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Design of a robotic robot for the Universidad Tecnológica del Sur del Estado de Morelos

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Abstract

This paper begins the research of educational robotics and the Internet of things, which is opening in the Career of Information Technologies and Communication of the Universidad Tecnológica del Sur del Estado de Morelos, which aims to tell with contributions of scientific inquiry in this field. This article proposes the design of a robot kit Vex Robotics®, programmed with software RobotC®. This robot will collect road and allow crops to be carried out at this university, through Career Sustainable and Protected Agriculture.

Robotics, educational, Internet, Technologies

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Introdution

The present research consists of designing a didactic robot that can be programmed by the students of the Information Technology and Communication Career of the Technological University of the State of Morelos (UTSEM), through a Robotics workshop within the institution, can put into practice their theoretical bases. The kits they manage are from Vex Robotics®, which is a very interesting platform for learning in the areas of science, technology, engineering and mathematics, where students can research using robotics technology.

Even after scientific and engineering principles, a VEX robotics project promotes teamwork, leadership, and problem-solving skills. It also allows teachers to easily customize projects to meet the students' skill level.

VEX is one of the platforms that is expanding more rapidly. It is intended for use from the secondary level to the higher level, although it is also an optimal platform for fans of robotics and competitions. (VEX, 2016)

The software used to manage robots is RobotC®, which is a programming language for the development of educational robotics, which is complemented by VEX kits. ROBOTC is a C-based programming language, with an easy-to-use development environment. (RobotC, 2016)

The article is organized as follows: in the beginning the introduction is placed, then the antecedents, then the methodology to be developed is presented, following the development, the results, the acknowledgments and, finally, the conclusions.

Background

The educational model of the Technological Universities is created as an alternative of vocational training for the student to join the productive sector in the short term. The above, due to the fact that in only 2 years of preparation, he received a professional title of Higher Technical University, having the option to carry out the continuity of studies for a year and eight more months to conclude with Bachelor's and / or Engineering degree. (UTSEM, 2016)

UTSEM is located in the municipality of Puente de Ixtla, Morelos, which began its academic activities on September 06, 2012 with the courses in Sustainable and Protected Agriculture; International Business Operations: International Business Area; Information and Communication Technologies: Multimedia Area and Electronic Commerce; And Tourism: Development of Alternative Products. (FIGUEROA-ÁVILA, 2015)

For the UTSEM, the integral education of the students is of paramount importance, where it is sought to combine the academic formation of the student with extracurricular activities, being the main objective to provide the bases in art and culture to the student so that he achieves an optimum development and exploits his Creativity in the actions that are carried out. In these workshops not only develops the theoretical part, also seeks to bring the student in practice. (UTSEM, 2016)

Among the several workshops that are taught, is the Robotics, which is made up of 25 students of the career of Information Technology.

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Methodology

In this research was handled a qualitative process of Sampieri, this approach is based on important research areas or topics. However, instead of clarity about research questions and hypotheses prior to data collection and analysis (as in most quantitative studies), qualitative studies can develop questions and hypotheses before, during, or after of data collection and analysis. Often, these activities serve first to discover what the most important research questions are, and then to refine and answer them.

The inquiry is moving dynamically in both directions: between the facts and their interpretation, and it is a rather "circular" process and not always the sequence is the same, varies according to each particular study. (Sampieri, 2010)

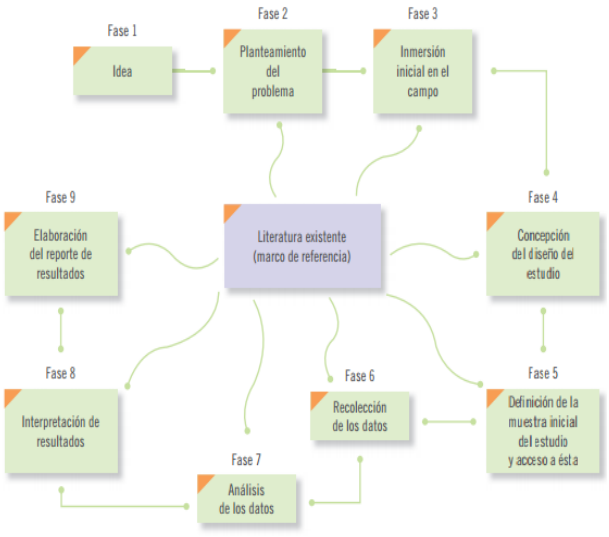

Figure 1 Conceptual map of the use of the methodology with qualitative approach Sampieri.

The present work requires that nine phases are carried out for the design and development process of the same.

1. Idea.- At this stage, the research and exploration of the techniques, tools and methodologies that will serve as support to develop the design of a harvesting robot is carried out, in order to know the new technologies that exist for the operation of the same.

2. Approach to the problem. - Once the idea has been established, the problem is presented, what is needed and how it is possible to make use of the bases already mentioned in the previous point.

