

# Proposal for Rural Robotics Program



**Contact Person:** Tony C. Duckworth, Sr.  
Mount Olive Ministries  
P.O. Box 875  
Mt. Olive, MS 39119  
(601) 797-4377 – Office  
(601) 466-0600 – Cell  
[tonyduckworth@bellsouth.net](mailto:tonyduckworth@bellsouth.net)  
[www.mtoliveministries.com](http://www.mtoliveministries.com)

**Date of Implementation:** August 2011 to May 2012

## Summary of Proposal

The goal of this proposal is to increase junior high and high school students' motivation to excel in math and science and better prepare them for college careers in Engineering, Pre-Med, Computer Science and Education through hands-on learning experiences building and programming robots.

Technology has become a vehicle for reaching not only the top students but also students that might not otherwise be interested in math and science unless they can see an exciting, real-life application for the acquired knowledge.

### ***Supporting research:***

*Computer Science Department*

*Center for Robotics and Embedded Systems ([cres.usc.edu](http://cres.usc.edu))*

*University of Southern California*

*Los Angeles, CA 90089-0781, USA*

*[mataric@usc.edu](mailto:mataric@usc.edu), <http://robotics.usc.edu/maja>*

*“Robotics is a growing field that has the potential to significantly impact the nature of engineering and science education at all levels, from K-12 to graduate school.”*

*Thus, we can really make a difference at the K-12 level, and should do so. By introducing robotics at this younger age group, we will have better prepared students in our undergraduate and graduate courses, and make more research progress in the long run as well. More importantly, given how appealing robotics is as a pedagogical tool, we will succeed in recruiting more students into engineering and science, in particular from the otherwise underrepresented groups (e.g., women and minorities). These are worthy goals.*

## Vision Statement

Covington County junior and senior high school students want more opportunities to learn marketable 21<sup>st</sup> Century skills. Robotics is one way students can actively participate in hands-on learning using current technology. This experience could eventually lead to the students pursuing an advanced degree in Engineering or a related field. The learning would not be limited to classroom experiences but would also include workshops and competition with students in Covington County as well as the opportunity to compete in robotics competitions nationally.

### ***Supporting research:***

*CREATE: Community Robotics, Education and Technology Empowerment **Head:** [Illah Nourbakhsh](#) **Contact:** [Illah Nourbakhsh](#) **Mailing address:***

*Carnegie Mellon University*

*Robotics Institute*

5000 Forbes Avenue  
Pittsburgh, PA 15213

[http://www.ri.cmu.edu/research\\_lab\\_group\\_detail.html?lab\\_id=33&menu\\_id=263](http://www.ri.cmu.edu/research_lab_group_detail.html?lab_id=33&menu_id=263)

*“In our past research, we have demonstrated in isolated pilot projects that technology education does not need to be the province of the few. We have shown that hands-on approaches to learning that use technology as inspirations for wonder and discovery can lead to lifelong learning skills such as teamwork, problem-solving and self-identification with technology as a tool for exploration and personal expression.”*

## **Proposal**

The **Rural Robotics Program (RRP)** program is designed to use robotics to enhance, supplement and enrich science and math learning experiences for secondary students. Research shows that today’s students are motivated to learn when using new technology and connecting the learning to a real-life applications. RRP would capitalize on this concept.

Mississippi ranks lowest in the nation for ACT scores – math and science scores being identifiable areas of incredible weakness. This deficit could be attributed to several things, but rather than focusing only on the “whys” of the situation, the RRP program would take what research reports about 21<sup>st</sup> century learners and the skills necessary to compete in the 21<sup>st</sup> Century work place to the next level and use that information to motivate and encourage Mississippi students to make themselves marketable in the future world of work.

Robots are complex and require competency in the basic disciplines of math, engineering and science. A working knowledge of algebra, ratios, electricity, force, physics, geometry, pre-calculus, chemistry, biology and computer science, batteries, mechanical structures, wheels and sensors is necessary when building and programming robots. Robotics is fun and enjoyable for the students and motivates them to pursue excellence in order to create a movable machine that when programmed can perform given functions.

