

## SUMMER LEARNING CAMPS ON ROBOTICS FOR MIDDLE AND HIGH SCHOOL STUDENTS

Harinath Doppalapudi  
University of Louisiana at Lafayette  
dwivedi@louisiana.edu

### Abstract

Robotics, virtual reality and rapid prototyping allow teachers to facilitate learning that their students get to "own". The summer camp projected by the proposal will allow students to feel comfortable with new and sometimes complicated Robotics concepts. They must also learn effective communication, teamwork and problem solving. They get to learn by making mistakes. In fact, mistakes are essential to their learning. As a part of this paper we discuss some of the important technical aspects of robotics and the results of the implementation of robotics subject as a summer camp to the middle and high school children. This paper will also give a perspective of the technical field trips intended to expose the middle and high school students to the real time environment of the industries. The students will also get to learn the art of robot building, as well as its uses within the industry. These summer camps will also expose students to the experience of living and learning in a university setting. The students will get a good exposure to the technical aspects of Robotics while also enticing them to aim for an undergraduate education in engineering, education or related fields. This will lay a strong foundation to their future undergraduate and graduate education. It will give a strong understanding related to the career prospective of the fields of technology and engineering. This paper will also discuss the results of these summer camps.

### 1. Introduction

Robotics is a tool for learning through experience and discovery. Teachers facilitate such learning, but students get to "own" the experience. These summer robotics camps will allow students to feel comfortable with the new and sometimes quite complicated concepts that come with robotics. For instance, in order to build an autonomous robot, students first must learn the basic concepts of mechanics, engineering, and computer programming. They also must learn the skills of effective communication, teamwork and problem solving. They get to learn by making mistakes. In fact, mistakes are essential to their learning.

The hands-on experiences will immerse students in the exciting and popular world of robotics. As students build, program, and test a variety of robots, they will explore topics such as building sturdy structures, working with gears, and programming the robots. Students can also be taught how to plan and design robots and even document them using CAD (computer-aided design). The camp's activities will challenge students to think critically and to work with others to solve problems. Participating students will have little to no experience in programming and robotics, but they will expand their knowledge while having an awesome time with classmates who share their interests. The camps are intended to motivate the most creative minds of a new generation of prospective electrical and computer engineers to become global leaders in an increasingly technological world. The program aims to create a community of

students who participate in and contribute to an intensive and powerful academic experience delivered by distinguished educators and professionals.

These summer camps will prepare students with the academic and leadership skills beneficial to succeeding in postsecondary education upon graduation from high school. In today's supposedly "flat world", business executives, educational leaders, and legislators are constantly challenging both teachers and students to excel and to be successful in this globally competitive market place, where "three billion new capitalists" have emerged. Organizing field trips will expose the students to whole new technical arena of the real world industrial environment. These summer camps will inspire and enable students especially those of middle schools to explore their creativity and engineering skills through the use of science and technology in a fun and competitive atmosphere that teaches them technical skills while also focusing on teamwork and leadership.

## **2. Goals and results**

Using the contemporary technology related subjects as a course for the summer camps have shown fruitful results and prosperous outcomes in the recent past. Many educational institutions are actually developing or using the robot models that have been commercially developed, to teach and train their students in the art of robot building. These kinds of initiatives will not only prepare the students for the future but will also play a strong role in making their future secure. Some of the goals of these summer camps that have been organized in the recent past are as follows.

1. Provide learning opportunities for the participating students with an emphasis on highly focused and constructional learning activities in science and robotics.
2. Develop and promote educational interests and career aspirations in engineering, education and related fields.
3. Help students develop an early awareness about the need to plan further education both academically and financially, by providing them with an opportunity to meet with representatives of related fields from various universities.
4. Empower the participants with training and access to applications of current technologies that reinforce and complement concepts taught in the classroom.
5. Enable the local families, individuals, and visitors to discover new insights into technology and the process of innovation through exploratory activities.

These summer camps have proven to be very fruitful for professional development as well as the education enhancement all across the nation. These results are very important when the student's academic performance is concerned. The results of these summer camps include enhanced student performance, improvement in the education standards, development of the tutors and trainers and trainees academically and professionally, increased number of students opting for careers in the fields related to the technology and engineering, increased career awareness etc.

