Journal of Information Technology, computer science and Electrical Engineering (JITCSE)
Vol. 1, No. 2, June 2024, pp. 20~27
E-ISSN: 3046-4900, DOI: 10.61306/jitcse

Clothesline Smart Device Design Based on Iot Device

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ABSTRACT

Drying clothes is a process of daily activities. Drying clothes through the drying process is a traditional method that is still widely used in various regions. However, the process of drying traditional clothes is often a challenge for people or individuals who have limited space and time, especially if the drying is done at home while at the same time not at home. So it takes innovation of smart clothesline devices based on the Internet of Things (IoT) that can help optimize the drying process of clothes. In designing and manufacturing this automatic clothes drying system uses two sensors, namely water sensors and light sensors. Both of these sensors function as weather detectors. If it rains, the water sensor will respond by sending voltage to the circuit and then moving the servo motor to rotate to the right or left so as to make the clothesline enter a closed room. When the clothesline enters, Arduino will give a command to the GSM module SIM800L to give a notification in the form of an sms that the clothesline has been inserted. Similarly, with the light sensor, when the rain has stopped, the light sensor responds to sunlight so that it makes the servo motor move to remove the clothesline.

Keyword : IoT; **Sensor**; **clothesline**

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Article history:
Received May 10, 2024
Accepted May 23, 2024

1. INTRODUCTION

Drying clothes healthily requires direct sunlight so that clothes dry quickly and some viruses and lice die with sunlight. However, weather situations are difficult to predict, even so innovation is needed in drying clothes traditionally while still using direct sunlight without neglecting in terms of skin health. innovation of smart clothesline devices based on the Internet of Things (IoT) that can help optimize the drying process of clothes. This innovation also proposes the concept of energy saving [1], [2], [3], [4]. Many studies have used IoT [5][6]such as application to smart homes [7],Smart Westafel [8], Smart helmet air quality meter [9] some even use IoT to detect formalin [10].

IoT is a device that has a connection with the internet and connects devices with data sensors and the ability to communicate with that data [11]. IoT innovation in automatic clothes drying devices by utilizing rainwater sensors and Light Dependent Resistor (LDR) light sensors. From the input data of the rainwater sensor and Light Dependent Resistor (LDR) light sensor will be monitored by an Arduino Uno which will then send commands [12], [13], [14], [15], [16], [17] and received by the recipient on the mobile phone through the GSM module SIM800L as a sending media where the report is in the form of Short Message Service (SMS) which will be received by the mobile phone if the sensor detects rain. The sensor will respond by sending voltage to the circuit and then moving the servo motor to rotate to the right or left so that the clothesline moves to the part protected from sunlight and rainwater so that the clothesline is not exposed to rainwater.

This research uses a product design method consisting of the need's identification stage of the situation at hand, conceptualization of design with IoT, modeling, and evaluation. The hardware used includes microcontrollers, weather sensors, servo motors, and communication modules. The software is designed to integrate all the components and features of the clothesline smart device. This research aims to design a smart clothesline device based on IoT devices that can monitor weather conditions, adjust the position of the clothesline, and provide notifications to users.

2. RESEARCH METHOD

Automatic clothesline uses two sensors, namely a water sensor and a light sensor that functions as a weather detector. If the weather is rainy, the water sensor responds by sending the Arduino Uno circuit voltage to drive the servo motor so that the clothesline enters the room, so that the clothesline is protected from rain. Likewise with the light sensor, when it is dark (night) or cloudy, the light sensor will respond by providing voltage to the Arduino Uno circuit so that the Arduino Uno circuit moves the servo motor to enter the clothesline. When it is light, the light sensor will respond again by issuing a clothesline. When the clothesline enters, the Arduino Unoakan Microcontroller will give a command to the GSM module to give information in the form of sms that the clothesline has been inserted.
In this study there is a block diagram as shown in figure 1.

