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Ramanagara District, Karnataka, India

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(IV Semester)

A Project Report on

"SMART FARMING USING IOT TECHNOLOGIES"

Submitted in partial fulfilment for the award of the degree of

BACHELOR OF TECHNOLOGY

IN

COMPUTER SCIENCE AND ENGINEERING

Submitted by

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CERTIFICATE

This is to certify that the project work titled **"SMART FARMING USING IOT TECHNOLOGIES"** is carried out by **P.irfan (22BTRCN207), K.Navya Sree (22BTRCN144), M.Likhitha (22BTRCN169), L.Vineeth Kumar(22BTRCN159), K.Nikhil(22BTRCN147).** a bonafide student(s) of Bachelor / Master of Technology at the School of Engineering & Technology, Faculty of Engineering & Technology, JAIN (Deemed-to-be University), Bangalore in partial fulfillment for the award of degree in Bachelor / Master of Technology in Computer Science and Engineering, during the year **2023-2024**.

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DECLARATION

We , **P.irfan (22BTRCN207), K.Navya Sree (22BTRCN144), M.Likhitha (22BTRCN169), L.Vineeth Kumar(22BTRCN159), K.Nikhil(22BTRCN147).**student of IV semester B.Tech in **Computer Science and Engineering**, at School of Engineering & Technology, Faculty of Engineering & Technology, **JAIN (Deemed to-be University)**, hereby declare that the internship work titled **"Title"** has been carried out by us and submitted in partial fulfilment for the award of degree in **Bachelor of Technology in Computer Science and Engineering** during the academic year **2023-2024**. Further, the matter presented in the work has not been submitted previously by anybody for the award of any degree or any diploma to any other University, to the best of our knowledge and faith.

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First, I take this opportunity to express my sincere gratitude to Faculty of Engineering & Technology, JAIN (Deemed to-be University) for providing me with a great opportunity to pursue my Bachelors / Master's Degree in this institution.

I am deeply thankful to several individuals whose invaluable contributions have made this project a reality. I wish to extend my heartfelt gratitude to ***Dr. Chandraj Roy Chand, Chancellor****, for his tireless commitment to fostering excellence in teaching and research at Jain (Deemed-to-be-University). I am also profoundly grateful to the honorable* ***Vice Chancellor, Dr. Raj Singh, and Dr. Dinesh Nilkant, Pro Vice Chancellor****, for their unwavering support. Furthermore, I would like to express my sincere thanks to* ***Dr. Jitendra Kumar Mishra, Registrar****, whose guidance has imparted invaluable qualities and skills that will serve us well in our future endeavors.*

I extend my sincere gratitude to ***Dr. Hariprasad S A, Director*** *of the Faculty of Engineering & Technology,* ***and Dr. Geetha G, Director*** *of the School of Computer Science & Engineering within the Faculty of Engineering & Technology, for their constant encouragement and expert advice. Additionally, I would like to express my appreciation to* ***Dr. Krishnan Batri, Deputy Director (Course and Delivery), and Dr. V. Vivek, Deputy Director (Students & Industry Relations),*** *for their invaluable contributions and support throughout this project.*

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I would like to thank our Project Coordinator ***Dr. Gaurav Kumar****, and all the staff members of Computer Science and Engineering for their support.*

I am also grateful to my family and friends who provided me with every requirement throughout the course.

Feel free to add any additional members that you want to acknowledge other than above.

I would like to thank one and all who directly or indirectly helped me in completing the work successfully.

Signature of Student(s)

ABSTRACT

Farming has a major impact on the economy of the country. A lot of Research has been carried out in the temperature, humidity and the moisture of the soil. This project is going to be focused on smart farming as a whole, it is one thing to monitor the weather and soil conditions on a farm but it is another thing to control what happens with the data that has been captured. I have developed an IOT based smart farming solution using various sensors whereby farming conditions are not only monitored but a decision is made by the system on what to do with the data gathered based on the threshold values that have been set and the data is automatically updated on a Arduino server and a website giving live feedback using graphs and charts. This is a unique and new approach unlike other methods introduced before. This project is aimed at improving the farming system to make it easier by automating it and controlling the variables on the farm.

