AUTOMATIC PROTECTION OF CLOTHES FROM RAIN USIN IoT

ABSTRACT

The practice of hanging clothes out to dry is a common and eco-friendly approach,but it is fraught with the risk of sudden rainfall, which can ruin freshly laundered garments.An innovative IoT-based system designed to retract clothes automatically hung for drying during rain showers is introduced. This is a problem especially when clothes are left out and drenched in rain. This system integrates a network of sensors that monitor weather conditions in real-time. When rain is detected, an intelligent mechanism is triggered to retract the clothes, protecting them from getting drenched. The system operates autonomously, eliminating the need for users to constantly check the weather or rush to retrieve their laundry. The automatic clothes retrieval system promises to enhance the convenience of traditional laundry practices and eliminate the risk of clothes being drenched by unexpected rain. The solution utilizes IoT technology to enhance sustainable household routines, reducing stress and burden associated with managing clothes during rain, allowing individuals to focus on other daily tasks.

Keywords: eco- friendly approach, drenched, laundry.

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Chapter 1

Introduction

1.1 Motivation

The automatic protection of clothes using the Internet of Things (IoT) is a revolutionary concept driven by the desire to enhance convenience, prolong garment lifespan, and reduce environmental impact. In a fast-paced world, where time is a precious commodity, incorporating IoT technology into clothing protection aligns with the modern lifestyle by minimizing manual efforts. IoT-enabled clothing protection systems offer real-time monitoring and response mechanisms. Smart sensors embedded in garments can detect environmental factors such as rain. This data is then processed to trigger automated protective measures, such as deploying water-resistant layers in the presence of rain or activating UV-blocking capabilities under intense sunlight. This not only shields the clothes from potential damage but also ensures the wearer remains comfortable and dry. Moreover, extending the longevity of clothing through IoT protection aligns with sustainability goals. By actively preventing wear and tear caused by environmental elements, individuals contribute to reducing the overall demand for new garments, thus curbing the environmental impact associated with the fashion industry. This shift towards a more sustainable approach resonates with consumers increasingly conscious of their ecological footprint. The integration of IoT in clothing protection is not just about preserving fabrics; it's about creating a seamless, intelligent experience for users. Imagine a world where individuals no longer worry about unexpected weather changes or accidental spills. The motivation behind automatic protection of clothes using IoT is grounded in the pursuit of a convenient, sustainable, and technologically advanced lifestyle that simplifies daily tasks while fostering environmental responsibility.

1.2 Objective

The primary objective of implementing automatic protection for clothes using the Internet of Things (IoT) is to revolutionize garment care and enhance user experience by leveraging advanced technology. This innovative approach aims to address several key objectives, with the overarching goal of providing convenience, preserving garment lifespan, and promoting sustainable practices. Firstly, the automatic protection of clothes through IoT seeks to simplify the daily lives of individuals. By integrating smart sensors and responsive mechanisms into clothing, users can effortlessly navigate various environmental challenges. Whether it's sudden rain, intense sunlight, or other external factors, the IoT system autonomously activates protective measures, freeing individuals from the need to constantly monitor and adapt to changing conditions. Another crucial objective is to extend the lifespan of clothing. IoT-enabled protection goes beyond mere convenience; it actively works to mitigate the wear and tear caused by environmental elements. By deploying preemptive measures based on real-time data, such as water-resistant coatings or UV-blocking features, the system acts as a guardian for garments, ensuring they endure longer periods of use without succumbing to premature damage. Furthermore, the automatic protection of clothes aligns with sustainability goals. In a world increasingly conscious of environmental impact, preserving and extending the life of clothing contributes to reducing the overall demand for new garments. This, in turn, lessens the ecological footprint associated with textile production and waste, promoting a more responsible and eco-friendly approach to fashion. In essence, the objective of automatic clothing protection using IoT is to create a seamless, intelligent, and sustainable solution that not only enhances user convenience but also fosters a paradigm shift toward mindful consumption and environmental stewardship. It envisions a future where technology actively contributes to a more resilient, resource-efficient, and user-friendly approach to garment care.

