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Programming of a robotic arm using PIC18F4550 microcontroller and direct current motors.

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Abstract
This research aims to develop a low cost controller for a robotic arm using direct current motors, encoders and a microcontroller from Microchip®, providing an alternative to the commonly used servomotors. The control is defined by software, which is interesting for didactic purposes regarding robotics at different levels of training, facilitating the dissemination of technologies aimed at Industry 4.0.

Key words:
Robotics, microcontroller, direct current motor.

Introduction

Robotics arms are mechanical devices whose functions are like those of the human arm, whose joints are rotated by a motor. Its physical capacity is optimized for performing repetitive and heavy tasks quickly and with accuracy[1-3]. Thus, they are very interesting to the industry, being widely used all over the world.

Generally, robotic arms have a high cost, due in large part to hardware. However, this research aims to study how satisfactory results can be obtained at lower cost through more complex coding.

The objective of this research is to study the operation and perform the programming of a robotic arm using direct current motors with speed reducers, rotary encoders and the PIC18F4550 microcontroller. Consequently, it might be used for didactic purposes regarding robotics at different levels of training.

Results and Discussion

Initially, a deepening of the hardware was done: the architecture and programming of microcontrollers; the operation of DC motors; the use of incremental rotary encoders, drivers and other electronic circuits, such as matrix keypad and LCD display. Thus, a study was made of the theory of DC motors as well as of several component datasheets. Also, the PWM motor control technique was studied. It was found that DC motors together with incremental encoders can be used for the goals of this research.

In sequence, the planning and assembly of the electronic circuit was carried out. Initially, codes were developed for the testing and study of electronic components, as well as for the analysis and solution of possible technical or compatibility problems. An algorithm was then developed to control a motor from the matrix keypad, using PWM to control its speed. Hence, extra features were inserted, such as recording the movements performed for later reproduction.

The programming was improved aiming to more precise movements. Practical tests, error resolution, and improved robotic arm accuracy were performed. At this stage, some difficulties in the operation had to be dealt with, mainly in the sense of precision and correct reproduction of the movements.

As main results, the following can be mentioned: the low cost of the components used; the reusable code, written in a clear, modularized and accessible language; movements of the robotic arm performed with satisfactory accuracy in view of the reduced cost; ease of use for didactic purposes and also expansion for commercial purposes, in performing repetitive and heavy tasks.

The robotic arm developed (see *Image 1* below) might and is going to be used in automation classes as a study tool.

Image 1. Robotic arm.

Conclusions

Low cost control of direct current motors can be achieved through relatively complex coding of a PIC184550 microcontroller, using feedback given by rotary encoders. So, it can be used as an alternative to the more expensive servomotors. Also, microcontroller classes can make use of this work as a training tool.

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