Mobile Tick Trap Project

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Engineering 151: Introductory Design and Computing

Introduction

Tick borne lyme disease is a growing problem in North America that is predicted to increase in the Pacific Northwest as a result of climate change. Researching ticks is essential to understanding both their prevalence and the diseases they may carry. The Whatcom biology department currently has only two ticks to study, it is our goal to find more.

Design Problem

Using CO2 as bait and dragging a blanket across brush are the two most effective methods of catching ticks discovered in our research. Our design brings both of these concepts together into one system. We are working off a CO2 emitting box trap that features slits on the bottom for ticks to enter, and an environment that mimics a host animal inside. Our challenge is to integrate this trap with a mobile system. We will be stringing a trolley between two trees that the box moves across. The trap will also feature a mop hanging below that mimics the blanket dragging methods we researched.

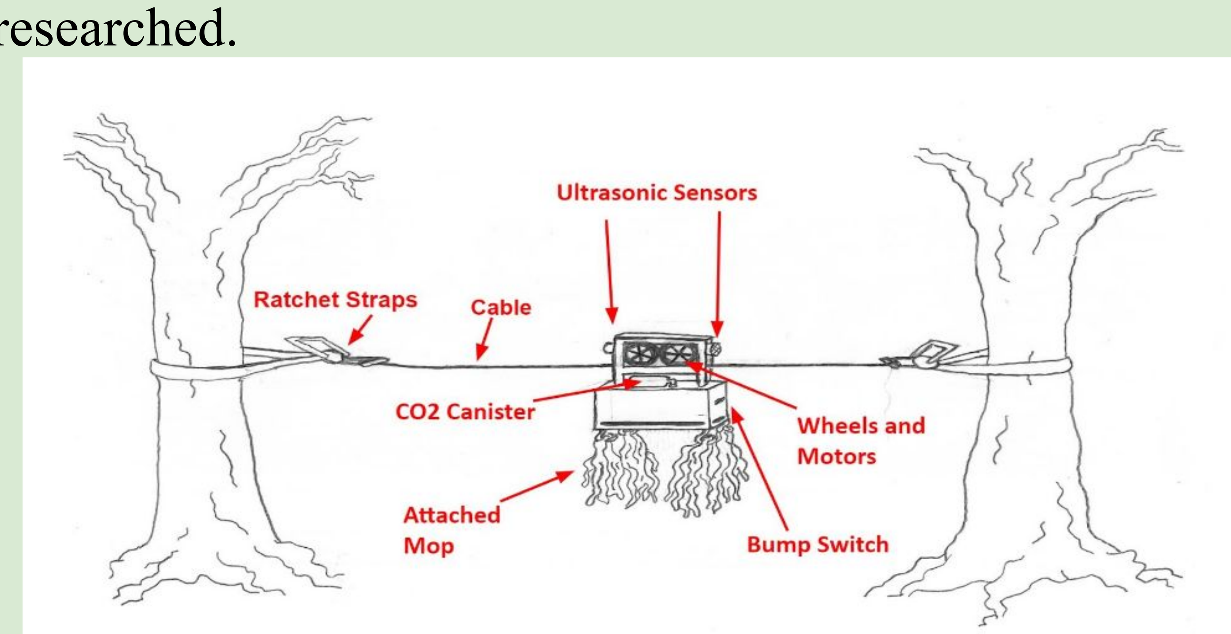

Figure 1: *Diagram of the entire system.*

Design Development

Our focus was adding mobility to the tick trap.We created a motorized trolley that is simple to set up and lightweight so that it is easy to travel with to remote locations. We decided to use steel cable so the wheels will grip on uniformly. Our wheels feature a cut-out section to rest over the wire that will be printed from soft plastic for grip.

We decided to use two ultrasonic sensors to detect the end of the cable. When a sensor detects the end, the motors change direction until the reaching the end again, tripping the other sensor.

Figure 2: *A lightweight Micro Gearmotor that controls the movement of the pulley system.*

Figure 3: *3/32 in stainless weatherproof steel cable that are strong enough for the pulley system to walk on.*

Figure 4: *Wheels in the pulley system are printed from soft plastic to grip the wire.*

Figure 5: *Ultrasonic sensors detect the obstacles send signals to the motor to decide the movement of the trap.*

Detailed Design Description

Ratchet straps are attached to two trees on either end of a metal cable strung tight between the trees. A motorized trolley with two motors and two wheels carries the tick trap and tick dragging system below the wire.

