UAV Assisted Energy Delivery

Team: sdmay19-43

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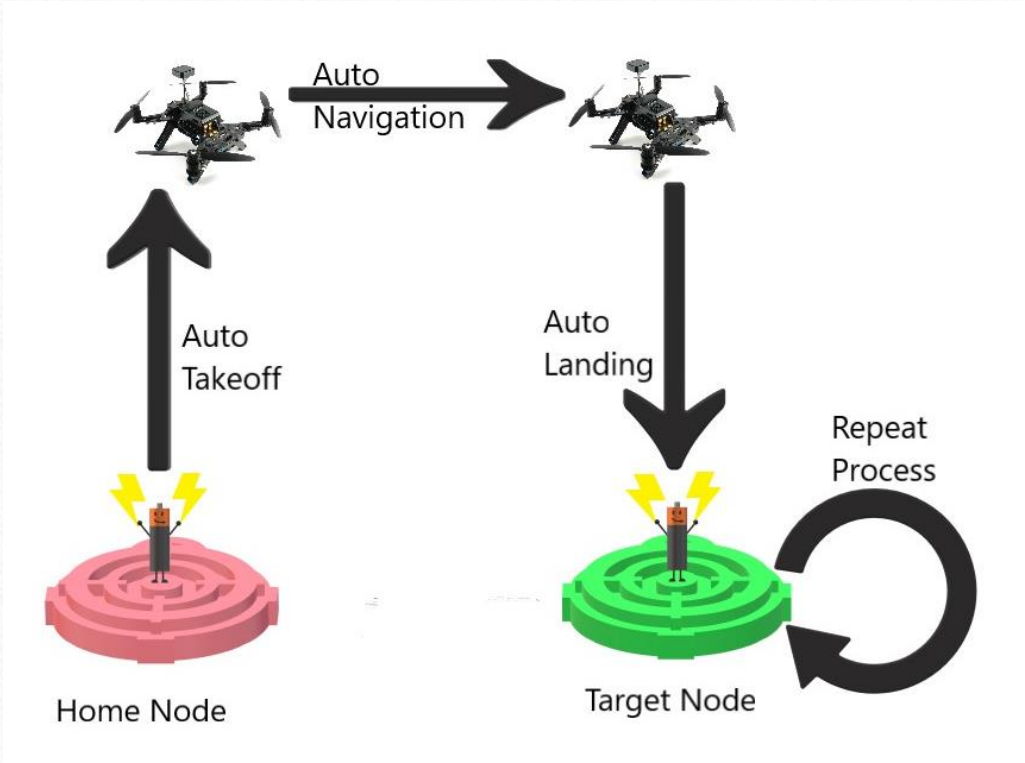
Problem Statement

- Many Devices, Few Connections
- Difficulty to add new systems to existing ones
- Flexibly Energy Delivery Through Drones

