## 1. Project title, names and email addresses of team members

NASA LEC Robotic Mining

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## 2. Faculty Advisor: name and email address

Dr. Marius Silaghi - msilaghi@fit.edu

## 3. Client: name and affiliation

Aerospace NASA Lunabotics Engineering Competition (LEC) and
Dr. Kimberly Demoret, FIT Aerospace Department

## 4. Progress of current Milestone (progress matrix)

| Task | Completion % | Bailey | James | Taylor | To do |
|---|---|---|---|---|---|
| 1. Investigate tools | 100% | 35% | 25% | 40% | none |
| 2. Hello World demos | 100% | 20% | 50% | 30% | none |
| 3. Requirement Document | 100% | 50% | 25% | 25% | none |
| 4. Design Document | 70% | 25% | 25% | 50% | interface between modules |
| 5. Test Plan | 70% | 25% | 50% | 25% | user studies |
| 6. Implement, test & demo *feature/module* | 20% | 10% | 10% | 0% | implement ..., debug ..., redesign ... |
| 7. Implement, test & demo *feature/module* | 50% | 0% | 30% | 20% | implement ..., debug ..., redesign ... |

## 5. Discussion (at least a few sentences, ie a paragraph) of each accomplished task (and obstacles) for the current Milestone:

- Task 1: We contemplated using a Unity to implement a robot model crafted in Blender, but decided against it as Unity requires C++ scripting and the Aerospace department noted that they preferred us to use Python. We also considered using SimPy for modeling and scripting. After research, we decided to use a combination of Python and ROS to program the robot simulation created in Gazebo.
- Task 2: We made a 3D model of a basic robot in the Gazebo GUI that we intend to make closely resemble the physical robot. As of now, the robot is a basic model being used to simulate essential movement and tasks such as forward and backward movement.

## 6. Discussion (at least a few sentences, ie a paragraph) of contribution of each team member to the current Milestone:

- Jame Spies: James created the basic robot model using Gazebo and prepared it to be adjusted to directly simulate the hardware. He has both communicated with the leads of the Aerospace department and researched competition specifications to

determine what the physical robot would be required to do in order to be competitive. This in turn allowed him to determine what features needed to be reflected in the simulation model, such as it's movement, arm, conveyor belt and camera.

- Taylor Ertrachter: Taylor setup GitHub repositories for the work being done on the simulation in Gazebo. He created two, one that is accessible to the whole team inclusive of the Aerospace department, and one that is for our computer science team to access and modify each other's work. Taylor aided in the installation of Gazebo and ROS libraries on all of our individual machines when we ran into issues with Virtual Machines and OS compatibility, being that ROS requires Linux and we did not all have Ubuntu previously.
- Bailey Hamant: Bailey researched and weighed the pros and cons of different simulation software and languages to use to program the simulation. Because the code in general should be generally readable across the departments, she decided in correspondence with the Software Lead from the Aerospace department, Steven Paziena to use a ROS/Python combination. The 3D modeling software that goes hand-in-hand with ROS is Gazebo, which we decided to use over SimPy which strictly used Python libraries.

## 7. Plan for the next Milestone (task matrix)

| Task | Bailey | James | Taylor |
|---|---|---|---|
| 1. Implement basic movement of the virtual robot | Implement forward movement | Implement backwards movement | Implement turning ability |
| 2. Implement controllability of the simulation via an Xbox controller | Control forward movement with an Xbox controller | Control backward movement with an Xbox controller | Control turning with an Xbox controller |

## 8. Discussion (at least a few sentences, ie a paragraph) of each planned task for the next Milestone

- Task 1: We plan to write scripts to control the basic movement of the robot simulation inclusive, to begin with, of forward movement, backward movement and turning ability. Eventually we will add a virtual arm to resemble the physical robot's arm for sample collection, which will need to implement upward and downward movement.
- Task 2: Before we begin working toward autonomy, we need the robot to be manually controllable to ensure all systems are working properly. We decided the most streamlined approach to this would be to control the simulation (and

eventually the physical robot) via an Xbox controller. We decided on an Xbox controller over keyboard input because of the ease of use and level of control that come from the joysticks over arrow keys.

9. **Date(s) of meeting(s) with Client during the current milestone**:
    - September 14th: Meeting with Client
    - September 21st: Meeting with Client
10. **Client feedback on the current milestone**
    - Client was pleased with the idea of having a virtual simulation of the physical robot due to the uncertainty of when the hardware will be finished because of COVID-19 restrictions.
11. **Date(s) of meeting(s) with Faculty Advisor during the current milestone:**
    - September 4th: Initial video meeting with advisor discussing early considerations for project design.
    - September 27th: Our advisor requested that we send him an email containing material for him to review rather than having a face-to-face meeting.
12. **Faculty Advisor feedback on each task for the current Milestone**
    - Task 1: ...
    - Task 2: ...

**Faculty Advisor Signature: _____ Date: _____**

## 13. Evaluation by Faculty Advisor

- Faculty Advisor: detach and return this page to Dr. Chan (HC 214) or email the scores to pkc@cs.fit.edu

- Score (0-10) for each member: circle a score (or circle two adjacent scores for .25 or write down a real number between 0 and 10)

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Taylor Ertrachter | 0 | 1 | 2 | 3 | 4 | 5 | 5.5 | 6 | 6.5 | 7 | 7.5 | 8 | 8.5 | 9 | 9.5 | 10 |
| Bailey Hamant | 0 | 1 | 2 | 3 | 4 | 5 | 5.5 | 6 | 6.5 | 7 | 7.5 | 8 | 8.5 | 9 | 9.5 | 10 |
| James Spies | 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: _____