## **3. Robots**

The robots that are currently being used to teach the students of various educational institutions all across the nation include basic robot arm, underwater robots, automated vehicle assembly robots, automated vehicles, real life luxury bots etc. As a part of the summer camps the students will be challenged to come up with their own ideas of a perfect robot. Some of the commercially developed robots which include Vex robotic training kit, Lego Mind storms kit etc are also being used some private organizations especially for the purpose of teaching the middle school and high school students. These summer camps

will be a very good initiative to a student enthusiast. The summer camps will provide a very good exposure of the environment of technical aspects of robotics and its uses in daily life to the students. Each robot that's being developed nowadays has its own purpose and special function. A lot of Japanese and American companies that include the likes of Honda, Suzuki, and Yamaha are currently indulged in developing the auto bots for the purpose of making daily life luxurious and comfortable. Some such robots include robot animals, vehicles etc.

#### **4. Robot Arm**

The most famous robot in the circle of middle and high school education is the robotic arm prototype. It mainly consists of touch sensors, a camera and a microphone. It also has motors, to control the arm and also the gripper. All motors are digitally controlled with metal/titanium gear. It is helpful in understanding the basic functionality of adaptive software development. The simplicity of design and its affordability make it fairly accessible to most of the educational institutions and it can prove quite useful for the science projects. These kinds of robots prove very effective and efficient when it comes to teaching the concepts of robotics to the high school students.

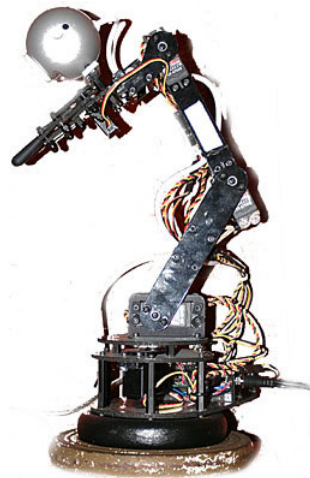


Fig1 Robotic arm [1]

These kinds of robots are very reliable, flexible and easy to use. Although they prove to be very efficient, they are a little expensive making them in affordable. These kinds of robots are frequently used for the purposes of welding, assembling the parts of a system or a vehicle etc.

Intelligent autonomous robots perform tasks according to different behaviors. Some Japanese companies have come up with robots that are especially designed to play soccer. These robots equipped with a camera and sensors find the ball try to score. They generate a lot of interest among the robot enthusiasts and middle and high school students in the field of robotics.

#### **5. Under water robots**

Some underwater robots are controlled by the built-in computers, and can operate without any connection to the surface. Many underwater robots are also attached to a cable that allows a human operator to control the robot's movements from a ship on the ocean surface. These robots are remotely operated.

The under-water robots are developed for undersea observation and water monitoring. These underwater robots once fully developed, will allow better observation and monitoring of complex aquatic systems,

and will support the advances in basic environmental science as well as applications to environmental management and security and defense programs. The underwater robots come in handy in situations that pose threat to human lives. Working underwater will be dangerous and difficult to humans. These underwater robots can easily travel to the deepest of the deepest areas in both the river as well as the ocean beds. Lost ships and damaged underwater cable systems can be repaired automatically. The underwater habitats can be monitored from time to time. These robots can also be used in the study of aquatic life of different species. These robots when used to teach the students will be extremely knowledgeable.

