



UNVEILING 2014 ROBOFI

Leading Autonomous Robotics Competition Expands

by CJ Chung, PhD, Professor of Computer Science, Founder & Director of Robofest

Robofest is an annual robotics festival and competition designed to promote and support STEM (Science, Technology, Engineering, and Mathematics) and Computer Science. Robofest challenges teams of students to design, build, and program autonomous robots to compete in various categories. Robofest has witnessed significant growth over the past 15 years. In the 2012-2013 season, 1,809 students participated in Robofest. Cumulatively, over 14,000 students have been a part of this program since its inception in the 1999-2000 school year at Lawrence Technological University in Michigan. Robofest has drawn students from 14 states (Michigan, Ohio, New Hampshire, Texas, Florida, California, Washington, Missouri, Hawaii, Colorado, Indiana, Minnesota, Louisiana, and New York) and eight countries (Canada, Mexico, United Kingdom, South Korea, Singapore, France, India, and China) and continues to expand at a rapid rate. The lead picture shows World Championship participants in May 2013 at Lawrence Technological University.

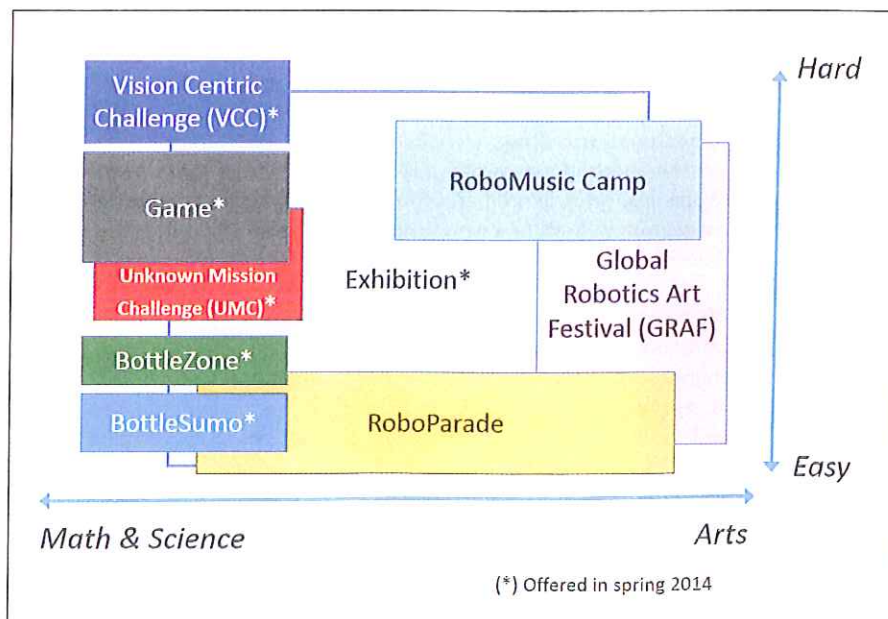
WHAT MAKES ROBOFEST EVENTS UNIQUE?

STEM learning focused through autonomous

robotics: When we make robots think, we learn more because we have to think more. Autonomous robotics is one of the best ways to learn all the STEM disciplines in a truly integrated fashion. Furthermore, Robofest challenges are designed in such a way that dead-reckoning is discouraged. Students must program their robots with sensors to accomplish

tasks in dynamic and partially unknown environments. Through the challenges, students must use math and science skills learned in their classes and re-enforce the learning.

Affordable. Our emphasis is on making Robofest affordable to all students, parents, and schools, and we accomplish this by charging a minimal team entry fee (\$30 -



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ROBOFEST CHALLENGES

\$50). Robofest does not require teams to hold major fundraisers to underwrite the cost of participation. Robofest encourages recycling of all the logistic materials, such as robotic kits, parts, sensors, actuators, and playing field materials, which helps to control costs. It is easy to host your own qualifier since our Robofest office provides basic qualifying competition materials including trophies, medals, name badges, and certificates for free.

