

ROBOFEST 2010

Little robots perform big missions for STEM

by CJ Chung, Associate Professor of Computer Science, Lawrence Technological University

People laughed at Prof. Seymour Papert at MIT when he talked about children using computers as tools for learning. In the 1960s and 1970s, the idea of an inexpensive personal computer was still science fiction. For example, in 1977 Ken Olson, president, chairman and founder of Digital Equipment Corp. said: "There is no reason anyone would want a computer in their home." Later on in 1998, LEGO began to produce the MINDSTORMS autonomous robotics kit, which was named after Dr. Papert's book, *Mindstorms: Children, Computers and Powerful Ideas*.

Robofest (www.robofest.net), launched in 2000, recognizes the powerful idea of using robot and computer programming for learning. A Robofest coach summarized the characteristics of Robofest during an online survey after the 2010 season: "A cost effective approach with challenging problems and various learning opportunities." Robofest originated at Lawrence Technological University in

Michigan and is mainly for students in grades 4 to 12. Robofest challenges student teams to design, build, and program fully autonomous robots. We believe STEM (science, engineering, technology, and mathematics) learning is reinforced and maximized when students program and test robots, not when they play with robots by using remotes.

Robofest is flexible and open, and promotes diversity because it is platform independent. Any type of robot

kit, materials, actuators, and sensors are allowed. Robots can be programmed by using any programming language.

OPEN AND AFFORDABLE

Robofest is affordable and easy to enter. No big corporate teams are necessary, and there is no need for several-thousand-dollar budgets. Reusing parts and old kits is encouraged. Still, some winning teams are using old LEGO RCXs. Field materials and parts are also affordable, simple, modular, and easy to transport. Teams can be formed by any organization, school, home schools, clubs or civic group. Some robotics competitions are for a few privileged

students, but Robofest is for all students.

In addition to STEM education, Robofest encourages the development of complete life-long educational goals. It extends into a realm of invaluable skills such as problem solving and critical thinking. Students participating in Robofest develop confidence, discipline, team work, trouble shooting abilities, presentation skills and leadership skills. Since Robofest requires innovation and creativity, students develop entrepreneurial mindsets.

Every student is a winner at Robofest. While adult mentorship is encouraged in all phases of preparation, students should make all decisions and perform all robot programming during the competition. Proctors observe teams to see if they are getting any direct adult help during the competition. Since Robofest ensures that the students understand the problems to be solved, and do the construction and programming, every student is a winner in learning. Robofest awards an IEEE sponsored medal as well as a personalized certificate to every participant.

Robofest is a festival of technologies that offers a variety of challenging and fun opportunities based on age, gender, learning methods and difficulty levels. Game competition is the regular challenge, but for rookie teams we recommend the RoboFashion and Dance Show. Robofest provides a stage for teams to show off any robotics projects as creative exhibitions. For advanced high school students, Robofest offers the Vision Centric Challenge.

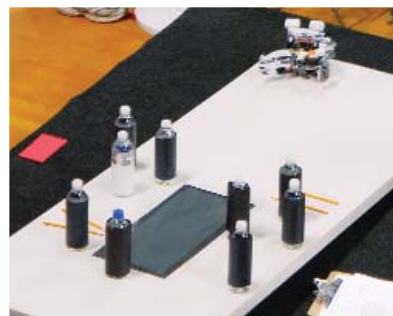
ROBOFEST 2010 GAME - ROBOPOWER

Robofest Game is an advanced competition. It is hard to achieve any Robofest Game missions with dead-reckoning; the use of sensors is required, which means teams are supposed to use closed-loop feedback control. Students must program their robots to accomplish tasks in an unknown and/or dynamic environment. In some past Robofest games, two robots were required to solve the challenge cooperatively.

