Mini Project Report

Smart irrigation using IOT sensors
Submitted to

Jawaharlal Nehru Technological University
Anantapur, Ananthapuramu

in partial fulfillment of the requirements for the
award of the degree of

BACHELOR OF TECHNOLOGY
IN
INFORMATION TECHNOLOGY
Submitted by

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SREE VIDYANIKETHAN ENGINEERING COLLEGE
(AUTONOMOUS)

SREE VIDYANIKETHAN
Engineering College (Autonomous)

(Affiliated to JNTUA, Ananthapuramu, Approved by AICTE, Accredited by NBA & NAAC) Sree Sainath Nagar, Tirupati – 517 102, A.P., INDIA
2023-2024

Institute Vision and Mission

VISION

To be one of the Nation's premier Engineering Colleges by achieving the highest order of excellence in Teaching and Research.

MISSION

To foster intellectual curiosity, pursuit and dissemination of knowledge.

To explore students' potential through academic freedom and integrity.

To promote technical mastery and nurture skilled professionals to face competition in ever increasing complex world.

DEPARTMENT OF INFORMATION TECHNOLOGY

VISION

To become a nationally recognized quality education center in the domain of Computer Science and Information Technology through teaching, training, learning, research and consultancy.

MISSION

The Department offers undergraduate program in Information Technology to produce high quality information technologists and software engineers by disseminating knowledge through contemporary curriculum, competent faculty and adopting effective teaching-learning methodologies.

Igniting passion among students for research and innovation by exposing them to real time systems and problems

Developing technical and life skills in diverse community of students with modern training methods to solve problems in Software Industry.

Inculcating values to practice engineering in adherence to code of ethics in multicultural and multi discipline teams.

PROGRAM EDUCATIONAL OBJECTIVES

After few years of graduation, the graduates of B. Tech. (IT) Program will be:

1. Enrolled or completed higher education in the core or allied areas of Computer Science and Information Technology or management.
2. Successful entrepreneurial or technical career in the core or allied areas of Computer Science and Information Technology.
3. Continued to learn and to adapt to the world of constantly evolving technologies in the core or allied areas of Computer Science and Information Technology.

PROGRAM OUTCOMES

On successful completion of the Program, the graduates of B. Tech. (IT) Program will be able to:

1. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES

On successful completion of the program, the graduates of B.Tech. (IT) program will be able to:

PSO1: Design and develop database systems, apply data analytics techniques, and use advanced databases for data storage, processing and retrieval.

PSO2: Apply network security techniques and tools for the development of highly secure systems.

PSO3: Analyze, design and develop efficient algorithms and software applications to deploy in secure environment to support contemporary services using programming languages, tools and technologies.

PSO4: Apply concepts of computer vision and artificial intelligent for the development of efficient intelligent systems and applications.

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ABSTRACT:
Irrigation plays a crucial role in agriculture and landscaping by providing the necessary moisture for plant growth. Traditional irrigation systems are often inefficient and can lead to overwatering or underwatering. The Smart Irrigation System, equipped with moisture sensors, aims to address this issue by delivering the right amount of water at the right time based on real-time soil moisture data.

KEYWORDS:
Smart Irrigation System, Moisture Sensors, Agriculture, Landscaping, Soil Moisture, Water Management, Sensor Technology, Data Collection, Water Delivery, Water Distribution, Control Unit

INTRODUCTION:
Smart agriculture, often referred to as precision agriculture, is a transformative approach to farming that leverages technology and data-driven solutions to optimize crop production while conserving resources. One of the pivotal components of smart agriculture is the use of moisture sensors, which play a crucial role in the efficient management of irrigation, reducing water wastage, and improving crop yields.

In traditional farming, irrigation systems often rely on fixed schedules or manual observation to determine when and how much water should be applied to crops. This can result in overwatering or underwatering, leading to resource inefficiency and potential crop damage. Smart agriculture, powered by moisture sensors, revolutionizes this process by providing real-time data on soil moisture levels, enabling precise irrigation management.

