Progress Review 01

Team FireFly | February 16, 2022

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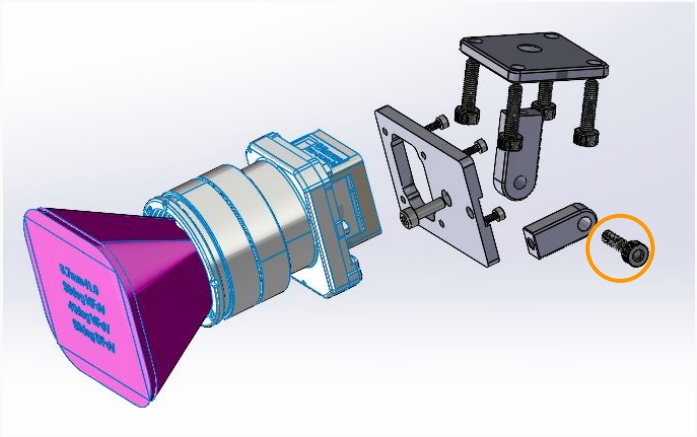
Progress

Mechanical Design Second Iteration



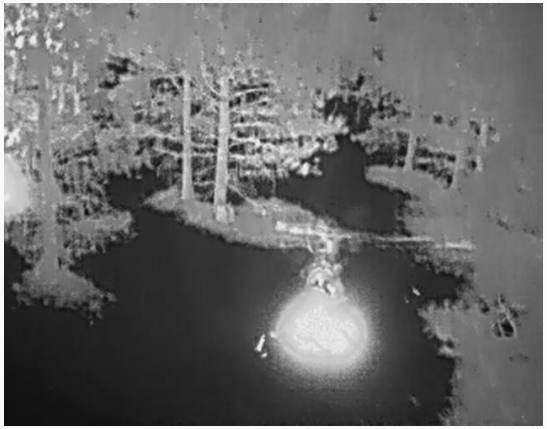
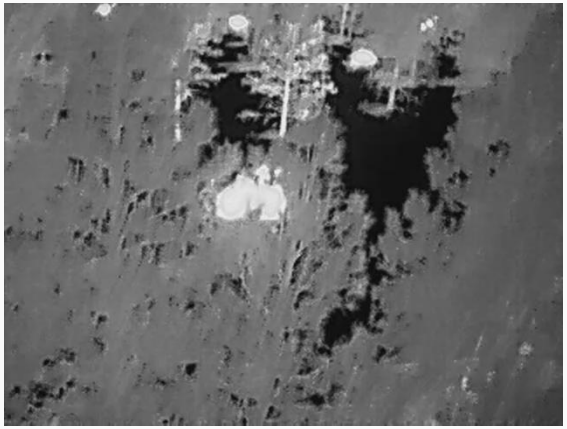
- CAD model finished
- Material in process of being acquired for machining components

Plan for Setting Up Fire Hotspots

- Have purchased
  - 1 Portable Fire Pit
  - Fire starters
  - Metal Ash bucket
  - Fireplace brush
  - Fire Resistant Gloves
  - Fire Extinguisher
- Procedure
  - Use fire starters to light fire wood
  - Put out fire using large jug of water
  - Sweep up ash into metal bucket
  - Mix some water into ash bucket
  - Keep ash in bucket for few days before dumping into gardens/dirt or throw out in trash can?

Image Dataset

FLAME dataset thermal video converted to images

LabelBox : Educational licence approved. Team has begun labelling images for semantic segmentation

Mapping

- Found way to get ground truth position
  - AirLab has 3DMGQ7-GNSS/INS RTK receiver with ± 2 cm positional accuracy
- Conducted research on mapping
  - Current tentative approach:
  - Probabilistic map merging through assumed known poses
    - Yu S, Fu C, Gostar AK, Hu M. A Review on Map-Merging Methods for Typical Map Types in Multiple-Ground-Robot SLAM Solutions. Sensors. 2020; 20(23):6988. https://doi.org/10.3390/s20236988

$$P(occ_{x,y}) = \frac{odds_{x,y}}{1 + odds_{x,y}} \quad (2)$$

$$odds_{x,y} = \prod_{i=1}^{n} odds^{i}_{x,y} \quad (3)$$

$$odds^{i}_{x,y} = \frac{P(occ^{i}_{x,y})}{1 - P(occ^{i}_{x,y})} \quad (4)$$

Challenges

IMU - GPS - Camera Calibration

- Challenge: IMU and camera relative location not certain
- Camera-imu calibration can estimate the spatial and temporal parameters of the camera system with respect to the intrinsically calibrated IMU
  - https://github.com/ethz-asl/kalibr
- Alternative: we can use the GPS-IMU-camera modelization and calibration for 3D localization
  - https://ieeexplore.ieee.org/document/5669675

Troubleshooting Timeline

- Challenge: Difficulty in troubleshooting quickly
  - Issues with RGB camera require field testing at hawkins, no way to simulate flight conditions to reproduce RGB camera behaviour
- Currently no alternative other than to try and schedule more field tests

Future Work

Plans Until Next Design Review

- Mechanical design and fabrication
- Label and train basic fire segmentation model on training dataset
- Make progress on algorithms
  - Camera-imu calibration
  - Converting local projection
- Fix rgb camera haze

Questions?