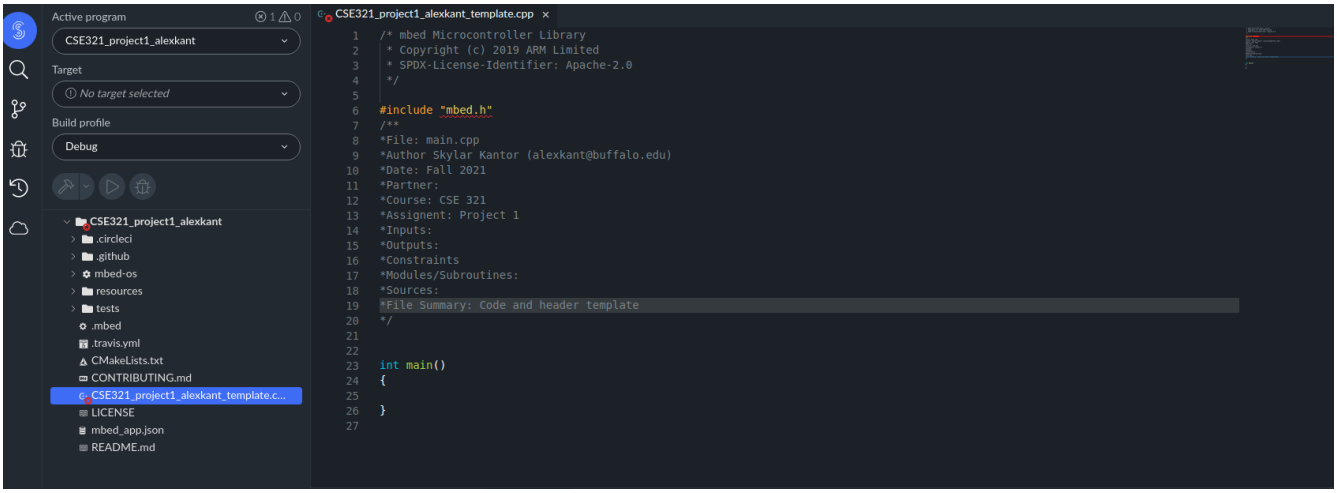

GitHub Username: skylar-kantor

Part 5

Ask

Purpose:
Keep geese and vehicles from colliding

Inputs:

- Goose sensor
- Vehicle sensor

Outputs:

- Solid red light when geese are present
- Flashing red light when no geese are present

Constraints:

- Single light
- Must keep geese and traffic separate

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Research

What options exist for detecting traffic?[1]

- Magnetic/induction
  - Pros:
    - Mature technology
    - Simple
    - Accurate
  - Cons:
    - Not good at detecting different types of vehicles
    - Road must be closed for maintenance (This will probably disturb the geese too)
- Radar
  - Pros:
    - Could possibly detect geese
    - Not sensitive to weather
  - Cons:
    - Cannot always detect stopped vehicles
    - Need to process the data before it's useful
- Infrared
  - Pros:
    - Simple
    - Mature technology
  - Cons:
    - Lens needs to be cleaned regularly
    - Weather sensitive, especially fog
- Acoustic:
  - Pros:
    - Widely used
    - Not sensitive to weather or light levels
    - Simple setup
  - Cons:
    - Temperature sensitive
    - Has issues with slow or stop-and-go traffic
- Video
  - Pros:
    - Easy to update with road expansion
    - Lots of information
  - Cons:
    - Movement of camera or other objects in frame can cause issues
    - Lots of extra processing
    - Lens needs to be cleaned

[1] https://ops.fhwa.dot.gov/publications/fhwahop06006/chapter_6.htm

What options exist for detecting animals?

- Video
    - Same as above
- Buried Cable[2]
    - Pros:
        - Not weather sensitive
        - Works even with snow on the ground
        - Accurate
    - Cons:
        - Not able to detect goose size animals well
- Radar:[3]
    - Pros:
        - Gives range information
        - Gives size information
        - Not weather sensitive
        - Also detects vehicles
    - Cons:
        - Not good at detecting stopped objects
        - Need to process the data before it's useful
- Laser Tripwire[4]:
    - Pros:
        - Simple
        - Widely used
        - Can be powered with roadside solar
    - Cons:
        - No range information
        - Cannot tell the difference between geese and anything else

Imagine

Looking at the available options, it seems that using an induction loop to detect vehicles, and a radar detection for geese would be most practical. The induction loop is one of the most commonly used traffic detection devices in the US[5], so it will be easiest to get installed and maintained. While both radar and video animal detection do require additional processing compared to something like a laser tripwire, the added range information will give the extra time needed to make sure cars are clear of the intersection without impacting the geese.

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[2] https://journals.sagepub.com/doi/abs/10.1177/0361198120936651

[3] https://ops.fhwa.dot.gov/publications/fhwahop06006/chapter_6.htm

[4] https://www.govtech.com/public-safety/roadside-systems-detect-wildlife-to-prevent-collisions.html

[5] https://www.fhwa.dot.gov/publications/research/operations/its/06108/03.cfm

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Plan

Test Plan

1. No goose, no car in intersection. Light should flash red
2. Goose, no car in intersection. Light should be solid red
3. No goose, car in intersection. Light should flash red.
4. Goose, car in intersection. Light should turn solid red with enough time for car to clear intersection