Faculty of Electrical and Electronic Engineering Technology

Development Of PID Controller For Conveyor Belt System With Different Tuning Method

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Bachelor of Electrical Engineering Technology (Industrial Automation & Robotics) with Honours

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Development Of PID Controller For Conveyor Belt System With Different Tuning Method

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A project report submitted
in partial fulfillment of the requirements for the degree of
Bachelor of Electrical Engineering Technology (Industrial Automation & Robotics)
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Faculty of Electrical and Electronic Engineering Technology
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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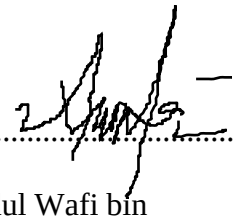

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Date : 8/1/2022

APPROVAL

I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Electrical Engineering Technology (Industrial Automation & Robotics) with Honours.

Signature : DR SAHAZATI BINTI MD ROZALI
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Date : .....

DEDICATION

To my beloved mother, ROZIAH BINTI ONAN, and father, ABDUL RAHEM BIN PARIMUN,

ABSTRACT

A conveyor system is a type of mechanical handling equipment used to transport products from one point to another. Conveying systems come in a variety of shapes and sizes, and it is used to meet the demands of numerous sectors. The goal of this project is to enhance a conveyor machine that is currently in use in a variety of industries or laboratories. Most of conveyer systems do not have a monitoring system to assess the conveyer belt's operation and efficiency. As a result, a conveyer's performance and durability decrease, and significantly interferes with effective production performance. Furthermore, the existing method for adjusting the speed is extremely inconvenient. Therefore, the goal of this research is to help prevent the problem from growing worse by developing PID control system for conveyor belt systems.

This project provides an overview of belt conveyor technology with an emphasis on the several types of control systems that may be implemented using a PID controller. The features, performance measures, requirements, and operating method of belt conveyor drives and control systems are also highlighted in this project.

ABSTRAK

Sistem tali sawat adalah sejenis peralatan pengendalian mekanikal yang digunakan untuk mengangkut produk dari satu titik ke titik yang lain. Sistem ini datang dalam berbagai bentuk dan ukuran, dan ianya juga digunakan bagi memenuhi permintaan berbagai sektor. Matlamat projek ini adalah untuk meningkatkan mesin tali sawat yang kini digunakan di pelbagai industri atau makmal. Kebanyakan sistem tali sawat tidak mempunyai sistem pemantauan untuk menilai operasi dan kecekapan dalam pengoperasiannya. Akibatnya, prestasi penghantar dan ketahanan berkurangan, justeru mengganggu prestasi pengeluaran yang berkesan. Selain itu, kaedah untuk melaraskan kelajuan yang sedia ada adalah amat terhad. Oleh itu, tujuan penyelidikan ini adalah untuk membantu mencegah masalah daripada bertambah buruk dengan mengembangkan kawalan PID dalam sistem tali sawat.

Projek ini memberikan gambaran keseluruhan teknologi sitem tali sawat baharu dengan penekanan pada beberapa jenis sistem kawalan yang mungkin dilaksanakan menggunakan pengawal PID. Ciri-ciri, ukuran prestasi, keperluan, dan kaedah operasi pemacu tali sawat dan sistem kawalan juga diserlahkan dalam projek ini.

ACKNOWLEDGEMENTS

First and foremost, I would like to express my gratitude to my supervisor, Ts. Dr. Sahazati binti Md. Rozali for her precious guidance, words of wisdom and patient throughout this project.

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My highest appreciation goes to my parents, and family members for their love and prayer during the period of my study. An honourable mention also goes to my eternity lovely mom, Roziah binti Onan for all the motivation and understanding.

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CHAPTER 1

INTRODUCTION

1.1 Background

A conveyor system is a common mechanical handling equipment that moves materials from one location to another. Conveyor systems allow quick and efficient transportation for a wide variety of materials, which make them very popular in the material handling and packaging industries. Various types of conveying systems are available that are used according to the various needs of different industries. There are chain conveyors (floor and overhead) as well. Chain conveyors consist of enclosed tracks, towline, power & free, and hand pushed trolleys. Conveyor systems are used widespread across a range of industries due to the numerous benefits they provide.