The arduino will be programmed to move slowly and incrementally along the cable. The code will pause for several minutes in each position before moving again. Through our research we learned ticks are slow so the system will pause for several minutes at a time. An ultrasonic sensor and bump switch will be featured on each side to turn the system around when it approaches the tree or if an obstacle gets in the way.

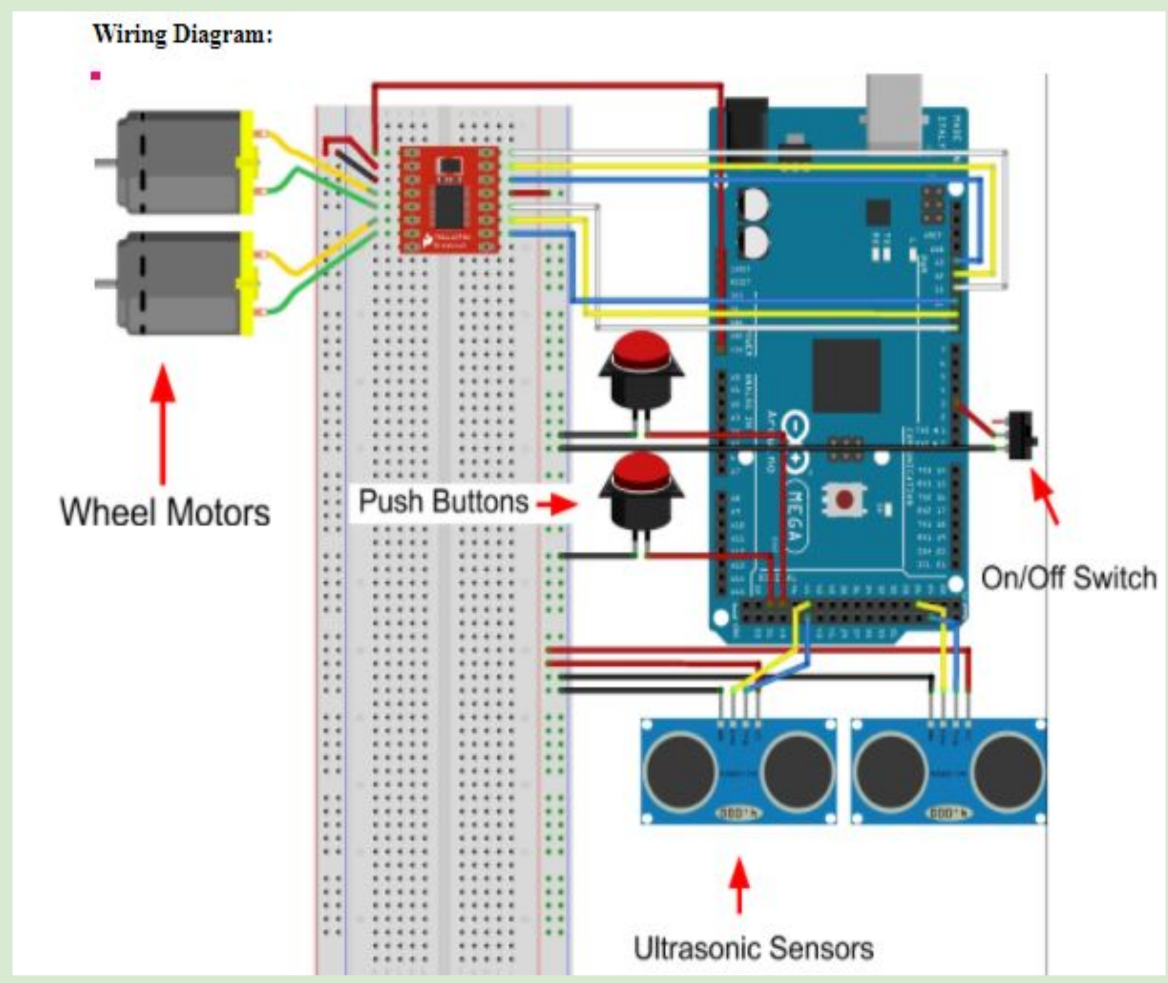

Figure 6: *The circuit diagram of the trap's mobile system with an on/off switch, 2 ultrasonic proximity sensors, and 2 bump switches.*

