A

Mini Project

Report On

"SMART IRRIGATION BY ARDUINO UNO"

Submitted In partial fulfillment of the

Requirement for the award of the degree of

BACHELOR OF TECHNOLOGY

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

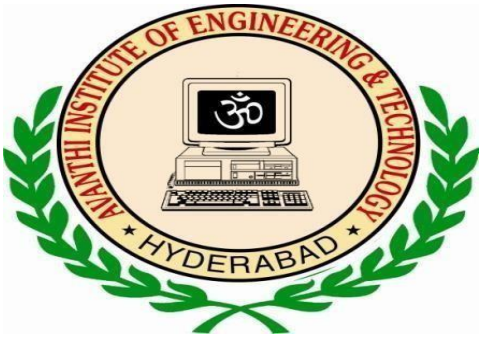
By

B. RAVI KUMAR	**(23Q61A0404)**
D. SAI KIRAN	**(24Q65A0414)**
M. VINAY	**(23Q61A0446)**
M. SIDDARTHA	**(23Q61A0447)**

Under the esteemed guidance of

MR.G.SRINIVAS

Assistant Professor, (Department of E.C.E., AIET.)



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Gunthapally(V), Abdullapurmet(M), R.R.District-501512

(2023-2027)

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CERTIFICATE

This is to certify that we have satisfactorily completed the project work entitled **"SMART IRRIGATION BY ARDUINO UNO"** in partial fulfillment of the requirement for the award of the **Bachelor of Technology** in **Electronics and Communication Engineering** to the **Jawaharlal Nehru Technological University**, Hyderabad for the academic year 2024-2025.

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We wish to express our sincere gratitude to everyone who helped and guided us in Completing this project work

We are immensely thankful to our internal guide MR.G.SRINIVAS, Associate Professor for his valuable guidance and suggestions in each and every stage of this work, which helped us in completing this project work successfully.

Our sincere thanks to the Principal **Dr.P.H.V.SESHA TAPLA SAI,** Principal of AVIH and to all my faculty members for having encouraged us in our academic endeavors.

We are grateful to Chairman, Avanthi Group of Institutions **Sri. M. SRINIVAS RAO** for granting me the permission for undergoing the practical training through development of this project of this thesis in college, Hyderabad.

We are thankful to one and all who co-operated us to complete our project successfully.

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AFFIDAVIT

We are the Team bearing in Avanthi Institute of Engineering and Technology. I solemnly affirm that the thesis entitled **"SMART IRRIGATION BY ARDUINO UNO"** submitted by us is the result of my own original work carried out under the Guidance of **MR.G.SRINIVAS** approved by the university. Furthermore, I confirm that this thesis has not yet been submitted as a part of another examination process neither in identical nor in similar form in any other university. If these conditions found anywhere in my thesis at a later stage then university can withdraw the degree.

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DECLARATION

We hereby declare that the results embodied in this dissertation entitled **"SMART IRRIGATION BY ARDUNIO UNO"** is carried out by us during the year 2023-2027 in partial fulfillment of the award of B.Tech **(Electronics and Communication Engineering)** from **Avanthi Institute of Engineering and Technology.** We have not submitted the same to any other university or organisation for the award of and other degree.

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Date:

DECLARATION BY THE CANDIDATE

I declare that this is entitled **"SMART IRRIGATION BY ARDUNIO UNO"** Is our own work conducted under the supervision of **Dr. S. Kishore Reddy** (Supervisor) in The Department of Electronics and communication Engineering.

I further declare that to the best of my knowledge, the thesis has not formed the basis for the award of any degree, diploma, associates ship or fellowship of similar other titles. It has not been submitted to any other University or Institution for the award of any degree.

Place: Hyderabad

Date:

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CERTIFICATE OF SUPERVISOR

This is to certify that the thesis entitled **"SMART IRRIGATION BY ARDUINO UNO"** has been undertaken and written under my supervision and it describes the original research work carried out by **MR.B.RAVI KUMAR, MR.D.SAI KIRAN, MR.M.VINAY & MR.M.SIDDARATHA** in the Department of Electronics and communication Engineering. To the best of my knowledge and belief, this work has not been submitted elsewhere for any degree of any other institution in India or abroad.