Conveyor systems are frequently used in many industries, including the automotive, agricultural, computer, electronic, food processing, aerospace, pharmaceutical, chemical, bottling and canning, print finishing and packaging. Although a wide variety of materials can be conveyed, some of the most regular items include food items such as beans and nuts, bottles and cans, automotive components, scrap metal, pills and powders, wood and furniture and grain and animal feed. Many factors affect the accurate selection of a conveyor system. It is important to know how the conveyor system will be used beforehand.

This project is to propose the development of PID controller in conveyer belt system. The main objective for this project is to apply a productive solution in Conveyer Belt System with PID control system. The main study of this project is to improve the performance of conventional conveyor belt systems in terms of speed and productivity, which can perform more productivity by maintaining the constant speed when it is worked on load. However, with the development of PID control, it can increase the length of its durability and effectiveness. The development of this project with a PID controller is targeted to overcome this lack of performance.

The PID controller continuously calculates an error value (motor speed) as the difference between a desired set point (SP) and a measured process variable (PV) and applies a correction based on the parameter of proportional, integral, and derivative terms (denoted P, I, and D respectively). This process will occur if a conveyor is used and there is a change of speed if a load is given to the conveyer.

1.2 Problem Statement

The fact that the majority of conveyer machines used in the industry are still applying the old method, which is incompatible with the current state of fast modernization. The majority of conveyer systems do not have a monitoring system to assess the conveyer belt's operation and efficiency. As a result, a conveyer's performance and durability decrease, and significantly interferes with effective production performance. Additionally, the existing method for adjusting the speed is extremely inconvenient. This is due to the fact because it is only limited to several speeds due to the application of potentiometer. As a result, the motor's time to achieve the designated speed is quite delay. Lastly the type of belting used

must be appropriate to the type of material that was used. If it is operated to arrange the goods in the right place, the flat belt conveyor type is definitely the most suitable, because it is very easy to use and to maintain. For heavy transfers, the chain conveyor is very relevant to work with because it is created for hard and challenging work such as cargo transfer and so on.

1.3 Project Objective

The aim is to develop more sophisticated methods to propose a systematic and effective methodology to estimate the conveyor system. After defining the problems, we will explain the goals of the previous project and research. The objective of the project is:

a) To develop of PID controller to control speed of conveyer belt system by set the value speed.
b) To analyze the effectiveness of PID controller on the system with different tuning method by monitoring the speed of the conveyor system.
c) To build a GUI to monitor the speed and value of PID control.

1.4 Scope of Project

Based on the requirement of the project, the scopes will cover:

a) The conveyor belt was able to be used in different value of speed.
b) The motor used for the conveyer was a DC type and can be tuned with different speed according to the input speed given and have a low limit value of voltage for torque.
c) There be a GUI for set the value of Kp, Ki, Kd and speed of DC motor.

d) The GUI show the current speed value of DC motor throughout process.

e) Push button are used to start and stop the process immediately if any emergency.

f) Lastly, this design also gives access to tune the speed when the conveyor was running.

1.5 Gant chart of Project

GANTT CHART PSM 1

ABDUL WAFI BIN ABDUL RAHEM **B081810065**

DEVELOPMENT OF PID CONTROLLER FOR CONVEYOR BELT SYSTEM WITH DIFFERENT TUNING METHOD

Task Complete %	Task	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14
100	**MILESTONE 1 (LITERATURE REVIEW)**														
100	Selection of title														
100	Set objectives, Project Scope, Problem Statement														
100	Chapter 1 - Introduction														
100	Chapter 2 – Literature Review														
100	**MILESTONE 2 (DESIGN)**														
100	Hardware and software														
100	Design the schematic diagram, develop part by part of the component's connection and the coding's for the project and troubleshooting														
100	**MILESTONE 3 (SIMULATION)**														
100	Simulation, Initial result using software														
100	**TESTING AND DATA COLLECT**														
100	Testing, record the initial result and tabulated														
100	Report Writing														

