Formation Flying Blimp Project MS#4

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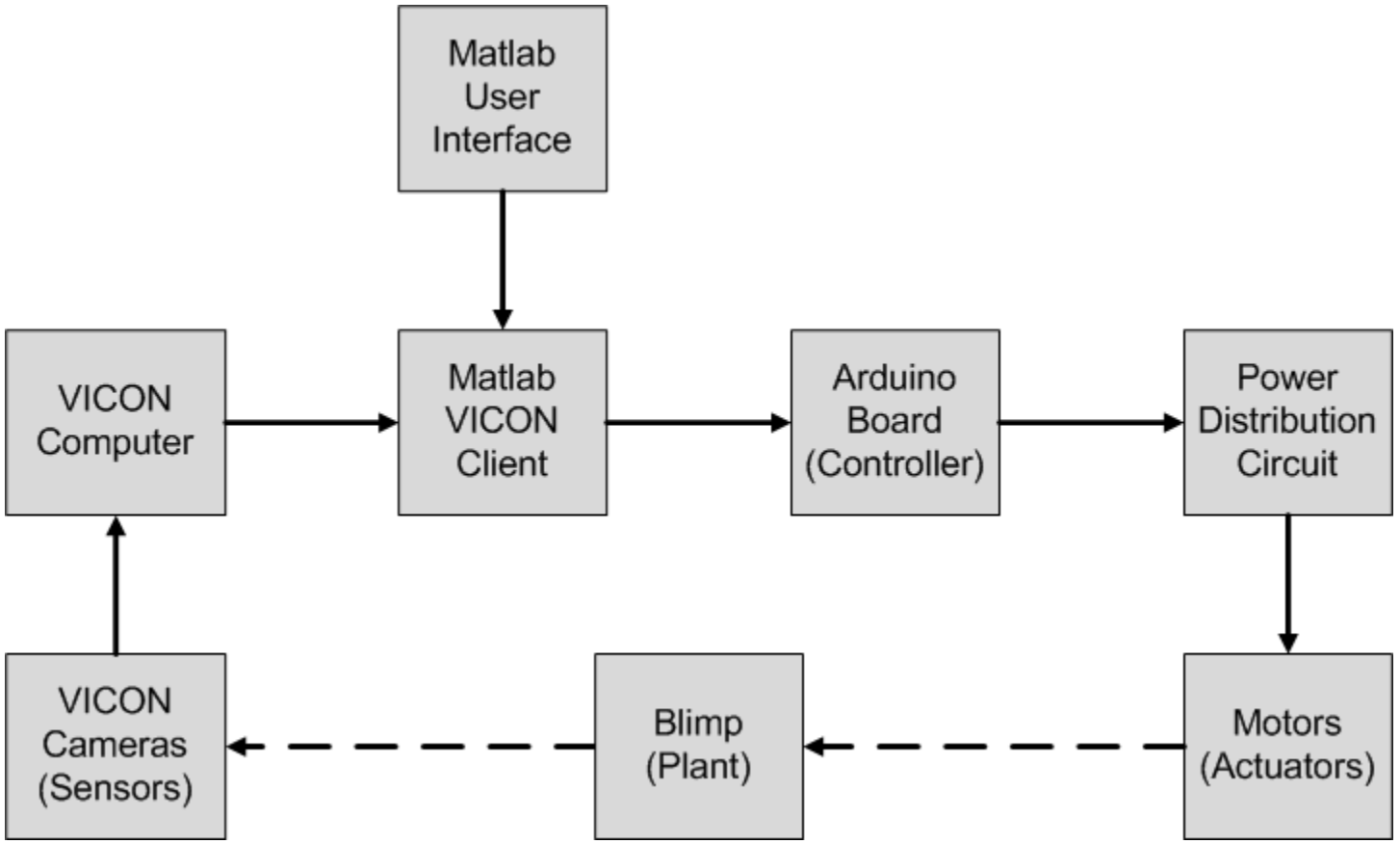
Presentation Outline

- Project recap
- System architecture
- Hardware
  - Motor/propeller selection
  - Blimp structure
- Electronic components
  - Power circuit
  - Wireless communication
  - Arduino board and shield
- Software
  - Vicon interface
  - Arduino onboard controller implementation

