International Symposium on Robotics and Intelligent Sensors 2012 (IRIS 2012)

Implementation of Industrial Robot for Painting Applications

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Abstract

Robot for painting is one of the earliest applications for industrial robot, however, the precision and finishing for the painting is an important issue for any painting job. Accordingly, the aim of this project is utilize an industrial robot (ABB robot model IRB1410) for painting applications. The robot was programmed to paint alphabets using its Flexpendant. The FlexPendant was used to manually teach the robot how to follow the paths for specific targets of letters. The robot End Effector (painting tool) was chosen and mounted on the robot to perform an effective painting task. It was programmed based on its functionality. Finally suitable painting environment was designing. Two software packages were used in this project. The Computer Aided Design (CAD) of the system work-objects and end effector was programmed based on Solidworks software. Robotstudio Software used to program the paths and target of the alphabets to be painted by the IRB1400 Robot which generate a RAPID GUI code used for robot interfacing. The final results demonstrate that implementation such system helps to boost the quality of painting, reduce paint consumption and improve safety.

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1. Introduction

Technology is growing at a pace that no one has been able to measure or quantify accurately. We have witnessed the invention of robots, machines, electricity etc. Industrial Robots can be used for different applications which simply cut across industrial and personal purposes. They perform different tasks based on how they have been programmed or taught manually. The project places emphasis on industrial painting using IRB1400 ABB Robots.

The Robot is a 6-axis Industrial Robot, designed specifically for any industry that uses flexible robot based automation. The Robot has an open structure that is adapted for flexible use, and can communicate extensively with external systems. It can also be used for project based applications, researches and for industrial purposes. Some application of the IRB1410 Robot includes welding, cutting, pick and place, assembling, painting, and inspecting etc. Most university uses the robot for educational based application. In the case of this project, the robot was used for painting application.

2. System Overview

The basic robotic system broadly defines the mechanics, control, and sensor design of Robots. Mechanics includes the design and structure of manipulators, arms, end-effectors, actuators, power, and energy storage. It also consists of the kinematics, dynamics of Robots, and simulation of Robot Systems. Control includes both theory and implementation (hardware and software) while Sensors include design of sensor systems and algorithms for sensory data acquisition and analysis. The study of Robotic System and its components were applied in the project. The project design and simulation where based on all the components. The other component that played a very vital role in the project is the design of the robot Work Object, air compressor and the paint being used in the spraying process.

Extensively, a nomenclature list arranged alphabetically, with Greek, subscript and superscript symbols listed separately, should be provided. Put a nomenclature above the main text if necessary, in a box with the same font size as the rest of the paper. Otherwise all symbols should be identified when first used in the text. The unit of the nomenclatures should be clarified following the description text. Authors are expected to use the SI system of units. Use Mathtype software to edit nomenclatures with Greek characters. Here introduce the paper, and the paragraphs continue from here and are only separated by headings, subheadings, images and formulae. The section headings are arranged by numbers, bold and 10 pt. Here follows further instructions for authors.

2.1. Manipulator

This is the main body of the robot; it consists of the links, the joints, and other structural elements. The weight of the robot is roughly 225kg. The IRB1410 robot is equipped with an operating system BaseWare OS. The BaseWare OS control every aspect of the robot, such as motion control, development and execution of application programs communications. The Robot can also be equipped with optional software for application support. The IRB1410 ABB Robot has a payload of 5kg and a working envelop (reach) of about 1.44m [7]. The IRB1410 Robot configuration shown in Fig. 1.

Fig. 1. IRB1410 Robot.

The model of the links and joints of the IRB1410 Robot can be represented it by Denavit-Hartenberg (D-H) parameter table shown in Table 1.

Table 1. D-H Parameters of the IRB1410 Robot

Links	$\theta_i(°)$	$\alpha_{i-1}(°)$	$a_{i-1}(mm)$	$d_i(mm)$
1	θ	90	0	475
2	θ	0	150	0
3	θ	90	600	0
4	θ	-90	120	720
5	θ	90	0	0
6	θ	0	0	85+d