



**TEAM PANTHER SWARM
FIU MIAMI**

**NASA SWARMATHON 2016:
FIU PANTHER SWARM TEAM
OUTREACH ACTIVITIES**

FIU Panther Swarm Team*

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***Complete FIU team is listed in the Appendix.**

Foreword

I am very pleased to report that a total of 46 students formed FIU's Swarmathon team named "Panther Swarm." Of these, 35 undergraduate students were registered to EML 4840 Robot Design course, and 7 graduate students took EML 6805 Advanced Robot Design course. In addition, two graduate students and two undergraduate students also participated in FIU's team Panther Swarm activities. One of the graduate students served as teaching assistant for EML 4840 and EML 6805. Overall, we formed 14 teams, where each team had three members.

As stated in our implementation plan submitted earlier to NASA, we reorganized our robot design courses EML 4840 and EML 6805 so that the major project of the course was defined as the NASA Swarmathon Event.

Although the weekly plan as we have envisioned earlier has not been executed completely along the proposed timeline, we nevertheless accomplished the goals of the project within a semester, which was a challenge, but we have gained valuable experience for next year.

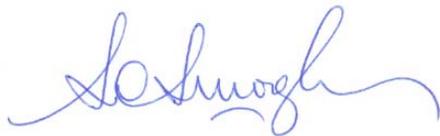
Several team projects were assigned throughout the semester that included the followings:

- Survey of swarm controllers and algorithms
- Modification of mobilityStateMachine, obstacleHandler, and sonarHandler functions
- Development of final algorithms
- Final code development and software simulations
- Testing of code on physical robots

All of the students participated in controller survey, algorithm and code development as well as testing of the code on physical robots. Each team developed a PowerPoint presentation on their controller survey and algorithms, and presented it in class. Each team also described their code in class as we have run them on the computer and later on physical robots.

One final note is that although we have originally planned to select the best team code to represent our team at the NASA competition, it was collectively decided to integrate strong features of different team codes to generate our final code, which is expected to yield a better code and represent the effort of the entire class.

I certify that I reviewed this report.



Sabri Tosunoglu, Ph.D.
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FIU Panther Swarm Team Experience on YouTube:

<https://youtu.be/qq2Nkrp3MQc>

by Scott Jagolinzer

Introduction to NetLogo on YouTube:

https://youtu.be/a_szxQ4ZW-w

by Laura Reyes

Purpose of Outreach Activities

The purpose of outreach activities is threefold: It is to (1) promote the STEM field and robotics, (2) promote FIU and engineering disciplines, and (3) promote NASA and the opportunities it offers to younger students so that they are excited about engineering and elect technical fields without hesitation, and become successful individuals. In fact, the main goal of channeling younger students to STEM and engineering fields will be accomplished, in this example, by the partnership of NASA and FIU.

Outreach Recipient Groups

Recipient groups in our outreach activities are mostly middle and high school students who are close to making a decision on their future education. Our target group also includes college students as some of them may not have selected a major or may be undecided. Even the advanced students may need guidance towards an internship program, graduate studies or job opportunities. Through our interactions, we essentially inform students that robotics is a fun and prosperous field to work in, and that we are here to advise them which options exist to pursue.

Description of Outreach Activities

1. Engineering Expo 2016

FIU's College of Engineering and Computing organizes the Engineering Expo as an annual event for almost 20 years, and the Robotics Laboratory regularly participates in the event every year since the field of robotics catches the imagination of middle and high school students. This year's event took place on February 26, 2016, and over 1,400 local middle and high school students participated. Student groups of 20 to 30 toured our lab entire day while the Panther Swarm teams of students guided and demonstrated our swarm robots to visitors.



Figure 1. FIU Engineering Expo 2016: Students meet FIU Swarmathon Robotic Platforms Larry, Curly and Moe

2. Visitors to Robotics Lab: Florya College from Istanbul, Turkey

Since we had 14 teams in our robot design courses, most of the day we had a few of the teams in the Robotics Lab developing or testing their codes. As we regularly receive scheduled and unscheduled visitors to the lab, Panther Swarm teams provided lab tours to these teams of visitors. One such team has come from Istanbul's Florya College (high school) to participate in the First Robotics Competition in West Palm Beach, Florida. They wished to visit our Robotics Lab and our teams provided them a presentation on Swarmathon Robots and Competition.

