DEVELOPMENT OF AUTOMATIC WATER PUMP CONTROL SYSTEM

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18 NOVEMBER 2005

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Tarikh : 17 NOVEMBER 2005

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

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ABSTRACT

The whole concept of this project is to build an automatic water pump control system. The construction would be based on the adapting idea from the similar system with fully machine which are used in Lafarge Malayan Cement. This control system will be targeted for the small and medium industries while marketing it with cheaper cost. Basically, the proposed system will be integrated with mechanical part, electronic units and electrical unit to make it as one control system. The inclusive of the software program to control the performance of the water pump. As a result the system would be complex free as the PLC replaces the necessary sequential relay circuit for the motor control. The operation of the system may not suite all the industries because some industry not using water to their process and it may need some adjustment. This adjustment can be overcome according to the requirement wanted by doing some editing on the system. The ac single phase motor used to bring the water. This motor is incapable of pulling the water when timer activate and motor run while the operation of the motor is terminated. This is due to the high torque it delivers while rotating. A high motor would be more convenient to bring or pull the water constantly.

ABSTRAK

Konsep utama projek Sarjana Muda adalah cadangan untuk pembuatan pam air yang berkebolehan berfungsi secara automatik. Pembuatan sistem ini adalah hasil daripada sebuah sistem yang sedia ada di kilang Lafarge Malayan Cement dan di pasaran. Sistem ini disarankan untuk kegunaan industri kecil dan sederhana dengan penawaran dengan harga yang minimum. Keseluruhan sistem ini merangkumi bahagian mekanikal, unit elektronik dan juga bahagian elektrikal. Kemasukan perisian dalam sistem ini dapat mengawal proses yang hendak dilakukan. Di samping itu juga kompleksiti dapat dikurangkan dari segi pembinaan. Pengoperasian sistem ini tidak begitu sesuai kepada industri-industri yang tidak menggunakan air dalam pemprosesan. Penggunaan motor 240V satu fasa tidak begitu jitu apabila pemasa diaktifkan dan arus mengalir walaupun tidak ada beban dan kuasa yang dilesapkan adalah rendah. Maka penggunaan motor yang tepat dengan kehendak industri perlu dipertimbangkan dalam projek ini.

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CHAPTER 1

INTRODUCTION

A "system" comprises a complex combination of resources (in the form of human beings, materials, equipment, software, facilities, data, information, services, etc.) integrated in such manner to fulfill a designated need. A system is developed to accomplish a specific function, or a series of functions, and maybe classified as a natural system, human-made system, physical system, conceptual system, closed loop system, static system, and dynamic system and so on.

The system in general addresses to identify the need for and the basic requirements for initially bringing systems into being and for later evaluating systems in terms of their effectiveness in a user's environment. In fact in recent years and for many systems, there has been an imbalance between the cost side of the spectrum and the effectiveness side. Many systems have grown in complexity, and although there has been an increase in emphasis in some performance factors, the resultant reliability and quality have been decreasing. At the same time, the overall long time cost has been increasing. Thus, there is a need to provide a proper balance in the development of system in the future, as any specific design decision will have an impact on both sides of the balance and the interaction effect can significant.

