

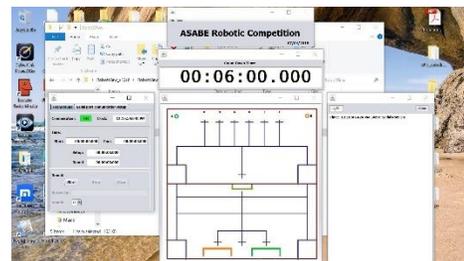
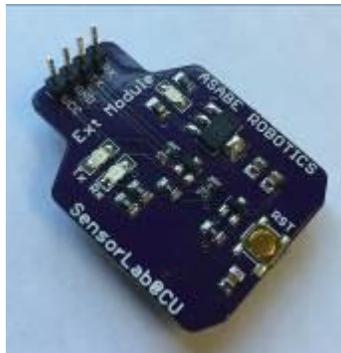
ASABE Robotics Competition 2016

Joe Mari J. Maja, Alireza Pourreza and João Camargo Neto

The ASABE Robotics competition was held last July 18-20, 2016 at the Colorado Sprint Resort, Ballroom C. There were originally 16 participants who registered to participate but two unfortunately were not able to make it. The main emphasis on this year's competition is on a cooperative harvesting robot.

This year's objective requires the construction of a fully automated robotic system designed to simulate the transfer of citrus fruits from the harvester to the processing plant. There will be two robots required from each team where one of the robots (hauler) will haul the fruits (represented by a ping pong balls) and transfer the fruits to the other robot (trailer), which will then move the fruits to its final destination (processing plant). There are two colored balls which represents oranges – orange and green. Either robot will have to sort the two colored balls before delivering it to its respective processing plant location. The trailer also transmits its current location and other information, e.g. ball color currently delivered and the number of balls that were already delivered. The trailer also has the capability to stop the timer of the visualization program using the standard string that was provided on the rule book. The committee for this competition also decided to create a common visualization program (Fig. 1b), which was created by Dr. Joao Camargo Neto of Embrapa Agricultural Informatics – Brazil to be used for this competition. Doing so minimizes the work required from each team and helps them focus on their robots.

This year's competition received full support from the ASABE in terms of funding and logistics. Funds for building the competition table, transceivers, plaque and prizes were also funded by ASABE. The committee received funds to develop the transceivers for the trailer, thereby creating a common transceiver (Fig. 1a) for all teams.



(a)

(b)

Figure. 1. (a) Transceivers used for the ASABE Robotics Competition 2016 and (b) Visualization Program used for the competition.

The Clemson University Sensor and Automation Laboratory designed and fabricated the transceiver which was also distributed to the registered teams.

Significant changes

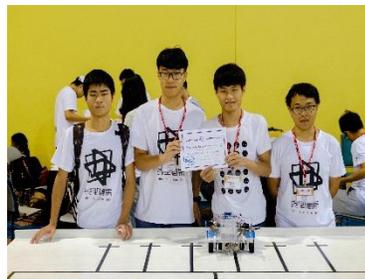
The highlight of this year's competition attributed to its success:

- The performance time was implemented using the visualization program which has proved to help a lot in running the competition as smooth as possible. Time performance is now part of the score calculations and provided more of a balance in terms of total score calculation.
- The score calculation was created to help teams know their standing after every round.
- The final score has shifted to emphasize consistency in terms of every round where the top two highest scores were used to calculate the overall team score.

Each team's design provided a glimpse of their creativity on how to accomplish the objective of this competition. Below are some pictures during the scheduled practice and competition:



(a)



(b)



(c)



(d)



(e)



(f)



(g)



(h)



(i)

Figure 2. (a) Clemson Iron Agrobotics (b) Zhejiang University – Team 2 (c) University of San Carlos (d) California Polytechnic State University (e) Clemson University – Edisto (f) Zhejiang

University – Team 1 (g) Zhejiang University – Team 3 (h) Iowa State University (i) Texas A&M University.

Winners for this year competition are as follows:

- 1st - Zhejiang University - Team 1
 - Lirong Xiang, Endai Huang, Luoyi Jin, Xiaoyue Xu, Zhan Lu
- 2nd – Clemson University – Iron Agrobotics
 - Chris Miller, Nicholas Rogers, Cengiz Koparan, Jordan Breland, Arnaldy Medina, Jonathan Rodriguez ,Kevin Gibson
- 3rd – Clemson University – Edisto
 - Adam Blocker and Ellie Stuckey

Next year's competition will be held at Spokane, Washington and the rules are currently being worked out by Joseph Trotochaud, the chair for 2017. We hope to see you again next year.

Joe Mari J. Maja is the Chair of the ASABE Robotics Competition 2016 and is currently the Research Sensor Engineer at Edisto Research and Education Center of Clemson University. He also supervised the Sensor and Automation Laboratory at the center. His current work is mainly on sensor development, automation and unmanned aerial vehicle on precision agriculture.

Alireza Pourreza is currently an Assistant CE Advisor at the University of California, Agriculture and Natural Resources (UC-ANR). His current research efforts are on precision agriculture, sensor and machine design for sorting and grading operations, computer vision, robotics and automation, quality assessment, GIS, remote sensing, and big data.

João Camargo Neto is currently a research at Embrapa Agricultural Informatics. His current research are on precision agriculture, pattern recognition, machine learning, computer vision and automation.