3. Initial immersion in the field .- Given the idea in conjunction with the approach of the problem, an inquiry is made in the area to be worked, what is intended at this stage is to know all the means where it is going to Develop the project and have the necessary relationships to carry it out. It is also sensitized with the environment in which the project will take place and identify the information that will be of assistance to the investigation, and also, verify its feasibility.

4. Conception of the study design. - This phase is where the previous bases must be in order to be able to carry out a research design to carry out the project. Conception provides depth to information, dissemination, interpretive wealth, contextualisation of the environment and experiences. It also provides a current, natural and holistic view of phenomena as well as flexibility.

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5. Definition of the initial sample of the study and access to it.- In this phase only some parts of the collected research are taken, as it is not intended to generalize the results of the study. They are not taken as statistical data, but the results obtained in the sample are taken as individual cases of a population.

6. Collection of data.- In this phase of data collection, it is based on gathering experiences and information that will be useful for the development of the project. Here the person is in charge of carrying out the research by collecting the data. The researcher is in charge of collecting the data and relies on several techniques that are developed during the investigation.

This means that data collection is not done with instruments that are already pre-established, but rather that the researcher begins to learn through the observation and descriptions of those involved and creates means to collect and record the data. They are going on as the project progresses.

7. Analysis of the data.- At this stage, the analysis of the information collected does not begin with anticipated ideas about how the concepts or variables are related. Once the data collected in written, verbal, or audiovisual form have been recruited, they are integrated into a database that is composed of text and visual elements, which is analyzed to determine the meanings and interpretation and thus be able to describe the phenomenon studied from the point of view of the people involved. Descriptions of people are also integrated with those of the researcher who collected the information.

8. Interpretation of results.- From the collection of the data, an interpretation of them has to be made, at this stage after the development of the project, the analysis of the data is elaborated and translated into a personal tone, which The people involved can access and understand.

9. Preparation of the results report.- Finally, a report should be made in which all phases are presented with their results, through different means, such as graphs, matrices, maps, photographs, texts, videos, Audios, etc..

Development

Nowadays, society needs students to transform themselves with their studies acquired throughout their lives in engineers, doctors, scientists, etc., who may be able to solve the problems that society requires. The unvarying advances of all branches of study in the world present new challenges and create even greater opportunities for problem solving through technology.

These problems are not academic, but technological; So that the solutions presented by the students in the technological area, will make it possible. This makes the challenge even more challenging, as it is not enough for students who graduate from the upper middle to choose technology-related careers at a university.

This does not show lack of capacity for the new students by the Technological Universities, what reflects is the lack of really interested applicants that are qualified. In short, we would not have the students required in the next generation to solve the problems of tomorrow, unless the lack of solvers are directly directed to the present.

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Many organizations are creating programs designed to appeal to students in the study of science and technology. The Technological Universities of the country, have found that robotics is a very strong platform to attract and maintain the attention of students. It is for this reason that the Technological University of the South of the State of Morelos (UTSEM) decided to openly open the Robotics workshop for the Information and Communication Technologies.

Figure 2 Robotics Workshop at UTSEM

Robotics captures the attention of this generation of students who is powerfully competitive and constitutes a good combination of programming, applied physics, digital prototype design and mathematics, which integrate problem solving, fostering teamwork and strengthening leadership.

Due to this, the Technological Universities are growing in enrollment, more and more students are interested in this Robotics program, since they inspire them in different branches such as science, mathematics, technology and engineering, Related to education and the existing professional careers.

While Robotics exists throughout the world, those in the VEX Robotics community have come up with extraordinary challenges that are easy and inexpensive to establish and implement.

The VEX Robotics design system helps motivate students to a higher level. The system is used as a robotic platform in a classroom that is designed to sustain creative advancement in robotics and knowledge of education in all areas.

The use of the pre-manufactured material, transforming into the easy assembly of a metal structure, intuitive VEX mechanical parts, combined with a powerful range of user-programmable microprocessors to control them, leads to great design possibilities. (VEX, 2016)

Figure 3 VEX Robotics Kits

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The prototype of the robot began to be designed in the Robotics Workshop within the Technological University of the South of the State of Morelos, which is carried out for students in the area of Information and Communication Technologies, this workshop consists of the Students put into practice their knowledge that they acquire throughout their career, such as programming and electronics.

The harvester robot will be used inside the UTSEM for the Sustainable and Protected Agriculture Race, since there is a space where the students sow and at some point they have to collect the fruits, this robot will be of help for the two races mentioned above, Since it is beginning with a prototype and according to the needs, will be improved in the aspects that is required.

Figure 4 Space of planting in the UTSEM

In the robotics workshop the VEX line is used, which has kits which offer very good quality parts. The finishes of the mechanical parts and gears are the best that exists in the field of educational robotics. The VEX kits are robust, as their metal parts allow very compact constructions and are not considered in the toy line, but are used more in the professional field.