Intel Drone: https://docs.px4.io/en/flight_controller/intel_aero.html

Conceptual Sketch

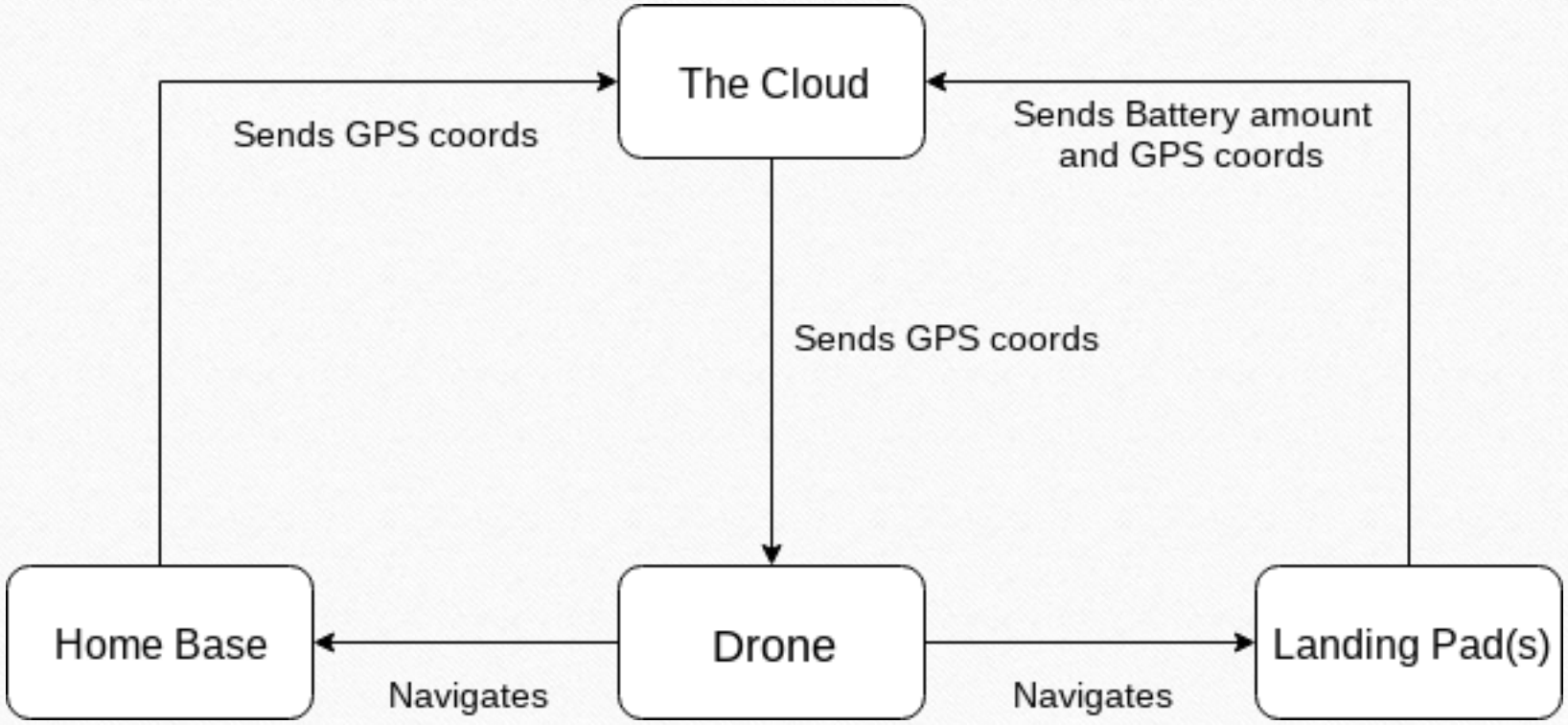


UPS: https://teamster.org/news/2018/07/teamsters-release-ups-national-agreement-principle-highlights

Proposed System Design

- Automated Flying
  - Using existing drone (Intel Ready-to-Fly)
  - Receive coordinates to target node
  - Flys autonomously at an efficient speed at variable distances
- Automated Landing Procedure
  - Docking node with unique shape
  - Controlled descent to prevent crashing
  - Fine movement to land
- Energy Transfer
  - Use different payload battery to transfer energy
  - Carriage design for payload battery transport
  - Attach and detach without human assistance

System Block Diagram



Operating Environment

- Overall system will deal with:
  - Adverse weather conditions
  - Objects to avoid
  - Regulatory areas
- Our scope will deal with:
  - Open field
  - Clear day
  - Outside of regulatory areas

Functional and Non-Functional Requirements

- Functional
  - Take off and fly to and from a specified location autonomously
  - Dock with docking node for power transfer autonomously
  - Deliver power to and from payload battery to docking node
- Non-Functional
  - Scaling system to miles
  - Multiple drones, bases, nodes
  - Bigger battery for bigger systems

Market Survey

- Demand for remote energy delivery
  - Amount and variety for power demand exponentially increasing
  - Amount of nodes is approximately constant
- No official product in the market
- Amazon has similar technology