1.3 Project Definition

In regions characterized by unpredictable weather patterns, individuals often face the challenge of protecting their clothes from unexpected rain showers. Sudden downpours can result in wet and damaged clothing, causing inconvenience and potential economic losses. The absence of a reliable and automated solution exacerbates this issue, compelling individuals to constantly monitor weather forecasts or manually cover their clothes when rain is imminent.

The problem at hand necessitates a practical and efficient solution that seamlessly integrates into daily routines, offering a hands-free mechanism for safeguarding clothes from rain. Traditional approaches, manually covering clothes, are not only cumbersome but also prone to oversight, leading to instances of clothing damage. Moreover, these methods demand constant vigilance and are not conducive to scenarios where individuals may be preoccupied with other tasks.

To address this problem, the proposed project leverages emerging technologies, including Arduino, rain sensors, LDR, and a stepper motor. By creating an automated system that can detect rain and deploy a protective covering over clothes, this project seeks to provide a seamless and reliable solution to the persistent challenge of safeguarding clothing during unexpected rain showers. This innovation not only enhances user convenience but also represents a step towards a more efficient and technologically driven approach to mitigating everyday challenges posed by unpredictable weather conditions.

Chapter 2

Literature Survey

2.1 Research papers

[1] ”AUCLOS: Automatic Clothesline System with Led Infrared Based on Microcontroller Arduino Uno using Ambient Light and Steam Sensors” is designed to protect clothes from rain. The system utilizes ambient light and steam sensors to detect weather conditions, a servo to unfold the roof, and an infrared light to minimize moisture inside the clothesline. The prototype successfully responds to changes in weather, unfolding the roof and activating the infrared light when it's dark or raining, and folding the roof when it's sunny. The research aims to simplify and expedite the clothes-drying process, particularly in unpredictable weather. The study demonstrates the successful implementation of the AUCLOS prototype and its potential application in the community, offering a practical solution to the challenges posed by uncertain weather conditions during clothes drying.

[2] ”Internet of Things (IoT) Based Rooftop for Clothing Stand” presents the development of an electro mechanical system designed to automatically protect clothes from rain and harmful sun rays. The system utilizes NodeMCU, rain and temperature sensors, a DC motor, and an Android app to monitor and control the rooftop for clothes drying. During rainy days, the rain sensor detects water, prompting the DC motor to close the mechanical parts of the cloth stand. The system is IoT-based, providing notifications to the user's smartphone during rainfall and high temperatures. The article emphasizes the system's energy efficiency and eco-friendliness, highlighting its potential to save time, reduce energy consumption, and improve the clothes drying process. Additionally, the article references related works on smart homes, IoT-based systems, and automatic wiper systems, providing valuable insights into the development of IoT-based solutions for every-

day challenges.

[3] The Automatic Clothes Retriever (ACR) is an innovative system designed to protect clothes from unexpected rain and weather changes. The system uses a mobile app-based monitoring system and advanced technology to retrieve clothes automatically depending on weather conditions. The ACR system is equipped with sensors such as LDR and rain sensors to detect weather changes and respond accordingly. The system can handle loads of up to 10kg and can retrieve clothes in 14.82 seconds if it starts raining. The ACR system consumes 0.289KWh of energy in an hour with full load. The system is designed to be controlled through the internet using GSM network and can monitor temperature, humidity, and movement of the hanger from a smartphone. The ACR system is a significant improvement over traditional clothes drying systems and provides a convenient and reliable solution for protecting clothes from unexpected weather changes.

[4] "Automatic Cloth Hanger System Using IoT" from Progress in Engineering Application and Technology (PEAT) Vol. 3 No. 2 presents innovative projects aimed at enhancing the functionality of cloth hanger systems. The projects utilize IoT technology, smart sensors, and microcontrollers to create automated systems capable of monitoring environmental conditions and adjusting the position of clothes accordingly. The projects discussed in the PDF include the use of microprocessors, sensors such as Light Dependent Resistor (LDR), rain sensors, and temperature sensors, as well as the integration of motors for mechanical movement. The advantages and disadvantages of each project are highlighted, along with details on the electronic and mechanical circuits, results of the project evaluation, and the use of flowcharts to guide system programming. The projects address the need for convenient cloth hanger systems, particularly in regions with frequent rain, and offer insights into the potential of IoT in improving everyday tasks.

