DS: Drone Project

Tracking Cattle with Infrared Imaging

Who We Are

Students:

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- Matt McInnes

Supervisors:

- Kevin O'Neil
- John Church

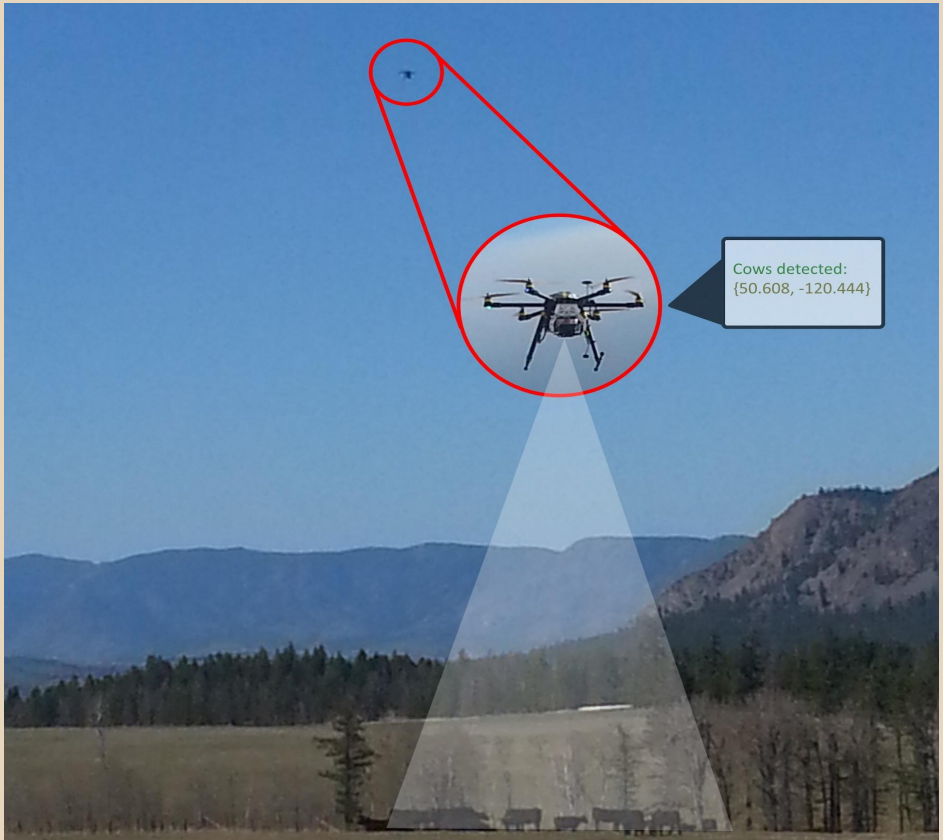
Problem Statement

- Ranchers need to find their cattle
- Ranchlands are *very* large
- Teams of people and significant time required
- Technology has yet to do much in this field

