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PLC Based Industrial Crane Automation & Monitoring

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Abstract : *In a traditional industrial crane control system, all control devices are wired directly to each other according to how the system is supposed to operate. Here human is the main to control the crane & that passes through large drawbacks such as more wiring work, appears large mechanical faults & difficulties in troubleshooting & repair work .Due to these drawbacks industrial production decreases largely[4].*
Keywords – *PLC, HMI, automatic control, Hardwar configuration (crane model).*

I. INTRODUCTION

In this paper we are using PLC to control the crane movements. Programmable Logic Controller (PLC) is a small computer used for automation of real-world processes, such as control of machinery on factory assembly lines. The PLC usually uses a microprocessor. The program can often control complex sequencing and is often written by engineers. The program is stored in battery-backed memory and/or EEPROMs. Unlike general-purpose computers, the PLC is packaged and designed for extended temperature ranges, dirty or dusty conditions, immunity to electrical noise, and is mechanically more rugged and resistant to vibration and impact. By implementing this project we decreases man power, thus increase in production of the industry [4].

II. DEFINITION OF PLC

A digital electronic device that uses a programmable memory to store instruction and to implement function such as logic, sequencing, timing, counting and arithmetic in order to control machines and processes. The term logic is use primarily concerned with implementing logic and switching operations .Input devices e.g. switches, and output devices e.g. motors, being controlled are connected to the PLC and then the controller monitors the inputs and outputs according t this program stored in the PLC by the operator and so controls the machine or process[11].

Originally they were designed as a replacement for hard-wired relay and timer logic control systems. PLCs have the great advantage that it is possible to modify a control system without having to rewrite the connections to the input and output devices, the only requirement being that an operator has key in a different set of instruction. The result is a flexible system which can be used to control systems which vary quite widely in their nature and complexity.

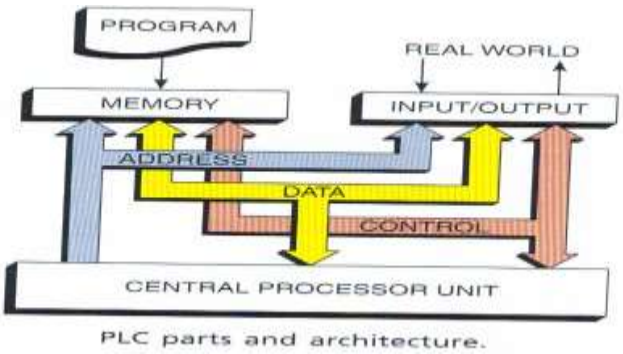
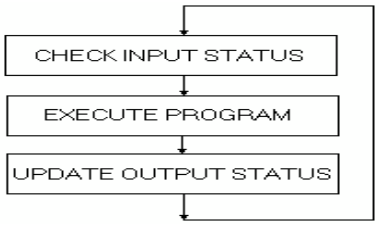


Fig. no.1

I. 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 [9].

II. FIGURES



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 [8].

Step 2-EXECUTE PROGRAM

The PLC executes your program one instruction at a time. Maybe our 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 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 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.