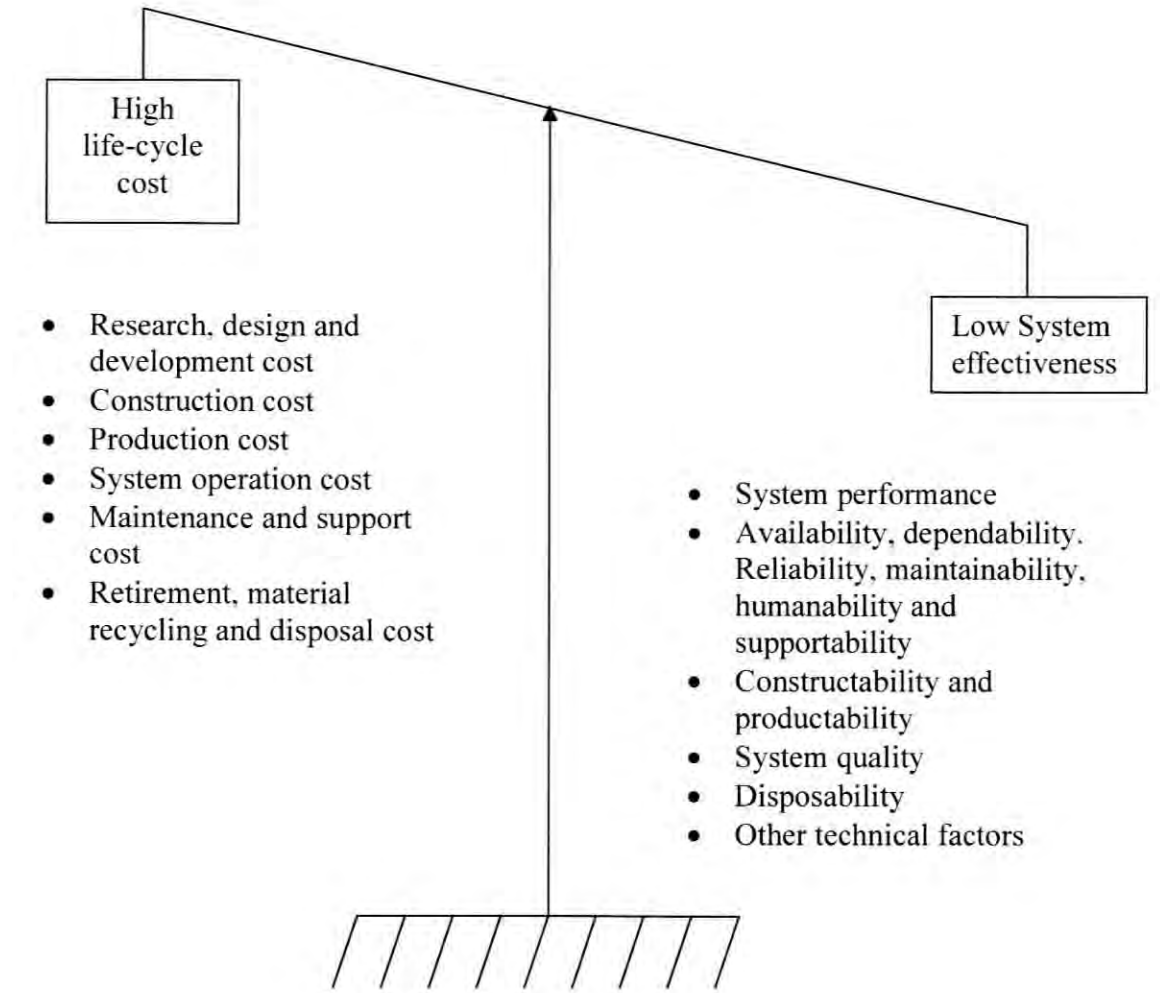

Figure 1.1: The imbalance between system cost and effectiveness factors

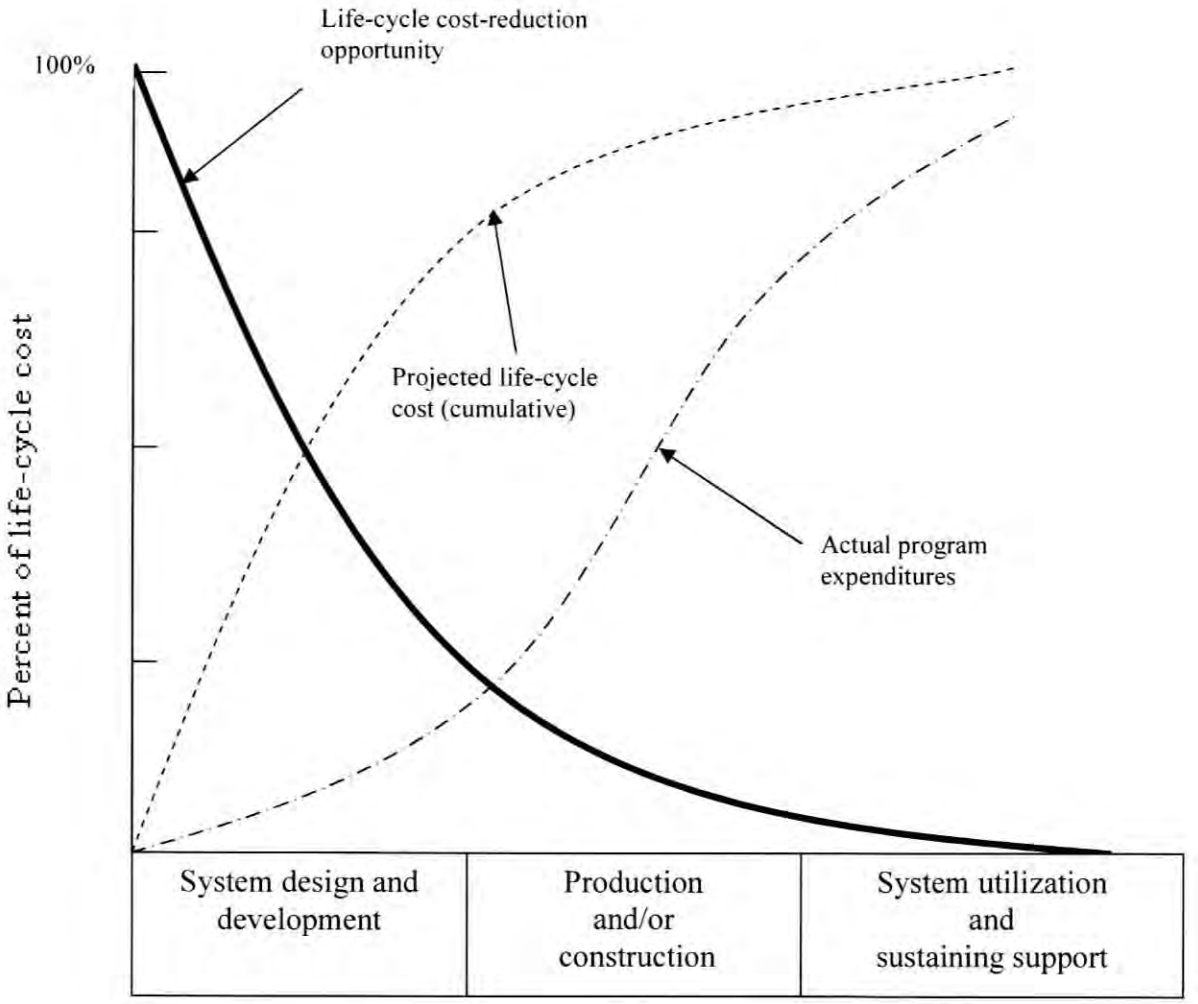

Figure 1.2: Commitment of life-cycle cost

A highly disciplined approach must be pursued in the design and the development of new system, with the objective providing the customer (user) with a quality system that is cost-effective, considering the proper balance among the factors identified in Figure 1.2. In addition, there must be more emphasis on systems from a life cycle perspective, which must be established from the beginning, as illustrated in Figure 1.2 above.

CHAPTER 2

THEORETICAL BACKGROUND

There are many types of water pump available on the world market. One type of water pump method may fit certain applications better than others. Conversely, some water pump methods are not suited for some applications at all and will result in wasted investment. It is therefore important that water pump supplier can offer a wide range of types with the greatest amount of flexibility to meet your specific product needs.

2.1 Different Technique and Comparison Between the Project

Basically, there are different kinds of technique used to construct the pump system mechanism. In the vast changing technology, each manufacturer complete in making a system which compromise latest equipment.

This equipment which has its own configures reliability and functions advantages actually increased the system complexity. The system life cycle will be a question mark as the constantly changing requirement because of the dynamic condition worldwide.

Expertise assistance is needed to handle the systems with care and also a frequent service is required to maintain the system function reliability.

2.2 PLC HIstory

