

Automatic Retractable Cloth Drying System

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Abstract: Nowadays, most people spend less time at home. Thus, an automatic cloth drying system is convenient for our daily routine. In this project, a cloth drying system, that can retrieve-in hanging clothes automatically when it is raining and then, retrieve-out out again when the sun is shining, is developed. The system is controlled by an Arduino UNO and applied two sensors, a rain sensor and an LDR to detect rain and sunlight, respectively. The project involved a conversion of electrical power into mechanical power for the movement of the retractable cloth drying system using a power window motor. This system can withstand until 5 kg of wet clothes.

Keywords: Cloth Drying System, Arduino, Sensor, Motor.

1. Introduction

The precarious climate can be troublesome to some individuals to dry their clothes outdoor due to unlikely weather conditions such as rain [1]. Most of the people who work and leave at a flat house worry about their clothes that have been dried outside. They have no time to keep clothes if raining.

There are a lot of cloth dryer rack designs are available in the market. However, most of the designs have a large size and take a lot of space. Some houses have a very small space. They have a lot of volume for drying clothes. So, they have a problem to buy the clothes dryer rack by the conditions of their home and bring in their clothes while raining. A product that consumes small space saves time and worry-free to users about hanging clothes outdoors is needed.

Here, an automatic retractable cloth drying system, to lighten the issues in the laundry for household usage, is developed. The retractable clothes drying system can move automatically during rain to help people when they hang clothes outdoors. The clothes drying rack can move forward and backward

automatically using DC power window motors and a microcontroller as the main function to control components [2]. The rack moves backward when raining or dark days. The rain sensor functions as a connecting circuit. LDR sensor is used to detect light [3]. When the weather is getting dark, clotheslines will move to a place that is not exposed to rain.

2. System Development

2.1 Diagram of the System

Figure 1 shows the diagram of the placement an automatic retractable clothes drying for this project. Arduino as a microcontroller drove all the control for the operation of input and output.

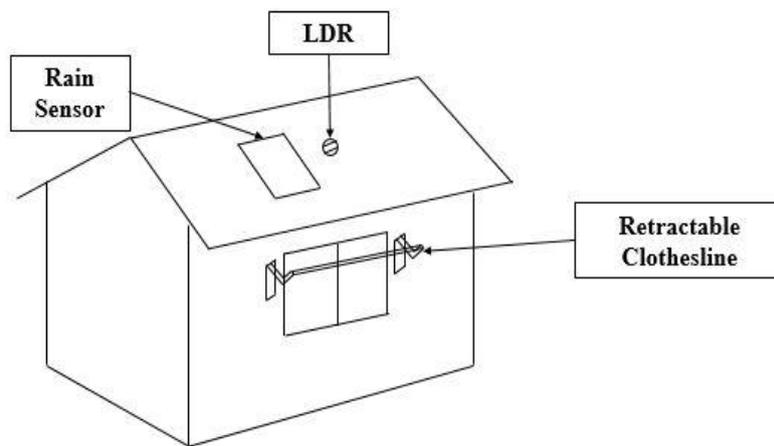


Figure 1: Diagram placement of the project

2.2 Block Diagram of the Project

Figure 2 shows the block diagram of the project automatic retractable clothes drying system were starting and final operation.

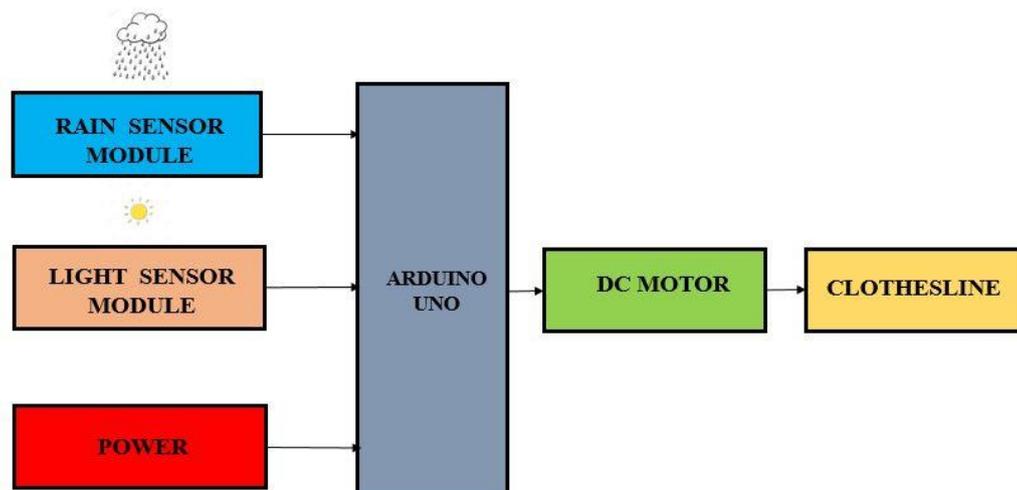


Figure 2: Block diagram of the project

The rain sensor and light sensor acts as input data to Arduino [4]. The Arduino response, process, and compare the data. After compared the data and getting the next process, it triggers the motor to operate as per setting to move the clothesline.