Name & Signature of the Supervisor

MR.G.SRINIVAS

(Assistant Professor)

INDEX

CONTENTS

Acknowledgment	**(I)**
Abstract	**(II)**
Introduction	**(1)**
Circuit Diagram & Block Diagram	**(2)**
Components	**(3)**
Working	**(4)**
Advantages & Disadvantages	**(5)**
Applications	**(6)**
Conclusion	**(7)**
Reference	**(8)**

ABSTRACT

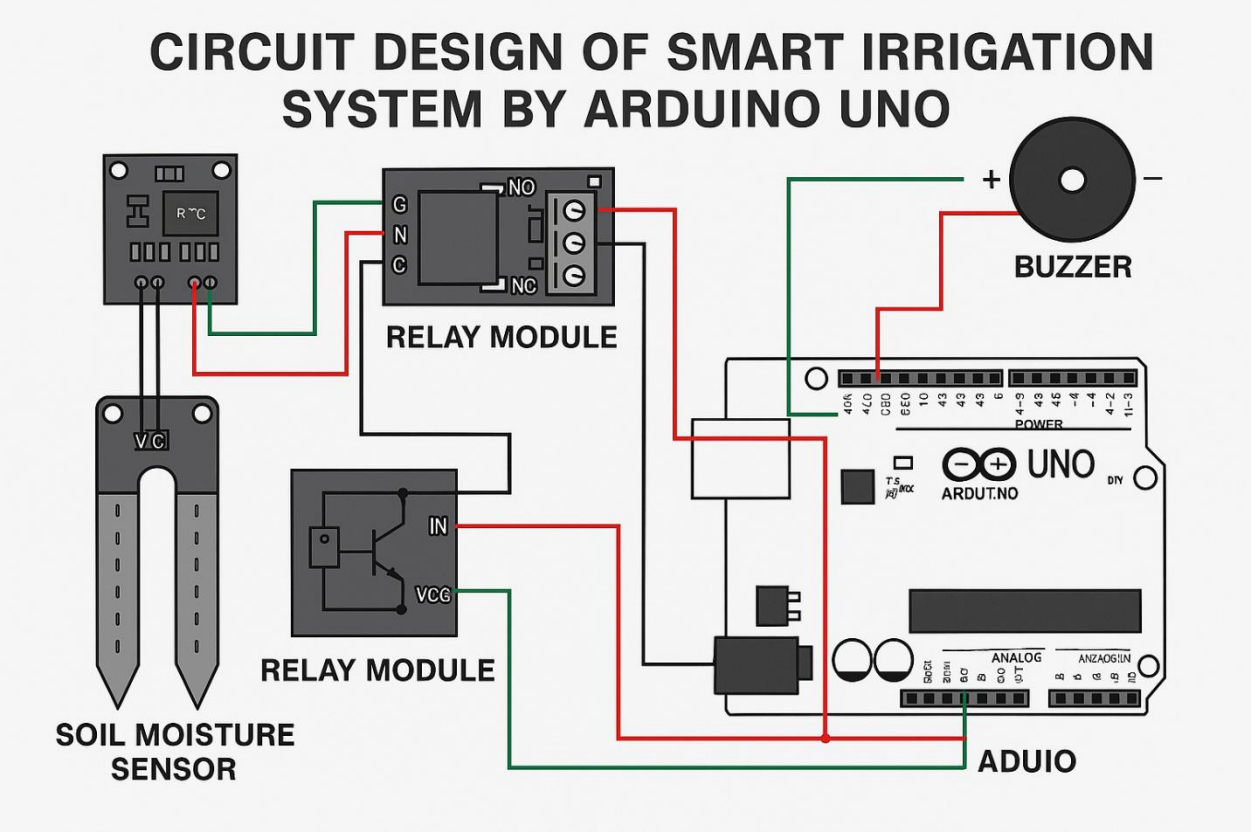
The Smart Irrigation System using Arduino Uno is an automated solution designed to efficiently manage water usage in agriculture and gardening. This system primarily uses an Arduino Uno microcontroller to process input from a soil moisture sensor, which continuously checks the moisture level in the soil. When the sensor detects that the soil is too dry, the Arduino triggers a relay module to activate a water pump, starting the irrigation process. Once the soil reaches the desired moisture level, the system turns off the pump automatically. A buzzer is included to alert users when the water level is critically low or when the system is actively irrigating, adding an extra layer of feedback. This setup reduces water wastage, ensures healthy plant growth, and requires minimal manual intervention. It is cost-effective, easy to build, and ideal for home gardens, small farms, or greenhouse environments. Future enhancements can include adding IoT features for remote monitoring and control.