The United States is working to help close the achievement gaps between students who attend school in resourced school districts and those who are educated in under-resourced districts. In order to leave “*no child behind*” in this global economy, school districts around the nation are incorporating

robotics into their basic curriculum. The U.S. won't be able to compete unless educational reform can keep up with the demands of a global market. In 1996 Rhode Island made robotics a part of every high school program. Currently, there are over 10,000 robotics teams around the nation competing year-round in organized contests. Over 800 schools now use robotics in some form of instruction. Public schools, private schools, after school programs and clubs have organized robotics teams for competition. Robotics could be the great educational equalizer because it is practical application of a variety of skills, however, if all learners don't have access to the technology, robotics could contribute to a greater divide between students in the nation.

*Supporting research:*

[Center for Mathematics and Science Education Aims to Raise the Bar in Math and Science Achievement](http://news.olemiss.edu/index.php?/201003094925/mathsciencecenter.html)

Written by Tobie Baker Tuesday, 09 March 2010 16:51

<http://news.olemiss.edu/index.php?/201003094925/mathsciencecenter.html>

*"American 15-year-olds lag behind their peers in 31 countries in math proficiency, and in science, the nation's eighth-graders' test scores trail those of eight countries, a 2009 U.S. Department of Education report concluded.*

*"Even worse, that standing is falling," said John O'Haver, a University of Mississippi chemical engineering professor and director of the UM Center for Mathematics and Science Education.*

*And just as America has fallen behind much of the developed world in math and science achievement, **Mississippi ranks dead last nationally in these areas.** The state's universities have produced only 20 bachelor's degrees in math education over the last two years and only a handful of doctoral degrees over the past four decades."*

*"If we cease to be competitive in education, then we will cease to be competitive as a nation," O'Haver said.*

*"Current middle and high school students will be the designers and producers of the greatest devices the world has ever seen," Dewitt said. "If America cannot raise its standings, then one day we will be working for India and China."*

## Curriculum

Robotics curriculum exists for all grade levels. Elementary students are already using their math and science skills to start doing basic robotics activities. Middle school and high school students are going to the next level by participating in robotics camps, after school programs and competitions. Colleges use robotics to teach advanced math and engineering principles as well as a tool for research. Having knowledge of robotics greatly enhances a student's ability to perform well in college-level science and engineering. Mississippi's own Jackson State University Engineering uses robotics extensively in their program and encourages experience with robotics prior to entering their program.

<http://education.ssc.nasa.gov/jsu.asp>

- Robotics Laboratory
- Electronics Laboratory
- Microcontrollers Laboratory
- Robotic manipulators
- Senior Laboratory
- Computer Open Laboratory

*Jackson State's CSET homepage website address to the left as well as a list of the laboratories in the Department of Technology*



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Carnegie-Mellon University Robotic Institute is continuously developing and enhancing curriculum for teaching robotics from elementary to high school. They also provide extensive teacher training and materials as well as their own robotics programming language, called ROBOTC.

*Carnegie Mellon's Robotic Academy is for middle school – high school students. Besides curriculum and training, the academy also offers competitions for these young engineers.*



<http://www.education.rec.ri.cmu.edu/>

**Robotics Academy**

*“The Robotics Academy develops tools for teachers that make it easier to implement robotics curriculum into today’s classrooms. Our curriculum is research-based, aligns with standards, and focuses on the development of 21st century skill sets in students.”*

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The University of Nebraska is also involved with developing robotics material. The resources from *Gear-Tech* are available to educators. Brad Barker, the author of the article linked on the following page, is credited with developing the robotics program that has become a national program.

<http://4hset.unl.edu/4hdrupal/>



GEAR-Tech-21 is based on the Nebraska Robotics and GPS/GIS in 4-H: Workforce Skills for the 21st Century program and is funded by the National Science Foundation.

