NASA KSC/Intern Abstract – 7/27/15

Internship Abstract

Regolith Advanced Surface Systems Operations Robot (RASSOR) Phase 2 and Smart Autonomous Sand-Swimming Excavator

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Abstract

As an intern at NASA's Kennedy Space Center I worked in the UB-R1 branch in the Swamp Works Granular Mechanics and Regolith Operations (GMRO) lab. The main project that I was assigned to was the RASSOR 2 robot. I worked on the software and programming of the robot. The RASSOR 2 runs on Linux and is programmed using the Robotic Operating System (ROS). In order to be competent in programming RASSOR 2, I spent time learning ROS by using the ROS Wiki beginner tutorials. I also learned how to use various functions of the Linux terminal. Furthermore, RASSOR 2 uses a robot simulation program called Gazebo to simulate how the robot would act in a real physical environment, so I learned how to use this program through gazebosim.org tutorials. Some of its programs are written in Python, so I spent some time learning the programming language through tutorials on codecademy.com. I was assigned to various aspects of the RASSOR 2 program in order to make it a fully functioning and professional robot. I created header files that are used in the C++ source code to use the joystick and to control the robot. Also, I modified the control of both the front and rear drums in the RASSOR 2 to turn on the rear drum to dig or dump when the d-pad is pressed down or up respectively, and to turn off when pressing up or down on the d-pad again. This also works when using the "A" or "Y" buttons for the front drum. I also changed the code for the mobility of the robot to only use commands that come from the left joystick. This saves bandwidth so that RASSOR 2 can operate more efficiently. Furthermore, I spent time creating a graphical user interface plugins to display the speeds of the motors and other robot information. RASSOR 2 will continue to be developed as a professional robot after my internship.

During this internship I also worked on a Kennedy Space Center Kick Start project called the Smart Autonomous Sand-Swimming Excavator. It was designed as a proof-of-concept of digging through sand to locate sample material. The first version uses an Arduino Uno and the 1sheeld for Bluetooth communication to an Android device. It is also being developed to work with a single board computer like the Raspberry Pi or the Intel Edison to communicate with the user over the internet. The user is able to know what orientation the Sandswimmer is in using an accelerometer, and the user can send commands back to the Sandswimmer through an Android device over Bluetooth. The Sandswimmer uses two solenoids connected to each other to move around. I programmed the Sandswimmer using the Arduino IDE and various programs on the single board computer as needed. I also worked on the circuits used to control and power the solenoids and the

Sandswimmer. In the future the Sandswimmer can be designed to dig through regolith on Mars or an asteroid.