

2018 IEEE R5 ROBOTICS COMPETITION

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Project Summary

By competing in the IEEE R5 robotics competition, our team was granted the opportunity to represent the University of Houston as a top tier school. The competition required our team to design a robot to face challenges in navigation, mobility, and dexterity with a high level of success. Our team's 3d-printed robot featured a storage carousel and computer vision algorithms to face the challenges at hand.

Beyond achieving 6th place (out of 35 teams), our robot became the center of attention at the competition, being the only robot to compete using computer vision. Additionally, our successful carousel design commanded the attention of the spectators and established a renowned for the aptitude of students from the Cullen College of Engineering.

Problem and Need

As outlined in 2018 R5 IEEE Robotics Competition rules, our robot was required to start in one of the white squares located on the top and bottom edge of the board. The robot must then navigate the 8' x 8' playing field and pick up coins which are embedded in the floor. The underside of each token was colored, corresponding to one of the colored squares on the outer edge of the board. Points were awarded during 3 rounds based on the robot's ability to correctly pick up and deliver tokens.

Significance

This team is significant for public relations. Unlike other projects which promote a relationship with industry, this project will promote the University of Houston to the public and to future students as a school worthy of prestige and reputation.

Goal

The goal of the competition is to challenge students to design and create a unique robotic system to solve a unique problem. To succeed, students were required to have a firm understanding of embedded systems, computer programming, electronics and mechanical systems.

Customer/User Analysis

Initially, the only users for this project are the four team members involved. They will be the sole uses of the robot until after the competition. After the competition, the robot will belong to the UH ECE department as a resource for students in future competitions and classes. Likewise, future students addressing similar challenges will have access to our technology and methods.

Deliverables

Final deliverables are dedicated to integrating hardware and software modules. The final deliverable was a robot free from malfunction and as a robust system to quickly and accurately complete the competition objectives. Deliverables include and overview of the computer vision methods used for robotic mapping.

Terminal Objective

The robot is fully integrated to collect, sort and deliver game tokens effectively. Our Hardware objectives included: the ability to pick up, sort and drop off the tokens, ensure power requirements are met along with locomotion. The software objectives included: the ability to interpret camera images to make meaningful conclusions, the operating system includes drivers to control hardware and lastly the program which is optimized to score as many points as possible. The integration objective included a demonstration of both hardware and software objectives working seamlessly together. These objectives included: the ability to run multiple program tasks at once, a fault-tolerant emergency stop, the dexterity is fluid and the robot can navigate the course accurately.

Overview Diagram

