

Automatic Cloth Hanger Using Rain Sensor

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Abstract—This proposal is about designing a model of automatic cloth hanger with box using rain sensor. This design is to help people that have no time to watch for their own cloth hang outdoor. This design is been controlled by the rain sensor and Programmable Logic Control (PLC). If raining, the sensor will sense it and turn the system on. When the rain sensor detects the rain, the cloth hanger is sliding into the box. The box is made from plastics and wood for water proof. After the cloth hanger is slide completely in the box, two plate of the box will automatically close the open space on a top and bottom. This is to make sure the cloths are not wet from the rain. If the rain is stop, the two side of the box that previously close will open and the cloth hanger in the box will slide the cloth hanger out again. The design will repeat the step again if there is a rain. The expected result from this design is it a user friendly and has a value of commercial promotion.

Keywords—rain sensor; Programmable Logic Control(PLC); cloth hanger;

I. INTRODUCTION

Advancements in software and microprocessor technology provide great conveniences to daily human life. Usage of new generation technologies are became an important requirement in these days [1]. Therefore, automatic cloth hanger with box is design to help daily life. Furthermore, it will operate automatically.

Today our world weather is rapidly changed. It is not the same because sometime in the middle of sunny day, accidently raining or vice versa. So this project to help those that have no time to pick up their cloth.

A. Literature Review

The rain has many forms, which makes the research and development process of raindrop sensor full of hardships. Differences in the intensity of rainfall are very large. The smallest is very thin mist, while the largest is heavy downpour [2]. An innovation for a standard intermittent windshield wiper is the concept of a smart wiper that automatically turns itself on or off and adjusts its wiping cycle according to the intensity of rain [3]. The function is the same to on or off but the application is different. From the statement before, we can see that they use the rain sensor and then turn on the wiper or one mechanism. But in this project, after the rain sensor turn it

on, the design move the cloth hanger and two plate of the box. The system has three mechanisms.

From the previous study, the mechanism of the system has been upgraded from one to three mechanisms and become more efficient base with this project application. A programmable logic controller (PLC) has been chosen as a control of the system. A PLC is a microprocessor-based control system, designed for automation processes in industrial environments.

A PLC can be programmed to sense, activate, and control industrial equipment and, therefore, incorporates a number of I/O points, which allow electrical signals to be interfaced. Input devices and output devices of the process are connected to the PLC and the control program is entered into the PLC memory [4]. Base on the previous study, PLC is relatively inexpensive, environmentally hardened, easy to program, operate, maintain and repair [5]. The previous study use the PLC for the water treatment for it is inexpensive. Base from it, this project want to efficient but cheap to design it.

The box that use in this design is a plastic and wood material because of it water proof. It can prevent the rain slip through into the box. When the box is close, it seals properly to avoid any water get into the box. The moving plate and the cloth hanger are in automatic mode. Without anyone makes them move but it moves their own by PLC. Similar when near from the opening door, it should smoothly start sliding open and then stop without impact [6].

It using a sensor to detect and then open the door if detected something near the door. For this design rain sensor detect and then the cloth hanger and the two plate of the box will move. The application for opening the door with the project is the same, but in the project it just not opens and closes for one thing. It made a three movement after the sensor detect.

II. METHODOLOGY

Basically, in this project there are 2 component that been separated to make it organize and easy to work. The component is hardware and software. Hardware is for the design, component that been used and assembling it. Software is only writing a ladder program in the software. This 2 component will be synchronies in the end. This is to make sure that the hardware can execute what the software want. Figure 1 shows the overall flowchart of this project.