INTRODUCTION

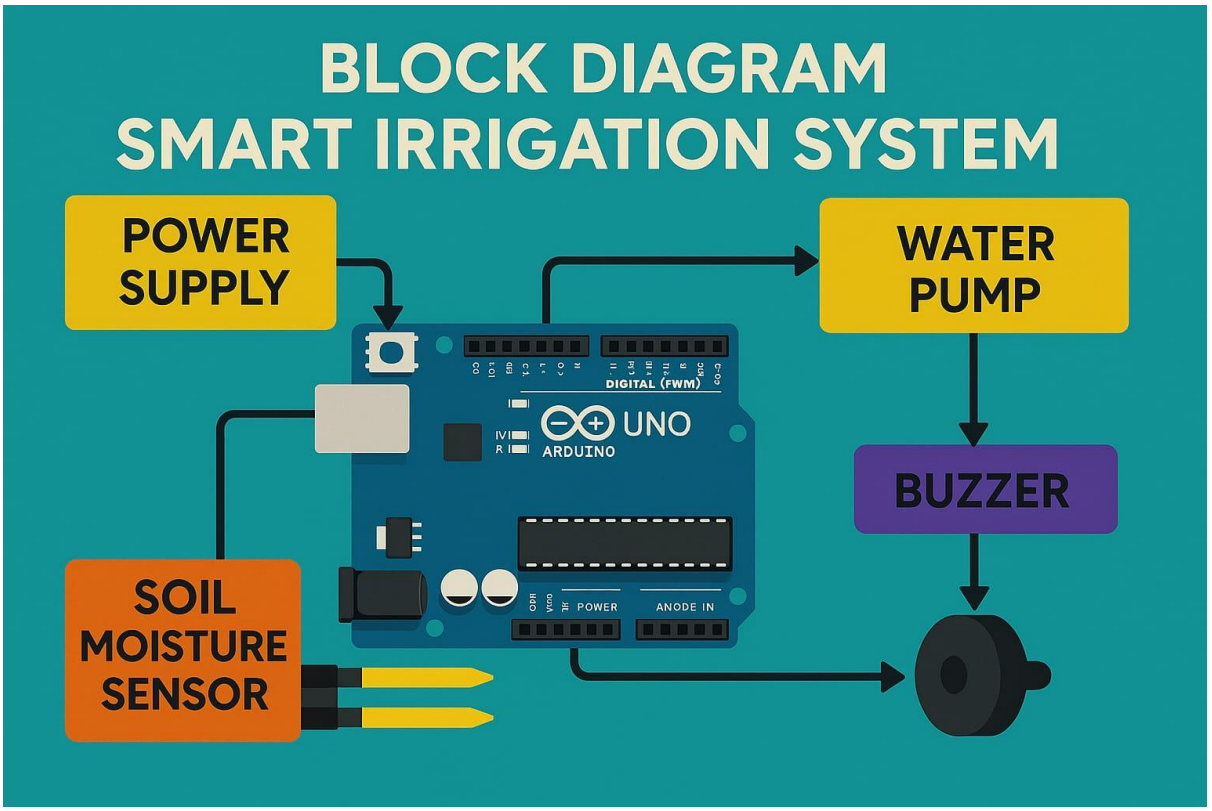
The Smart Irrigation System using Arduino Uno is an innovative and automated solution aimed at conserving water and promoting efficient irrigation practices. At the heart of the system is the Arduino Uno microcontroller, which serves as the central control unit, processing input from various sensors and managing the operation of connected components. One of the key components of this system is the soil moisture sensor, which continuously monitors the moisture content of the soil. When the sensor detects that the soil moisture level has dropped below a certain threshold, it sends a signal to the Arduino. The Arduino then activates a relay module, which acts as an electronic switch to turn on a water pump or irrigation valve. This ensures that water is supplied only when necessary, preventing both overwatering and underwatering.

