DustySWARM Team

Outreach Paper

NASA Swarmathon

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This document has been reviewed by the faculty advisor prior to its submission to NASA and verified that the document reflects the design used for the 2016 NASA Swarmathon Competition.

Introduction and Purpose

A new tradition has commenced at the School of Engineering at Texas A&M International University (TAMIU). DustySWARM team was created this year to participate in the first NASA Swarmathon Competition. The team collaborated with local engineering organizations, local engineers, TAMIU professors, and other system engineering students to spread the word about their goals, and the reasons behind their participating in such event. Our team's outreach objective is to bring awareness to the School of Engineering in an effort to invoke an interest in systems engineering, STEM related topics, and NASA competitions. The team's members took advantage of all available chances to express their appreciation of being STEM students who are inspired by science, technology, engineering, and mathematics. The members were very proud with their work and skills and how participating in the NASA's Swarmathon inflicted and enhanced their perspective to STEM. Outreach events' audience were mixed of elementary, middle, high school students, their teachers and parents, university students, faculty members and administrators, local engineers, and engineering firms. This report is a short summary of DustySWARM outreach activities. Outreach was performed in collaboration with the university's other robotics teams under the name of DustryTRON Robotics Organization (DustySWARM, DustyTRON, and DustyQuad). DustyTRON is another multidisciplinary team and is participating in 2016 NASA's Robotic Mining Competition. Together we presented our projects and outreached to the community about the STEM fields and the possibilities of an engineering career.

Outreach Activity Designs

DustySWARM team was involved with many organizations and local schools to promote STEM by expressing their excitement to be part of NASA's discoveries and participation. Some of these organizations are Youth Science Leaders of Laredo (YSLL) Organization, Harmony Science Academy at Laredo, TAMIU Society of Hispanic Professional Engineers (SHPE) and TAMIU Student Engineering Council (SEC).

Activities were planned to attract and engage young students to ask and explore the science and technology behind all DustyTRON Robotics teams (DustyTRON, DustySWARM and DustyQuad). Some of the planned activities are expressed in details in the following sections.

1- STEM Alliance

Congressman Henry Cuellar (D-TX28) and TAMIU host a four-day STEM Alliance, where local high and middle schools' students and teachers come to explore all the different activities and presentations from STEM teams in TAMIU. The DustySWARM team presented the simulation of rovers collectively looking for resources. Team members explained that searching logic for the rovers had been developed, and answered questions about autonomous rovers and swarm robotics. DustyTRON team presented DustyTRON robot, which was used in 2015 NASA Robotic Mining Competition. Both teams spoke to several students on the process of designing the robot, the obstacles that each team were presented with, and the importance of teamwork. The DustyTRON team explained how last year experience is being used to improve several things on this year's robot. The teams demonstrated the type of projects that can be done as a

Systems Engineer and informed students the type of concepts used in the robot and the swarm rovers.

STEM Week provided a great opportunity where younger students can see what is engineering and some of its fun and challenging projects. In this event, eighteen DustySWARM and DustyTRON members attended and presented for an audience of about 198 attendees (11-16 years-old), which included about 110 female students and 18 teachers.

2- First Tech Challenge (FTC)

The First Tech Challenge is a robotics competition where several local high and middle schools in Laredo, Texas participate and compete. 300 students of ages 13 to 18 years-old and 30 adult teachers and mentors take part in designing robots to meet specific tasks. The event is divided into four days. The first three competition days were hosted on different local high schools while the last qualifying competition was held at TAMIU. The TAMIU Society of Hispanic Engineers Society (SHPE) host this event each year and this year they invited TAMIU DustyTRON Robotics teams to participate (14 members were able to attend) and help in referring, inspecting, collecting debris, score keeping, and animating the crowd. The FTC competition consisted of several rounds where different robotic teams created their own alliance and competed against each other attempting to collect as much different debris as possible. Furthermore, there were several categories in this competition that gave the students an opportunity to demonstrate different aspects of the robot.

The audience in this event were high school students focused and familiar with the robotics environment. Many of the students participating, are searching for a potential future in a STEM related field. During the competition, TAMIU DustyTRON and DustySWARM teams served as an example to demonstrate what can be done through STEM and showcase last year's mining robot and this year's swarm rovers to provide an influence into what students can do later on in their education. Through DustyTRON team, young students were engaged, and curious and comparing the different obstacles they were presented with their competition and the ones that DustyTRON had in the RMC 2015. Through the DustySWARM team presentation the students were intrigued with the power of autonomous robots that can collaborate to find resources in an unknown environment such as Mars.

