Code and Sensors for a Raven Deterring Robot

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Abstract

The Rimmon Substation near Goffstown, NH suffers power outages every year from ravens playing with high voltage equipment.

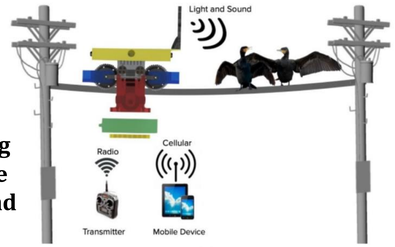
Simple solutions proved ineffective at deterring ravens from high voltage switches as the ravens would become complacent to the unreactive solutions.

A more advanced solution was required that could actively seek out and deter ravens from dangerous equipment.

Background

There have been attempts to deter the ravens from the Rimmon Substation, such as coverings of sensitive equipment, bird repellent spray, wacky waving inflatable tube men, and faux bird carcasses [1]. As none of these attempts worked, a new solution was sought out in the form of the deterrent robot.

The previous iteration of the deterrent robot was created with cormorants on a power line in mind. It had the same deterrents, which included bright flashing lights, piercing speakers, and movement. The light and sound were fixed and aimed along the cable the robot traverses.



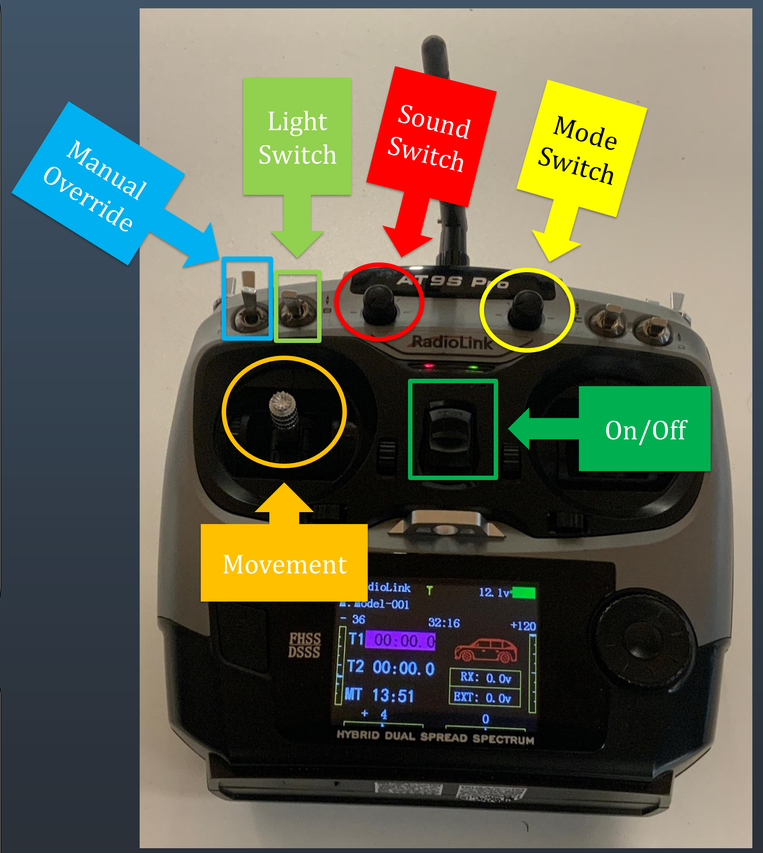
[2]

At the substation, the dangerous, high-voltage switches are nestled inside a metal structure jungle. These areas are inaccessible to the fixed deterrents on the cormorant deterring robot

Method

A turret was developed to replace the fixed deterrents of the cormorant deterring robot to achieve the following:

- **Detect and activate deterrents within 360° of the robot.**
- **Allow additional deterrents to be integrated if necessary.**
- **Internalize components to weatherproof them.**



New Additions

Code

A generic controller used previously to only stop and start ROS communication was expanded upon. Code was added to the Arduino to accommodate new channels read in from the remote for more switches and dials for more features, such as movement control, light and sound control, a custom mode for object detection which allows for manual movement and automatic deterrent, and the switch to control autonomous mode.

Sensor

A time-of-flight sensor from Adafruit was chosen to replace the previous ultrasonic sensor because of higher accuracy and longer sensing distance. This ToF sensor is classified as a LiDAR sensor which relies on a laser to hit an object and return to calculate object distance using time elapsed.

Microcontroller

To utilize the new sensor, a microprocessor with a larger amount of RAM was needed. This was due to the interfacing library taking a significant amount of RAM on the previous Arduino Mega which far surpassed the total amount when used alongside the code added for the controller. This was remedied with a board made by Sparkfun.

Conclusions

By using the new features and hardware obtained, it is feasible for this robot to scare ravens away through more accurate detection and user-operated actions. This will hopefully lead into a final product after more adjustments involving a trained model to identify incoming birds as ravens, and a revolving hub for the camera and deterrents such that it can be stationary and still detect and deter ravens.

References and Acknowledgements

[1] T. Tracy, “Common Raven Assessment Report,” GZA GeoEnvironmental, Inc., New Hampshire, Tech. Report. 04.0190507.60, 28 June 2019.
[2] K. Kadoya, “‘Bot on a Wire,” Worcester Polytechnic Institute, 2021.
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