

remote interface control for a pick-and-place robotic manipulator: a didactic approach

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ABSTRACT

Abstract - This paper presents a remote interface control for a pick-and-place robotic manipulator based on the integration of RS-232-C communication standard between a PLC and a microcontroller. This solution is obtained by the connection of two Arduino UNO boards and a ILC 131 ETH PLC from Phoenix Contact through an RS-232-C to TTL signal convert interface. The description of all the selected hardware and software is presented through different sections. A PLC webserver solution was developed to teach manually the robotic manipulator the desired positions in order to adjust to the pick-and-place application.

Keywords – PLC; RS232 interface; RS-232-C/TTL conversion; robotic manipulator; Arduino UNO.

I. INTRODUCTION

Industrialized systems are currently designed with different possibilities of interconnection to diverse equipment/systems to face most demanding applications. Due to this, it is necessary to use several types of interconnected equipment, among which two of them are used in this work: a robotic manipulator and a conveyor belt for pick-and-place operation. These types of devices are widely used in industrial settings and the system is normally designed to move objects continuously in harsh environments due to ability to lift heavy payloads, good accuracy, good repeatability, and versatility in terms of the different end that can be used. Due to the importance of these systems in the industry, this work was developed for didactic purposes, teaching undergraduate students at the Instituto Superior de Engenharia de Lisboa (ISEL) some concepts about industrial automation.

II. ROBOTIC MANIPULATOR

Robotics is a multidisciplinary sector of science and engineering dedicated to the design, construction and application of mechanical robots, requiring knowledge of mathematics, physics, mechanics, electronics, computing, and other areas. The definition of an Industrial Robot is provided by the Robotics Industries Association (RIA): "An industrial robot is a reprogrammable, multifunctional manipulator designed to move specific materials, parts, tools, or equipment with varying motions and programmed for the execution of diversified tasks." [1], [2]. The choice of the robotic manipulator depends on the application (type of motion, workspace, desired speed, etc.) For the purpose application and because the conveyor belt is small, and the workspace is reduced it was

selected a small robotic manipulator with six degrees of freedom (see Figure 1):

- Servomotor "M1" Base;
- Servomotor "M2" Shoulder;
- Servomotor "M3" Elbow;
- Servomotor "M4" Vertical Wrist;
- Servomotor "M5" Rotatory Wrist;
- Servomotor "M6" Gripper.

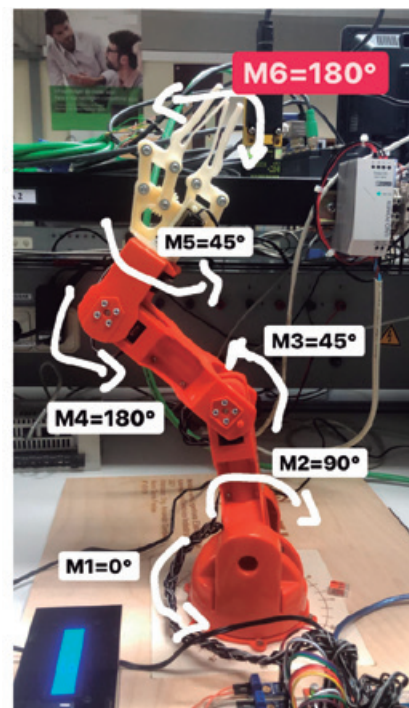


Figure 1. Robotic Manipulator [2] (braccio-robot).

It is a fully operational robotic manipulator, controlled by an Arduino board. It is supplied in kit format so that it can be assembled according to the needs of each application. The characteristics of this robotic manipulator is described next:

- Maximum operating distance: 80 cm;
- Maximum height: 52 cm;
- Width of the base: 14 cm;