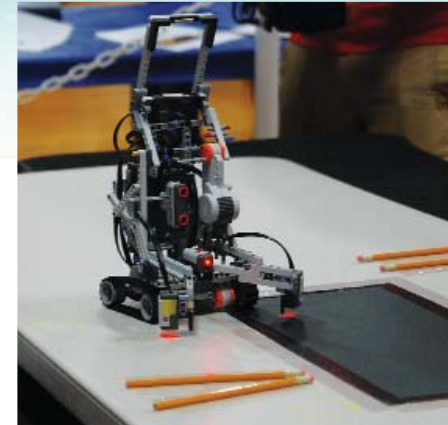
The object of this year's robot game, RoboPower was to completely remove debris (water bottles) caused by a



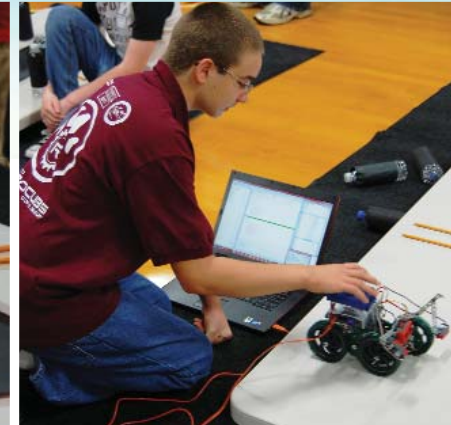
This IEEE sponsored medal is awarded as well as a personalized certificate to every participant.



The table on which the Robofest 2010 game was played.



landslide from a make believe mountain road, rescue a trapped human (another water bottle) and return to the safe zone. The locations of bottles were unknown. Heavy bottles and pencils taped down on the playing field table sim-



ulated uneven muddy and rocky terrain. This made it very difficult for robots to remove bottles from the table. Only the following 4 teams out of approximately 300 Game teams had perfect runs at least once throughout the season.

ROBOFEST SPONSORS

- Tank Automotive Research, Development and Engineering Center
- The Herbert and Elsa Ponting Foundation
- DENSO
- IEEE Region 4 and Southeast Michigan Chapter
- MCWTF (Michigan Council of Women in Technology) Foundation
- RIIS
- Lego Education
- Realtime Technologies
- The Michigan Association for Computer Users in Learning (MACUL)
- CMU Robotics Academy – RobotC
- Mindsensors.com
- Detroit Chinese Engineer Association
- ARAMARK
- StoutWare Engineering
- Operation Chocolate (Team 304-2)
- David E. Bindschadler
- CJ Chung
- Howard Davis
- Dennis J. Howie
- Starlett Sinclair
- Joel Stein
- Emily Trudell

Division	Competition	Team ID	Team Name	Coach Name	Score	Time	Award
Sr. Game	Canada Aurora Qualifier	725-17	ESS-2	Michael Roy-diclemente	135	N/A	1 st place
Sr. Game	World Championship	1190-1	Hightech	Sangyong Bae	135	0:56	1 st place
Sr. Game	World Championship	536-1	Rocky Robot	Jason Liu	135	1:39	2 nd place
Jr. Game	IGVC	833-3	Geek Squad - 3	Steve Tao	105	1:49	1 st place

Teams with perfect game runs at least once.



The Jr. Game World championship first place award went to team 828-1 4Jesus, Northville, Michigan

The Sr. Game world Championship first place award went to 1190-1, team high-tech, Suwon, Korea



Junior Exhibition team 1094-1 Dawg Botz from Canton, Michigan won the first place award with their robot called P.L.A.N.T. (Plant Locating Autonomous Nurturing Technology). P.L.A.N.T. is a Green technology robot that waters growing plants after determining requirements by measuring the moisture level of the dirt.



Many other superb exhibition projects were entered this year. Team 833-2 Geek Squad - 2, from Canton, Michigan showed off robots for future green energy generation.



EXHIBITIONS

Since a game competition with fixed rules may limit students' creativity, Robofest offers a stage to demonstrate any autonomous robotics project. The robotics exhibition is a great way for students to show off their imagination and creativity.



Team 1049-1 K.C.'s Technobotz from Median, OH introduced a robot to assist the elderly by taking medication to them on a daily basis.



