Temperature Optimized Hinge System using IoT (Arduino)

A PROJECT REPORT

submitted by

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BONAFIDE CERTIFICATE

Certified that this project report titled "TEMPERATURE OPTIMIZED HINGE SYSTEM" is the bonafide work of SANJEEV U (210701232) SHARVESH R (210701244)" who carried out the work under my supervision. Certified further that to the best of my knowledge the work reported herein does not form part of any other thesis or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

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CHAPTER 1
INTRODUCTION

In today's day and age, it has become quite impossible for people to manage a million different things at once. People's lives have become very hectic in this modern era that they find complex ways to put off even the smallest of work. As people spend most of their time in their houses, it is necessary to simplify their lives at home as much as possible. To address this need, the proposed project, Temperature Optimized Hinge System using IoT, leverages advanced technology to provide a comprehensive solution for real-time temperature, humidity and automated control. Temperature Optimized Door System Using IoT utilizes the Arduino UNO, DHT11 sensor, and our own website to create a robust and user-friendly system.

This system allows users to monitor temperature and humidity levels remotely and control a door or a window automatically based on predefined threshold levels. In automatic mode, the system ensures a continuous temperature and humidity detection by activating the door to close when temperature levels go above the threshold. For greater flexibility, the system also offers a manual mode, enabling users to control the door directly via our own website designed with HTML and CSS. The integration of Wi-Fi connectivity ensures that data collected by the Arduino is transmitted to the website, providing real-time updates and a seamless user experience. The app features an intuitive interface, allowing users to easily switch between automatic and manual modes, monitor temperature and humidity levels, and help beat the summer heat.

By employing Temperature Optimized Door System, homeowners who are remotely residing are benefited, thereby conserving water and enhancing operational efficiency. This project not only promotes sustainability but also simplifies management processes through the power of IoT technology. With its ability to transform traditional systems into smart solutions, Temperature Optimized Door System empowers users to make informed decisions and optimize their strategies for maximum impact and success.

CHAPTER 2
LITERATURE SURVEY

2.1 LITERATURE SURVEY

The need for efficient and reliable home automation systems is growing due to increasing temperature due to global warming and people want to beat the summer heat. Traditional methods are often manual and inefficient, leading to laborious tasks and inaccessibility to resources. The integration of IoT technology in Home Automation provides a promising solution for automated monitoring and control, enhancing temperature and humidity control and operational efficiency. This literature survey reviews various research works that have contributed to the development of IoT-based Home Automation Systems, highlighting their methodologies, implementations, and benefits.

transform a normal house in a smart house while reducing the energy consumption [1]. IoT has been found to have enhanced the smart home automation by ensuring that home appliances and devices can be commanded remotely and at a convenient, safe, and comfortable mode. [2]. Making the house smart is to allow for intelligent automatic executing of several commands after analyzing the collected data. Automation can be accomplished by using the Internet of Things (IoT). This gives the inhabitant accesses to certain data in the house and the ability to control some parameters remotely. [3].

Research on smart home automation systems underscores the significance of real-time data collection and control, which are crucial for maintaining optimal indoor environments. For instance, IoT-based systems using Arduino for home automation highlight how IoT enables continuous and real-time monitoring of environmental conditions, which is essential for efficiently managing indoor climate and energy use.

Studies on IoT systems for environmental monitoring demonstrate the capabilities of IoT in providing real-time data and alert systems. These systems are adaptable for various applications, including temperature and humidity control in smart homes, showcasing their versatility and effectiveness in maintaining indoor comfort and safety.

A comprehensive review of IoT-based home automation systems provides insights into the various approaches and technologies employed in this field. It highlights the benefits of integrating sensors and actuators for creating responsive and intelligent home environments, which can be applied to projects involving automatic window and door closures based on temperature thresholds.

Research on smart home energy management systems using IoT reveals their advantages in urban settings for efficient energy distribution and consumption. These systems illustrate how IoT can enhance the management of household energy use, directly relevant to projects aiming to reduce energy consumption through automated climate control.

IoT-based environmental monitoring systems emphasize the role of IoT in improving the management and conservation of resources. These systems, which often incorporate various sensors for real-time data collection, can be adapted for applications such as monitoring indoor air quality and maintaining optimal indoor conditions.

