https://doi.org/10.46335/IJIES.2024.9.2.16 **e-ISSN: 2456-3463**
Vol. 9, No. 2, 24 PP. 78 -81

International Journal of Innovations in Engineering and Science, www.ijies.net

Smart Irrigation System

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***Received on**: 16 April, 2024* ***Revised on**: 13 May, 2024* ***Published on**: 15 May 2024*

Abstract *– Over the past decade, significant advancements have not only enhanced and matured technology but have also paved the way for numerous new applications in agriculture and related fields. Presently, a wide range of sensors finds application in various contexts, including moisture sensors, ultrasonic sensors, etc [1] [2]. In this research, we have developed a smart irrigation system. Our prototype incorporates a soil moisture sensor capable of detecting soil moisture levels [3]. It effectively communicates with a watering system or water pump, enabling automatic activation or deactivation as per the soil's moisture condition [4]. Additionally, the system's status is conveniently displayed on an LCD screen. The microcontroller at the heart of this irrigation system is the Arduino Uno board [5].*

Keywords- Soil Moisture System, Soil Moisture Sensor, Arduino UNO, LCD, Smart Irrigation

INTRODUCTION

In this innovative Smart Irrigation System, a Soil Moisture Sensor diligently assesses soil moisture levels. When the sensor detects low moisture levels, the Arduino, serving as the microcontroller, activates a water pump to supply the necessary water to the plants [6]. This system operates autonomously, turning off the water pump as soon as it detects sufficient soil moisture. Real-time status updates for the water pump and soil moisture are displayed on an integrated LCD screen, ensuring users are well-informed [7] [8].

This system proves invaluable in various settings, including farms, gardens, and homes, offering automated, efficient plant care without the need for constant human intervention. By intelligently managing water resources, this Smart Irrigation System represents a significant advancement in modern agricultural and horticultural practices, promoting both sustainability and convenience [9].

II -LITERATURE REVIEW

This research aims to carry out a systematic review about the smart irrigation systems we have developed.

Components Used in the Research Project

2.1 Arduino UNO R3

Arduino UNO is a microcontroller board based on the **ATmega328P**. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains

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everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

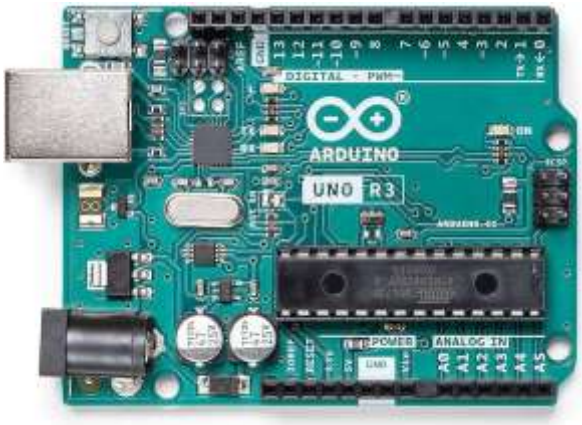

Figure 1: Arduino UNO R3

2.2 16x2 LCD Display

The abbreviation LCD stands for "Liquid Crystal Display," a type of electronic display module widely employed across a diverse spectrum of applications, including electronic circuits and devices such as mobile phones, calculators, computers, and television sets.

Figure 2: LCD Display

2.3 . Soil Moisture Module

The soil moisture sensor is used to measure the moisture content present in the soil. It consists of 4 pins. Vcc and Gnd pins, responsible for connecting to the power supply, while the other two pins serve as digital and analog output interfaces. Specifically, the digital pin produces a low output signal when the soil's moisture content surpasses a predetermined threshold level.

Figure 3: Soil Moisture Module

2.4 Relay Module

Relays modules are essentially circuit boards that host one or more relays. These modules are available in various sizes and shapes, with rectangular configurations being the most common. They typically accommodate 2, 4, 8, or sometimes even up to 16 relays on a single board.

Figure 4: Relay Module

2.5 USB Cable

USB bus has a voltage range of 4.75 to 5.25 volts. The official Uno boards have a USB-B connector, but 3rd party Uno boards may have a miniUSB or microUSB connector. This cable is used to interface any of the Arduino board with your computer, you can also connect your USB printer, scanner, and more to your computer. These cables Transmits data at high speeds with the error-free, high-performance transmission.

Figure 5: USB Cable

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III -METHODOLOGY

The smart irrigation system can be explained with the help of a block as shown in Figure 7 and the circuit diagram mentioned in Figure 6. Smart irrigation systems employ soil moisture sensors to estimate and monitor the current moisture levels of plants. Based on these measurements, the water system or pump is automatically engaged or disengaged to meet the specific water requirements. This seamless operation is made possible through the utilization of an Arduino UNO as a microcontroller, complemented by a relay module that functions as a switch. When the system detects low soil moisture levels, it triggers the watering system, and when moisture levels stabilize, the system deactivates itself automatically.