Keywords: -
IOT – internet of things
Sensors – devices that are frequently used to detect and respond to electrical or optical signals.

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Chapter 1

INTRODUCTION

1.1Background and Motivation

smart farming is a management concept focused on providing the agricultural industry with the infrastructure to leverage advanced technology – including big data, the cloud, machine learning and the internet of things (IoT) – for tracking, monitoring, automating and analysing operations. Also known as precision farming, smart farming is software-managed and sensor-monitored.

Background

Agriculture is a vital industry that feeds the world's population, but traditional farming practices often face challenges related to efficiency, resource management, and sustainability. Key factors affecting crop health and yield include soil temperature, humidity, and soil moisture. These parameters are crucial for maintaining optimal growing conditions, but they are often monitored manually or infrequently, leading to inefficiencies and suboptimal crop management.

The rapid advancement of Internet of Things (IoT) technologies offers a transformative approach to modern agriculture. IoT involves the use of interconnected devices and sensors that collect and transmit data in real time. By integrating IoT technologies into farming, it becomes possible to monitor soil conditions continuously and accurately, providing valuable insights that can enhance crop management and productivity.

Motivation

1. **Precision Agriculture**:
    - Traditional farming often relies on generalized practices that may not account for the specific needs of different crops or soil types. By

using IoT to monitor soil temperature, humidity, and moisture, farmers can adopt precision agriculture techniques that tailor interventions to the exact conditions of their fields, improving crop health and yields.

2. **Water Conservation**:
    - Water is a critical resource in agriculture, and its efficient use is essential for sustainable farming. IoT-enabled soil moisture monitoring allows for precise irrigation, ensuring that crops receive the right amount of water when needed, reducing wastage, and conserving water resources.
3. **Enhanced Crop Management**:
    - Continuous monitoring of soil conditions provides real-time data that can help farmers quickly respond to changes that might affect crop health. For example, if soil moisture levels drop below optimal levels, the system can alert the farmer to irrigate, preventing stress on the plants and promoting healthy growth.
4. **Cost Reduction**:
    - Automated monitoring and data-driven decision-making reduce the need for manual labor and minimize the overuse of resources such as water and fertilizers. This leads to significant cost savings for farmers, making agriculture more economically viable.
5. **Environmental Sustainability**:
    - Sustainable farming practices are essential to protect the environment and ensure long-term agricultural productivity. By using IoT technologies to monitor and manage soil conditions, farmers can reduce the environmental impact of their activities, such as minimizing runoff and soil erosion.
6. **Data-Driven Insights**:
    - Collecting data on soil temperature, humidity, and moisture over time allows for the analysis of patterns and trends. These insights can inform future farming practices, helping farmers to anticipate and mitigate potential issues, and optimize their overall agricultural strategies.
    -

1.2 Objective

The specific objective of this smart farming project using IoT technologies is to develop an efficient and reliable system for monitoring critical soil parameters such as soil temperature, humidity, and soil moisture. The goals of this project include:

1. **Real-Time Monitoring**:
    - To implement an IoT-based system that continuously monitors soil temperature, humidity, and soil moisture in real time, providing farmers with up-to-date information on soil conditions.
2. **Data Collection and Analysis**:
    - To collect accurate and detailed data on soil parameters, which can be analyzed to identify trends and make informed decisions to enhance crop management and productivity.
3. **Optimized Irrigation**:
    - To use the monitored data to optimize irrigation practices, ensuring that crops receive the right amount of water based on current soil moisture levels, thereby conserving water and improving crop health.
4. **Enhanced Crop Growth**:
    - To maintain optimal soil conditions by monitoring and managing soil temperature and humidity, creating a conducive environment for crop growth and maximizing yields.
5. **Resource Efficiency**:
    - To improve resource utilization by providing precise data that helps in reducing the overuse of water and other agricultural inputs, leading to cost savings and environmental benefits.

