In Search of Modern Teaching Methods - Humanoid Nao Robot, as Help in the Realization of it Subjects

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Abstract **This paper presents examples of implementing interesting solutions in the field of programming on the NAO platform, both for those who put their first steps in the programming path as well those who profession is connected with programing and robotics. Through interesting implementations of various programming methods to create interaction with a robot. Provided the NAO platform allows you to implement the necessary new solutions to enhance the application of humanoid robots, educational and IT promotion.**

Keywords – **IT education, robotics, teaching methods, improving programing methods.**

1. Introduction

New technologies have become an essential part of our life, at work, at school, at home, providing improved solution in everyday life. Thanks to modern innovations, we create better and more effective solutions for business, economy and life. And just as in these areas, technology also enters the world of education. The teachers are increasingly starting use modern teaching methods in their workplace. Teaching aids such as multimedia boards, audio-video systems, e-learning and educational platforms, several years back were used sporadically

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and were used as a supplement of teaching process. Sometimes financial issues or problems with the use of new methods were a barrier for teachers, especially those with longer teaching experience. At present and in the future, IT solutions will be increasingly used as learning and teaching aids. Their quality, form and accuracy in choice is an elementary success rate in the learning process and improves educational results [2]. The use of interesting and innovative didactic aids helps students improve learning outcomes. Learning material passed through gamification and entertainment with robots, is an interesting form of programming. Shaping pupils' interest in IT, robotics and electronics, as an interesting and engaging way [1].

2. Development directions in a modern education

With the changes in the labor market, there is a change in the approach to learning outcomes. Choosing a career path has so far set a number of consequences like isolation on the new educational pathway. Targeting personal development nowadays requires constant development, acquiring new skills and competencies.

More and more universities are taking advantage of the rapidly growing online Massive Open Online Course (MOOC). Expanding their offer not only to people attending their universities, but also creating advanced and content-rich courses that will allow graduates to earn e-diplomas. LMS or LCMS, optimized and implemented by universities in the fields of programming, electronics engineering, etc., such as Stanford, MIT Harvard, and the Universe of Hong Kong, provide quality assurance in a comfortable and interactive form. Effective programming environments such as Udacity, for example, help you develop your skills in web development, frameworks, Java programming, or C. Micro learning helps to cross the limits of availability by offering the resources available from mobile application levels providing personalized

solutions in a pleasurable and accessible way for every phone platform [5].

Classical teaching methods slowly come to the back, allowing new roads of more interactive, engaging, and entertaining ways to deliver the same content [10]. At the same time, providing a vast entertainment and new experiences, gamification and Virtual Reality allow you to focus your attention and create pleasant conditions for education through games and interactions in virtual reality. Spatial design elements help look at architectural designs at the design stage. Changes to the program curricula of technical subjects that focus on the implementation of 3D design subjects and the basis of algorithms are introduced early in the learning process [3]. Countries such as Finland, Ireland and France introduced as extra courses modelling children's toys in Solid Works, and then allowing pupils to print them on 3D printers. Introducing from the very early age different and interesting solutions will help develop children's interests in engineering while building productive solutions, developing creative thinking, using ingenuity and unconventional thinking of the school-aged children.

3. Education based on friendly programming

Programming as a discipline that does not just involve writing lines of code, it's about process that focuses on solving a specific problem, focusing on a methodical approach. Defining the scope of the problem, possible solutions, implementation of the solution, optimization and possible correction of errors. The whole process shapes such competencies as logical thinking, teamwork, abstract thinking, finding solutions, and effective work organization. Skills obtained at the classes also improve goal archiving and received grades help motivating for further professional horizons [8].

