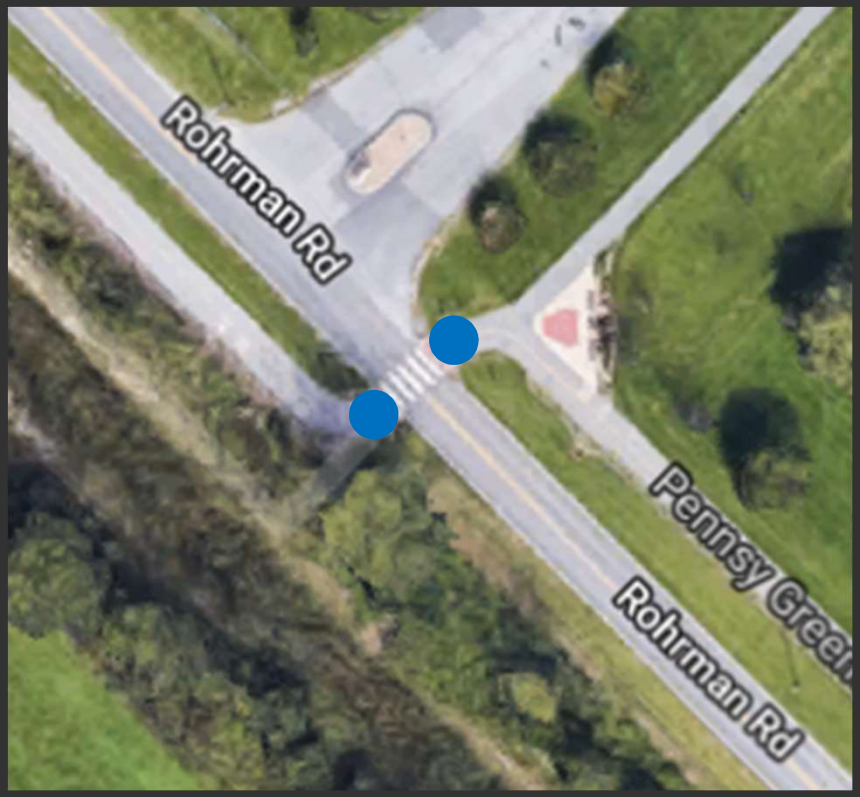
- Single unit that senses a change in the ambient




- Used is automatic light switches
- **Pros:**
  - No receiver module needed on other side of trail
  - Easy installation
  - Built in delay time and distance sensitivity adjustments
- **Cons:**
  - Wide detection angle could pick up animals

