SIMULATION DESIGN ON WATER FLOW CONTROL SYSTEM

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This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Manufacturing Engineering (Robotics & Automation) (Hons.)

by

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APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering (Robotic & Automation) (Hons.). The member of the supervisory is as follow:

……

Project Supervisor

(Mr. Mohd Nazmin Bin Maslan)

ABSTRAK

Projek ini adalah simulasi untuk menunjukkan konsep asas sistem kawalan aliran air. Fokus utama projek ini adalah untuk mewujudkan Antara Muka Pengguna (GUI) secara grafik dengan simulasi menggunakan perisian Visual Basic. Projek ini dimulakan dengan melakukan kajian dan penyelidikan daripada jurnal, internet atau buku untuk mendapatkan pengetahuan yang berkaitan dengan projek ini. Projek ini berjalan dengan lancar selagi ia mengikuti perancangan cartaaliran projek. Simulasi ini adalah kawalan untuk dua pengawal adalah gelung terbuka dan gelung tertutup. Dalam pengawal gelung terbuka, ia menunjukkan pergerakan air dari takungan ke tangki dengan mengawal injap beban. Pengawal gelung tertutup menunjukkan pergerakan air yang dikawalan oleh sensor aliran. Apabila simulasi bermula, paparan maklumat akan ditunjukkan di bahagian penerangan. Simulasi ini dibina untuk mendapatkan pemahaman pelajar mengenai konsep asas sistem kawalan. Pengesahan daripada pelajar selepas menggunakan simulasi ini adalah sangat penting sebagai pengesahan kepada projek ini. Pengesahan tersebut dilakukan melalui kaji selidik dalam talian. Hasil daripada kaji selidik tersebut, beberapa cadangan untuk penambahbaikan yang telah diberikan untuk meningkatkan mutu dan membenarkan projek ini untuk menjadi lebih baik dan berguna untuk pelajar.

ABSTRACT

This project is the simulation show the basic concept of water flow control system. The main focus of this project is to create the Graphical User Interface (GUI) with simulations using the Visual Basic software. Before starting the project, it is important to study and do a research from journal, internet or a book to get knowledge about the project. The project is conducted in smoothly as long as follows the project flow diagram planned. This simulation is controlled for two controllers are open loop and closed loop. In the open loop controller, it is shown the water movement from the reservoir to the tank by controlling the loading valve. The closed loop controller shows the water movement is controlled by the flow sensor. When the simulation starts, the information will display in the description part. The simulation is built to gain understanding about the basic concept of a control system from the student. The result is gained from validation from a student after used this simulation. Some ideas for future works were suggested in this report to improve and allow this project to be more useful to students.

DEDICATION

This is for my parent that has been the greatest and best supporter and helper for to complete this project and my degree.

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I would like to thank Encik Mohd Nazmin bin Maslan for being a good supervisor of the project. His extravagant guide, sentient criticisms and patient support the writing of the report in inestimable ways. His support of the project was greatly needed and deeply be pleased about.

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BASIC	-	Beginners All-Purpose Symbolic Instruction Code
FKP	-	Fakulti Kejuruteraan Pembuatan
GUI	-	Grapichal User Interface
IDE	-	Integrated Development Environment
PC	-	Personal Computer
PID	-	Proportional, Integral, Derivative
PSM	-	Projek Sarjana Muda
VB	-	Visual Basic
VB6	-	Visual Basic 6

CHAPTER 1
INTRODUCTION

This chapter covers on the introduction, problem statement, objective and scope of the research study. The introduction discusses the overview about the project that will be conducted. The problem needs to be found before starting the project is identified in the problem statement section. Lastly, the objective is about the target to be achieved with this project meanwhile the scope is project limitation of the project.

1.1 Overview of the Project

At the university, the application of the water flow control system is usually used in water flow and level control system. It is can be used in learning the basic control system so that the student able to know about the connection between water flow control in process control system. This project is about the simulation design on water flow control system. It uses Visual Basic (VB) to show the water movement and the Graphical User Interface (GUI) as the monitoring system interface using the Visual Basic 6 (VB6) software.

In water flow and level control, it has the process control that is the operational control in the internal characteristic. It is usually in the fluid process as a component device to control the fluid flows and need to control the continuous flow of fluid through a large set of following operations. The process is defined as a set of operation that perform

physical or a series transformation in which fluid is converted into a more useful state. A process forms part of a set of production or processing functions complete in and by means of process hardware such as tanks, pipes, fittings, measuring device and others. The performance of an industrial process is influenced by internal and external condition called process variables such as flow, level, temperature, dimension, speed, volume and others. The control of the process variable is archived by the control equipment and the controlling them to the desire level called set points. Figure 1.1 shows the process control variables where the manipulated variables determine the control that state of the system the examples flow rate. The flow rates entering or leaving the process so the control will be changed. The controlled variable there is an associated manipulated variable; it is maintained despite any disturbance.