Deliverables

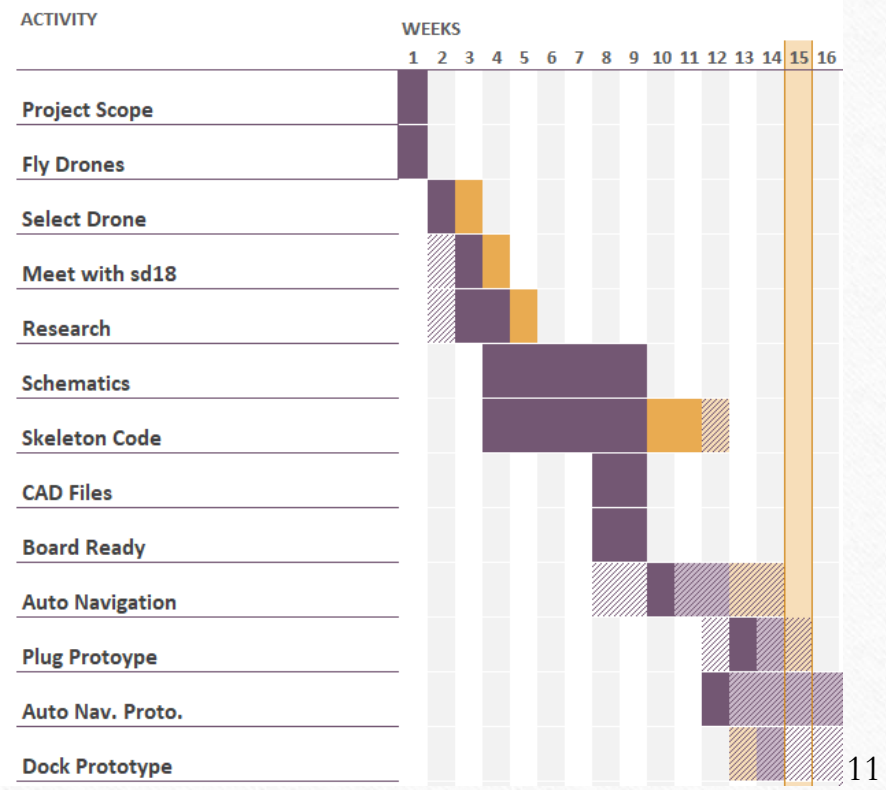
- Energy Distribution System
  - Procedure for energy delivery
    - Takeoff
    - Flight path
    - Landing at docking node
    - Repeat
- Demo of drone
- Docking node
  - Drone lands and establishes reliable connection
  - Connect without human interaction

Project Management

- Work breakdown
  - Hardware and image processing: Kevin, Brendan
  - Precision landing: Connor, Kaitlyn
  - Movement: Garth, Alexandra
- Resource Requirements
  - Intel RTF drone
  - Materials for docking node(s)

