

Automation Control Development with Capstone Projects

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I. Abstract

This article presents the development of the automation control projects developed in the Mechanical Engineering Technology Program of the Engineering Technology Department at Old Dominion University. These capstone projects are designed to help students gain industrial application experiences on design, test, and implementation. Two projects on automation controls are the focus of this article: (1) an automatic ship-bottom blasting machine and (2) a fully automated Car Jack. Three major topics are presented in each project: (1) introduction of the background, (2) methods to solve the problems in mechanical designs and automation controls such as hydraulic circuit and/or PLC programming, and (3) implementation and test results.

II. Introduction

The course objectives of Automation and Controls that offered in the Mechanical Engineering Technology Program of the Department of Engineering Technology at Old Dominion University are:

- (1) Pneumatic components and pneumatic circuit designs.
- (2) Feedbacks from electrical sensors and related ladder diagrams.
- (3) Introduction to Programmable Logical Controllers (PLC) and PLC ^{[1][2]} programming.
- (4) Integration of pneumatic, electrical, and/or hydraulic components with PLC programming controls.

To ensure students have hands-on experiences in this course, a two-hour/week lab is also required to teach the students with integrate mechanical, pneumatic, and electrical components in ladder diagrams and PLC programming. Basically, the lab includes three main sessions: (1) four weeks of pneumatic applications, (2) four weeks of pneumatic components, electrical sensors, and ladder diagrams, and (3) five weeks of PLC programming using IDEC ^[3] and TRiLOGI ^[4] PLCs. In addition, the simulation software of Automation Studio ^[5] is also used in each project so that students can check their designs before the actual implementation. Depending on the

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