This innovative prototype serves as a valuable tool for managing irrigation systems, ensuring that water is supplied when necessary while concurrently reducing excess water consumption. Precisely controlling the volume of irrigation water applied, the frequency of irrigation cycles, and overall water utilization efficiency are pivotal factors in optimizing plant health and conserving this vital resource.

IV-DESIGN

Schematic Diagram

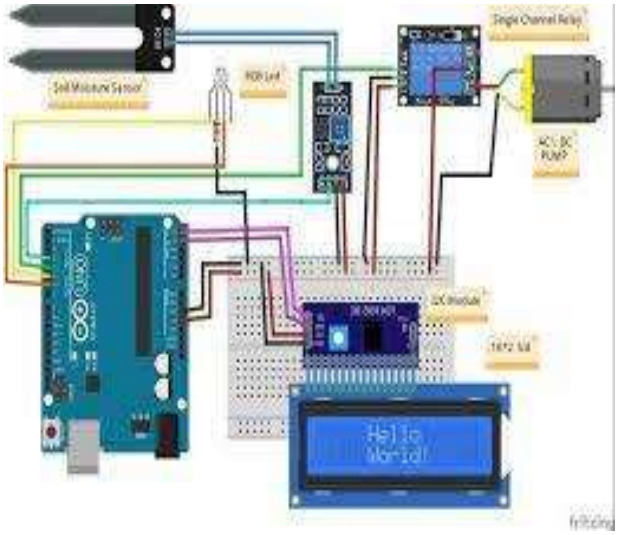

Figure 6: Smart Irrigation System

Block Diagram

The block diagram visually presents the step-by-step functioning of the smart irrigation system.

It commences by detecting the soil moisture level, subsequently triggering the activation or deactivation of the watering system or pump through a microprocessor.

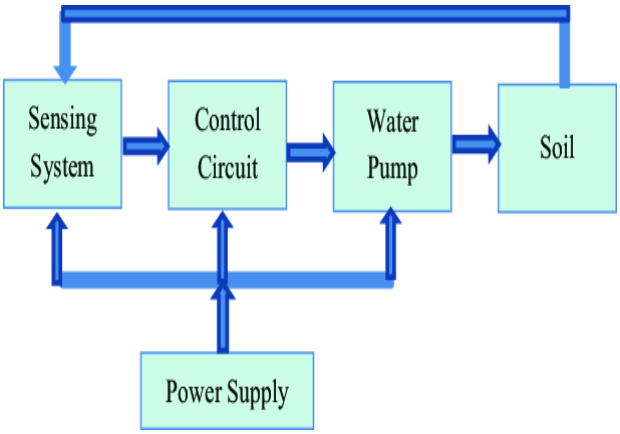

Figure 7: Smart Irrigation System Block Diagram

Implementation

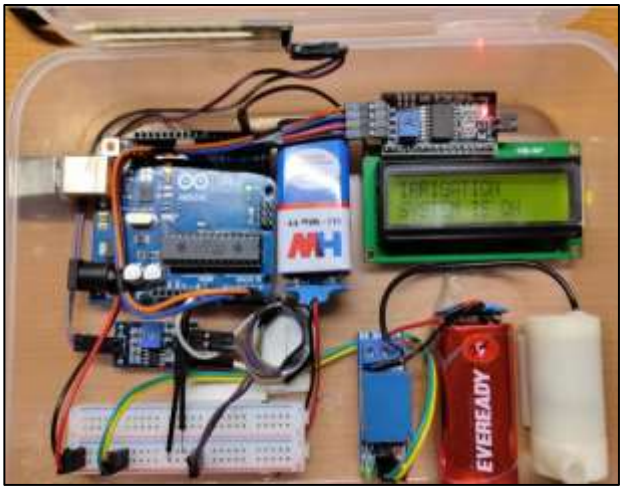

Figure 8: Implementation of Smart Irrigation System

V -CONCLUSION

As the availability of water diminishes and concerns about water quality increase, there is a growing imperative to enhance irrigation efficiency, thereby minimizing both water consumption and the leaching of chemicals.

The proposed system proves highly effective in addressing these challenges within the agricultural sector, representing a significant advancement. By substantially reducing the reliance on manual labor for

field irrigation, it not only conserves water but also optimizes time management, offering a dual benefit to agriculture.

The future scope for smart irrigation systems involves integrating technologies like Raspberry Pi for advanced data processing, IoT connectivity, and AI-driven optimization. This enhances water conservation, remote monitoring, energy efficiency, and user-friendly interfaces, making them adaptable to various scales of agriculture and landscaping.

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