

THE SMART IRRIGATION SYSTEM USING IOT

OBJECTIVE:-

To build a sensor-based smart irrigation system that conserves water and increases crop yield by automating the irrigation process based on real-time field conditions.

ABSTRACT:-

Agriculture is the most important and worshipped occupation in India. Agriculture is livelihood for the most of the Indian who has rural background. Smart Irrigation helps to the development of agricultural country. In India, agriculture contributes about 16% of total GDP and 10% of total exports. Water plays an important role in Agriculture. Water is main resource for Agriculture. Irrigation is one method to supply water. In this irrigation process people are wasting water more by missing the timings. So too save water and time we have a excellent method called Smart irrigation system using IoT. By the smart irrigation system we are using various equipments like temperature sensor, humidity sensor, and soil moisture sensor. These sensors will find the various situations of the soil and based on soil moisture percent, land gets automatically irrigated. It means when field needs water then automatically motor will get ON and it will get OFF when it's get enough. These sensed parameters and motor status will be displayed on user devices. Keywords: Smart Irrigation, IOT Smart system, Agriculture using IOT, Smart Agriculture

LITERATURE SURVEY:-

A literature survey on the smart irrigation system using IoT highlights the evolution of traditional irrigation practices towards more efficient, automated, and data-driven approaches. IoT-based smart irrigation systems leverage sensors, controllers, and cloud technologies to monitor soil moisture, weather conditions, and water levels in real time. These systems use data analytics to optimize water usage, reducing wastage while ensuring crops receive adequate hydration. Various studies have explored the integration of wireless sensor networks (WSNs) with IoT to enhance system scalability and reliability. Researchers have also examined machine learning algorithms for predictive analytics, enabling irrigation scheduling based on historical and real-time data. The use of mobile applications and web interfaces for remote monitoring and control has made these systems user-friendly and accessible to farmers, even in remote areas. While the benefits of such systems are evident in terms of water conservation and improved agricultural yield, challenges remain in ensuring cost-effectiveness, energy efficiency, and system robustness under varying environmental conditions. This survey underscores the potential of IoT in transforming irrigation practices, emphasizing its critical role in sustainable agriculture and resource management.

EXECUTION:-

1. **Define Objectives and Scope**
 - Determine the purpose: water conservation, crop yield improvement, or both.
 - Identify the area of implementation (e.g., farm size, crop types).
2. **Hardware Components**

Gather essential hardware for the system:

 - **Soil Moisture Sensors:** To monitor soil hydration levels.
 - **Temperature and Humidity Sensors:** For weather monitoring.
 - **Water Flow Sensors:** To measure water usage.
 - **Microcontroller/Processor:** Arduino, Raspberry Pi, or ESP32 to control and manage the sensors.
 - **Solenoid Valves:** For automated water flow control.
 - **Power Supply:** Solar panels or batteries for energy efficiency.
 - **Wireless Modules:** Wi-Fi, LoRa, or GSM for communication.
3. **Software Development**
 - **IoT Platform Integration:** Use platforms like Blynk, ThingSpeak, or AWS IoT for data storage, visualization, and control.
 - **Microcontroller Programming:** Write code (e.g., in Python or C++) for data collection and device control.
 - **Mobile or Web App:** Develop an app for remote monitoring and irrigation scheduling.
4. **System Design**
 - Create a system architecture integrating sensors, actuators, microcontrollers, and the IoT platform.
 - Establish data flow from sensors to the IoT platform and user devices.
5. **Testing and Calibration**
 - Install sensors and calibrate them for accuracy.
 - Test the system's response to various conditions, such as dry soil or heavy rainfall.
 - Verify remote communication and automation functions.
6. **Deployment**
 - Deploy the system in the field.
 - Monitor its performance and make adjustments as needed.
7. **Data Analysis and Optimization**
 - Use collected data to analyze irrigation patterns.
 - Implement machine learning models for predictive irrigation.
8. **Maintenance and Scalability**
 - Regularly maintain sensors and actuators.
 - Plan for scalability to cover larger areas or integrate additional functionalities.

