



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**CONVEYOR SPEED CONTROL APPLICATION BASED ON
PID CONTROL ALGORITHM**

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electronics Engineering Technology (Industrial Electronics) with Honours.

by

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfilment of the requirements for the degree of Bachelor of Electronics Engineering Technology (Industrial Electronics) with Honours. The member of the supervisory is as follow:

.....

(Mr. Shahrizal bin Saat)

ABSTRAK

Sistem penghantar adalah salah satu sistem pemindahan yang paling biasa digunakan dalam industri untuk memindahkan barang-barang dari satu titik yang lain dalam jarak yang terhad. Ia digunakan dalam industri seperti pembuatan perhimpunan elektromekanik atau mekanikal untuk memindahkan bahan kerja dari satu stesen ke stesen yang lain atau satu proses yang lain dalam industri makanan. Dalam proses biasa, yang melibatkan penghantar, melambatkan, atau mempercepatkan penyalur kerana beban ditambah atau dikurangkan beban boleh menyebabkan miss masa. Kertas kerja ini membentangkan kaedah dan pengesahan untuk pelaksanaan berkadar derivatif Integral (PID) pengawal berasaskan peraturan digunakan untuk gelung tertutup DC kawalan kelajuan motor. Dengan menggunakan pengekod putar, ia akan mengukur kelajuan motor dan perubahan kepada format yang boleh dibaca dan ia menjadi input kedua kelajuan yang ditetapkan. Proses ini berterusan sehingga motor mencapai kelajuan yang ditetapkan sebagai contoh apabila kesilapan itu menjadi sifar. Reka bentuk, pelaksanaan, dan keputusan eksperimen pada keadaan beban dan tanpa beban dibentangkan. Pengawal ini boleh dilaksanakan dengan menggunakan hanya sejumlah kecil komponen dan mudah diperbaiki untuk menjadi pengawal PID adaptif. Kepentingan Pengawal PID dari yang lain pengawal adalah, mereka adalah kemungkinan dan mudah untuk dilaksanakan. Keuntungan PID boleh direka berdasarkan parameter sistem jika ia boleh dicapai atau dianggarkan dengan tepat.

ABSTRACT

Conveyor system is one of the most common transfer systems used in industry to transfer goods from one point to another in a limited distance. It is used in industries such as the electromechanical or mechanical assembly manufacturing to transfer work piece from one station to another or one process to another in food industries. In a common process, which involves conveyors, slowing down, or speeding up of conveyors due to added loads or reduced loads can cause a timing miss. This paper presents a methodology and verification for implementation of a rule-based Proportional Integral Derivative (PID) controller applied to a closed loop DC motor speed control. By using the rotary encoder, it will measure the motor speed and changes it to a readable format and it becomes the second input of the set speed. This process continues till the motor reaches the set speed for example when the error becomes zero. The design, implementation, and experimental results on load and no-load conditions are presented. The controller can be implemented by using only a small amount of components and easily improved to be an adaptive PID controller. The importance of the PID Controllers over the others controllers are, they are feasibility and easy to be implemented. The PID gains can be designed based upon the system parameters if they can be achieved or estimated precisely.

DEDICATION

To my beloved parents, family members and friends.

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CHAPTER 1

INTRODUCTION

1.0 Introduction

This section basically guides the author in preparing the entire report content including the graphical illustrations which can be found in appendices. All the setting, problem statements, objectives, scopes, and the abstract of the project will be presents in this chapter one.

1.1 Background

As we know, today system of conveyor is one of the common type of handling equipment that it's allow to transfers materials from sentence place to another. The system of conveyors it's consent a faster and good effective of transportation that can uses for a varied usage of things, which can make them most familiar in the handling materials and industries promotion. Several types of conveying systems today are available and they are skillful that based on the demanding of different of manufactures. In sentences operation that involves the conveyor operation, lower down or faster up of conveyors during the added loads or things and during the decreased of loads it can affect the timing process and the next step of the process also can't achieve the setting time.

For this project the aim is to designing, analyzing and fabricating the speed control for the conveyor that to be testing with variety of load. Thus, the Proportional Integral Derivative (PID) controlled that used for speed control to a closed loop DC motor is the based for this project. To measure the speed, the rotary encoder will be

use and it will change it to a new format and the set speed will be the second input by using the rotary encoder from the DC motor. This process will go on until the speed of motor passes. For case when the error is becoming or almost to zero. An Arduino Uno is an open-source platform for building projects electronics will be uses as the controller of this project. This Arduino Uno is not need a separate part of hardware to make a new code into a table but, we just only apply by using a USB cable. The DC motor is the final element control for this final year project. Because of the high performance of this DC motor drive system, that it must have a better dynamic speed command of tracing and the load response variable.

1.2 Purpose of the Statement

The most aim of this final year project is off course to implement the control speed for conveyor that applied at the many of load that by using a PID controller in the Arduino Uno. Furthermore, this project also the purpose to analyze speed control of conveyor system when the various load applications is applied to it and finally to implement and fabricate control speed for conveyor that can be test for various of applications load.