[5] "Design and development of smart automated clothline" discusses the development of a smart automated clothesline, addressing the challenges of unpredictable weather and the inconvenience of drying clothes outdoors. The project follows the Waterfall Model, encompassing phases such as requirement analysis, system design, implementation, testing, deployment, and maintenance. The functional requirements of the system include components like the Arduino UNO, water sensor, and servo motor. The Arduino UNO is described as a microcontroller board with various input and output pins, while the water sensor is highlighted as a device actuated by rainfall. The system aims to address the issue of clothes getting wet due to sudden rain, especially in regions with unpredictable weather patterns. The study emphasizes the need for an innovative solution to mitigate

the impact of weather on daily chores like laundry. Additionally, the potential commercialization of the automated clothesline in the local market is highlighted. The references cited in the document cover a range of topics related to automation, weather phenomena, and system design, providing a comprehensive background for the project. Overall, it presents a detailed exploration of the development process and the potential impact of the smart automated clothesline on sustainable living and household convenience.

[6] "Development of Intelligent Clothesline Sytem" Intelligent Clothesline System to address the challenge of unpredictable weather affecting clothes drying. The system utilizes light dependent resistor (LDR) and rain sensor to detect changes in environmental conditions, sending input signals to an Arduino microcontroller. The study involves testing the sensors to obtain threshold values, which are then integrated into the program to determine brightness and rain availability. The prototype is designed to be portable, with a large base area for stability and easy assembly and disassembly for storage. Testing the completed prototype in various environmental conditions demonstrates its success in determining suitable conditions for drying clothes. Additionally, the system incorporates sensors such as LDR, impedance sensor, temperature sensor, and rain detector sensor as input switches, with outputs including an LCD display, motor, and GSM module. The study also includes sensor analysis, particularly testing the reaction of LDR and rain sensor module to changes in light intensity and water volume, respectively.

[7] "Designing of an Internet of Things (IoT) based automatic clothesline" regulates the drying of clothes during unpredictable weather conditions. The system uses a NodeMCU ESP8266 microcontroller, rain sensor, relay module, and RGB LED strip to control the drying process. The NodeMCU ESP8266 is an open-source IoT platform that uses the Lua scripting programming language. The rain sensor detects rainfall and sends a signal to the microcontroller, which then activates the relay module to retract the clothesline and turn on the RGB LED strip to indicate that the clothes are wet. Once the rain stops, the microcontroller sends a signal to the relay module to extend the clothesline and turn off the RGB LED strip to indicate that the clothes are dry. The system can be customized to fit different types of clothing materials and can be controlled remotely through a smartphone application. The article highlights the benefits of IoT technology in improving the efficiency of clothes drying and reducing energy consumption.

[8] Smart Cloth Line System based on Internet of Things (IoT) technology to address the issue of clothes getting wet during rainy days. The system consists of various components including Arduino UNO microcontroller, rain sensor, LDR, temperature and humidity sensor, servo motor, and LCD display. The system is

programmed using C++ language to detect the presence of water and light, and automatically compress the cloth line to protect the clothes. The Arduino microcontroller coordinates the system and sends notifications to the user's smartphone through the Blynk application. The prototype successfully demonstrates the functionality of the system, and it is suggested that this invention has the potential for future commercialization to help people ease their daily lives. The system is part of the broader trend of using technology to improve daily life and household management.