According to the social diagnosis in 2015, in Poland desktop and laptop computers are located in 72% of the Polish homes. Adding to this the already popularized digitization in schools, it's allowing to create a situation in which young people have the full potential of effective computer-aided instruction. As it may look, this should increase the digital skills of the young people. Unfortunately, according to the PISA survey, Poland is below the OECD average, falling behind Finland, Sweden, Netherlands and Japan. The poor results on the use of specialized software for writing programs are shown in Figure 1. This figure shows the number of programs written at age 16-24 in each EU country.
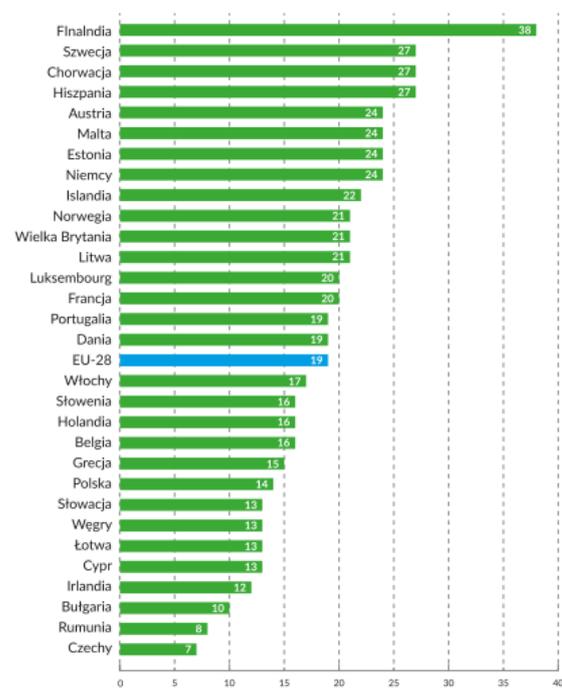

Figure 1. Edu-tech 2016 report showing the number of written programs up to 24 years' old

At the average of 19%, Poland has only 14%, for example compared to Finland, where it is 38%. According to the same report on the use of digital competences in shaping innovativeness, Poland's score of 23% is in the penultimate place just before Romania, while in Germany it is 67%. The EU as an entire region has average of 48.9 percent.

Only 13% of high school students chosen IT subject's as their additional part of final exam. The low number of hours written in the curriculum program for IT classes as well as the small number of hours hindered the development of appropriate competences during present education.

The need to develop new solutions based on the use of appropriate measures to improve learning outcomes and increase interest in IT in the context of labor market expectations will help to increase the interest in IT, at the same time, providing fun and interesting way that engages and develops appropriate skills.

4. Using robots as a mean to improve the quality of education

An enormous amount of scientific evidence shows the positive use of robots to increase motivation for learning and improving student achievement [6] . Educational robots used during extra classes help better understand the educational material and create

an interactive interaction [9] . Exercises in which robots generate additional stimulation in the learning process , give students satisfaction and improve learning effectiveness . However , in this process it is important , in addition to increasing the motivation of the students to learn , to focus on improving proper motivation to learn [7] . Achieving better learning outcomes should be combined with the students ' awareness that the work and the commitment they translate into the classroom gives measurable results that they can point and observe . Teaching through the use of humanoid robots increases not only the interest in the subject but also the interest in the students in robotics which is an important factor of the learning process and the achievement of the learning outcomes [3] .

New ways of using robots in education are still strongly linked to the hardware and the software capabilities of the available platforms. Communication between the robot and the learner is a powerful stimulus that affects both the efficiency of working with the robot and the form of the material that the student assimilates during contact [4]. Appropriate predispositions to contact present modern robots - Humanoids. They allow students to be more friendly and easier to "make friends" with the robot. Although still expensive, humanoid robots can be part of everyday activities. Such educational platforms should be adapted to learning through the use of materials that are geared towards specific methods, receiving the form of classroom-oriented activities and categorized in terms of languages and forms that is transparent and accessible to the student that conducts learning through interaction with the robot [2].

5. Nao as form of educational platform

The result of a unique combination of mechanical engineering and software is a humanoid robot called NAO. It is composed of many sensors, motors and hardware forged into one friendly user platform. It is a great combination of sophisticated software with a range of different sensors and accurate servomotors, making the NAO a professional working platform. Subsequent versions of the robot (now 5) introduce a broad modernization and user-friendly solutions. Using the open software provided with the robot, allows you to make a specialized job with a NAO, which will astound even a skilled robotic specialist. Thanks to the four microphone and speech analysis algorithms, NAO is not only able to determine the direction and intensity of the sound, but also recognize words and even sentences spoken in one of the 19 implemented languages through the Nuance software. The robot can be programmed to perform multitasked activities on the given command, and even responded with its own voice in to two speakers located in the head. Two cameras let you capture images of to 1280x960 pixels at 30 frames per second. In addition, it is able to recognize objects and faces, thanks to the created base of objects and people can teach it to kick the ball or greet a friend by saying that person's name allow, entering into interesting and emotional interaction with the caller. Choreography program allows you to contact users in one of 19 supported languages in an easy and transparent way. All of this allows contextual programming of the robot in virtually impossible manner on any other device. While ensuring high level of achieved results, using simple and intuitive software. NAO accurately recognizes its surroundings with a set of two IR sensors in the eyes and two ultrasonic scales on the chest. The balance is supported by 2 gyroscopes, an accelerometer and 8 level pressure sensors located in the feet's. The position of each part of the body is carefully tracked with 36 hallotron sensors in the joints, so that no unwanted collision between the NAO's mobility limbs will occur, giving it 25 stages [11]. The movement of the body corresponds to 26 high-performance servomotors (brushless, non-core). Everything is controlled with very sophisticated robot software, allowing it to avoid falling, to stand up and interpret complex and even contradictory commands [12]. The robot itself has 640 ready-made simple animations, providing the user with simple and easy methods for creating projects. For more experienced programmers, the robot supports promising programmer languages like C ++, Java Script, Python, .NET, URBI scripts.

6. Programming methods

With the provided software, we are able to program the robot in two main ways. Similar to other platforms such as Scratch, we can use simple and clear programming with icons and commands organized in blocks (see figure 2). Programming in such a form takes place in a simple and transparent manner. Utilized by dragging individual icons, then joining them together creates networks of more or less complex programs, where knowledge of algorithms goes as not requirement, giving the users a place to show off their own ingenuity and how to program the same sequence in different ways.
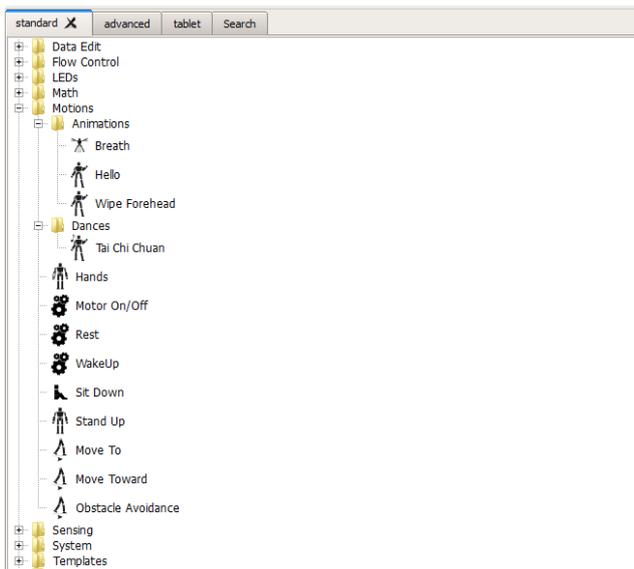
Figure 2. Simple set of ready icons representing robot basic movements possibilities

