FUZZY LOGIC LIGHT TRACKER

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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Dedicated to:

My beloved parents and friends for giving me unconditional love and care……

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ABSTRACT

Nowadays, people are chasing for technology. Technology makes people life perfect and simple. In control designing, the conventional system used is so complicated. To design, a person has to derive the mathematical calculation, simplify using control theorem, and derive the model. Another simpler method in designing is fuzzy logic. Fuzzy logic is a powerful tool in problem solving methodology that can be applied in embedded control and information processing. It is a simple way to draw the definite conclusions from vague, ambiguous or imprecise information. In a sense, fuzzy logic applies the human decision making with the ability to work from approximate data and find the precise solutions.Light tracker meanwhile is a concept where a movement of object is based on the light. Light will act as the main part in moving the object or specifically the robot. When the object receives the light, it will move base on the programming requirement. The light intensity is given account here based on the distance of the robot and source.In this project, it is mainly to build a light tracker that uses the concept of fuzzy logic. The sensor is used as the input to trigger the function of the motor to make movement.

ABSTRAK

Pada zaman kini, manusia mengejar teknologi. Teknologi menjadikan hidup semakin sempurna dan menyenangkan. Dalam rekaan kawalan, sistem konvensional yang digunakan adalah sangat rumit. Untuk merekacipta, seseorang mestilah mendapatkan pengiraan matematiknya, memudahkan dengan teori kawalan, dan mendapatkan model sempurnanya. Satu lagi cara alternatif yang boleh diaplikasi adalah dengan merekacipta menggunakan logic kabur**.** Logik kabur adalah satu kaedah yang berkesan dalam menyelesaikan masalah yang boleh di aplikasikan dalam kawalan dan pemprosesan maklumat. Ianya adalah antara cara mudah untuk mendapatkan keluaran daripada masukan yang tidak tepat. Dalam erti kata lain, logik kabur adalah aplikasi dari cara manusia memikirkan penyelesaian dengan menggunakan data –data yang tidak berapa tepat tetapi mampu mencapai penyelesaian yang sempurna. Pengesan cahaya pula adalah satu konsep dimana pergerakan objek adalah berdasarkan pada lampu. Lampu akan bertindak sebagai bahan utama dalam pergerakan objek atau spesifiknya robot. Apabila objek menerima cahaya, ianya akan bergerak berdasarkan program yang telah diaturkan kepadanya. Kepekaan cahaya diberi tumpuan berdasarkan jarak antara robot dan sumber lampu. Dalam projek ini, ia adalah bertujuan untuk membina sebuah pengesan lampu, yang menggunakan konsep kabur. Pengesan digunakan sebagai masukan untuk menggerakkan motor supaya model prototaip dapat bergerak.

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DC	-	Direct Current
DOS	-	Disk Operating System
FBD	-	Function Block Diagram
IL	-	Instruction List
PIC	-	Programmable Integrated Circuit
PSM	-	Projek Sarjana Muda
SFC	-	Sequential Function Charts
ST	-	Structured Text

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CHAPTER 1

INTRODUCTION TO PROJECT

1.1 Introduction

Fuzzy logic is a powerful tool in problem solving methodology that can be applied in embedded control and information processing. It is a simple way to draw the definite conclusion from vague, ambiguous or imprecise information. In a sense, fuzzy logic applies the human decision making with the ability to work from approximate data and find the precise solutions.

Fuzzy logic is gaining increasing acceptance for this past few years. Starting from 1965, when Lofti Zadah, a professor at University of California-Berkeley, published a paper on fuzzy logic, it has been both hyped and criticized. Now, there are over thousands commercially available products using fuzzy logic, ranging from

washing machine to high speed train. Among the benefits gained from fuzzy logic applications are simplicity, performance, cost and productivity.

