NASA SWARMATHON OUTREACH REPORT

ROBOT TRACKERS WINSTON-SALEM STATE UNIVERSITY AND

CARTER G. WOODSON CHARTER SCHOOL

WSSU

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WHO WE ARE

Winston-Salem State University (WSSU) is a vibrant student-centered learning community, embracing educational excellence in a caring culture that supports student success. Students prepare for careers with innovative programs in more than 40 majors. Ranked first in the UNC system for job placement in North Carolina, WSSU graduates receive the highest mean wage compared to graduates of all four UNC system campuses in the Piedmont Triad. For more than one hundred twenty four years, Winston-Salem State University has provided access to education for young people who otherwise would be denied that opportunity. Historically black colleges and universities (HBCUs), including ours, have contributed significantly to the economic and social empowerment of African Americans in this country.

Science, Technology, Engineering, and Mathematics (STEM) programs at WSSU have a proven track record for exposing students to innovative and challenging opportunities. The Department of Computer Science has been a leader in these initiatives. Programs such as outreach Space Camps, Robotics Camps, assisting the local school system with Robotics Competitions, and ongoing outreach to underserved populations is the hallmark of the department. The advisors for this competition have a track record of engaging students in robots. They were the PIs on an NSF Broadening Participation grant that focused on using robotics to motivate students. That program ended four years ago, thus when notice of the Swarm-a-thon arrived, a call was sent out and our team answered the call.

OUTREACH PARTNER

We selected Carter G. Woodson Charter School (CGWS) as our outreach site. The student population is all African American and Hispanic students. These students, grades 6-12, had no exposure to coding or robotics. We began the outreach with sessions on coding and progressed to robotics. Because this is a Charter School, the students do not participate in the Winston-Salem Forsyth County School System Robot Run. To bridge the digital divide, low income students need to have access to computing resources found in the school present in their everyday environment as well. While most of the families represented in this population do not have personal computers or tablets in the home, they do have smartphones that can be used for mastering technology and STEM content.

Coupling the mastery of skills using computing devices found in the school or recreation center labs with instruction and support, we want to help these students transfer these skills to programming and problem solving in robotics navigation. We want this outreach to help bridge the digital divide, and also improve student mastery of STEM concepts, especially in the area of robotics.

OUTREACH ACTIVITIES

Since our WSSU Swarm Team was new to ROS, C++, and swarm robotics, we decided the initial outreach activities should be focused on coding. Students were taught to code using the Scratch programming language. This timeline allowed our team to become familiar with the language and tools we needed for our project. It also allow the students to become comfortable with coding. Listed below is the timeline for our outreach.

PERIOD (Mon & Wed)	ACTIVITY
January-February	Graphical coding using Scratch (instruction, demonstrations, student projects, assessment)
March-April	Robotics using the Scribbler robot (instruction, demonstrations, student projects, assessment)

WSSU SWARMaTHON TEAM

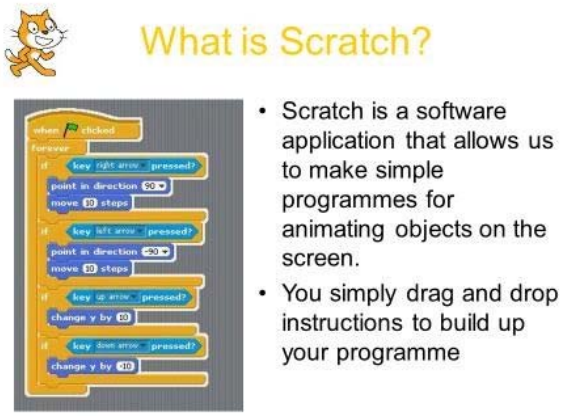
MENTORS

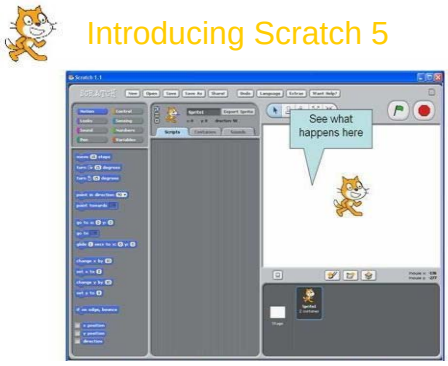
CGW STUDENTS PROGRAMMING

CGW STUDENTS TESTING ROBOTS

CODING USING SCRATCH

The Swarm team used the Scratch system to introduce the students at CGWS to coding. The student were introduced to scratch through a PowerPoint lesson and video presentation.





The first task after the instructional period was for students to write a hello world program. The students successfully completed this activity with assistance from the team.

Scratch Hello-World program

The class was able to write small programs, and had a tremendous amount of fun doing so. The team assisted the students in developing individual projects using Scratch. The projects were very creative.

SCRIBBLER CHALLENGES

The Scribbler Robot

The Scribbler robot manufactured by Parallax was used to engage the students and introduce robotics. The Scribbler is an in expensive programmable robot with multiple sensors. The features of the robot are as follows:

- 3 light sensors
- 2 obstacle avoidance sensors
- 2 line following sensors
- 2 independent DC wheel motors
- Wheel encoders for precise maneuvers
- Stall sensor for wheel motors
- Pen port for drawing on paper
- Speaker to make a full range of notes
- Programmable indicator lights
- Microphone for detecting tones from other S2 robots
- Bi-color LEDs for visual feedback
- Hacker port for connection to external sensors, RF devices, and servos

The robotic activity was jubilantly introduced to a class of 14 boys by the Swarm team. The students were divided into teams of two and three. The students were firstly shown an instructional video about the Scribble robot. After the video, members of the Swarm team demonstrated the eight demo modes on the Scribbler robot. The students were introduced to activities utilizing sensors for light-seeking, object detection and object avoidance during the scribbler challenges. Each team had to present one of the eight scribbler challenges along with the designated Swarm member in order to receive credit for completing the challenges. The students were amazingly engaged with the robots from start to finish during the sessions. The team's goal for the final scribbler challenge is to have the class program the scribbler to navigate an obstacle course.

Future Outreach

We have adopted Carter G Woodson School and will continue to provide outreach activities for 2017. Additionally, the team is working with the Boys and Girls Club of the Salvation Army. We plan to work with high school students at Carter G. Woodson on the NASA SWARMATHON high school competition during 2017-2018.

I certify that I reviewed this report before submission. Elva Jones, Mentor