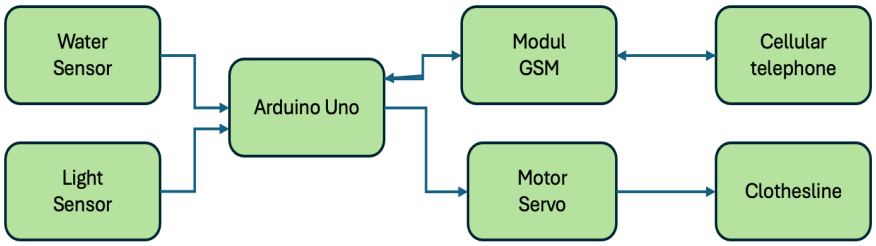

Fig 1. Diagram Blok

A. Rain Sensor

Panel The rain sensor is installed in the open drying area of direct sunlight, if rain falls it will hit the panel board, this panel is made of ordinary PCB board which is made into a circuit, to avoid rust because rainwater should be copper coated by tin, in principle the rain sensor works when rainwater hits the sensor panel, there will be an electrolyzation process by rainwater because rainwater is included in the electrolyte liquid, namely liquid that can conduct electric current, Rain Sensor Is a type of sensor that will be active if the sensor is exposed to rainwater. If the sensor is exposed to rainwater, then path 3 between the port and ground will be connected. So that the voltage value in the port is zero because it is directly connected to ground.

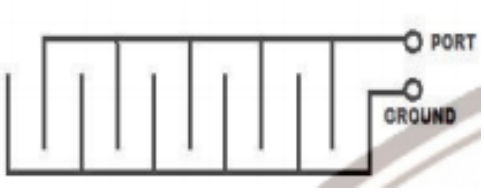

Fig 2. Rain Sensor network

B. Light Sensor

Fig 3. Light Sensor Network

R1 = 220 Ω; R2 = 1,5 Ω; Vin = 5 v; Vout = ?

Vout=R2/(R1+R2)×Vin

Vout=(1,5 Ω)/(220 Ω+1,5 Ω) ×5 v

Vout=(1,5 Ω)/(221,5 Ω) ×5 v

Vout = 0,03 v

The light sensor used in these automatic clothes drying device is an LDR (Light Dependent Resistor) as a light detector when this tool is run. The way LDR works itself is that if the light conditions are bright, the resistance value becomes small and can even touch zero depending on the intensity of the light hitting the LDR and if the conditions are dark, the resistance becomes even greater. In addition to the LDR, in the light sensor block there is also a comparator. As the name implies, the comparator functions to compare the voltage divisor with the reference voltage that can be adjusted as needed.

C. Mikrokontroler

The microcontroller functions as a receiver of data from the sensor and sends it to the transmitter so that it can be sent to the receiver. This block processes the results from the input blocks (light sensor and rain sensor) to be passed on to the next block. The output of this microcontroller block is determined from the program that has been created. The microcontroller used is an Arduino Uno microcontroller, Arduino Uno is an Arduino board that uses an ATmega328 microcontroller This is because the way to use it is more practical and simple and Arduino Uno also has 14 digital pins (6 pins can be used as PWM output), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a voltage source connector, an ICSP header, and a reset button. Arduino Uno contains everything needed to support a microcontroller. Just connecting it to a computer via USB or applying DC voltage from a battery or AC adapter to DC can make it work. Arduino Uno uses Atmega328 which is programmed as a USB-to-serial converter for serial communication to a computer via a USB port.

D. Modul GSM SIM800L

In these automatic clothes drying device, the GSM module SIM800L functions as a serial communication regulator. This serial communication will later send a message to the mobile phone. When the Arduino microcontroller gets input from the sensor, the receiving data will be sent to the GSM module SIM800L. The voltage of the Arduino microcontroller is 4.5 volts - 5.5 volts in accordance with the datasheet and the voltage of the GSM module SIM800L is 3.7 volts - 4.2 volts.

E. Motor Servo

Servo motor is used as a clothesline drive. A servo motor is a device consisting of a DC motor, a series of gears, a control circuit, and a potentiometer. A series of gears attached to the DC potor will slow down the rotation of the shaft and increase the torque of the servo motor, while the angle of the axis of the servo motor is set based on the width of the pulse sent through the signal leg of the servo motor cable. The use of a closed-loop control system on the servo motor is useful for controlling the movement and final position of the servo motor shaft.