Cattle roundup is expensive and time consuming

Problem Statement

Proposed Solution



Actual Solution Setup

Solution Overview

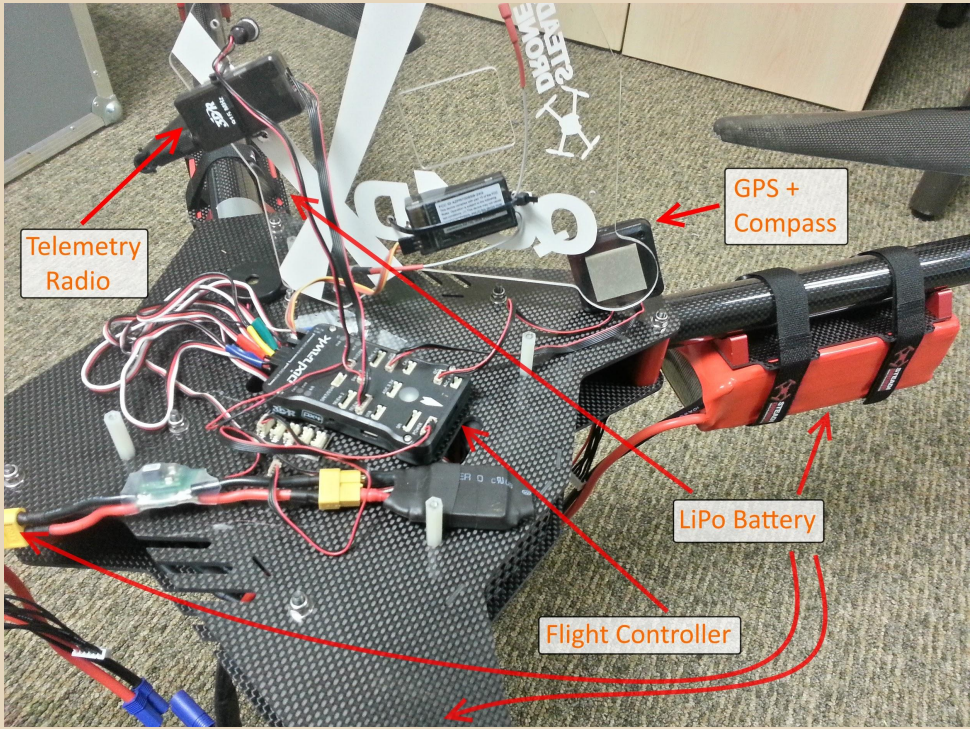
Two main parts:

- Multi-Rotor drone (UAV)
  - Fully autonomous navigation
  - Laptop/tablet/phone ground station
- Optics payload
  - Remote sensing
  - Image processing

Hardware Overview

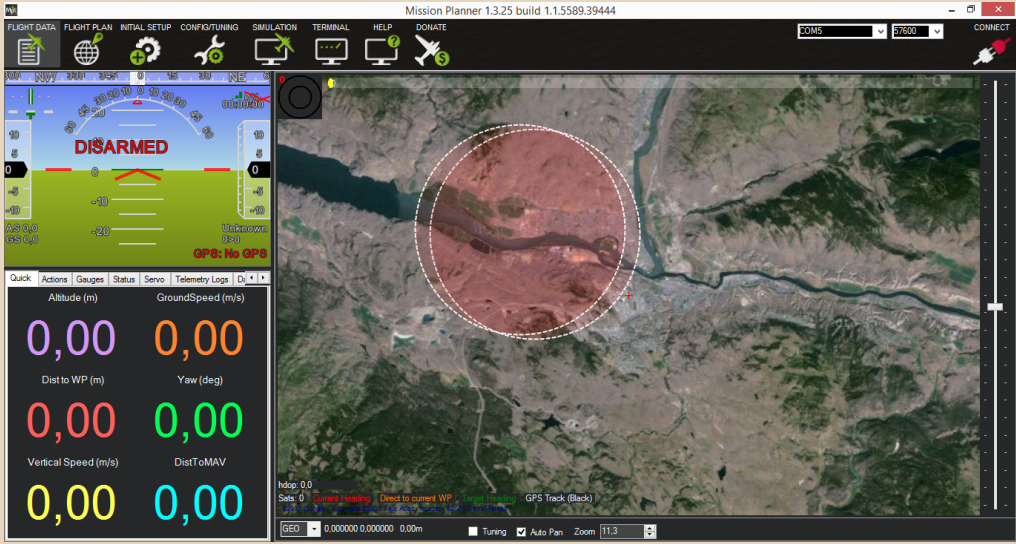
Quadcopter (BigX)

- PixHawk Flight Controller
- GPS + Compass
- Lithium Polymer (LiPo) batteries
- Base station