[9] "Design and Experimental Study on Automatic Cloth Retrieval and Drying System" presents a comprehensive study on the development of a system that aims to automate the cloth retrieval and drying process based on weather conditions. The system utilizes microcontroller technology, specifically the PIC 16F877, to control and manage the automatic cloth retrieval and drying process. The microcontroller is programmed to read data from various sensors, including temperature sensors, and to accept signals from these sensors to maintain the temperature inside the server room at suitable levels. Additionally, the system incorporates rollout awnings made of heavy American-made stock components, ensuring durability and reliability in various weather conditions. The study also delves into the selection of proper materials for the system's components, highlighting factors such as scrap utilization, appearance, and non-maintenance of the designed part. Sheet metal, a fundamental form used in metalworking, is discussed in detail, emphasizing its versatility in fabrication and the varying thicknesses available for different applications. Furthermore, it addresses the energy aspect of the cloth drying process, providing insights into the heat conversion involved in drying a typical wash load. The study outlines the heat conversion process and the latent heat stored in evaporated water, offering a detailed approach to calculating the heat energy involved in the drying process. Overall it provides a comprehensive overview of the design and experimental study on the automatic cloth retrieval and drying system, offering valuable insights into the technology, materials, and energy considerations involved in the development of this innovative system.

[10] "Automatic Protection of Clothes from Rain" presents a project that aims to provide a solution for protecting clothes from rain and ensuring they are exposed to sun rays for drying. The project uses a sensing system implemented using LDR with 555 timers, a tray fixed on the roof, and an 8-bit microcontroller that recognizes the status of the weather. The sensing system is fixed on the roof, and the tray is controlled by a driver circuit via a relay. The project is cost-effective, easy to understand, and simple to construct. The paper also includes a literature survey that analyzes existing products for cloth protection during rain and identifies their demerits. The project's potential applications include use in homes, offices, and

other places where clothes need to be protected from rain and exposed to sun rays for drying.

Chapter 3

System Design

3.1 Proposed Method

The proposed method for Design and development of Automatic retractable roof for clothesline . Main theme of this is to prevent washed clothes becoming wet by rain while hanged in clothesline. This problem occurs when the user is not at reachable area when the rain occurs. A retractable roof which senses rainy condition and covers the clothesline from rain. Thus, the proposed hardware contains two modules sensing, driving . Sensing and driving modules are controlled by Arduino UNO controller. As in many retractable roof the driving mechanism is by a tubular motor. Tubular motor works in servo mechanism, hence in this prototype servo motor is used for driving module. And this proposed method is more simple in design and high cost to construct.

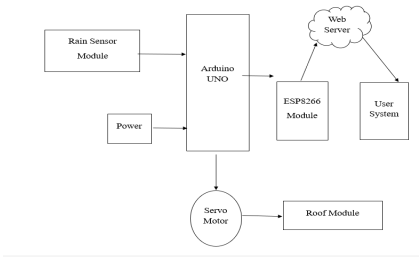


Figure 3.1: Block Diagram of Propoesd Method

3.2 Architecture

Developing an Automatic Protection of Clothes From Rain using IoT involves several stages :

Selection of IoT Components : The appropriate IoT components are chosen, including Rain sensor, arduino Uno, LDR, Stepper Motor to move the clothline clockwise or anti-clockwise.

Design and Prototyping : Automatic Protection of Clothes from Rain prototype is created with IoT components to enhance the user experience.

Software : The software used is Arduino IDE where we wrote code to control the IoT components.

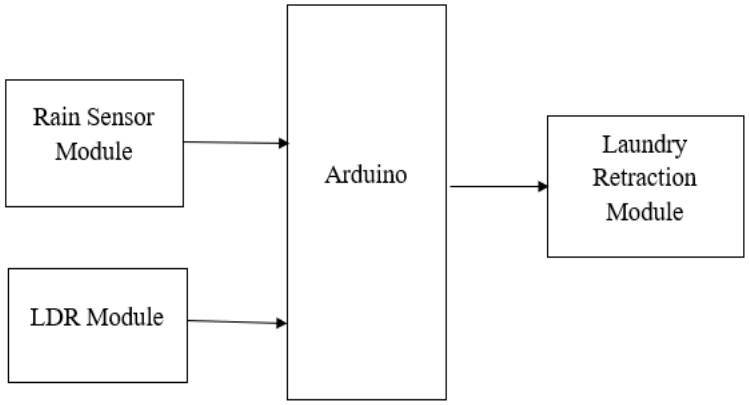


Figure 3.2: Architecture

3.2.1 Components

Here are some of the key components typically used in this project:

Arduino Uno:
The central processing unit and control hub of the system.
Interactions:Reads input signals from the rain sensor and LDR. Executes the decision-making algorithm based on sensor data. Controls the stepper motor to open or close the protective cover.

