4-2016

Flying by Fire: Making Controlled Burns Safer for Humans and UAVs

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FLYING BY FIRE

Making Controlled Burns Safer for Humans and UAVs

Rebecca Horzewski and Dr. Carrick Detweiler

Overview

Nimbus lab is developing a UAV that can start controlled burns by injecting and dropping chemical-containing plastic balls. This method will be much safer than currently used techniques.

This research focuses on allowing the fireball dropper UAV to avoid dangerously hot areas and notify the UAV operator of hotspots and cold areas.

The goal for this year was to develop the temperature sensing circuit board the fireball dropper will use.

Figure 1: The drip-torch method currently used for starting controlled burns

Image credit: http://forums.nicoclub.com/killing-weeds-t344024.html

Figure 2: The fireball dropper UAV in action

Image credit: Dr. Carrick Detweiler

Results and Future Work

The temperature sensor board was designed, fabricated, programmed, and tested in the lab.

Field tests with a prescribed burn group are ongoing in April.

Next year code will be developed to process the temperature readings and achieve the overall objectives. Then the board and code will be integrated with the fireball dropper UAV.

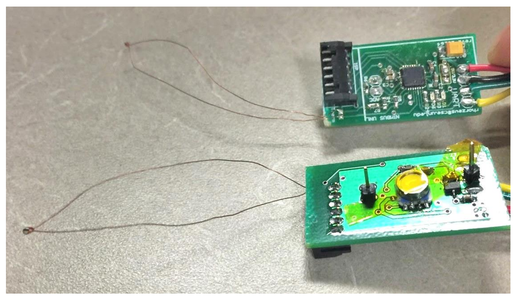

Figure 3: The fully assembled circuit board for sensing temperature

Image credit: John-Paul Ore

Acknowledgements

Faculty: Dr. Sebastian Elbaum

Grad students: John-Paul Ore, James Higgins, Evan Beachly

Undergrad students: Christian Laney

Approach

1) Algorithm exploration

Instruct a UAV to sweep an area, use photoresistors to measure light, and assemble data into a map of the area. Much of this code will be modified next year to work with the temperature data.

2) Choose a sensor

Thermistors were chosen over thermocouples, RTDs, and IR sensors for their balance of precision, price, response speed, and durability.

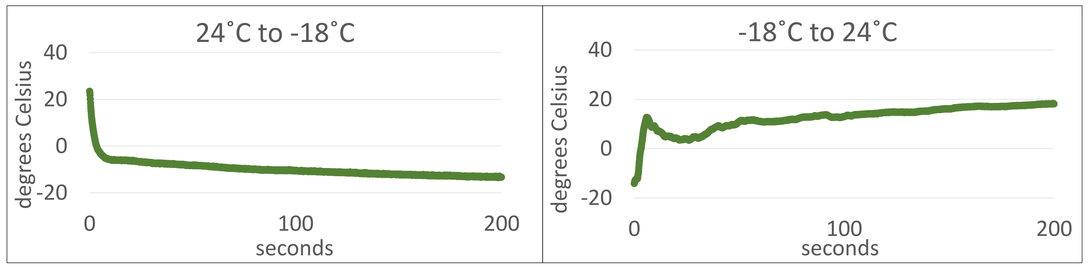

Figure 4: Response time of the thermistor. Effect of wind is visible in right-hand plot.

3) Modify circuit board

- Add thermistor and Wheatstone bridge
- Remove unneeded components
- Reroute for minimum size

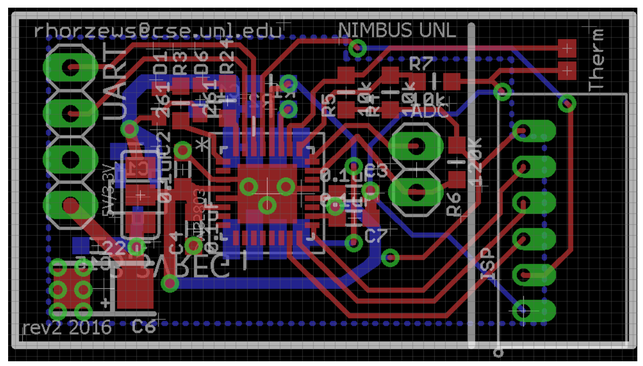

Figure 5: Diagram for the circuit board

4) Program circuit board

- Calculate temperature value
- Send value over UART port
- Store value in EEPROM memory
- Send memory over UART upon request

5) Communicate with board

A ROS node running at the other end of the UART connection can send memory requests to the board as well as parse memory and temperature values received over the UART. A GUI node generates memory requests and displays the data.