



Faculty of Electrical and Electronic Engineering Technology



**DEVELOPMENT OF MOTOR SPEED CONTROL SYSTEM USING
IOT FOR ONLINE LEARNING**

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

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**DEVELOPMENT OF MOTOR SPEED CONTROL SYSTEM USING IOT FOR
ONLINE LEARNING**

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**A project report submitted
in partial fulfillment of the requirements for the degree of
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ABSTRACT

Due to the pandemic covid-19, students especially engineering students has suffered to cope with online lab sessions. This peaks when they were used to do hands-on lab experiments and now has to do simulations that questions their credibility to do the lab hands on if they were given too. This project focuses on constructing a simple DC Motor connection that the input voltage or input voltage can be controlled using Wifi from an app on a smartphone. To help students understand more on Motor Speed Control System, a simple MATLAB step response is created in this project with suitable interfaces and steps to gain the transfer functions is made. An infrared speed sensor (LM393) is used to sense the speed of the motor and a DC motor attached with wheels with slits. The speed sensor uses a disc with holes (encoder disc) to block the infrared beam, thus by counting the number of times the sensors go from Low to High, hence, can calculate the number of revolutions for a given time period. ESP8266 is the main microcontroller used for this project. Before proceeding with this project, a simulation is carried out so that the results can be compared between the theory results and actual results.

ABSTRAK

Oleh kerana pandemik covid-19, golongan pelajar terutamanya pelajar kejuruteraan mengalami masalah untuk menghadapi sesi makmal dalam talian. Hal ini bertambah rumit apabila mereka telah biasa melakukan eksperimen makmal secara langsung atau bersemuka atau *hands on* dan sekarang mereka harus melakukan simulasi yang akan mempersoalkan kredibiliti mereka untuk melakukan sesi makmal jika mereka akan melaksanakan sebarang aktiviti makmal di masa hadapan. Projek ini memfokuskan pada pembinaan sambungan DC Motor mudah agar voltan input atau voltan input dapat dikendalikan menggunakan Bluetooth dari aplikasi pada telefon pintar. Untuk membantu pelajar memahami lebih lanjut mengenai sistem kawalan kelajuan motor, aplikasi PC ringkas dibuat dalam projek ini dengan antara muka yang sesuai dan langkah-langkah untuk mendapatkan fungsi pemindahan (*transfer function*) telah diajar dan disediakan di dalam aplikasi tersebut. Sensor kelajuan inframerah (LM393) digunakan untuk mengesan kelajuan motor dan motor DC yang dilekatkan dengan roda dengan lubang berjarak. Sensor kelajuan menggunakan cakera dengan lubang (cakera pengekod) untuk menyekat pancaran inframerah, dengan itu dengan mengira berapa kali sensor pergi dari Rendah ke Tinggi, oleh itu, dapat mengira bilangan putaran untuk jangka waktu tertentu. ESP8266 adalah pengawal mikro utama yang digunakan untuk projek ini. Sebelum meneruskan projek ini, simulasi dilakukan agar hasilnya dapat dibandingkan antara hasil teori dan hasil sebenar.

DEDICATION

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LIST OF SYMBOLS

S	-	Second
A	-	Ampere
V	-	Voltage
L	-	Length



LIST OF ABBREVIATIONS

RAM	-	Random access memory
ROM	-	Read only memory
LED	-	Light emitting diode
GUI	-	Graphical user interface
AC	-	Alternating Current
DC	-	Direct Current
MCU	-	Microcontroller Unit



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CHAPTER 1

INTRODUCTION

1.1 Background

This project is for the development on the implementation function of IoT to control and observe the motor response for Online Learning purpose. The IoT or internet refers to the trillions of mobile datasets now connected to the web around the world, which collect and distribute all the information. (Steve, 2020) . If any physical gadget is connected to the internet to manage or transmit information, it can be converted into an IoT device. The smartphone app can turn on an IoT device, such as a motion sensor or an intelligent thermostat in the office or a connected engine. Some gigantic devices can be filled with many additional IoT-miniature units, such as a jet generator, now filled with dozens of sensors storing and accessing and address data to help make it work. On an even larger scale, smart cities programmes provide sensors to entire regions to help the citizens discover and deal with the environment. The term IoT applies primarily to devices that would normally not have an Internet connection and that can freely connect to a human network. Hence, this project has got the idea to implement IoT to control and observe the speed of a motor for studying purpose. A simple motor module will be construct with controllable speed. In this case, ESP8266 will be used to control the speed of the motor. Then, using suitable sensors such as accelerometers or speed sensors, the sensor will gather the speed of the motor to be sent by signal to an app to view the numbers accordingly to this project such as the speed of the motor and the values to make the transfer function of the motor speed. Any suitable software such as Visual Studio IDE or Eclipse IDE can be used to develop the Graphical

User Interface of the app. The performance of the motor will be analysed in this project. The app will also be able to control the motor speed by using PID controller method.

1.2 Problem Statement

As university students performed Online Distance Learning for 2 semesters already, there has been this one problem that the students have been facing and maybe have been faced by the lecturers too. The problem is student tend to take time to understand the lab session that involved motor speed in the subject Control II have been done because they have been using simulation only instead of seeing the motor to be run in front of their eyes. So, this project has the idea of creating an app that allows student to observe the transfer function that has been produced by the motor speed.

As this project will be implementing the function of IOT as it uses wireless connection to control and come out with the transfer function of the motor, this app can later be used and developed to function more widely to other application that requires wireless connectivity and controlling.

This project will develop an application with the suitable software such as Visual Studio IDE, Eclipse IDE that will be used to make the GUI to calculate the transfer function of the motor speed. To move and observe the motor, this project will be using ESP8266 and other suitable controlling software such as NodeMCU. This project also needs to find the best method to analysis the motor speed data to be sent to the app through wireless connections.

