

# Building a Robotics STEM Outreach Program from the Ground Up

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**Abstract** – Since joining the University of Memphis Engineering Technology faculty two and a half years ago, the author has made a concerted effort to be involved with outreach to the K-12 students in Memphis City Schools and the community at large to generate interest in STEM fields via mobile robotics. Through public events, national robotics programs like USFIRST and B.E.S.T., mentoring robotics teams, internet blogging and hobbyist organizations, this effort is starting to build a network of robotics enthusiasts in the Memphis area.

This interim report on ongoing outreach efforts will discuss various steps taken to get K-12 students, as well as the public at large, interested in mobile robotics as a tool to generate interest in STEM education. It will also discuss building partnerships with Memphis City Schools, companies, professional organizations and hobbyists to support these efforts and the need to create this network to support the teachers interested in promoting STEM through mobile robotics projects and contests.

*Keywords:* STEM Education, K-12 Outreach, Robotics

## INTRODUCTION

To build a successful K-12 STEM Outreach Program centering on mobile robotics, the following tasks must be completed:

- 1) Become involved and volunteer in various STEM Robotics Programs such as US First and B.E.S.T.
- 2) Establishing oneself as a “go to person” in mobile robotics information and knowledge.
- 3) Generating excitement in mobile robotics and associated contests geared towards K-12 students.
- 4) Establishing a network of like minded individuals that see the need to get K-12 students interested in STEM fields amongst hobbyists, professionals and those in the teaching professions.

Since starting at the University of Memphis, the author has taken steps to establish himself and the Herff College Engineering Technology Department as a resource for K-12 Mobile Robotics Stem Outreach to assist Memphis City Schools (MCS) in their effort to involve as many students as possible in Mobile Robotics STEM Programs.

### Getting Involved

In the past, the author has been involved in many robotics contests and activities including the IBM Technology Camp, IEEE SouthEastCon Hardware Competition, First Lego League, and First VEX (now First Tech Challenge), so he was aware of many programs that were regional, national or international contests.

Upon arriving in Memphis, a search was conducted to see what activities were established in the area. It was discovered that Mid-South Community College was a B.E.S.T. Hub. Boosting Engineering Science and Technology (B.E.S.T.) is a program run by Auburn University that promotes STEM Fields through mobile robotics contests. A simple phone call was all it took to get involved. Since it was near the competition date, it was too late to volunteer as a mentor for a team, but the author, along with one of his colleagues, volunteered to help judge the event.

At the same time, the author volunteered to become a co-advisor for the IEEE Student Chapter Hardware Team that would compete in the IEEE SouthEastCon regional Hardware (Robotics) Competition. Although not a K-12

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program, having University students who are working on robotics and having working robot to demonstrate for K-12 students is important to generate the excitement and to show that students can become involved in robotics competitions. It also is a pool of talent to draw upon when needing help in future activities.

Lastly, the author was approached by a US First Robot Team, the Bluff City Bots (Team #2817) who needed an electronics and computer programming mentor. I eagerly accepted and became an active mentor, not only to the Bluff City Bots, but also in the larger program trying to establish US First Robot Teams in high schools in the Memphis City Schools (MCS) system.

### **“The Go to Robot Guy”**

To create an effective K-12 outreach program, one must establish themselves knowledgeable and enthusiastic about a subject and is willing to share that knowledge with K-12 students.

Being involved, as described above, is the first step to establishing this reputation. But one must also have direct contact with mentors, teachers and students participating in K-12 STEM Robotics Programs.

One of the largest opportunities to establish this connection is the University of Memphis, Herff College of Engineering’s Open House (a.k.a. E-Day) which is held once a year, right before Thanksgiving. During this event, MCS students, and the community at large, come to participate in contests and see demonstrations put on by the various faculty and students of the college. The first year the author participated in this event, he assisted in a robot arm game with the students where the students used robot arm trainers to stack blocks as a contest. During this contest, a presentation was given to show students opportunities to do robotics within their schools. This generated many questions, contacts and requests for mentors from robotics teams.

In following two years, a “Mobile Robotics Demonstration” was offered to show off various robots, give basic theory and also to show that students of various ages could build, program and participate in various robotics contests such as B.E.S.T. and US First. This program further established the author as someone interested in and willing to help with various STEM Robotics Activities and generated even more questions, contacts and requests from various robot teams in the area.

During the same period, an internet blog was started to discuss general Robotics News and what was going on with Robot Contests and Teams in the Memphis Area and helps generate excitement about Robotics STEM Programs and Robotics in the Memphis Area.

