Outreach Report

TEAM-NORCO

Dona Sisk | Norco College | 3-22-17

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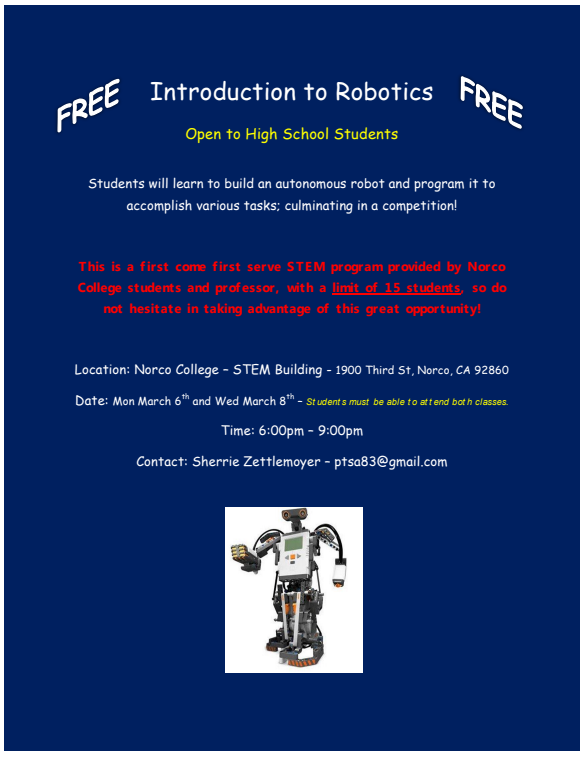
This report was reviewed by the instructor, Dona Sisk, prior to submission

Introduction

On March 6th, an outreach program was implemented to bring awareness of robotics and programming to a young generation. This program reached out to high school students from grades 9 through 12 in an attempt to excite and engage them in a field of robotic science. In a competition, using Lego NXT robots, these students grouped into pairs to face off, with the exception of one team that had three members. The competition was set up as homage to the NCAS program set up by JPL that two of the mentors for the team had participated in. This competition lasted for two days. The teamed up students were able to get some mentoring from the two NCAS participants that would help teach them how to assemble and build programs. Each day the students were here, they had a total of three hours to learn, build, and implement programs with their robots to ultimately maneuver their robots on a mat with multiple interactive objects. The mat, itself, was only four feet by six feet in size, but having multiple objects gave the students several different opportunities on how they wished their robots to behave. Allowing them this broad range of action, this gave them the opportunities to be unique in their programming designs. By giving these high school students the ability to be so unique, we were able to see just how creative they were when they had no bounding criteria to hold too. Each team had their own unique style and direction they choose to use.

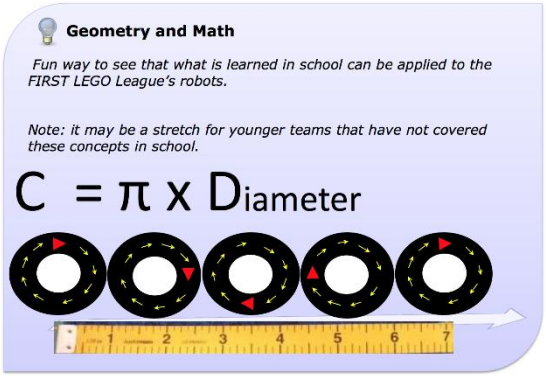
Our team was able to send out a mass email to the principals of all of the high schools within the Corona-Norco Unified School District through team member Sherri Zettlemoyer- who is a part of the Parent-Teacher Association (PTA). We reached out to the local high schools with a flyer that invited up to fifteen high school students to participate in this outreach program. We were able to receive seven students within several weeks' notice from the city of Riverside, Corona, Norco, and even Lake Elsinore. We subdivided the high schoolers into three teams with one mentor each The following paragraphs describe the energy level, involvement, and learning goals for each of the three teams that were involved according to their mentor.



TEAMS

The two students who were working with Jimena Navarro-Garcia had experience in programming in C++. Both had taken a C++ introductory course at Norco College. They were interested in majoring in Computer Science, but they found programming in the C++ language difficult and were considering to change their major. But Jimena encouraged them to take a few more classes before calling it quits. Jimena has some experience in programming in C++ as well as Java. She explained to them that programming can be a little difficult to understand at first, but once they figure out the logic behind projects, they will be able to enjoy programming more. During the first day, the students focused on building the robot body using Lego. The students were also introduced to the basics of programing through the NXT-G advanced programming. The students were able to notice the logic similarities in different programming languages. In comparison to their programming experience, using the NXT-G program was very simple. The students were able to manipulate the robot's movements and decisions through programming 'blocks'.

Using this particular program, the students learned about program control and how to control the outcome of the robots movements by using simple math functions.



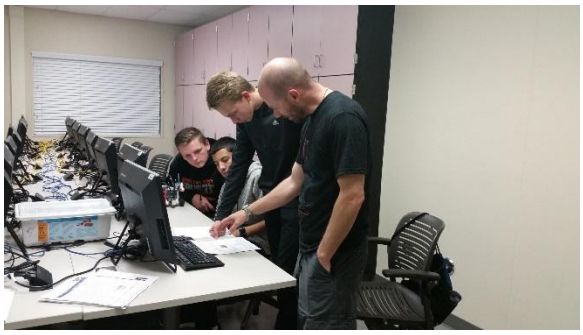
Overall, the high school students who participated in this event were thrilled to learn about robotics and programming. All of the students wanted to pursue a degree in a S.T.E.M. field and were encouraged to follow this path. The students enjoyed learning how to assemble a robot

with Legos and learned the basics of programming through a simplified program. There was supposed to be a competition between the students, modeled after Professor Sisk's robotics team competition, but the students were so engaged in learning, they ran out of time to actually compete against each other.