Project Recap and Update

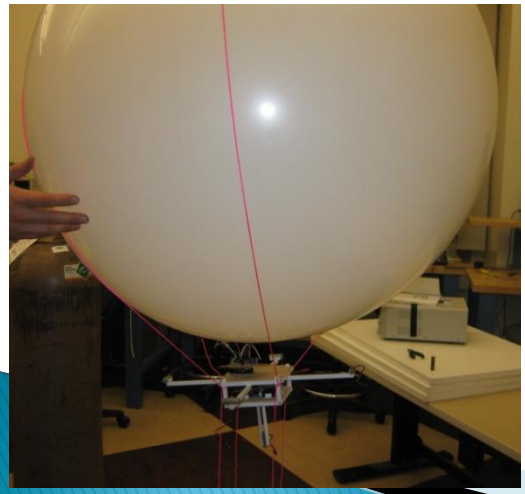
- Autonomous blimp project for testing of distributed system algorithms
- Blimp structure and hardware assembled
- Interface with VICON camera system
- Circuit board designed and tested
  - Currently in production
- Controllers for multiple operating points
- Onboard microcontroller programming

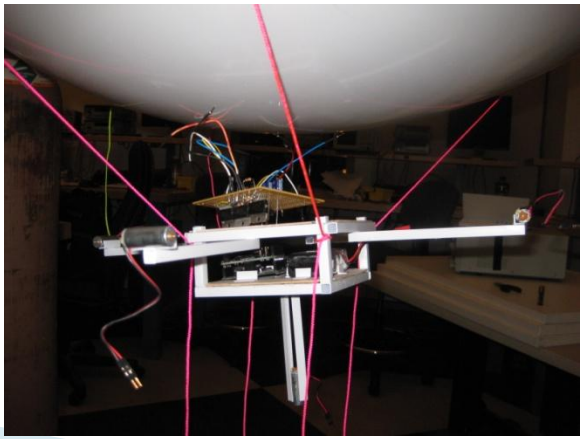
System Architecture

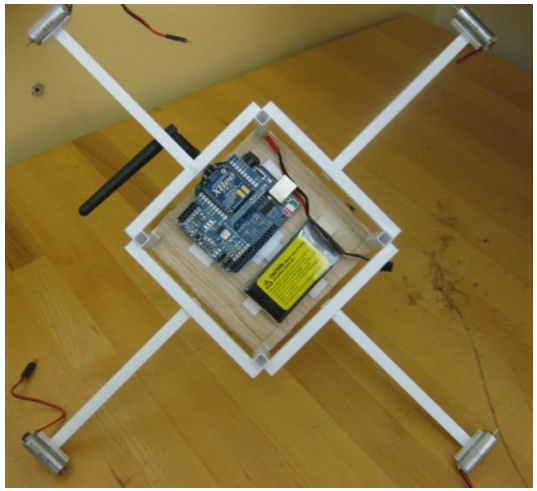


Blimp and Structure

- Weather balloon (diameter 1 meter)
- Blimp structure must be light weight
  - Styrene supports with 2 balsa decks
  - Motor arms supported to prevent deformation
  - Motors/propellers mounted away from structure to provide yaw authority