Chapter 2

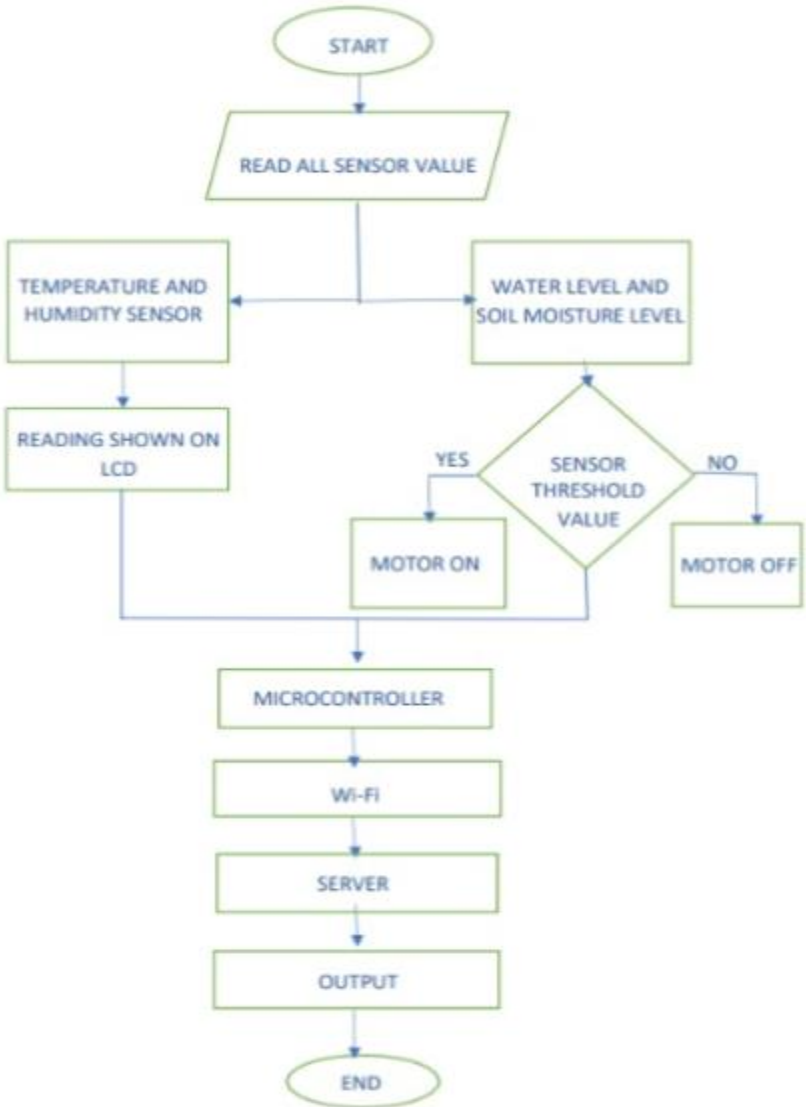
Literature survey

Paper Title	Objectives	Summary
AgriSys: A Smart and Ubiquitous Controlled Environment Agriculture System	To develop a smart agriculture system that can analyze and maintain an adequate environment.	AgriSys is designed to monitor and control environmental factors such as temperature, humidity, and pH, specifically addressing challenges in desert environments. It offers remote access, enhancing productivity and safety while providing instant interventions.
Design and Implementation of a Connected Farm for Smart Farming System	To create a connected farm using IoT systems for smart farming.	The connected farm integrates IoT for sensor and controller connectivity using the Cube platform and Mobius service platform. A smartphone app allows users to remotely monitor and control farm conditions, like operating an air conditioner.
Smart Farming using Bluetooth Wireless Transmitter	To utilize Bluetooth transmitters for soil moisture and temperature sensing, aiding in irrigation decisions.	Bluetooth Wireless Transmitters send soil moisture and temperature data to a base station, which makes irrigation decisions. This system helps in operating sprinklers based on field requirements and is exploring variable rate sensor-based irrigation systems.
An Automated Field-Specific Irrigation System	To develop an automated irrigation system with soil moisture sensors and sprinkler valve controllers.	Wall and King created an irrigation system that uses soil moisture sensors and sprinkler valves. This system does not monitor water pollution or employ M2M communication but focuses on scalable, self-organizing sensor-based irrigation monitoring.
Machine Learning in Agricultural Monitoring	To apply machine learning for monitoring and predicting diseases in grape cultivation.	Machine learning algorithms are used to detect grape diseases early by analyzing data from temperature, humidity, and leaf wetness sensors. The system sends alerts to farmers and experts, improving disease management and providing guidance on agricultural practices.
Automated Irrigation System (A2S)	To develop an automated irrigation system using a sensor network.	The A2S system uses wireless sensors to monitor and control fields, with a management subsystem that facilitates communication and data storage. Farmers access the system through PDAs, which provide services based on sensor data.

Chapter 3

Problem Formulation and Proposed methodology

3.1 Introduction



Smart farming, also known as precision agriculture, leverages Internet of Things (IoT) technologies to enhance agricultural practices, optimize resource use, and improve crop yields. By integrating sensors, connected devices, and data analytics, smart farming provides real-time insights into various farming operations. These technologies enable farmers to monitor soil moisture, humidity, and weather conditions, allowing for precise irrigation, fertilization, and pest control. The result is increased efficiency, reduced environmental impact, and improved profitability.

3.2 Problem Statement

- Agriculture is the broadest economic sector and plays an important role in the overall economic development of a nation.
- In traditional farming, farmers grow crops and spray fertilizers without knowing soil health & its composition. This results in severe decrease in soil health.
- Usually in farming, irrigation is done manually so specifically, it results in huge manpower and increasing cost.
- There is no effective use of weather predication data in traditional farming.
- Fire in farms is the one of most important problem in world and there is no sufficient system to tackle it.

3.3 System Architecture

1. **Sensors and Actuators Layer**
   - Soil Moisture Sensors
   - Temperature Sensors
   - Humidity Sensors
2. **Connectivity Layer**
   - Communication Protocols (Wi-Fi, Zigbee, LoRaWAN, NB-IoT, Cellular Networks)
   - Gateways
3. **Data Processing and Storage Layer**
   - Edge Computing Devices (Local Gateways, Edge Servers)
   - Cloud Computing Platforms (AWS, Azure, Google Cloud)
4. **Application Layer**
   - Web Applications
5. **Integration and Interoperability Layer**
   - APIs
   - Middleware Solutions
6. **Security Layer**
   - Data Encryption Mechanisms
   - Authentication and Authorization Systems
   - Network Security Solutions

Workflow:

1. **Data Collection**: Sensors collect real-time data from the field (e.g., soil moisture, temperature).
2. **Data Transmission**: Data is transmitted via communication protocols to gateways.
3. **Edge Processing**: Gateways perform initial data processing and send critical data to the cloud.
4. **Cloud Processing**: The cloud platform performs advanced analytics and stores data.
5. **User Interaction**: Farmers access insights and control systems through web applications.
6. **Automated Actions**: Based on analyzed data, actuators perform actions like adjusting irrigation.

3.4 Proposed Methodology

Sensor Deployment: Install IoT sensors across the farm to monitor soil moisture, temperature, humidity. These sensors collect real-time data, providing insights into crop conditions.

Environmental Monitoring: Monitor environmental factors such as air quality and weather conditions using IoT devices. This information aids in optimizing farm operations and ensuring environmental sustainability.

Scalability and Adaptability: Design the IoT infrastructure to be scalable and adaptable to different farm sizes and types of crops. Ensure compatibility with existing farm equipment and infrastructure.

Remote Monitoring and Control: Enable remote monitoring and control of farm operations through IoT-enabled devices. Farmers can access data and control systems from smartphones or computers, facilitating timely interventions and adjustments.

Chapter 4

Hardware and Software Requirements

4.1 Hardware Design

1. **Sensors**:
    - **Soil Moisture Sensors**: To measure the water content in the soil.
    - **Temperature Sensors**: To monitor soil temperature.
    - **Humidity Sensors**: To measure the moisture level in the air around the crops.
2. **Microcontroller/Processor**:
    - **Arduino uno** : To process data collected from the sensors and transmit it to the cloud or a local server.
3. **Wireless Communication Modules**:
    - **Wi-Fi Modules** (e.g., ESP8266): To enable wireless communication between the microcontroller and the cloud/server.
4. **Gateway Device**:
    - **Edge Device**: To collect data from multiple sensors and transmit it to the cloud/server.
5. **Enclosures**:
    - **Weatherproof Enclosures**: To protect sensors and electronic components from environmental elements.
6. **Additional Components**:
    - **Wires and Connectors**: For connecting sensors to the microcontroller.
    - **Mounting Equipment**: For installing sensors in the field.