Comparing DustyTRON and DustySWARM with FTC robots, was a conversation starter and got the audience to engage in an intellectual conversation. Because both DustyTRON and FTC deal with robotics, the audience was able to relate more with DustyTRON team projects and objectives. However, the introduction of swarm robotics had a big impact as well because of the power of collaboration between robots to achieve a common task. Thus, students were able to obtain a preview on more complex problems faced by engineers at NASA. Showing robot's performance in real life scenarios opened the kids' minds into how robots and STEM fields help to make every day problem a thing of the past with simple solutions.

3- TAMIU Society of Hispanic Professional Engineers (SHPE)

The Society of Hispanic Professional Engineers also known as SHPE, is an organization that helps college students get familiarized into the engineering environment. This organization promotes community service, leadership, and professional development. Through the organization students and members are exposed to professional engineers, and leadership development conferences. SHPE also encourages students to attend national career fair conferences where they can begin networking with other organizations and professionals to hopefully build relationships that can help them obtain a better job in the future. Nine members of DustyTRON Robotics are active members of SHPE. In the SHPE meetings, members are kept posted on DustySWARM and DustyTRON 2.0 updates. The objective is to show them that with hard work and dedication, big projects can be tackled easily. DustyTRON Robotics members encouraged those of SHPE to get involved in projects similar to RMC, Swarm Robotics and Quadcopter design by stepping out of their comfort zone so they can bring new projects and ideas to TAMIU DustyTRON Robotics.

4- Professional Events

Some of the events that DustySWARM team members presented their project and progress are:

1- TAMIU Student Conference: 3 team members presented for 20 university level students and three faculty members, they ranked the first place.
2- Leaders Influencing STEM Futures: 18 team members attended with 3 members from last year team, presented to 20 local school teachers and administrators, 10 university professors, and 10 university level students.
3- Logistics Manufacturing Association (LMA) presentations: 4 team members attended and presented to 60 local and international companies managers and personals.
4- The Laredo Rotary Club Presentation: three team members presented the DustySWARM project, 48 attendees (30-70 years-old).

5- Educational Events

a. Discover TAMIU

Discover TAMIU is a university wide event where kids, parents and local community of all ages are invited to attend and visit TAMIU campus. The purpose is to present all opportunities and programs that TAMIU and the School of Engineering can offer. DustyTRON team has been an essential part of this event for the last two years, to promote technology and engineering. On March 19, 2016, 12 members were introducing DustyTRON 1.0 to people of 6-23 years of age and their parents about the project and all the engineering degrees. About 253 individuals (65 females) had the opportunity to manually control the robot in a 10 min simulated competition run. They were given an explanation and background about the robot and its mission. Also, they have given and insight into how systems engineers work to develop a system from early stages of development to final disposal of the system. This event helped in encouraging younger coming generation of students to be leaders to take an active role in getting involved in STEM projects.

b. DustDevil Game Day

The DustDevil Game Day was March 8, 2016, and sponsored by DustyTRON Robotic Team. This event aimed to inform the public about the DustyTRON team and its participation in NASA RMC 2016. Team members invited friends and family to attend the baseball and softball games for demonstrations with the robot model. The DustyTRON team engaged the public by answering questions about the robot, team, and the competition. Moreover, the team allowed the public to interact with the robot and see firsthand how the robot performed its main task. They also addressed the importance of STEM in enhancing their future careers. Furthermore, the public was given a brief introduction of systems engineering and the overall life cycle of a system. They explained project management, engineering design, and how embedded system components were embedded in real life functioning robot.

Long-Term Outreach

In future years, we plan to integrate our knowledge of the three different projects under DustyTRON Robotics (DustyTRON, DustySWARM, and DustyQUAD). The three robotics teams will integrate ideas and knowledge to possibly design an autonomous physical rover that can be tracked with an autonomous quadcopter. Having this type of integration between the robotics projects will demonstrate to students that the sky's the limit for the possibilities of robotics. In the coming year, we hope to be able to participate in the physical competition of the Swarmathon. This will give us more hands-on interaction with the students by having them drive the rovers in manual mode. We intend to follow up with the groups of students that we presented in this year’s outreach seemed interested in order to continue fostering their interest in STEM field. We plan to reach more students by approaching schools we were not able to reach this year.