FIATAL MŰSZAKIAK TUDOMÁNYOS ÜLÉSSZAKA XIX.

Kolozsvár, 2014. március 20–21.

PROGRAMOZÁS OKTATÁSA GYEREKEKNEK, RÉSZVÉTELÜK ROBOTIKA VERSENYEN

EDUCATIONAL PROGRAMMING FOR CHILDREN FOCUSED ON COMPETITIONS

Yan FARIA⁽¹⁾, Igor MARTINS GENUINO⁽²⁾,
Gustavo ADRIANO SILVA⁽³⁾

*Óbuda University, Bánki Donát Faculty of Mechanical and Safety Engineering 1083
Budapest, Népszínház u. 8; Telefon / Fax: +36-1 666 5300, E-mail:*

(1) yan-faria@hotmail.com (2) gustavo.pitangui@gmail.com (3) igor.margen@gmail.com

Összefoglaló

Szüntelen technológiai fejlődéssel állunk szemben, amelyben mindig jó dolog tudni, hogy ez a technológia hogyan is működik. A jövő kihívásaival való szembenézésnek egy hatékony módja, ha erre gyermekkoruk óta tanítjuk az embereket. Amikor folyamatos a kapcsolat a technológiával, minden könnyebbé válik. A gyerekek bevezetése a technológiába segíti őket annak megtanulásában, hozzájárul későbbi pályaválasztásukhoz. Mivel valószínűleg valamikor az életben már játszottak vele a LEGO® Csoport[1] az a technológia, amely a gyerekek figyelmét is könnyebben leköti, versenyre ösztönzi őket és tanulmányaik során megkönnyíti számukra egy határozott cél felállítását és elérését. Több brazil egyetem kínál lehetőséget általános iskolás diákok számára, hogy programozást, robotikát tanuljanak és fejlesszék a csapatmunkában való részvételük képességeit. Ez a cikk bemutatja az ilyen oktatási módszer alapjait, amelynek keretében a gyerekek robotika versenyeken vesznek részt Brazíliában.

Kulcsszavak: LEGO MINDSTORMS, gyerekek, oktatás, robotika verseny, Brazília.

Abstract

With the incessant technology growing we are facing, is always a good thing know about how this technologies work. An effective way to learn how to face this growing is to teach people since childhood. When you have constant contact with the technology, everything becomes easier. Placing children in the context of technology helps them to like this area and maybe even help them in choosing their profession in the future. Using LEGO® Group technology, have the children's attention is easier because they probably, sometime in life, already played with it and placing them in a competition causes them to have a concrete goal, facilitating the channeling of studies. It is through this that several Brazilian universities are offering vacancies for elementary students to have the opportunity to learn programming, robotics and develop their responsibility and teamwork. This paper will show the basics of such teachings are passed to students participating in robotics competitions in Brazil.

Keywords: LEGO MINDSTORMS, children, education, robotics competition, Brazil.

1. Introduction

Considering the computer as the most used tool nowadays, teaching computational basis for children is a good idea, especially if that basis is taught through quite attractive and didactic tools. The use of educational robotics has been widely discussed in literature, but

there are few reports of its effective application in Brazilian education. Using robots as method development reasoning can be a very interesting activity and involving various types of knowledge. The use of robotics in learning requires the student becomes multidisciplinary and develop reasoning. Theoretical and practical way is used in order to apply the same, so that the robot can execute its orders satisfactorily. The students must still use their knowledge gained through programming to execute sequences of logical commands and solve problems using a robot [3].

2. LEGO History

Everything started in 1932, Billund, Denmark, when one carpenter, called Ole Kirk Christiansen, starts to make wooden toys such as piggy banks, pull toys, cars and trucks and houses for his son. In 1934, that company change its name to LEGO®[1]. That name come from the words “legt” and “godt”, which means “play well” in Danish. In 1947, when plastics became available in Denmark, Lego purchased a plastic injection moulding machine. In 1986, the LEGO® Group released the first-computer controlled LEGO® kit. Two years later, The LEGO® Group with Massachusetts Institute of Technology begins to develop an “intelligent brick” that will bring LEGO® Group creations to life via computer programming. In 1998 the LEGO® MINDSTORMS® RCX® Intelligent Brick and Robotics Invention System was launched. In the same year, LEGO® Group owner, Kjeld Kirk Kristiansen, and famed inventor, Dean Kamen of FIRST (For Inspiration and Recognition of Science and Technology) launched together the FIRST LEGO® League, which is a robotics competition for middle school students introducing LEGO® MINDSTORMS® sets to regional competitions. Then, the LEGO® MINDSTORMS® build and program robotics tool set has become the best-selling product in the LEGO® Group’s history. Thenceforward the LEGO® MINDSTORMS®, the number of Championships and its participants is been improved. Today there is championship with more than 100,000 participants. The current version of LEGO® robots is the LEGO® MINDSTORMS® EV3. [1]

