Team Brabot and the use of colaborative robot systems for competition

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Abstract. The aim of this paper is to describe the team Brabot, which is composed br three institutions and the work enrolling the communication of three robot systems for the competition.

Keywords: Brabot, robot sytems, collaboration

1 Team Brabot and the research topic

Team Brabot is a workgroup formed by three teaching institutions that are attached to the SETEC, a department of the Educatiion Ministry of Brazil. From each one of the institutions are three people, one teacher and two students. Besides that, one robot of each one institution have been trained and used for tests that emulate previous editions of Robocup.
The use of Robotino, a didactic robot from company Festo, as an autonomous system for industrial and commercial applications is a real possibility. On the other hand, this effort requires, besides of knowledge, development time, commitment and a good relationship with possible aplicants. The participants of team Brabot are students of technical and graduation course s of three Technological Federal Institutes in Brazil, where for each one institute the team is composed by a teacher and three students. They've participated in other competitions, including the LARC/CBR editions 2016 and 2017.

2 Robotino configuration

The robot Robotino is a mobile device that uses location through sensors, actuators and software interfaces. The main objective is the didactic, practical and practical aid for learning, training and research purposes.
Robotino consists basically of two systems: the head and the body. A head is an electro-electronic piece of device, which it is fragile and should be handled with care. The body corresponds to the electro-mechanical part: batteries, wheels, motors and sensors. "Body" corresponds to a more resistant part (made of steel) and requires care due to the manipulation of sensors.

The Robotino consists of a set of three axes and three omni-directional wheels, spaced apart 120º from each other. The engine set has a motor, an encoder for each motor, a gearbox which is a power transmission assembly that is coupled as omni-directional wheels. The omni-directional wheels are so called because they are moved in any direction.

The camera has a USB connection to the robot and it allows for the identification of cores of several objects. The identification of the colors is done from the comparison with a stored image and, according to the luminous intensity, there can be interferences and consequent errors in the identification.

There are some sensors present in the structure of the Robotino: anti-collision and infrared sensors. The bumper switch, which is the anti-collision sensor, is a black tape that involves the robot and indicates a collision with something.

The Robotino is equipped with nine distance infrared sensors with an angle of 40° among them [1]. Their analogic sensors have a measurement range of 0 V to 3 V, with a distance accuracy of 4 m to 30 cm [2].

Optical sensors and sensors can be connected to the metal frame of the robot to perform specific tasks.

The inductive sensors are analogic and detect metallic elements (bands and structures). Their response ranges from 0 to 9.99.

The infrared sensors are composed by two elements: one is the element sensor thar is connected to an optical fiber; and another is the driver. They are used for the identification of black and white colours. When the sensor is on a surface (black band), the sensor sends a "true" signal, that is, normally open; and when it is on a white surface it sends a "false" signal, normally closed.

Some sensors can be coupled to the body of the Robot and aim the auxiliary displacement, as is the case of the gyro sensor.

Robotino can be programmed with several languages, such as Matlab, Java, C, C ++, C #, .NET, Labview and Microsoft Robotics Developer Studio.

There is software included with Robotino, which is the Robotino View (Fig. 1) [6]. Its language is based on C, but it is a block-based language for executing tasks. The combination of the blocks forms the programs.

The Omnidrive is a function that makes it possible to analyze and control the rotating mechanical part of the robot, indicating the control of the wheels in relation to the motors, the direction and the speed of displacement.

Robotino works with Grafcet in the so-called Main Program. Grafcet stands for "functional step-by-step transition graph". It basically consists of a flowchart logic language to control functions. Grafcet is organized into function blocks, where each of these blocks performs a specific command, such as connecting a specific motor and initiating time counting.

So there is a call to a function, which will be programmed in Grafcet. In the Grafcet blocks, there are steps that correspond to what will be executed, as shown in Fig. 2.

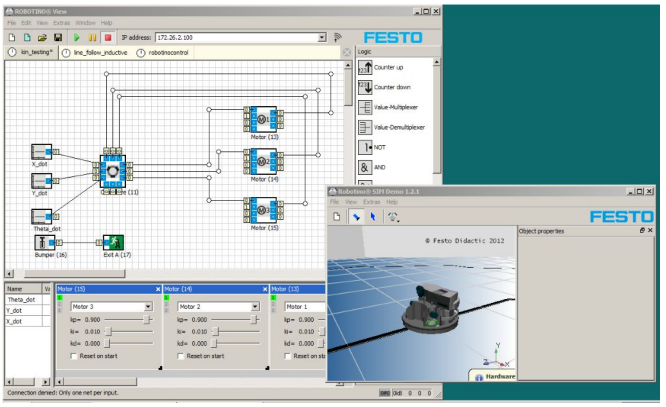

Fig. 1 - Overview of Robotino View

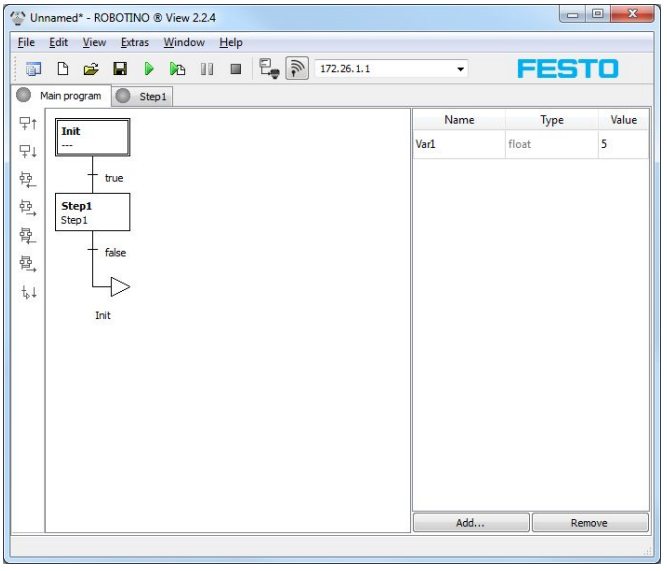

Fig. 2 - Main Program view and steps structure.

Fig. 2 illustrates the initial structure of the Main Program, in which two function blocks are displayed: one called "Init", which is not associated with any functions; and another called Step1, associated with the "Step1" function. For the two functions exemplified, there are return functions via the "true" and "false" commands. These two commands representing pass variables.

In the Robotino View, arithmetic, relational and logical operations can be performed, as well as the generation of constants and interface with actuators and sensors, among others. In the blocks of arithmetic, relational and logical operations there are two inputs, one representing the operand and another the result of the operation.

3 Team Brabot

Team Brabot has a reasonable experience in latino-american competitions (LARC 2016 and 2017) and preparatories for WordSkills, editions 2015 and 2017. At the last LARC (LARC 2017), the team Brabot was the first place and then it was classified for Robocup 2018.
The members of this team are part of a research group in the Robotics area of the technological institutes IFPB, IFRN and IFTO, which are vinculated to SETEC, a department from the Education Ministry in Brazil. This group includes teachers and students of technical and superior courses who take turns in the preparation of competitions and in the research of hardware and software tools for applications in domotics, rehabilitation engineering, among other areas.

4 Conclusion

Here, a paper presented the Team Brabot, one of the teams interested in to participate in ROBOCUP 2018. Some comments about hardware and software from Robotino were also presented.

References

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