1.3 Problem Statement

In the process of conveyor operation today, slower down or speed up of the conveyor operation during the added load or decreased the load that applied to it can affects the timing process. Moreover, the most problem is to apply a conventional algorithm control in a controller speed are can effects in a DC motor non-linearity. Because of this non-linear characteristic of a DC motor like friction and saturation can make degrade the conventional performance controller. Mostly, a not accurate of the not linear model of an actual of DC motor is not easy to know and the values of parameter from the system documentation may be just approximate the values. So, the conveyor control of boundaries main are:

- i. Not linearity in motor
- ii. Inputs are flexible and changeable
- iii. The spread noise along a series of unit operations
- iv. The limitations unknown
- v. The load dynamics of changes

1.4 Scopes of Project

The scopes project for this final year project is includes of combination some elements and include the software, electronic and hardware system. The scopes project of work to be complete this project purpose are:

- i. Software: PID controller was use in this system to develop using Arduino Uno. PID controller is the best way to control the problems in engineering area. On that point are precise components criteria of a PID controller to support a design process.
- ii. Hardware: The project design was developing by using Arduino Uno microcontrollers. Arduino Uno are circuits of electronic that can be programmed to transmit out a huge variety of projects.
- iii. Prototype: The arrangement will have applied on a conveyor model using Arduino Uno.

1.5 Outline of Project Report

The outline project of this report is separate into five sections to make clearly view about this project. The first section of this project is to elaborate strongly about the system operation and hardware that has been made in this project to make sure its along and parallel with the aims and objectives of this final year project. Some review paper for the past and previous of researches with the same topic was been explain into section 2. For the section 3 it more to explained the details about the method or the way and to made the implementation steps of this project. Section 4 is to discuss all the findings, results, discussion, and analysis about this project. And lastly of the

section of this project is section 5 that to summarize the conclusion and made a recommendation for future work that can use to improve for this project.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

For this part, will be introduced the discussion of the others reviews of earlier work that have been come out with the same related to the topic of this project. The related literature review was being discussed depending on the three objectives interest as below:

- i. The DC conveyor system modelling.
- ii. The speed controller for DC conveyor system for conception and implementation.
- iii. The used of Arduino Uno to implementation of advance technique control.

2.1 Controller

As we know there are many types of controllers today that had been made by others people. For information, controller is one of the hardware device or a programming software that can allow us to conduct the flow of the data among the two entities. In computer, the controller is like the card, microchips, mother board or split hardware component to control of some device. For the common sense, the controller will be the assumed of as something that can interfaces between the two systems and communication manages among them. Two types of controller today in power systems are the passive controller and adaptive controller. The example of passive controllers is relay control and sliding mode control and the example of adaptive controllers are like PID, PI Repetitive, P-Resonance and Fuzzy Logic Controller (FLC).

2.2 Proportional Integral Derivative (PID) Controller

The most common of the control algorithm that most used in the industry today is the Proportional Integral Derivative (PID). This is because the PID controllers it can be assigned because of their ability in a bigger range of conditions operating, simplicity functionality and how the engineers easily to implement the PID using the modern technology computer. So, this previous article had been discussed about the PID control and the applications and give a strong view on how to tuning the optimum the PID controller's parameter [1].

The most including on the paper [2] is the also the PID controller. This paper say that the controller of PID are most used in the control systems of industrial today. A PID controller is a closed loop instrument normally with include the control feedback system industrial. This PID was compares with a measured value for the process operations usually in industrial process or of the system output to compare it with the set point reference or the desired value by the systems. The difference of the error signal among the value target and value that measure from the process and then will be used to calculate a new manipulated value of input to the process that can make the value measured of the process is go to the desired value that has been set by the user. The controller of PID can changes the outputs process that based on the theory and the change of the signal error was been rate which can bring a most exact and stable condition. To the desired application or system, the PID controllers is most can be easy adjusted. So, a PID controller is the best performance among other controllers. The PID consists of three parameters which is K_p , K_i and K_d that can be adjusting and tuning so the controller will give control action for the target of required process. The controller algorithm of the response can be explaining in terms of the awareness of the controller to an error. The controller degree which can overshoots the set point and the degree of the oscillation of the system.

The most using of this PID controllers is control process, motor drives, control flight and instrumentation operation. Because of it is simple structure which can be easily to understand and application is make them the reason of the acceptability. The previous state that many improvements of advancing to keep in attention the needed of the end users. Implementation of hardware is being easy and the software simulation it is can help to gain the popularity. Many methods where been known in the review

literatures for the know the PID parameters like controllers Ziegler-Nichols tuning which is the first was founded [3].

The controller proportional integral derivative (PID) was designed and tuning to be theoretically, but it will be hard in practice, if the multiple purpose for example transient short and stability high was to be target. Normally, the designs initial was obtained must to be changed continually by using computer simulation till the performances of closed loop system was desired. The intelligent tools development was stimulating that make assist the engineers to reach the optimum of overall PID control to entire the envelope operating. Some of advanced tuning algorithms into the PID hardware modules was be development for further led to the incorporation. Based on the development, this paper was presents a new overview of usefully and the methods of tuning in patents, the commercial hardware modules, and the packages. It can say that most the PID have been designed because of to make transient performance improving but, due of the PID control are desired to standardizing and modularizing. The identification system was inclusion and the intelligent techniques in software based systems of PID its help automate the design entire process tuning to a degree of useful. So, that it must assist the further designed of PID controller that can big acceptable and can be easily set up and optimally operate for productivity enhanced, quality better, and keep requirements decrease.

2.3 Proposed Controller (PID Controller)

The proposed of the PID controller for this final year project is to make easy, strengthens, and give the characteristic of the closed loop response and make it regulate the time domain characteristic for any difference of plants type. The user can be determined from each of these terms. To optimize the precision of control all the terms must to be adjusted. PID tuning known because of the process of determining of parameters values.

The term of proportional, term of integral, and term of derivative, was included into the PID controllers. Where all the controller output according to all the error magnitude can be adjust using proportional term. The steady state error of the system control it can be used the integral term. The derivative term was used to increase the