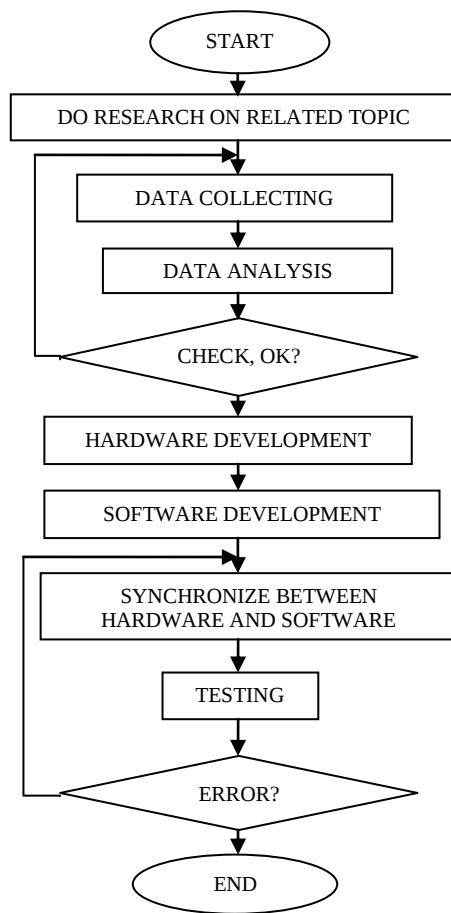


Figure 1: Overall flowchart

Relay is an electrical switch. This device becomes a switch when a signal is give to it. Relay that been used is 24V direct current and 5 pin. Because of the signal from PLC is 24V direct current, so the relay receives the signal 24V and make the relay function. Motor is function when the relay is switching it on and has a power supply. The power supply for the motor will connected to the relay. The motor either turn clockwise or counter clockwise because of the using 2 relay towards motor. Figure 2 is the flowchart of the system operation.

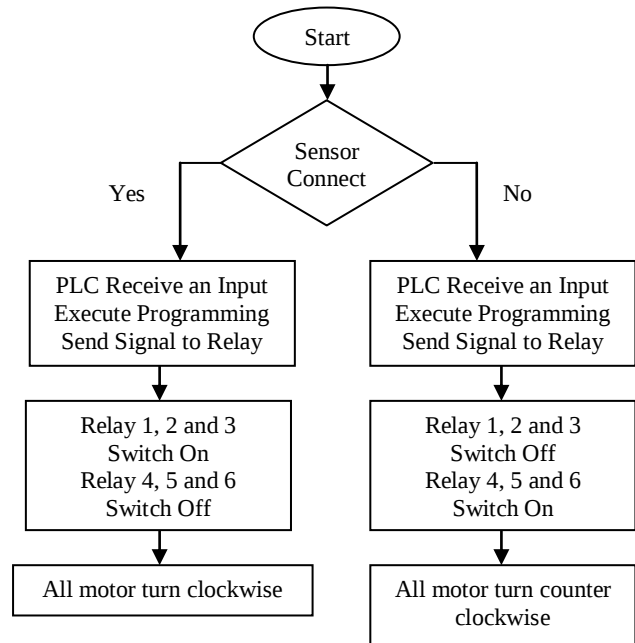


Figure 2: Flowchart for Hardware

A. Hardware

The main hardware that been used in this project is PLC. PLC is an electronic device that provides overall control with incorporated timing, counting, storage and arithmetic functions and control any system with its' input / output units[1]. PLC that been used is CP1E-N20DT-D, manufactured by Omron.

The PLC is using a 24V direct current to make the PLC function. This type of device has 12 input and 8 outputs. It is suitable for this project because this project using 2 inputs and 6 outputs. The device has 8K steps program capacity and 8K words data memory capacity [7]. The PLC will connect to the laptop with a USB cable for receiving a data from the programming [8]. An adapter is needed to convert from alternating current to direct current for supplying power for the PLC.

Rain sensor is use as switch for the input. If the sensor is switch on or connect, it will make the PLC function. The fundamental function of the rain sensor is detected existing of water on the sensor. It will short circuit and connect the unconnected wire. Thus, the voltage can flow through it and to PLC. If the input is the rain sensor, the outputs are relay and motor.

Majority of my hardware made from wood and only the moving plate is made of plastic. I use the plastic because of it is lighter than wood and easy to move rather than using wood because it is heavy. But wood is stronger and solid to use as the model body. It can support heavy things than the plastics as the model body. Figure 3 shows the diagram of the hardware.

