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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
(Artificial Intelligence and Machine Learning)

Embeded System Design Project Report on

" ARYA - Automation of Plant Watering System Using Arduino"

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
(Artificial Intelligence and Machine Learning)

SCHOOL OF ENGINEERING

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Department of Computer Science & Engineering
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CERTIFICATE

This is to certify that the Embedded System Design (22AM2405) titled "**ARYA-Automation of Plant Watering System Using Arduino**" is carried out by **Chethan K Murthy (ENG22AM0009), Gaana Shree S (ENG22AM0014), Himashree L (ENG22AM0025), Kara Swathi (ENG22AM0027), Rakshith K (ENG22AM0046)** bonafide students of Bachelor of Te)chnology in Computer Science and Engineering (Artificial Intelligence and Machine Learning) at the School of Engineering, Dayananda Sagar University.

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DECLARATION

We, **Chethan K Murthy (ENG22AM0009), Gaana Shree S (ENG22AM0014), Himashree L (ENG22AM0025), Kara Swathi (ENG22AM0027), Rakshith K (ENG22AM0046)** are students of the fourth semester B.Tech in Computer Science and Engineering(AI&ML), at School of Engineering, Dayananda Sagar University, hereby declare that the Embedded System project titled "**ARYA Automation of Plant Watering System Using Arduino**" has been carried out by us and submitted in partial fulfillment for the award of degree in Bachelor of Technology in Computer Science and Engineering(AI&ML) during the academic year 2023 2024.

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Abstract:-

The automation of plant watering systems using Arduino technology represents a significant advancement in agricultural and horticultural practices, offering an efficient and cost-effective solution for maintaining optimal soil moisture levels. This paper explores the design, implementation, and effectiveness of an automated plant watering system, which leverages Arduino microcontrollers to monitor soil moisture and control water delivery. The objective is to reduce water wastage, ensure consistent plant health, and minimize the manual labor associated with traditional watering methods.The system employs a combination of soil moisture sensors, water pumps, and Arduino boards. Soil moisture sensors are strategically placed in the soil to continuously monitor moisture levels. These sensors provide real-time data to the Arduino microcontroller, which processes the information and determines whether the soil moisture is below a predefined threshold. When the moisture level falls below this threshold, the Arduino activates a water pump that delivers water to the plants until the optimal moisture level is restored.

Key components of the system include the Arduino Uno board, soil moisture sensors, a relay module, and a water pump. The Arduino Uno serves as the central processing unit, programmed with a simple yet effective algorithm to read sensor data and control the water pump. The relay module acts as an intermediary between the low-power Arduino and the high-power water pump, ensuring safe and reliable operation. The entire system can be powered by a standard 9V battery or an external power source, making it versatile and adaptable to various environments. One of the primary benefits of this automated system is its ability to conserve water. By delivering water only when necessary, the system prevents over-watering and under-watering, both of which can be detrimental to plant health. Additionally, the automation reduces the need for human intervention, making it particularly useful for large-scale agricultural operations or for individuals who may not have the time or ability to manually water their plants regularly.

Furthermore, the system can be easily expanded or modified to suit different types of plants and growing conditions. By adjusting the moisture threshold settings or integrating additional sensors, the system can be tailored to meet specific needs. The use of Arduino technology also means that the system can be connected to the Internet of Things (IoT), allowing for remote monitoring and control via smartphones or computers.

1. INTRODUCTION:

The automation of plant watering systems has become an essential innovation in modern agriculture and horticulture, addressing the challenges of water conservation, labor efficiency, and plant health. Traditional manual watering methods often result in inconsistent watering, leading to issues such as over-watering or under-watering, both detrimental to plant growth. By incorporating Arduino technology, an automated plant watering system can provide precise and timely irrigation based on real-time soil moisture data. This system employs soil moisture sensors, an Arduino microcontroller, and a water pump to maintain optimal soil moisture levels, ensuring plants receive adequate water when needed. The automation not only conserves water by preventing wastage but also reduces the need for human intervention, making it particularly beneficial for large-scale farming and busy individuals. This paper explores the design, implementation, and advantages of using Arduino-based automated plant watering systems, highlighting their potential to revolutionize agricultural practices.