Studies on smart irrigation systems using IoT demonstrate the application of IoT in optimizing resource usage. These systems, which focus on efficient water use, provide a relevant framework for developing automated systems for indoor climate control, highlighting the potential for significant improvements in energy efficiency and comfort through smart home automation.

These references collectively demonstrate the transformative potential of IoT technology in traditional home automation systems. By leveraging IoT for real-time environmental monitoring and control, significant improvements can be made in energy conservation, indoor comfort, and operational efficiency. The integration of sensors like the DHT11 with Arduino Uno and servo motors for automated window and door management, along with features like buzzer alerts and real-time data display on a website dashboard, exemplifies the innovative applications of IoT in creating smart, efficient, and responsive home environments.

2.2 EXISTING SYSTEM

Current smart home automation systems for climate control often rely on basic, manual methods or limited automation. In many households, occupants must manually adjust windows and doors to regulate indoor temperatures, which is both time-consuming and inefficient. Additionally, some systems employ simple thermostat-based controls to manage heating and cooling, but these systems lack the capability to respond dynamically to changing environmental conditions within the home.

Basic automation systems in use today might include programmable thermostats and basic environmental sensors. While these devices offer some level of automated control, they are often limited to managing HVAC systems and do not extend to controlling windows or doors. Furthermore, these systems typically do not provide real-time data or remote monitoring capabilities, making them less effective in optimizing energy usage and maintaining consistent indoor comfort.

2.3 PROPOSED SYSTEM

The proposed smart home automation system aims to enhance indoor climate control by integrating IoT technology with advanced environmental monitoring and automation mechanisms. Utilizing the DHT11 sensor in conjunction with an Arduino Uno, this system automates the closing of windows and doors via servo motors when indoor temperatures exceed 30 degrees Celsius. Additionally, a buzzer is activated as an alert mechanism, and real-time temperature and humidity data are displayed on a website dashboard.

The system is designed to offer continuous and precise monitoring of indoor environmental conditions. The DHT11 sensor accurately measures temperature and humidity, while the Arduino Uno processes this data to control the servo motors, which automatically close windows and doors when necessary. This automated response helps maintain a comfortable indoor environment and reduces the need for manual intervention.

The integration of a buzzer provides an immediate audible alert when the temperature threshold is exceeded, enhancing the system's functionality as a proactive warning mechanism. Furthermore, the real-time data is transmitted to a website dashboard, accessible from any device with an internet connection. This feature allows users to monitor their home's environmental conditions remotely and make adjustments as needed.

The proposed system also includes flexible control modes, enabling users to switch between automatic and manual operation. This flexibility ensures that occupants can override automated actions if specific situations require manual intervention. The system's scalability allows for expansion to include additional sensors and control mechanisms, adapting to larger homes or more complex environmental management needs.

By automating the control of windows and doors based on real-time environmental data, the proposed system optimizes energy usage, enhances indoor comfort, and promotes energy efficiency. This approach represents a significant improvement over existing systems, demonstrating the potential of IoT technology to revolutionize smart home automation practices.