The program includes:

- Innovative curriculum and educator’s guide for 300 instruction hours set over a two-year period.
- Summer camps with camp-in-a-box organizational resources, coordinated by Nebraska 4-H and local programs across the country. Camp programs are available for beginner and advanced levels.
- Annual national 4-H robotics virtual competitions.

GEAR-Tech-21 is current in its second National Science Foundation grant to “scale up” the project, and increase participation

*Taken from the Gear-Teach website:* <http://4hset.unl.edu/4hdrupal/>

**Achievement Scores in an Informal Learning Environment**

**Bradley S. Barker and John Ansorge**  
*University of Nebraska-Lincoln*

<http://www.iste.org/Content/NavigationMenu/EducatorResources/YourLearningJourney/InnovativeLearningTechnologies/robotics.pdf>

<http://ianrnews.unl.edu/static/1001140.shtml>

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LEGO® robotics materials are the most commonly used robotics materials. LEGO also offers First Lego League (FLL) for teams to get involved in robotics learning and competition.

<http://www.firstlegoleague.org/>



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## **Pilot Program**

The RRP is designed to for teaching the fundamentals of robotics. It is designed to teach students (and parent/adult mentors) as a team, 25 students total over the first years and an additional of 50 students will added each year. Students will be from grades 4-12. Classes will be taught for three hours every Saturday per class (two classes each Saturday). The first year will teach basic robotics and nine modules thereafter. Three modules for grades 4-6, three for grades 7-9, and three for grades 10-12. The differences between the modules are primarily the familiarity with the robots and the complexity of the programming projects.

Each year will be divided into two semesters. Competition between the groups will take place at the end of each semester. All students/teams will be encouraged to enter State and National level competitions.

By pairing students with one parent/adult mentor students will be encouraged to have meaningful and challenging discussions at home concerning the robotics assignments and projects.

## **Pilot Program Time Frame**

Teacher training will take place during June, July and August, 2011. Each year's student instruction will start in September and continue through May of the following year.

## **Facilities**

It is recommended that the facilities of Mount Olive Ministries be used for this pilot program for several reasons. 1) It is located centrally in rural Mississippi 2) the facilities are ideally suited for teaching robotics - two large classrooms, a large common room and a well-equipped computer lab with Internet access. 3) The Directors of Mount Olive Ministries have long been champions of enhanced education for rural students and they support this program. 4) The local school facilities will be used for operating the robot tracks and holding the contests for participating students.

## **Program Instructor**

This program will be organized and taught by Mr. Ray Holt, a technology pioneer and computer scientist. Mr. Holt's career has spanned over 35 years of design, manufacturing, distribution, education, service and installation of many types of computer systems. Mr. Holt has a BS Degree in Electronics Engineering and a MS Degree in Computer Science. Mr. Holt is currently living in Mississippi and has had successes in teaching website and computer logic design to rural high school students who have formed a Website Design Club and is currently acquiring website work.

## **Performance Measuring**

Students will be tested upon entering the program. Tests will be based on basic math and engineering principles that will be taught in the robotics curriculum. Exams and projects will be given during each semester. Final projects and competition will help determine the overall learning for each student. Each student pair will make a presentation of their accomplishments to family and community members. The students will also host a learning fair for area youth to showcase their projects and get other students interested in robotics. The fair will be very hands-on and will contain some elements of construction and competition.

### ***Support research:***

The Use of Digital Manipulatives in K-12:

Robotics, GPS/GIS and Programming

Gwen Nugent, Brad Barker, Neal Grandgenett, and Vaichoslav Adamchuk

University of Nebraska, gnugent@unl.edu, bbarker@unl.edu, ngrandgenett@mail.unomaha.edu, vadamchuk2@unl.edu

<http://fie-conference.org/fie2009/papers/1041.pdf>

*“Beyond the potential to influence youth learning, educational robotics also represents a unique technology platform with the potential to excite youth and to attract them into technological careers.”*