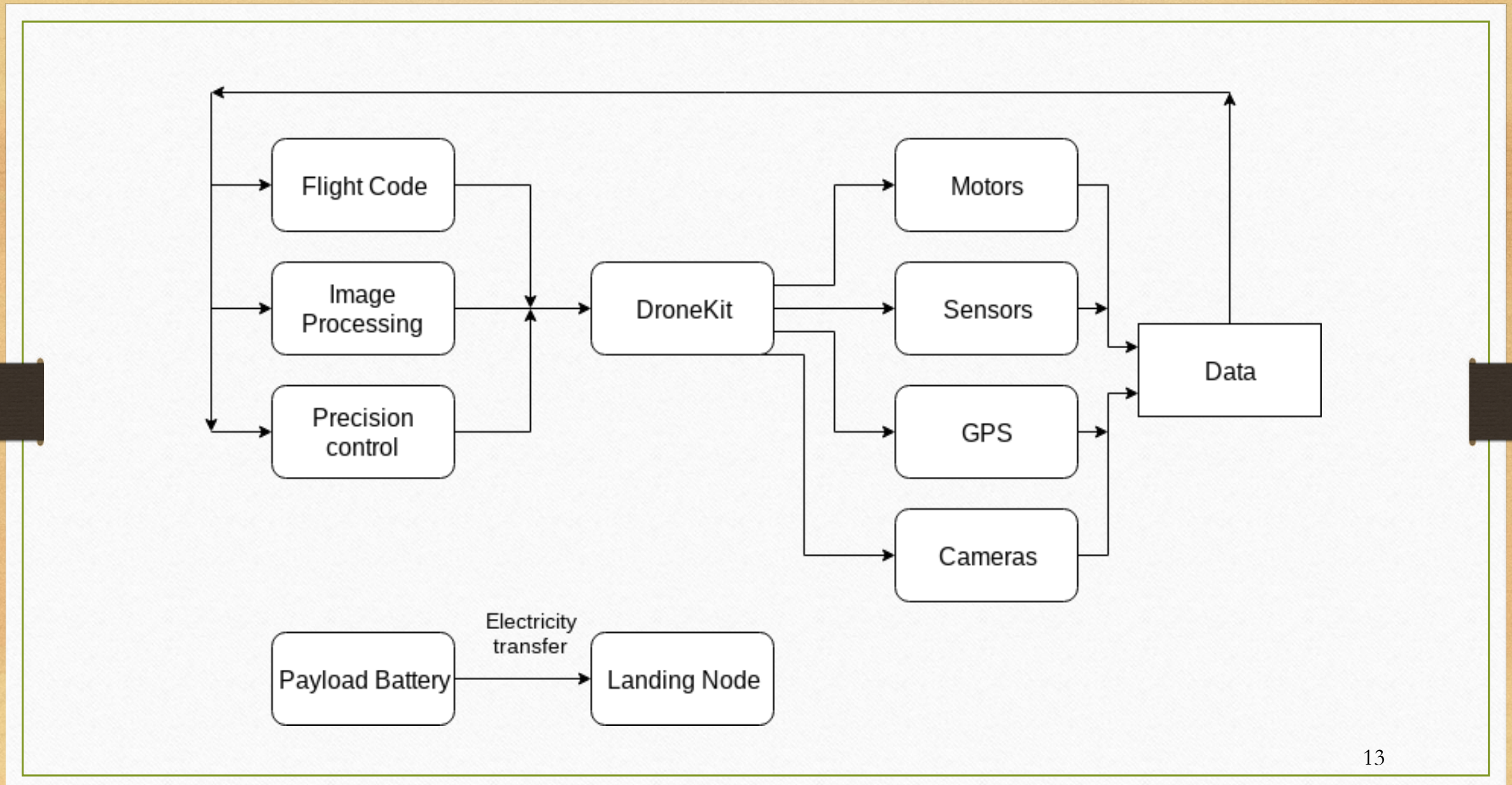
Project Management

- Project Schedule
- Risks
  - Environmental variables: wind, temperature
  - Image processing while sustaining flight
  - Down to centimeter resolution for image processing



System Design

- Autonomous flying
  - Use DroneKit for high level design
  - Use Intel Drone due to open source
- Automated landing
  - Image processing well documented and easy to use
  - Resolution change for better landing
- Power transfer
  - Magnetic cord will be easy to attach and detach
  - 3D printing will allow lightweight, custom carriage design


Flight Code
Image Processing
Precision control
DroneKit
Motors
Sensors
GPS
Cameras
Data
Payload Battery
Electricity transfer
Landing Node

Detailed Design

- Hardware/Software Specification
  - Arrival times 1 ~ 10 minutes.
  - Time to Land ~ < 1 minute
  - Centimeter level precision while landing
  - Power transfer time ~ < 2 minutes

Testing Plan

- Autonomous drone flying to a location with 1 meter accuracy
- Fine precision movement to 1 centimeter
- Image processing defines 90% of object
- Simulation testing

Basic Implementation

- Basic Building Blocks
  - Old Project Code
  - Online Code
- Familiarity to tools
  - Most new to Python
  - All new DroneKit users
  - All have now flown drone

DroneKit: http://dronekit.io/

Current Project Status

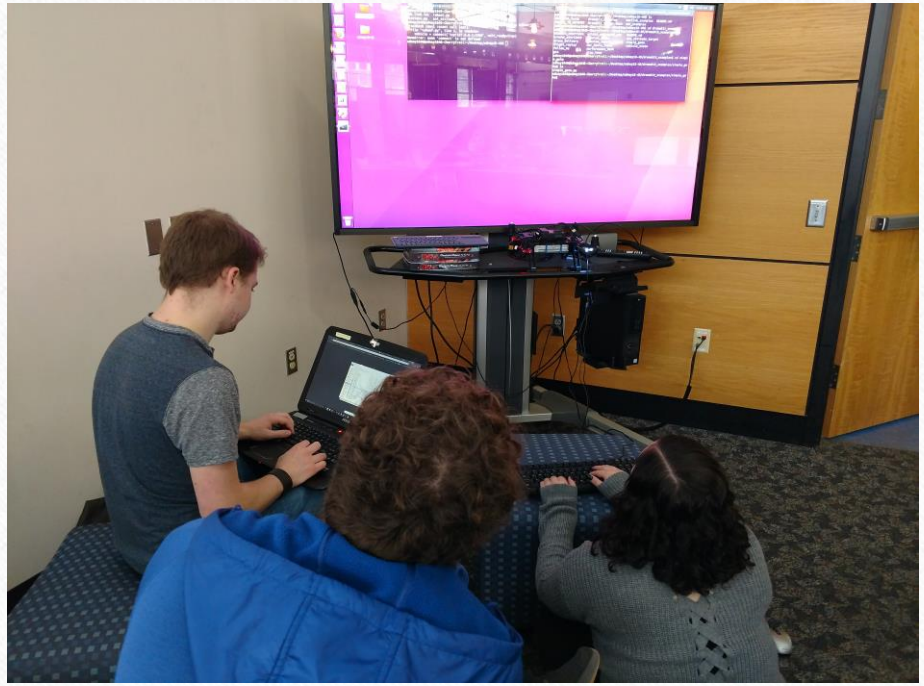
- Docking node constructed
- Code to move drone to location
- Research
  - Image processing
  - Landing
  - Pathing