Fuzzy logic method is much easier than the classical logic which requires a deep understanding of the system, exact equation and precise numerical values. Fuzzy logic attempts to mimic the way people applied logics in grouping and featured determination. In this light tracker, the fuzzy logic will be used to move the motor based on the intensity of the light received by the sensor. This project can be used for the movement of robotic. It also can be applied in mechanical system in the form of conveyer.

1.2 Objectives

Following are the objectives set in this project:

- To learn how fuzzy logic functions in robotic application
- To learn how dc motor functions when programmed using fuzzy logic
- To learn the function of PIC microcontroller in robotic application
- To learn the function of sensor especially photodiode that controlled based on the light intensity.
- To develop a motor tracker based on the application of fuzzy logic.

1.3 Problem Statement

At the moment, there is no fuzzy logic application in robotics. The robotic movements that already exist use conventional system which the model will have the feedback that acts as the closed loop system. The problem that always arises is the system must have the accurate and precise value to achieve the required output. It differs from the fuzzy logic that it still can achieve a precise output although the input is fuzzy. Besides that, the existing conveyer system uses mechanical system to make the movement. This light tracker using fuzzy logic gives better control movement of the conveyer system and the possibility for the system to breakdown is much less compared to the conventional system.

The normal light tracker uses programming language such as C++ and visual basic. By using fuzzy logic, the programming language is easier and has the character of artificial intelligence. Light tracker is much more convenient to be applied in industries. The easy movement to the light source makes it available to move around with the condition of having light source at the destination. It is also applicable in heavy industries where there is more mechanical movement. This mechanical movement such as conveyer and robotic arm are hard to set once there is error. By using this tracker, the error can be minimized as the tracker needs to follow the light source.

1.3 Scope

The scopes of the project are as follow:

- The tracker is designed based on the fuzzy logic. The fuzzy logic will control the motor rotation by using the light sensor. The sensor that receives more light will trigger the motor circuit towards the light until both photo cell sensors have equal light source.
- This project will use the PIC microcontroller and DC motor.
- Use of PIC Basic compiler to interface the programmed data with the photocell sensor and DC motor

1.5 Expected Outcome

The expected outcome of this project is the tracker should be able to follow the light source based on the intensity of the light that falls on the surface of the photocell sensor. The gearbox of the light tracker will rotate the sensor array towards the light source. In complete darkness or when there are two even light sources, the motor will stop functioning. The motor should be applicable in robotics and industries.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction to Fuzzy Logic

Most of the time, when confronted with a control problem for a complicated physical process, an engineer generally will follow a relatively systematic design procedure. For example, lets take a control problem in an automobile “cruise control” that provides automobile with the capability of regulating its own speed at a driver-specified set-point (e.g., 100 kmh). Among the solution that can be considered is by adding an electronic controller that can sense the speed of the vehicle via the speedometer and actuate the throttle position to regulate the vehicle speed as close as

possible to the driver-specified value. The speed must be accurate even there are obstacles like head winds or variation in number of passengers. Based on the understanding, an engineer will solve the problem by doing the following:

- Developing a model of the automobile dynamics (which may model vehicle and power train dynamics, tire and suspension dynamics, the effect of road grade variations, etc.).
- Using the mathematical model, or a simplified version of it, to design a controller (e.g., via a linear model, develop a linear controller with techniques from classical control).
- Using the mathematical model of the closed-loop system and mathematical or simulation-based analysis to study its performance (possibly leading to redesign).
- Implementing the controller via, for example, a microprocessor, and evaluating the performance of the closed-loop system (again, possibly leading to redesign).

Based on the example shown of this conventional system design, it's a very accurate system. But to achieve the solution, it involves a very good understanding of the problem .The computational of the system is very complex and it's hard to maintain the system.

Another approach on solving this kind of problem is by using the concept of fuzzy. From the Oxford dictionary, fuzzy is defined as blurred. Fuzziness is a deterministic uncertainty where it is connected with the degree to which events occurred rather than the probability of their occurrence. For example, the degree to which a person is young is a fuzzy event rather than a random event: classification of young.