These moisture sensors, often deployed in the soil or on the plant leaves, continuously monitor moisture content and transmit data to a central control system. This data is then analyzed to make informed decisions about when and how much water to apply. By combining sensor technology with data analysis and automation, smart agriculture ensures that crops receive the right amount of water at the right time, improving crop health and resource efficiency.

In this report, we will delve into the methodology, components, and benefits of smart agriculture using moisture sensors. We will explore the technology behind these sensors, how data is collected and analyzed, the components of a smart agriculture system, practical implementation, as well as the advantages and challenges associated with this innovative approach.

The adoption of smart agriculture techniques, particularly those involving moisture sensors, promises not only to increase crop yields but also to contribute to sustainable and environmentally friendly farming practices. It is a significant step towards addressing the challenges of feeding a growing global population while conserving vital resources.

IMPLEMENTATION:

Implementing a smart irrigation system involves several steps to ensure its effective operation. Here is a general outline of the key steps for implementing a smart irrigation system:

1. **Needs Assessment and Planning:**

- Identify the specific needs of your irrigation system. Consider factors like the type of plants, soil conditions, climate, and water sources.
- Create an irrigation plan that outlines the areas to be irrigated, the required water volume, and the preferred irrigation schedule.

2. Select Appropriate Sensors and Equipment:

- Choose the right moisture sensors for your soil type and the plants you are irrigating. Other sensors, such as weather sensors, can also be valuable for smart irrigation.
- Select irrigation equipment, including controllers, pumps, valves, and sprinklers, that can be integrated into the smart system.

3**. Install sensors and hardware.**

- Place moisture sensors at appropriate depths in the soil, ensuring they are adequately distributed across the irrigated areas.
- Install weather sensors to collect data on temperature, humidity, wind speed, and rainfall.
- Set up the irrigation controller and connect it to the sensors and valves.

4. **Data Collection and Analysis:**

- Begin collecting data from moisture and weather sensors. This data provides essential information about soil moisture levels and weather conditions.
- Implement a data analysis system that processes the collected data to make decisions about when and how much to irrigate.

5. Programming and Calibration.

- Program the irrigation controller with the appropriate settings, such as crop type, root depth, and desired moisture levels.
- Calibrate the system to ensure the moisture sensor readings align with your irrigation goals.

6. Automation and Scheduling:

- Set up an automated irrigation schedule that takes into account real-time data from sensors and the specific irrigation needs of your plants.
- Ensure that the system can adjust irrigation schedules based on changing weather conditions.

7**. Remote Monitoring and Control:**

- Implement remote monitoring and control capabilities, allowing you to access the system from a mobile app or a web interface.
- This enables you to make real-time adjustments to the irrigation system when necessary.

8. Alerts and Notifications:

- Set up alerts and notifications to inform you of critical events, such as sensor failures, unusually dry conditions, or system malfunctions.

9.Regular Maintenance:

- Establish a maintenance schedule for the system, including sensor calibration and equipment checks.
- Ensure that sensors are cleaned and functioning correctly.

10. Data Analysis and Optimization:

- Continuously analyze the data collected by the system to identify trends and areas for improvement.
- Use this data to optimize irrigation schedules and conserve water while maintaining plant health.

11. Documentation and Records:

- Maintain records of system configurations, sensor data, and maintenance activities for future reference.

Implementing a smart irrigation system is an ongoing process that requires careful planning, monitoring, and adaptation. The system's effectiveness will depend on the quality of your sensors, the accuracy of data analysis, and your commitment to sustainable water management practices.

