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Unwanted Weather Forecasting And Automatic Protection For Crops

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Abstract—

This paper presents an intelligent agricultural system that detects and forecasts unwanted weather conditions and automatically takes protective actions to safeguard crops. The system uses IoT sensors to monitor environmental parameters in real-time and employs machine learning algorithms to predict hazardous weather. It automates measures such as irrigation control and shelter activation, thereby reducing farmer dependency on manual intervention and enhancing crop yield.

Keywords—

IoT, Smart Farming, Weather Forecasting, Crop Protection, Agriculture, Automation

1.Introduction

The agricultural sector faces serious losses due to sudden changes in weather. Traditional methods do not offer timely or accurate forecasting for specific farm areas. This paper aims to develop a smart farming system using IoT sensors and automation that can predict unwanted weather and respond in real-time to protect crops.

2. Methodology

IoT sensors collect data (temperature, humidity, rainfall).

- System activates irrigation or cover mechanisms.

1. Sensors collect environmental data.
2. ARM Cortex M3 analyzes the data.
3. If bad weather is forecasted or the soil is dry:
   - Motor pump is activated.
   - Crop protection mechanism is deployed.
4. Wi-Fi module sends updates to the user.

3. System Architecture and Components

- **Sensors:** Rain, humidity, temperature, and soil moisture sensors monitor real-time field conditions.
- **Controller:** ARM Cortex M3 processes the sensor data and makes decisions.
- **Relay and Motor Pump:** Irrigates the soil when it is too dry.
- **Servo Motors:** Control protective crop covers.
- **Wi-Fi Module:** Sends data to farmers via cloud or mobile app.
- **LCD Display:** Shows real-time values and system status.
- **4. Results and Discussion**

- The prototype was tested in controlled environments. The system responded accurately to simulated weather changes. It successfully irrigated dry soil and activated protective covers during high humidity and rainfall detection. This proves its potential for real-time field application.

- Case studies of smart farming.
- Government meteorological data.
- Technical documentation of ARM Cortex and sensor modules.

Users can access the latest information promptly, ensuring they are kept informed about events, deadlines, or important announcements.

How it works:

1. Sensors Collect Data

- Rain sensor checks if it's raining.
- Humidity and temperature sensor measures the air condition.
- Moisture sensor checks how wet the soil is.

2. ARM Cortex M3 (Controller) Processes the Data

- All the sensor data is sent to the ARM Cortex M3 microcontroller.
- It analyzes the data and checks if the weather is bad or if crops need protection.

3. System Makes Decisions Automatically

- If it's raining or too hot, the system activates the servo motors to open or close the crop protection cover.
- If the soil is too dry, the relay turns on the motor pump to water the crops.

4. Live Information Displayed

- A 16x2 LCD display shows the current weather, soil moisture, and system status.

5. Wi-Fi Module Sends Alerts

- Data and alerts are sent to the farmer's phone or cloud system using the Wi-Fi module.

data to the microcontroller **2. Microcontroller Processing:**

Receive and Decode:

The microcontroller receives the data from the app and decodes it.

Display Control:

The microcontroller then controls the electronic display, displaying the notice content.

3.Display:

Electronic Display:

The notice is displayed on an electronic display like an LCD, LED, or other digital display.

Real-time Updates: The system allows for realtime updates, so the notice board can be changed quickly and efficiently.

5.Study of Research Paper:

- "Smart Agriculture System using IoT" – This study explained the importance of real-time monitoring using temperature, humidity, and soil moisture sensors.
- **Paper 2:** "Automated Irrigation System using Microcontroller and GSM" – Helped in designing the automated irrigation system and alert mechanism.
- **Paper 3:** "AI-based Weather Forecasting Models in Agriculture" – Provided insight on integrating AI/ML algorithms to predict weather based on sensor data.
- **Government Meteorological Reports:** Provided real-time weather data for designing thresholds.
- **Case Studies of Smart Farms:** Helped in understanding practical challenges and solutions in real-time deployment.

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5.1Future Scope:

The system can be further improved and expanded through the following advancements:

- Mobile App Integration: Developing a user-friendly mobile application to remotely monitor and control the system, receive alerts, and analyze historical weather and crop data.
- Cloud Dashboard: Integrating cloud-based dashboards for real-time visualization of farm conditions and remote control over IoT devices.
- AI and Machine Learning Integration: Enhancing forecasting accuracy through AI models that learn from historical weather patterns and crop responses.
- Solar Power Integration: Using solar panels to make the system suitable for remote or off-grid locations, promoting sustainability.
- Advanced Communication Protocols: Implementing LoRaWAN or NB-IoT for long-range and low-power data transmission in large or rural farms.
- Scalability for Large Farms: Designing modular systems that can scale and be customized for various farm sizes and crop types.

- Automated Fertilizer and Nutrient Control: Adding modules to measure and distribute fertilizers based on soil health data.

Conclusion:

This system offers a reliable, automated, and affordable solution to protect crops from weather-related damages. It empowers farmers with predictive technology and automation, ensuring better productivity.

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