# RESULTS

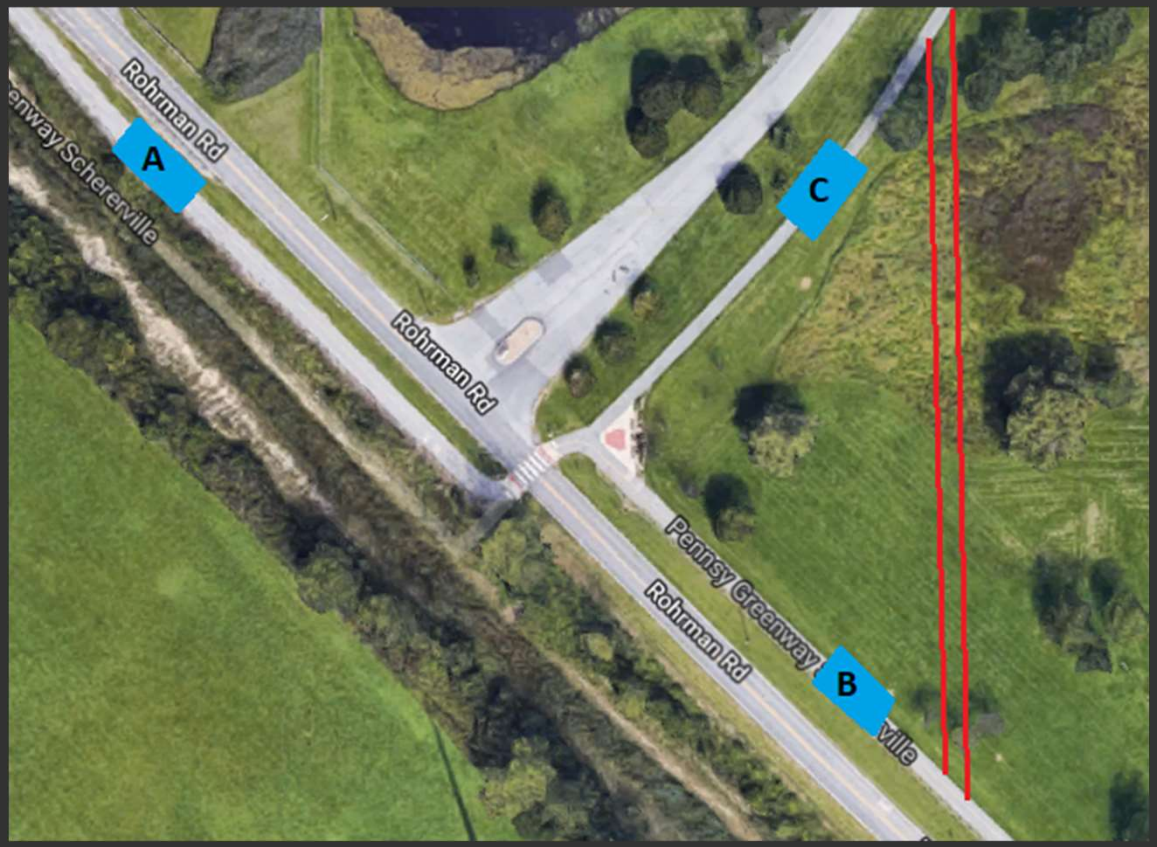
# DESIGN 1




- Similar to current setup
- Automating the current push button system
- Activates warning lights as people approach the interaction

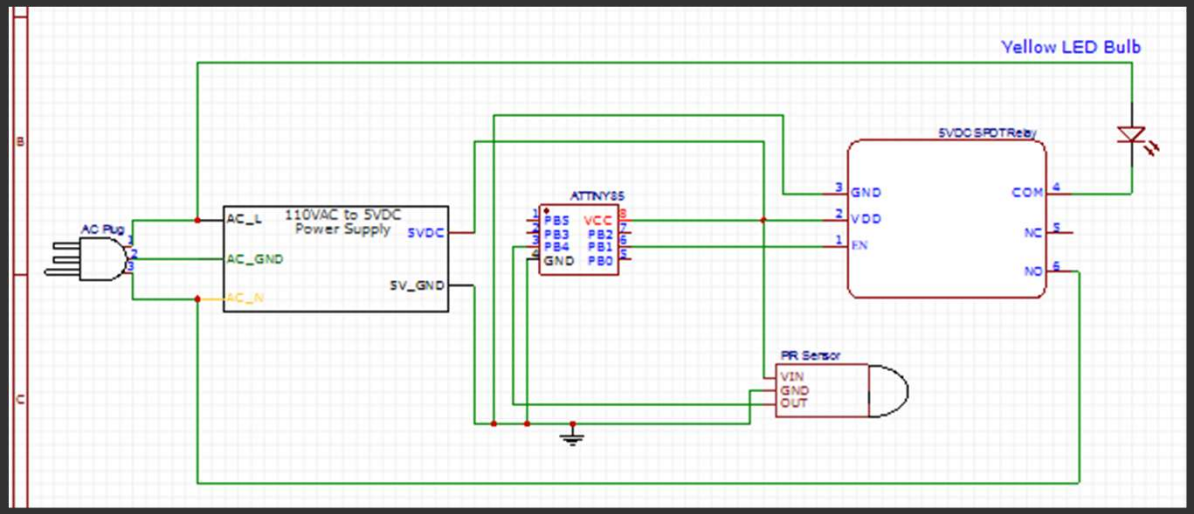
- Reduce inconvenience
- Safety for pedestrians and drivers
- Real time sensors

# DESIGN 2




- Pre-emptive detection system
- Uses the Pre-Emptive Sensors
- Turn on Light as they arrive at the intersection, senses before they arrive
- Calculates timer based on speed of walkers or bicyclist
- Bypass(red):
  - Reduce False positives
  - Unnecessary traffic interference
  - Signs tell people to take bypass if not crossing