Individual Responsibility/Contributions

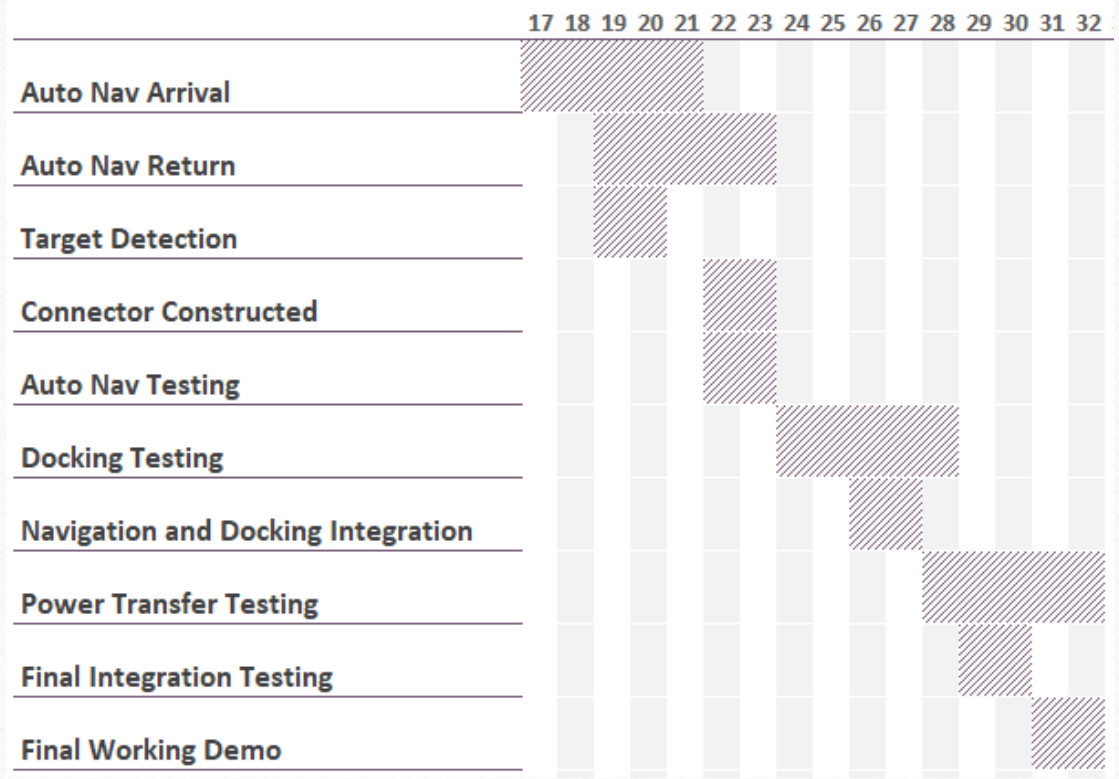
- Hardware
  - Docking Node
    - Kevin, Brendan, Kaitlyn
  - Carriage Design
    - Brendan, Kevin
  - Battery Placement
    - Kevin, Brendan

Individual Responsibility/Contributions

- Software
  - Flight Pathing
    - Garth, Alexandra
  - Precise Movement
    - Connor, Kaitlyn
  - Drone Flashing
    - Alexandra, Connor, Garth, Kaitlyn



Second Semester Plan



Sources

- Intel drone

https://docs.px4.io/en/flight_controller/intel_aero.html

- UPS guy

https://teamster.org/news/2018/07/teamsters-release-ups-national-agreement-principle-highlights

- DroneKit

http://dronekit.io/

Questions?