IPRO 312

Unmanned Aerial Systems (UAS)

Illinois Institute of Technology: Spring 2011

Major Tasks

Design/Assemble an inexpensive and lightweight aerial vehicle capable of:

- **Autonomous take-off & landing**
- **Waypoint navigation via GPS co-ordinates**
- **Automatic target search & detection**
- **Analysis of target**
- **Going into safety mode/manual control**

Potential Markets

- Military
- Law Enforcement
- Agriculture
- Construction
- Maps
- Customs and Border Protection

Team Organization

AUTO PILOT

Team Members: Lidens Cheng, Nishanth Samala, Matt Simpson

Leader: Lidens Cheng

VISUAL

Team Members: Kay Traylor, Yaofu Zhou, Jiang Lan, Bernie Mendez

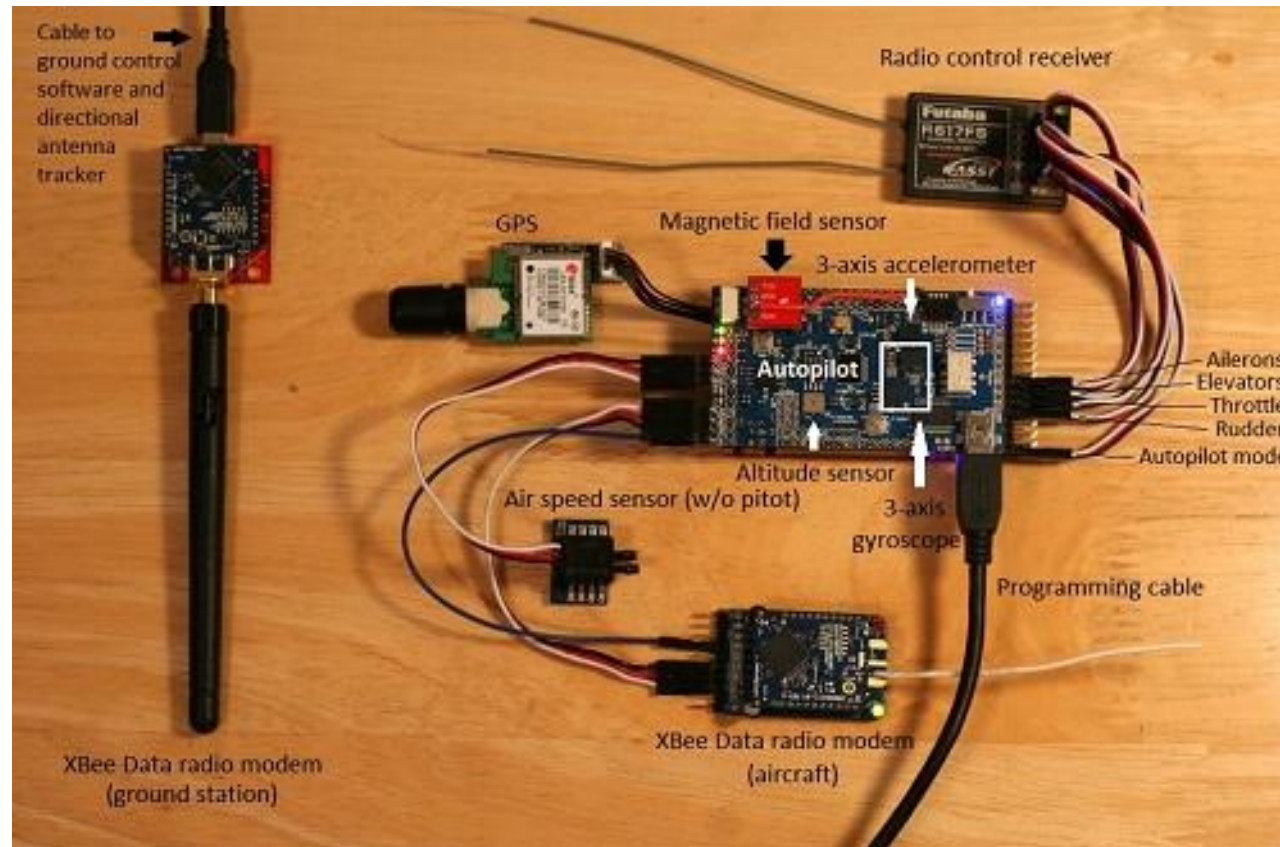Leader: Kay Traylor

GROUND STATION

Team Members: Artemio Perez, Tushar Nair, Brian Schubert
Leader: Artemio Perez

Problem:

The original ArduPilot Mega autopilot software must be modified in order to achieve autonomous flight

Goals:

Modify software for:
- autonomous takeoff and landing
- navigation through waypoints

"Return to Launch" and "Flight Termination" fail -safe features

- Perform a series of test flights

Progress:

- Ran diagnostics on the software
- Determined the autopilot flight mode works
- Ran autopilot mode in X-Plane 9 flight simulator

Challenges:

- Other 5 flight modes are not recognized from radio transmitter or in X-Plane 9
- Need to modify features in software related to reading in and implementing flight modes
- Anticipate several parameters will need to be adjusted after series of test flights

VISUAL

Problems:

- System functioning under the constraints of power, weight, and time
- Inadequate video recording
- Connection issues between on board visual recordings and ground station
- Software development

VISUAL

Goals:

- Acquire and install camera
- Acquire and install image transmission
- Complete image detection and identification code