Figure 4 shows the circuit diagram for this project. Using the PLC as the main component, rain sensor as switch or input and relay and motor as the output. 24V direct current is using as power supply for PLC, relay and motor for below part. As for 12V direct current is use for motor at the top and the middle part. Each motor will pair with 2 relays. The relay has 5 pin, so 5 of the pin must have connection. There are pin for output, pin that receive PLC signal, pin receive from power supply, pin receive power supply for the motor and pin for the ground.

Motor 1 is with relay 1 and 4, motor 2 is with relay 2 and 5 and motor 3 is with relay 3 and 6. So either relay 1, 2 and 3 will turn on or vice versa. Relay 1, 2, 4 and 5 are connected with 12V direct current and for relay 3 and 6 only connected to 24V direct current because of using different motor.

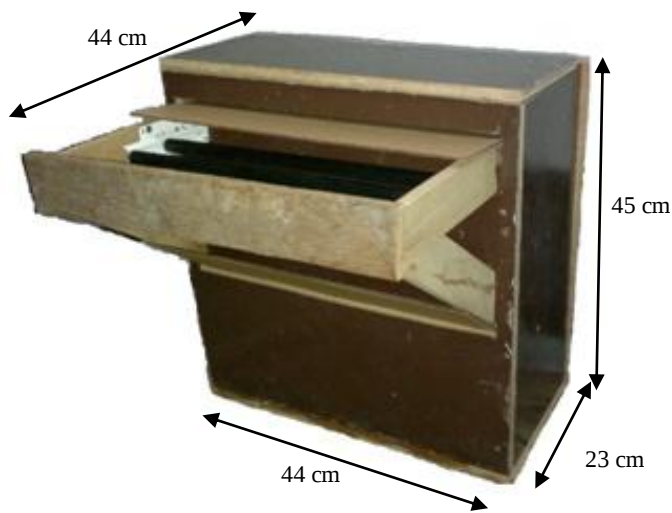


Figure 3: Hardware Diagram

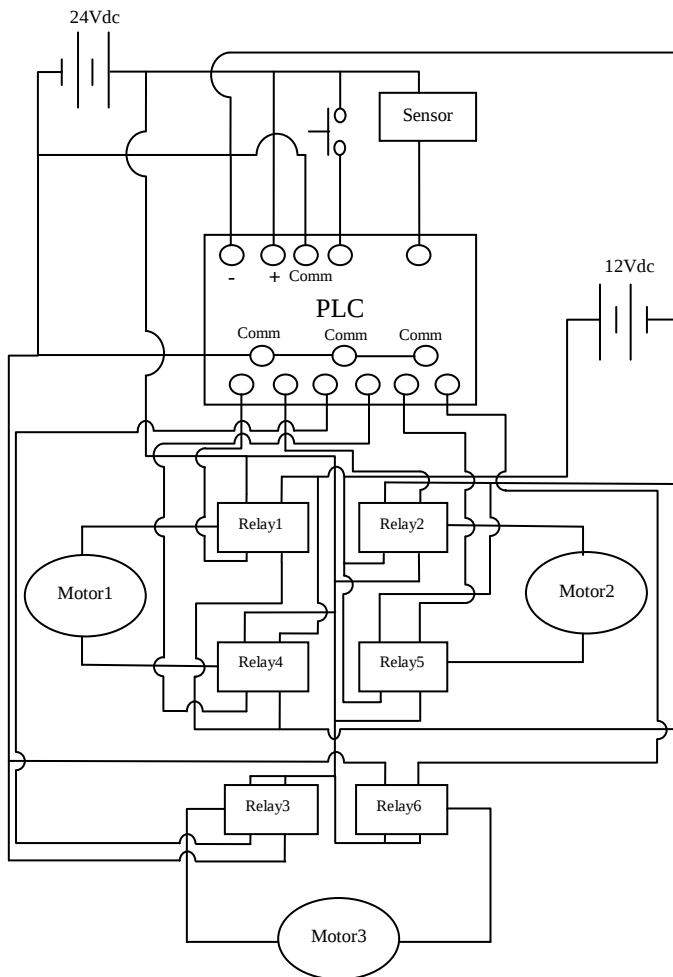


Figure 4: Circuit Diagram

B. Software

A programming device is a software application for initializing, programming, monitoring, and debugging PLCs [8]. CX-Programmer is one of the programming device is use for this PLC. This software is using ladder diagram to program it. It has an address for the input and the output. Figure 4 shows the flowchart of the software programming