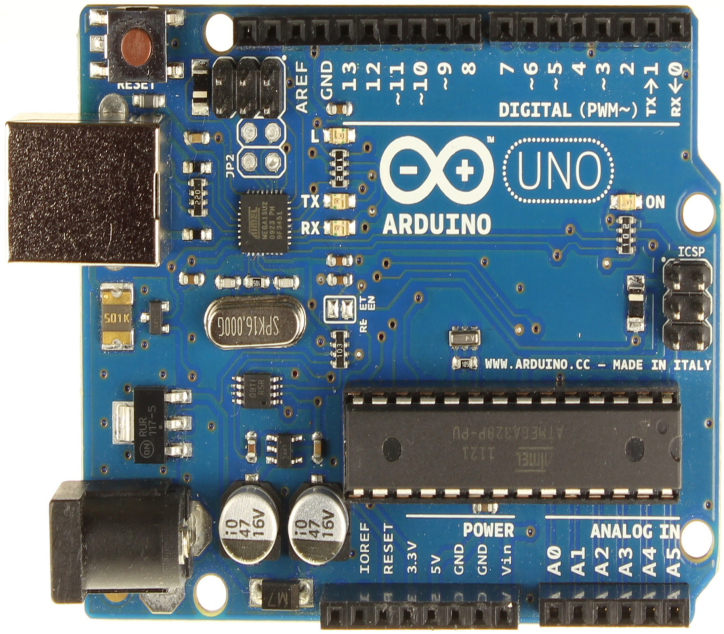


Figure 3.3: Arduino

Rain Sensor:
Detects the presence of rain by measuring the conductivity between its conductive traces.
Interactions:Sends a signal to the Arduino when rain is detected. The Arduino uses this signal as an input to make decisions regarding the activation of the rain protection system.

Figure 3.4: Rain Sensor

LDR: Lght Dependent Resistor
Measures ambient light conditions to determine whether it's day or night. Interactions: Provides input to the Arduino about the current light conditions. The Arduino uses this information to make decisions regarding the activation of the rain protection system.

Figure 3.5: LDR

Stepper Motor:
Controls the opening and closing mechanism of the protective cover. Interactions: Receives commands from the Arduino to either open or close the protective cover. The stepper motor movement is based on the decision-making algorithm executed by the Arduino. The motor movement opens the protective cover to shield clothes from rain or closes it when rain is not detected.

Figure 3.6: Stepper Motor

Chapter 4

Methodology

Building a system for automatic protection of clothes from rain using Arduino, a rain sensor, a stepper motor, and an LDR (Light Dependent Resistor) involves integrating these components effectively. Here's a step-by-step guide:

4.1 Climate Sensing

4.1.1 Rain Sensor

Connect the rain sensor to the Arduino. Typically, rain sensors have analog outputs. Connect the signal pin to an analog input on the Arduino. Connect power (VCC) and ground (GND) accordingly.It detects the presence of rain, allowing the system to trigger the protective mechanism when needed.

4.1.2 LDR

Connect the LDR(Light Dependent Resistor) to another analog input on the Arduino. Use a resistor in series with the LDR to create a voltage divider circuit. LDR can be used to detect ambient light conditions. The LDR can help determine whether it is daytime or nighttime.By incorporating the LDR, the system can make decisions based on both rain conditions and the time of day, providing a more context-aware and adaptable solution for automatic clothing protection.

4.2 Cloth Retraction

Connect the stepper motor to the Arduino using a stepper motor driver. Stepper motors have multiple wires; connect them to the driver based on the motor's specifications. Connect the driver to the Arduino. it works based on the input from the rain sensor and possibly the LDR. We have to adjust the delays and sequence of signals based on the specifications of stepper motor for optimal performance. The Arduino Uno serves as the central control unit in the automatic protection system for clothes from rain. It manages the inputs from sensors, makes decisions based on predefined conditions, and controls the stepper motor to deploy .

Chapter 5

Implemention

5.1 LDR Module

This is used to measure the light intensity. The code checks the LDR reading and controls two sets of green and blue LEDs based on whether the LDR reading is above or below a certain threshold (400).

5.2 Rain Sensor Module:

It is used to detect rain. The code checks the rain sensor reading and controls another set of red and green LEDs based on whether the rain sensor reading is above or below a certain threshold (900).

5.3 Stepper Motor Module:

It is Used to control a stepper motor. The stepper motor is used to move something (possibly a drying rack) forward or backward based on the difference between the LDR and rain sensor readings.

5.4 CODE:

```
//smart dying
const int pinLDR = A0;
const int pinRS = A1;
int LEDa = 7;
int LEDb = 6;
int LEDc = 5;
```

```
int LEDd = 4;
int x=0;
int C1=8;
int C2=9;
int C3=10;
int C4=11;
int step = 25;
int delaytime = 2;
void setup()
Serial.begin(9600);
pinMode(pinLDR,INPUT);
pinMode(pinRS,INPUT);
pinMode(LEDa,OUTPUT);
pinMode(LEDb,OUTPUT);
pinMode(LEDc,OUTPUT);
pinMode(LEDd,OUTPUT);
pinMode(C1,OUTPUT);
pinMode(C2,OUTPUT);
pinMode(C3,OUTPUT);
pinMode(C4,OUTPUT);
float total;
int dataLDR=0;
int dataRS=0;
void loop ()
dataLDR = analogRead(pinLDR);
if(dataLDR¿400)
digitalWrite(LEDa,HIGH);
else
digitalWrite(LEDa,LOW);
Serial.print(”Data LDR = ”);
Serial.println(dataLDR);
if(dataLDR¡400)
digitalWrite(LEDb,HIGH);
else
digitalWrite(LEDb,LOW);
dataRS= analogRead(pinRS);
if(dataRS¡900)
digitalWrite(LEDc,HIGH);
else digitalWrite(LEDc,LOW);
Serial.print(”Data RS = ”);
Serial.println(dataRS);
```