2.3 Bill of Materials (BOM)

Table 1 shows the lists the components and hardware which wash the used to complete the project and allow the retractable clothes drying system functioning properly. Readily accessible hardware is not listed as they are deemed irrelevant.

Table 1: Bill of Materials (BOM)

No.	Components	Quantity
1	Arduino Uno board	1
4	Power window motor	2
5	Rain Sensor	1
6	LDR Sensor	1
7	Power Supply Unit	1
8	DC Buck Converter	1
9	Light Emitting Diode (LED)	1
10	Resistor	1
11	Aluminium Retractable Clothesline	1
12	Regulator Gear Power Window	2
13	Breadboard (small)	1
13	Jumper Wire	20
14	Screw and nails	15

2.4 Rain Sensor

The rain sensor was an easy tool that used for sensing rain. The PCB of the raindrops sensor consists of copper tracks which act as a variable resistor. The rain sensor module works on the principle of resistance. Its resistance varied with respect to the wetness on the rainboard. The sensitivity of the rain sensor could be adjusted to either less or big sensitivity [5]. Figure 3 shows the element of rain sensor that used in this project.

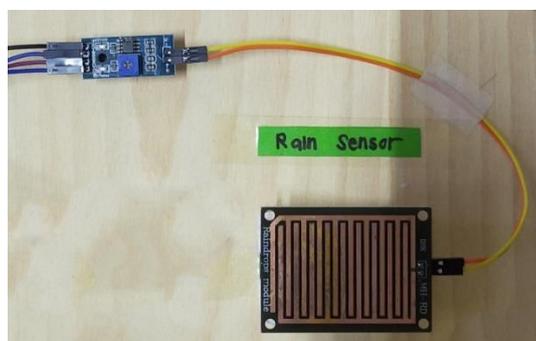


Figure 3: Element of the rain sensor

When the surface of the rainboard was exposed to rainwater, the resistance in low condition. So, the Arduino triggers the left and right power window motor to retrieve in the clothes drying system.

The other condition, when the surface of the rainboard is not receiving rainwater, the resistance in high condition. It activates the second sensor in this project.

2.5 Light Dependent Resistor Sensor (LDR)

The LDR was used to detect the presence of light and it also functions to measure the intensity of light. The basic operation of LDR when there was light, the resistance of LDR become low according to the intensity of light. In this project, the sunlight is taken over by light-emitting diode (LED) as the intensity of light. A potentiometer knob in the LDR sensor can be adjusted to change the sensitivity of LDR towards light [6] as shown in Figure 4.



Figure 4: Element of LDR sensor with a knob sensitivity level

2.6 Power Window Motor

Power window motor is the mechanical part in this project to move retractable clothesline for retrieve-in and retrieve-out. A combination power window motor and integrated scissor-type regulator able to make a movement of the drying system. The torque in the power window motor is 30 kg.cm, and there was no problem to hang in wet clothes. This project used two power window motors at the left side and right side of the retractable clothesline as shown in Figure 5. It uses a power supply of 12V DC through a DC Buck Converter [7].



Figure 5: Power window motor and regulator gear

2.7 Software Development

Arduino Software (IDE) software is used to write the program for this project. With the guidance of the flowcharts made beforehand, the code was written down through the interface of the Arduino Software (IDE) and compiled. The compiled code was then uploaded on the Arduino UNO board directly using a USB cable [8].

The flowchart of the automatic retractable clothes drying system as shown in Figure 6. Initially, a clothes drying system hanging outside, when the rain sensor detects raindrops and the clothesline retrieve-in. The other case is a light detector (LDR) receive high light intensity, so the clothes move outside and dry.

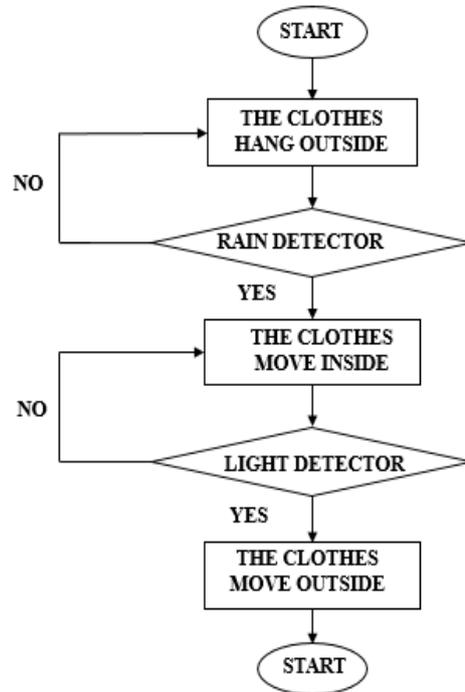


Figure 6: Flowchart of the automatic retractable clothes drying system

3. Results and Discussion

This project contains two sensors as shown in Table 2 (Results), the first is a rain sensor and the second is LDR sensor. There are two conditions of the automatic retractable cloth drying system to operate. The sensitivity of each sensor is setting by adjusting the sensitivity level sensor. The situation is started in the first case when the circuit detected water, it automatically becomes a close circuit and the clothesline retrieve-in. In the second case, when the LDR receives high intensity, it will automatically retrieve-out and dry the clothes.

