Automatic Plant Watering System

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***Abstract*—Efficient water management is a major challenge in agriculture and plant maintenance. This research proposes a smart automated irrigation system using Arduino technology integrated with a soil moisture sensor and relay-controlled water pump. The system monitors real-time soil conditions and supplies water only when required. Additionally, the system design allows future integration with IoT platforms for remote monitoring. The solution reduces water wastage, minimizes manual labor, and ensures healthy plant growth through optimized irrigation control.**

***Keywords*—Smart Irrigation, Arduino, Automation, Soil Moisture, Water Conservation, Embedded System, IoT**

I. INTRODUCTION

Water scarcity and inefficient irrigation methods are major concerns in agriculture. Traditional irrigation systems rely heavily on manual operation, which often results in overwatering or underwatering.
With the advancement of embedded systems, automation can significantly improve irrigation efficiency. This project introduces a smart irrigation system that automatically monitors soil moisture levels and controls water supply accordingly.

II. PROBLEM STATEMENT

- Manual irrigation leads to inconsistent watering
- Excess water causes root damage
- Insufficient water affects plant growth
- Lack of monitoring systems in small-scale farming

III. OBJECTIVES

- To develop an automated irrigation system
- To optimize water usage
- To reduce human intervention Power Supply
- To provide real-time monitoring of soil moisture

IV. LITERATURE REVIEW

- Previous studies show that:
- Automated irrigation improves crop yield
- IoT-based systems provide remote monitoring
- Soil moisture sensors are reliable for irrigation decisions
- However, many systems are costly and complex. This project focuses on a low-cost and simple solution.

V. PROPOSED SYSTEM

System Description
- The system uses:
- Soil moisture sensor to detect soil condition
- Arduino UNO for processing
- Relay module to control water pump
- LCD display for output
- Working Logic
- Moisture < 40% → Pump ON
- Moisture ≥ 40% → Pump OFF

VI. BLOCK DIAGRAM

[Soil Sensor] → [Arduino UNO] → [Relay] → [Water Pump]
↓
[LCD Display]

VII. HARDWARE REQUIREMENTS

- Arduino UNO
- Soil Moisture Sensor
- Relay Module
- Submersible Water Pump
- LCD Display (I2C)

VIII. SOFTWARE IMPLEMENTATION

The Arduino program:

- Reads analog data from sensor
- Converts it into percentage
- Compares with threshold value
- Controls relay accordingly
- Displays data on LCD

IX. ALGORITHM

1. Start system
2. Read soil moisture value
3. Convert to percentage
4. Compare with threshold (40%)
5. If low → Turn ON pump
6. Else → Turn OFF pump
7. Display result
8. Repeat

X. RESULTS AND DISCUSSION

- Accurate moisture detection achieved
- Automatic pump control works efficiently
- System responds quickly to dry soil
- Reduces unnecessary water usage

XI. ADVANTAGES

- Cost-effective solution
- Easy to install and maintain
- Saves water and electricity
- Suitable for small and medium farms

XII. APPLICATIONS

- Smart agriculture
- Home gardening systems
- Nursery plant management
- Greenhouse automation

XIII. LIMITATIONS

- Sensor accuracy affected by soil type
- No remote access (basic version)
- Requires stable power supply

XIV. FUTURE ENHANCEMENTS

- IoT integration using Wi-Fi (ESP8266)
- Mobile app monitoring system
- Weather-based irrigation control
- AI-based smart irrigation decisions

XV. CONCLUSION

The smart automated irrigation system demonstrates an effective approach to managing water resources efficiently. By using simple hardware components and automation techniques, the system ensures optimal plant growth while conserving water. It is a scalable solution that can be enhanced with IoT and AI technologies in the future.

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