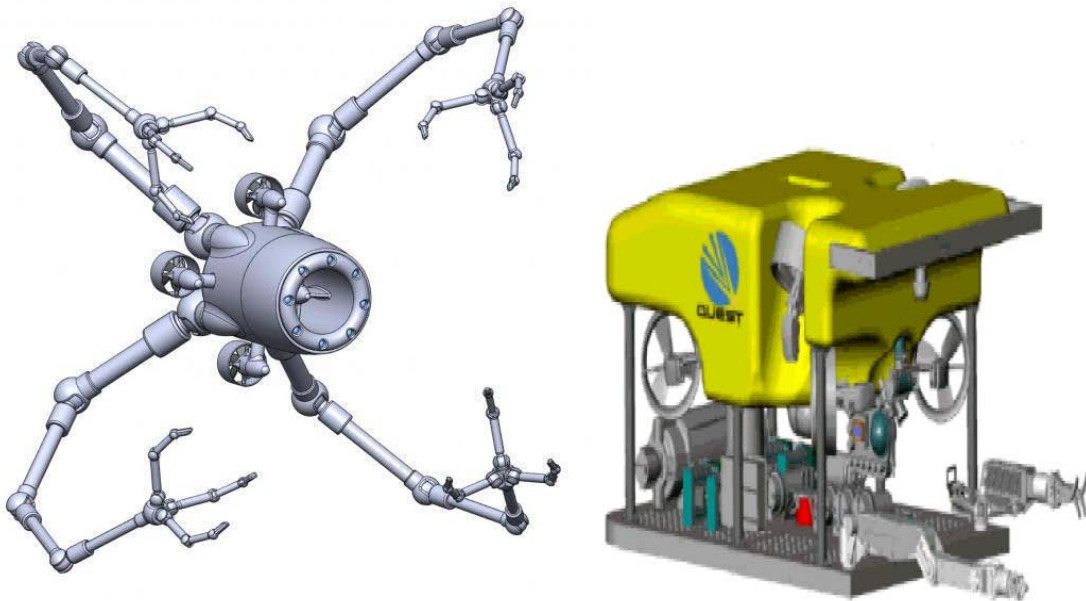


Fig 2 Under-water robots [2,3]

These robots dive into the deep blue waters, and swim to the submerged technical subjects and carry out the necessary repairs, letting the person controlling the robot stay on the ground. Although at sometimes it becomes very difficult to control the robot because of the underwater current and the depth of the water. Equipped with cameras and specially designed sensors, these robots are being used by various international telecommunication companies for repairing the cable lines and underwater electric lines. Still being underdevelopment these robots in the near future will be able to find their own way without the need for a person to control them using a remote or a computer. These robots prove to be very efficient when it comes to the underwater observation of aquatic habitat and underwater cable and pipeline repairs. Robot designs often rely on vision to identify objects, but this new technology relies solely on sophisticated touch technology, enabling the robot to function in places like dark underwater areas, where vision cannot be used. This kind of technology has the potential for a number of applications from using robots underground, under the sea, or in extremely dusty conditions, where vision is often seriously compromised.

## 6. Lego Mind storms Training Kits

Working in small teams, students in this summer robotics camp will use the Lego® Mind storms robot System to compete in fun real-world challenges like rob soccer, obstacle courses, capture-the-flag, tag, sumo wrestling, maze solving and much more. Advanced students will have an opportunity to learn about building complex robotic sensors, advanced robot arms, drive trains and programming “smarter” robots.

These robots are being commercially manufactured especially for the purpose of teaching middle and high schools students and faculty members the contemporary art of robotics and other related innovative technologies.



Fig. 4 Lego Mind Storms robots [4]

The greatest advantage of these robots is that their simple-to-learn programming can control the robots that perform such complex functions. These robots are equipped with improved light sensors that can detect different colors and intensities; the new sound sensor enables robots to respond to sound patterns and tones. These robots have an extra ordinary sense of touch with highly developed sensors. These robots can be controlled with a remote control that connects to it via Bluetooth. Sometimes these robots can also be controlled using a mobile phone. These robotic kits are the most potent educational project training kits. The students can be taught about computers and mechanics than to let them build an actual working machine and program it.

These robotic kits stimulate the interests of the engineers and robot hobbyists.

These robots are optimized for the maximum performance. They are easy to program and also to use. These robots can be programmed to execute multiple tasks. The students will be able to learn the art of programming the robots according their requirements. They will also learn using the robots in various scenarios of day to day life. The students will be challenged both mentally and physically and they will be able to understand the basics of robotics which will lead them to fruitful careers in the fields of engineering and technology. Vision has been the biological sensory modality most studied by the scientists. But the active touch sensing is a key focus for those looking at biological systems that have implications for futuristic robotics research. In humans, for example, where sensors are at the fingertips, they are more vulnerable to damage and injury than whiskers. Rats have the ability to operate with damaged whiskers and in theory broken whiskers on robots could be easily replaced, without affecting the whole robot and its expensive engineering.