Above: The winner of senior exhibition was the team 981-3 Elmhurst Trojan Bots from Indiana. They invented an autonomous robotic system that sorts plastic bottles, metal cans, and aluminum cans. Their achievement was introduced in several newspapers in Indiana.

Right: Team 725-15 from Aurora High School, Canada created a sophisticated computer vision system called the Artemis Targeting System that detects movement, orients toward that movement and fires projectiles



Team 336-1 The Galactic Hamsters from Newark, OH introduced a game of tag with two robotic hamsters. The system uses bluetooth communication between NXTs, and it has an infrared beacon and IR seeker sensors.

A notable project was done by team 725-15 from Aurora High School, Canada. They created a sophisticated computer vision system called the Artemis Targeting System that detects movement, orients toward that movement and fires projectiles. A video of Project Artemis can be found at: <http://artemis.cheshire.ca>.

Division/Category	Winner Team Name	School/Org. Name	Coach Name
Junior Exhibition	Geek Squad - 2	Geek Squad, Canton, MI	Steve Tao
	K.C.'s Technobotz	Highland Middle School, Medina, OH	Annette Wissel
	Geekabytes	Plymouth Christian Academy, Plymouth, MI	David Cusumano
	Dawg Botz	Dawg Botz, Canton, MI	Michael Bonello
Senior Exhibition	The Galactic Hamsters	Newark Area Youth Robotics, Newark, OH	Karen Lepper
	Aurora High Exhibition	Aurora High School, Aurora, Ontario, Canada	Michael Roydiclemente
	Elmhurst trojan bots	Elmhurst High School Robotic Club, Yoder, IN	Phillip Springer

Winners of the 2010 TARDEC CI (Creativity and Innovation) grant

CREATIVITY AND INNOVATION GRANTS

Robofest promotes creative and innovative ideas by awarding CI (Creativity and Innovation) Development cash grants sponsored by TARDEC and Lawrence Tech to exhibition teams. The following table shows all the CI grant winners this year.

These teams also participated in the Maker Faire Detroit held at the Henry Ford Museum, Dearborn, Michigan. A list of all the winners of Robofest competitions can be found at www.robofest.net.

ROBOFASHION & DANCE SHOWS

Robofest RoboFashion & Dance Show creates an exciting and simulating classroom environment that promotes imagination, creativity, harmony, collaboration, and arts. It has gotten more students, especially female students, interested in STEM area at an early age. In 2010, 24% of the participants were girls.

In these shows, a team of robots (two or more are recommended) uses a stage that does not have walls to show off their costume, walk (drive), and perform dancing motions. Robots can communicate each other wirelessly for the synchronization of moves. Robots have up to two minutes for their demonstration and they move in time with music chosen by the teams. Robots may start from any area and may finish at any location. They may follow the edge of the boards and do not need to follow the lines, especially on the table area. Team members may interact/dance together with their robots while sending various signals to the robot.



Team Cougarbots (1066-4) won First Place award. They were from Our Lady Of Victory School, Northville, MI. Tim Kalvaitis was the coach.



Team I.C.D-2 (421-3) from Dong-jak Center, Korea won Second place award. Kyungseol Lee was the coach. Third place award went to team CYBORG (1189-3) from Ulsan High School, Korea. The teacher was Cho Yong Min. The two Korean teams were using ZigBee for synchronization of their robots.



The Vision Centric Challenge (VCC) used a laptop-based robot named L2Bot that read a 2D barcode using an on-board webcam.

VCC: VISION CENTRIC CHALLENGE

This year's Vision Centric Challenge (VCC) used a laptop-based robot named L2Bot and was very challenging. The game was similar to the one held at the IEEE Robotics and

Automation chapter competition for professional engineers in Italy in 2006. Our VCC added the recognition of 2D barcode using an on-board webcam. The Challenge is to recognize and read the mission data represented in a 2D barcode placed by a judge on the floor). The mission data barcode includes the number of landmarks and first turn direction, either left or right. Then the robot needs to completely navigate through all the landmarks and return home and stop. The following figure depicts the synopsis of the mission.