CHAPTER 3

PROJECT DESCRIPTION

3.1 METHODOLOGY

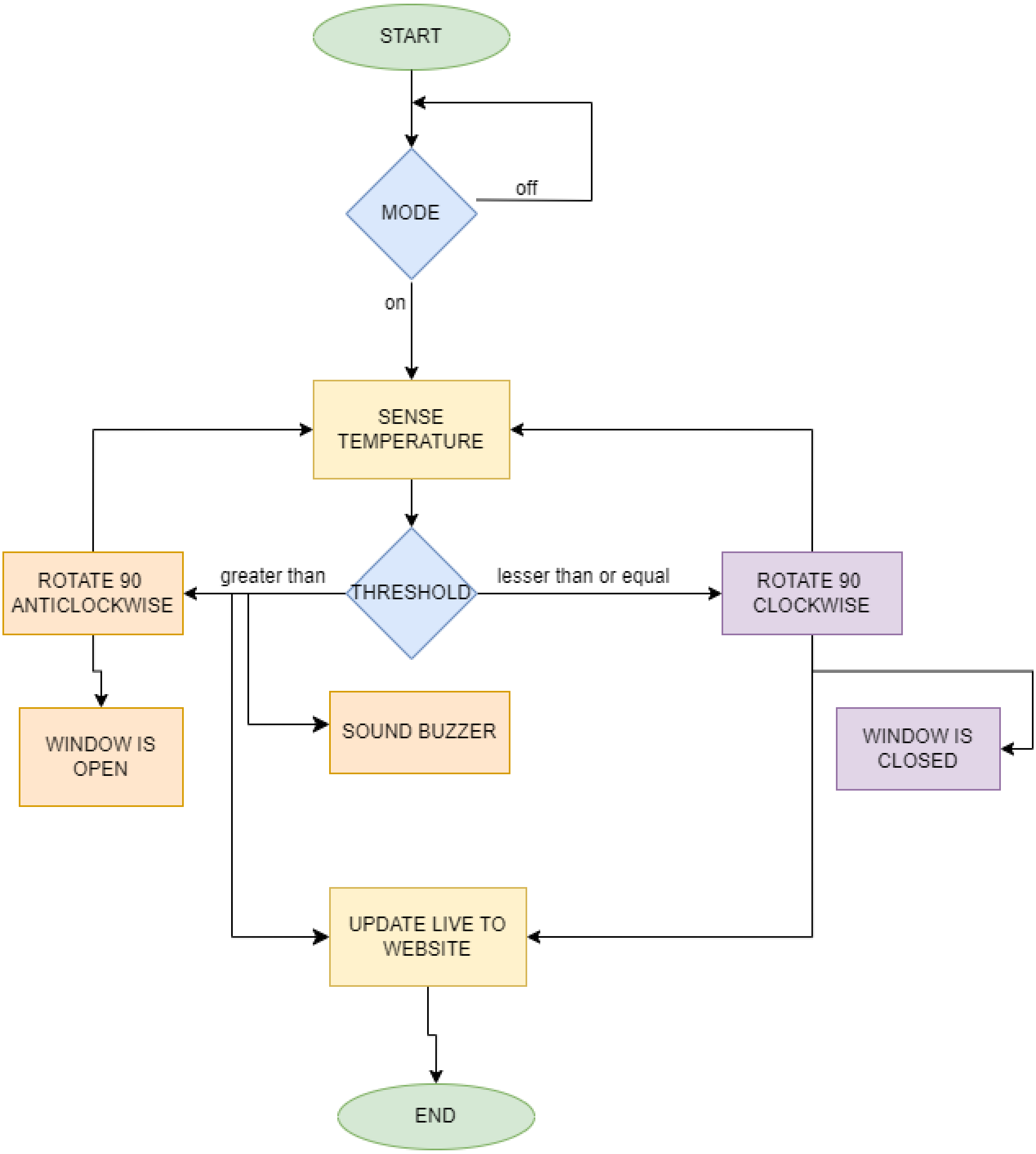


Fig 1 Flow Diagram

This system aims to provide a smart water level management mechanism using an ESP32 microcontroller and a DHT11 Temperature and Humidity sensor. As mentioned in Fig 1, the Arduino is turned on, and necessary libraries are installed and initialized as follows:

Steps to Add Libraries in Arduino IDE

1. **Open Arduino IDE**:
   - Start your Arduino IDE on your computer.
2. **Open Library Manager**:
   - Go to the menu bar and select Sketch > Include Library > Manage Libraries....
3. **Install the DHT Library**:
   - In the Library Manager, type DHT sensor library in the search box.
   - Look for the library by Adafruit with the exact name DHT sensor library.
   - Click the Install button next to this library.
4. **Install the Servo Library**:
   - In the Library Manager, type Servo in the search box.
   - Find the Servo library by Michael Margolis.
   - Click the Install button next to this library.

Verifying the Installation

To verify that the libraries have been installed correctly, you can check if the examples for these libraries are available:

1. **Check DHT Library Examples**:
   - Go to File > Examples > DHT sensor library and ensure you see example sketches.
2. **Check Servo Library Examples**:
   - Go to File > Examples > Servo and ensure you see example sketches.