CODE:

```
const int moistureSensorPin = A0;  // Change this to your actual pin
const int pumpPin = 13;  // Change this to the pin connected to your pump relay

void setup() {
  Serial.begin(9600);  // Initialize the serial communication for debugging
  pinMode(pumpPin, OUTPUT);  // Set the pump pin as an output
}

void loop() {
  // Read the analog value from the moisture sensor
  int moistureValue = analogRead(moistureSensorPin);

  // Calculate the moisture percentage based on your sensor's characteristics
  float moisturePercentage = calculateMoisturePercentage(moistureValue);

  // Print the moisture percentage to the serial monitor
  Serial.print("Moisture Percentage: ");
  Serial.print(moisturePercentage);
  Serial.println("%");

  // Check if the moisture percentage is less than 30%
  if (moisturePercentage < 30) {
    // Turn on the pump
```

```
    digitalWrite(pumpPin, HIGH);
  } else {
    // Turn off the pump
    digitalWrite(pumpPin, LOW);
  }

  delay(1000);  // Adjust the interval as needed
}

float calculateMoisturePercentage(int sensorValue) {
  // You'll need to determine the logic for calculating the moisture percentage.
  // This can vary depending on the sensor you're using and its calibration.
  // Please consult your sensor's datasheet or documentation for the formula.

  // Example calculation (assuming a linear calibration between 0% (dry) and 100%
(wet)):
  float moisturePercentage = map(sensorValue, 0, 1023, 0, 100);
  return constrain(moisturePercentage, 0, 100);  // Ensure the result is within 0-100%
}
```

OUTPUT:

Moisture Level: 15%
Moisture Level: 15%
Moisture Level: 15%
Moisture Level: 20%

Code to triger pump:

```
// Define the analog pin connected to the moisture sensor
const int moistureSensorPin = A0;  // Change this to your actual pin
const int pumpPin = 13;  // Change this to the pin connected to your pump relay

void setup() {
  Serial.begin(9600);  // Initialize the serial communication for debugging
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  // Print the moisture percentage to the serial monitor
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  Serial.print(moisturePercentage);
  Serial.println("%");

  // Check if the moisture percentage is less than 30%
  if (moisturePercentage < 30) {
    // Turn on the pump
```
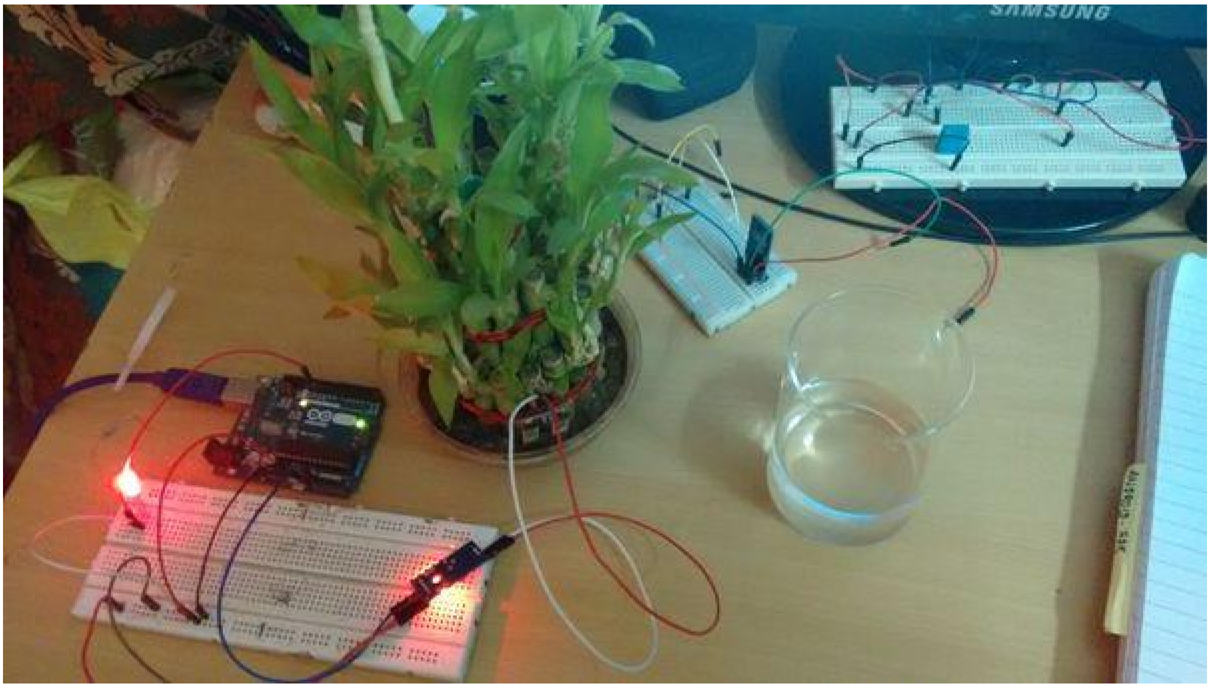

```
    digitalWrite(pumpPin, HIGH);
    Serial.println("Pump is ON");
  } else {
    // Turn off the pump
    digitalWrite(pumpPin, LOW);
    Serial.println("Pump is OFF");
  }

  delay(1000);  // Adjust the interval as needed
}

float calculateMoisturePercentage(int sensorValue) {
  // You'll need to determine the logic for calculating the moisture percentage.
  // This can vary depending on the sensor you're using and its calibration.
  // Please consult your sensor's datasheet or documentation for the formula.

  // Example calculation (assuming a linear calibration between 0% (dry) and 100%
(wet)):
  float moisturePercentage = map(sensorValue, 0, 1023, 0, 100);
  return constrain(moisturePercentage, 0, 100);  // Ensure the result is within 0-100%
}
```