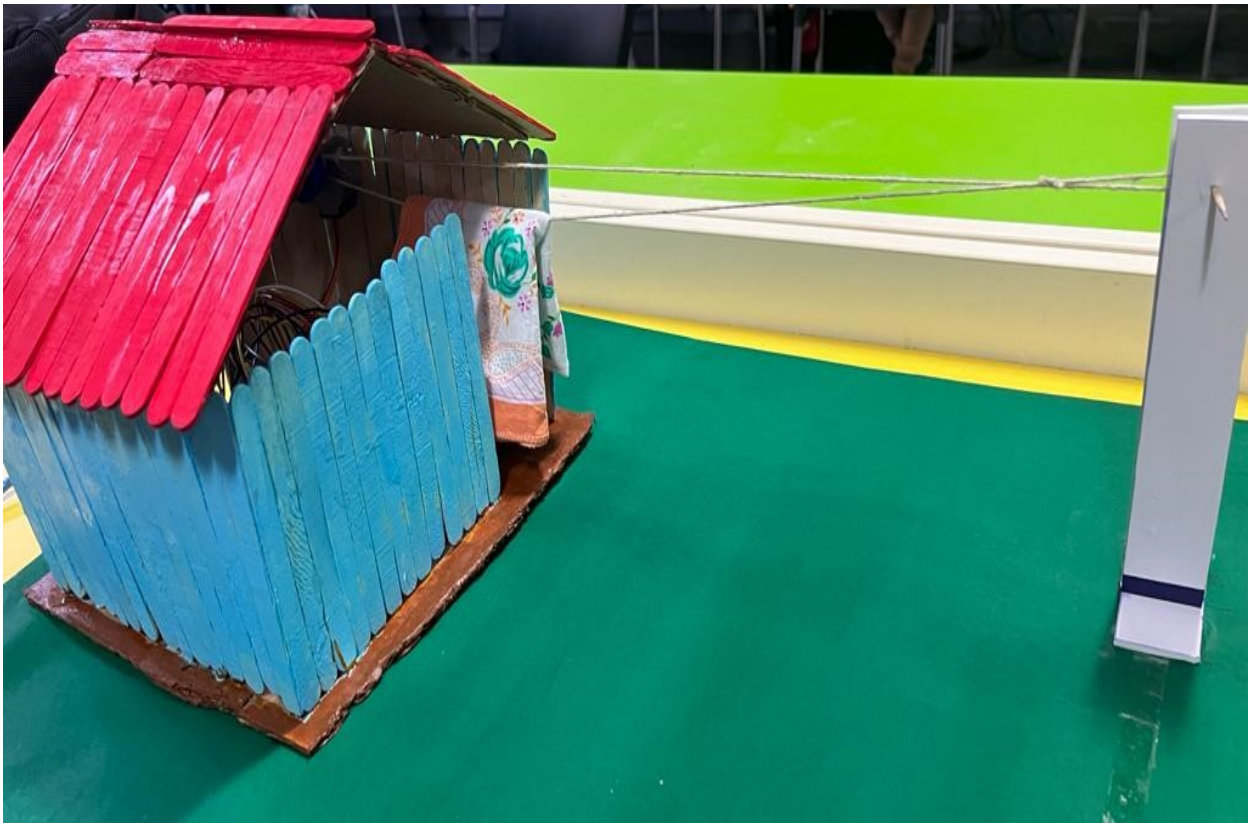
```
if(dataRS¿900)
digitalWrite(LEDd,HIGH);
else
digitalWrite(LEDd,LOW);
total = (dataRS - (dataLDR+600));
Serial.print(”total ”);
Serial.println(total);
if (total¡-10)
if (x==1)
Serial.print(”jemuran keluar”);
for (int i=0; i¡2000; i++)
mundur();
x=0;
else if (total¿-10)
if(x==0)
Serial.println(”jemuran masuk”);
for (int i=0; i¡2000; i++)
maju();
x=1;
delay(1000);
void mundur()
step4();
delay(delaytime);
step3();
delay(delaytime);
step2();
delay(delaytime);
step1();
delay(delaytime);
void maju()
step1();
delay(delaytime);
step2();
delay(delaytime);
step3();
delay(delaytime); step4();
delay(delaytime);
void step1()
digitalWrite(C1,LOW);
digitalWrite(C2,LOW);
digitalWrite(C3,HIGH);
```

```
digitalWrite(C4,HIGH);
void step2()
digitalWrite(C1,HIGH);
digitalWrite(C2,LOW);
digitalWrite(C3,LOW);
digitalWrite(C4,HIGH);
void step3()
digitalWrite(C1,HIGH);
digitalWrite(C2,HIGH);
digitalWrite(C3,LOW);
digitalWrite(C4,LOW);
void step4()
digitalWrite(C1,LOW);
digitalWrite(C2,HIGH);
digitalWrite(C3,HIGH);
digitalWrite(C4,LOW);
```

Chapter 6

Results and Discussions

6.1 Experimental Result



Chapter 7

Conclusions and future works

The IoT-based rain protection system, integrating a rain sensor, LDR, LED, Arduino, and a stepper motor, excels in efficient rain detection and adaptive light sensing. The Arduino facilitates real-time decision-making, while the stepper motor and LED contribute to precise control and user feedback. Safety features ensure system reliability. The scalable design allows for future enhancements and modifications. Users benefit from a user-friendly interface and convenience. Overall, this system offers a comprehensive and adaptable solution for protecting clothes from rain, combining technological sophistication with practical usability in a seamless integration of smart sensors.

The Internet of Things (IoT) can play a pivotal role in expanding the functionality of the system. Enabling IoT connectivity would allow users to monitor and control their rain protection system remotely through dedicated mobile applications. Real-time weather updates, personalized settings, and notifications could be delivered to users, creating a more interactive and user-friendly experience.

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