Remarks: **Approved By**

GANTT CHART PSM 2

ABDUL WAFI BIN ABDUL RAHEM **B081810065**

DEVELOPMENT OF PID CONTROLLER FOR CONVEYOR BELT SYSTEM WITH DIFFERENT TUNING METHOD

Task Complete %	Task	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14
0	**MILESTONE 1 (LITERATURE REVIEW)**														
0	Improvement previous PSM 1 report	■	■	■	■	■	■	■	■	■	■	■	■		
0	**MILESTONE 2 (DESIGN)**														
0	Develop the schematic diagram & troubleshooting for remaining sensors	■	■	■	■	■									
0	Develop the rest of the component's connection and the coding's for the projects & troubleshooting	■	■	■	■	■	■	■	■	■	■	■	■		
0	**MILESTONE 3 (SIMULATION)**														
0	Simulation, Initial result using software	■	■	■	■	■	■	■	■	■	■	■	■		
0	**TESTING AND DATA COLLECT**														
0	Testing, record and tabulate the final result	■	■	■	■	■	■	■	■	■	■	■	■		
0	Testing 1 – DC motor to the mechanism				■	■	■	■	■	■	■	■	■		
0	Testing 2 – Arduino programmed and GUI screen for PID									■	■	■	■		
0	Overall Report Writing	■	■	■	■	■	■	■	■	■	■	■	■		

Remarks: **Approved By**

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In this chapter, research and case study is done by reviewing the previous research paper, journal, and anything related to the project titles. The information from the previous research gives an overview on the implementation of the project about how to prepare for the project and it can be used to improve the efficiency and functionality of the system.

2.2 Conveyor Belt Design

A conveyor system is a common piece of mechanical handling equipment that moves materials from one location to another. Conveyors are especially useful in applications involving the transportation of heavy or bulky materials. Conveyor systems allow quick and efficient transport for a wide variety of materials, which make them very popular in the material handling and packaging industries. They also have popular consumer applications, as they are often found in supermarkets and airports, constituting the bag delivery to customers. Many kinds of conveying systems are available and are used according to the various needs of different industries,(Galkin, 2019).

Figure 2.1 : Conveyor belt system in distribution system

Based on Figure 2.1 shows that the design of the conveyor at the distribution center used to transport and sort the goods to their respective places. The condition of the conveyor must be sturdier, durable and easy to manage the distribution of load. Conveyor design should also be simple for workers to perform tasks easily to help them place and pick up goods from the conveyer.

2.2.1 Types of Designs for Conveyor Belts

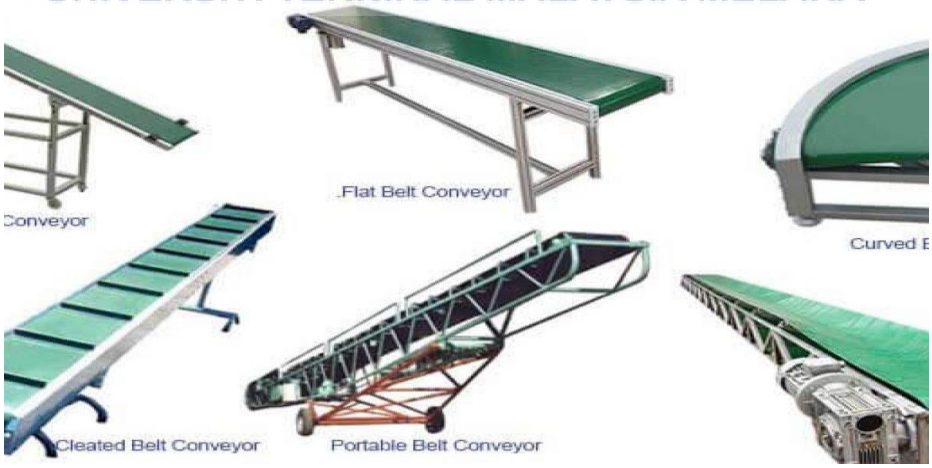

Figure 2.2 : Basic type of conveyor that is used in industries