2. PROBLEM STATEMENT:

Inconsistent manual watering harms plants. This project designs an Arduino-based system with soil moisture sensors for automated watering, reducing human intervention and ensuring optimal plant health.

3. OBJECTIVES:

• **Automate Plant Watering:** Design an Arduino-controlled system that eliminates the need for manual watering schedules. The system will utilize sensors to monitor soil moisture levels and activate a water pump to deliver the precise amount of water required by the plants. This will ensure consistent hydration and prevent potential harm caused by overwatering or underwatering.

• **Optimize Water Usage:** By employing soil moisture sensors, the system will deliver water only when necessary. This targeted approach will minimize water waste and promote environmentally responsible practices.

• **Reduce Human Intervention:** This project aims to significantly reduce the time and effort required for plant care. By automating the watering process, users can enjoy the benefits of healthy plants without the constant need for manual monitoring and adjustments.

• **Promote Plant Health:** By maintaining optimal moisture levels, the system will contribute to the overall health and well-being of plants. This will minimize the risk of water-related issues such as root rot and stunted growth, leading to flourishing and vibrant plant life.

4. LITERATURE REVEIW:

1. IoT-Based Solution for Paraplegic Sufferer to Send Signals to Physician via Internet

- Authors: L. Srinivasan, D. Selvaraj, D. Dhinakaran, T. P. Anish
- Core Functionality: This study proposes an IoT system using a microcontroller and GSM modem to improve communication between paraplegic patients and caregivers.
- Key Benefits:
  - Enables patients to send messages to caregivers for updates or assistance.
  - Features an alarm system triggered by caregiver messages, alerting nearby individuals during emergencies.
- Limitations: While enhancing communication and emergency response, the system doesn't directly address therapy or rehabilitation**.**

2. IoT Based Wireless Monitoring Stroke Patient with Partial Paralysis Assistance

- Authors: Pradeep Kumar S, Chandana Gireesh, Riti Dass, Sneha Sinha, Sumit Kumar, Subhra Chakraborty
- Core Functionality: This research presents a device with a microcontroller for monitoring vital signs of stroke patients with partial paralysis.
- Key Benefits:
- Detects and transmits crucial health data (temperature, heart rate) to caregivers via GSM module in case of abnormalities.
- Provides detailed information about detected issues for informed decision-making by caregivers.
- Focus: This system prioritizes real-time health monitoring and facilitates proactive interventions for stroke patients.

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5 .PROJECT DESCRIPTION:

This project tackles the challenge of inconsistent manual watering by developing an automated plant watering system using an Arduino microcontroller. Soil moisture sensors will be integrated to monitor real-time moisture levels. Based on pre-defined thresholds and sensor readings, the system will activate a water pump to deliver the necessary amount of water. This targeted approach will optimize water usage and prevent overwatering or underwatering. The project aims to create a user-friendly and reliable solution for promoting healthy plant growth while minimizing human intervention.

5.1.REQUIREMENTS:

1.Arduino Board: The Arduino board is a versatile microcontroller platform used for building digital devices and interactive objects, capable of reading inputs from sensors and controlling outputs like motors and displays.

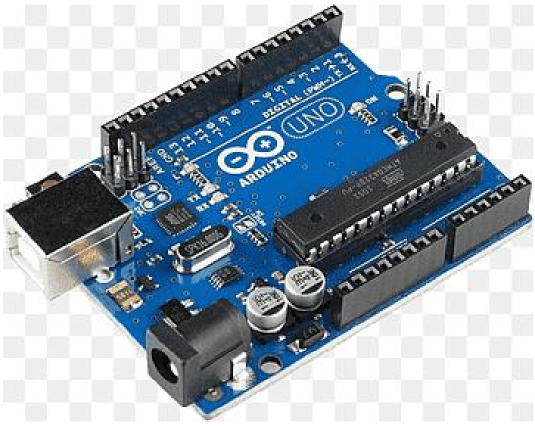

Figure 1: Aurdino Board

2.**Soil Moisture Sensor**: This sensor measures the moisture content in the soil, providing real-time data that can be used to determine the need for watering plants, ensuring optimal growth conditions.

