MOVING TRAIN-CAR TRAFFIC CONTROLLER

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MAY 2008

“I hereby declared that I have read through this report and found that is has comply the partial fulfillment for awarding the degree of Bachelor of Electrical Engineering (Control, Instrumentation & Automation)

Signature : ....

Supervisor's Name: Mr. MOHD ARIFF B MAT HANAFIAH

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This Report Is Submitted In Partial Fulfillment of Requirements For
The Degree of Bachelor in Electrical Engineering
(Control, Instrumentation & Automation)

Faculty of Electrical Engineering
Universiti Teknikal Malaysia Melaka (UTeM)

MAY 2008

"I hereby declare that this report is a result of my own work except for the excerpts that have been cited clearly in the references"

Signature : ....

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Date : MAY 2008

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Student : MOHD HAYATULNIZAM B MOHD NASIR

Date : MAY 2008

Specially dedicated to my family, friends,

Lecturers and FKE

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Praise to Allah S.W.T, The All Mighty that give me the strength to finish and complete this PSM on time. Praise to Allah S.W.T for without His blessing this report would not have been completed. First of all, I would like to thanks to my parent that who had been helping, motivating, and supporting me from the very beginning to the end in order to complete this report.

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Thank you!!

ABSTRACT

This system is intelligent systems that automatically operate using PLC, limit switches, relay and control car. Limit switches (sensor) is an input that fixed at the road and will transmit the signal to PLC while relay and control car as an output for the PLC. When PLC gets a signal, it wills generates an output and transmit to the output devices that are crossbar, traffic light and cars. Generally, this system contains a roadway, road train, traffic light and cross bar.

ABSTRAK

Sistem ini adalah merupakan sistem bijak yang beroperasi secara automatik dengan penggunaan asas PLC, suis, relay dan kereta kawalan. Suis sesentuh adalah sebagai masukan kepada PLC sementara relay dan kereta kawalan adalah keluaran bagi PLC. Sensor yang di tempatkan secara tetap di laluan kereta dan keretapi akan menghantar isyarat kepada PLC. Apabila PLC mendapat isyarat berkenaan, ia akan mengeluarkan isyarat keluaran dan mengaktifkan peralatan keluarannya iaitu palang, lampu isyarat, dan kereta. Secara umumnya, sistem ini mempunyai jalan raya, landasan keretapi dan palang.

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1.1 DEFINITION

A control system is a device or set of devices to manage, command, direct or regulate the behaviour of other devices or systems. This project is categorized in on/off control. In most applications of on-off feedback control, some consideration needs to be given to other costs. Therefore, practical on-off control systems are designed to include hysteresis, usually in the form of a deadband, a region around the setpoint value in which no control action occurs. The width of deadband may be adjustable or programmable. Larger more complex systems can be controlled by a Distributed Control System (DCS) or SCADA system.

1.1.2 GENERAL DESCRIPTION (PROJECT OVERVIEW)

This project is the integration between programmer logic controllers (PLC), and sensors. This project is divided into two stations, which are mechanical part and electrical part. The mechanical parts are consisting of mechanical drawing, measuring, fabrication and assembly. The electrical parts are consisting of electrical drawing, electrical wiring, testing, troubleshooting and programming. General overview of the controller system is as shown in Figure 1 below.

