Perching Drone

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Introduction

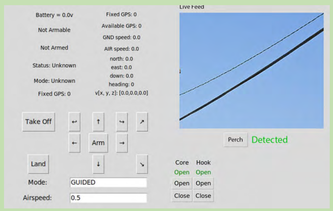
- Drones are becoming more popular among a wide variety of users.
- A common problem among users is the lack of battery life.
  - Drones must be as light as possible.
  - Drone Batteries must be very light, thus aren't able to store much electricity.
  - A battery dying during flight results in the drone crashing.
- Our team aims to remedy this issue.

Objectives

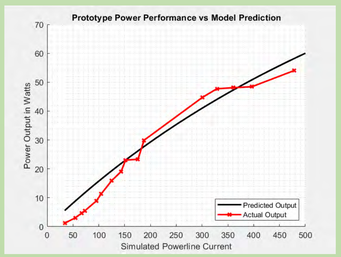
- Design a mechanism capable of perching quickly with a significant factor of safety.
- Design an inductive charging coil capable of extracting significant amount of power from the magnetic field of the powerline.
- Design a circuit capable of converting the harvested electricity into a form that can safely charge the battery.
- Integrate all systems on the drone.
- Write the code necessary to control all systems on the drone.
- Successfully perch drone on the powerline and charge its batteries with extracted power.
- Write an IEEE paper and attempt to get it published in a scientific journal.

Metrics

- Ease of Use
- Closing Time
- Charging Rate
- Weight
- Passive Gripping



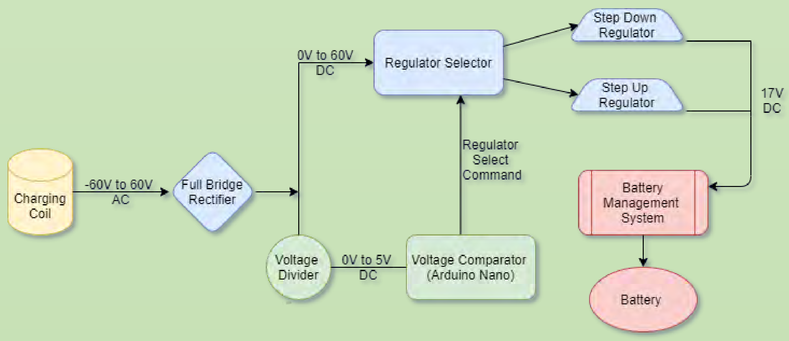
Graphical Interface that allows manual control of drone functionality



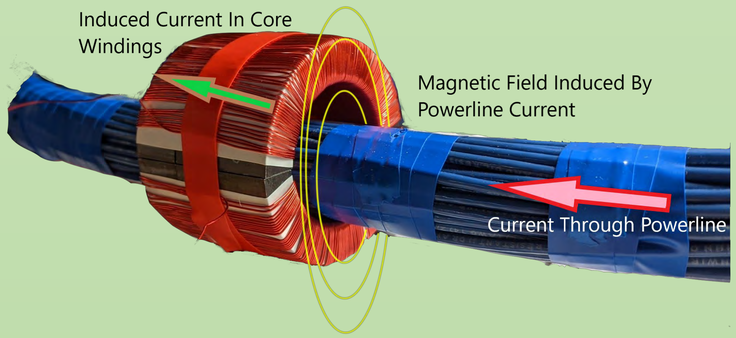
Power output of the charging coil compared to the predicted output. The predicted output of the charging coil was determined using a mathematical model that describes the induced voltage in the charging coil as a function of powerline current.

Final Prototype

Full Drone Assembly with perching mechanism shown in blue



Flow diagram of power conditioning circuit



Final charging coil prototype with silicon steel core

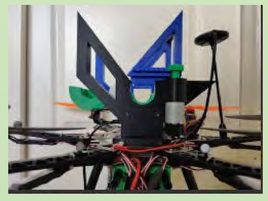
Results

- We have met and exceeded our design goal of 10 watts power output from the charging coil.
  - Its output is between 10 and 80 watts.
- The perching/charging system weighs about 50% of the maximum payload.
- The gripping mechanism can hold about 10x the drone's total weight.
  - The gripping mechanism closes in about 0.5 seconds.
- We have successfully perched on a mock powerline.
- We created a Graphical User Interface that
  - Controls flight capabilities.
  - The closing and opening of the perching mechanism.
  - The visual detection of the power cable.
- We still need to perfect the automatic perching function.
- Our design may need to be refined to become more manufacturable.

Perching Mechanism closing

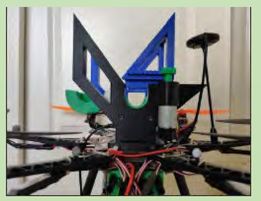
T = 0.0 Seconds

T = 0.25 Seconds



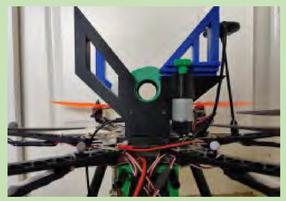
T = 0.5 Seconds

Coil Mechanism Closing



T = 0.0 Seconds

T = 4 Seconds



T = 8 Seconds

Conclusion

- Our drone's core outputs at least 10 times more power than last year's drone.
- Our mechanism closes 6 times faster than last year's mechanism.
- We wrote a program that allows our drone to perch automatically which makes our drone much easier to handle than the previous team.
- Our core can charge the drone's battery in less than 1 hour where the previous team's drone took about 3 days.
- Our drone outputs so much power that our charging circuit has a difficult time keeping up the output.