Hardware Overview

Base station laptop

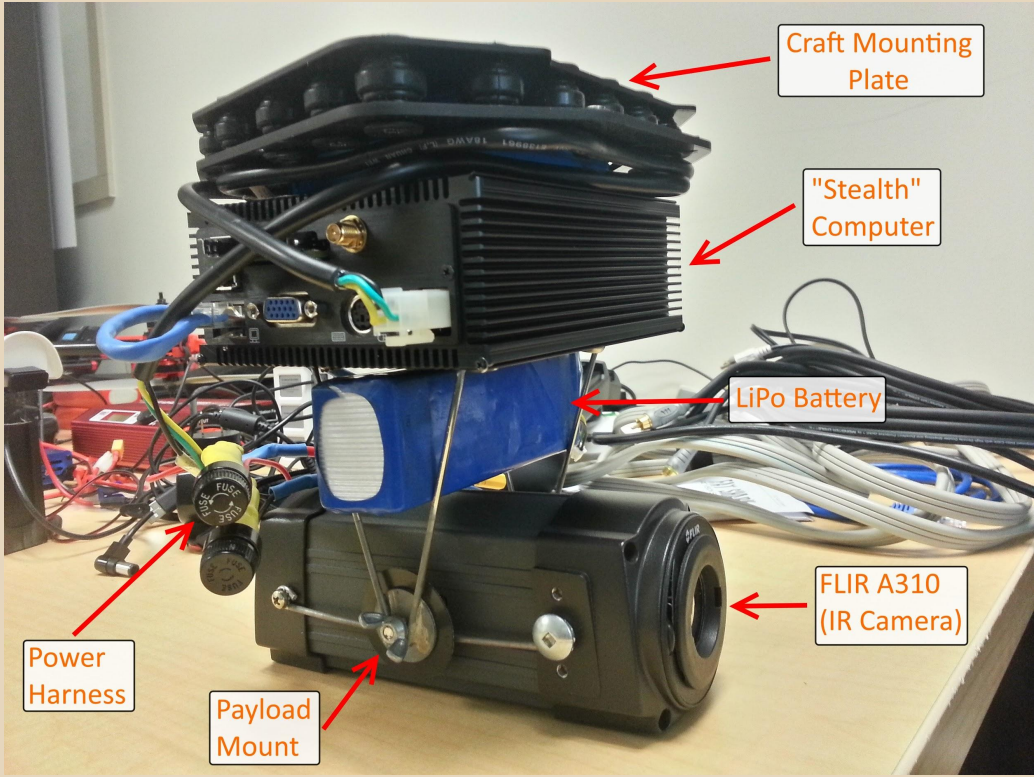


Base station software

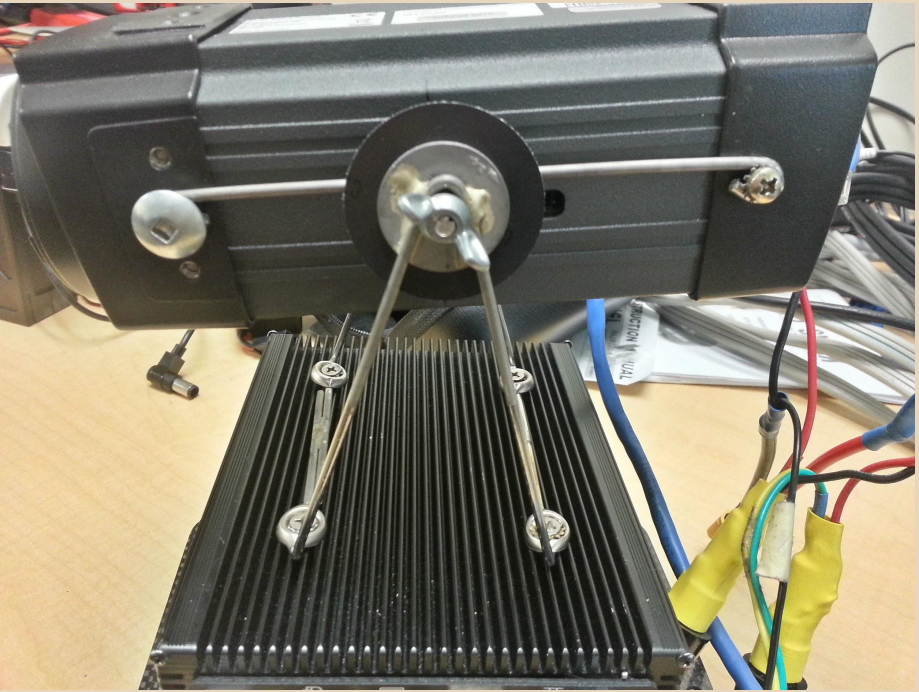
Hardware Overview

Optics Payload

- “Stealth” Computer
- FLIR A310 IR camera
- Lithium Polymer (LiPo) battery
- Custom mount
- Custom power harness