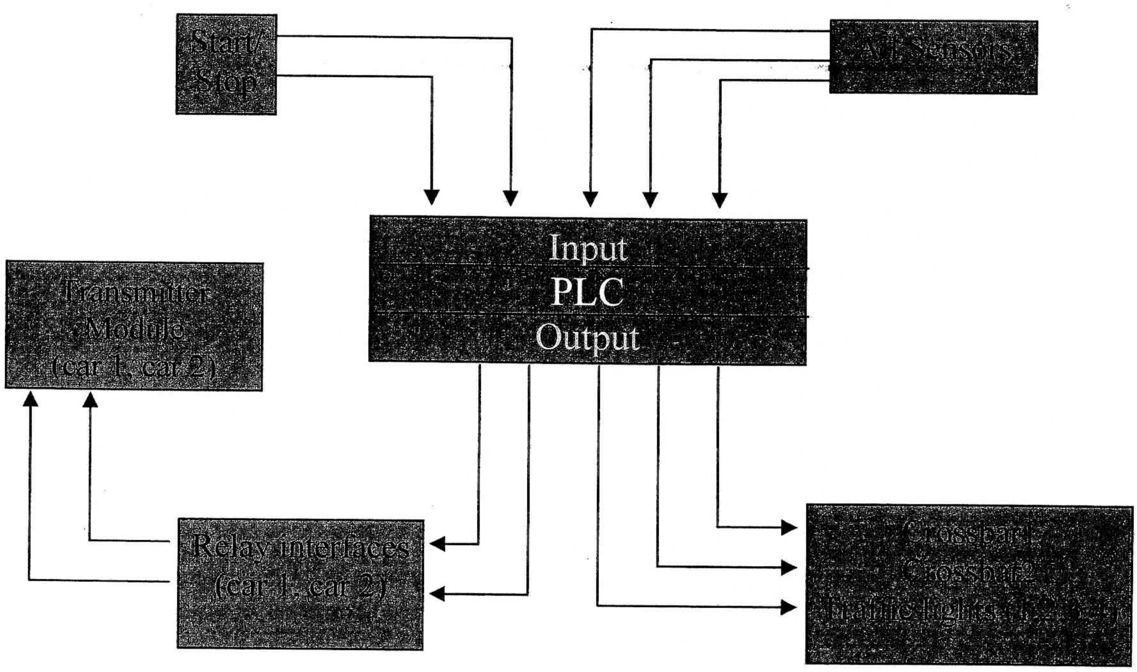

Figure 1: Controller System

1.1.3 DRAWING AND OPERATIONS

The train is always operated and if it nears the road, the sensor detected and gives a signal to PLC to automatically close the crossbar. The cars also always move until it gets a signal to stop movement. The car only stopped when the traffics light turn to red and when the crossbar closes. Then the cars continue moving when the traffic light turns to green or the crossbar open.

For the traffic lights operations, the sensor detect the car when it arrive near by the cross road. When the sensor contact, it gave a signal to the PLC, so that the car can stopped if the traffic light turns to red. The output from PLC makes a contact to the relay interface and gives a signal to wireless control for car. Once the wireless is activated or ON, it gave a signal to the car to make an operation.

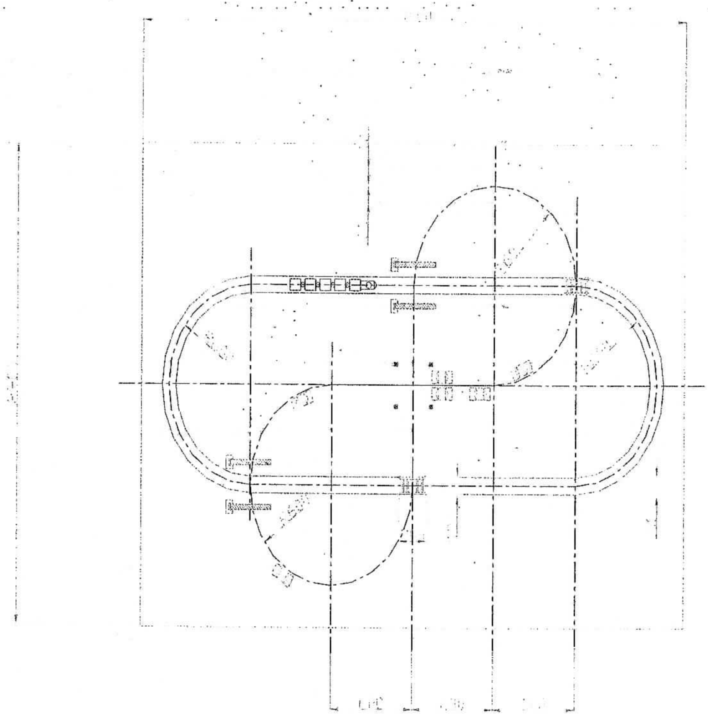

Figure 2: Roadway, road train, traffic light and crossbar drawing

1.2 PROBLEM STATEMENTS

- Make the car and train move as their programmed.
- Designing the track for train and car.
- Build the best and suitable PLC program.
- Control the movement of train and car.
- Wireless car transmitter and receiver.
- A constant speed of the car.

1.3 PROJECT OBJECTIVE

The project is aimed to meet the following objectives:

- To design a roadway system that can give signals to the car for operating using a PLC.
- To design a wireless control car using a relay interface that can get signals from the roadway.
- To design an automatic crossbar using pneumatic system when the train passed the roadway.
- To design an intelligent traffic light.
-

1.4 PROJECT SCOPE

The scope of this project is to design a traffic simulator consists of PLC and limit switch as a sensor. The type of the PLC is OMRON with relay output. The sensor is using limit switch while the crossbar is using a cylinder. Indicator display will be use as a traffic light. Wireless controller as a transmitter device will transmit data to the car. The car receives data and move.

This project is divided into 5 major parts, which are track, train, car, traffic light/crossbar and counting display as shown in Figure 3.