The system provides two modes of operation:

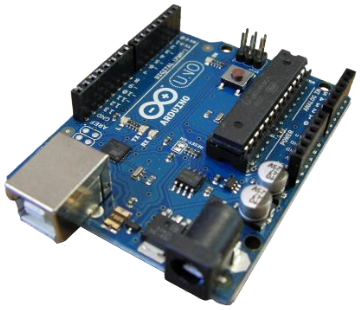
Automatic Mode: Automatically controls the door based on temperature and humidity thresholds set beforehand.

By integrating IoT technology with real-time monitoring and control capabilities, this project offers a scalable and cost-effective solution for Home Automation. It enhances operational efficiency, making it suitable for various applications, from residential uses to industrial purposes.

3.2 REQUIREMENTS

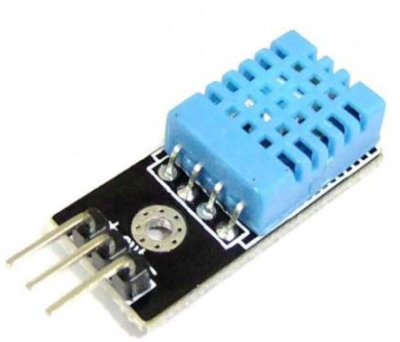
3.2.1 HARDWARE REQUIREMENTS

- Arduino UNO microcontroller



- Ultrasonic sensor

- DHT11 Sensor



- Buzzer 6V

- Power supply (5V)
- Breadboard
- Jumper wires
- Buzzer (6V)
- Servo motor
- Computer (for webiste access)

3.2.2 SOFTWARE REQUIREMENTS

- Arduino IDE for Arduino UNO programming
- SmartDoorz website (for remote monitoring and control)