Flexible Robofest allows students to use robotics kits and software of their choice. Any material can be used. The playing field materials are affordable, modular and easy to transport and store, allowing student teams to practice anywhere at their convenience. Teams can be formed by any organization, school, home schools, clubs, neighborhood or civic group.

Students rule. While adult mentorship is encouraged, students design, construct and program the robots; adult coaches/mentors are not allowed to assist during the competition.

Everyone is a winner. All registered participants receive personalized medals and certificates if they do not drop out. Winners of the qualifying and championship rounds receive trophies. Top teams in the World Championship senior division receive \$2,000 LTU renewable scholarships.

Fun and exciting opportunities for every student. Robofest meets the needs of a variety of students based on their respective age, gender, learning methods and difficulty levels. The

following table shows all the Robofest programs offered throughout the year and the different skill levels and interests.

In the summer months, Robofest offers Robot Music Camp, where students create robotic musical bands and robotic musical instruments that humans can play. RoboParade and GRAF (Global Robotics Art Festival) are organized in the fall.

SPRING 2014 COMPETITION CATEGORIES

The following (Table 1) shows spring 2014 competition categories. Jr. Division is for grades 5 - 8 and Sr. division is for grades 9 - 12

Competition Category Name	Age (grade) Divisions	Team Size	Platform	Unknown Factors	Competition Sites
Game: "Avoid Meltdown"	Jr. and Sr.	Max. 7	Any	Yes	Qualifiers, North American Championship (Qualified teams only), and World Championship
Exhibition	Jr. and Sr.	Max. 7	Any	No	
Vision Centric Challenge (VCC)	Sr. College	Max. 3 Max. 2	Any vision based robot	Yes	North American Championship and World Championship. There is no qualifier. First come first serve, but space is limited.
BottleSumo	Jr.	Max. 3	Any	Yes	
BottleZone	Sr.	Max. 3	Any	Yes	
Unknown Mission Challenge (UMC)	Jr. and Sr.	Max. 3	Approved platforms only	100% Unknown	

(Table 1) Spring 2014 competition categories. In this article, we unveil rules for the 2014 spring season challenges shown in the above table.

GAME 2014: "AVOID MELTDOWN"

In Robofest Games, a team of students compete to accomplish robotics missions using fully autonomous mobile robots. Robofest Games puts math skills to the test. A new

Game is introduced each year and the name of the 2014 Game is "Avoid Meltdown."

Game synopsis: A nuclear power plant is in trouble. An autonomous nuclear responder robot detected the problem and instantly delivers up to three water balls (tennis balls) and a special ball (hardboiled egg) into the plant (box) without human help in two minutes. The robot can carry only one ball at a time. Two concrete blocks ("AA" size batteries) near the plant need to be removed off the table. Also, the volume of the box (outer dimension) should be reported in cubic millimeters at the Home Base.

For the Junior Division, the height and depth of the box will be given. The box is aligned in parallel with the table. For the Senior Division, only the depth of box will be given and the box is NOT aligned in parallel with the table.