Figure 5 Parts to be used for the robot

For the design of the robot harvester, the caterpillars were needed, since they are the ones that allow a better adhesion to the ground. The construction of the robot will be all terrain, the tread like a tank allows the robot to overcome difficult terrain.

It also allows its conveyor belt to pick up objects, jump over obstacles and drive through soft sand or spongy surfaces. For the armature of the track, it was necessary to have tread links, as well as the tread, bogie wheels, screws of the support wheels and the locking nuts.

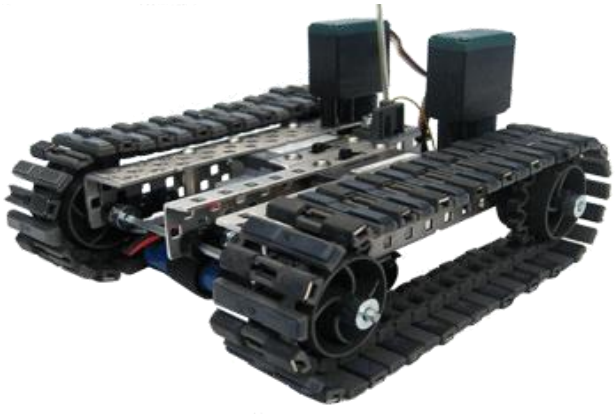

Figure 6 Robot tracks (VEX, 2016))

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The robot must harvest the fruits with one arm, to release them in a basket that will lead from the front. In addition, an evaluation of the movement and utility of the robot should be made regarding the distribution of plants in the field space.

The robot will be composed of sensors, sensors provide the robot with the ability to detect several things in their environment. The sensors are the eyes and ears of the robot, and can always be available in the robot to operate independently of human control.

You will have a touch sensor, which will detect if it is the fruit you are taking, it will advance and when the sensor is activated, the robot will turn its motor and take it until it is started. It will consist of six engines. Two engines will be the base of the robot, which make the robot advance, the third will be in the arm to make it rise and fall, and the fourth engine in the clamp that will take the fruit.

The robot will have a simple bumper switch that will allow the switch to have impacts without any damage happening to it. This bumper also provides feedback to the microcontroller. Its functionality is pre-programmed by VEX.

Figure 7 Bumper(VEX, 2016)

It will have an arm that will have a pair of limit switch sensors built for VEX Robotics Design System. The switches send a signal to the microcontroller when they are in motion. These switches are used to signal when the robot arm has reached the top or bottom of its movement.

The robot uses potentiometers, with them the position and direction of its rotation can be determined. The use of these sensors will be to achieve an analogous behavior of an angular position. This measure can help to understand the position of the robot arms or other mechanisms.

Figure 8 Potentiometers (VEX, 2016)

The robot must measure distances, so it is recommended that you use the ultrasonic range finder. This is programmed the cortex so that the robot detecting the obstacle, can move the arms and collect the fruit.

Handling of the robot can be done through the movement controls by means of a person, but it will also be programmed to perform its movements autonomously.

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Figure 9 Ultrasonic range finder (VEX, 2016)

Results

Thanks to the design of the harvester robot in the robotics workshop within the Technological University of the South of the State of Morelos has been able to increase in the students of the Information and Communication Technologies Career the motivation and creativity of each one of them, Enrollment has grown significantly because they consider the Robotics workshop as a platform in which they can exploit their knowledge and ideas, bring their theoretical part of their areas of study into something practical and real that can be useful in society.

Figure 10 Construction of the robot in the Robotics workshop.

As for the Sustainable and Protected Agriculture Career will be a support for the collection of the fruits, since the robot can carry out the arduous task that they face in the practices.

Figure 11 Crops in the UTSEM.

Aknowledgement

For Engineer Hermann Grafe, German belonging to "Senior Experten Service" (SES), a German industry foundation for international cooperation and public utility organization. Who traveled from Germany to support and share their experiences in Robotics and Internet of things with the students and teachers of the Information Technology and Communication Career of the Universidad Tecnológica del Sur de Morelos.

Conclusions

Universities today have the mission of preparing students to play roles in an increasingly technological society. In addition, studies say that new skills and abilities are needed to meet the needs of today's society.

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Robotics emerges as an innovative didactic resource, which favors the investigation of knowledge in different areas, such as mathematics, engineering, science, programming, etc., from the infantile level to the university level.

Educational robotics is currently focused on the use of this technological resource by the teacher as an incitement factor, to guide the student to the development of their skills such as autonomy, initiative, commitment, creativity, teamwork, Self-esteem and interest in research. (Miglino, 2014)

The robot harvester is tested, the pieces chosen in the design of the robot have been appropriate. As a proposal for improvement will be to combine the management of the robot with the Internet of things to be able to control it from a device. It is thought to have a measurement tool automatically in the harvesting robot, which when it is sent to the area of seed, it will be able to read what the plants require, which will allow to monitor the growth of the crops.

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