DESIGN OF AN AUTONOMOUS PLATFORM FOR
SEARCH AND RESCUE UAV NETWORKS

Group Members:

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Advisors:

Professor Padir
Professor Wyglinski
"A Search and Rescue volunteer who has completed our Academy will have over 220 hours of Search training prior to responding to missions."

San Diego County Sheriff’s Department
Design Specs

- 400 feet
- 35-55 Mi/h
- 150 feet

Camera Gimbals: 10 lbs

GPS
Airframes

“Goose”

“Blue Jay”

“Red Robin”

“Duck”
Flight Results

Altitude Plot

Velocity Plot
Camera Gimbal

Image with Dampening

Images without Dampening
Power Board

- MSP control logic
- Initial estimates between 90-95% efficient
- Flexible battery input

<table>
<thead>
<tr>
<th>System</th>
<th>Voltage</th>
<th>Current</th>
<th>Allowed Power</th>
<th>Priority level*</th>
</tr>
</thead>
<tbody>
<tr>
<td>FPGA Power</td>
<td>5 V</td>
<td>5 A</td>
<td>25 W</td>
<td>4</td>
</tr>
<tr>
<td>Camera</td>
<td>6 V</td>
<td>.5 A</td>
<td>3 W</td>
<td>4</td>
</tr>
<tr>
<td>SDR Amplifier and Computer</td>
<td>5 V</td>
<td>4 A</td>
<td>20 W</td>
<td>3</td>
</tr>
<tr>
<td>SDR</td>
<td>6 V</td>
<td>3 A</td>
<td>18 W</td>
<td>3</td>
</tr>
<tr>
<td>WIFI</td>
<td>15 V</td>
<td>.8 A</td>
<td>12 W</td>
<td>2</td>
</tr>
<tr>
<td>Panda</td>
<td>5 V</td>
<td>1 A</td>
<td>5 W</td>
<td>2</td>
</tr>
<tr>
<td>Autopilot System</td>
<td>8 V</td>
<td>.5 A</td>
<td>4 W</td>
<td>1</td>
</tr>
<tr>
<td>Servos</td>
<td>5 V</td>
<td>3 A</td>
<td>15 W</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>102 W</strong></td>
<td></td>
</tr>
</tbody>
</table>

- **Regulator Circuit**
- **Control Logic**

+5Vdc @ 10A Servos

• MSP control logic
• Initial estimates between 90-95% efficient
• Flexible battery input
Autopilot Control

Paparazzi Autopilot System

- Ground Control Station (UI)
- Radio Control Manual Override
- Incremental Testing
  - Auto 1
  - Auto 2
- Radio Telemetry
- Multi Plane Connection
Autopilot Simulations

Roll Navigation Simulation

Launch Altitude Simulation
Autopilot Results

- Sensor Configuration
- Data Acquisition
- 2 Manual Mode Flights
- 1 Auto 1 Engagement
- Multi-board Connection
Navigation Integration

Waypoint Insertion
# Flight Results

<table>
<thead>
<tr>
<th>D</th>
<th>Goal</th>
<th>Outcomes</th>
<th>Resulting Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nov 13</td>
<td>Robin RC Flight</td>
<td>- Engine stalled in final flight, planes steered right</td>
<td>- Altered engine mount thrust angles and pressure gas tank</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Moved the gas tank back 4 inches</td>
</tr>
<tr>
<td>Feb 2</td>
<td>Robin RC Flight</td>
<td>- Successful GPS downlink</td>
<td>- Added Aluminum Frame and hard mount point for wings</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Wings shifted and sheered off wing struts connection</td>
<td>- Mounted the IR sensors</td>
</tr>
<tr>
<td>Feb 9</td>
<td>RC Flight Decoder Board</td>
<td>- Calibrated thermo sensors on plane</td>
<td>- Replaced the broken wheel</td>
</tr>
<tr>
<td>Feb 15</td>
<td>Auto 1</td>
<td>- Lost the down link before going into Auto 1</td>
<td>- Added New decoder board</td>
</tr>
<tr>
<td>Feb 18</td>
<td>Auto 2</td>
<td>- Caught a cross wind and <strong>crashed</strong></td>
<td>- Fixed all crash damage, replaced glue on tail and installed the dome</td>
</tr>
<tr>
<td>Apr 7</td>
<td>Jay Flight Auto 1/2</td>
<td>- Too windy, taxi test only</td>
<td>- NA</td>
</tr>
<tr>
<td>Apr 11</td>
<td>Jay Flight Auto 1/2</td>
<td>- Jay flew, slight warp in right wing discovered</td>
<td>- to be continued…..</td>
</tr>
</tbody>
</table>
Planes in Action

Design of an Autonomous Platform for Search and Rescue UAV Networks

Catherine Coleman, Joeseph Funk, James Salvati, Chris Whipple
Advisors: Taskin Padir, Alexander Wyglinski

WPI Robotics
Where We Stand

- Robin
  - RC flight
  - Auto 1 flight
  - Crash, need airframe replacement
- Jay
  - RC flight
- Duck
  - Some assembly required
- Integration
  - External waypoint insertion
  - Power board designed

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Sterling Airport  
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