3.3 ARCHITECTURE DIAGRAM

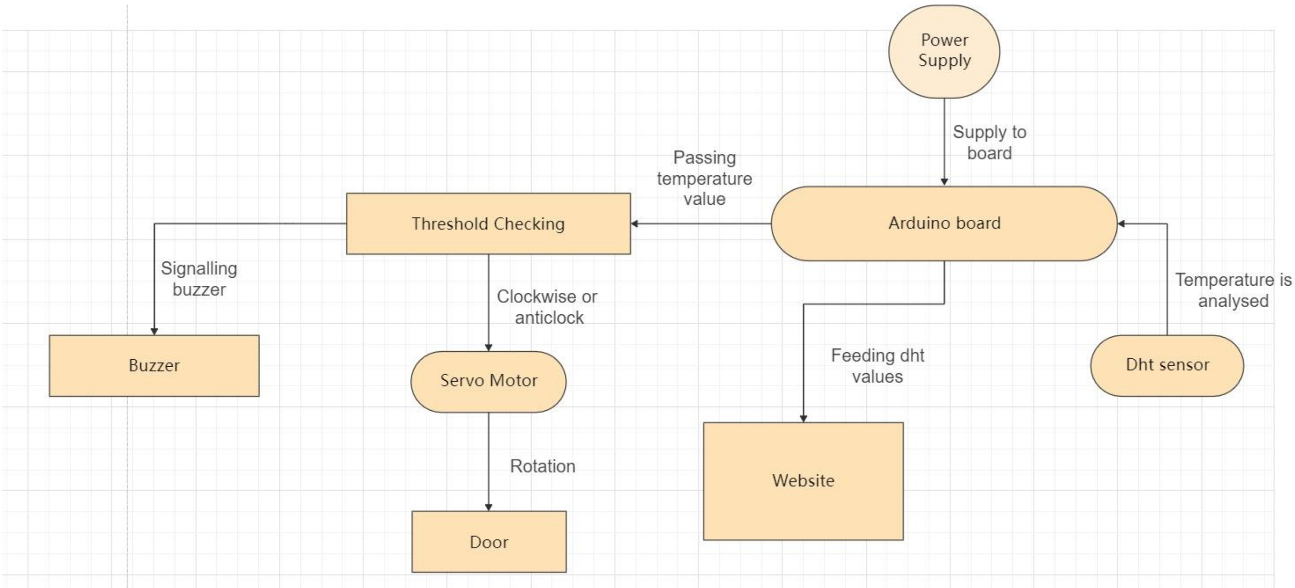
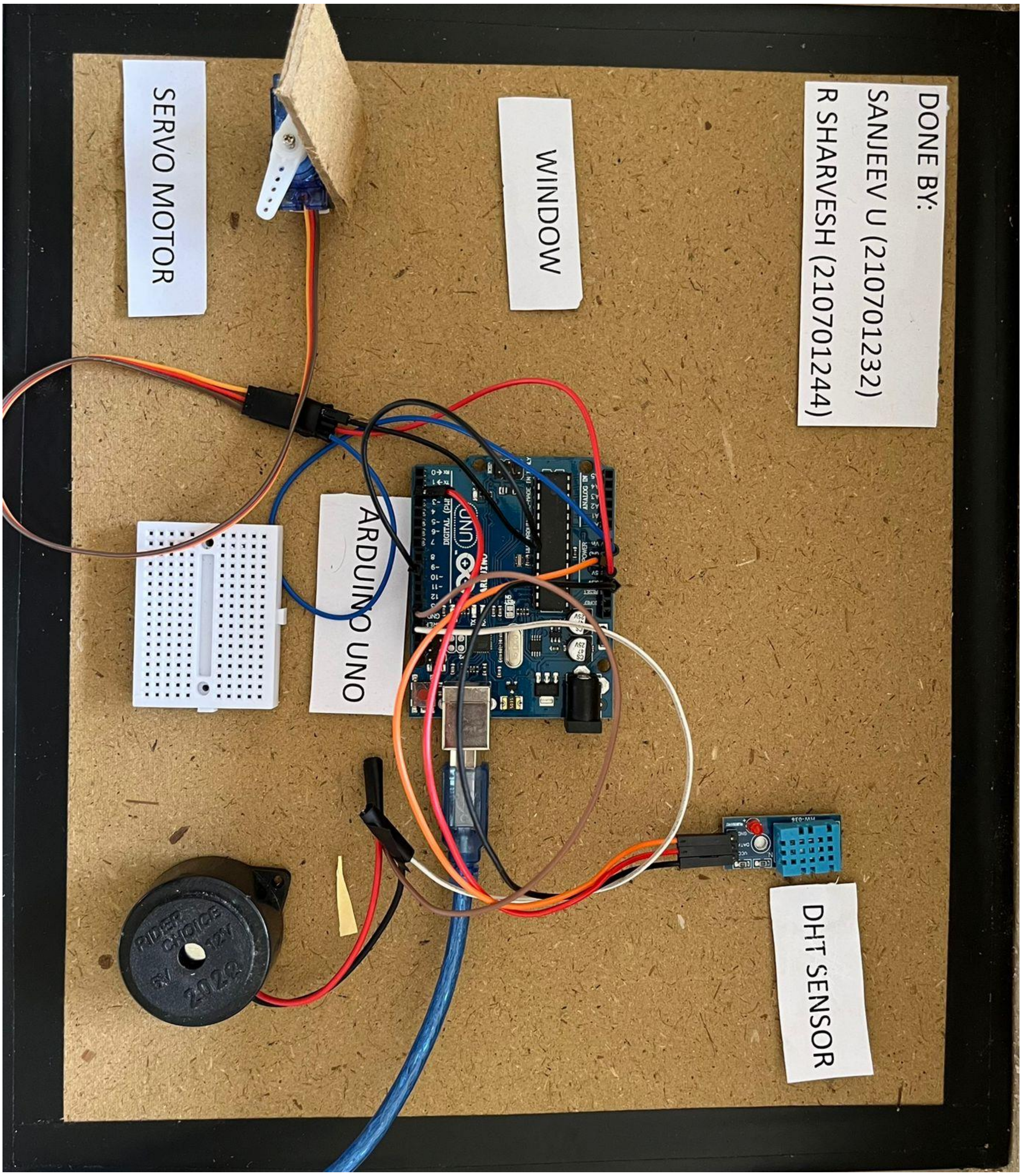


