Department of Mechanical and Materials Engineering

SENIOR DESIGN ORGANIZATION SYNOPSIS – SPRING 2013

Lunar Excavation Robot

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The nature of our project is to design and build a robot that meets NASA's Lunarbotics competition criteria in order to test our capabilities in building robots and to further our own understandings and expertise within the field of robotics and the encompassing mechanical engineering spectrum.

NASA's Lunarbotics competition is held annually with participants from around the world competing for the winning position. We are to design a robot capable of traversing an obstacle course to reach a specified location in order to mine moon “material”, reaching a minimum of 10 kilograms of mined material within 10 minutes. Other rules and regulations apply such as size and weight limitations to the robot, as well as being able to operate while completely autonomous, with a low energy-consumption operation that allows the robot to operate for extended amounts of time. The robot also needs to operate at certain bandwidths in order to reduce radio-interference Dust-free operation and structural integrity both serve as important qualifications for robot design in order to improve the overall functionality of the robot.

The design selected will utilize caterpillar tracks in order to provide optimal contact with the lunar soil “BP-1”. The tracks and the motors driving them will have reversible rotary directions and the software will be coded accordingly in order to provide the robot with turning capability akin to other track-driven vehicles such as tanks and construction vehicles. The front of the robot will have a rotary auger-dredge drill component with raised grooves/fins along the surface of the drum in order to dig into the BP-1 and propel the material towards the robot and into a collection bin. The drill itself will be raised during the robots transitory stage, and lowered during the excavation process. The holding bin emulates construction or waste management dump-trucks, with the capability of being lowered during the mining process, raised during transportation in order to provide ground clearance while traversing the obstacle course. The receptacle bin will be raised when the robot has reached the loading station, lifting the bin and depositing the collected BP-1 into the competition bins. The bin will be tilted via a mechanism, as opposed to relying on an individually regulated motor to cut back on power consumption and weight. The mechanisms functions by providing the bin with an angular tilt in order to deliver the payload into the reception bins. Our design focuses on the concept of keeping the robot at a low center of gravity in order to provide operational stability, as well as keeping the overall weight of the robot light to reduce energy consumption and allow ease of handling and possible transportation to the moon itself.