**Overview of Eureka WUI Structure Burn Test Project**

**Disaster Lab Summary:**

In early June of 2024, the Disaster Lab conducted a structure fire test to evaluate the fire resistant potential of several different exterior and interior coatings and building coverings. Six small ADU-size structures (Tuff Sheds) were set up, using primarily timber products. Two units were controls (one for exterior coatings, another for interior), and the remaining had different fire resistant coatings and materials applied:

1) exterior fire resistant paint and a membrane window covering;

2) exterior fire resistant paint, a membrane window covering, and a land-scape fire retardant applied to hay scattered around the perimeter;

3) a quick-apply “spray and go” fire resistant coating for emergency applications applied to the exterior of a structure; and

4) an internal fire resistant coating applied to interior walls and surfaces with standard US furniture within.

All of the units were exposed to flames from large torches for 10 minutes. Results were recorded with thermocouples (Disaster Lab) , a research IR camera (Cal Poly Humboldt), an optical GoPro (Squishy Robotics), and a gas and particulate sensor system (Squishy Robotics). Now we need to match up the time-series from each sensor with each other and then analyze the detection ranges, heat exposure curves, and resulting emissions from each structure.

**Squishy Robotics Summary:**

2024 Northern California (Humboltd) Structural burn - june 5?

* Robot 48(which is a wildfire pod) has a ton of data logged (~11MB == ~200mins of ground data). Graphs have been plotted for the sensor data vs time. Check [here](https://drive.google.com/drive/folders/1VB1dm0WBi_vty5tAS54XMYyDF0QHlE_u?usp=drive_link) .
* Ground Truth is to be verified against the timestamped graphs. [Go pro video footage](https://drive.google.com/drive/folders/15SSTkYJU-_Gnpd-Sqig_8VD0kYAZtS5z?usp=drive_link) has been analysed in the Go pro player application. Video is not timestamped and is in timelapse mode. Total time duration of the video is 08:50 min. In real time it should be around 200 mins as per the robot data.
* We can see a basic correlation with the sensor data and the ground footage. See [here](https://drive.google.com/drive/folders/1VB1dm0WBi_vty5tAS54XMYyDF0QHlE_u?usp=drive_link)
* Categorize different types of sheds/house with emission data

**Junsu Summary:**

All of the relevant data for this project has been compiled in a Google Drive that can be accessed at this link:[structure test](https://drive.google.com/drive/folders/1_u_dbrzVnaVSPF8GQBv9XcxQaKIyFf3h?usp=drive_link).

Datasets:

* Thermocouple temperature data (Disaster Lab)
  + Source: Google Sheet
  + Confidence: low (failure of thermocouples)
  + Progress: aligned by time series and analyzed in brief
* Infrared camera temperature data
  + Source: CSVs
  + Confidence: high
  + Progress: N/A
* Squishy sensor emissions data
  + Source: MatLab script
  + Confidence: medium (sensor might not have picked up emissions, heavily dependent on external factors such as wind and placement relative to structure)
  + Progress: plots have been created but data needs to be extracted

Videos for Cross Verification:

* Infrared camera footage
  + Videos of structures taken by infrared camera that show temperature
* GoPro optical footage
  + Time-lapse video of entire structure burn test
  + Ground truth for ignition time

**OBJECTIVES**

* Contribute to research brief
  + Focused on evaluation of the flame resistant materials
  + If brief goes well then contribute to peer-reviewed academic paper
* Identify limitations of structure burn tests
  + Evaluate effectiveness of different sensors
* Attempt to characterize fires using data
* Explore potential for incorporating multi-modal image processing

Matlab script for processing data and producing plots:

<https://github.com/BerkeleyExpertSystemTechnologiesLab/Spherical-Tensegrity/blob/5d4d4e066fe4aece19538c5693743b163859f626/DropTest/MatlabDataAnalysis/controlled_burn.m>

Drive containing emission data:

<https://drive.google.com/drive/folders/1Fcs92Dj40fkdHqQ3z_6LQKX2TtnmXP35>

Google Doc explaining project:

<https://docs.google.com/document/d/1wXw3_-erAaAUR4FV69DXn3s3cKxESR9XV05pXMqjH2A/edit?tab=t.0#heading=h.acfhb0y25dxi>