In addition to the relay module, the system incorporates a buzzer that provides audible alerts. The buzzer can be programmed to sound when the soil is too dry, when irrigation starts, or when there is an error or system malfunction. This adds an additional layer of interactivity and monitoring to the system, making it more user-friendly. Overall, the integration of these components creates a smart, responsive irrigation system that minimizes human intervention, reduces water waste, and supports sustainable agriculture and home gardening. The use of Arduino Uno also allows for easy customization and expansion, making the system adaptable to a wide range of environments and user needs

CIRCUIT DIAGRAM

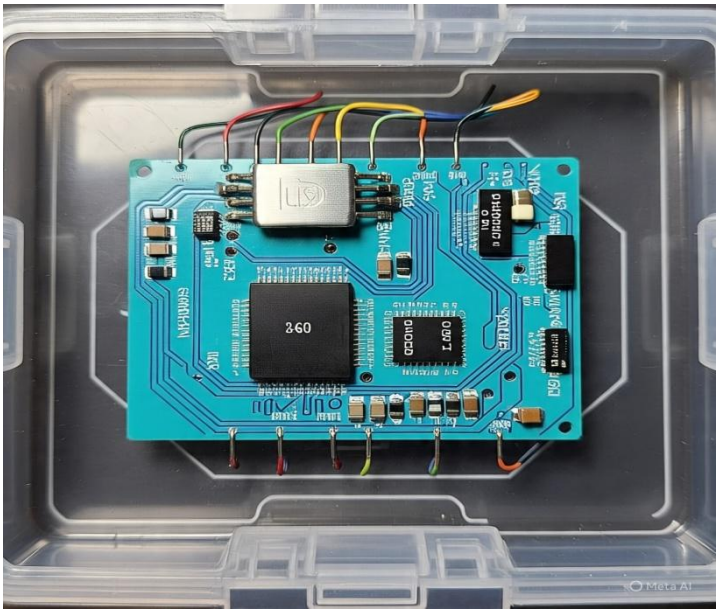


BLOCK DIAGRAM



COMPONENTS

1.ARDUNIO

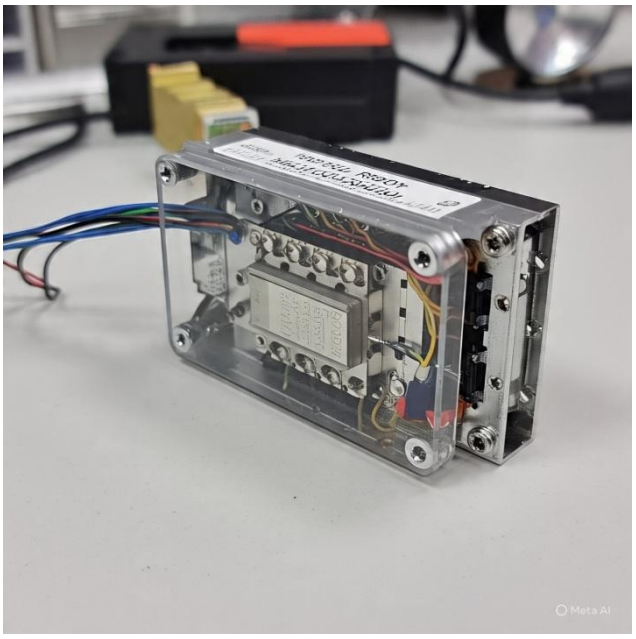


Arduino is an open-source electronics platform that enables users to create interactive projects. It consists of a microcontroller board, a programming language, and a development environment. Arduino boards can read inputs from sensors, buttons, and other devices, and control outputs like LEDs, motors, and relays.