The servo motor is controlled by providing a pulse wide modulation (PWM) signal via a control cable. The pulse width of the given control signal will determine the position of the rotation angle of the servo motor shaft. For example, a pulse width with a time of 1.5 ms (milliseconds) will rotate the servo motor shaft to an angular position of 900. If the pulse is shorter than 1.5 ms it will rotate towards position 00 or to the left (counterclockwise), while if the pulse given is longer than 1.5 ms then the servo motor shaft will rotate towards position 1800 or right (clockwise). For more details, see the picture below.

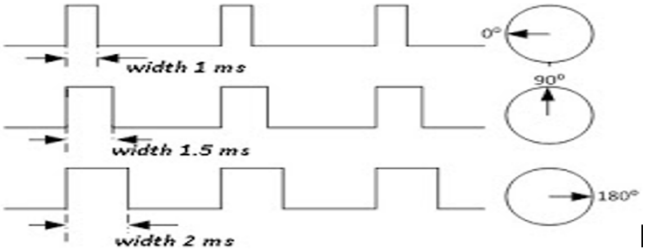

Fig 4. Servo Motor Working System

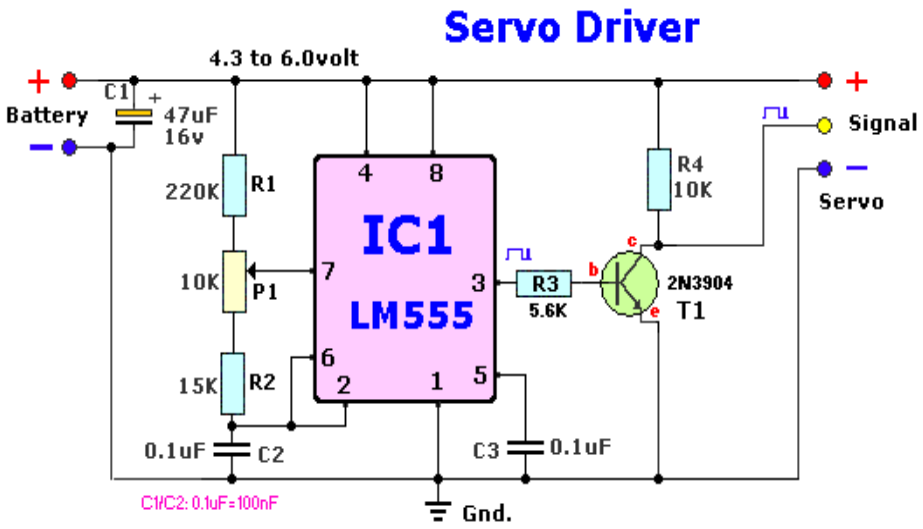

Fig 5. Servo motor circuit

When the control pulse width has been given, the servo motor shaft will move or rotate to the position that has been commanded and stop at that position. If there is an external force trying to rotate or change the position, then the servo motor will try to resist or fight back with the amount of torque force it has (servo torque rating). However, the servo motor will not maintain its position forever, the control pulse width signal must be repeated every 20 ms (milliseconds) to instruct the shaft position of the servo motor to remain in position.