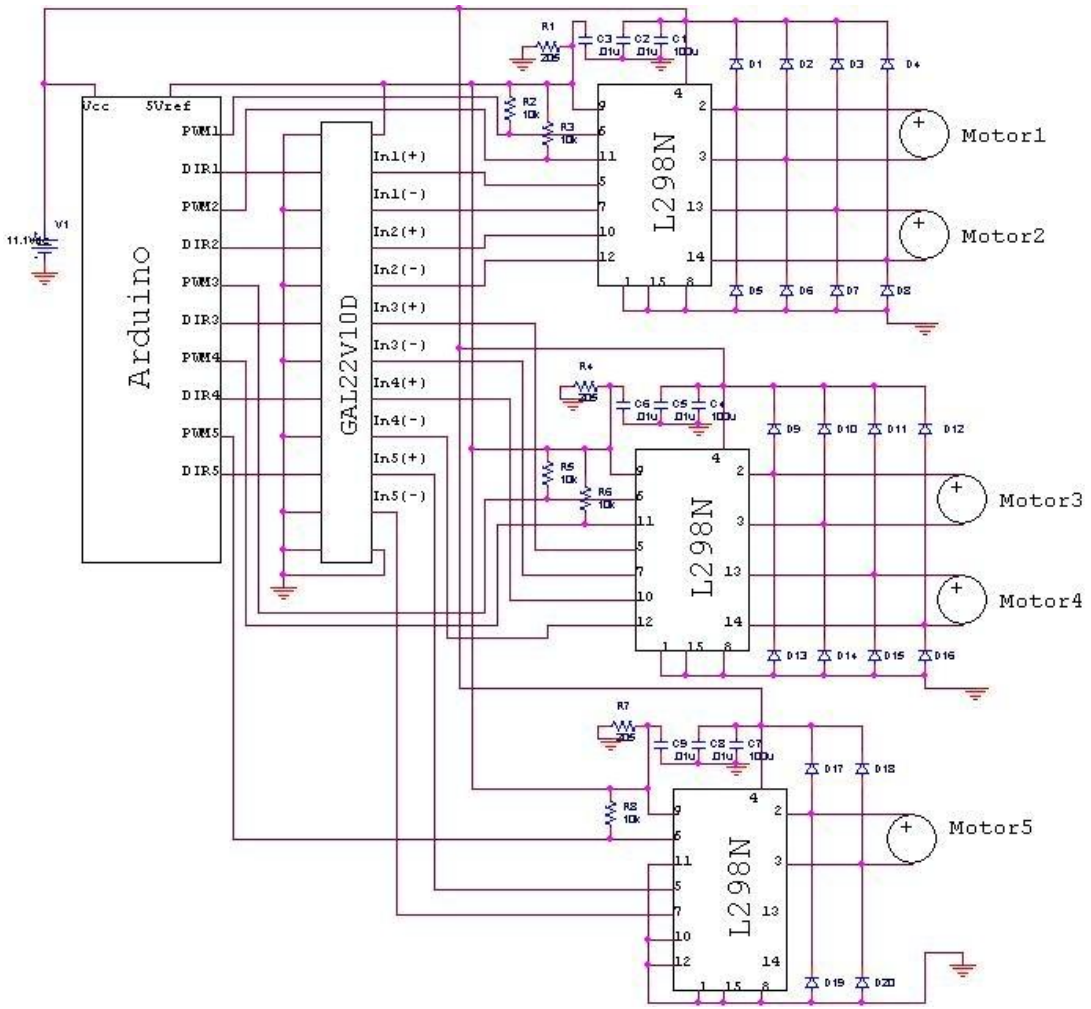




Electronics

- Arduino/ATMega328p
  - Serial communication
  - Onboard controller
  - Easily implement controller/circuit board configuration
- Xbee communication system
  - Wireless serial communication
  - Interfaces with Arduino using shield

Power Board Schematic



Power Circuit Implementation

- L298N H-Bridge Central Component
- Three signals required for bi-directional motor control

Duty	Direction 1	Direction 2	Motor Output:
P	5V	0V	CW (αP)
P	0V	5V	CCW (αP)

- Arduino only has 14 I/O pins
- GAL22V10 Programmable Logic Device switches between signal cases with one Arduino input

VICON Software Interface

- VICON data is gathered in MATLAB
- GUI allows user to define new reference position at any point during the trajectory
- Blimp position data is sent from the loop over serial connection to the Arduino (via Xbee)
- Position and commands separated into bytes prior to sending to allow easy serial read by Arduino

Onboard Controller Implementation

- Arduino board takes in serial data representing position and reference position
- Estimator and PI controller operate using matrices (linearized system model)
- Controller output voltages are adjusted to implement bidirectional motor control
- Arduino outputs PWM signals and outputs representing direction

Remaining Schedule:

- Finish Circuit Board: 5/23
- Create gondola attachment system: 5/28
- Create gondola ballast system (+mass): 5/28
- Implement Controller on to Arduino: 5/31
- Tinker until demonstration date

Questions, comments or concerns?

Resources:

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