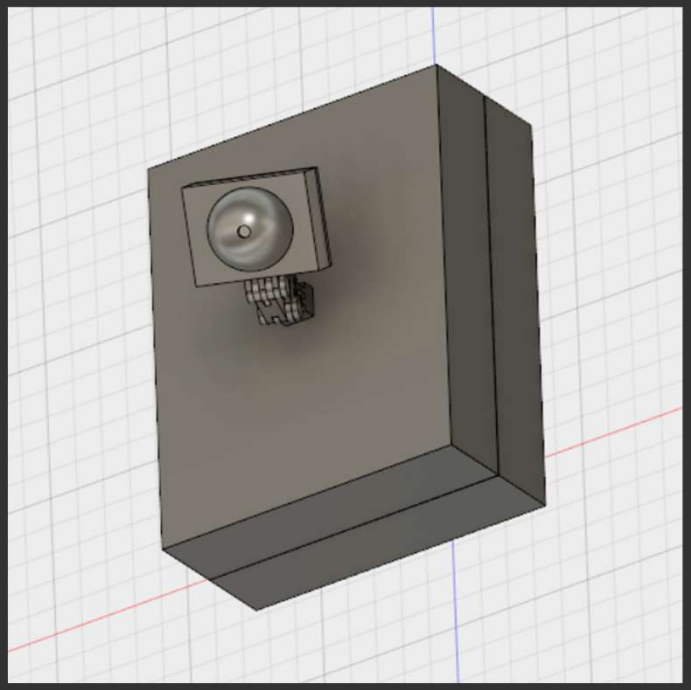
# PROTOTYPE: ELECTRICAL




- Design 1: Cheaper option

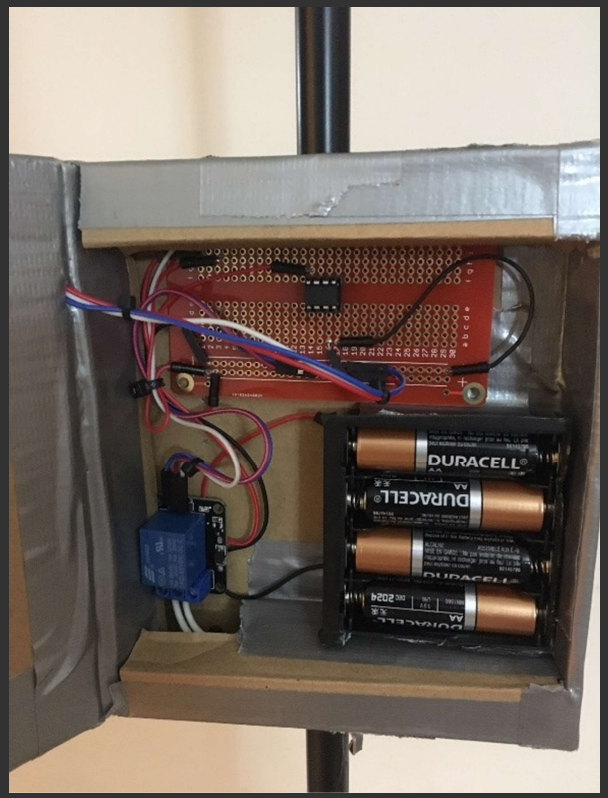
- Utilizing passive infrared sensor
- Sensor placed in parallel with the button
- ATTiny85 microcontroller