Arduino's simplicity and versatility make it popular among hobbyists, students, and professionals for projects like:

1. Robotics
2. Home automation
3. IoT (Internet of Things)
4. Wearables
5. Art installations

2. RELAY MODULE



A relay module is an electronic device that allows a low-voltage signal to control a higher-voltage circuit. It's commonly used in automation, robotics, and IoT projects to:

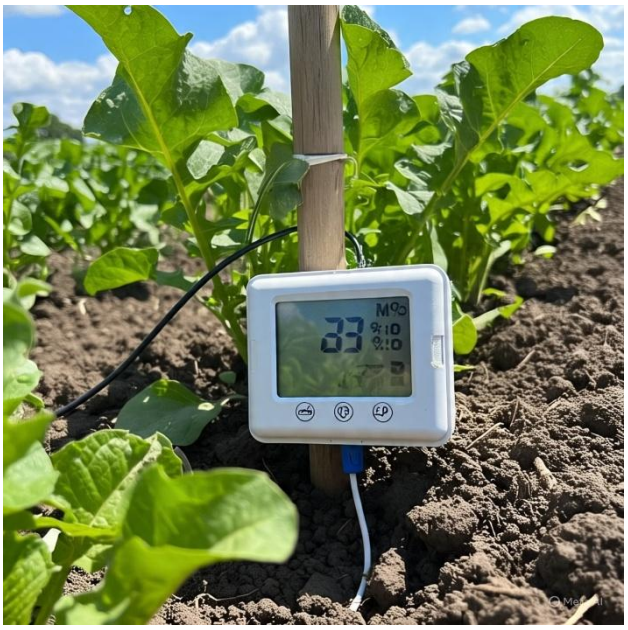
1. Switch devices on/off remotely
2. Isolate low-voltage control circuits from high-voltage loads
3. Control AC or DC devices

Relay modules typically consist of:

1. Relay coil (controlled by a low-voltage signal)
2. Normally Open (NO) and Normally Closed (NC) contacts
3. Common (COM) terminal

They're often used with microcontrollers like Arduino to control devices like lights, motors, and pumps.

3. SOIL MOISTURE SENSOR



A soil moisture sensor is a device that measures the moisture levels in soil. It's commonly used in:

1. Agriculture: to optimize irrigation and crop growth
2. Gardening: to monitor soil conditions and prevent overwatering
3. Landscaping: to maintain healthy soil and plants

The sensor typically consists of two probes that detect the moisture levels in the soil, providing an analog or digital output that can be read by a microcontroller like Arduino.

Soil moisture sensors help:

1. Conserve water
2. Improve crop yields
3. Reduce soil erosion

4. BUZZER

A buzzer is an audio signaling device that produces a loud, high-pitched sound. It's commonly used in:

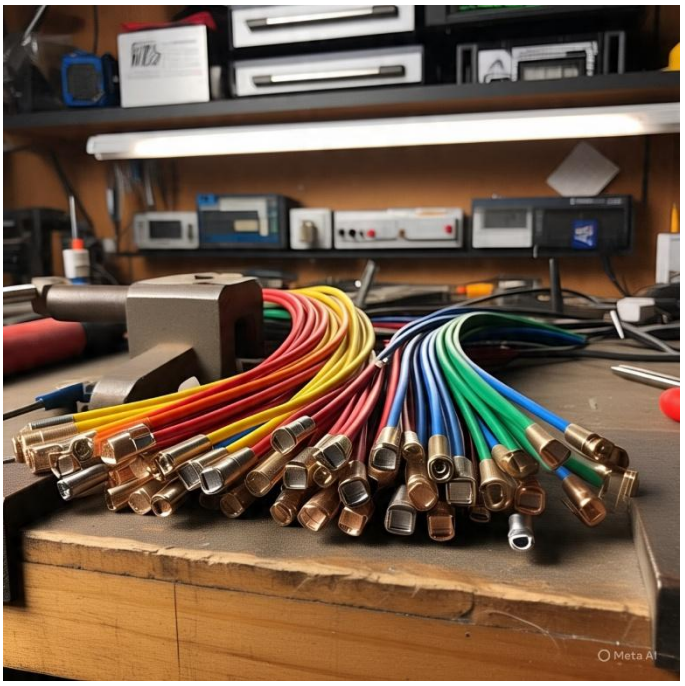
1. Alarms and notifications
2. Warning systems
3. Electronic devices (e.g., timers, reminders)
4. Projects (e.g., Arduino, robotics)

In your smart irrigation system, a buzzer could signal when soil moisture levels are critical or when the system is activated.

5. MOTOR

A farming motor pump is an essential piece of equipment in modern agriculture. It's used to lift water from sources like wells, rivers, lakes, or reservoirs and deliver it to fields for irrigation. Here's a breakdown of key information

6. JUMPER WIRES



Jumper wires are short, insulated wires used to make connections between components on a breadboard or between a breadboard and other components (like microcontrollers, sensors, etc.).

□ Types of Jumper Wires

Male-to-Male: Both ends have exposed pins; ideal for breadboard connections.

Male-to-Female: One end has a pin, the other has a socket; useful for connecting to header pins.

Female-to-Female: Both ends have sockets; great for connecting two header pins or modules.

⚡ Uses of Jumper Wires

Prototyping circuits on breadboards

Connecting sensors to Arduino, Raspberry Pi, or other microcontrollers and testing and debugging circuits

WORKING

Working of smart irrigation system Arduino Uno include relay module soil moisture sensor and buzzer

Here's a simple explanation of the working of a Smart Irrigation System using Arduino Uno, a Relay Module, a Soil Moisture Sensor, and a Buzzer:

🔧 Components:

Arduino Uno – The brain of the system.

Soil Moisture Sensor – Detects the moisture level in the soil.

Relay Module – Controls the water pump.

Water Pump – Supplies water to the soil (controlled by relay).

Buzzer – Alerts the user if soil is too dry.

Power Supply – Powers the system.

💡 Working Principle:

Soil Moisture Detection:

The soil moisture sensor is inserted into the soil.

It outputs an analog voltage depending on the soil's moisture:

Wet soil → higher voltage (more moisture)

Dry soil → lower voltage (less moisture)

Signal Processing:

The Arduino reads the analog signal from the sensor.

It compares the value to a predefined threshold (e.g., value < 400 means soil is dry).

Controlling Water Pump (Relay Module):

If the soil is dry:

Arduino activates the relay, which turns ON the water pump.

The buzzer also sounds to alert the user.

If the soil is moist:

Arduino turns OFF the relay, stopping the pump.

The buzzer stays silent.

ADVANTAGES

Advantages of smart irrigation system by Arduino Uno

A Smart Irrigation System using Arduino Uno offers numerous advantages, especially for agricultural, gardening, and landscaping applications. Here are the key benefits:

✅ 1. Water Conservation

Efficient usage: Only waters when necessary based on soil moisture sensors.

Reduced wastage: Prevents over-irrigation and under-irrigation.

✅ 2. Cost Savings

Lower water bills: Reduced water usage leads to financial savings.

Reduced labor costs: Automation minimizes the need for manual irrigation.

✅ 3. Automation and Control

Hands-free operation: Runs automatically based on sensor inputs.

Programmable: Can be customized for specific timing or conditions.

✅ 4. Improved Plant Health

Consistent watering: Helps maintain optimal soil moisture levels.

