

Introduction

- Student Unmanned Aerial Systems (SUAS) 2017 Competition.
- Simulated search and rescue mission for a stranded hiker.

Waypoints/Path

Geo-fence

Search Area



- **1st stage development:**
 - Design, build, test UAV system
- **2nd stage development:**
 1. Upgrade electronics package
 - Implement:
 2. Target alphanumeric detection
 3. Dynamic target detection
 4. Target color detection
 5. Target shape detection
 6. Payload delivery

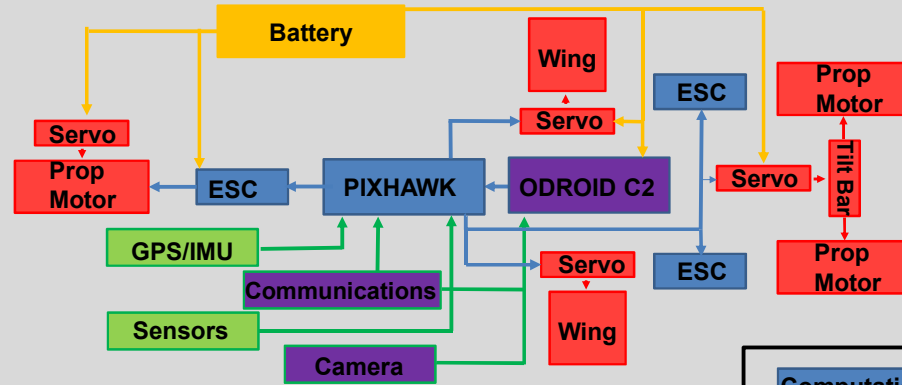
6'-7"



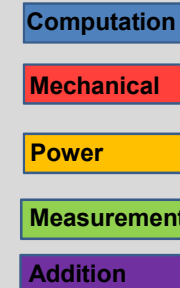
Goal Statement

- Develop an autonomous UAV featuring autonomous takeoff and landing, autonomous flight and navigation, target detection and classification, stationary and dynamic object avoidance, and payload delivery. Demonstrate autonomous flight and waypoint capturing, detect stationary clues and dynamic hiker.

1. Electronics Top Level Design

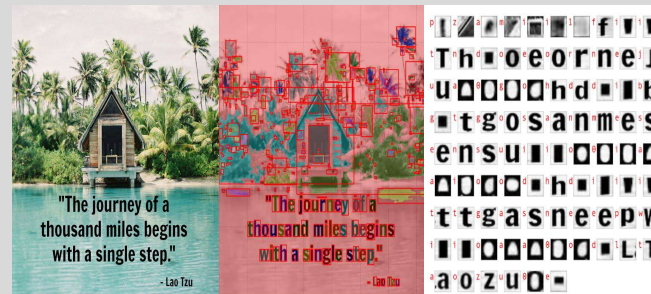


- **Modifications:**
 - ODRROID C2 Central Processing Unit (CPU)
 - WIFI Antennas
 - ZubaX Global Navigation Satellite System (GNSS)
 - Sony Point and Shoot Camera
 - Ultrasonic sensor



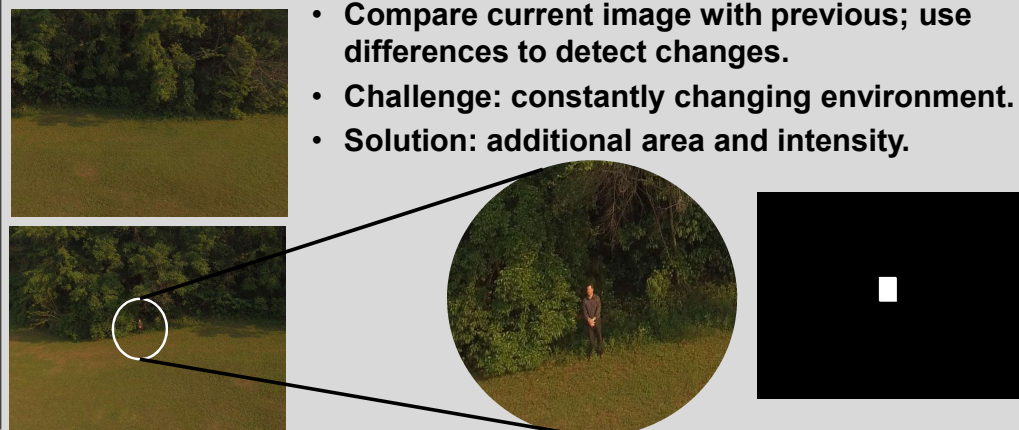
2. Alphanumeric Target Detection

- Recognize shape, color, and alphanumeric symbols.



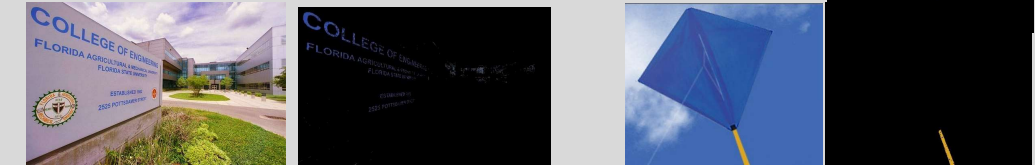
3. Dynamic Target Detection

- Compare current image with previous; use differences to detect changes.
- Challenge: constantly changing environment.
- Solution: additional area and intensity.



4. Color Target Detection

- Resize image
- Categorize pixels by color
- Determine color based upon RGB boundaries



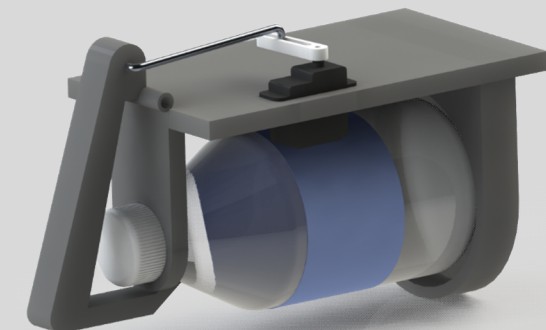
5. Shape Target Detection

- Resize image
- Gray scale image and blur
- Detect contour lines



6. Payload Delivery

- An 8oz, water bottle will be mounted on the underside of the UAV, aft of the camera. The latch will be engaged by a servo motor to release upon recognition of the hiker.



Summary

- **Accomplished:**
 - Developed electronics package
 - Completed stationary target detection
 - Completed hiker detection
- **Future Work:**
 - Develop safe autonomous flight test
 - Improve target detection robustness

- **References:**
 - Competition Rules SUAS 2017. (2017).
 - K. Aley, J. Denman, D. Fitzpatrick, C. Mard, P. McGlynn, and K. Ijagbemi, "Needs Assessment" Sep. 25, 2015.
 - K. Aley, J. Denman, D. Fitzpatrick, C. Mard, P. McGlynn, and K. Ijagbemi, "Project Plan & Product Specifications" Oct. 22, 2015.
 - "Hardkernel," in ODROID. [Online]. Available: <http://www.hardkernel.com/main/products/>. Accessed: Oct. 6, 2016.