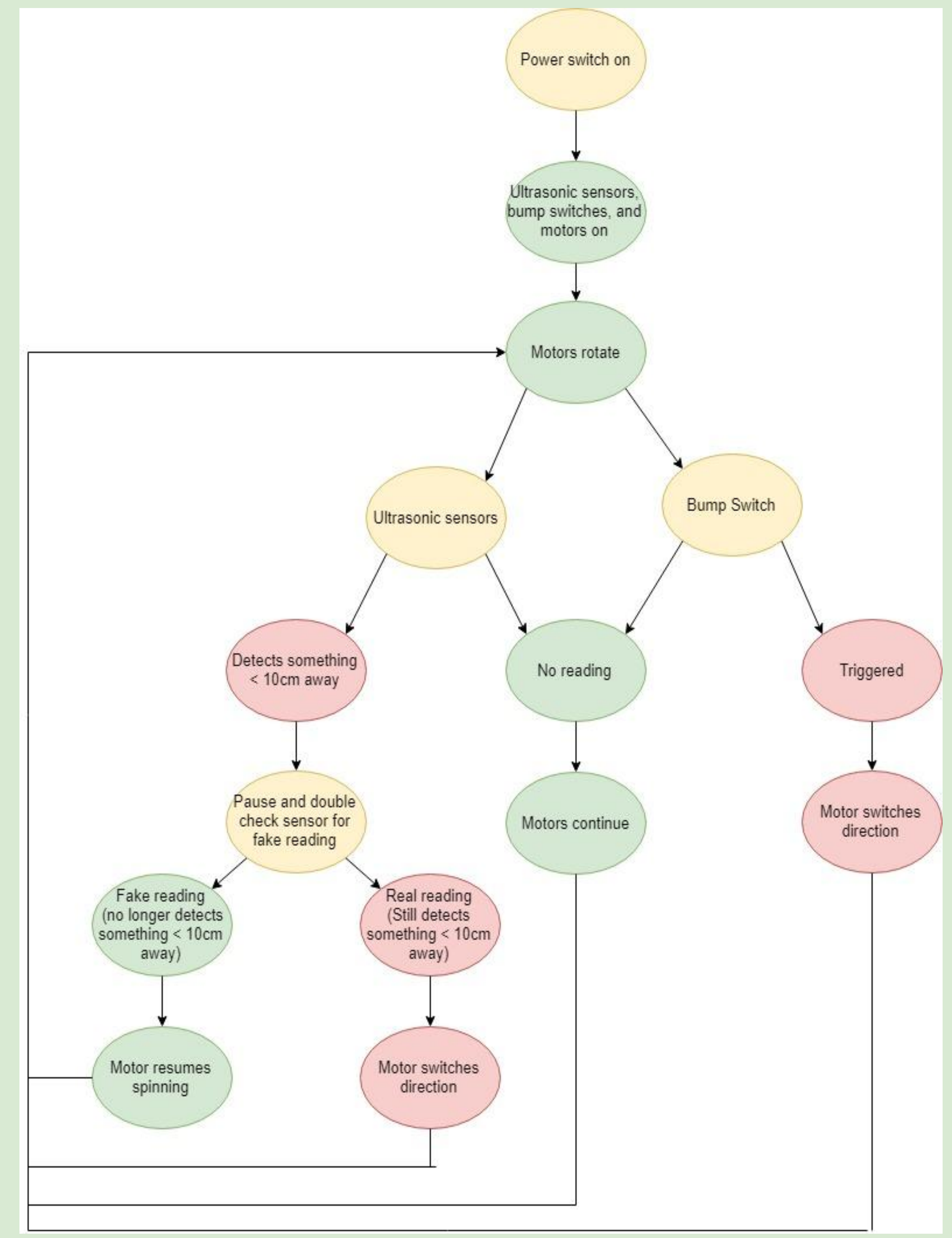

Figure 7: *Indication of how the mobile tick trap's code works.*

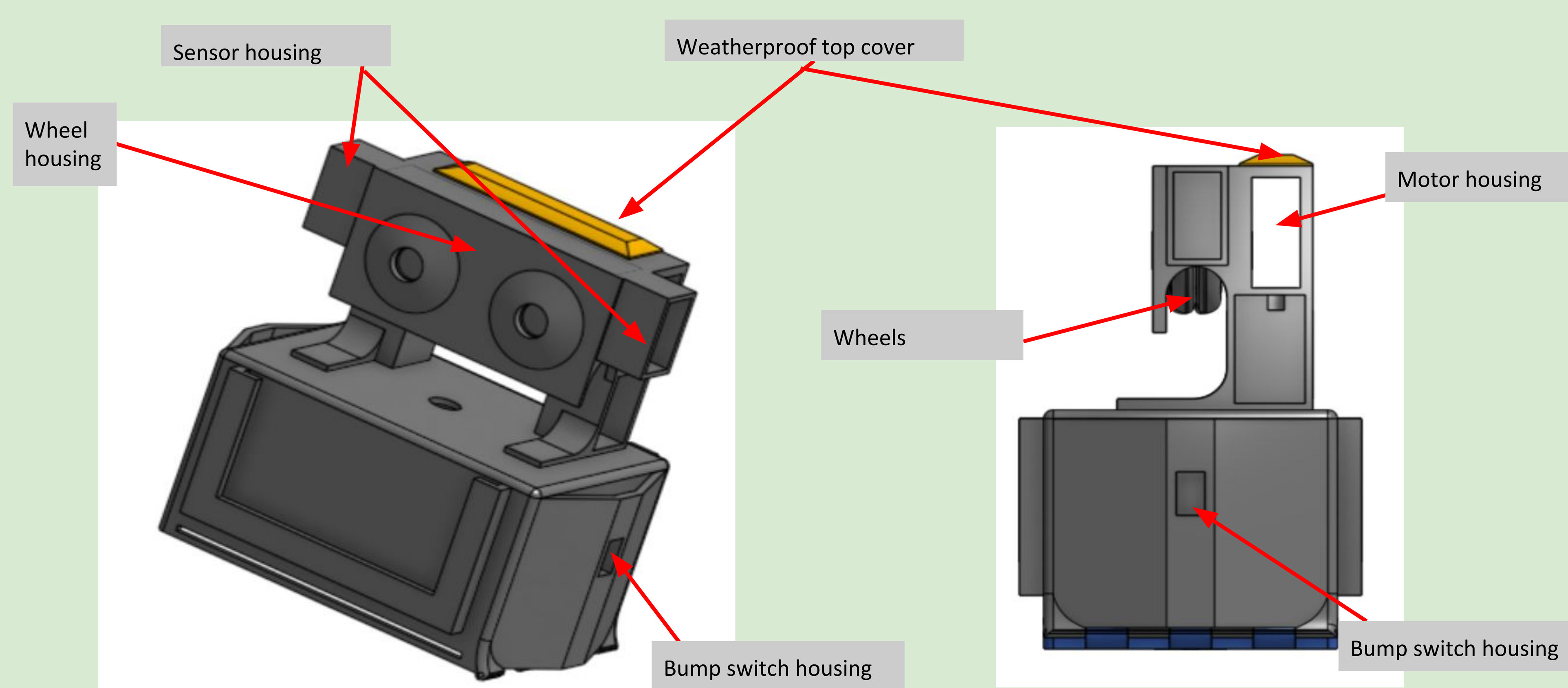

Figure 8: *Isometric and side view of the mobile tick trap.*

Testing Results

Everything functions as planned: the motorized wheels rotate based on the reading of the sensors and bump switches and the power switch control the activation of the whole trap.

The only problem we ran into is the ultrasonic sensor giving false readings. To work around this we made the code pause and double check before turning around.

Discussion and Recommendations

Our model heavily depends on the the laptop since it still requires connection between the Arduino and laptop. We would recommend the next group integrate a power supply, this will be needed for the trap to function separately from a computer.

More improvement could be made in the CO_2 capacity on the trap. From the last groups designs, the CO_2 cartridge would only last 24 hours. A larger tank and battery pack need to be added for the trap to remain isolated for at least a week. Also the ultrasonic sensors have been inconsistent, buying better sensors to improve the traps responsiveness may be warranted.

References

Centers for Disease Control and Prevention, National Center for Emerging and Zoonotic Infectious Diseases. (2018) Lyme Disease. Retrieved from https://www.cdc.gov/lyme/index.html

Mays, S. E., Houston, A. E., & Trout Fryxell, R. T. (2016). Comparison of novel and conventional methods of trapping ixodid ticks in the southeastern U.S.A. Medical & Veterinary Entomology, 123–134.