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"Automatic Plant Watering System Based On The Environmental Changes"

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Abstract— *In recent years, the integration of Internet of Things (IoT) technology in agriculture has revolutionized traditional farming practices. This project focuses on developing an Automatic Plant ouWatering System (APWS) that utilizes environmental data to optimize plant care. The system incorporates sensors for monitoring soil moisture, temperature, and humidity, which are crucial factors influencing plant health and growth. By continuously analyzing these parameters, the APWS autonomously adjusts watering schedules to ensure plants receive adequate moisture levels tailored to their specific needs. A microcontroller serves as the central processing unit, interpreting sensor data and controlling the water supply mechanism. The implementation of IoT connectivity allows remote monitoring and management of the system via a user-friendly interface, enhancing convenience and efficiency. This project aims to promote sustainable agriculture practices by minimizing water wastage while maximizing crop yield through intelligent environmental responsiveness*

Keywords— *IoT in Agriculture, Automatic Plant Watering System (APWS), Soil Moisture Monitoring, Environ mental Data Optimization, Microcontroller, Remote Monitoring, Sustainable Agriculture, Water Management, Crop Yield Maximization, Intelligent Environmental Responsiveness.*

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I. INTRODUCTION

Internet of things IOT consists of two words Internet and Things .The term things in IOT refers to various IOT devices having unique identities and have capabilities to perform remote sensing , actuating and live monitoring of certain sort of data.IOT devices are also enable to have live exchange of data with other connected devices and application either directly or indirectly , or collected data from other devices and process the data and send the data to various servers. The other term internet is define as Global communication Network connecting Trillions of computers across the planets enabling sharing of information .Thus the IOT can be define as:"A dynamic Global Network Infrusture with self configuring capabilities based on standard and inter operable communication to protocol where physical and virtual things have identities, physical attributes ,and virtual personalities and use intelligent interfaces and are seamlessly integrated into the information network ,often communicate data associated with user and their environment."

An ideal IOT device consists of various interfaces for making connectivity to other devices which can either be wired or wireless.

Any IOT based device consists of following components:
- I/O interface for Sensors.
- Interface for connecting to Internet.
- Interface for Memory and Storage.
- Interface for Audio/Video

A.IOT AND ENABLING TECHNOLOGIES

Internet of Things has a strong backbone of various enabling technologies- Wireless Sensor Networks, Cloud Computing, Big Data, Embedded Systems, Security Protocols and Architectures, Protocols enabling communication, web services, Internet and Search Engines. Wireless Sensor Network (WSN): It consists of various sensors/nodes which are integrated together to monitor various sorts of data. Cloud Computing: Cloud Computing also known as on-demand computing is a type of Internet based computing which provides shared processing resources and data to computers and other devices on demand. It can be in various forms like IAAS, PAAS, SAAS, DAAS etc. Big Data Analytics: Big data analytics is the process of examining large data sets containing various forms of data types i.e. Big Data to uncover hidden patterns, unknown correlations, market

trends, customer preferences and other useful business information. Communication Protocols: They form the backbone of IOT systems to enable connectivity and coupling to applications and these protocols facilitate exchange of data over the network as these protocols enable data exchange formats, data encoding and addressing. Embedded Systems: It is a sort of computer system which consists of both hardware and software to perform specific tasks. It includes microprocessor/microcontroller, RAM/ROM, networking components, I/O units and storage devices

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B. OVERVIEW OF THE PROJECT

It is regarded as IOT gadget focusing on Live Monitoring of Environmental data in terms of Temperature, Moisture and other types depending on the sensors integrated with it. The system provides the concept of Plug & Sense in which farmers can directly implement smart farming by as such putting the System on the field and getting Live Data feeds on various devices like Smart Phones, Tablets etc. and the data generated via sensors can be easily shared and viewed by agriculture consultants anywhere remotely via Cloud Computing technology integration. The system also enables analysis of various sorts of data via Big Data Analytics from time to time.

II. LITERATURE SURVEY

A. OVERVIEW

Irrigation is most important for high yield of the farm. Today, by using WSN technology it is possible to monitor and control the environmental conditions as soil moisture, temperature, wind speed, wind pressure, salinity, turbidity, humidity etc for irrigation. Automated irrigation performed by using solenoid valve and pump. Solenoid valve is an electromechanical valve used with liquid controller to control an electronic current through solenoid which is a coil of wire that uses to control the state of the valve according to need of irrigation.