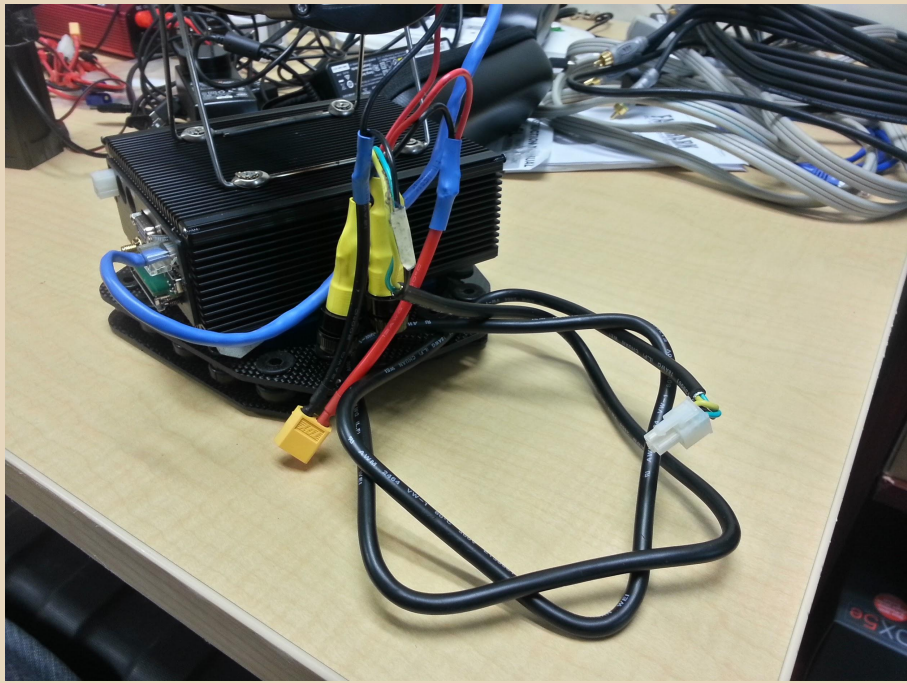


Custom Payload Components



Custom Mount

(created by Dave Pouw)



Custom Power Harness

(created by Matt)

Vespadrones XYRIS 6

Software Overview

Break Down

1. Python
2. OpenCV
3. Hardware and Software Interaction
4. Algorithm Overview

Python

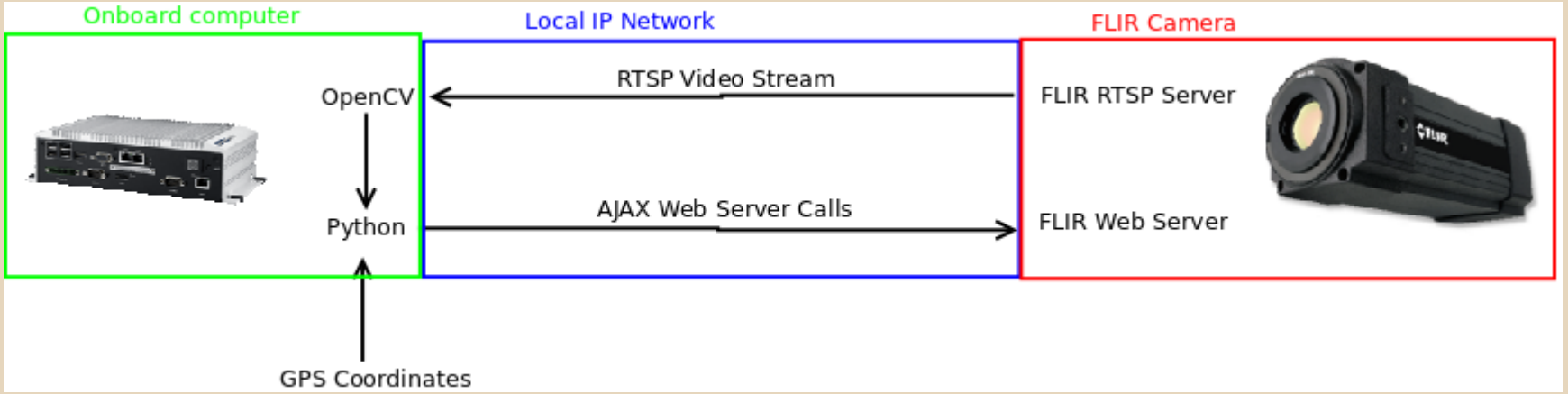
- Fast coding and extensible speed
- More sensible than Visual C++
- Known computer vision benefits
- Developer history and familiarity

OpenCV

- Reduction in code size
- Quicker, with lower-level API
- Supports many languages
- Industry favourite, popular

Hardware and Software Interaction

- Camera is controlled via AJAX API
- Video is streamed via RTSP server

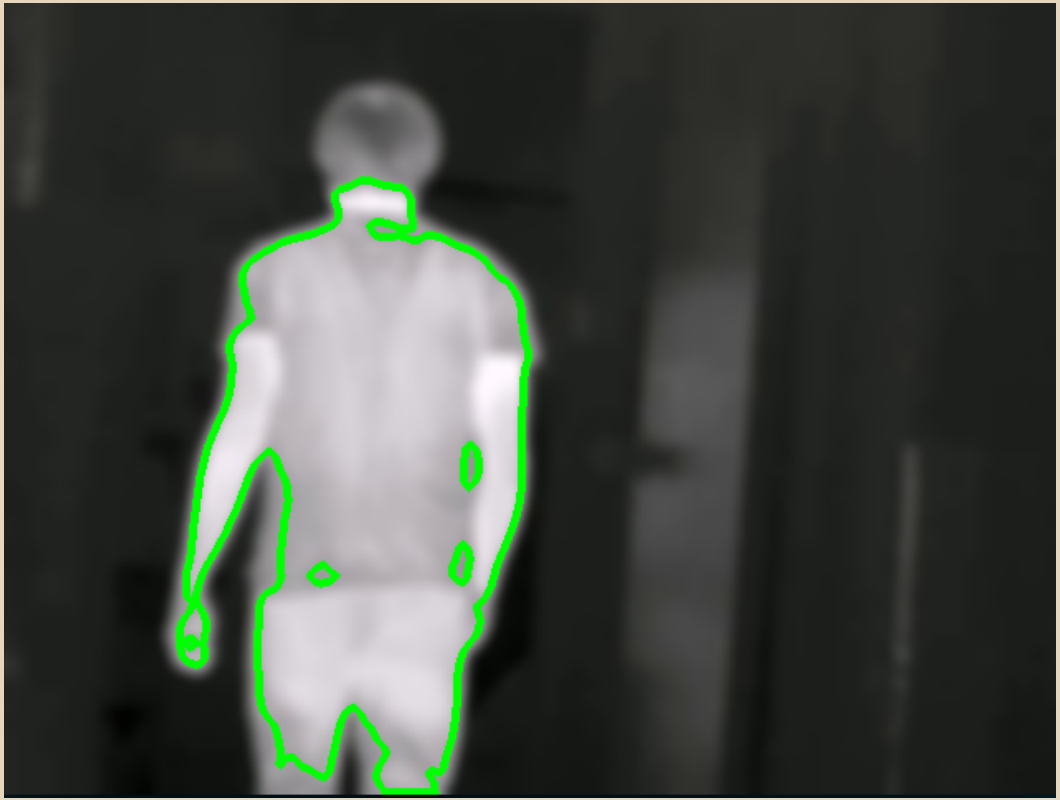


CV Algorithm Overview

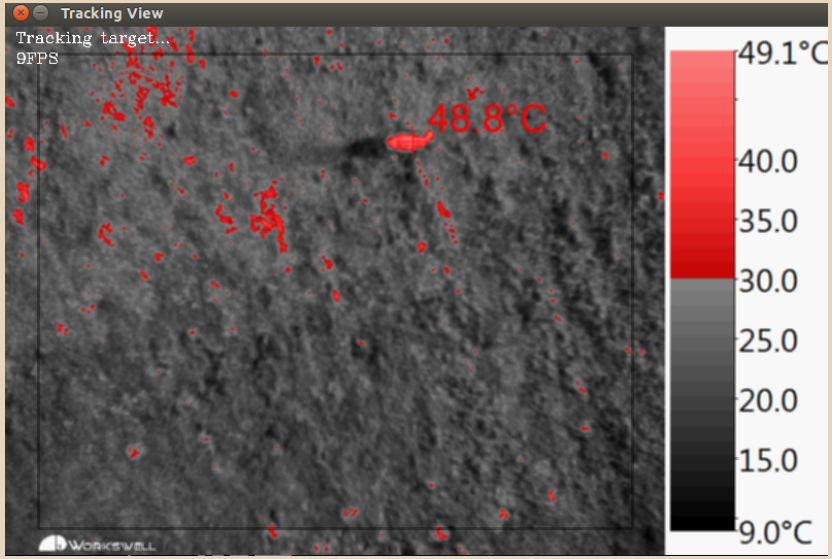
1. Pull an image from the video source
2. Blur the image slightly
3. Filter everything below threshold temperature
4. Define contour regions
5. If contour regions exist, query the GPS location
6. Output/log the GPS location
7. Repeat

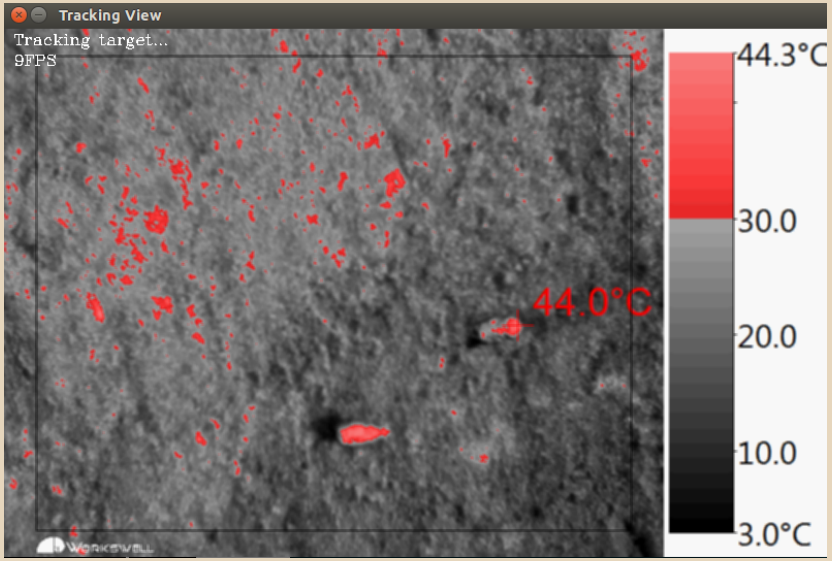
Example

Recognized Contours

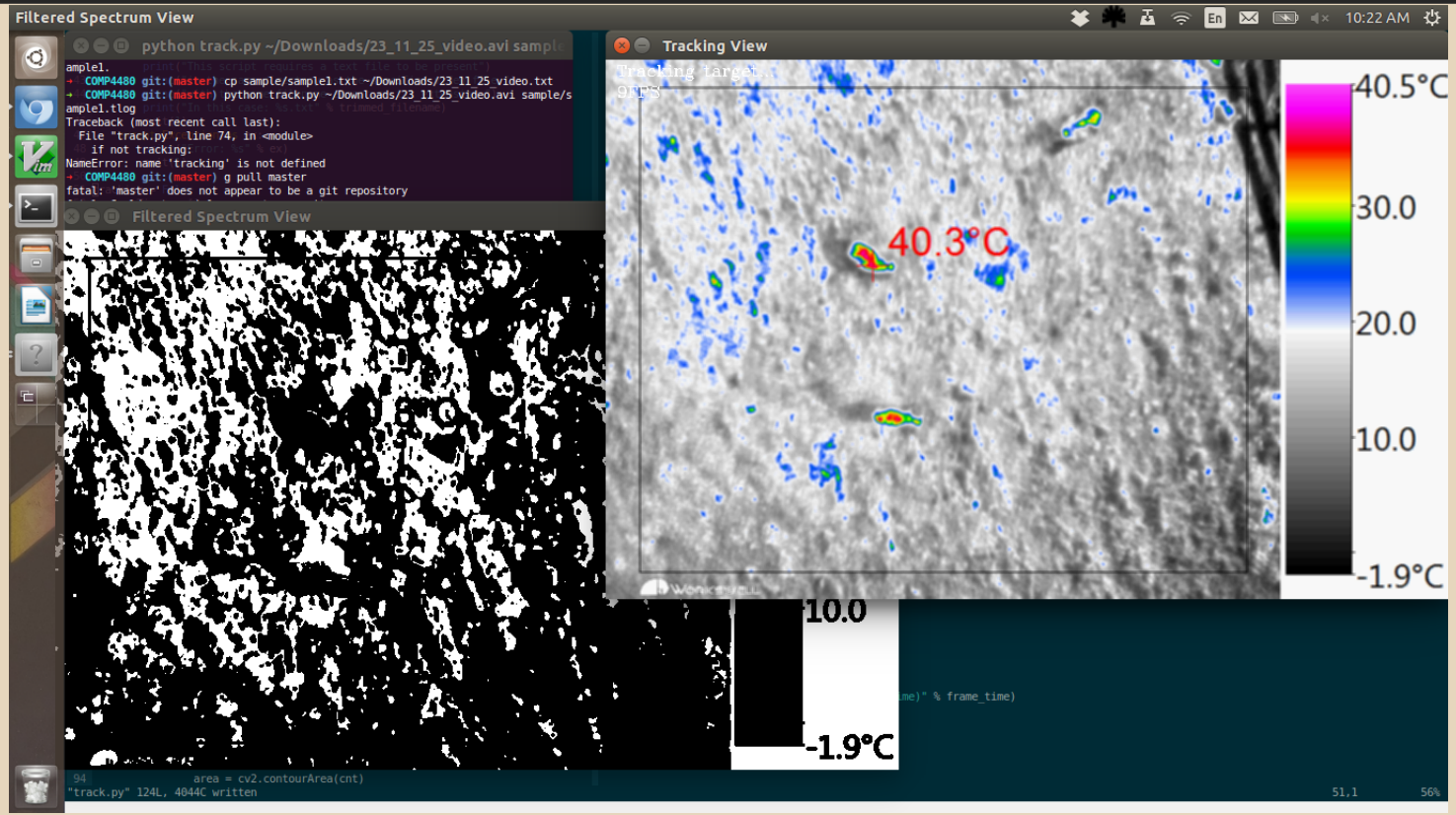


Working with Real Data





Working with Real Data



Research Results

- Analysed multiple drone models / configurations
- Analysed multiple onboard computing solutions
- Developed infrared camera interface solution
- Developed computer vision algorithm
- Collected test data with multiple configurations
- Established well informed solution prototype

Challenges to Research

- Multidisciplinary nature
- Heavy reliance on 3rd parties for hardware
- Lack of background research

- We expanded our breadth of knowledge
- We learned the hardware well
- We performed original research

Mistakes Happen

Turns out drones can be difficult!

Potential for Commercial use

Two main options:

- Farmers run their own drones
  - Most still hard to fly
  - Technology not quite ready
- Farmers pay for service
  - Fits (current) legal constraints better
  - Trained, certified pilot
  - More reliable

Potential for Future Research

Many avenues for further research:

- Add GPS to on-board computer
- Other drones
- Lighter payload
- ODroid instead of Stealth
- Different thermal camera

Updates and Upgrades

In the future we'd love to:

- Implement software on XYRIS 6 (USB)
- Improve detection accuracy
- Implement real-time tracking
- Test on more cows

Conclusion

Big thanks to:

- Mickael Maddison
- Dave Pouw
- Kevin O'Neil
- John Church

Extras