Fig 5 Lego robot [4]

## 7. Vex Robotics

The Vex robotics training kits are robot creation kits that allow students to develop and assemble the complex autonomous robots for the middle and high school levels with utmost ease.



Fig 6. Vex robot [4]

A large number of educational institutions make use of these robots to teach the problem solving techniques and how to work in team building interaction sessions. The authorities of the educational institutions are trying to inspire innovation that fosters well-rounded life capabilities including self-confidence, communication, and leadership.

## 8. Results of summer camps

These workshops have proved to be very successful in raising the enthusiasm and the interests of the participants towards the careers in Marine industry. The participants were able to develop the content knowledge as well as improve focused attitudes towards careers in technical and engineering related fields.

These summer camps will be able to

1. Enhance the student content knowledge because of the improved classroom instructional strategies using practical applications.
2. Increased awareness and knowledge of the use of relevant state and national assessments to improve decision-making processes in the classroom, instructional practices, and student achievement. In other words training teachers to increase their ability in understanding student's needs.
3. Increased success rate of a student.
4. Increased career opportunities and awareness.
5. Increased and well developed problem solving skills.
6. Having fun while developing problem solving skills.

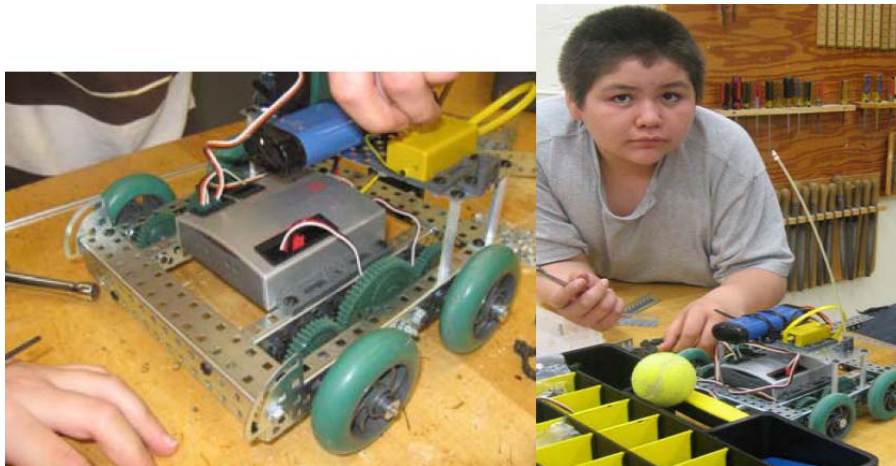


Fig 7. Vex Robotics Summer Camps [5]

Results have indicated that participants scored higher on the posttest than the pretest. The results also have shown that these kinds of summer camps have the potential to increase STEM content knowledge. These summer camps can be innovative strategies to teach youth about science, technology, engineering, and mathematics (STEM) concepts.

## 9. Conclusion

The summer camps have proven to be very fruitful for the advancement of the technical education all across the nation. Studies have shown that these kinds of camps generate the interest of the students and foster their careers and direct them towards life in the fields of engineering and technology. Attending summer camps will increase the self-esteem of the students.

## References

- [1] Ref:-[http://larryo.org/work/robotics/robot\\_arm\\_1\\_side.jpg](http://larryo.org/work/robotics/robot_arm_1_side.jpg)
- [2] Ref: -<http://www.sciencedaily.com/releases/2009/05/090505061836.htm>
- [3] Ref: -<http://www.learnaboutrobots.com/undersea.htm>
- [4] Ref: -<http://www.robotbooks.com/Lego-Mindstorms.htm>
- [5] Ref:-[http://www.core2062.com/WaukeshaVEX\\_Brochure.pdf](http://www.core2062.com/WaukeshaVEX_Brochure.pdf)
- [6] Ref: -<http://mindstorms.lego.com/en-us/Default.aspx>
- [7] Ref: -[http://www.botmag.com/articles/04-26-07\\_summer\\_camps.shtml](http://www.botmag.com/articles/04-26-07_summer_camps.shtml)
- [8] Ref: -[http://robotics.nasa.gov/students/summer\\_camps.php](http://robotics.nasa.gov/students/summer_camps.php)