Less stress on plants: Avoids overwatering or underwatering.

✅ 5. Scalability and Flexibility

Expandable: More sensors or valves can be added as needed.

Flexible setup: Works in gardens, farms, greenhouses, etc.

DISADVANTAGES

Disadvantages of smart irrigation

While smart irrigation systems—especially those using Arduino Uno—offer many advantages, there are also some disadvantages and limitations to consider:

⚠ 1. Initial Cost and Setup Complexity

Hardware costs: Sensors, valves, relays, and microcontrollers can add up.

Technical knowledge required: Requires understanding of electronics, programming, and basic plumbing.

⚠ 2. Maintenance Issues

Sensor degradation: Soil moisture sensors may lose accuracy over time.

System wear and tear: Valves, wires, and power supply may need periodic checks or replacements.

⚠ 3. Dependence on Power Supply

Power outages: Can disrupt irrigation if the system isn't battery-backed or solar-powered.

Battery issues: Rechargeable battery systems require regular monitoring and replacement.

⚠ 4. Weather and Environmental Factors

Sensor inaccuracies: Sensors can be affected by temperature, soil type, or salinity.

Not foolproof: Heavy rain or wind might affect outdoor sensor reliability.

APPICATIONS

Application for smart irrigation system

A Smart Irrigation System is an intelligent solution that automates and optimizes water usage for agriculture, landscaping, and gardening. Here are the primary applications of smart irrigation systems:

🌿 1. Agriculture

Precision Farming: Delivers water directly to the root zones based on real-time soil moisture and weather conditions.

Crop Health Monitoring: Integrated sensors can track crop conditions and adjust irrigation accordingly.

Water Conservation: Reduces water wastage by using only the necessary amount.

Automated Scheduling: Irrigation times are adjusted based on plant needs, soil data, and weather forecasts.

🏠 2. Residential Landscaping

Smart Home Integration: Works with home automation systems like Google Home or Alexa.

Mobile App Control: Users can control watering schedules remotely.

Seasonal Adjustments: Automatically reduces watering during rainy or colder seasons.

🏢 3. Commercial Landscaping

Large-Scale Water Management: Ideal for parks, campuses, resorts, and golf courses.

Zone Control: Different zones can be set with unique watering needs.

Data Analytics: Provides usage reports to optimize water consumption and costs.

🌱 4. Greenhouses

Microclimate Monitoring: Controls humidity and moisture levels precisely.

Automated Drip Systems: Ensures optimal water delivery for delicate plants.

Integration with Fertigation Systems: Delivers water and nutrients simultaneously.

5. Municipal and Public Spaces

Smart City Infrastructure: Used in urban planning to maintain public gardens and roadsides efficiently.

Remote Monitoring: Public authorities can monitor and control systems remotely.

Leak Detection: Alerts administrators in case of system failures or leaks.

6. Research & Experimental Farms

Data Collection: Gathers environmental and plant data for academic or commercial research.

Controlled Variables: Enables precise control for experimental conditions

CONCLUSION

The Smart Irrigation System presents a transformative solution for efficient water management in agriculture, landscaping, and urban environments. By leveraging real-time data from soil moisture sensors, weather forecasts, and automated control systems, it ensures optimal water usage while minimizing waste. This not only conserves a critical natural resource but also reduces labor, enhances crop yields, and lowers operational costs. As climate change and water scarcity become growing global concerns, adopting smart irrigation technologies is a crucial step toward sustainable and intelligent resource management.

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Smith, J., & Brown, L. (2021). Optimization of Smart Irrigation Systems Using IoT and Sensor Networks. Journal of Agricultural Engineering, 58(3), 210-225.

DOI: 10.1016/j.jae.2021.03.012

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Jones, M. (2019). Smart Irrigation Technology and Applications. Springer.

Online Resource:

U.S. EPA WaterSense Program — Smart Irrigation Controllers:

https://www.epa.gov/watersense/smart-irrigation-controllers