EXHIBITION 2014

Since Games competitions with fixed rules

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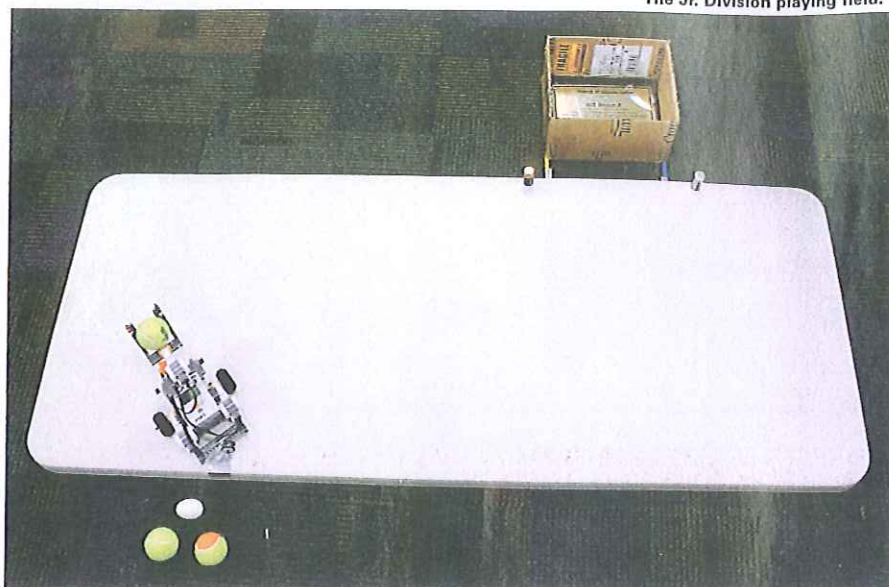
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may limit students' creativity, Robofest offers a science fair-like stage for exhibitions to demonstrate creative robotics projects. The robotics exhibition is a great way for students to show off their imagination and creativity. Each team has complete freedom to create any autonomous robotics projects such as robot pets, robots for scientific experiments, and practical robotics applications for any fields. Computer-controlled robots with sensors may be of any size and can use any material as long as it is safe for team members as well as spectators. Hard-wired remote control is not allowed. However, wireless host computer/robot control via software messages is allowed.

Human interaction with the robots is allowed and encouraged. The application of math and science theories that is appropriate to the team members' age level is a strong plus for judging. The following picture shows the 2013 World Championship Sr. Division 1st place winner team PACE



The Jr. Division playing field.

Invaders from Canada when presenting their project. They developed Z-bots with an Arduino micro controller and four omni wheels solving maze problems and demonstrating swarm behaviors. All the plastic body parts were made from a 3-D printer from scratch.

VISION CENTRIC CHALLENGE (VCC) 2014

Why is vision important to robots? Clearly, vision will enable a robot to become intelligent and autonomous in undertaking manipulation, navigation, and even social interactions. In this VCC, teams are required to build and program a robot with a camera(s). The robot will be shown a digit on a letter-size paper. After recognizing the digit, the robot should navigate through the path in such a way that blue cups are always on the left side. If the number given was two, the robot needs to return back home at the 3rd yellow cross-line while maintaining the left blue color rule. This VCC is for advanced high school students as well as college students. Teams may lease an L2Bot platform from LTU. Please feel free to contact Dr. Chung at chung@LTU.edu if you are interested in this challenge.

BOTTLESUMO 2014

The objective of this game is to either be the first robot to find and intentionally push a two-liter bottle (filled with one liter of water) off the table or be the

last robot remaining on the table. In either case, after the event (either the bottle was pushed off or the opponent is off the table), the robot must survive on the table for at least three seconds. A robot is considered off the table when any of its parts are touching the floor, whether it was pushed off the table by the other robot or it fell off the table on its own. Each robot must be fully autonomous. No human control, signal or remote computer control (tele-operation) is allowed. Through this BottleSumo, students can learn multiple STEM subjects such as physics,