The second team was mentored by Nathan, and he was involved with two kids from different schools. And right away you could tell these kids liked to mess with the computers. They decided to rotate the screen upside down within Windows, just to get my attention. Which was awesome, because I remember doing the same thing in my computer classes. Even though they were pretty tech savvy, this was a new experience for them both. They carefully studied the introduction to NXT-G coding samples, and were able to pick up the logic of the graphical user interface GUI in a reasonable amount of time. As soon as they could, they were able to demonstrate that they understood the code by building a sample music compilation. This compilation had piano note's in a sequence that looped continuously throughout their program. This was a great gateway for them, to connect their passion for music to programming a robot. They were able to compile a shortened version of one of their classical songs, and was able to effectively use the loop command to simultaneously run their composition simultaneously while maneuvering their robot. And after they were pumped with a learning passion, they were able to show understanding for the sensors, most notably the ultrasonic and light sensor.

For the light sensor, they were able to create a program to detect a dark line on the floor, make a 180 degree turn, and head back to base. The neat part is they showed interest, and inquired if they could have the program calculate the distance they would need to travel back to base after seeing the black line. They were successful with some help, to make a program able to determine the distance it travelled to the black line, and

use that information to travel back to its starting point. A proud moment for me and my team for sure, and their code would prove to be helpful on their competition if they were allowed more time to fully develop their program.



Team three was the team in which Thomas, an NCAS alumnus from 2015, was the mentor. The three students that were on that team were Jeremy, a tall blonde boy, Ian, a tall athletic boy, and Zach, a dark haired shorter boy that was also quite shy. After the initial introductions to one another, their mentor introduced himself to them and to get them started on their first project of the competition, the building of the NXT robot. The boys seemed to be willing to build the robot but were having trouble on who would be build and who would supply the parts. After a few minutes of trying to figure out their roles, they started to build their respective parts. While they were building, the mentor would go to each of them to give assistance or supply them a missing part from their parts box. He observed that the teams focus and enjoyment built as time passed. It was also observed that all the teams seemed to be of like mind. The students were smiling and talking to one another about what was needed and how it should be assembled. There were, of course, a few times where there was some frustration in building the robot that they would be using because they ended up using the wrong parts, but they ultimately figured it out and felt like they were accomplishing their goal. Once they had finished constructing their robot, they held it up like a trophy with the biggest smiles on their faces. They seemed to be very pleased with themselves about what they had built on their own, for the most part.

After completing the build of their robot, the next step was learning the software that they would be using to program the robot to perform certain functions that they would need to compete with. Soon after the students started to build programs to get the robot to move, a student quickly started to stand out from the other two. That student was Jeremy. He was faster than the other two and seemed hungry to learn and be challenged. Thomas saw this and instituted a little competition in the group, Jeremy against the other two. This way Jeremy was being challenged to figure out the programming on his own while the other two were able to put their heads together. These two sub groups seemed to have a great time having their own little race before the main event. Both sides came up with

fantastic strategies in their programming style, but both sides also learned that they were better as a whole team as the programs got larger and more complicated. Each team mate had strengths that they could add to the team to accomplish what they had set out to create. Jeremy was fast but tended to overlook parts that were necessary to the program. Ian was the slowest but came up with very unique ways of putting together the program. Zach was the steadfast one of the team and helped to keep them on target of what they wanted to get done. It was great to see the shy one come out of his shell and take the reins when it was needed. The fun that was apparent in their faces seemed to drive them into creating their programs and want to make it bigger and better then they had it before. Each time the rover moved in the way that they wished it to, they would recall it, rebuild the program to become more complex, and test their remastered program. No matter how the robot acted, the enthusiasm was always there along with smiles and laughter.

CONCLUSION

In our 2017 outreach, we wished we could have devoted more time towards hosting and mentoring our high school students. So as we look forward to the 2018 competition outreach, we will be expanding the allotted time to double that of 2017. This would allow them to explore the software in more detail, and have the time to develop their own strategies for coding. The purpose for 2018, is to include more high school students, more time, and continue to introduce and develop Engineering ideas and principles. In 2018 we will focus on four days of three hour activities, three of those days for introducing the software and hardware. The last day will be an exciting day of competition, were the students have the opportunity to actively apply their learning for practical real world scenarios, such as a mars rover mission to collect samples and return to base. This will all be done autonomously, meaning there will be no remote control, the students must be able to program the robot to solve the problem and come back with no human interference in between, as we did in 2017. Like before, each group of students will each have their own mentors to help them progress. Unlike 2017, we will put out a schedule far in advance, within a few months' notice. With this notice, I would reasonably expect to gain at least double the amount of students, but I wouldn't be surprised if we were able to receive twenty students for 2018.

For this outreach, and the one to come, we felt compelled to continue the use of the Lego robotic kits. The reason is, it has inspired two of our college students when they used the kits at NASA's Community College Aerospace Scholar Program, and it had intrigued the high school students in much the same way. The robot kits in fact are a good learning tool for any age, because you need little to no special prerequisite knowledge to operate it. This application of coding is also highly beneficial, because you can see almost instantly what went wrong (or right) due to the movement of your robot.