Team Puzzles – A Meteoric Rise of Austrian Students

Participating in the **R**obotic **W**orld **C**hampionship of **B**otball

[1]*S. Stoppacher, and* [1–3]*M. Stifter*
[1]*HTBLuVA Wr.Neustadt, Department of Computer Science,*
Wiener Neustadt, Dr. Eckener-Gasse 2/Austria, sara.stoppacher@gmail.com
[2]*Danube University Krems, Center for Integrated Sensor Systems,*
Wiener Neustadt, Viktor Kaplan Straße 2/Austria, michael.stifter@donau-uni.ac.at
[3]*Vienna University of Technology, Institute of Sensor and Actuator Systems,*
Vienna, Gusshausstraße 27–29/Austria

Abstract

This publication describes the participation of an Austrian student team in the World championship in robotics. It provides insights of the competition procedure and its requirements. The student group shown in Figure 1 consisted of three female students and three male ones aged between 16 and 19. They won the European championship in robotics in Vienna in 2012. Hence, they were entitled to participate in the World Cup in the United States.

Introduction

Figure 1: **The members of team Puzzles at the Global Conference on Educational Robotics in Honolulu. Standing from left to right: F. Krause, M. Wallner, A. Stockinger, and D. Weber. Squatting from left to right: S. Stoppacher, and V. Schrenk.**

Team Puzzles, a robotic student group of the Federal Secondary College of Information Technology located in Wiener Neustadt, Austria, participated in the **G**lobal **C**onference on **E**ducational **R**obotics during July 18 to July 22 2012 (GCER12) in Honolulu/Hawaii [1]. The annual competition is part of the American educational program under the auspices of the National Aeronautics and Space Administration (NASA).

The aim of the Botball program is “to stimulate and engage students in exploring their potential in engineering, science and math” [2]. For this purpose, a predefined set of robot parts (motors, sensors, structural parts, 2 controllers, camera, etc.) is required to fulfill certain tasks of the competition. The set is available at the KISS Institute for Practical Robotics [3].

Among the world's top 60 teams [4], Puzzles got to the finals and was honoured with the following exceptional awards:

- **Finalist**
- **Outstanding Onsite Presentation and Documentation**
- **Judges‘ Choice – Outstanding Programming**
- **Judges‘ Choice – Spirit Team Award**

The outstanding programming award was granted due to an implemented C++ software architecture exclusively developed for this specific robotic contest.

What is the competition all about?

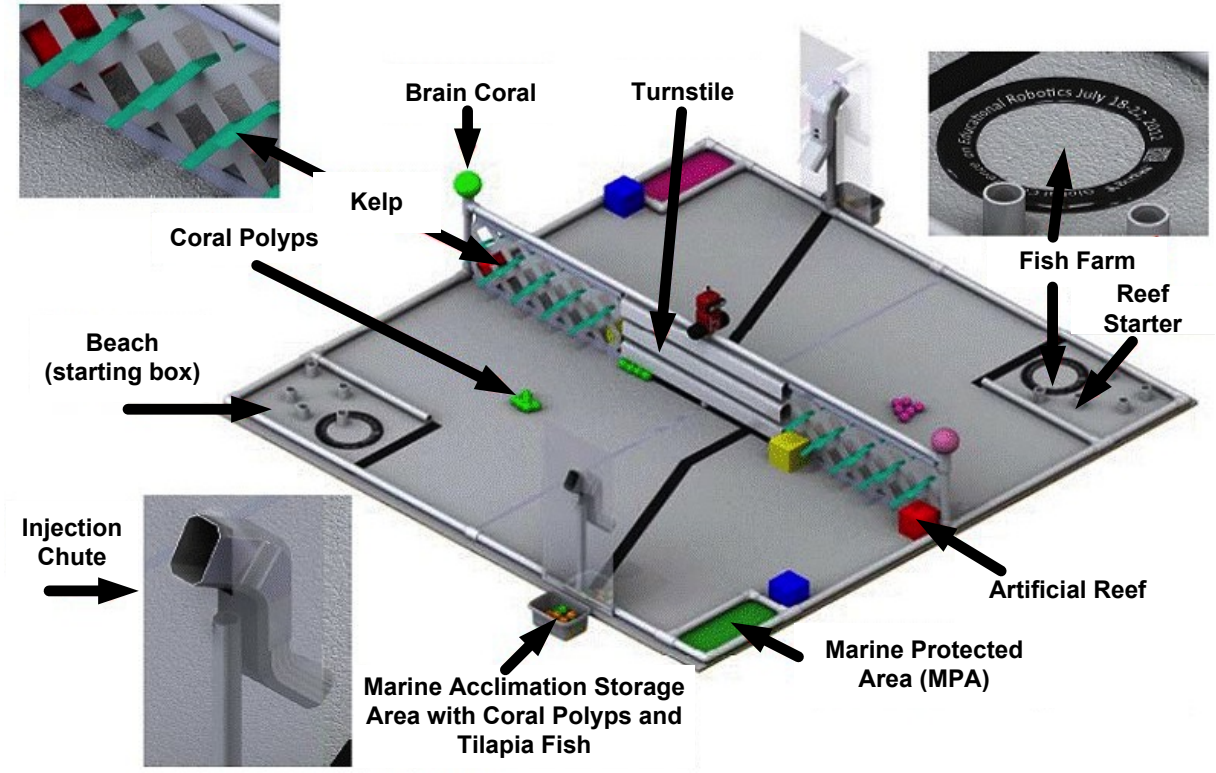

Figure 2: Scheme of the challenge course for the tournament. The theme is based on the ocean reef and is called Reef Renewal/GCER12 [5].