4.2 Software Requirements

1. **Microcontroller Programming Environment**:
    - **Arduino IDE**: For programming Arduino microcontrollers.

4.3 Software algorithm:

1.Data loading and Pre processing:

```
#include<DHT.h>   // including the library of DHT11 temperature and humidity sensor
 #define DHTPIN 9      // Selecting the pin at which we have connected DHT11
 #define DHTTYPE DHT11 // Selecting the type of DHT sensors
 DHT dht ( DHTPIN, DHTTYPE ) ;

void setup()
 {
  Serial.begin(9600);
  pinMode(8,INPUT);
   pinMode(7,OUTPUT);
 dht.begin (  ) ;    // The sensor will start working
}

void loop()
{
 int A=digitalRead(8);
 if(A==LOW)
 {
  Serial.println("SOIL IS WET");
  digitalWrite(7,HIGH);
  delay(1000);
   digitalWrite(7,LOW);
   delay(1000);
 }
 else
 {
  Serial.println("SOIL IS DRY");
  delay(1000);
 }

 // Reading temperature or humidity may take about 2 seconds because it is a very slow sensor.
float humid = dht.readHumidity ( ) ;  // Declaring h a variable and storing the humidity in it.
  float temp = dht.readTemperature ( ) ; // Declaring t a variable and storing the temperature in it.
  // Checking if the output is correct. If these are NaN, then there is something in it.


Serial.print ( " Temp is " ) ;
     Serial.print ( temp ) ;         // Printing the temperature on display.
     Serial.println ( " *C " ) ;     // Printing “ *C ”  on display.
