Space Debris Grappling System

Aerospace Engineering Capstone Design

Project Plan

Team Members	Emails
Control Subsystem Lead: Matthew Intriago and Nouraldean El-Chariti **Controls Subsystem Supporting Engineers:** Michael Leard and Daniel Soto	mintriago2017@my.fit.edu nelchariti2017@my.fit.edu
Project Manager: Kyle Watkins **Project Systems Engineer:** Luca Rizza	watkinsk2017@my.fit.edu lrizza2017@my.fit.edu
Structures Subsystem Lead: Vincent Panicelli **Structures Subsystem Supporting Engineers:** Nouraldean El-Chariti, Vincent Panicelli, Daniel Soto, Ali Lebbar	vpanichelli2017@my.fit.edu dsotoperezco2017@my.fit.edu alebbar2016@my.fit.edu
Electronics Subsystem Lead: Michael Leard **Electronics Subsystem Supporting Engineers:** Michael Leard, Ali Lebbar, Davey Renoid	mleard2017@my.fit.edu drenoid2016@my.fit.edu
Grappling Mechanism Subsystem Lead: Daniel Soto **Grappling Mechanism Subsystem Supporting Engineers**: Laura Guziczek, Nouraldean El-Chariti, Davey Renoid, Vincent Panichelli, Ali Lebbar	dsotoperezco2017@my.fit.edu lguziczek2018@my.fit.edu

Faculty Advisor and Client	Emails
Advisor: Dr. Silaghi	msilaghi@fit.edu
Client: Dr. Wilde	mwilde@fit.edu

Client Meeting Log	
August 26, 2020	Initial Meeting to discuss project scope
September 2, 2020 – December, 2020	Recurring weekly meetings every Wednesday

Goal and Motivation

The goal of our project is to provide a tool that improves the safety of all space missions by removing the risk of colliding against space debris. As space technology progresses the necessity of having a safe orbit becomes crucial and through the use of our product multiple companies could benefit from it. Not only are future space missions at risk, but also all current satellites that are orbiting our atmosphere are in danger against debris.

Approach

Grappling Device Prototype Autonomy

1. The grappling device can autonomously perform the welding process.
2. When objects collied, the device can transfer collision data such as velocity and momentum of the space debris.

Grappling Device Prototype Manual Mode

3. The device shall be able to provide an accessible interface for power and data transfer.
    a. Users can check status of welding completion with aircraft
    b. If autonomy fails, users can manually cancel or shut off the welding process.

4. Using the collected data that is transferred to the user-interface, users can adjust the grappling hook to fix the errors that occur during autonomy.

Novel Features

1. Autonomous welding performed by a completely new designed algorithm that supports working inside a vacuum and zero gravity.
2. Utilizing the latest in sensor and software technology to protect and optimize the welding process.

Technical Challenges

1. The programing of the microcontrollers such as Arduino or Raspberry Pi to connect the algorithm in use to the grappling hook itself.
2. The designing of the interface that will demonstrate the user the power and data transfer of the welding process.
3. The design of the autonomous algorithm that will adapt to different types of debris welding.

First Milestone

- Compare and select technical tools for microcontrollers. Current options are Arduino and Raspberry Pi.
- Provide small ("hello world") demo(s) to evaluate the tools for *Arduino and Raspberry Pi* microcontrollers.
- Resolve technical challenges:
    - Understanding which microcontroller will be most effective for implementing the algorithm
    - Decide in the language for the user-friendly interface used for data transfer information
    - Design an outline of the autonomous algorithm that will be implemented for welding.
- Compare and select collaboration tools for software development, documents/presentations, communication, task calendar
- Create Requirement Document
- Create Design Document
- Create Test Plan

Second Milestone

- Have a fully designed autonomous algorithm to be tested on the microcontroller that will be used on the grappling hook.
- Once designed and tested, fix bugs that might show up after testing.
- Develop a demo removal of space debris to display the features of the algorithm.
- Locate the appropriate software to use for the graphical simulation of the demo algorithm.

Third Milestone

- Once the algorithm is fully functional, have a designed interface that will allow for a user-friendly usage of the grappling hook and data collected.
- Test the user-interface, making sure that the grappling hook is collecting and transferring accurate data of velocity and momentum.
- Develop a demo using the already decided software where we test both the algorithm itself through the use of the hook and observe as data is collected on the user-interface.

Signature of CSE Student(s):

Signature: Matthew Intriago Date: 8/30/2020

Approval from Faculty Sponsor:

"I have discussed with the team and approved this project plan. I will evaluate the progress and assign a grade for each of the three milestones."

Signature: _____ Date: _____