Output:

Moisture Percentage: 28%
Pump is ON
Moisture Percentage: 33%
Pump is OFF
Moisture Percentage: 25%
Pump is ON
Moisture Percentage: 29%
Pump is ON
...



CONCLUSION:

The implementation of a smart irrigation system represents a significant leap forward in the realm of sustainable agriculture and landscaping. By integrating moisture sensors and data-driven technology into traditional irrigation practices, this system offers numerous advantages and holds the potential to address critical challenges.

The key takeaways from the implementation of a smart irrigation system are as follows:

- Efficient Water Usage: Smart irrigation systems, equipped with moisture sensors, optimize water usage by delivering the right amount of water precisely when and where it is needed. This efficiency helps conserve water resources, reduce water bills, and promote environmentally responsible irrigation practices.

- Improved Crop Health: Smart irrigation prevents overwatering or underwatering, which can harm plant health. By monitoring soil moisture levels in real-time, this system ensures that plants receive adequate moisture, enhancing their growth and yield.

- Resource Conservation: The system contributes to resource conservation by reducing water wastage and energy consumption. It aligns irrigation with actual plant requirements and local weather conditions.

- Data-Driven Decision-Making: The integration of moisture sensors and data analysis enables informed decision-making. Precise data collection allows for accurate irrigation scheduling and adjustments based on changing conditions, resulting in healthier plants and optimal crop production.

- Cost Savings: Through reduced water consumption and minimized manual labor, smart irrigation systems offer long-term cost savings for both agricultural and landscaping operations.

- Environmental Benefits: The implementation of smart irrigation aligns with environmentally conscious practices by reducing the carbon footprint associated with excessive water use.

While the benefits of smart irrigation systems are clear, it is crucial to acknowledge that their effectiveness depends on proper planning, installation, and ongoing maintenance. Soil types, plant varieties, and local climate conditions all play a role in customizing the system to meet specific needs.In addition, addressing challenges such as sensor accuracy, remote monitoring, and equipment maintenance is critical to ensuring the system's long-term success. Regular data analysis and system optimization are key components of this process.Smart irrigation using moisture sensors is poised to revolutionize agriculture and landscaping practices. As technology continues to evolve, these systems hold even greater potential to advance the sustainable and efficient use of water resources, making them an essential tool for the future of responsible land and water management.

REFERENCES:

- "Principles of Environmental Physics: Plants, Animals, and the Atmosphere" by John Monteith and Mike Unsworth: fourth edition,published on 2014.

- "Irrigation Engineering" by N. N. Basak: 3rd edition,published on 2021.

- "Irrigation Management: Principles and Practices" by Martin Burton: 2nd edition,published on 2020.

- "Environmental Soil Physics" by Daniel Hillel: For a deeper understanding of soil physics, 2nd edition,published on 2013.

- "Principles of Soil and Plant Water Relations" by M. B. Kirkham: 4th edition,publihed on 2020.

- 6."Irrigation and Water Power Engineering" by Dr. B. C. Punmia, Dr. Pande Brij Basi Lal, and Ashok Kumar Jain: 2nd edition,published on 2020.