In Figure 3 we see a simple script created in Choreograph. Blocks represented by single strings consisting of linear or branched block of arbitrary configurable blocks. In a given program, after a simple interaction with the robot after the word hello, a break follows, then the robot performs a simple gesture of hand waving.
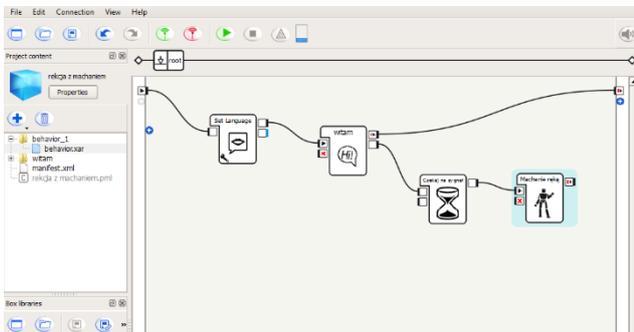

Figure 3. Simple block modeled program created in the Choregraphe Software

Pupils using simple ready-made configurable blocks are able to design imaginary and implemented robot action plan. Through interaction and a few minutes of programming, the student creates a clear, easy-to-read robot movement plan. Then after uploading content to the robot, one can check the effect of his work, providing a quick and interactive feedback, allowing to get quick feedback. Based on logical and algorithmic thinking, the student implements his plan. Thanks to the iconographic programming, the student obtains a full blown visual programming language, instead of complicated mysterious-command and incomprehensible syntax, a student obtains visual effects, you can achieve educational results regardless of the initial level. Such a solution ensures effective and stimulus results, giving children availability for creating projects requiring only interesting ideas and proper self-commitment.

7. Programming in professional platform

The robot also offers the ability to write commands easily through NAOqi framework. It is responsible for programming requirements related to parallel work of the systems, data management, thread synchronization, event operation. It supports homogeneous communication between different modules (audio, video, motion, sensory), sleeping in one native platform. Through the same software, programs can be written on various operating systems (windows, MacOS, Linux). What is very helpful, it is a platform that supports various languages, giving the developer flexibility in language selection and syntax handling.
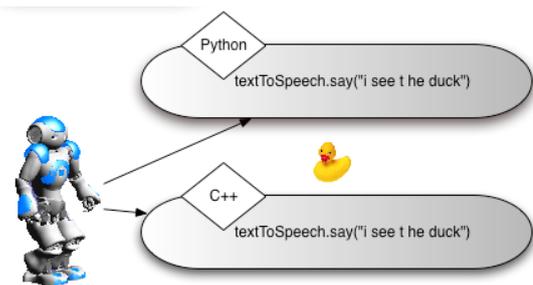

Figure 4. implementation the speech module in Python and C ++

The executive module is Broker. When enabled, the robot loads the libraries that contain the individual modules available during the robot's programming. This module supervises access over running services. By allowing you to implement chosen modules and use methods related to chosen service. Supports interruptions of running functions, allowing you to manage running processes and access through out-of-process services.

Typically, each module is a class of the library. When the library is loaded from the autoload.ini file, it automatically creates an instance of the module class. In the class constructor derived from the ALModule, you can "bind" methods. It advertises their names and signatures to the broker's methods so that they become available to the others. After reading the broker syntax and how to use the modules, you can write a simple program as in Figure 5.

Figure 5. Simple program written in Python

In the above program, after calling a remote connection by specifying the robot's IP and communication port, using the modules in the audio library, the robot says Hello World, while executing the animations available in the robot's animation library under the name Crouch. Using simple commands and module support, you can create programs written as in this example in Pathon. To learn about the full capabilities of the framework you should familiarize yourself with the rich and complete examples of NAOqi semantics available on the manufacturer's website.

8. Conclusion

This paper presents examples of implementing interesting solutions in the field of programming on the NAO platform, both for those who start their journey in programming By making interesting multidimensional exercises using flexible robot interaction. Providing a platform in the time of search for implementation necessary search for new solutions attractive spread and application of humanoid robots, as well as the promotion of IT. They allow to present possibilities of the NAO robot in an interesting way to introduce the idea of programming projects in the areas of promotion and activation in school environment.

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