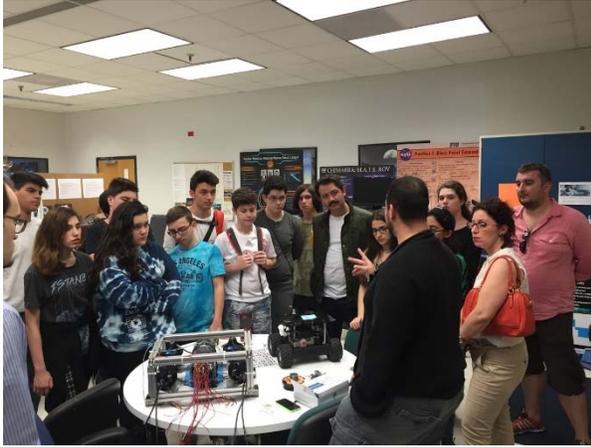


Figure 2. Team “Florya Bisons” Visiting Robotics Lab from Florya College, Istanbul, Turkey

3. NetLogo Presentation at Middle Schools and FCRAR Florida Robotics Conference

Panther Swarm team members Laura Reyes and Carlio Porsenna are tasked to develop a PowerPoint presentation on Net Logo outlining and demonstrating its capabilities.



The presentation prepared by Laura Reyes entitled “Introduction to NetLogo” is posted on Youtube: https://youtu.be/a_szxQ4ZW-w

In May 2016, we are planning to make presentations at two local schools using this material: W. R. Smith Science and Medical Technology Magnet Middle School and Ruben Dario Middle School.

In addition, these students are developing a technical paper on NetLogo capabilities and swarm robot modeling for presentation at the upcoming 29th Florida Conference on Recent Advances in Robotics (FCRAR 2016), which will be held in Miami on May 12-13, 2016.

4. Exposure at FCRAR 2016 Conference and Robot Showcase

FCRAR is an annual Florida Robotics Conference, where most of the researchers and graduate students in Florida attend to present their recent research results. In addition, we hold a Robot Showcase in parallel to the technical sessions, where usually college students submit their robotics projects to demonstrate to conference attendees. Since this event gets significant attention, we invite local students to participate with their teachers.

This year, we will enter our three swarm robots to the Robot Showcase and have our Panther Swarm teams demonstrate the workings of the swarm robots while describing NASA’s Swarmathon Competition.

In addition to the paper that will be submitted on NetLogo platform, we will also submit a second paper based directly on our experience with NASA Swarmathon Competition. This paper will also be written by Panther Swarm team members.



Figure 3. Engineering Expo 2016



Robot Showcase: May 12, 2016	Florida International University	No registration fees
FCRAR Conference: May 12-13, 2016	MMC Campus, Graham University Center	Robot Showcase Open to Middle and High Schools

Sponsored by

FIU American Society of Mechanical Engineers (ASME) • Panther Robotics Club • FIU Council for Student Organizations (CSO)

<http://www.eng.fiu.edu/mme/robotics/fcrar2016/>

Figure 4. FCRAR 2016 Florida Robotics Conference Announcement

5. Swarmathon Robot Demo in Introduction to Engineering Course

A presentation was made on Swarmathon Competition in EGS 1006 Introduction to Engineering course offered by Ms. Carmen Schenck. Team members Rudnei Moran and Julian Sellan demonstrated the swarm robots and Dr. Sabri Tosunoglu described the Swarmathon Competition, swarm robots and related NASA programs.



Figure 5. FIU Engineering Expo 2016: Visitors in the Robotics Lab

Participation of Swarmathon Team in Outreach Activities

As described above, in each of the activities, our team members had direct roles in executing each activity.

- 1. Engineering Expo:** Since the event lasted entire day, a total of five teams that did not have classes took turns to welcome the visitors. Graduate student Scott Jagolinzer was also present most of the day and coordinated demonstrations.
- 2. Florya College:** This visiting team from Istanbul, Turkey, was guided by the Panther Swarm team members Giuliano Grahl, Rudnei Moran and Julian Sellan.
- 3. NetLogo Survey, Presentation and Paper:** Laura Reyes and Carlio Porsenna were responsible for this activity.
- 4. FCRAR Conference Participation:** All of the students in Robot Design class will attend the FCRAR Robotics Conference since majority of them have submitted papers for presentation. In addition, we will have one paper that will summarize the preparation and competition experience of the Panther Swarm team in this year's Swarmathon Event. Contributors to this paper will be Scott Jagolinzer, Jonathan Higgs, Jorge Larrarte, Nicolas Polignan, Sebastian Maciel, Frank De La O and Rodolfo Guerrero.
- 5. Swarmathon Robot Demo in the Course Intro to Engineering:** This course is mostly taken by freshmen. Introductory presentation was made by the faculty advisor Dr. Sabri Tosunoglu on NASA Swarmathon Competition, swarm robots and their controllers. Later, Rudnei Moran and Julian Sellan described the work developed by all teams and the code their team developed.