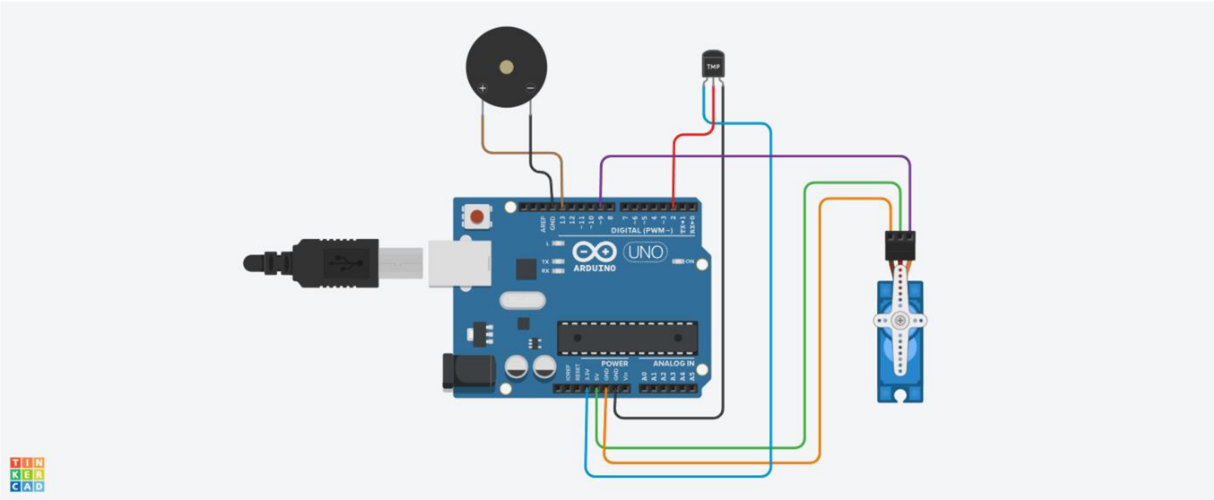
Fig 3.3 Architecture Diagram

Fig 3.3 shows the Architecture diagram of the Temperature Optimized Hinge System using IoT. This diagram displays all the modules present in our project, like Arduino UNO, Servo Motor, 6V Buzzer, DHT11 sensor.

3.4 PROJECT DIAGRAM



3.5 CIRCUIT DIAGRAM



3.6 OUTPUT

```
Temperature: 32.10 °C   Humidity: 70.90 %
Temperature: 32.10 °C   Humidity: 70.80 %
Temperature: 32.10 °C   Humidity: 70.80 %
Temperature: 32.10 °C   Humidity: 70.70 %
Temperature: 32.10 °C   Humidity: 70.60 %
Motor rotated done
Temperature: 32.10 °C   Humidity: 70.20 %
Temperature: 32.10 °C   Humidity: 70.20 %
Temperature: 32.10 °C   Humidity: 70.20 %
Temperature: 32.10 °C   Humidity: 70.10 %
```