F. Series Image

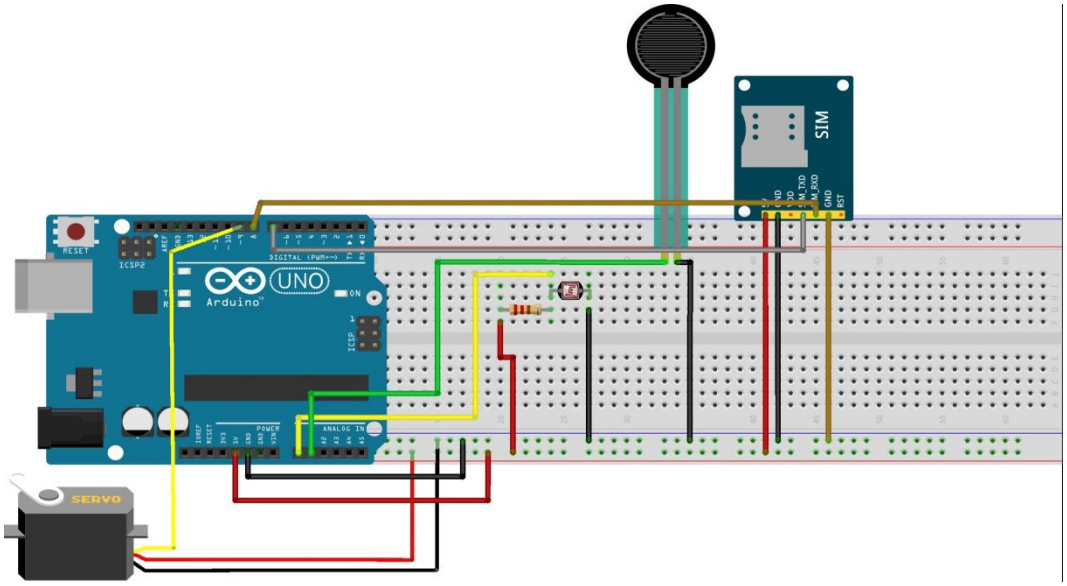

Fig 6. Automatic clothes drying tool breadboard range

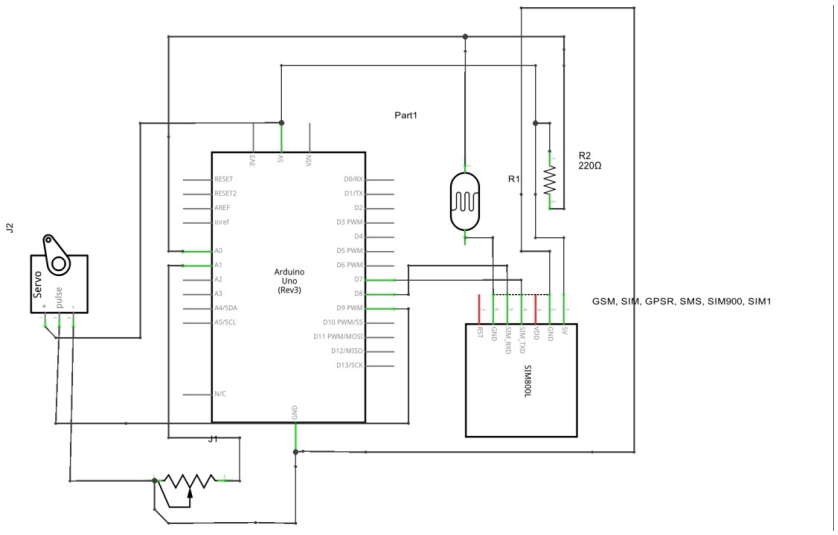

Fig 7. Schematic range of automatic clothes drying tools

G. Software

rain sensor program, Light Dependent Resistor (LDR) light sensor program, servo motor driver program, and AT Command program as commands to send reports in the form of Short Message Service (SMS). In these clothes drying simulation, the software used is Arduino 0022 software with the programming language used is C programming language and In System Programming (ISP) software which is used to download programs into the microcontroller. In a flowchart works when the program starts by initializing the input port and output port connected to the Arduino microcontroller. In the initialization of the port port connected to the Arduino microcontroller, it is explained whether the port port has been connected and is ready to use. In the Light Dependent Resistor (LDR) light sensor program and rain sensor, there are two conditions understood by the sensor, namely logic 0 and logic 1. Light Dependent Resistor (LDR) light sensor in logic 0 describes the light sensor in standby condition, and logical condition 1 light sensor in working condition. While on the rain sensor, logical condition 0 explains that the sensor is in working condition while in condition 1 the rain sensor is in standby condition.

