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PROTOTYPING AND CONTROL OF A ROBOTIZED EDUCATIONAL PLATFORM

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ABSTRACT

This paper describes the prototyping of an educational kit based on a robotic arm and a conveyor belt. Initially, it was necessary to choose the structure to be used in the arm, develop its construction and carry some tests in order to know its mechanical limits. In order to perform a study of the workspace for the chosen robotic arm, the 3D modeling program Solidwoks® was used. By using this software it is possible to design and carry out studies related to the arm, such as its workspace and mechanical limits. To move the arm, it are used servomotors, controlled by an Arduino. Thereafter, a structure for the conveyor belt has also been developed, so that the arm can work in conjunction with the conveyor. A DC motor is applied to move the conveyor and to detect the parts a distance measuring sensor is used.

Keywords: Robotic arm, conveyor belt, prototyping, servo motors, Arduino, DC motor.

INTRODUCTION

Nowadays, more and more, the classes tend to involve more laboratory work. In this paper it is described the development of a low-cost platform with the purpose of its use in robotics education. Several educational robotic arms exist in the bibliography, such as the EasyARMDSmini, which is simple and inexpensive, constituted by 6 servo motors, providing 4 degrees of Freedom [1]. Another educational robotic arm is the Niryo One, a 6-axis anthropomorphic arm developed by *NIRYO*. This arm is printed in 3D, has a weight of 3.2 kg and supports 500g, its repeatability being approximately 1mm [2].

RESULTS AND CONCLUSIONS

Considering the study carried out, it was chosen to be developed a manipulator with 3 degrees of freedom. The components of the robotic arm were printed in 3D. Once printed, for the arm to operate it was necessary 3 servo motors, each one for each degree of freedom, and a micro servo motor capable of opening and closing a claw, which is the end effector. These servo motors are controlled by the Arduino. The conveyor was developed through the SolidWorks geometric modeling program, a software that allows for prior planning and the choice of the best possible design. Once the pieces are developed, it are 3D printed. In the conveyor prototyping, it was chosen not to use bearings, in order to reduce the cost. A joint system has been created, and a part that is not centered can be routed through this system. To detect the parts, a SHARP infrared sensor was chosen and a 19:1 DC motor was used to move the conveyor belt.

Through the whole procedure it was obtained the desired model. After the connections were made, a controller was developed in the Arduino that was used to operate the final model, as shown in Figure 1.

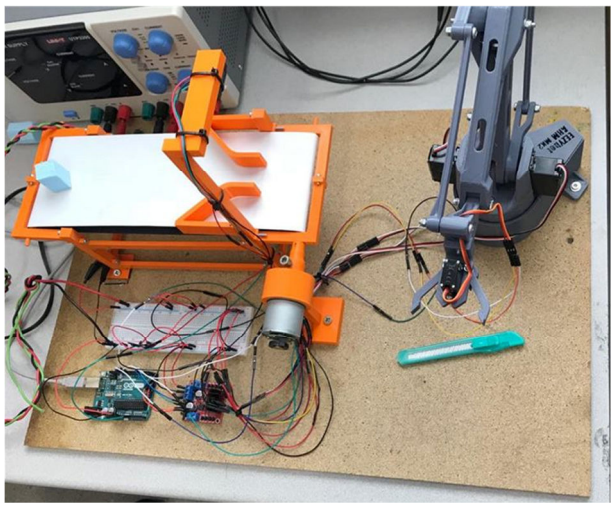

Fig. 1 - Final Model.

The developed controller has the purpose, initially, to transport a material part towards the robot workspace. Once the part is detected, the conveyor will stop, and the robotic arm will be activated, moving towards the piece. When the arm reaches the part, it will grab it, and move it to the free corner of the educational kit, which was previously defined. When it arrives at the destination, it drops the piece, it will be in rest position and the conveyor will be activated again.

With the work done, it was concluded that Solidworks® is a very complete and important program nowadays. Through this it is possible to carry out a previous planning, to carry out studies and to opt for the best possible design. Concerning Arduino, it was a great bet because it uses an a low-cost development board that it is used by an enormous and very active community. Through this it was possible to control, the DC Motor, the servo motors and to get the Sharp sensor reading. The used library was Braccio, being possible to control up to 6 servo motors. Through this library it is possible to vary the speed with which the arm executes the movements, since it allows to vary the time between the movement of each servo between 10 and 30ms. The use of servo motors in precision work is an excellent option as they are very precise components. The use of the DC motor to move the conveyor belt was also a successful approach, although it presents some difficulty in moving, because it has no bearings and thus have a lot of friction, the engine has overcome the specs because the conveyor belt moves very well. The choice of arm and carpet to be printed in 3D has proved to be an excellent choice as the material provides great resistance and presents a low cost. Whenever a piece is printed in 3D, one must consider its wholes and its faces, because of this type of printing sometime presents some imperfections, and it is necessary an inspection and repair.

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