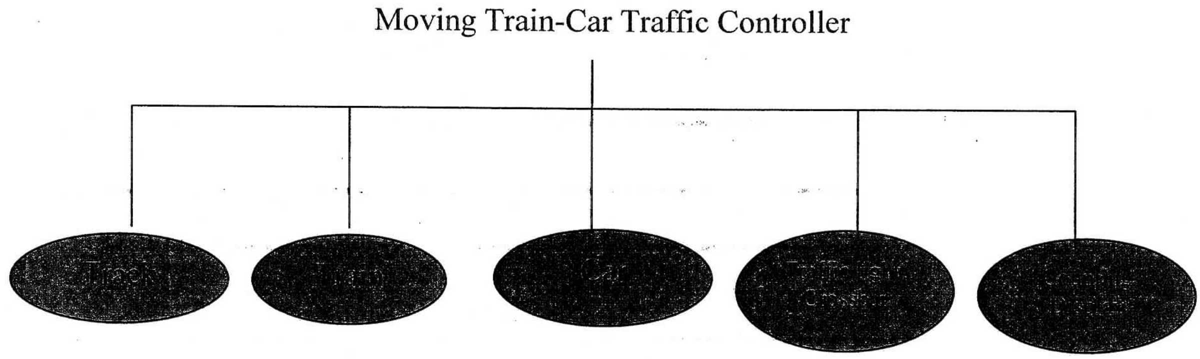

Figure 3: 5 major parts of the project

1.6 PROBLEM SOLVING

The detail design includes specifying the materials, the sizes, the type of motor, the size of the hydraulic pump and cylinders, where the attachment and assembly holes should be drilled, the size of the holes, etc. It requires a lot of skills to specify this myriad of items correctly if the design is to ``go together" in a satisfactory manner. Many alternatives and options should be considered during this part of the engineering design processes.

Design problem solving is a complex activity involving a number of subtasks and a number of alternative methods potentially available for each subtask. One way to conduct a task analysis is to develop a task structure that lays out the relation between a task, applicable methods for it, the knowledge requirements for the methods, and the subtasks set up by them.

For sufficiently complex versions of the design problem, a common theme emerges for design as a process. It involves mappings from the space of design specifications to the space.

The design problem is specified by (1) a set of functions to be delivered by an artifact and a set of constraints to be satisfied and (2) a technology, that is, a repertoire of components assumed to be available and a vocabulary of relations between components. The constraints might pertain to the design parameters themselves, the process of making the artifact, or the design process.

The solution to the design problem consists of a complete specification of a set of components and their relations that together describe an artifact that delivers the functions and satisfies the constraints. The solution is expected to satisfy a set of implicit criteria as well.

2.0 LITERATURE REVIEW

2.1 OVERVIEW

This chapter discussed about source or article that related to the project. There have many sources or researches done before and from there, details about this project are known and can understand briefly about the automation.

2.2 FIRST REVIEW: PROGRAMMABLE LOGIC CONTROLLER (PLC)

In the late 1960's PLC's were first introduced. The primary reason for designing such a device was eliminating the substantial cost involved in replacing the complicated relay based machine control systems. Bedford Associates (Bedford, MA) proposed something called a Modular Digital Controller (MODICON) to a major US car manufacturer. Other companies at the time proposed computer based schemes, one of which was based upon the PDP-8. The MODICON 084 brought the world's first PLC into commercial production.

The 80's saw an attempt to standarize communications with General Motor's manufacturing automation protocol(MAP). It was also a time for reducing the size of the PLC and making them software programmable through symbolic programming on personal computers instead of dedicated programming terminals or handheld programmers. Today the world's smallest PLC is about the size of a single control relay.

The 90's have seen a gradual reduction in the introduction of new protocols, and the modernization of the physical layers of some of the more popular protocols that survived the 1980's. The latest standard (IEC 1131-3) has tried to merge plc programming languages under one international standard. We now have PLC's that are programmable in function block diagrams, instruction lists, C and structured text all at the same time, PC's are also being used to replace PLC's in some applications. The original company who commissioned the MODICON 084 has actually switched to a PC based control system.

2.2.1 ADVANTAGES OF PLC

PLCs have been gaining popularity on the factory floor and will probably remain predominant for some time to come. Most of this is because of the advantages they offer.

- ❖ Cost effective for controlling complex systems.
- ❖ Flexible and can be reapplied to control other systems quickly and easily.
- ❖ Computational abilities allow more sophisticated control.
- ❖ Trouble shooting aids make programming easier and reduce downtime.
- ❖ Reliable components make these likely to operate for years before failure.

2.2.2 WHAT ARE PLC AND HOW DO THEY WORK

PLCs are often defined as miniature industrial computers that contain hardware and software used to perform control functions. A PLC consists of two basic sections: the central processing unit (CPU) and the input/output interface system. The CPU, which controls all PLC activity, can further be broken down into the processor and memory system. The input/output system is physically connected to field devices (e.g., switches, sensors, etc.) and provides the interface between the CPU and the information providers (inputs) and controllable devices (outputs).

