Project for 3rd semester of Bachelor of Information Technology

**Soil Humidity Monitoring System**



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**ACKNOWLEDGEMENT**

It is with greatest satisfaction and euphoria that we are submitting our project report entitled “**Soil humidity monitoring system**”. We have completed it as a part of the curriculum of PURBANCHAL UNIVERSITY. This project would have not been possible without some people who really devoted their time to guide us, and some tutorial sites found on internet.

Firstly, we would take this opportunity to express a deep sense of gratefulness to our Project Instructor as well as our Project Supervisor Mr. Miraj Pandey for his amiable support, valuable information and guidance which helped us in completing this task throughout its various stages. We are indebted to all members of KIST College of Information Technology, for the valuable support and suggestion provided by them using their specific field’s knowledge. We are grateful for their cooperation during the period of our project.

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Lastly, our sincere thanks to our parents, teaching and non-teaching staffs of our college and my friends.

We hope our university will accept this attempt as a successful project. Thankyou.

# STUDENT’S DECLARATION

We hereby declare that the project entitled “**Soil humidity monitoring system**” submitted in partial fulfilment of the requirement for the degree of Bachelor’s in Information Technology (BIT) of the Purbanchal University is our original work and has not been submitted for award of any other degree or other similar title or prize.

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# TO WHOM IT MAY CONCERN

This is to certify that Mr. Taweshal Dev Thakur, Mr. Priyanshu Kushawaha and Mr. Bipesh Paudel of Bachelor’s in Information Technology (BIT) has studied as per the curriculum of BIT 3rd Semester and completed the project entitled “**Soil humidity monitoring system**”. This project is the original work and was carried out under the supervision of Mr. Miraj Pandey as per the guidelines provided by Purbanchal University and certified as per the student’s declaration that project “Gas Detector” has not been presented anywhere as a part of any other academic work.

The detail of the student is as follows: Name of Students: Taweshal Dev Thakur

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Semester: 3rd Semester

Subject Code: BIT 156 CO

Subject: Project- III

Project Title: Soil humidity monitoring system

…………………………….

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Date: / /

# ABSTRACT

This project presents the design and implementation of a microcontroller-based system for monitoring soil humidity. The primary objective is to develop a reliable and cost-effective solution for agricultural applications, ensuring optimal soil moisture levels for crop health and yield. The system utilizes a soil moisture sensor interfaced with a microcontroller to measure and analyze soil humidity in real-time.

The methodology involves integrating the sensor with an Arduino microcontroller, which processes the data and displays the moisture levels on an LCD screen. Additionally, the system is programmed to trigger an alert when the soil moisture falls below a predetermined threshold, indicating the need for irrigation. This ensures timely watering, preventing both under-watering and over-watering of crops.

The results demonstrate the system's effectiveness in accurately monitoring soil moisture and providing timely alerts. The system is tested in various soil types and conditions, showing consistent performance and reliability.

In conclusion, the microcontroller-based soil humidity monitoring system offers a practical solution for farmers and gardeners, promoting efficient water use and improving crop management. Future work may include the integration of wireless communication to enable remote monitoring and control.

**Background of the Study**

Efficient water management is crucial in agriculture to ensure healthy crop growth and maximize yields. Traditional irrigation methods often lead to water wastage or crop damage due to inconsistent watering. Therefore, precise and efficient irrigation management systems are increasingly necessary.

Soil humidity is a key factor in determining the water needs of crops. Proper monitoring of soil moisture can enhance crop productivity and conserve water. With advancements in technology, microcontroller-based systems have emerged as a promising solution for real-time soil moisture monitoring and irrigation management.

Microcontrollers are compact, cost-effective computing devices capable of interfacing with various sensors and actuators. This project leverages an Arduino microcontroller and a soil moisture sensor to develop a system that provides real-time soil moisture data and triggers alerts when irrigation is needed. This automated system ensures efficient water usage, reduces labor, and improves crop health.

Building on existing research in precision agriculture, this project aims to address the limitations of manual monitoring and traditional irrigation methods, contributing to sustainable agricultural practices and the adoption of smart farming technologies.

**Problem Statement:**

Efficient water management in agriculture is essential for ensuring healthy crop growth, maximizing yields, and conserving resources. However, traditional irrigation methods and manual soil moisture monitoring present significant challenges. This project aims to address these challenges by developing a microcontroller-based soil humidity monitoring system.

1. **Inefficient Traditional Irrigation Methods**:

• **Over-Watering**: Leads to water wastage, increased costs, and potential crop damage due to waterlogged soil.

• **Under-Watering**: Results in poor crop growth and reduced yields, as plants do not receive the necessary moisture to thrive.

2. **Labor-Intensive and Error-Prone Manual Monitoring**:

• **Time-Consuming**: Requires regular physical checks of soil moisture levels, which can be impractical for large fields.

• **Prone to Human Error**: Inconsistent readings and delayed responses to changing soil conditions can negatively impact crop health.

3. **Lack of Precision in Current Practices**:

• **Variable Soil Types and Conditions**: Different soils retain moisture differently, making uniform irrigation practices inefficient.

• **Climatic Variations**: Changing weather patterns necessitate frequent adjustments in irrigation schedules, which are difficult to manage manually.

