

Fixed-Wing Survey Drone

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Outline

- Project Summary
- Previous Work and Constraints
- Project Description
- Equipment and Parts List
- Task Schedule

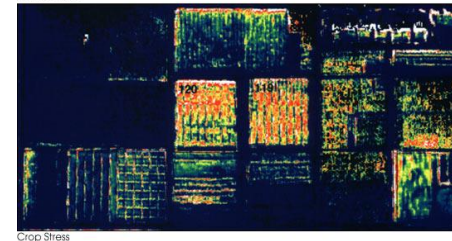
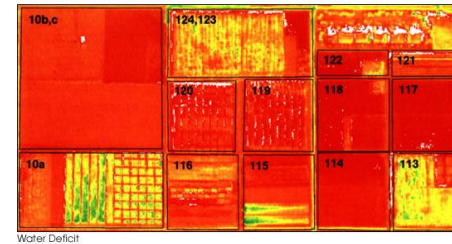
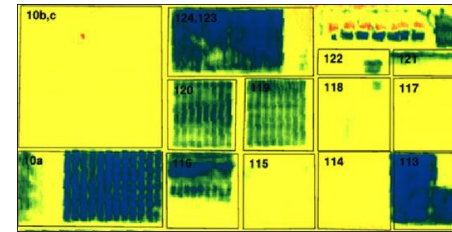
Project Summary

- Create an autonomous drone
- Take GPS-registered images
- Low-cost



Previous Work and Constraints

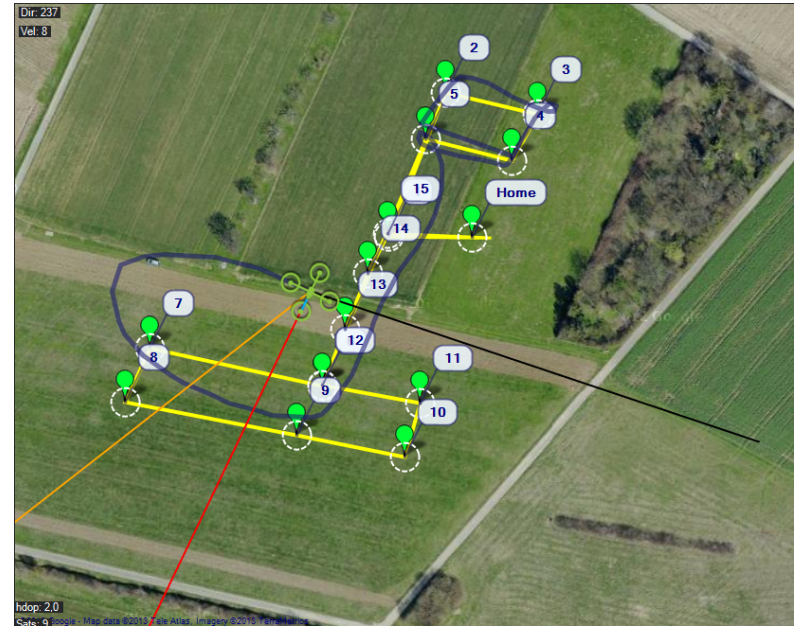
- Growing Market
 - Precision Agriculture and UAVs
- Existing Products
 - CropCam
- FAA Regulations
 - Below 400 ft
 - Manual Override



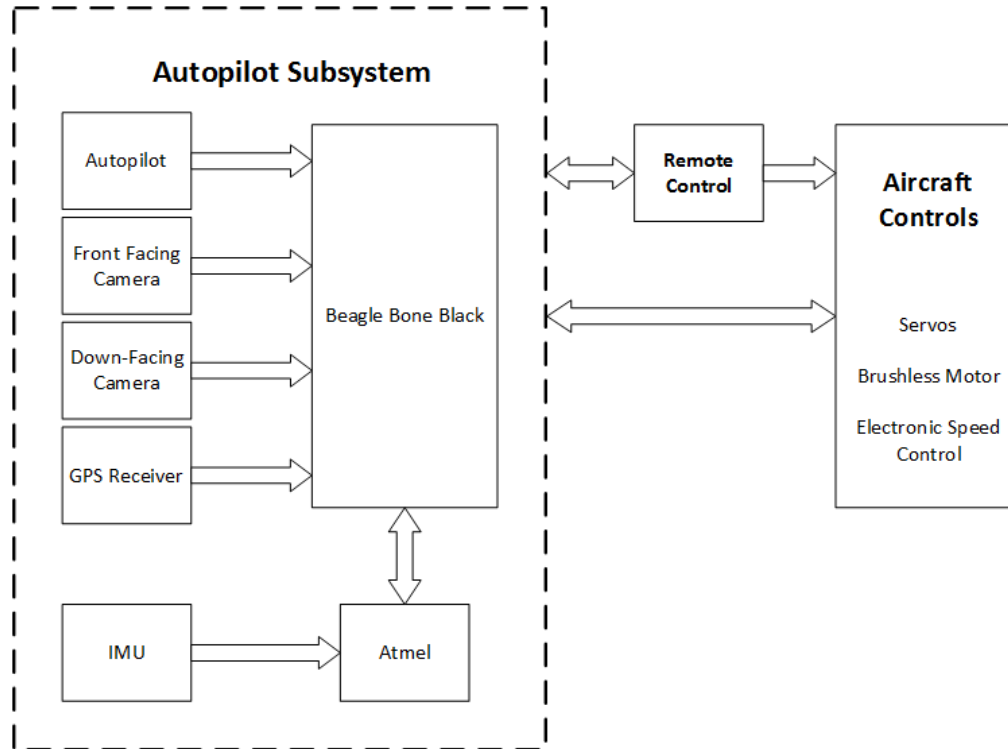
Project Description

Autopilot System:

- Generate waypoints
- Control all flight
- Obstacle Avoidance
- Allow for manual control



Aircraft Subsystems



Project Description

Image Processing

- Tag images with GPS data
- Stitch together all images
- Send final data to the user

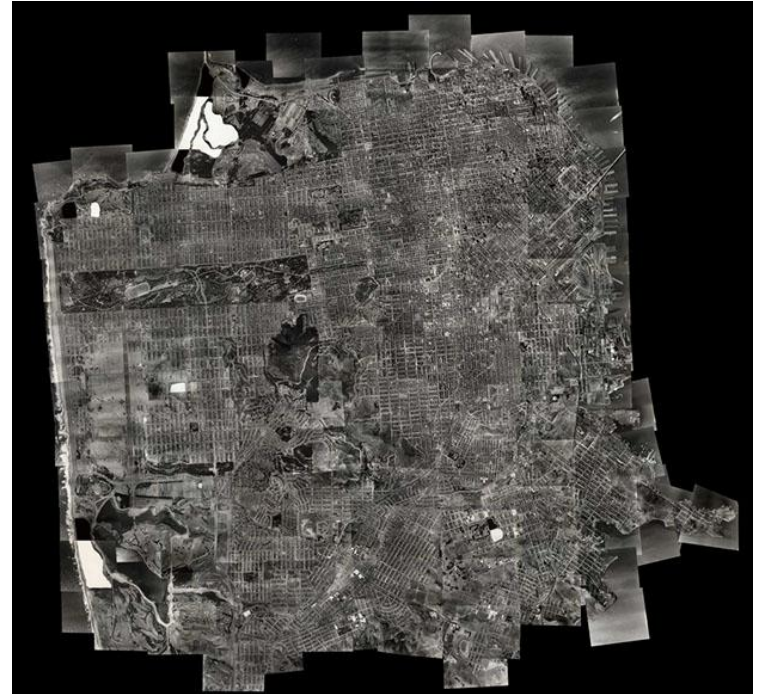
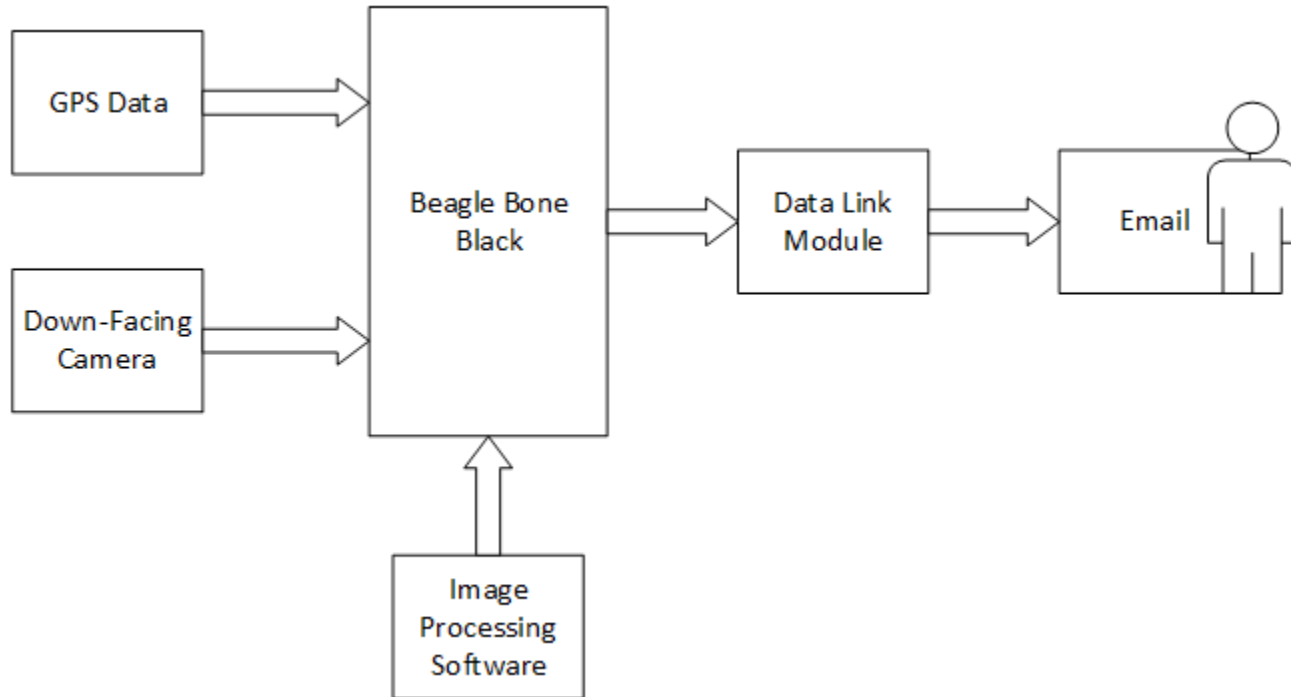


Image Processing Subsystem



Component Requirements

- Components:
 - IMU
 - GPS receiver
 - Autopilot
 - Flight controller
 - Two digital cameras
 - Microcontroller
 - Data link module

Functional Requirements

- One high resolution image is created by combining all of the acquired images and their GPS tags in software
- Survey completion within 25 minutes
- Survey summary alert via email, using the data link module

Autonomous Requirements

- Entirely autonomous UAV
- Generates its own waypoints to cover the entire user defined area
- Autonomous flight adjustment to avoid object collisions
- Manual override available at all times during flight

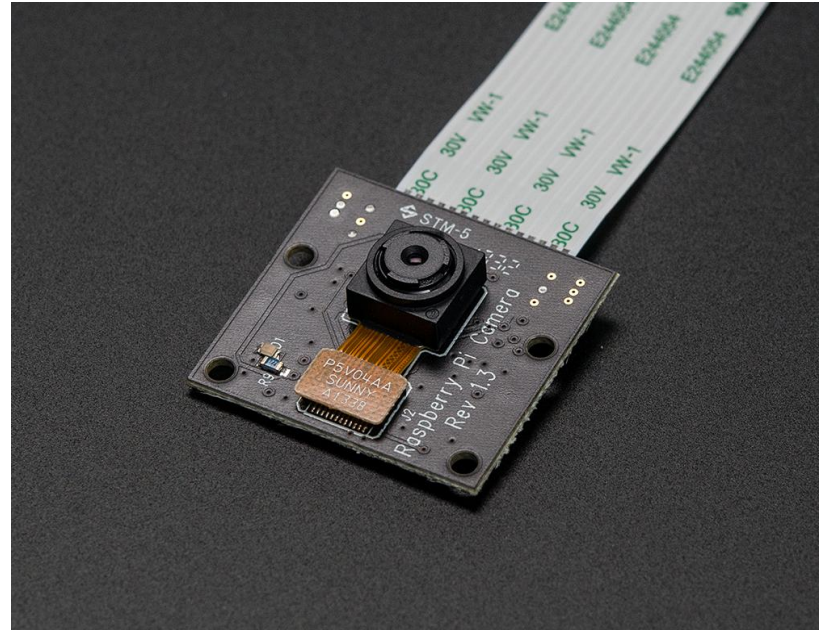
Airplane Requirements

- Electrically powered
- Hand launched
- Battery life long enough to complete a survey in one charge (~20 minutes)
- Capable of holding the payload of all components



Camera Requirements

- Front facing camera
 - Lower resolution
 - Used for obstacle detection
- Ground facing camera
 - High resolution
 - Captures near infrared pictures
 - Tags all ground images with GPS information



Preliminary Work

Research Conducted:

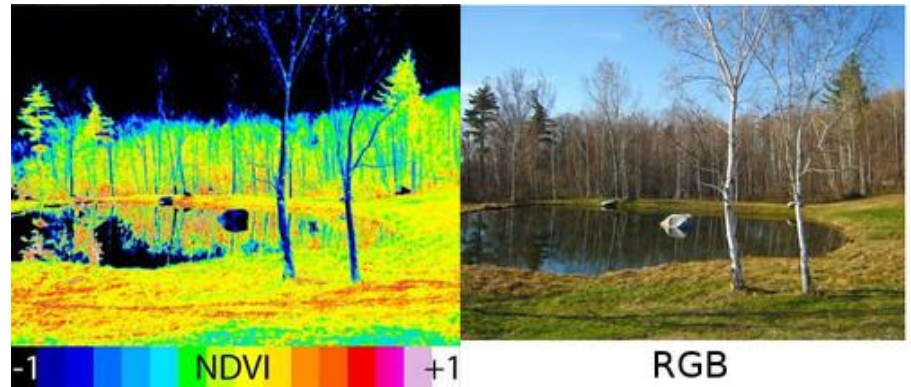
- Finding products:
 - Plane
 - Flight Controller
 - GPS
 - Cameras
 - Controllers
 - Autopilot



Preliminary Work

Image Processing:

- Images that assess crop health
- Requires a camera without an infrared filter
- Plants absorb visible light and reflect infrared
- Using software, useful images can be created
- Normalized Difference Vegetation Index



Preliminary Work

Obstacle Avoidance:

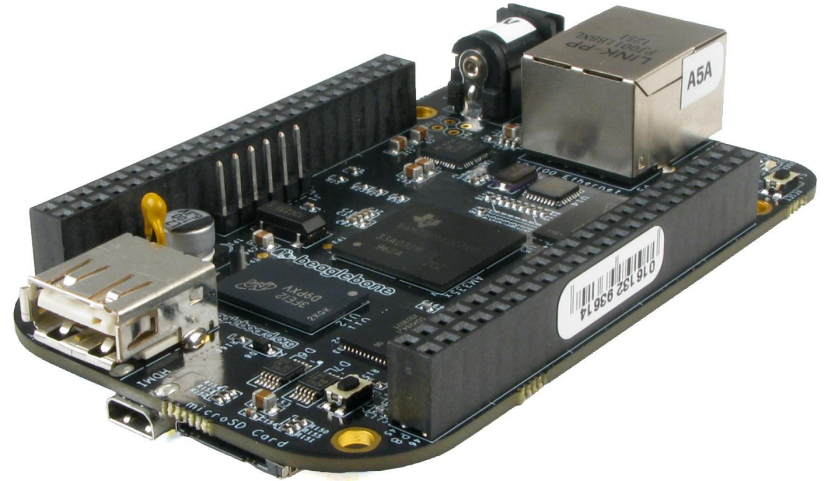
- Intersections with waypoints
- Multiple algorithms
- Consider object radius, angle, height, and distance from aircraft
- Corner detection/image frame correlation
- Movement detection and optical flow
- Aviones Simulator & City Maker App



<http://www.et.byu.edu/~beard/papers/thesis/BrandonCall.pdf>

Preliminary Work

- BeagleBone and Atmel board robotics labs
- Aircraft construction
- Test flight of manual controls



Equipment List

- Bixler Aircraft
- LiPo Battery
- RC Controller
- BeagleBone Black
- GPS
- Autopilot
- IMU
- Data transfer unit



Task Schedule

Week 1: Image processing with BeagleBone Black

Week 2: Image processing with BeagleBone Black and GPS-tagged images

Week 3: Autostitch software

Week 4: Obstacle avoidance software

Week 5: Obstacle avoidance simulations

Week 6: Waypoint Generation

Week 7: Waypoint Generation

Week 8: Integration of waypoint software with autopilot and GPS

Week 9: Test Flight

Week 10: Work through any remaining issues

Week 11: Create senior project webpage

Week 12: Fly and correct any problems

Week 13: Final Presentation