To operate, the CPU "reads" input data from connected field devices through the use of its input interfaces, and then "executes" or performs the control program that has been stored in its memory system. Programs are typically created in ladder logic, a language that closely resembles a relay-based wiring schematic, and are entered into the CPU's memory prior to operation. Finally, based on the program, the PLC "writes" or updates output devices via the output interfaces.
This process, also known as scanning, typically continues in the same sequence without interruption, and changes only when a change is made to the control program.

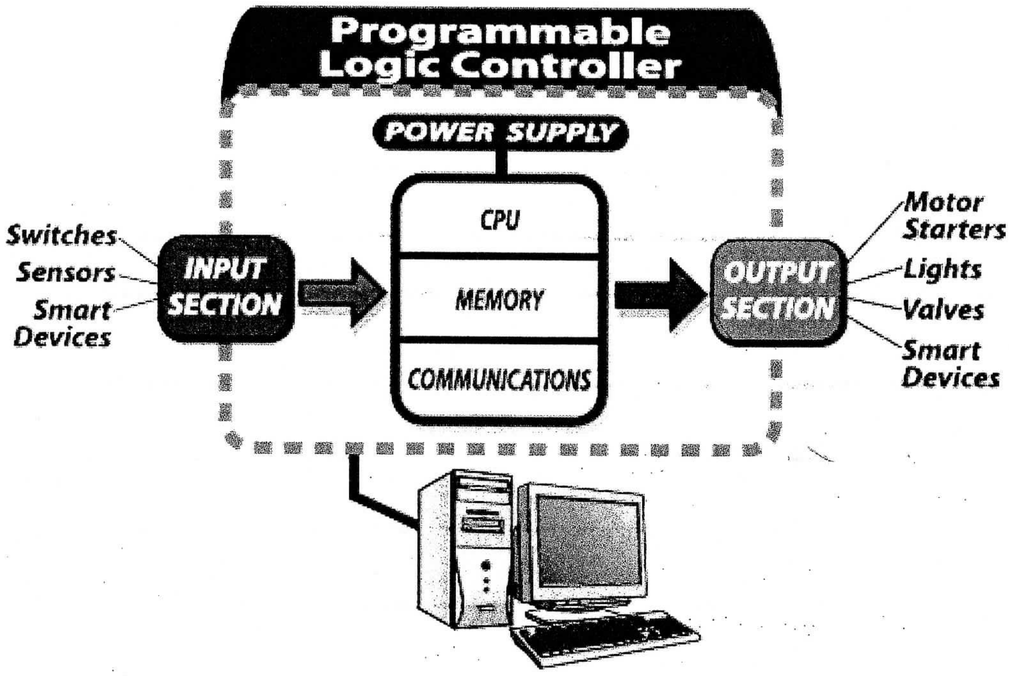

Figure 4: Flows of PLC's input and output section

2.2.3 DISCRETE APPLICATION

PLCs are often used to control machines or processes that are sequential in nature, using "discrete" inputs and outputs that have defined states. For example, if a limit switch detects the presence of an object, it provides an "ON" signal to the PLC; if no object is detected, it provides an "OFF" signal. The machine or device typically performs actions based on time or events in a pre-defined order. The expected sequence is typically interrupted only when an abnormal condition occurs.

2.2.4 PROCESS CONTROL APPLICATIONS

PLCs can also control continuous processes that use analog I/O. For example, a temperature sensor may provide a variable signal, such as 0-10 volts, based on the measurement of an actual temperature. The PLC program monitors the sensed values continuously and operates devices that may also be analog in nature. This could include setting the position of a valve between 0-100% open, or controlling the speed of a motor. Continuous applications are so called because they typically have no defined start or end once they are initiated; they maintain a process in a "steady" operating state.

2.2.5 TODAY'S PLC

As PLC technology has advanced, so have programming languages and communications capabilities, along with many other important features. Today's PLCs offer faster scan times, space efficient high density input/output systems, and special interfaces to allow non-traditional devices to be attached directly to the PLC. Not only can they communicate with other control systems, they can also perform reporting functions and diagnose their own failures, as well as the failure of a machine or process.

Size is typically used to categorize today's PLC, and is often an indication of the features and types of applications it will accommodate. Small, non-modular PLCs (also known as fixed I/O PLCs) generally have less memory and accommodate a small number of inputs and outputs in fixed configurations. Modular PLCs have bases or racks that allow installation of multiple I/O modules, and will accommodate more complex applications.

2.2.6 CHOOSING THE RIGHT PLC

Choosing the most effective PLC for the application depends on a number of factors. To begin the selection process, a drawing of the machine or process is a good start. This can help identify field devices and physical requirements for hardware locations. From the drawing, how many analog and/or discrete devices have are determined.