A Pipeline Repair Robotic Team For SEK Competition – The MauaBots Team

Henrique O. Franco, Guilherme C. Roque, Daniel M. Jones, Kenji N. Horiguchi,
Alessandra D. Coelho, Wânderson O. Assis

***Abstract*— This paper describes the development of the MauaBots team, from "Instituto Mauá de Tecnologia" in order to participate in the IEEE Standard Education Kits category of LARC (Latin American Robotics Competition) in 2010.**

I. INTRODUCTION

THE main objective of the research project "Development of Autonomous Robots" at "Instituto Mauá de Tecnologia" - IMT is the development of researches related to autonomous robotics including the publication of papers [1] – [6] and to promote other related researches in mechatronics, artificial intelligence and image processing, as for example [7], [8] and [9]. Within this context, the opportunity to participate in competitions in robotics is an interesting attraction that incorporates an element of challenge to the student that results in a growth in interest in learning.

At the category SEK (Standard Education Kits) the students develop robots to perform tasks with autonomy, using teaching kits, as for example, LEGO® (NXT or RCX), PNCA® or MECCANICA VEX Robotics. This category is an interesting alternative to encourage education based on practical and technological research, especially for those who are starting in engineering. In a simplistic vision, the development of robots at this category allows the student focus their efforts in the software to control the robot, since the mechanical structure of the robot can be quickly and easily restored.

Each year the challenge is different. The theme for 2010 is to prepare a pair of robots capable of repairing pipelines, to repairing pipeline, and built alternative pipelines in the shortest time possible, to avoid environmental damage and disruption in production.

II. THE COMPETITION

In 2010 the competition simulates the repair of the pipeline in arena that simulates an area with a leaking pipe and tubes (Figure 1 and Figure 2). In order to reduce the time of interruption in the flow of oil, the robots need to construct an alternative pipeline moving around the scenario and carrying the tubes.

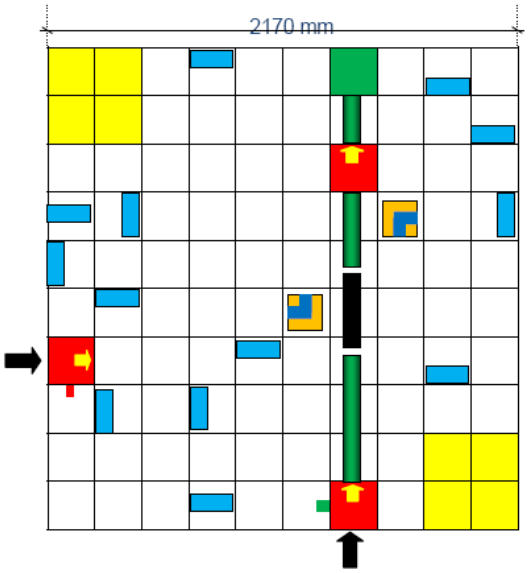

Fig. 1. Competition scenario – Initial positions of objects.

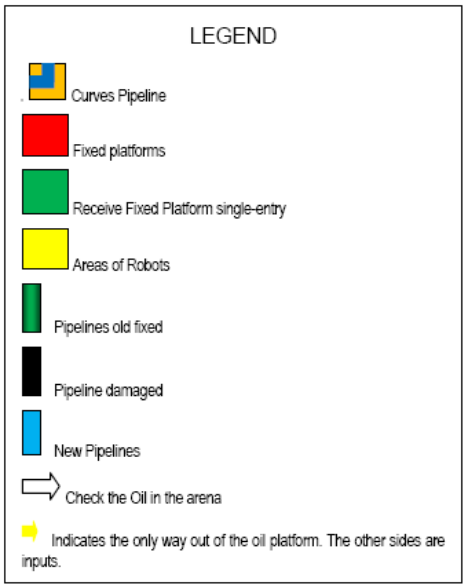

Fig. 2. Competition scenario – Legend of Pieces.

The authors are students or researches from IMT – Instituto Mauá de Technologia. Mailing address: Alessandra Dutra Coelho. Praça Mauá, 1 – 09580-900 – São Caetano do Sul – SP. E-mail: alessandra.coelho.assis@maua.br.

The robots are initially positioned at opposite ends of the arena, one at the bottom and another at the top. The robots will work collaboratively to build an alternative pipeline to the detriment of an old and ancient duct that has already leaked.

The scenario was designed in Instituto Mauá de Tecnologia for test the programming in robot.

III. THE ROBOT

The team consists of two identical robots as illustrated at Figure 3. When its mechanical claw is fully open, the robots present height of 18 cm, width 15 cm and length 25 cm, thus within the size limit for competition.

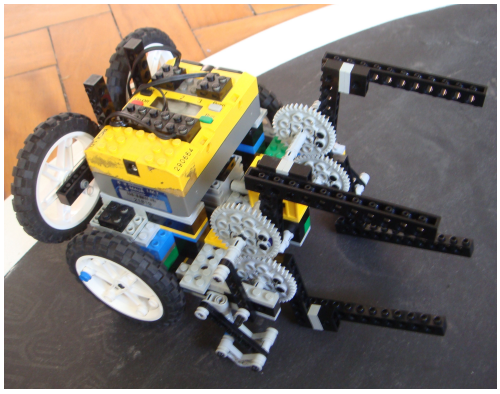

Fig. 3. The Robot Built With LEGO® Bricks.

Each robot has three motors, one of them at each wheel in order to enable the locomotion. The third motor was used in claw, being mounted on a gear system, in order to get up and load the pipes in arena. Two light sensors were used at the wheels to develop an encoder. The robots also include infrared transmitter / receiver, so they can communicate during the competition.

IV. THE STRATEGY

The strategy of programming the robots was simulated step by step using slides in Microsoft Power Point (Figure 4) that turned easy to define the tasks for robot, each movement and the resulting new position of pipes.

The program was developed using NQC (Not Quite C) language. This language gives a freedom to explore the functionalities of the RCX. The program use a system of "task" and "void" in order to enable the execution of actions simultaneously, such as turning the two wheels at the same time, move while the robots closes the claw, etc. The program also allows the continuous communication between the robots in order to guarantee that each task developed can be synchronously performed by them.

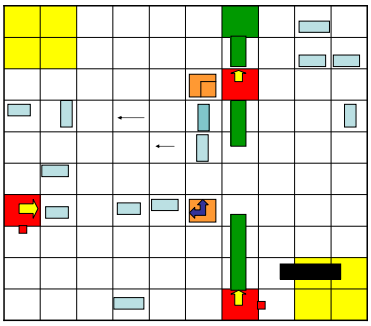

Fig. 4. Simulating the Strategy at Simplified Design of Arena.

V. CONCLUSION

This TDP (Team Description Paper) presented briefly describes the robot and strategy being developed for participating in IEEE SEK robotic competition.

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.

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