     Serial.print ( " Humidity in % is : " ) ;
     Serial.println ( humid ) ;     // Printing the humidity on display
     delay(1000);
     if(humid>80)
```

```
 {
  Serial.println("HIGH HUMIDITY");
  digitalWrite(7,HIGH);
  delay(1000);
   digitalWrite(7,LOW);
   delay(1000);
 }
 else
 {
  Serial.println("NORMAL HUMIDITY");
  delay(1000);
 }

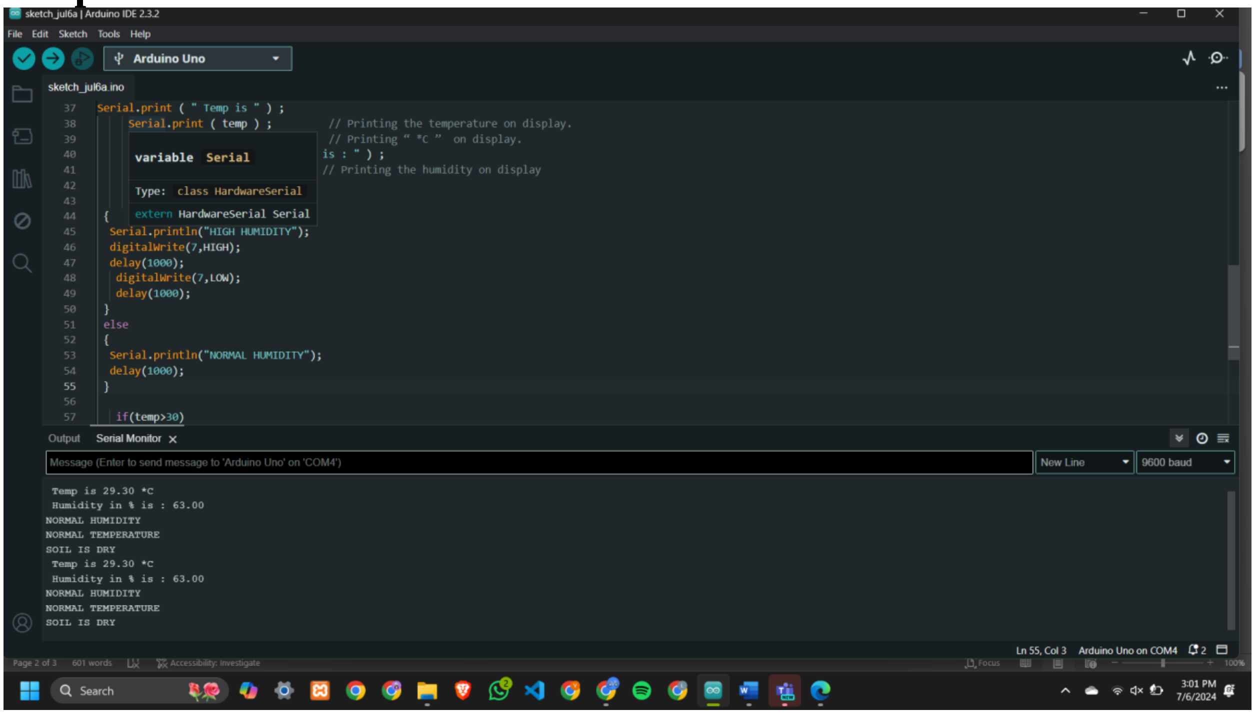
   if(temp>30)
 {
  Serial.println("HIGH TEMPERATURE");
  digitalWrite(7,HIGH);
  delay(1000);
   digitalWrite(7,LOW);
   delay(1000);
 }
 else
 {
  Serial.println("NORMAL TEMPERATURE");
  delay(1000);
 }

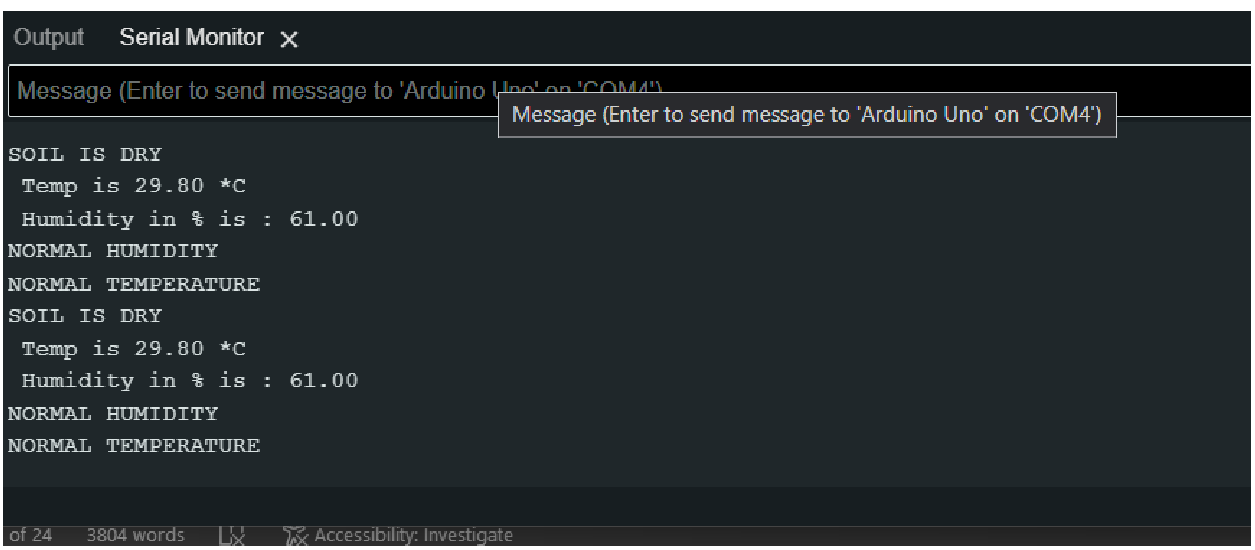
}
```

Chapter 5

Result and Discussion

Output:





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Appendix

Source Code

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     Serial.print ( " Humidity in % is : " ) ;
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  Serial.println("HIGH HUMIDITY");
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   digitalWrite(7,LOW);
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  Serial.println("NORMAL HUMIDITY");
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   if(temp>30)
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  delay(1000);
   digitalWrite(7,LOW);
   delay(1000);
 }
 else
 {
  Serial.println("NORMAL TEMPERATURE");
  delay(1000);
 }

}
```

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