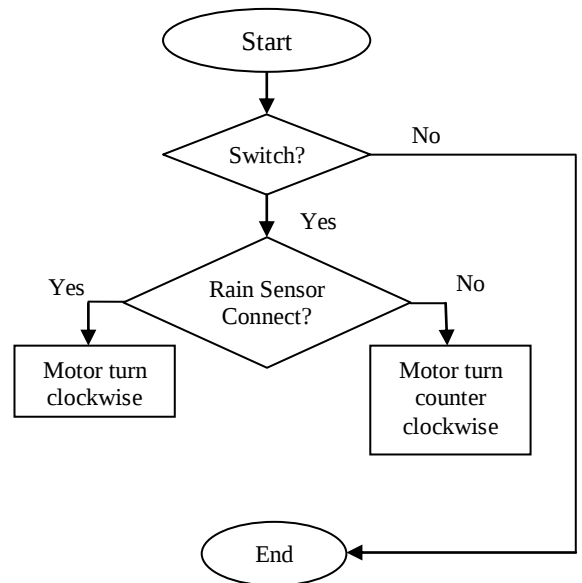


Figure 4: Flowchart for Software

III. RESULT AND DISCUSSION

Input		Output		
Main switch	Rain Sensor	Relay 1, 2 and 3	Relay 4, 5 and 6	Motor
0	0	Off	Off	Off
0	1	Off	Off	Off
1	0	Off	On	On
1	1	On	Off	On

Table 1

Table 1 shows the result for overall of the project. It is about how it function and been controlled by switches. 0 is consider as no connect and 1 as connected. This is show that, when the main switch does not connect, the relay and motor does not function. When the rain sensor detected water on it, it will connect and act like a switch. Whether the rain sensor is connected or not, the system is on but doing a different task that been programmed.

Input	Output		
Rain Sensor	Relay 1, 2 and 3	Relay 4, 5 and 6	Motor
Not Connect	Off	On	Counter Clockwise
Connect	On	Off	Clockwise

Table 2

Table 2 shows the rotation of the motor and the relay switching ON/OFF. When relay 1, 2 and 3 are off, relay 4, 5 and 6 are on and make all the motor will rotate counter clockwise and vice versa. The relays are considered on when the PLC sent a signal to it and to the motor too. There are 3 motor have been used, 1 motor was controlled by 2 relay. The motor do not rotate clockwise and counter clocks wise simultaneously.

Input / Volt(V)	
Main Switch	Rain Sensor
24.17	0
24.17	24.17

Table 3

Output / Volt(V)				
Relay 1, 2 and 3	Relay 4, 5 and 6	Motor 1 (Upper)	Motor 2 (Middle)	Motor 3 (Below)
0	24.11	12.32	12.75	24.05
24.11	0	12.32	12.75	24.05

Table 4

Table 3 and Table 4, shows the voltage of the inputs and outputs of the PLC. Power supply of the PLC and inputs must be a 24V direct current, so when the switch and rain sensor is connect, their value of voltage is 24.17V. For the output, the signal that the PLC sent to relay is 24.11V, which means the PLC has a power supply, input and output of approximately 24V direct current.

The value of voltage for motor is approximately the same because of the direct supply voltage to it. Whether relay 1, 2, 3 or relay 4, 5, 6 are on, the motor's voltage is still approximately the same but the rotational is different. Relay 1, 2, 3 will not turn on simultaneously with relay 4, 5, 6 because the PLC is been programmed to sent the signal either relay 1, 2, 3 or relay 4, 5, 6.

IV. CONCLUSION

I conclude that this project is success. The model can do what the program commands it. In the future, I hope it will be improvise for make it more efficient. Even though this project, only a model but if can make it real. It will have value of a

commercial promotion. And the import thing is to help those had no time to pick up their cloth.

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