Inspiration to Others

During the Engineering Expo event in the college, this year students were more interested in robotics and showed a stronger wish to come back to our university as a college student as soon as they graduated from their middle and high schools. Demonstration of three swarm robots in our lab, and describing the Swarmathon Competition as it intends to simulate and eventually feed to NASA's future Mars missions especially intrigued younger students.

Middle and high school students visiting the Robotics Lab were also invited to attend the FCRAR Robotics Conference in May 2016, and we are expecting a surge in local school participation in Robot Showcase component of the FCRAR conference.

In general, NASA robotic platforms and Swarmathon Competition have provided a fertile topic to talk about robotics. Sponsorship by NASA undoubtedly increases the interest in students and parents alike.

In the Robot Design class alone, more students than ever have shown interest in obtaining an internship or full-time job at NASA, which was not the case in earlier years.

Overall, this has been a very useful tool to promote robotics as well as NASA, which already commands a high and respectable profile with the general public.

Hands-on and Interactive Activities

Robotics Lab demonstrations showed remote and autonomous control modes separately, where in remote control mode students could run individual robots by hand by issuing commands via the keyboard. They also tracked robot motions and sensor readings on screen, which seemed to fascinate especially pre-college students.

NetLogo presentation was prepared targeting pre-college students and it was intended to be an introductory tutorial complete with a few simple sample programs and simulations. Since this is a free development tool, students can easily download it and start developing a wide variety of simulations with relatively small investment of time to learn it. The presentation is intended to encourage students to experiment with it on their own.

Participant Profile in Outreach Activities

- 1. Engineering Expo:** Over 1,000 middle and high school students from the Greater Miami area participated. We receive groups of 20 to 30 students per group and the event continues entire day. Different teams of students take turns in the Robotics Lab to guide visiting groups.
- 2. Visitors from Florya College, Istanbul:** This was a group of 18 high school students and three teachers. Many students in the group showed great interest to attend FIU for their college education, and we provided the necessary information on how to apply to FIU.
- 3. NetLogo Presentations:** Two presentations will take place in May 2016 at local middle schools where students active in their respective Robotics Clubs will attend our presentation on NetLogo and Swarmathon Competition. Previous experience shows that each school will have about 30 to 40 students to attend the NetLogo presentation.
- 4. FCRAR Robotics Conference:** A total of 50-100 faculty members and students from various Florida universities are expected to attend. Several hundred local middle and high school students and their teachers are also expected to participate in Robot Showcase that will be held in parallel to technical paper presentations.
- 5. Swarmathon Robot Demo in the Course Intro to Engineering:** This course is generally taken by freshmen some of which have not yet declared a major. This particular class had about 40 students. After hearing the NASA Swarmathon Event, many students showed interest in robotics and became members of our Panther Robotics Student Club, which also invites students to participate in Swarmathon Competition, organizes workshops on Arduino programming among other activities.

Planned Future Outreach Activities

Based on this year's experience, it is expected that time will be used more efficiently to develop the code and test it sufficiently.

- 1. Visit Middle and High Schools:** Two middle and two high schools will be visited to make a presentation on NetLogo capabilities and simulations as well as give a demonstration with swarm robots.
- 2. Engineering Expo 2017 and 2018:** Continue welcoming many school groups to the Robotics Lab and describe the NASA Swarmathon Project and its advantages it provides to students. Establish contacts with interested schools for later visits that is listed in the item above.
- 3. FCRAR 2017 and 2018:** Continue to participate in FCRAR Robotics Conference with at least one technical paper on swarm robots and Swarmathon Competition. Continue participating in Robot Showcase with specially developed code running on swarm robots.
- 4. Short Summer Course on Robotics:** We are also considering to offer a short summer course on robotics for next year. Such a course will offer a platform to spend a portion of the course on NASA Swarmathon Competition and the opportunities offered by NASA.

