# The MauaBots Team for IEEE Very Small Robot Soccer Competition

Rafael K. Lima, César O. M. Castro, Wânderson O. Assis, Marcelo M. Gomes, Alessandra D. Coelho

Abstract— This paper describes the development of the system and the robots by the MauaBots team, from "Institute Mauá de Tecnologia" in order to participate in the IEEE Very Small Robot Soccer category of LARC (Latin American Robotics Competition) in 2010.

### I. INTRODUCTION

The system of robot soccer is being increasingly used in academic research because it combines various technologies of engineering and computing at the same time it incorporates an element of challenge that results in an attractive for students and consequently the learning.

This platform gives support the application of many techniques of artificial intelligence and control of processes and can be used to realize a lot of related researches [1] – [5]. One feature that deserves mention is the interaction with the environment, which makes that the algorithms require great robustness.

The structure of the implementation of soccer robots is illustrated in Figure 1 that presents the following characteristics:

- there is a camera positioned above the field that collects images of the field of play; these images are sent to a computer that identifies the position of robots (including robots opponents) and the ball (which should be a orange golf ball);
- the robots and ball positions are sent to a program of strategy that alone decides which attitude that each of the robots should take, i.e., isn't a human who decides what the robot should do, but the strategy is developed by the researcher;
- the commands produced by strategy program are sent to robots by a system of radio frequency;
- the robots are made by a system receiver that converts the radio waves into electrical impulses for the motors that drive the robots, these may still have a system of kick.

The authors are students or researches from IMT – Instituto Mauá de Technologia. Mailing address: Wânderson de Oliveira Assis. Praça Mauá, 1 – 09580-900 – São Caetano do Sul – SP. E-mail: wanderson.assis@maua.br.

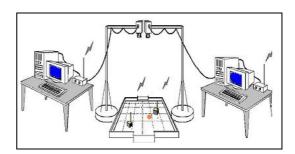


Fig. 1. Structure for implementation of robot soccer.

The students working in the research project "Development of Autonomous Robots" from "Instituto Mauá de Tecnologia" participate at the Very Small Robot Soccer competition since 2003 and have competed in four events. At the last participation the robots used are presented at Figure 2.



 $Fig.\ 2.\ Robot\ soccer\ players\ from\ Very\ Small\ Category-2006\ Team.$ 

Only one MauaBot team will be registered in 2010 Very Small Robot Soccer complete competition. However, the same team has two groups of three robots. The first them consists of an improved version of the 2006 Team (Figure 2). The following improvements were made in robots:

- maintenance in the electronic circuit (PCB);
- replacement of the power (batteries) for another more powerful, modern and durable;
- replacement and adjustment in the external structure (cover and uniform).

The resulting robots are shown in Figure 3. This is the reserve team of MauaBots. These robots only will be used in 2010 if we have any problem with the main robots team or the design of them can not be completed in time before the date of competition.



Fig. 3. Robot soccer players from Very Small Category  $2010-\mbox{Reserve}$  Team.

#### II. THE ROBOTS

At 2010 the students are constructing a new robots team as illustrated at Figure 4. The following aspects were improved at robots:

- introduction of a new communication system using modules with ZigBee® technology (Figure 5);
- now the electronic circuit of robots consists of the Arduino 2009 Board (Figure 6), that can be programmed directly by USB;
- the modulo ZigBee is introduced using a shield as illustrated in Figure 7;
- the robots use a new power circuit;
- the movement is controlled by 9 g servomotors HXT-900 (Figure 8);
- the robot presents a relatively low kicker;
- the structure is constructed using both aluminum and cibatool; etc.

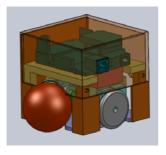


Fig. 4. New robot - Very Small Robot Soccer Category



Fig. 5. ZigBee® Module.



Fig. 6. Arduino 2009.



Fig. 7. Arduino XBee Shield.



Fig. 8. Servomotor HXT-900

# III. PROGRAM

The strategy program developed in Delphi<sup>®</sup> is totally different than the solution used in previous competitions and includes:

- the communication system used to data transfer between a personal computer and the robots using ZigBee® module;
- a interface program for servomotors test;
- algorithm for capture and processing images from camera (computational vision system); etc.

# IV. CONCLUSION

This TDP (Team Description Paper) presented describe the overall system developed for participating on IEEE Very Small Robot Soccer competition including the structure of new robots.

Many steps still to be accurately developed until the effective participation in the competition. But, the initial projects have already been developed and the next steps are being forwarded.

## ACKNOWLEDGMENT

Especial thanks are made to "Instituto Mauá de Tecnologia" for sponsor, scholarships for initiation scientific students and financial support to project.

### REFERENCES

- [1] A. D. Coelho, W. O. Assis, J. G. Silva, "The Scientific Initiation as an Instrument of Training for Future Researchers", 9<sup>th</sup> IFIP World Conference on Computers in Education – WCCE 2009, Bento Gonçalves, RS, Brasil, 2009.
- [2] W. O. Assis, W. J. Genova, M. M. Gomes, A. D. Coelho, "Application of Technologies of Process Control and Image Processing at Robot Soccer" Proceedings of SBAI 2007 – Symposium on Artificial Intelligence and Brazilian Robotics Competition, Florianópolis, SC, 2007.
- [3] W. O. Assis, A. D. Coelho, M. M. Gomes, B. A. Martins, C. S. S. Machado, C. G. Labate, J. C. G. Conde Filho, W. J. Genova, "Construção de Robôs Jogadores de Futebol" CSBC 2006, XXVI Congresso da Sociedade Brasileira de Computação Jornada de Robótica Inteligente, III EnRI Encontro de Robótica Inteligente, Campo Grande, MS, 2006.
- [4] F. A. Guimarães, W. O. Assis, "A Radio Frequency Communication Protocol Applied on Mobile Robot Control System", COBEM 2009 – International Congress of Mechanical Engineering, Gramado, RS, 2009.
- [5] F. A. Guimarães, "Development of Mobile Robot Used for Exploration of Hostile Environments" Master's thesis. Instituto Mauá de Tecnologia. São Caetano do Sul, SP, Brazil, 2007.