The robot which became a community

The Butiá project: The experience in educational robotics in Uruguay

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Abstract

In Uruguay there is a deep technological asymmetry between public education and private education institutions. The limitation is regarding both hardware availability (robotic kits) and the training of teachers. The Butiá project began in 2009 with the aim of reducing the technology gap between public and private education. It developed an affordable robotic kit for students in public education. This project is a proposal from the MINA research group at the computer institute (InCo) of the Universidad de la República in Uruguay. The main result of the project is the creation of a community that besides using the robot has made it its own. As additional results, there are currently three versions of the robot, robotics courses for teachers are offered at the University, advanced college students have projects to work with the robotic kit and some companies have added the robot as a product for sale. All these components interact and contribute towards the development of educational robotics in our country.

Introduction

The inclusion of robots in classrooms is a powerful pedagogical tool as it creates environments for learning that enhance academic interdisciplinarity, exploring, and an interaction between theoretical knowledge and its practical application [1]. In Uruguay, the Plan Ceibal [2] (OLPC program implementation) in Elementary and Secondary education allows teachers, students and their families to be in contact with computer resources, which allows for direct and permanent contact with technology, increasing its impact in schools, families and community life, and makes for an environment that leads to robotics education development in the formal education system. In the year 2005 Plan Ceibal gave a laptop (called XO) to every student of public education. Taking advantage of this context, in 2009 the MINA[3] research group developed a robotic arduino-based platform in order to turn the XO laptop into a robotic kit. During its first stage, the Butiá project gave 30 robotic kits to 30 public education centers all over the country. At the same time, a course for undergraduate students was created in which they had to incorporate improvements to the Butiá platform, take part in robotics workshops for school teachers and provide support to institutions that had received said kit. These actions started to reinforce the link between university and society. Additionally, a web page, wiki [4] page and mailing lists where robot users, both students and developers, were created. Everyone can use these resources in order to publish and discuss the kit, and how to improve it. From that point on, the developers started

receiving reports on frequent issues and ideas on how to improve the robotic platform.The project evolved and teachers requested for training in robotics. Due to this request, the MINA group started providing training on how to use the robotic kit and what they can do with it. In recent years, private institutions became interested in the Butiá robotic kit, and even some companies decided to include the Butia kit developed at the university among its products. These companies not only sell it but do some research to develop improvements on the kit. [5][6].

The development of the Butiá robotic kit

The first goal of the project was to develop an affordable and easy to use robotic kit which works with XO laptops. The first version Butiá 1.0 (2010) was built on Arduino Mega Board [ref]. We had to build an Arduino shield that allows to connect plug and play sensors in an easy way. The software we used to control the robot was the same that teachers have been using in the classroom (to teach Maths or Physics), called TurtleBlocks, developed by Walter Bender[7]. One of the most remarkable feature of this program is that you can see which sentences of your code is running in real time. It is a graphic programming language and you program by simply joining together blocks of code. After working with Bender we developed TurtleBots, a software based on a plug-in system for robotic kits, which nowadays it supports Butiá, Arduino, Lego, Wedo, Fisher, some quadcopters and more.

Because we think that the best way to make something your own is to build it, we developed a second version based on a single layer board called USB4Butia [8], it is like Arduino but easy to make from scratch, and there is no need to use a shield. This new version of the robot is the Butiá 2.0 (2012).

Two years ago we released Butiá 3.0, which is orientated to advanced college students. This version was built on Beagleboard Black Board and you can program it from a browser with a web version of TurtleBots. Since 2009 all schematics, user manuals and information have been accessible in the Butiá wiki. The whole project is under GPL license.

Results

From 2009 to 2015 about 400 educational institutions have been participating in the Butiá project. More than 200 teachers from public education have been trained in robotics and also in the use of de Butiá kit. Nearly 4,000 young students took part in workshops and learned how to use the kit.

Conclusion

A very strong tie has arisen between our society and the university. This means teachers and researchers enrich one another. We think this was possible since it was an open project and also because a lot of different ways of interaction between teachers and researchers

were implemented. Also, the fact that we turned the XO laptops into robots instead of building a new kit made young students feel like they own the robot since the XO laptops are theirs.

Another important aspect of the project is the fact that the kit is easy to build from scratch with recycled materials, and, because of that, a lot of students and teachers had the opportunity to build their own version of the robot.

References

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