In light sensors, logic 0 explains that the sensor is in standby or night conditions so that the clothesline is indoors, while logic 1 on the light sensor explains that the sensor is in working conditions or daylight conditions. If the rain sensor condition is at logic 0 or in rainy conditions, it falls and the next process is a clothesline into a closed room until the servo motor stops. Until the servo motor process stops then the GSM module SIM800L will automatically send a message in the form of Short Message Service (SMS) on the mobile phone.

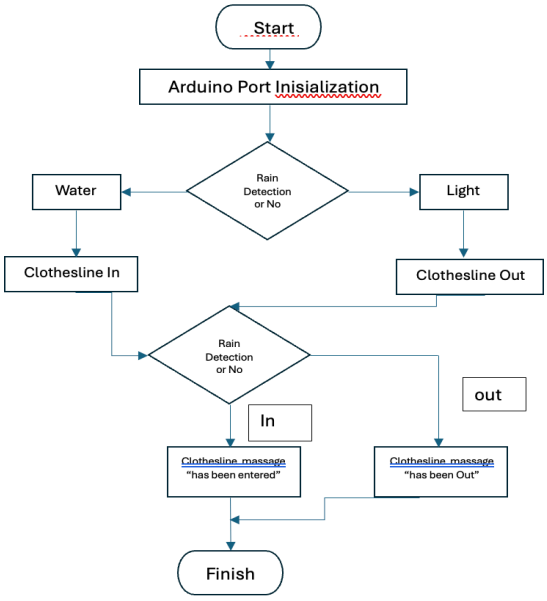

Fig 8. FLowchart

3. RESULTS AND DISCUSSION

Testing of the series of Automatic Clothes Drying Tools Using Water Sensors and Cell Phone-Based Light Sensors aims to see the results of the circuit that has been designed. The measurement data is used to analyze and make circuit improvements if the results obtained are not as expected.

Measurements are carried out on several circuit blocks to determine the success of each circuit block whether it is in accordance with its function as in the design, namely Arduino as a system controller, Rain sensor, Panel This rain sensor will be installed in an open area, where rainwater will hit the panel board, this panel is made of ordinary PCB board made into a circuit, LDR sensor to capture light from the sky or outdoors and provide input to Arduino Uno, and a series of servo motors to relay messages to mobile phones via GSM Module SIM800L. The measuring instrument used is a multimeter.

Based on the results of the measurement data, the following results were obtained:

After Entering the Microcontroller the voltage is adjusted to the needs used by 5V :

Table 1. Light Sensor Testing

Light sensor	Value	Tegangan	Measurement results
Bright light	0,5 – 1,5 Ω	5 Volt	4,9 Volt
Dark light	4 Ω	5 Volt	1,8 Volt

Table 2. Water Sensor Testing

Water Sensor	Value	Tegangan	Measurement Results
Dry	~	5 Volt	0,00 volt
Wet	0 Ω	5 Volt	4,76 Volt

When it rains, the water sensor will read that there is water on the sensor panel. The sensor will give a signal to the microcontroller so that the microcontroller instructs the servo motor to move the clothesline, so that the clothesline will enter the closed room, then after the clothesline enters, the microcontroller instructs the GSM module SIM800L to send notifications in the form of sms (short message service) to the cell phone.

Likewise, when the light sensor detects light, the light sensor will automatically send a signal to the microcontroller so that the microcontroller instructs the servo motor to move the clothesline so that the clothesline comes out, then after the clothesline comes out, the microcontroller instructs the GSM module SIM800L to send a notification berupasms (short message service) cellular phone.

4. CONCLUSION

Designing and manufacturing smart clothes drying tools automatically with IoT, namely with rainwater sensors and light sensors by utilizing sensors as inputs which are then strengthened by motor control, the movement of the motor according to the sensor will be generated. In the series of light sensors will emit and insert clotheslines when conditions are dark and bright. Where in bright conditions the voltage obtained is 4.9 Volts while in dark conditions the light sensor obtained a voltage of 1.8 Volts. In the series of rain sensors will insert clotheslines during rainy conditions, where when the rain sensor is exposed to water, the voltage obtained is 4.76 volts.

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