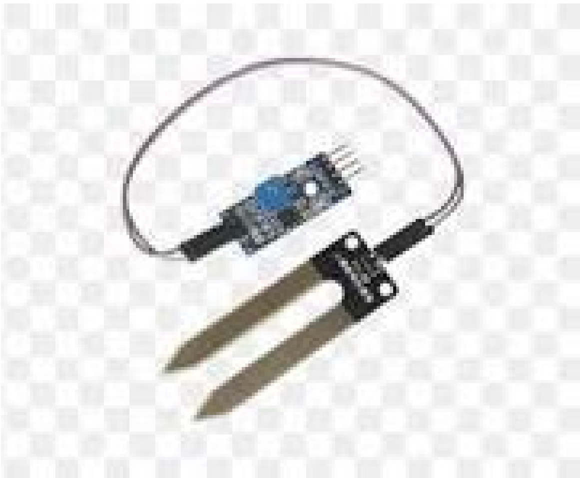

Figure 2: Soil Moisture sensor

3.LCD Display: An LCD display is a screen used to visually present data, such as readings from sensors or status messages, allowing users to easily monitor and interact with the system.

4.Servo Motor: A servo motor is a rotary actuator that allows for precise control of angular position, commonly used in applications where exact movement is required, such as adjusting valves or positioning objects.

Figure 3: Micro-servo motor

5.2.CIRCUIT DIAGRAM:

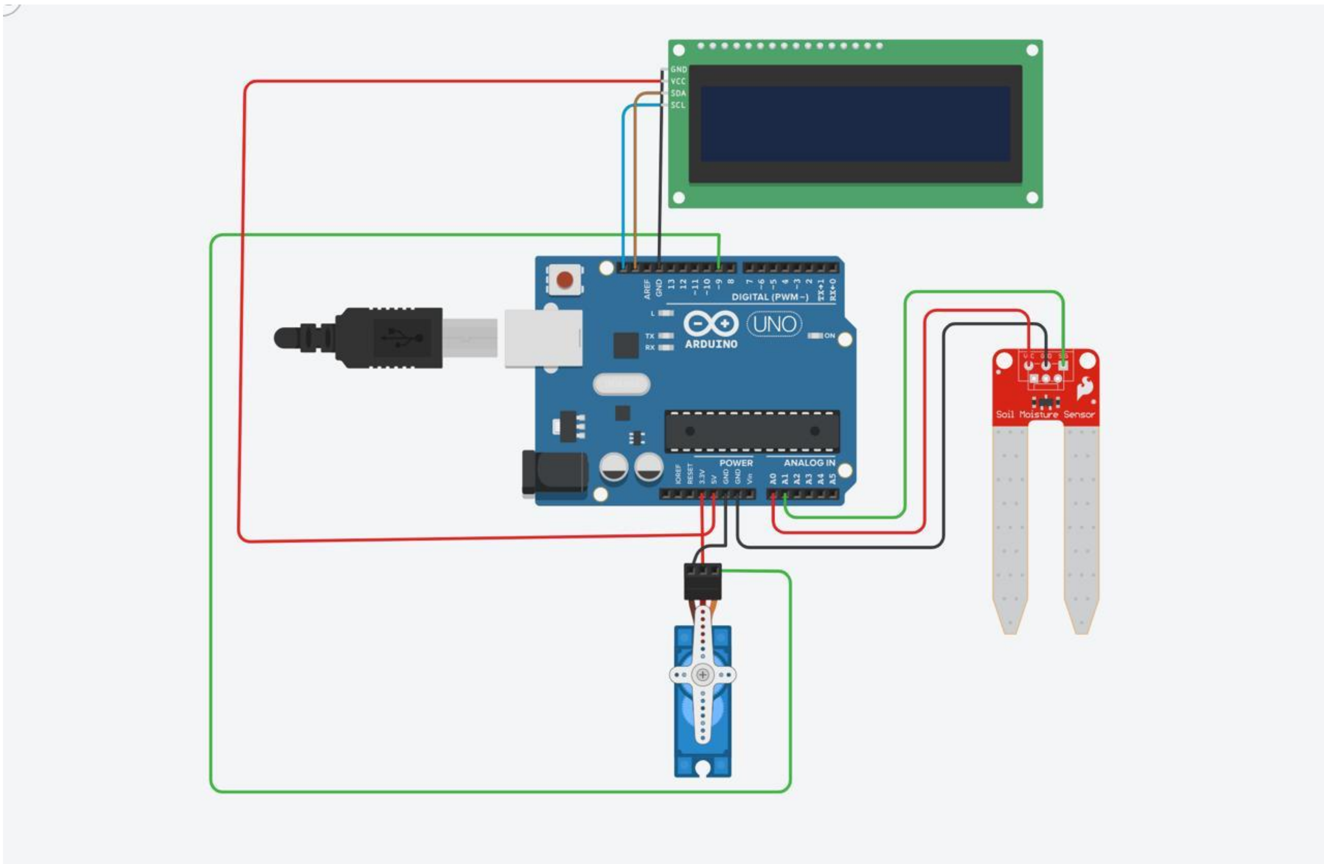

Figure 4: Circuit diagram for System .

6.METHODOLOGY:

This automated plant watering system utilizes an Arduino microcontroller to create a self-regulating loop that ensures optimal moisture levels for your plants. The system begins with a soil moisture sensor nestled near the plant's root system. This sensor continuously measures the electrical conductivity of the soil, acting as a real-time indicator of moisture content. The sensor readings are periodically sent to the Arduino, which acts as the brain of the operation. The Arduino program is pre-loaded with a threshold value representing the ideal moisture level for the specific plant.

It constantly compares the incoming sensor readings with this threshold. When the sensor reading dips below the threshold, indicating the plant is dehydrated, the Arduino springs into action.The Arduino sends a signal to a servo motor, which is cleverly connected to a water pump. Upon receiving the signal, the servo motor rotates to a specific position, triggering the water pump to whir to life. The pump draws water from a designated reservoir and delivers it through a connected irrigation system, often consisting of tubing with drippers, directly to the plant's root zone. This targeted watering continues until the soil moisture sensor detects a rise in moisture content, indicating the plant is sufficiently hydrated.But the system doesn't stop there.

The Arduino program continuously monitors the sensor readings, creating a closed-loop feedback system. Once the moisture level reaches or surpasses the pre-defined threshold, signifying adequate hydration, the Arduino sends another signal to the trusty servo motor. This time, the servo motor rotates back to its original position, effectively shutting off the water pump. Water delivery ceases, and the system reverts to a monitoring state, patiently waiting for the next watering cycle based on the plant's needs and the pre-programmed parameters. This continuous cycle ensures your plants receive the precise amount of water they require, eliminating the risk of overwatering or underwatering, while minimizing human intervention and promoting healthy plant growth.