3. Competition

In the 90s, with the growth of computing, a computer beat a man in a chess game. In this technological context, Japanese researchers in 1993 created a robotic football competition that was later called RoboCup® [4]. Nowadays, RoboCup® has other competitions like rescue robots, home robots and there is also the RoboCup® Junior [5]. In Brazil, there is the OBR [6], Portuguese acronym that means Brazilian Robotic Olympics. The OBR is a Brazilian RoboCup® partner that promotes theoretical and practical modalities competitions between students from different places of the country, aiming children's interest about programming, robotics and technology. In the practical modality, the students are instructed to build and program robots to do simple tasks like following a line, passing through gaps in the line, climb a ramp and identify an object characterized as a victim. The practical modality of OBR has two levels. The first level respects to Elementary School students and the second level respects to High School students. The teams have a maximum of four students and the tasks to be solved are performed, basically, using color and ultrasound sensors.

The color sensor detects the line and the ultrasound sensor detects the victim. The students can build their own robots or they can use the LEGO® MINDSTORMS® kit in this competition to do the track and they need to complete the track in the shortest time possible. The track are divided in four parts, two follow line rooms which may have obstacles and gaps, one ramp and one victim room. Each part works as a checkpoint and the students have three attempts to complete each one otherwise the robot will be moved to the next part. With less

tries and shorter time the team wins more points and the team with more points wins the competition [6].

Fig. 1. Track model[4]

4. Methodology

To work with the first level, MINDSTORMS® NXT is a good option because it is not too complex software. Using few command blocs that perform simple actions, students can make the robot do many different things, but first they need to know how it works. So, starting with very basic topics like "loops" and "if then else" commands, they already can make the robot do many kinds of movements, and the way to explain it for them is through easy examples and associations with their daily activities. A good way to show how a "loop" works is to make a comparison with the simple act of walking; giving just one step you will not get anywhere unless you repeat it and take another step again and again. And about the "if then else", a comparison with the weather fits well, if it is raining then you take your umbrella else you do not. This is how basic programming was passed to students. As programming is focused on competition, the students, since the beginning, build their kits and start to test the robots in the follow line circuit. They start programming then they test it. If there is some problem, they are encouraged to solve it and develop solutions by themselves. The MINDSTORMS® NXT interface helps a lot for being easy to handle and highly didactic.

Fig. 2. Print Screen of LEGO® MINDSTORMS® NXT interface

With weekly two-hour classes, the students train with a model based on the competition track. In the course of time, they advance on the track improving the time to do all the tasks. During the rest of the week, they have to work, at home, ways to improve their program.

5. Results

In 2012, the Federal University of Lavras [9] in partnership with the Municipal School José Luiz de Mesquita, both in the city of Lavras in the state of Minas Gerais, started a project which graduate students of the Control and Automation Engineering course, using LEGO® MINDSTORMS® kits. The selected best students of the Municipal School were separated in two teams with four students each and taught with the basics of programming using the methodology described in this article. The students were aged from eleven to thirteen years.

Since the beginning, the students proved quite interested on the competition. Two main points contributed to this: the opportunity to have contact with robots for the first time in their lives and encouragement from teachers.

The teams won the first and second place on the OBR state competition of Minas Gerais on June 30, 2012. In August 2012, the winning team returned to training and was ranked 14th in national competition, in October. With some changes in the team, the students were ranked third on the last state competition, in August 2013[10].

6. Conclusion

The robots in the education field show to have potential. Not only in programming and technological contact but there are some projects using robots in other areas such as physics education. With the ease of holding the attention of students using robots the chances, in the future, that they will be present in most areas of knowledge are very high but much effort is still need to expand this kind of technological inclusion. With the advancement of this inclusion through robotics competitions, will likely increase the participation of robots in our everyday lives, making them easier as they have been doing for a few years.

References

- [1] LEGO®, <http://www.lego.com/en-us>
- [2] LEGO® MINDSTORMS®, <http://www.lego.com/en-us/mindstorms/>
- [3] SILVA, V. N. and NASCIMENTO, M. N.: *Investigação da melhoria do aprendizado de alunos do ensino médio da rede pública de ensino através do uso de programação, robótica e jogos digitais*. Brasília, DF (2012).
- [4] RoboCup®, <http://www.robocup2014.org/> and <http://www.robocup.org/>
- [5] RoboCup® Junior, <http://rcj.robocup.org/>
- [6] OBR, <http://www.obr.org.br/>
- [7] KALIL, F., HERNANDEZ, H., ANTUNEZ, M. F., OLIVEIRA, K., FERRONATO N. and SANTOS, M. R.: *Promovendo a robótica educacional para estudantes do ensino médio público do Brasil*. <http://www.tise.cl/volumen9/TISE2012/739-742.pdf>. Accessed on January 23th, 2014
- [8] Federal University of Lavras, <http://www.ufla.br/>
- [9] <http://www.lavras.mg.gov.br/?p=15480>. Accessed on January 24th, 2014