Fig 3.1 Datastreams

Fig 3.1 shows the datastreams to the microprocessor from Arduino UNO

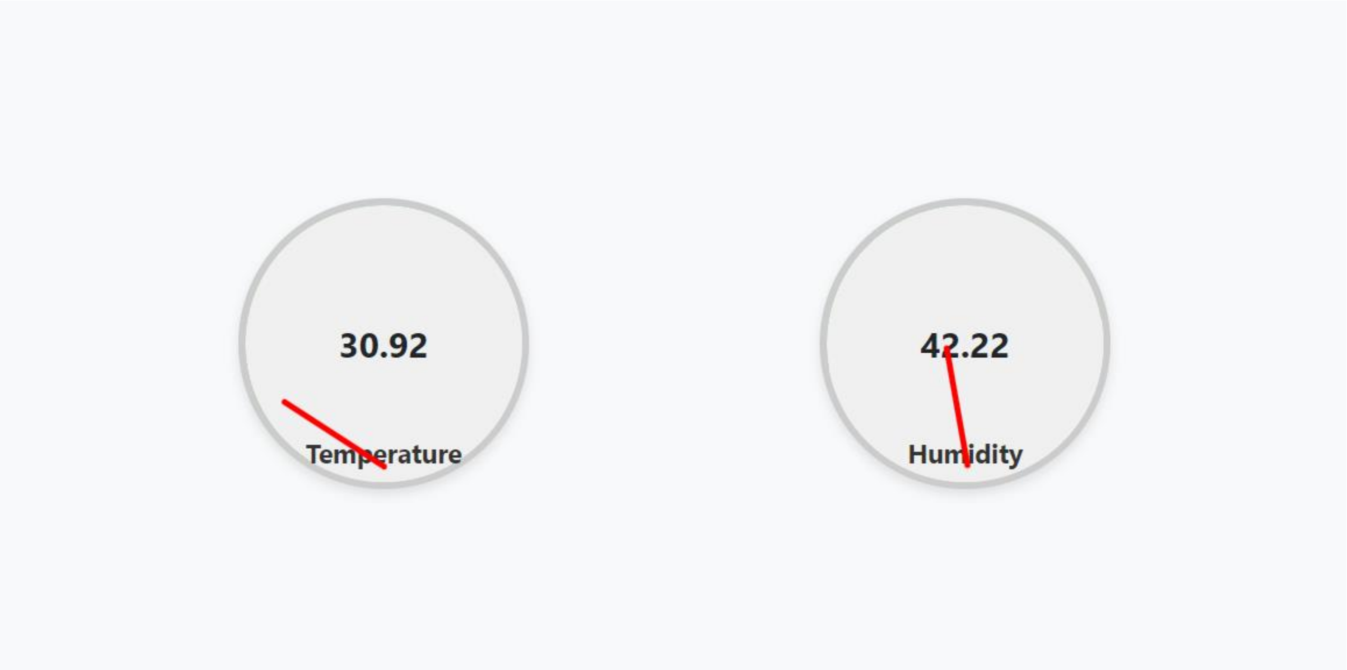


Fig 3.2 Web Dashboard

Fig 3.2 shows the layout of Web Dashboard which is visible to the user, showing the real-time data.

CHAPTER 4

CONCLUSION AND FUTURE ENHANCEMENT

4.1 FUTURE ENHANCEMENTS

The functionality of this smart home automation system can be significantly enhanced by integrating various types of sensors and control mechanisms. For instance, incorporating additional environmental sensors such as CO2, smoke, and motion sensors can provide added functionality like improved air quality monitoring, fire detection, and enhanced security.

The system can be expanded to monitor environmental conditions in multiple locations simultaneously by deploying additional DHT11 sensors and using Arduino UNO microcontroller, enabling more comprehensive climate control solutions. This scalability allows the system to be implemented on a larger scale, effectively managing the indoor environment in larger homes, office buildings, or multi-room setups.

Furthermore, the integration of advanced automation models, such as predictive algorithms and machine learning, can enhance the system's efficiency and responsiveness. By analyzing historical data and predicting future conditions, the system can make proactive adjustments to window and door positions, heating, and cooling systems to optimize energy use and maintain comfort levels.

In addition, integrating biometric sensors for fingerprint or facial recognition can enhance the security and access control of the system. This improvement ensures that only authorized individuals can override automated actions or access the control dashboard, adding an extra layer of security to the smart home environment.

Implementing voice control and smart assistants like Amazon Alexa or Google Home can provide users with more intuitive and convenient ways to interact with the system. Voice commands can be used to adjust settings, receive real-time updates, and control various aspects of the home environment without needing a manual interface.

Lastly, the development of a mobile application can offer users greater flexibility and convenience in monitoring and controlling their home environment. The app could provide real-time notifications, detailed historical data analysis, allowing users to manage their smart home system from anywhere in the world.

These enhancements will not only increase the system's versatility and user-friendliness but also contribute to creating a more intelligent, responsive, and secure home automation environment.