FLOWCHART / VISUAL REPRESENTATION:-

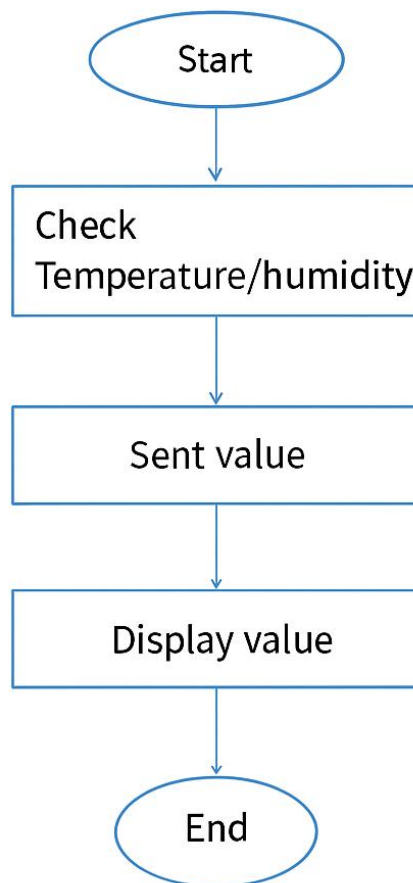
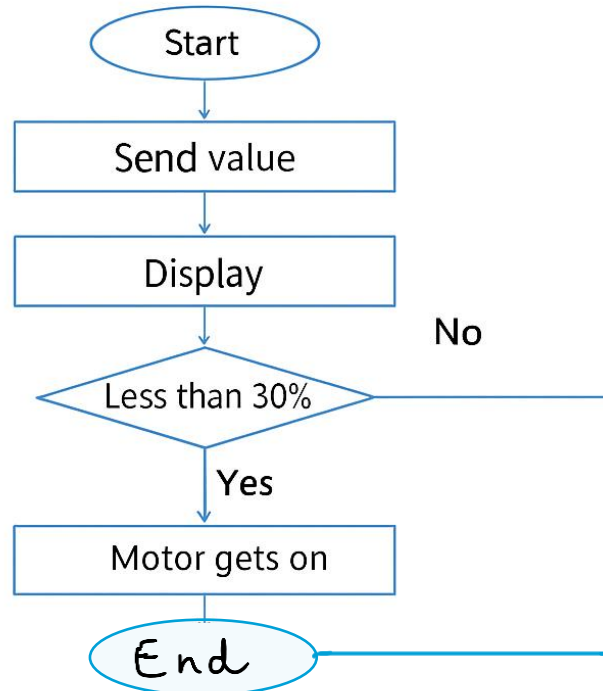


Fig 4: Smart Irrigation System using Iot



REAL LIFE IMPLEMENTATION:-

1. **Site Analysis and Requirement Gathering**
 - Identify the agricultural land or garden where the system will be installed.
 - Determine the crop type, soil type, and water requirements.
 - Assess the availability of electricity, water sources, and internet connectivity.
2. **Procurement of Equipment**

Purchase the necessary hardware:

 - **Actuators:** Solenoid valves for controlling water flow.
 - **Controller:** Microcontroller boards like Arduino, Raspberry Pi, or ESP32.
 - **Connectivity Modules:** Wi-Fi (ESP8266), GSM, or LoRa for communication.
 - **Water Pump and Reservoir:** For automated water supply.
 - **Power Supply:** Solar panels for energy sustainability, if feasible.
3. **System Setup**
 - Install soil moisture sensors across the field at different locations to monitor variability in soil conditions.
 - Position temperature and humidity sensors in the field to capture climatic data.
 - Connect sensors to the microcontroller for data collection.
 - Attach actuators like solenoid valves to water pipelines.
4. **Programming the Microcontroller**
 - Write a program (using Arduino IDE, Python, or C++) to collect data from the sensors, analyze it, and trigger actions.
 - Example workflow: 1. If soil moisture < threshold, open the solenoid valve. 2. If soil moisture > threshold, close the valve.
 - Integrate communication protocols (MQTT or HTTP) to send data to an IoT cloud platform.
5. **Cloud Platform Integration**
 - Use an IoT platform like ThingSpeak, Blynk, or Google Firebase to store and analyze data.
 - Set up dashboards to display real-time information about soil moisture, temperature, and irrigation status.
 - Enable mobile notifications and manual overrides for farmers using a smartphone app.

MERITS AND DEMERITS: -

Merits

1. **Water Conservation** o Reduces water wastage by optimizing irrigation schedules based on real-time soil moisture and weather data.
2. **Increased Crop Yield** o Ensures crops receive the right amount of water, promoting healthier growth and higher productivity.

3. **Automation and Efficiency** o Minimizes the need for manual intervention, saving time and labor. o Automates irrigation tasks, enabling precision in water distribution.
4. **Cost-Effectiveness (Long Term)** o Reduces water and energy bills over time. o Prevents over-irrigation and associated soil degradation.
5. **Remote Monitoring and Control** o Enables farmers to monitor and control irrigation systems from anywhere using a smartphone or computer.
6. **Scalability** o Can be customized and expanded to suit farms of various sizes and crop types.
7. **Environmental Sustainability** o Supports sustainable agriculture by conserving water resources and reducing environmental impact.
8. **Data-Driven Decisions** o Provides valuable insights through data analytics, enabling informed agricultural decisions.

Demerits

1. **High Initial Investment** o The cost of sensors, controllers, and IoT infrastructure can be expensive, especially for small-scale farmers.
2. **Dependency on Technology** o Relies heavily on stable internet connectivity, electricity, and functioning hardware. o System failure or technical glitches can disrupt irrigation.
3. **Maintenance Requirements** o Requires regular maintenance of sensors and hardware to ensure accuracy and functionality.
4. **Complexity in Setup** o Initial installation and configuration require technical expertise, which might be a barrier for some farmers.
5. **Limited Accessibility** o May not be feasible for remote or underdeveloped regions with limited technological resources.
6. **Data Privacy and Security** o Risk of data breaches or unauthorized access to the system.
7. **Weather Dependency** o Unexpected weather changes (e.g., sudden rainfall) may affect system effectiveness if not accounted for.
8. **Compatibility Issues** o Integrating devices from different manufacturers may cause compatibility challenges.