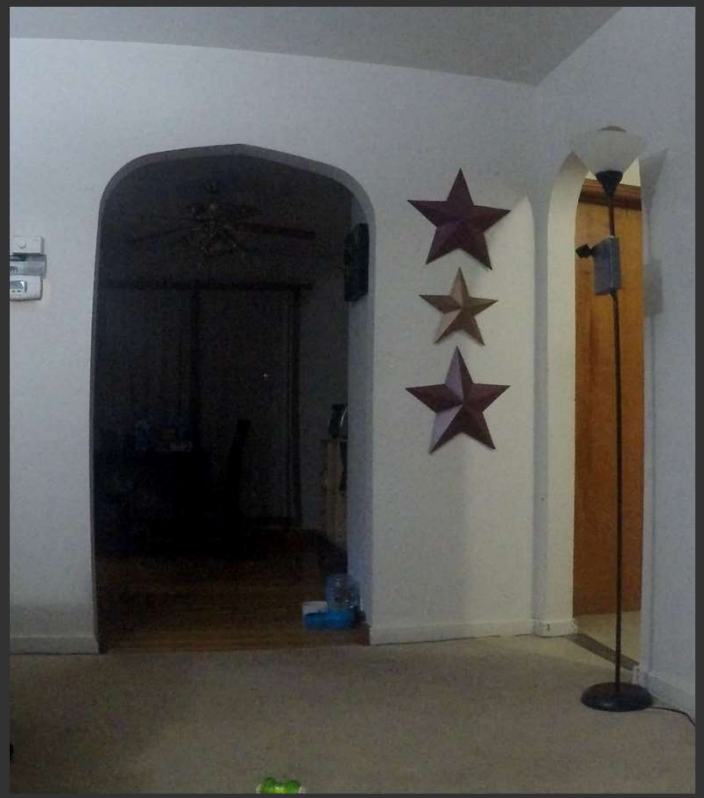
# PROTOTYPE: ENCLOSURE



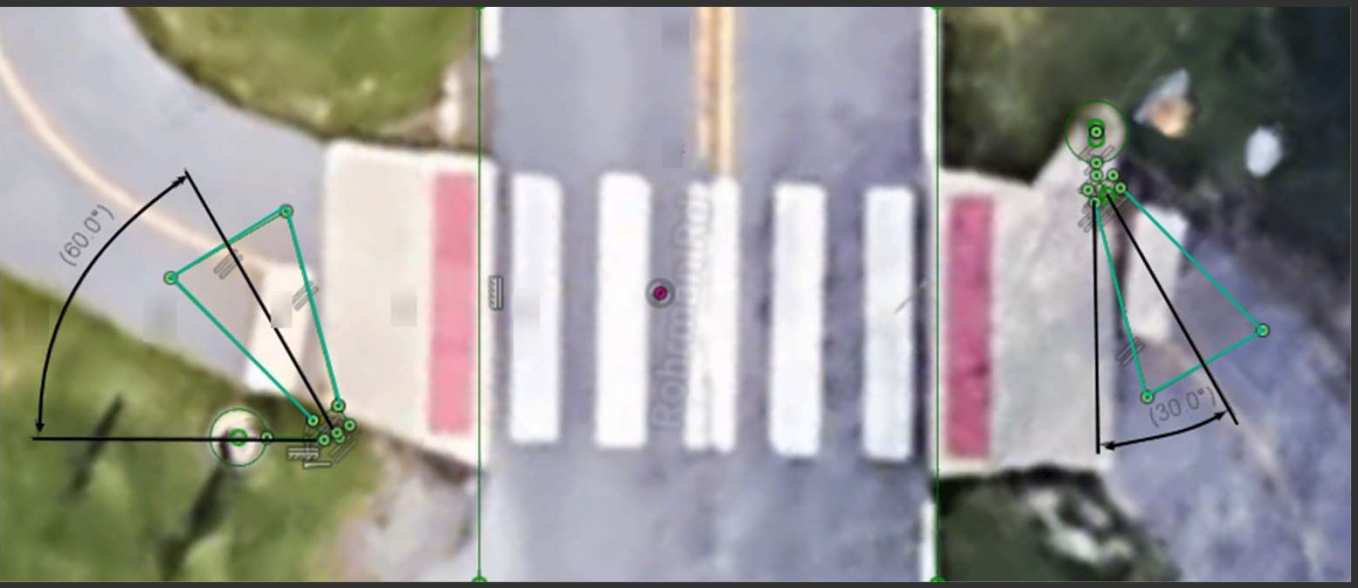
- Enclosure used in testing
- Adjustable sensor positioning
- 3D printed sensor enclosure

# PROTOTYPE



# TEST RESULTS




- Placement:
  - 6 ft. up from post
  - 30 degrees away from road
  - 30 degrees downward
- Sensor:
  - 20 ft. detection range
  - Sensor cover reduced detection
- Consistently detects  in detection zone

# TEST RESULTS

# RELEVANT FINANCIAL DATA

| Description | Quantity | Price | Vendor |
|---|---|---|---|
| 8 pin dip through hole solder socket | 2 | $1.23 | uxcell (Amazon.com) |
| ATtiny85 Microcontroller, 8 pin PDIP | 2 | $5.39 | ELITE.CITI (Amazon.com) |
| USB ISP Programmer for ATtiny | 1 | $9.99 | Atomic Market (Amazon.com) |
| EMY 5 X HC-SR501 Adjust Ir Pyroelectric Infrared PIR Motion Sensor Detector Modules | 2 | $4.40 | EMY LTD (Amazon.com) |
| Solder-able Breadboard Proto Board | 2 | $5.15 | Gikfun_Official_Store (Amazon.com) |
| 5v Relay Module | 2 | $11.60 | MyDealsZone (Amazon.com) |
| Total | | $37.76 | |

# CONCLUSIONS

- Increase the safety and convenience
  - Light gets utilized
  - Drivers not “numb” to constantly blinking light
  - Eliminates human element
- Best sensors for implementation
- Consistently detects pedestrians on trail
- Does not detect cars on road if positioned correctly
- Results can be used in similar crosswalks

# QUESTIONS?

Thank You