Debris in Space Autonomous Removal Mechanism (DISARM)

Milestone Four

Team Members

Controls System Supporting Engineer: Matthew Intriago (mintriago2017@my.fit.edu)

Project Manager: Kyle Watkins

Project Systems Engineer: Luca Rizza

Electronics System Lead: Michael Leard

Electronics System Supporting Engineers: Nouraldean El-Chariti, Ali Lebbar

Grappling System Lead: Daniel Soto

Grappling System Supporting Engineers: Laura Guziczek, Ali Lebbar, Davey Renoid

Control System Lead: Nouraldean El-Chariti

Control System Supporting Engineers: Laura Guziczek, Michael Leard

Structure System Lead: Vincent Panichelli

Structure System Supporting Engineers: Davey Renoid, Ali Lebbar, Daniel Soto

Client: Dr. Markus Wilde (mwilde@fit.edu)

Faculty Advisor: Dr. Silaghi (msilaghi@fit.edu)

Current Milestone Progress

Task	Completion %	To do
1) Finish developing distance sensor	100%	None
2) Develop DISARM plugin	50%	Implement guiding rod joint movement to extend towards the desired object
3) Develop demo video	50%	Develop demo video for the rest of the test cases

Discussion

Task 1: Initially I had attempted to use a plugin that had been developed by ROS called hokuyo which is essentially a LIDAR sensor. However, when trying to use it for my project, I encountered many errors. For this reason, I decided to try and make my own sensor plugin from scratch, designing a simple cad model, and then creating the plugin for the model. This allowed me to add my own specifications relating to the sensor we purchased, and I was able to successfully recreate it in Gazebo.

Task 2: Apart from developing the sensor plugin, I additionally had to develop a plugin for DISARM itself. This included adding actions for each necessary joint, the most essential in this case were adding the circular rotation of the lead screw, and the linear motion of the guiding rods fully extending and retracting. However, I ran into several issues. The initial model of DISARM was made with SolidWorks, when transferring the model to gazebo the joints were lost and hence the coding of it became complicated. I was able to add the joints to the model, but still need to add the movement of said joints when approaching the debris.

Task 3: In the case of the demonstration, I successfully recorded a video showing the capture of a 1-unit CubeSat, without the movement of the joints. The next steps would be to show the capture of a 6 unit and lastly a 27-unit CubeSat once the joint movement has been completed. If time permits, a demo of DISARM attempting to capture debris with multiple debris present could be recorded.

Plan for next Milestone

Task	Matthew
Finish recording demo video and joint development	Record videos for the rest of the test cases and finish coding disarm plugin.
Implement sensor code with Arduino and motor	Work on adding code with control systems lead

Discussion

Task 1: The current demonstration of the simulation shows the capturing of a 1-unit CubeSat. The simulation shows how the sensor detects the object, disarm approaches it and then simply attaches the object without the extension of the guiding rods, simply by the calculation of the distance using the lidar sensor.

Task 2: The sensor has currently been tested for its accuracy at its lower limits and upper limits. Furthermore, we no longer need to convert the sensor output from analog to digital, since the sensor outputs its data on the Arduino terminal and those values can easily be stored into an array of values to be used. Knowing that the next step is to implement the sensor to work alongside the motor of the linear actuator, so that when the sensor locates the object, DISARM will extend towards the object and begin welding.

Date(s) of meeting(s) with Client during the current milestone

Client Meeting Log	
January 20, 2021	Initial Semester Meeting
January 27, 2021	Weekly Progress Report Meeting
February 10, 2021	Weekly Progress Report Meeting

Client feedback on the current milestone

- Find outage limits for capacitor
- We need an emergency shutoff for safety
- Find shielding to prevent damage from Arduino
- Research into using covering for exposed wires
- Look into use of the Mars chamber in OPS highway

Date(s) of meeting(s) with Faculty Advisor during the current milestone

Faculty Advisor Meeting Log

February 18, 2021   Meeting to discuss milestone 4
                                                                        progress

Faculty Advisor feedback on each task for the current Milestone

Faculty Advisor Signature: _____ Date: _____

Matthew Intriago	0	1	2	3	4	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10

Faculty Advisor Signature: _____ Date: _____