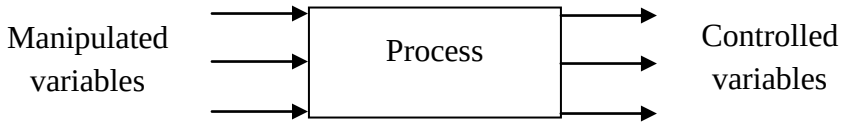

Figure 1.1: Process control variable (Singh, S.K, 2012)

Visual Basic was developed by Microsoft to extend the capability of BASIC by adding objects and programming like buttons, menus, and other elements of the GUI. VB can also be used within other Microsoft software to program small routine. Programs are commonly referred to as software. Software is essential to a computer because it controls everything the computer does. All of the software is used to make the computers useful is created by individuals working as programmers or software developers. A programmer, or software developer, is a person with the training and skills necessary to design, create, and test computer programs.

1.2 Problem Statement

The problem statement of the project needs to be identified in order to perform the project. Through meticulous observation, it is found out that engineering student lack of a learning kit that can aid them to understand the basic process control system. This simulation is developing as guidance on how to manipulate the process control system using the water level and flow control system. The programming is required to operate the simulation animation using VB6 and to integrate the GUI and animation with their programming lines.

1.3 Objective

A project must have the objective to ensure the project can achieve the target and Gantt chart. The main objective of this project is to create the Graphical User Interface (GUI) with simulations using the Visual Basic software. The other objectives that support it are:

1. To demonstrate the systems in water flow system; open-loop control system and closed-loop control system.
2. To control the water flow in the system for the required process control.

1.4 Scope

The scope of the project is to determine the specified project limitation. The scope of this project is design a basic simulation for water flow control system and Graphical User Interface (GUI). The simulation is to control the water flow simulation moving

created in visual basic 6. This simulation system allows student understanding about how to control the water flow control system.

1.5 Summary

This chapter briefly explains about the project that will be conducted. It also states the motivation the project must be conducted with the problems that crop up with mentioning also the project limitation.

CHAPTER 2

LITERATURE REVIEW

The literature review is done to gain the information on the project that is being carried. Firstly the explanation of water flow followed by process control fundamental, component are related to flow control of fluid, fluid flow fundamental and GUI monitoring system that allows to control the tank.

2.1 Fluid Flow Control System

Fluid level and flow control system is usually found in the chemical engineering sector. It is important to them to know and understand how to control flow and level the fluid in the rig. Fluid flow and level control system is the control fluid in the tank with several process control algorithms. This project focuses on the concept experimental rig as a simulation platform. That can be used in the university to show and aid the student to understand more in the basic control system. There are many experimental rigs exist in the market which includes a couple tank experimental level and flow control rig.

In fluid flow control system, the water must be controlled continuously and accurately during treatment. Various methods of water flow control can be used. The valves can be the set to allow specific flows of water through a treatment plant either an inlet or the outlet. If the regulating valve is fitted, it will require regular adjustment to ensure that constant flow maintains.

Flow measurement gives an indication of the efficiency of a process. Water flow rate is the important measurement in fluid flow. The water flow is the amount of water passing through a pipe within a given period of time. The flow in pipes under pressure or in open channels under the force of gravity, the volume of water flowing past any given point in the pipe or channel per unit time is called the flow rate or discharge (Q). The water flow rate can calculate using equation velocity multiply cross section vector area to get the volume of fluid passing given station per unit time (Esposito, A , 2009).

$$Q = v \cdot A$$

2.2 Process Control System

Process control is the control of a physical variable within a particular system. By controlling a particular physical variable, it controls the entire process. Process control allows manufacturer to obtain a higher level of quality control and to conform to stricter safety requirement, creating better products and protecting the safety of workers and consumers. Manufactures need to control the manufacturing environment in order to produce uniform product. Many chemical reactions are dependent on very specific reaction conditions. For safety reasons, manufacturers often need to control physical variable of processes (Singh, S.K, 2012).

The benefit of process control system has increased production level or in other word productivity, reduces the raw material costs; improve product quality and uniformity of the manufactured goods and services, increased efficiency, improved profitability, increased safety in operation environmental condition and comfort and convenience of operation. There are four levels of process control systems. The level process is shown in Figure 2.1 below (Singh, S.K, 2012).

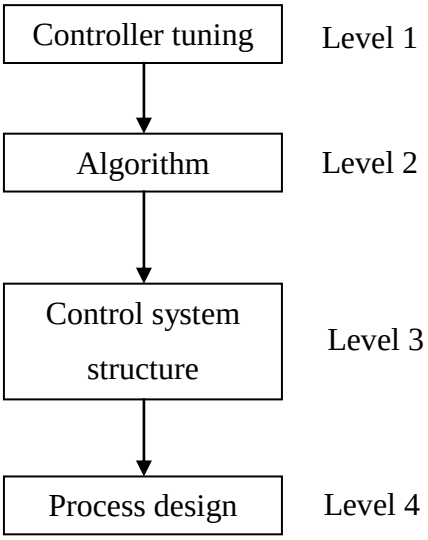

Figure 2.1: Process control system level (Singh, S.K, 2012).

In level 1, it is controlled tuning to determining the values of controller tuning constants that give the best control. For level 2 is algorithms, it is deciding the type of controller to be used in example P, PI, PID or others. The level 3 is a control system structure, it is determining what to control and manipulate and how to match one controlled variable with one manipulated variable or in other word pairing. The last level is level 4 for process design; it is developing a process flow sheet and using the parameters that produce an easily controllable plant (Singh, S.K, 2012).