1.3 Project Objective

In this project, there are several objectives that will be achieved in this study:

- a) To develop a Speed Control System application using software for Online Learning purpose.
- b) To design the controller using ESP8266 and IoT software for Speed Control System.
- c) To analyse the effectiveness and accuracy of the Online Learning System.

1.4 Scope of Project

There are several limitations needed to be considered for this project:

- a) To detect the speed of the motor using speed sensor.
- b) The movement/speed of the motor will be controlled by ESP8266/NodeMCU.
- c) The values that have been calculated based on the transfer function will be for learning purpose.
- d) The use of BLYNK and use suitable GUI for the viewing of data from the motor speed data.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This section reviews and analyses the overall concept and theory for the development of motor speed control using IoT for Online Learning purpose in this project. This chapter's main objective is to explain past research and existing research and articles of this project. Moreover, this chapter also discusses about the theory and concept used to solve this project's problems. Articles, past research, journals, web search and case studies are the main sources of the information inside this chapter. These sources were selected based on the project scope that are similar to this project and the timeline for the articles/journals were from 2016 till now.

2.2 Review of Current Situation

The Malaysian Government Movement Control Order, often known as the MCO or PKP, is a cordon sanitaire imposed by Malaysia's federal government as a preventative measure in response to the COVID-19 epidemic in the community on March 18, 2020. The order was referred to as a "lockdown" or "partial lockdown" in regional and international media. Many people in the country have been affected by the MCO, including students at educational institutions. During those periods (early MCO), the Prime Minister instructed the Ministry of Education to conduct home-based study activities throughout MCO because learning institutes across the country were closed. Assessments and exams for a variety of national higher education courses were cancelled after some institutes were converted into temporary inspection and quarantine centres, and students' achievement assessments were

replaced with limitless evaluation grades. Hence, this is one of the purposes of the project is to be able to do the project realistically even though going through Online Learning.

2.2.1 Review of Learning Control System Through Online and Offline Learning

The COVID-19 has led to worldwide schools being shut down. Over 1.2 billion students are out of the classroom worldwide (Li and Lalani, 2020). As a result, education has dramatically shifted with the distinctive increase in e-learning, teaching on digital platforms and remotely. Research indicates that Online Learning has proved to increase the retention of information and take less time so that the changes caused by coronavirus may remain here. Engineering students especially to the technical engineering students suffers a bit because of this situation. As they used to carry out experiments and laboratory with hands on, now they have to do it online with simulations. Pandemic led to loss of education, delaying graduations, cancellation of internships and job losses. Some learning experiences may be lacking in the new generation of students who were absent from face-to-face instructions. For example, a generation of engineering students could do almost all their work and thus lack true hands-on skills.

2.3 Theory

Controls Systems can be found in unexpected places, unseen by the bare eyes. Control systems are used to manage the performance of equipment in a predictable and repeatable manner. They could be simple electronic or electrical devices or highly sophisticated computer-controlled systems.

A Control System's foundations include calibrating an error signal and then adjusting the system to achieve the intended course or result. The Control System is

insufficient to handle the disturbances if the system diverges too quickly and the control system is unable to change the course or outcome.

A cruise control in a car, chemical concentrations in drinking water, the speed of a conveyor belt in an industrial plant, and temperature control in a building are all examples of control systems.

Control systems are being used in home tasks, general manufacturing, the military, and almost every modern vehicle on the road. SCADA and Industrial Automation systems use a lot of control systems.

In Industrial Automation, control systems are used to control how equipment perform in real time. The controller (RTU, PLCS, DCS) feedback (error) signal is used in a closed-loop control system to adapt the control variable so that the mechanism is constantly operating to match the operational set point. A control-loop is a term used to describe the system described here. To fine-tune the system and keep it stable, the controller must consider an appropriate dynamic reaction.

The control-loop is said to be “out of control” if the controller is unable to progress to a stable condition (with minimal estimation)(Romig, Jaulin and Rauh, 2019). A single closed-loop control system may not be sufficient to stabilise a tremendously complicated process. When there is conservative complexity and the process is “adjusting quickly” in terms of time, cascaded control-loops can be used. Advanced Process Controllers, on the other hand, may be required for slow-moving processes such as distillation and bioreactors.

Control Systems Engineering is an engineering approach to understanding how automation devices can control a process and putting it into action. Process engineers create plants that perform in a specific way. The Process Engineer distributes the plant's operation and a Control Systems Engineer clarifies it. The Control Systems Engineer occasionally documents the functionality of how devices monitor signals, control the process, calibrate

performance, including the accumulation of statistical data, and connect data to a host system or peer control devices. Control Systems Engineering necessitates a diverse set of skills, including electrical, mechanical, and computer software system design.

A control system is a system that controls the output to produce the desired response. The simple block diagram of a control system is shown in the diagram below.



Figure 2.1 Block Diagram of a Control System

A single block represents the control system in this diagram. The control system was given this name because the output is controlled by variable input. This research going to do something with this input.

2.3.1 Motor Speed Control System

A variety of motors are utilised for a variety of purposes in the environment, ranging from household appliances to machine tools in industrial machinery. In many businesses, the electric motor is currently a required and indispensable source of energy. These motors have a wide range of functions and efficiency requirements. When it comes to the speed control area of the motor market, stepper and servo motors use a pulse train to control their speed, whereas brushless DC motors and induction motors need an external resistor. DC voltage can also be used to control it (Chaithanakulwat, 2020).

A speed control circuit's output control method can be roughly divided into two groups: inverter control and phase control, which form the output groups depicted in Figure 2.2.