Organization: VISUAL

VISUAL
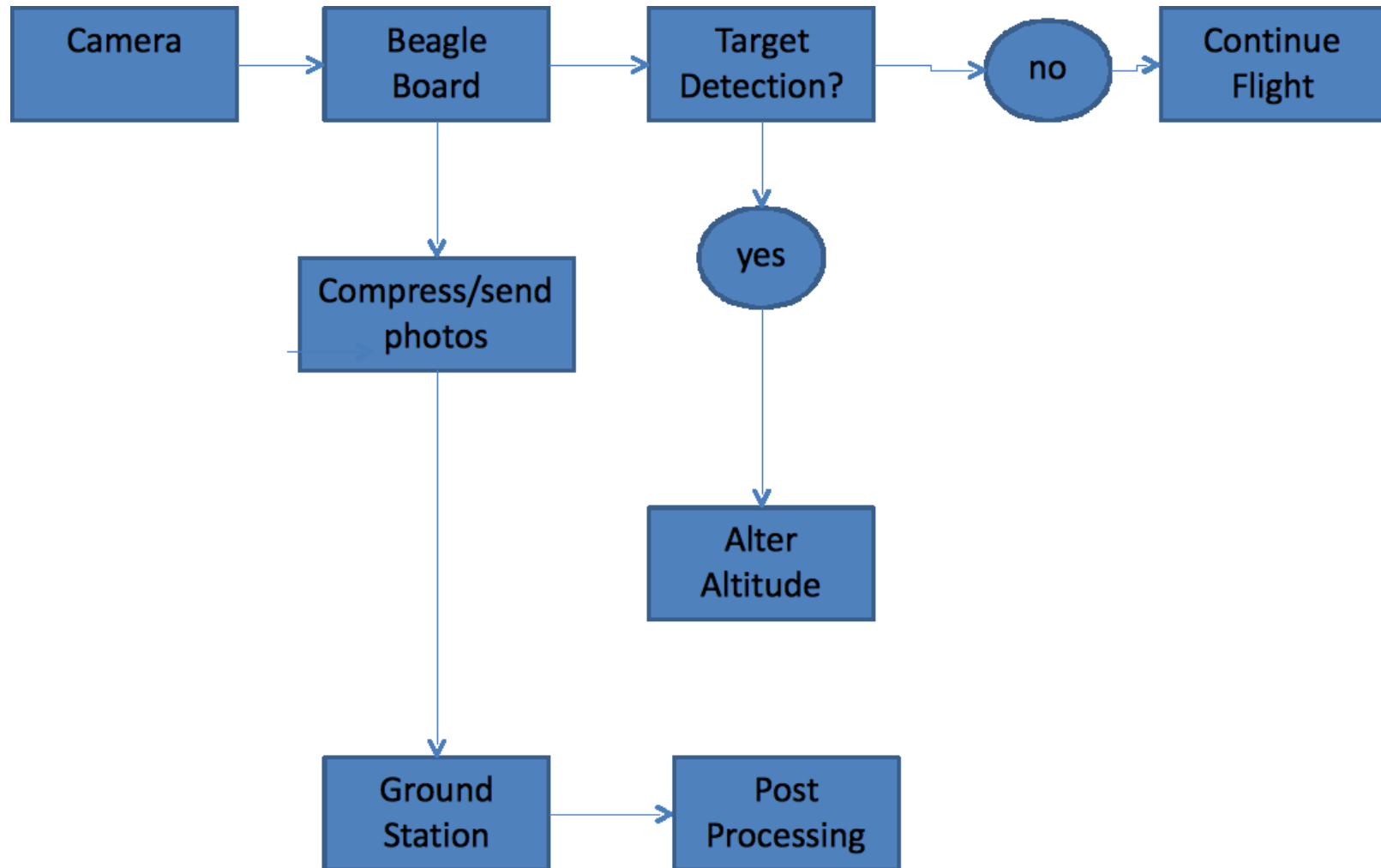
- ## Current: SN-777

  - 22 grams

  - High resolution

- ## GoPro Motorsports Hero

  - 94grams

  - HD quality

Progress: Beagle Board used for image Detection, compressing, and transmission

3.25" $\times$ 3.25"
113 grams
4 USB 2.0 ports
10/100 ethernet port
1-GHz ARM® processor
512 MB of RAM

Data Transmission:

2.4GHz Wifi

2 mile range

500mA at 5V

150Mbps