VISION CENTRIC CHALLENGE 2010 COURSE

The winner of this year's High school VCC challenge was team Roboteers (348-1) from Michigan. The coach was Jonathan Crocker. Rocky L2bot (1161-1, Coach Cathy Wu) won 2nd place award. Gsquad (1023-2, coach Leann Bigos) from Southfield, Michigan won 3rd place award.

ROBOFEST 2010 OVERVIEW

Would you like to watch Robofest robots in action? Please go to YouTube.com and search for "Robofest 2010." You will find numerous video clips including the official 15 minute video. Robofest is not about making noise and rewarding large groups. Our goal is to let each student truly understand the concepts of math and science while solving real-world problems with autonomous robots. Rather than using a joystick to drive a robot, we are certain students will learn more when they implement algorithms in a programming language so that a robot can move and react intelligently while sensing the environment. Computer programming makes robots alive and students exercise STEM. We are glad to see many other Robotics competitions are moving in this direction to emphasize computer programming and computer based learning as Prof. Papert dreamed.



The winner of this year's High school VCC challenge was team Roboteers (348-1) from Michigan.

QUALIFYING SITES

AlBrook School, Saginaw, MN
 Ann Arbor Trail Magnet School, Detroit, MI
 Austin Middle School, Galveston, TX
 Austin Robotics Network, Austin, TX
 Belleville High School, Belleville, MI
 Calhoun Area Career Center, Battle Creek, MI
 Canton Charter Academy, Canton, MI
 Computer Learning Center at Ross Norton Recreation Center, Clearwater, FL
 Emerson Elementary, Detroit, MI
 Highland Local Schools, Medina, OH
 Hillside Middle School, Northville, MI
 isisHawaii at Pearlridge Center, Aiea, HI
 John D. Pierce Middle School, Redford, MI
 Lawrence Tech University, Southfield, MI
 Macomb Intermediate School District, Clinton Twp., MI
 MACUL at DeVos Place, Grand Rapids, MI
 Skyline High School and WCC, Ann Arbor, MI
 Sky Valley Education Center, Monroe, WA
 Southfield Christian School, Southfield, MI
 Windemere Ranch Middle School, San Ramon, CA
 Aurora High School, Ontario, Canada
 Hanyang University Regional Championship, Ansan, Korea
 SABRE at Cardston Junior High School, Alberta, Canada
 Sichuan University, Chengdu, China
 IGVC at Oakland University, Rochester, MI

A total of 1,443 students, 441 teams from four countries (Canada, Korea, China, and the USA) participated in the 11th Annual Robofest student robotics competition. Robofest 2010 featured a warm-up competition, 25 qualifying competitions, a video qualifier, a video regional, a regional championship, the World Championship, and two afterglow events (IGVC and Maker Faire Detroit). 56% of student participants were from outside of Michigan. Average team size was 3.3 students.

CONCLUSION

Robofest is a great event that encourages students to learn the technical disciplines involved in robotics as well as life skills such as teamwork and project management. This growing competition would not be possible without the partnership of many schools and organizations worldwide. We thank all the partners and our sponsors for making this great competition possible, and we invite educators and students to jump in and join the fun. You can get involved—just visit www.robofest.net and follow the links.

Links
 Project Artemis Vision System video, <http://artemis.cheshire.ca>

Robofest, www.robofest.net, (248) 204-3568

For more information, please see our source guide on page ____.

PLANS AND TIME LINE FOR ROBOFEST 2011

~ Nov. 1, 2010 - Call for local qualifying competition site hosts
 Nov. 20th, 2010 - RoboParade
 December 4, 2010: Robofest 2011 Kick-off; team registration begins at www.robofest.net
 Jan ~ Feb, 2011: Technical Workshops
 Feb. 19, 2011: Warm-up competition (Judges Training)
 Feb ~ early April 2011: Qualifying Competitions
 Mid April 2010: Regional Championships
 May 7, 2011: World Robofest 2011 Championship, 8:30am-5pm, Lawrence Tech, Southfield, Michigan
 June: IGVC Invitational at Oakland University
 June-July, 2011: RoboMath Camps