

Montgomery College Wins Penn State Robotics Mini Grand Challenge 2008

On Saturday, April 26, 2008, the Robotics Club at Montgomery College (MC), Rockville, contested against 14 other robotics teams at the Robotics Mini Grand Challenge organized by the Pennsylvania State University (PSU), Abington, PA.

Beginning around October, 2007, two teams from MC robotics club, both sponsored by the Engineering department of MC, Rockville, and supervised by Engineering Professor, Alex Hou, worked diligently at designing, developing and programming two autonomous robots for the PSU competition, which, according to the organizers, “was designed to be very difficult”, with a main purpose of “promoting advances in robot technology, robotics education, and creative thinking”. The competition was open to participants of all ages or professions to allow for the construction of a low-cost robotics platform, with the focus being on the software development and mechanical design of the sensors and interface. The robots were judged on their ability to a) completely navigate through a prescribed outdoor course (consisting of a paved-path route and an off-road route) with a total distance of about 0.5; and b) exhibit extra-ordinarily creative personalities such as telling jokes, playing music, singing, educating spectators about robots or providing tour guide of the campus. The robots were also required to stop within 2 feet of any human obstacle, and then proceed with its journey when the human has been removed from its path.

Robotics Team # 1, led by MC Robotics Club president, Frange Abaraka, worked on “Undefined”, shown in Figure 1 below, while Team # 2, led by Keyvan Nawai, a worked on “Rahyab”, shown in Figure 2 below.



Figure 1

MC Robotics Team #1 at the PSU, Abington, PA: Showing Robot, Undefined, and team members: (Front, l-r) Frange Abaraka, Robert Thompson, Matthew Starr, Dr. Alex Hou; (Mid, l-r) Manden Keita, Ertugrul Anaz, Chris Bunai, Dr. Uche Abanulo; Mary Murphy; (Back, l-r) Chris Perkins, Grimaud Kouwenaar



Figure 2

Members of MC Robotics Team #2, Keyvan Nawai (left), and Shayan Navaie (right), with Rahyab.

The following description was provided by Chris Bunai, the mechanics specialist for “Undefined”:



Figure 3:
“Undefined”

the frame of the robot began with two Razor electric scooters; these scooters were then modified to fit beneath a beam of super-strut connected with a threaded rod. The frame was designed to be fully adjustable in order to have a level mounting platform. We then have the electronics board mounted to the super-strut platform containing an ITX board, two motor controllers, 80 Gigabyte hard drive, and USB sonar connection. There is also a Harmon Kardon powered subwoofer with two MTX midranges and tweeter component speakers. The control system of the robot uses a combination of visual, sonar, and GPS devices. The visual is provided by a webcam that interprets the color of the region in front of the robot and determines the proper path. There are five sonar sensors placed around the robot with three in front and two

in back on either side. These are used for obstacle avoidance and ideally path detection. The GPS is used to track various points of the course that robot was designed to follow. The motors that the robot uses are Kollmorgen servo motors that have a gear ratio of about 100:1. They are very powerful motors that can have precisely controlled rotation speed and position made possible from optical encoders that provide feedback information to the motor controllers. Undefined’s power source is four 12V lead acid batteries wired in parallel.

Some noteworthy features of Undefined were the fact that it entertained spectators during its journey through the path, it also communicated with human obstacles in a very elegant fashion, telling the obstructor to “please exit the path”, and politely thanking the him/her after s/he has left the path.



Figure 4:

MC Robotics Team #2
member, Noosin Pourkarim,
holding the First Place trophy.

Keyvan Nawar, a highly talented robotics expert, provided the following description for Rahyab:

“Rayhab” is a mobile pathfinder robot which is able to find GPS waypoints and analyze the path using vision and sensor data. It is a dynamically programmable robot, so, the program can be changed for varying applications. Its Mechanical component consists of two separate gear motor, a metal frame, front and rear axles, chains, chain adjusters, and water proof covers to prevent any damages to the electrical control system during the rain. The electrical control system consists of a wiring system, power supply (batteries), a GPS, the motor controller, terminal blocks, switches, a vision camera, sensors, and input/output devices. Several programming language were used in developing Rayhab. A technique known as “Sequence Chart” was used to manage all programming procedures and subroutines.

“Rahyab”, in addition to being the first robot to ever complete the paved-road path, finished FIRST PLACE at the competition winning \$400 and a trophy (shown in figure 4).

MC's representatives for "Undefined" were: Robotics Club President, Frange Abaraka; the programming team, Robert Thompson (MC Alumna and robotics software expert), Matt Starr and Ertugrul Anaz; the mechanical team, Chris Bunai and Mary Murphy; the electrical team, Chris Perkins and Manden Keita. the representatives for "Rahyab" were: robotics expert, Keyvan Nawai, Shayan Navaie and Nooshin Pourkarim. Accompanying them were faculty advisor, Dr. Alex Hou and Dr. Uche Abanulo from the Engineering Department. Other participants at the competition were Drexel University, Penn State University, Abington, Penn State University, State College, Rochester Institute of Technology, Hobart College, New York, and several other robotics groups around the eastern region.

This is a great victory for Montgomery College, being the only two-year college participant.