**Objective of the project**

The primary objective of this project is to design and implement a microcontroller-based system for real-time monitoring and management of soil humidity to improve irrigation efficiency and crop productivity. The specific objectives are:

* **Develop a Reliable Soil Moisture Monitoring System**: Utilize a soil moisture sensor integrated with a microcontroller to accurately measure soil humidity levels.
* **Provide Real-Time Data and Alerts**: Display soil moisture readings on an LCD screen and trigger alerts when moisture levels fall below a predetermined threshold to prompt timely irrigation.
* **Optimize Water Usage**: Ensure efficient water management by preventing over-watering and under-watering, thereby conserving water resources and reducing costs.
* **Enhance Crop Health and Yield**: Maintain optimal soil moisture conditions to support healthy crop growth and maximize agricultural yields.
* **Implement a Cost-Effective Solution**: Design an affordable and scalable system that can be easily adopted by farmers and gardeners for improved irrigation practices.
* **Promote Sustainable Agricultural Practices**: Encourage the use of technology in agriculture to achieve better resource management and sustainable farming practices.

**Scope of project**

By achieving these objectives, the project aims to provide a practical solution for efficient irrigation management, contributing to the overall improvement of agricultural productivity and sustainability.

The scope of this project encompasses the design, development, and implementation of a microcontroller-based soil humidity monitoring system aimed at improving irrigation efficiency and agricultural productivity. The key areas covered by this project include:

1. **System Design and Development**:

• Selection and integration of appropriate hardware components, including a soil moisture sensor, Arduino microcontroller, LCD display, and alert mechanism (e.g., buzzer or LED).

• Development of software to process sensor data, display real-time moisture levels, and trigger alerts for irrigation needs.

2. **Implementation and Testing**:

• Construction of a prototype system to demonstrate functionality.

• Testing the system in various soil types and environmental conditions to ensure accuracy and reliability.

3. **User Interface and Alerts**:

• Development of a user-friendly interface for displaying soil moisture data.

• Implementation of alert mechanisms to notify users when soil moisture falls below or exceeds optimal levels.

4. **Optimization and Calibration**:

• Calibration of the sensor to ensure accurate moisture readings.

• Optimization of the system for different soil types and moisture requirements of various crops.

6. **Scalability and Cost-Effectiveness**:

• Evaluation of the system’s scalability for larger agricultural fields.

• Ensuring the cost-effectiveness of the system to make it accessible for small and medium-sized farms.

7. **Future Enhancements**:

• Exploration of additional features such as wireless communication for remote monitoring and control.

• Potential integration with weather data and other environmental sensors for a comprehensive smart farming solution.

**Limitations**

While the microcontroller-based soil humidity monitoring system offers numerous benefits, it also has certain limitations that need to be considered:

1. **Sensor Accuracy and Calibration**:

• The accuracy of soil moisture sensors can be affected by soil type, temperature, and salinity, requiring regular calibration and adjustment.

• Inconsistent sensor performance in different environmental conditions may lead to inaccurate readings.

2. **Limited Range and Coverage**:

• The system’s effectiveness is confined to the area where the sensor is placed, which may not be representative of larger fields with variable soil conditions.

• Multiple sensors and microcontrollers may be required for extensive fields, increasing the complexity and cost.

3. **Power Supply Requirements**:

• The system requires a consistent power supply for continuous monitoring and data processing.

• In remote or off-grid locations, ensuring a stable power source can be challenging and may necessitate the use of batteries or solar panels.

4. **Environmental Factors**:

• Extreme weather conditions, such as heavy rain or drought, can impact the performance and reliability of the system.

• Physical damage to sensors and components from agricultural activities or wildlife can disrupt system functionality.

**Methodology**

The methodology for developing the microcontroller-based soil humidity monitoring system involves several key steps. First, the system requirements are defined, and appropriate hardware components, including a soil moisture sensor, microcontroller (e.g., Arduino), LCD display, and alert mechanisms, are selected. Next, the hardware is assembled, with components integrated and connected as per the designed circuit schematic. Software development follows, where the microcontroller is programmed to read sensor data, process it, and manage the display and alert functions. Calibration of the sensor and setting of moisture thresholds are performed to ensure accurate readings and effective alerts. The prototype is then tested in various soil types and conditions to validate performance. After field installation, users are trained on system operation and data interpretation. Comprehensive documentation is prepared, and the system is reviewed and improved based on user feedback. Future enhancements may include features like wireless communication for remote monitoring and integration with weather data for improved irrigation management.

**System Requirements:**

1. **Hardware Components**:

• **Soil Moisture Sensor**: Measures the soil’s moisture level. Should be compatible with the microcontroller and capable of providing accurate readings across a range of moisture levels.

• **Microcontroller**: For example, an Arduino board (e.g., Arduino Uno) to process sensor data, control the display, and manage alerts.

• **LCD Display**: A 16x2 or similar LCD screen to display real-time soil moisture readings and system status.

• **Alert Mechanism**: Such as a buzzer or LED to provide visual or auditory notifications when soil moisture falls below or exceeds the set thresholds.

• **Power Supply**: A stable power source, such as a battery pack or AC adapter, to power the microcontroller and associated components.

2. **Software Requirements**:

• **Microcontroller Programming Environment**: An Integrated Development Environment (IDE) such as Arduino IDE for writing, compiling, and uploading code to the microcontroller.

• **Firmware**: Code to read data from the soil moisture sensor, process the data, display it on the LCD, and trigger alerts based on predefined thresholds.

• **Calibration Algorithms**: Code to calibrate the sensor and adjust readings for accuracy.

SYSTEM DESIGN

Algorithm

Step 1: Start

Step 2: Initialize the LCD and display “ Detecting…”.

Step 3: Enter a infinite loop to continuously monitor for smoke.

Step 4: Set ‘input’ pin to detect display “

Gantt Chart

The project required ………………… to be completed. The all time period required for this project for the different task are shown in the table below: