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THE NEED TO USE LEGO KITS IN TEACHING ROBOTICS

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Summary: However, how can we communicate such a large volume of information as efficiently as possible, as covered by the generic description of "Robotics"? The answer may come almost instantly: via education.

The fundamental issue for any science in the process of founding it is that of designating its object of research in connection to which it intends to discover new facts and principles.

As the same phenomena are often dealt with and approached by several sciences, as a result of the universal connections between phenomena, the precise delimitation of the object of a science implicitly involves the designation of the position from which one or the other aspects of reality are studied.

This applies to Robotics as well, which, by definition, is a multi-disciplinary science, and to which the following contribute: the theory of systems, physics, mechanics, the theory of mechanisms, electronics, automatics, computer science, information technologies, industrial engineering,
logistics (fig.1).

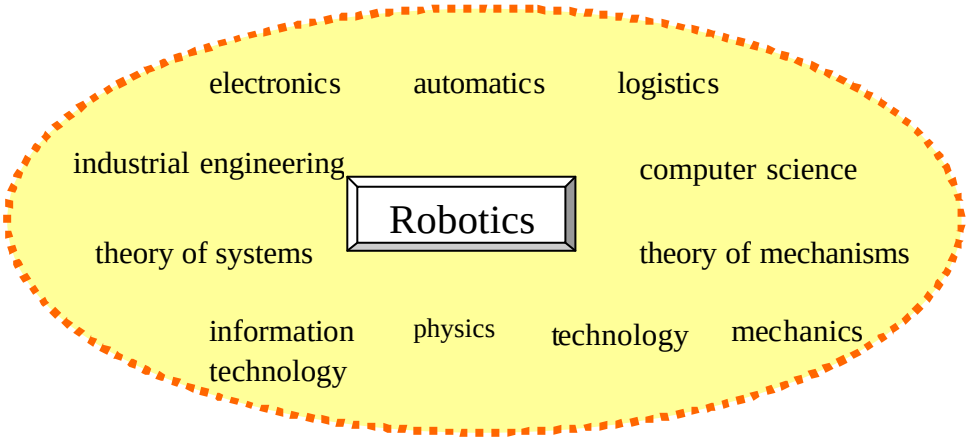

Fig.1. Areas connected to Robotics

However, how can we communicate such a large volume of information as efficiently as possible, as covered by the generic description of "Robotics"? The answer may come almost instantly: via education.

Education occurred at the same time as humans did. It a specific to humans and it exists only in human society.

Efficient education can be obtained only from teaching process capable of adjusting to society requirements.

Education, as a process of systematic, planned and aware guiding of the younger generation has a special role, as intellectual education intends to develop cognitive processes.

Developing perceptiveness, memory, imagination, but especially thinking and its flexibility helps man easily adjust in various circumstances, and to quickly and correctly solve new problems posed by society.

Knowledge, abilities and skills that a student must acquire now have an increased volume and complexity, and the organization and functioning of education institutions must come up with viable solutions, adjusted to current needs.

Teaching should not only be based on passing on information, but also on organizing and guiding students' individual work, in order to consolidate the information acquired and support perception on the object of study.

By applying practically the information acquired in course classes, students can be assured of its truthfulness, if students actually use such information in laboratory classes.

Robotics, as a multi-disciplinary field, is quite difficult to study strictly as theory, unless there are opportunities to put into practice the information learned in courses. This issue can be solved in laboratories, by using lego kits.

Lego kits are successfully used in universities abroad, leading to actual inter-student competitions, which ultimately generate high performance.

We should not forget that: "Robots possess two features typical for life: free movement and intelligence. Moreover, we can only admire their ability to take over hazardous, unpleasant or demeaning (human) activities, to tirelessly, precisely and uncomplainingly carry out the work they are ordered to". (Shimon Y. Nof)

By means of lego kits, students can make robots that replace humans in their activities, and learn:

- how to build a mechanical system actually using the information acquired in the "Mechanisms" and "Machinery Parts" courses
- they can observe and make gears (fig.2)
- they can study the effects of improper gearing
- they can understand the role of various degrees of mobility
- they can study transmissions (fig.2)
- they can study sensors (fig.3) and their importance in a robot
- actually learn how to program a robot
- learn to work in a team, etc.

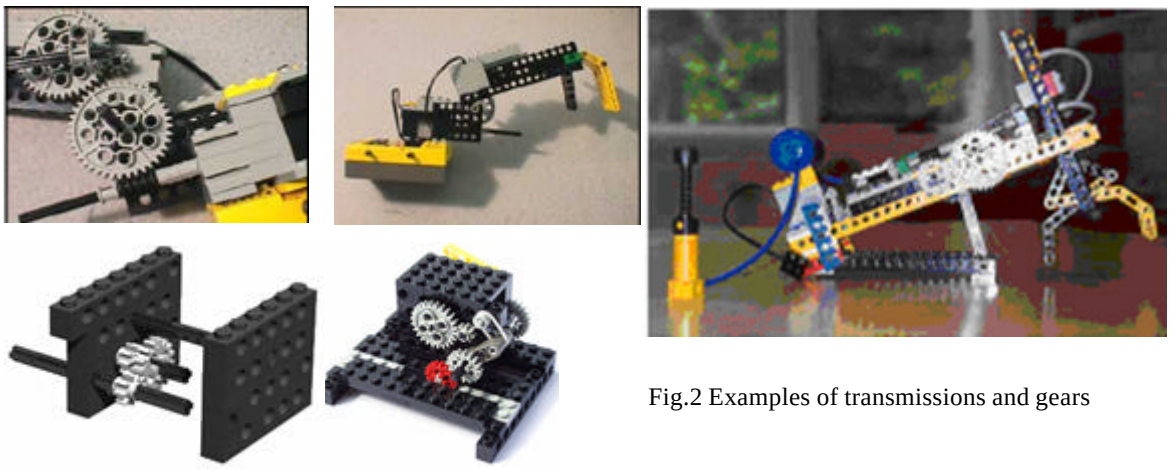

Fig.2 Examples of transmissions and gears

These are only part of the benefits of using robot kits.

As an example of the above, I would like to submit the Lego Mindstorms Robot kit to your attention.

Lego Mindstorms has become popular all over the world, as it allows creating robots of various complexities.

The history of this kit began in the Massachusetts Institute of Technology (MIT) in 1987. The idea was taken over and developed by the Lego Company, which today produces a large variety of models.

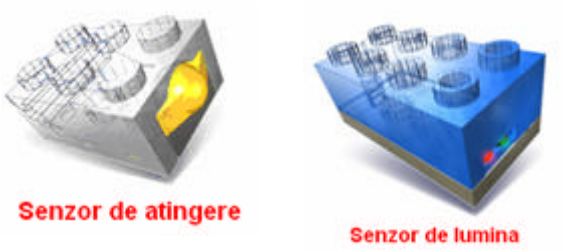

Fig.3. Examples of sensors

One of the version is: Robotic Invention System (RIS) (fig.4), containing 727 parts, 2 motors, 2 touch sensors, 1 light sensor, infrared transmission, RCX controller programming, and a user's manual Several sensors can be tested in this system: rotation sensors, temperature sensors, etc.

Fig.4. Robotic Invention System (RIS)

In order to assist those who want to learn to use lego kits, specialized companies have already created several books, which can be successfully used in thorough documentation (fig.5), both by students, and by teachers, who can use these kits as teaching materials in specialized laboratory classes.

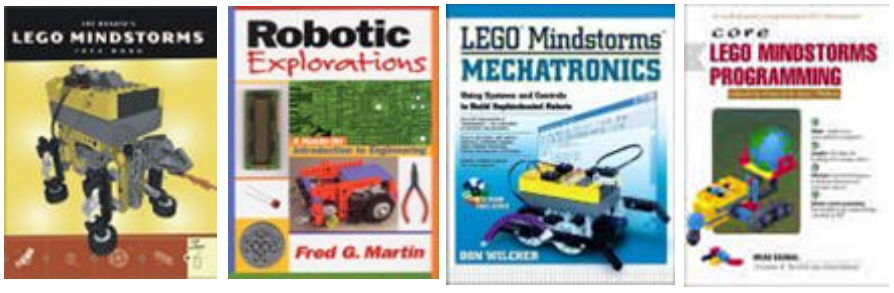

Fig.5. Examples of manuals on the market

Such a package allows students to work in groups and actually build a robot:

- a group may be responsible for building the robot
- another group may be responsible for programming it

Fig.6 Examples of constructions and aplications

The pictures below show several examples of lego kit constructions and applications (fig.6)

Thus, future robotics engineers can learn by playing, and efficiently work with such structures, which will allow graduates to be true specialists, and not only conversant with theory.

Purchasing a “real” robot that functions in a production facility is very expensive, while purchasing a lego kit is highly affordable and low cost, depending on the complexity of the lego kit selected.

Therefore, the single purpose of a lego kit is to be used as teaching material and may involve a series of inter-disciplinary projects and future mechanical, electric and information technology engineers in a common project, in order to create and control highly complex robots.

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