B. SURVEY OF PREVIOUS WORKS

Title: "IoT-Based Smart Irrigation Systems for Sustainable Agriculture: A Review"
Author:Abdullah,M.,&Rahman,T.(2020).
This survey reviews various smart irrigation systems leveraging IoT technology, focusing on sustainable agriculture. The study discusses how IoT-based systems optimize water usage by monitoring key environmental factors such as soil moisture, temperature, and weather conditions. It also addresses the challenges of integrating these technologies in different agricultural settings and proposes solutions for improving the scalability and cost effectiveness of smart irrigation systems. The paper emphasizes the role of real-time data collection and analysis in enhancing the efficiency of water management practices.
Title: "Advancements in Automatic Irrigation Systems: Integration of Environmental Monitoring and Machine Learning"
Author:Ahmad, S., & Yaseen, M. (2021)

This literature survey explores advancements in automatic irrigation systems that integrate environmental monitoring technologies. It examines various sensors used for detecting soil moisture, temperature, and other environmental parameters, and how these sensors contribute to the efficiency of irrigation systems. The survey also reviews the use of machine learning algorithms and predictive models to automate the irrigation process based on 4 environmental data. The paper highlights the potential of these systems to reduce water consumption and increase agricultural productivity while adapting to varying environmental conditions.
Title: "IoT-Based Irrigation Systems in Smart Farming: Applications, Challenges, and Benefits" Author:Ali, M., & Zaman, F. (2022).
This paper presents a comprehensive survey of IoT-based irrigation systems, focusing on their applications in smart farming. The authors review the different types of sensors and communication technologies used in these systems, as well as their integration with cloud computing and big data analytics. The survey also discusses the challenges of implementing IoT in agriculture, such as data security, system reliability, and scalability. Additionally, the paper explores the potential benefits of IoT-enabled irrigation systems, including improved water management, increased crop yield, and reduced labor costs. organizational editing before formatting. Please note sections A-D below for more information on proofreading, spelling and grammar.
Title: "Soil Moisture Sensors in Automatic Irrigation Systems: Types, Applications, and Integration"
Author:Bhatt, R., & Patel, S. (2019).
This review focuses on the use of soil moisture sensors in automatic irrigation systems. The authors discuss the various types of soil moisture sensors available, such as capacitive, resistive, and tensiometric sensors, and their applications in agriculture. The paper highlights the importance of soil moisture monitoring in optimizing water

use and preventing over-irrigation or under-irrigation. Additionally, the review covers the integration of these sensors with microcontrollers and IoT platforms to create automated irrigation systems that respond to real-time soil moisture data.

Title: "Technological Advancements and Future Directions in Smart Irrigation Systems"
Author:Chakraborty, A., & Das, S. (2021).
This survey provides an overview of smart irrigation systems, examining the current technologies used and suggesting future research directions. The paper discusses the role 5 of IoT, wireless sensor networks, and machine learning in developing automated irrigation systems that can adapt to environmental changes. It also explores the potential of integrating these systems with weather forecasting models to optimize irrigation schedules. The authors highlight the challenges of implementing smart irrigation systems on a large scale, including the need for standardized protocols, energy-efficient sensors, and reliable communication networks.

Title: "Automated Irrigation Control Systems: Adaptability, Benefits, and Challenges"
Author:Deshmukh, P., & Jadhav, R. (2020).
The authors review automated irrigation control systems that are adaptable to environmental changes. They analyze the various technologies used, such as microcontrollers, sensors, and IoT, to create systems that automatically adjust irrigation schedules based on real-time environmental data. The paper discusses the benefits of these systems, including water conservation, reduced labor costs, and improved crop yield. The survey also explores the challenges of integrating these technologies in small-scale farming operations, such as cost, complexity, and the need for technical expertise.

Title: "Smart Plant Watering Systems: IoT and Sensor Network Integration"
Author:Gupta, A., & Sharma, V. (2022).
This paper surveys smart plant watering systems that utilize IoT and sensor networks. It reviews the different types of sensors used for monitoring soil moisture, temperature, and other environmental parameters, as well as their integration with IoT platforms for remote monitoring and control. The authors discuss the potential of these systems to improve water use efficiency and reduce the environmental impact of irrigation practices. The survey also highlights the challenges of implementing IoT-based plant watering systems, such as data security, system reliability, and the need for user-friendly interfaces.

Title: "Automated Irrigation Systems: Environmental Data Utilization and Case Studies"
Author:Hussain, A., & Khan, S. (2021).
The authors conduct a literature survey on automated irrigation systems, focusing on the use of environmental data to optimize irrigation schedules. The paper reviews various case studies and applications of these systems in precision agriculture, highlighting their potential 6 to reduce water consumption and increase crop yield. The survey also discusses the challenges of integrating environmental monitoring technologies with existing irrigation systems, such as cost, complexity, and the need for reliable data transmission. Additionally, the authors explore the potential of using machine learning algorithms to improve the accuracy and efficiency of automated irrigation systems.

Title: "IoT-Enabled Smart Irrigation Systems: Environmental Monitoring and Optimization"
Author:Iqbal, N., & Qureshi, M. (2020).
This survey highlights IoT-enabled smart irrigation systems, with a focus on environmental monitoring. The authors discuss the various sensors used for measuring soil moisture, temperature, and humidity, and how these sensors are integrated with IoT platforms to provide real-time data for irrigation management. The paper also explores the use of cloud computing and big data analytics to analyze environmental data and optimize irrigation schedules. The survey highlights the benefits of IoT-based smart irrigation systems, such as improved water use efficiency, reduced labor costs, and increased crop yield.