Every year a new theme for the competition is announced. There are about 30 tasks that can be carried out by the team robots on the game board in Figure 2. During the competition, the robots have to act autonomously, i.e., without the intervention of the teams. They should do as many tasks as possible within two minutes. Each team has two robots, built up with exactly the same components, but individually designed. The choice of the design is made due to the different strategies of the robotic teams.

The overall standing consists of the achieved score regarding the documentation and presentation of the robot project, the placement of the seeding rounds and the result of the double elimination, altogether in equal parts [6]. The documentation is separated into three periods. All of them have to be completed before the Global Conference starts. Each period consists of different tasks to document. Finally the documentation has to be concluded und presented during the competition. In the seeding rounds the robot has to solve as many tasks as possible. This can be e.g., object detection or object collection associated with its transportation. The objects have different shapes, textures and colors. They have to be placed in specified areas or must be stacked due to their shape or color. Finally, in the double elimination rounds the challenge becomes very competitive because two robots have to fulfill the tasks of the seeding rounds, but additionally they have to fight against each other. The different applied strategies can either be passive or active, and simultaneously constructive or destructive. Whether the latter conforms to the rules is a matter of interpretation by the referees.

Perspective of the Participants

The Global Conference lasted for five days. On the first day the teams had the chance to adapt their robots to the environment, e.g. to the specific light conditions on the game table. Periodically, the teams were called up to test their robots for exactly three minutes on the game table.

On the second day the seeding rounds started. The task of the day for the autonomous robots was to gather as many points as possible within a time period of two minutes. There were three runs, only the best two runs were counted. The seeding rounds were part of the overall standings. Due to the place of the seeding rounds, it turned out which team would compete in the double–elimination against each other.

On the third day, all teams had the opportunity to prepare their robots for the double–elimination. Most of the teams changed their strategies. Hence, knock out rules determined the remaining contest. Additionally, very dedicated participants optionally held presentations on one of the following four categories:

- Robotics and Movement
- Best Practices Lightning Talks
- Practical Programming
- Autonomous Projects

On the fourth day the double–elimination started. The double–elimination is a very competitive round, where the robotic teams fight against each other in a knock out system. Those who can respond best to the strategy of their opponent will win and proceed to the next round until they reach the finals. Again, the results of the double–elimination rounds are part of the overall standings.

In addition to the seeding and the double–elimination rounds, the documentation plays an important role, for example, describing the strategy and the design of the robot in detail. The on–site presentation is also part of the overall standings. Two team members have to present the progress of the project in English in front of a jury. The focus should be placed on the hardware design and the software implementation. Afterwards, the presenters are interviewed by the jury for half an hour regarding the contents of their presentation. The overall rating results from the points of the seeding, the double–elimination rounds, the documentation and the on–site presentation. Furthermore, emphasis is laid on the cooperative attitude and enthusiasm of each team.

On the fifth and last day the final double–elimination rounds are performed. The impressive competition is concluded with speeches of scientists who have been invited and the award ceremony. Beside the participation during the five–day competition a conference is performed. Scientists, students and pupils have the chance to submit publications regarding educational robotics. After a positive review process they can publish their latest scientific results and give a talk about the topic of the papers.

The contribution of team Puzzles was published in the proceedings of the conference with the title "Sparkling Coding – a Paradigm Shift in Teaching Programming Robots" [7].

Conclusion

During the GCER12 the participants were able to listen to very interesting talks from other teams, but the highlights were the talks of three international robotics specialists. These three keynote speakers were Dr. Vijay Kumar (Quadrotors Perform), Dr. Maurizio Porfiri (Robotic Fish) and Dr. Hiroshi Ishiguro (Roboticist Explores Nature of Humanity). They presented interesting future aspects of robotics, where we could

expand our horizon enormously. During the competition we came in contact with a lot of nice and interesting like–minded people and we made a lot of friends. We look forward to further competitions and conferences and we think that this experience has changed the perspective of our future!

Acknowledgement

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Comments

S. Stoppacher was a student of the Federal Secondary College of Information Technology located in Wiener Neustadt and head of team Puzzles. The team participated at the **G**lobal **C**onference on **E**ducational **R**obotics during July 18 to July 22 2012 (GCER12) in Honolulu/Hawaii under the supervision of Dr. M. Stifter. Team Puzzles reached the finals of the double elimination at their first participation at GCER, which is a rare event.

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