Table 2: Result of the situation

Case	Sensor	Condition	Explanation
1	LDR	ON	The clothes move outside
	Rain Sensor	OFF	
2	LDR	OFF	The clothes move inside
	Rain Sensor	ON	

3.1 Hardware of Procedure

This project to develop an automatic system for a clothesline in condition retrieve-in and retrieve out depending on the weather condition. There was some technical and mechanical part was involved. Figure 7 is a retractable clothesline.



Figure 7: A retractable clothesline

There were many wall-mounted clotheslines in the market. For this project retractable clothesline that has three bar of clothesline was selected. In my observations, the three bars of clothesline suitable for people living in a flat house that have limits if space.



Figure 8: Integrated Gear and Power Window Motor

This part needs technical skills and mechanical ideas to place the sector gear and power window motor together with the existing retractable clothesline. An unnecessary part of integrated gear is removed as shown in Figure 8. The motor rotation is decided and control as a setting in the microcontroller.

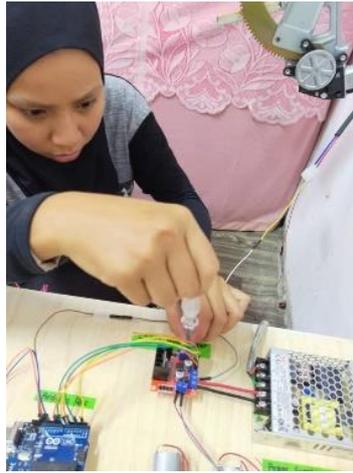


Figure 9: Electrical part of the automatic retractable clothes drying system

Figure 9 shows the electrical part of the automatic retractable clothes drying system. The instruction for the system to operate is code in Arduino software and upload on the Arduino board. Both side of the retractable clothesline successful in retrieve-in and retrieve-out regarding the conditions state. The sensitivity of the rain sensor, LDR sensor and troubleshoot is adjusted during this process.

3.2 Final Product

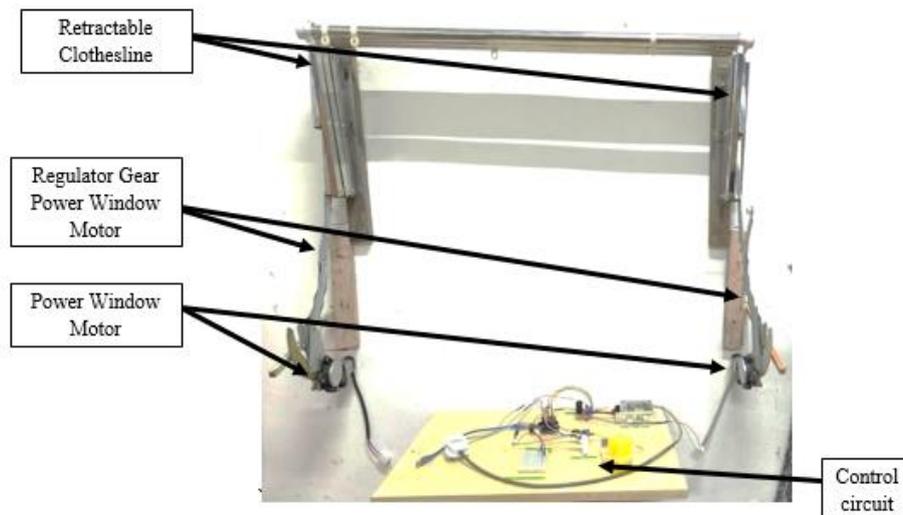


Figure 10: Full construction build of the project

The final product of the project can be seen by referring to Figure 10. A commercial wall mounted retractable drying rack cloth hanger is used. The regulator gear power window motor is placed on the left side and the right side of the retractable drying rack. The main arm of regulator is modified and installed at the retractable cloth hanger. When the circuit control start, the distance length of the cloth rack retrieve-out below 1 meter. It can hang wet clothes. The power window motor, proven to be acceptably strong being able to retrieve-in and retrieve-out the retractable cloth fast and smoothly. Both sides of the regulator gear power window motor are operating synchronously based on the condition that has been set.

The retractable cloth having three bar of clothesline that able to hang around ten to fifteen clothes at a certain time depending on the size of clothes. When the control circuit trigger high intensity of light, the power window motor would move the main arm of the regulator gear move forward. While, when the rain sensor detecting raindrops, the regulator gear moves the cloth rack backward.

4. Conclusion

Automatic retractable clothes drying system one of the solutions for the laundry issues facing by busy peoples and working couples. It is hard to find time to have a laundry day where the cloth to dry throughout the whole day, because the weather can change from sunny to rainy days and oppositely. This project operates automatically retrieve-out the clothesline during a sunny day and retrieve-in the clothes when rain. This project can withstand below 5 kg of wet clothes on the rod.

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