### **Generating Excitement**

Many of the aforementioned activities generate excitement, but the best way to excite a student, in the author’s experience, is to demonstrate mobile robotics wherever possible. E-Day is the best opportunity to do this, and the Bluff City Bots Team has been more than willing to lend their robot to this display the last two years. A number of mobile robots are demonstrated during that activity including a NXT Lego Robot, a number of simple mobile robots used for my microprocessor interfacing class, some personal and toy robots and even a internet controlled mobile robot that was a senior project, but none are larger or have a greater impact than the US First Robot. Each year the point is made that the biggest robot in the demonstration was built and programmed by MCS High School Students. It is also made clear that elementary school students can build and program the NXT Lego Robot and participate in contests, such as the First Lego League competition. This puts these projects out of the realm of “rocket science” and into the realm of “if they can do it, so can I.”

The blog also helps generate excitement for those students who participate in these activities and also provides information that is readily available when an opportunity arises to recruit a mentor, participant, sponsor or to educate someone on the various programs and contests to interest students in the STEM fields. It is also provides a place for teams to advertise their activities to the public at large.

### **Robotics Network**

Through the efforts already mentioned, many relationships have been established. E-Day was invaluable to make contact with those teachers directly with students with such programs as US First and B.E.S.T.

The blog establishes a line of communication with the public and those who are interested in robotics in the local area. Contact with local groups such as MidSouthMakers, a group of hobbyists and enthusiasts interest in many topics including robotics was established because of the blog.

Also, through my work and contacts with the local Institute of Electrical and Electronic Engineers (IEEE), our Industrial Advisory Board, the Society of Manufacturing Engineers (SME) and other engineering and technical groups throughout Memphis information about these programs is starting to reach individuals and companies who are concerned about STEM Education and wish to introduce students to these fields.

Having a direct tie to MCS and to their effort to establish and expand US FIRST Robotics teams within the MCS system has been the single most important contact. In the past two and a half years the program has been expanded and the need for support has also grown. MCS has established themselves as a real supporter of US First and will field 6 teams this upcoming year and also host their second Kickoff Event in January 2011.

### **CURRENT STATUS OF THE STEM EFFORT**

As of this paper, the author has been involved in the MCS US First program for the past two and a half years and has promoted both US First and B.E.S.T. in the Memphis area.

Unfortunately the Mid-South Community College Hub closed down, not due to the lack of interest but due to its success. The contest outgrew the size of the facility in which it was held at and a larger venue was not found. The author was approached about helping to find a new venue, but unfortunately a lack of funding made this impossible since this happened early in this effort.

The MCS US First effort began at about the same time the author moved to Memphis and is about to enter its third season. There are now six teams in the MCS system (involving nine schools) and MCS has been chosen both to hold the US First Regional Kickoff for the past two years and also to be a Beta Tester for this year's Java programming software. This was the result of the efforts of Mrs. Jada Askew, of the Office of Academic Operations, Technology and Innovation, who has been instrumental in the establishment of US First in the MCS System. A strong working relationship between the author and Mrs. Askew has been established and we are currently working on a contract between MCS and the Engineering Technology Department at the University of Memphis as part of the "Race to the Top" Grant from the TN Department of Education to help further the US First Program within the MCS system.

A lot of interest in Mobile Robotics has been established during the Mobile Robotics Demonstrations during the past three E-Day's. During these events, the author has made connections with many teachers currently involved with, or thinking about establishing a Robotics Program within their schools.

Efforts are just starting to establish a mentoring network within the Engineering Community in Memphis. It has been discussed with the local chapter of IEEE and efforts are being made to contact other engineering groups in the area to obtain mentors for current and future programs.

### **THE FUTURE**

The future plans are to establish a number of on-going programs to assist MCS in the Robotics STEM K-12 Programs. In the near future, it is hoped that the contract will be finalized and that a program will be established to help teach students the basics of engineering, mobile robotics and project management. The contract will also establish the first week long summer camp for mobile robotics with similar goals.

In the long term it is hoped to expand the US First program of MCS into lower grades by expanding the network to support First Lego and First Tech Challenge teams. It is also a goal of the author to further the participation of the University of Memphis in the US First program by encouraging the University to sponsor and/or host US First events.

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Daniel Kohn is an Assistant Professor of Engineering Technology at the University of Memphis. He has been teaching for ten years and has over thirteen years of industrial experience in the area of computer control and measurement system. He also has an extensive background in Mobile Robotics and K-12 STEM Outreach.