Title: "Automatic Irrigation Systems Using Environmental Sensors: A Systematic Review"
Author:Jain, P., & Singh, R. (2021).
The authors present a systematic review of automatic irrigation systems that utilize environmental sensors. The paper discusses the different types of sensors used for monitoring soil moisture, temperature, and other environmental parameters, and their integration with microcontrollers and IoT platforms. The authors also review various algorithms and models used to automate the irrigation process based on environmental data. The survey highlights the potential of these systems to improve water use efficiency, reduce labor costs, and increase agricultural productivity. Additionally, the authors discuss the challenges of implementing these systems on a large scale.

III.PROPOSED METHODOLOGY

Automatic watering of plants is based on Internet Of Things(IOT).In this proposed system we use Arduino uno software and hardware, Soil moisture sensor, Rechargable Battery, Relay Module, Dc motor. The sensors automatically checks the soil moisture and based on some threshold value if soil is dry then it waters the plant and if soil is wet which is more than threshold value then is stops watering the plants.

Advantages of Proposed System

Ensures data redundancy and disaster recovery by replicating data across regions.
Improves data availability and resilience by maintaining copies of data in multiple geographic locations.
Helps organizations comply with regulatory requirements by storing data in accordance with data sovereignty laws.
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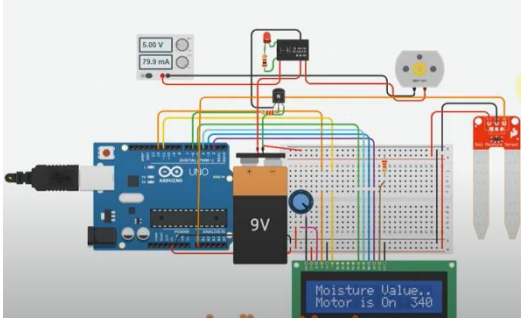
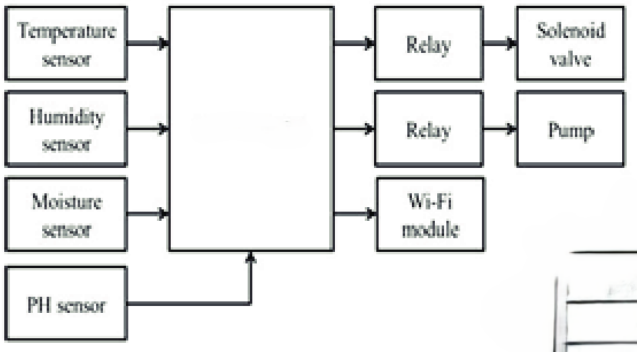
A.SYSTEM ARCHITECTURE



B.PROPOSED SYSTEM



IV.ALGORITHM

An Automatic Plant Watering System (APWS) based on environmental changes typically uses a combination of s ensors and algorithms to ensure plants receive the right amount of water at the right time1. Here are some commo n algorithms and components used in such systems:

1. **Soil Moisture Sensors**: These sensors measure the moisture content in the soil. When the soil moisture level drops below a certain threshold, the system triggers the watering mechanism.
2. **Temperature and Humidity Sensors**: These sensors monitor environmental conditions that can affect plant water needs. The data from these sensors is used to adjust the watering schedule accordingly.
3. **Fuzzy Logic Controllers**: Fuzzy logic is often used to handle the uncertainty and variability in environmental conditions. It takes inputs like soil moisture, temperature, and humidity, and processes them to determine the opti mal watering amount.
4. **Arduino or NodeMCU**: These microcontrollers are commonly used to process sensor data and control the wa tering system. They can be programmed to automate the watering process based on the sensor inputs.

V. RESULTS

The results of an Automatic Plant Watering System (APWS) project can vary depending on the specific design an d implementation, but here are some common outcomes:

1. **Improved Plant Health**: By providing consistent and optimal watering, plants are less likely to suffer from u nder or over-watering, leading to healthier growth.
2. **Water Conservation**: These systems can help conserve water by ensuring that plants receive only the amount of water they need, reducing waste.
3. **Convenience**: Users can save time and effort by automating the watering process, especially useful for those who travel frequently or have busy schedules.

4. **Data Collection**: Some systems collect data on soil moisture, temperature, and humidity, which can be used t o further optimize watering schedules and improve plant care.

VI.CONCLUSION

An automatic plant irrigation system using Arduino is designed in this project. The prototype of the model worked properly when tested on different soils.

- The components that we use in the system are readily available and easy to operate. Thus, this system acts as an effectual method of irrigation.
- It is far better than the manual irrigation process which requires a lot of manpower and time. By using the app, thefarmer can operate the system from distant places.
- The farmer can utilize this time in other significant activities.
- Also, the major issue of water scarcity is dealt with. No amount of water is wasted in the process of irrigation.
- Thus, this system can be very useful in areas where water is in short supply. As the required amount of water is provided to the crop, the crop growth is better.
- Farmers can thus benefit from the enhanced crop yields.
- The project is tested for different types of soils and it works properly.
- The future work of the system can include the addition of temperature sensors and a more powerful motor to pump water to the fields.
- Thus, the large-scale implementation of the project can also be done.

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