2.2.1 About PLC

A PLC (i.e. Programmable Logic Controller) is a device that was invented to replace the necessary sequential relay circuits for machine control. The PLC works by looking at its inputs and depending upon their state, turning on/off its outputs. The user enters a program, usually via software, that gives the desired results.

PLCs are used in many "real world" applications. If there is industry present, chances are good that there is a PLC present. Industries such as machining, packaging, material handling, automated assembly or countless other industries are probably already using them. If these industries do not use the PLC software, they are indeed wasting money and time. Almost any application that needs some type of electrical control has a need for a PLC. For example, let's assume that when a switch

turns on we want to turn a solenoid on for 5 seconds and then turn it off regardless of how long the switch is on for. This can be done by using simple external timer. Figure 2.1 shown the Model of PLC used in this project.

As the bigger the process the more a need for a PLC is needed. We can simply program the PLC to count its inputs and turn the solenoids on for the specified time wanted.

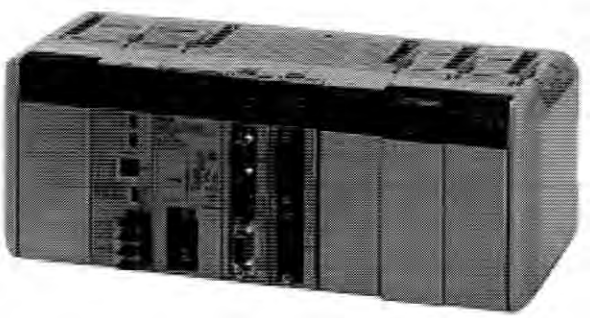

Figure 2.1: Programming Logic Controller

2.2.2 The Guts Inside

The PLC mainly consists of a CPU, memory areas, and appropriate circuits to receive input/output data. We can actually consider the PLC to be a box full of hundreds or thousands of separate relays, counters, timers and data storage locations. These counters, timers, don't really exist physically but rather they are simulated and

can be considered software counters, timers, etc. These internal relays are simulated through bit locations in registers. [8]

