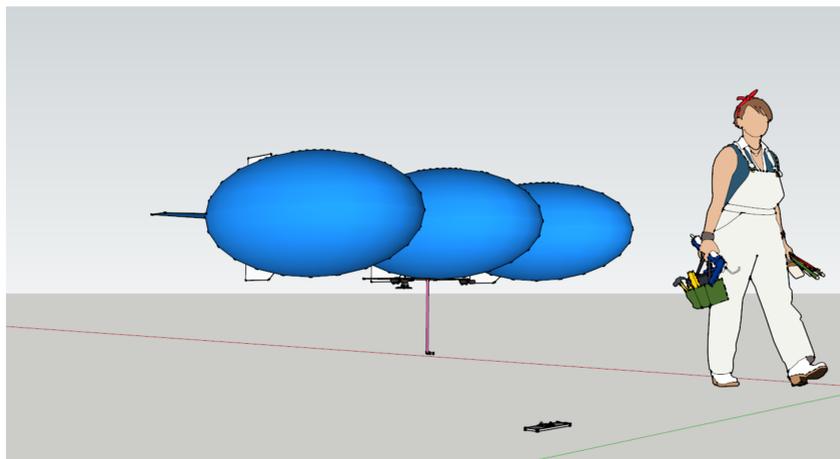


## Introduction

Today, the United States is heavily reliant on commercial trucking for the transportation of cargo. According to Truck Driver Institute, the average yearly cost of operating a commercial truck is \$180,000. The bulk of this heavy cost is due to fuel consumption, driver salary, truck cab, trailer, and maintenance. Due to the need of additional infrastructure when using trucks, it is expensive to reach remote locations without damaging the local wildlife. A heavy lift blimp can safely and sustainably carry cargo loads in areas with little to no infrastructure. A blimp offers the simplicity of a commercial truck by carrying loads to and from remote areas, not just during certain seasons or only after major road, rail or airport infrastructure is developed.

## Objectives

- Autonomous Detection of Beacons
- Autonomous Flight and Object Collection
- Object Identification using Color Detection



## Research Challenges

- Environmental background noise in the infrared spectrum
- Object detection system for locating and centering of beacon
- Balancing flight time, airship weight, power consumption
- Beacon to receiver infrared accuracy and noise filtering
- LED emission wavelength, radiant intensity, viewing angle
- Microcontroller programming language and processes

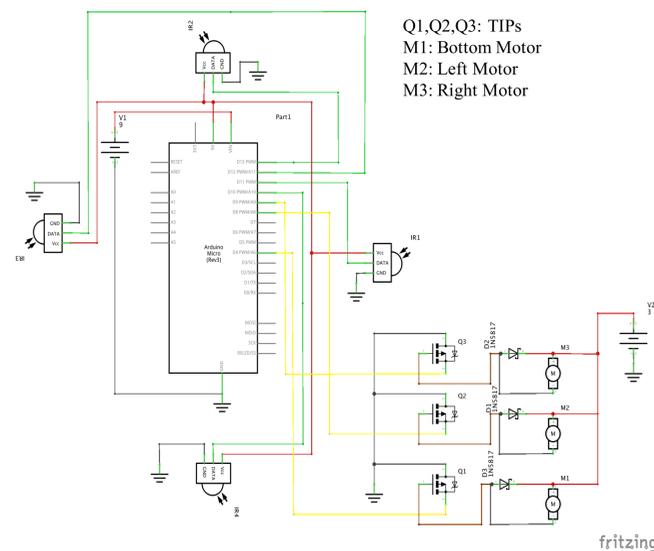
## Design

### Beacon

- Designed and built light weight 56 kHz astable multivibrator

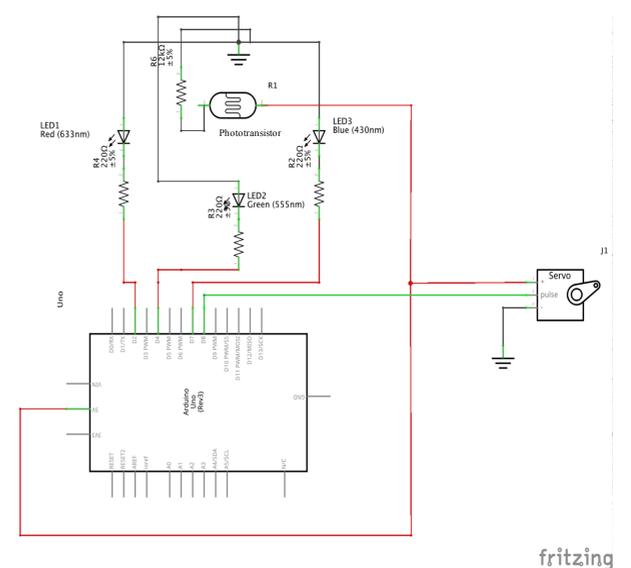
### Airship

- Infrared receiver module using 56 kHz BPF photo detectors
- Arduino based MCU board with IR signal processing and flight control system
- Power control system for distribution of power to Arduino MCU board and motors



### Lift Mechanics

- Color detection circuit using three LEDs (Red, Green, Blue) and a phototransistor.
- Code and construct servo hardware for hook mechanism
- Use color detection circuit to control hook servo positioning.
- Using Arduino MCU to color compare for object detection system



## Tests

- Preliminary beacon to photo detector transmit/receive test
- Preflight motor to microcontroller flight instrument interface
- Full system integration and flight testing
  - Autonomous flight to beacon.

## Acknowledgments

- Dr. Richard Howard for his excellent support throughout the research and development of our capstone project

## Future Work

To enhance the functionalities, we plan to implement

- Increase flight control system accuracy w/ GPS assistance
- Decrease airship weight while increasing power efficiency
- Improve upon payload extraction mechanisms and system
- Increasing scaling size to better prove lift capabilities
- Implementing cameras to accurately identify objects

## References

- [1] "Arduino Forum - Index". *Forum.arduino.cc*. N.p., 2016. Web. 22 Apr. 2016.
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- [3] Krein, Philip T. *Elements Of Power Electronics*. Print.