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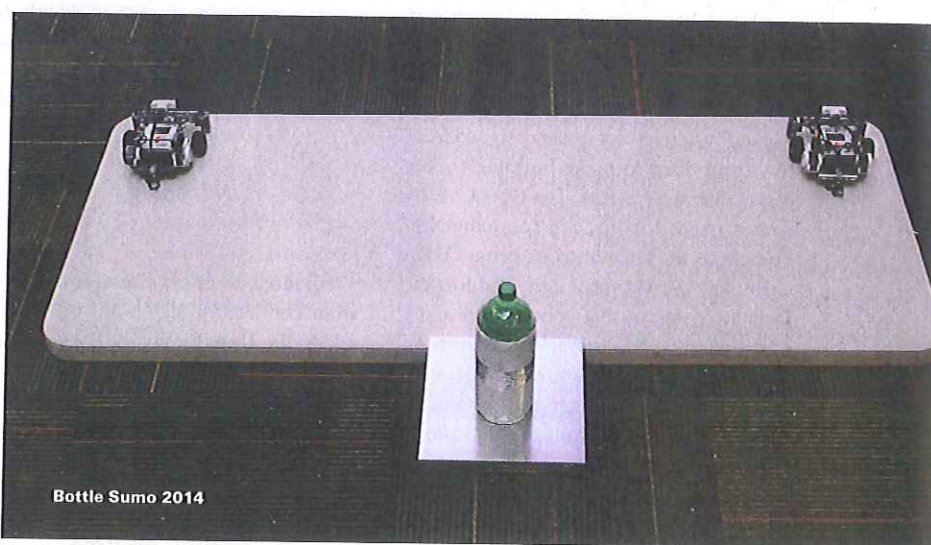
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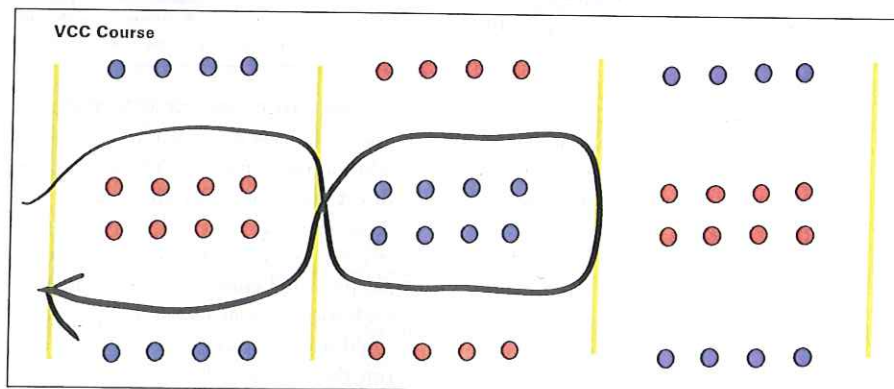
math, gears, logic, mechanical engineering, computer programming and engineering design process – by doing. Especially, the introduction of an additional target object makes the game more challenging and minimizes the random chance of winning. The photo shows participants at the BottleSumo North American Championship at LTU in November 2012.

BOTTLEZONE 2014

This game is similar to BottleSumo, but it has additional landmarks to detect, which makes it more complex to program. The objective of the game is to find a square shiny zone and be the first to (intentionally) occupy it for three seconds. Successful occupation means every part of the robot, except wires, must be



Bottle Sumo 2014



inside the zone for the full three seconds. A bottle covered with white paper is placed on the center of the zone to make it easy for robots to find the zone. The exact location of the zone is unknown prior to the start of the game. Starting location and orientation of the robots are also unknown. A robot may also win a game, like Sumo wrestling, when it pushes its opponent off of the table or if the opponent falls off the table by itself. A robot is off the table when any part of it touches the

floor, even if that part is no longer connected to the main body of the robot. The photo shows an example of initial configuration. Unknown Mission Challenge (UMC) 2014

Mission tasks will be totally unknown until the day of competition. The goal of this challenge is to provide an opportunity to develop problem solving skills on the fly without any help from adult coaches. Teams may use only approved robot kits. Pre-assembled robots cannot be used. Sensor or motor multiplexors are not allowed.

TEAM REGISTRATION AND COMPETITION SCHEDULE

For more information and to register teams, please go to robofest.net. Qualifying competitions in North America will be held from February-April. The North American Championship will be held on May 3, 2014, at Lawrence Technological University, Michigan. The World Championship will be held on May 30-31, 2014, in Daegu, South Korea. Teams may get travel grants if they are trophy winners from qualifying competitions and/or North American Championship. ©

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Link
RoboFest, robofest.net

For more information, please see our source guide on page 81.

BREAKTHROUGH! EDU-BOT: LEGO EV3

UAV'S HELP WILDLIFE IN NEPAL

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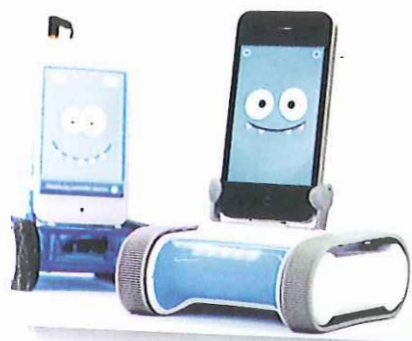


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