III. FUNCTIONAL BLOCK DIAGRAM

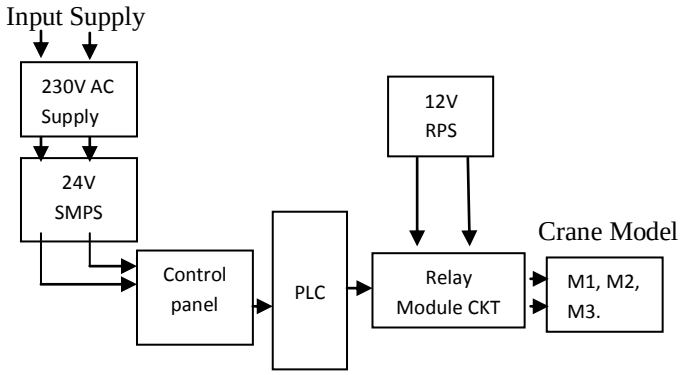


Fig. No. 3

V.2. CONTROL CIRCUIT DIAGRAM

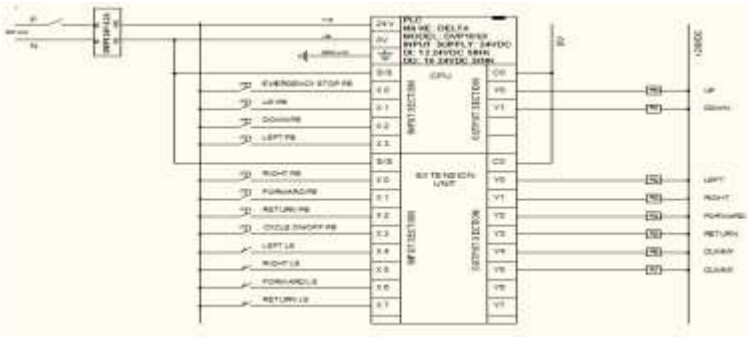


Fig. No. 4

VI. PRESENT THEORIES & PRACTICES

Originally they were designed as a replacement for hard-wired relay and timer logic control systems. PLCs have the great advantage that it is possible to modify a control system without having to rewrite the connections to the input and output devices, the only requirement being that an operator has key in a different set of instruction. The result is a flexible system which can be used to control systems which vary quite widely in their nature and complexity.

PLCs are similar to computer but have certain features which are specific to their use as controllers. These are:
1. They are rugged and designed to withstand vibrations, temperature, humidity and noise.
2. The interfacing for inputs and outputs is the controller.
3. They are easily programmed and have easily understood programming language.
4. It contains programmable functions.
5. It scans memory, inputs and outputs in predetermined manner.
6. It provides error checking diagnostics.
7. A PLC can provide some form of monitoring capabilities
8. A PLC can be effectively designed for a wide variety of control tasks.

VII. PROPOSED WORK

Now let's compare a simple ladder diagram with its real world external physically connected relay circuit and see the differences.

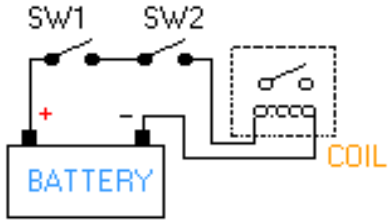


Figure.5 Relay Circuit

In the above circuit, the coil will be energized when there is a closed loop between the + and - terminals of the battery. We can simulate this same circuit with a ladder diagram. A ladder diagram consists of individual rungs just like on a real ladder. Each rung must contain one or more inputs and one or more outputs. The first instruction on a rung must always be an input instruction and the last instruction on a rung should always be an output (or its equivalent).

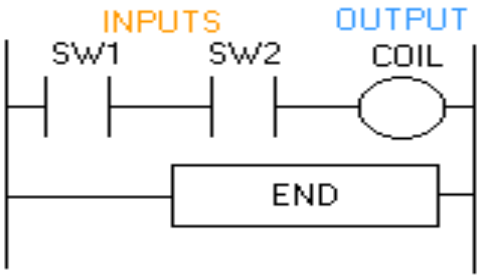


fig. no.6

Notice in this simple one rung ladder diagram we have recreated the external circuit above with a ladder diagram. Here we used the Load and Out instructions. Some manufacturers require that every ladder diagram include an end instruction on the last rung. Some PLCs also require an end instruction on the rung after the end rung [8].

VIII. IMPLIMENTATION STEPS:

1. Development of ladder logic to control the crane in X, Y, Z.direction.
2. Simulation of ladder programming using WPL software.
3. Design and assembling of crane model.
4. Selection of Motors.
5. Design and testing of relay logic module.
6. Monitoring Voltage, Current & Temperature of the drives in present instant.

VIIII. CONCLUSION:-

The soft wiring advantage provided by programmable controllers is Tremendous. In fact, it is one of the most important features of PLCs. Soft wiring makes changes in the control system easy and cheap. If it want a device in a PLC system to behave differently or to control a different process element, all have to do is change the control Program. In a traditional system, making this type of change would involve physically changing the wiring between the devices, a costly and time-consuming endeavor. In future definitely PLC is dominated on all other controlling methods.

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