Less than 200grams

VISUAL

Visual Software:

Linux Environment, Open CV program

1.Target detection by color contrast between

target and background

(see example)

2. Post processing

to identify color, shape, and

Alphanumeric

(working in progress)

Pre-detection

Post-detection

Goals:

☐ Upgrade mechanical components

☐ Optimize antenna type and focal point

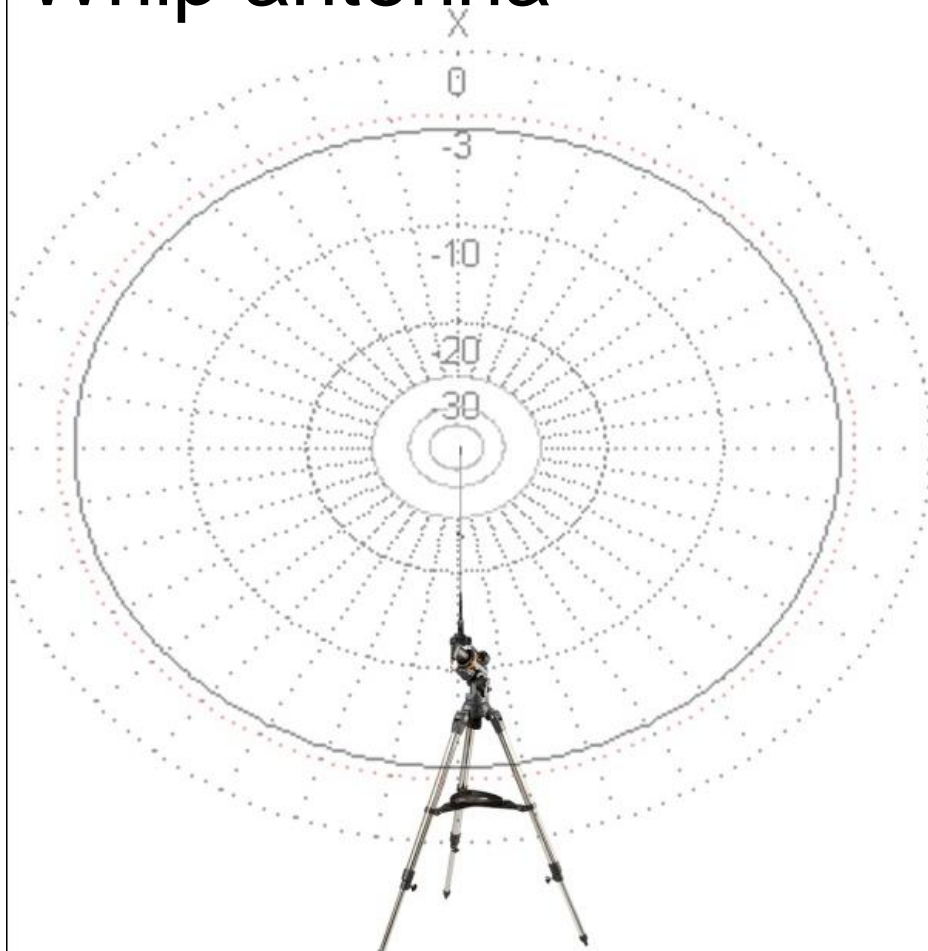☐ Create transportation system for quick setup

GROUND STATION

Problems:

☐ Data transmission limitations

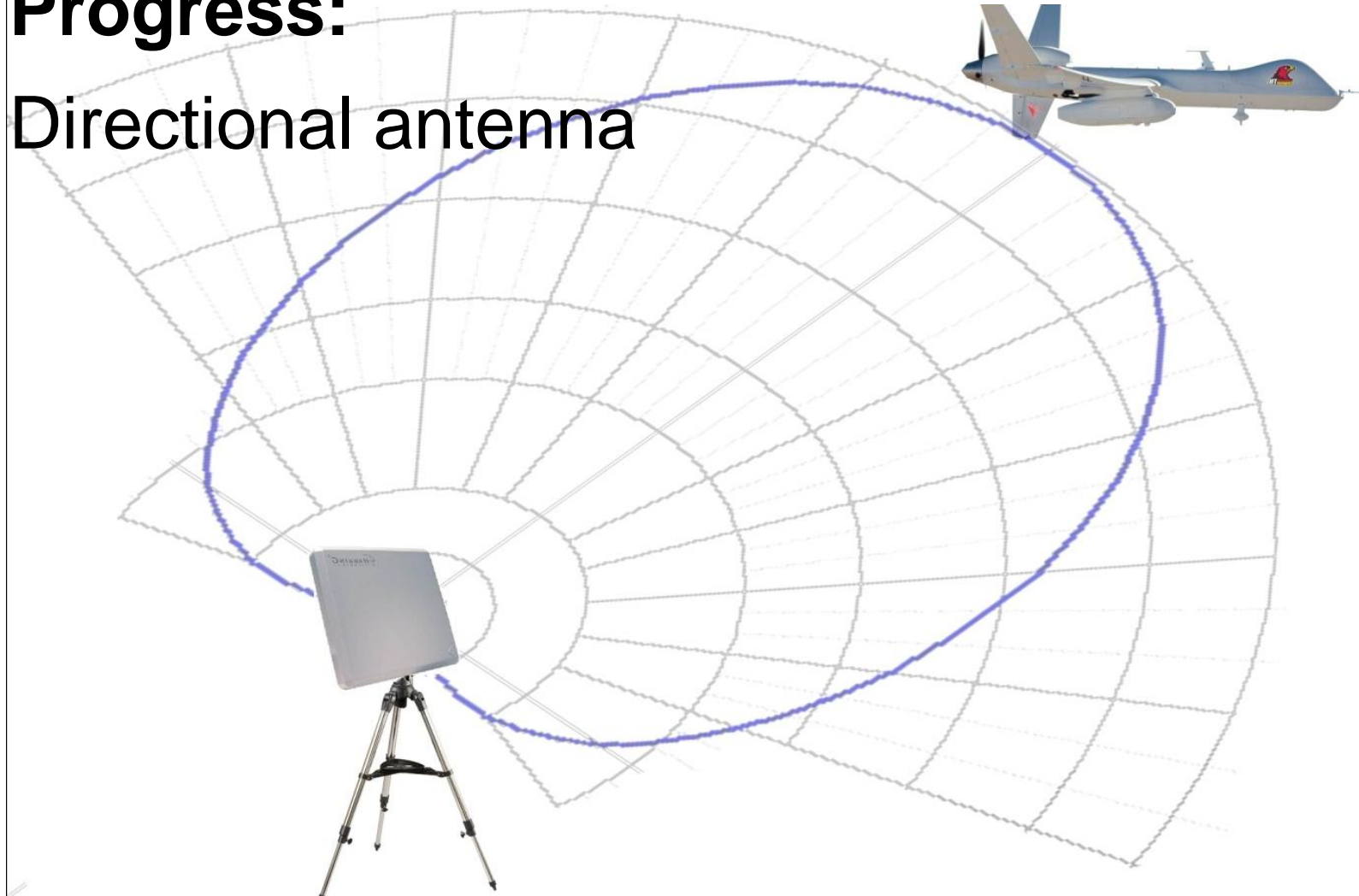☐ Limited power source

☐ High speed tracking

GROUND STATION

Progress:
Whip antenna

GROUND STATION

Progress:

Directional antenna

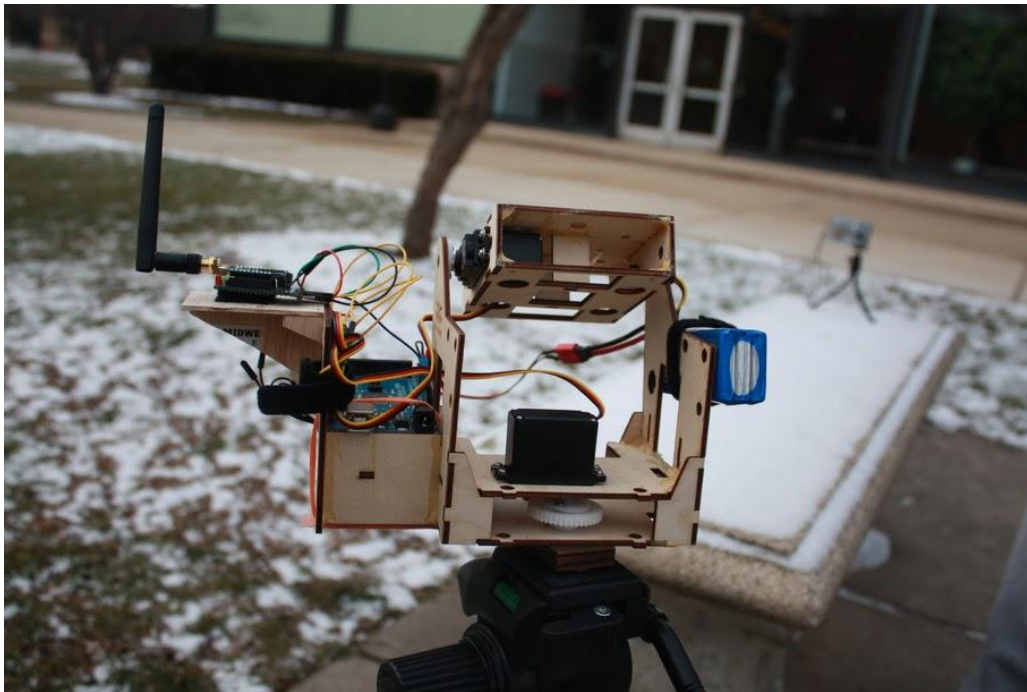# GROUND STATION

Challenge:

Directional antenna that tracks UAS

Questions?