APPENDIX

Temperature.ino

```
#include <Servo.h>

 #define DHTPIN 2      // Digital pin connected to the DHT sensor
 #define DHTTYPE DHT11 // DHT 11
 #define SERVOPIN 9    // Digital pin connected to the servo motor
 #define BUZZERPIN 13  // Digital pin connected to the buzzer

 DHT dht(DHTPIN, DHTTYPE);
 Servo myservo;

 bool isServoAt90 = false;

 void setup() {
   Serial.begin(9600);
   dht.begin();
   myservo.attach(SERVOPIN);
   myservo.write(0);
   pinMode(BUZZERPIN, OUTPUT);
   digitalWrite(BUZZERPIN, LOW);
 }

 void loop() {
   delay(2000);
```

```
 // Read temperature and humidity data from the sensor
 float temperature = dht.readTemperature();
 float humidity = dht.readHumidity();

 if (isnan(temperature) || isnan(humidity)) {
   Serial.println("Failed to read from DHT sensor!");
   return;
 }



 Serial.print("Temperature: ");
 Serial.print(temperature);
 Serial.print(" °C\t");
 Serial.print("Humidity: ");
 Serial.print(humidity);
 Serial.println(" %");



myservo.write(90);
 Serial.println("Now checking for threshold");

 if (temperature > 30 && !isServoAt90) {
   // Serial.println("Temperature above 30°C. Moving servo to 90
degrees and activating buzzer.");
   myservo.write(90);
```

```
    digitalWrite(BUZZERPIN, HIGH);
    delay(1000);  // Keep buzzer on for 1 second
    digitalWrite(BUZZERPIN, LOW);
    isServoAt90 = true;  // Update the flag
    Serial.println("Motor rotated done");

  } else if (temperature <= 30 && isServoAt90) {
    Serial.println("Temperature 30°C or below. Moving servo back to 0
degrees.");
    myservo.write(0);
    isServoAt90 = false;
  }
}
```

GaugeWebsite.html

```
<!DOCTYPE html>
<html lang="en">
<head>
<meta charset="UTF-8">
<meta name="viewport" content="width=device-width, initial-
scale=1.0">
<title>Gauges</title>
<link
href="https://maxcdn.bootstrapcdn.com/bootstrap/4.0.0/css/bootstrap.m
in.css" rel="stylesheet">
<style>
    body {
```

```
    background-color: #f8f9fa;
    display: flex;
    justify-content: center;
    align-items: center;
    height: 100vh;
}
.gauge-container {
    display: flex;
    justify-content: space-around;
    width: 100%;
    max-width: 800px;
}
.gauge {
    position: relative;
    width: 200px;
    height: 200px;
    border-radius: 50%;
    background: #f0f0f0;
    border: 5px solid #ccc;
    margin: 20px;
    display: inline-block;
    box-shadow: 0 4px 8px rgba(0, 0, 0, 0.1);
}
.gauge .fill {
    position: absolute;
    width: 100%;
```

```
    height: 100%;
    border-radius: 50%;
    background: linear-gradient(90deg, #4CAF50 50%, transparent 50%);
    transform: rotate(90deg);
    transform-origin: center;
  }
  .gauge .mask {
    position: absolute;
    width: 100%;
    height: 100%;
    border-radius: 50%;
    background: #f0f0f0;
  }
  .gauge .value {
    position: absolute;
    top: 50%;
    left: 50%;
    transform: translate(-50%, -50%);
    font-size: 24px;
    font-weight: bold;
  }
  .gauge .needle {
    position: absolute;
    top: 50%;
    left: 50%;
```

```
        width: 4px;
        height: 45%;
        background: red;
        transform-origin: bottom;
        transition: transform 0.5s;
        border-radius: 2px;
        z-index: 1;
    }
    .gauge .label {
        position: absolute;
        top: 90%;
        left: 50%;
        transform: translate(-50%, -50%);
        font-size: 18px;
        font-weight: bold;
        color: #333;
    }
</style>
</head>
<body>

<div class="gauge-container">
    <div class="gauge" id="temperature-gauge">
        <div class="fill"></div>
        <div class="mask"></div>
        <div class="value" id="temperature-value">30</div>
```

```
        <div class="needle" id="temperature-needle"></div>
        <div class="label">Temperature</div>
    </div>

    <div class="gauge" id="humidity-gauge">
        <div class="fill"></div>
        <div class="mask"></div>
        <div class="value" id="humidity-value">40</div>
        <div class="needle" id="humidity-needle"></div>
        <div class="label">Humidity</div>
    </div>
</div>
```

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