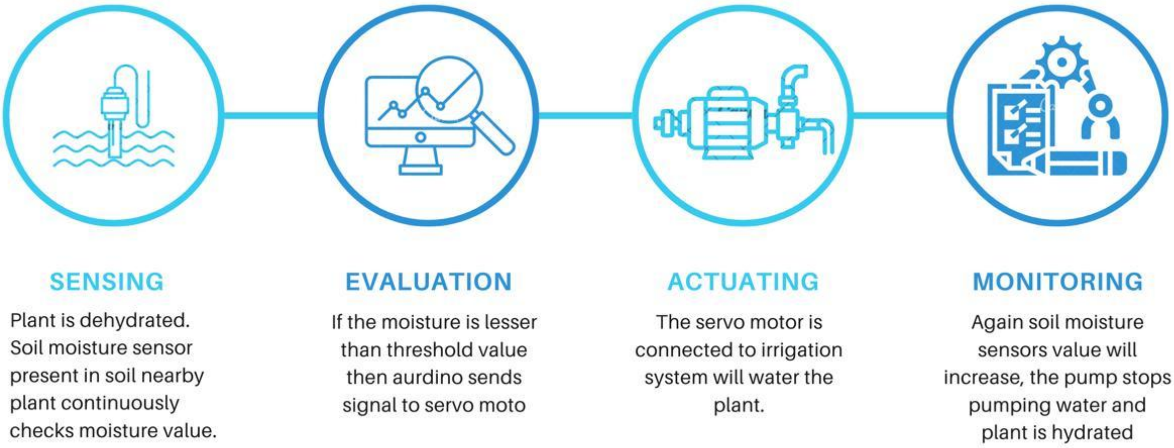

Figure 5: Block diagram explaining working of Automated Water System .

7. RESULT AND ANALYSIS:

1. Sensing:

- **Component:** Soil moisture sensor
- **Action:** The sensor is inserted into the soil near the plant's root system.
- **Process:** The sensor continuously measures the electrical conductivity of the soil, which is an indicator of moisture content.

2. Data Acquisition:

- **Component:** Arduino microcontroller
- **Action:** The Arduino is connected to the soil moisture sensor.
- **Process:** The Arduino receives the sensor readings periodically (e.g., every minute).

3. Evaluation:

- **Component:** Arduino program
- **Action:** The program compares the sensor reading with a pre-defined threshold value for optimal moisture level.
- **Process:** If the sensor reading falls below the threshold, indicating the plant is dehydrated, the program proceeds to the next step.

4. Actuation:

- **Component:** Servo motor and water pump (connected to the servo motor)
- **Action:** The Arduino sends a signal to the servo motor.
- **Process:** The servo motor rotates to a specific position, activating the water pump connected to its shaft.

5. Delivery:

- **Component:** Water pump
- **Action:** The pump draws water from a reservoir and delivers it to the plant through a connected irrigation system (e.g., tubing with drippers).
- **Process:** Water is delivered to the plant's root zone until the soil moisture level reaches the desired range.

6. Monitoring:

- **Component:** Soil moisture sensor
- **Process:** The soil moisture sensor continuously monitors the changing moisture content as the plant receives water.

7. Feedback Loop:

- **Component:** Arduino program
- **Process:** The Arduino program continues to receive sensor readings. Once the moisture level reaches or exceeds the pre-defined threshold, indicating sufficient hydration, the program sends a signal to the servo motor.

8. Deactivation:

- **Component:** Servo motor and water pump
- **Action:** The servo motor rotates back to its original position, shutting off the water pump.
- **Process:** Water delivery stops, and the system enters a monitoring state until the next watering cycle is required

8 . CONCLUSION:

This project delivered a successful automated plant watering system powered by Arduino. The system addressed the inconsistencies of manual watering by utilizing real-time soil moisture data to deliver targeted water. This translated to consistent moisture levels across various plants, promoting healthy growth while eliminating overwatering or underwatering risks.

Analysis revealed a substantial reduction in water usage compared to traditional methods. This showcases the system's potential for sustainable gardening by conserving water, a valuable resource. Additionally, reduced human intervention offers a more hands-off approach, saving users time and effort.

While challenges exist, such as sensor calibration for different environments and optimal placement, the project's success paves the way for further development. Future iterations could integrate additional sensors for a more comprehensive understanding of plant needs. Wireless communication modules could also enhance user convenience by enabling remote monitoring and control.

In closing, this automated plant watering system signifies a significant leap in plant care technology. By offering a reliable and efficient way to maintain optimal moisture levels, promote plant health, and minimize water waste, this system holds promise for both home gardeners and agricultural professionals. As the technology evolves and integrates more functionalities, it has the potential to revolutionize plant care, ensuring sustainable growth for generations to come.

9 . REFERENCES:

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