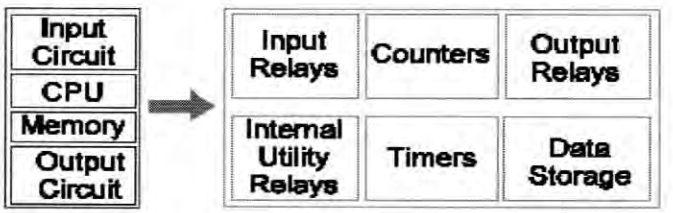

Figure 2.2: Internal Of PLC

- **Input Relays-**(contacts) these are connected to the outside world. They physically exist and receive signals from switches, sensors and others. Typically they are not relays but rather they are transistors.

- **Internal Utility Relays-**(contacts) these do not receive signals from the outside world nor do they physically exist. They are simulated relays and are what enables a PLC to eliminate external relays. There are also some special relays that are dedicated to performing only one task. Some are always on while some are always off. Some are on only once during power-on and are typically used for initializing data that was stored.

- **Counters**-These again do not physically exist. They are simulated counters and they can be programmed to count pulses. Typically these counters can count up, down or both up and down. Since they are simulated they are

limited in their counting speed. Some manufacturers also include high-speed counters that are hardware based. We can think of these as physically existing. Most times these counters can count up, down or up and down.

- **Timers**-These also do not physically exist. They come in many varieties and increments. The most common type is an on-delay type. Others include off-delay and both retentive and non-retentive types. Increments vary from 1ms through 1s.

- **Output Relays**-(coils) these are connected to the outside world. They physically exist and send on/off signals to solenoids, lights, etc. They can be transistors, relays, or triads depending upon the model chosen.

- **Data Storage**-Typically there are registers assigned to simply store data. They are usually used as temporary storage for math or data manipulation. They can also typically be used to store data when power is removed from the PLC. Upon power-up they will still have the same contents as before power was removed.

2.3 PLC Operation

A PLC works by continually ***scanning*** a program. We can think of this scan cycle as consisting of 3 important steps. There are typically more than 3 but we can focus on the important parts and not worry about the others. Typically the others are checking the system and updating the current internal counter and timer values. [8]

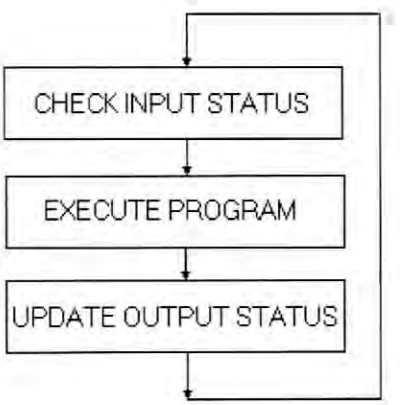

Figure 2.3: Scan cycle

Step 1-CHECK INPUT STATUS-First the PLC takes a look at each input to determine if it is on or off. In other words, is the sensor connected to the first input on? How about the second input? How about the third. It records this data into its memory to be used during the next step.

Step 2-EXECUTE PROGRAM-Next the PLC executes your program one instruction at a time. Maybe your program said that if the first input was on then it

should turn on the first output. Since it already knows which inputs are on/off from the previous step it will be able to decide whether the first output should be turned on based on the state of the first input. It will store the execution results for use later during the next step.

Step 3-UPDATE OUTPUT STATUS-Finally the PLC updates the status of the outputs. It updates the outputs based on which inputs were on during the first step and the results of executing your program during the second step. Based on the example in step 2 it would now turn on the first output because the first input was on and your program said to turn on the first output when this condition is true.

After the third step the PLC goes back to step one and repeats the steps continuously. One scan time is defined as the time it takes to execute the 3 steps listed above.

CHAPTER 3

DESIGN METHODOLOGY

3.1 Some Reason Behind The Project

The proposed system of "Automatic Water Pump Control System "is design according to the environment it will be in use. Although individual perception will differ, depending on what various people observe, there are number of trends that appear to be significant.

- **Constantly changing requirements**: The requirement for the new system are frequently changing because of the dynamic conditions worldwide, changes in mission, thrusts and priorities, and the continues introduction of the new technologies.

- **More emphasis on 'system'**: This is greater emphasis on the total system versus the components of the system. One must look at the system "in total," and throughout its entire life cycle, to ensure that the functions that need to be performed are being accomplished in an effective and efficient manner.