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Automated Irrigation System Using Arduino and Moistures Sensor for Water Conservation

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ABSTRACT: Water scarcity is a critical global issue that necessitates innovative solutions for efficient water management, particularly in agriculture. This research project aims to develop an automated irrigation system using Arduino microcontrollers and moisture sensors to conserve water in agricultural practices. The proposed system utilizes moisture sensors to monitor soil moisture levels in real-time, enabling precise irrigation control based on plant water requirements. By automating the irrigation process, water usage can be optimized; minimizing wastage and ensuring that plants receive adequate moisture for optimal growth. The project involves the design and implementation of a hardware setup consisting of Arduino microcontrollers, moisture sensors, and water valves. The moisture sensors are deployed in the soil, continuously measuring soil moisture levels. The Arduino microcontroller receives these moisture readings and processes the data to determine whether irrigation is required. If the moisture levels fall below a predetermined threshold, the microcontroller triggers the water valves to open, initiating irrigation. Once the soil moisture reaches the desired level, the valves are closed, terminating the irrigation process. To ensure the system's reliability and efficiency, an appropriate control algorithm is developed to regulate irrigation based on the specific crop's water requirements. The algorithm considers factors such as crop type, climate conditions, and soil characteristics. This adaptive approach ensures that the system responds accurately to varying environmental conditions, optimizing water usage and conserving this valuable resource. this research project aims to develop an automated irrigation system utilizing Arduino microcontrollers and moisture sensors to conserve water in agriculture. By providing precise irrigation control based on real-time soil moisture data, the system aims to optimize water usage, minimize wastage, and promote sustainable water conservation practices in agricultural settings. The outcomes of this research have the potential to contribute to the development of efficient irrigation systems, benefiting both farmers and the environment by ensuring sustainable agricultural practices.

KEYWORDS: Irrigation, Moisture Sensor, Microcontroller, Algorithm, Conservation, Sustainable Agricultural.

I. INTRODUCTION

Water shortage is currently one of the biggest issues facing the globe, and agriculture, being a labor-intensive industry, uses a lot of water and increasing population of the world is also reason of water scarcity.

One major reason of which is unnecessary wastage of water in agriculture field due to unawareness of farmers about sufficient supply of water, there are many plants that are very sensitive to water levels and they required specific level of water supply for proper growth, if this not they may die or results in improper growth. It's hardly possible that every farmer must possess the perfect knowledge about growing specifications of plants in case of water supply[1] As we know that the agriculture dominated nation, 1/3 part is rely upon farming so it is mandatory to implement technologies in agriculture sector. In this digital era every possible thing around us to be automatic which reduces human efforts. There are increasing electronic circuits that make today's life easier and simple. To overcome these problems and to reduce the man power smart irrigation system has been used [2]. Therefor in this project we have make a system by using Arduino-Uno and moisture sensor in order to minimize wastage of water.

Author proposed on "Automated Irrigation System" in which using they have use sensors in project to make aware about changing conditions of humidity level according to weather so according to changing conditions of humidity they had able to schedule the proper timing for water supply [1]. Writer explain about various sensors such as pH, soil moisture, DHT11, PIR (intruder detecting system) and pressure sensors are connected to the input pins of Arduino microcontroller. If the sensed value goes beyond the threshold values set in the program, the pump will be automatically switched ON/OFF by the relay circuit and it is connected to the driver circuit which helps to switch the voltage [2]. The humidity and soil moisture

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sensors are positioned in the plant's root zone. The microcontroller is utilized to manage the water supply to the field based on the measured data [3]. Author proposed an IOT based automatic irrigation system using wireless sensor networks in which various sensors are used to measure the soil parameters. This system provides a web interface to the user to monitor and control the system remotely. Weather monitoring is not done in this system [4]. Proposed prototype monitors the amount of soil moisture and temperature. A predefined range of soil moisture and temperature is set, and can be varied with soil type or crop type. In case the moisture or temperature of the soil deviates from the specified range, the watering system is turned on/off. In case of dry soil and high soil temperature, it will activate the irrigation system, pumping water for watering the plants.[5].

II. PRAPOSED SYSTEM

Components

- Relay (5v)
- Arduino Uno
- Moisture sensor
- DC MOTOR (5V)
- 16x2 LCD display
- wooden Board
- Jumper Wires
- Water Tank
- AC/DC Adopter
- PVC Pipe

Software

- Arduino IDE
- Arduino Libraries:
- It is Arduino library provided pre-written code and functions that simplify the process of reading data from the sensor.
- C/C++ (Programming language)

Block Diagram

The basic block diagram of the automatic light controller using microcontroller and bidirectional visiting counter is shown in the figure below.

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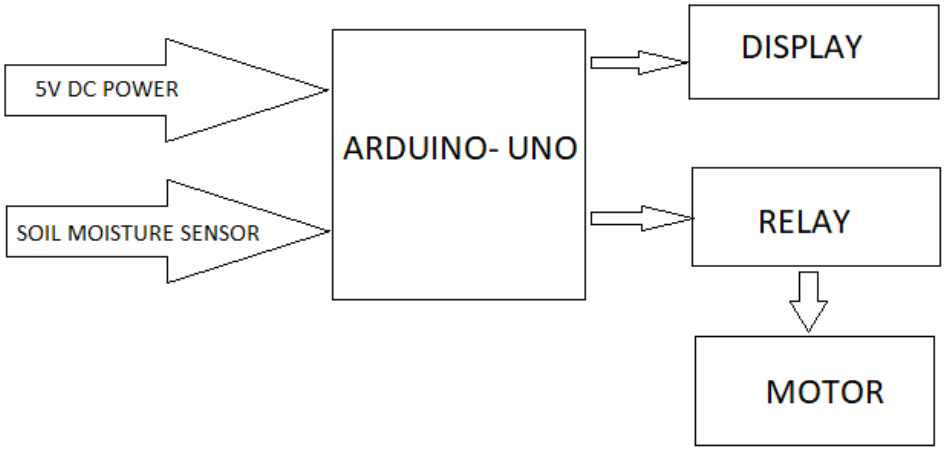

Fig. 1 (Block diagram)

Arduino Uno

Arduino is an open scores electronic platform based on AT mega microcontroller, Arduino software can work on Windows, Macintosh and Linux operating systems which is based on C programming language and can be expanded through C++ libraries[6]. 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 everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

Fig. 2 (Arduino uno)

Moisture Sensor

Moisture sensor is one of analog sensors. It is an easy-to-use sensor, and it works on two copper rods that increase the contact between them by increasing the water in the soil. It is suitable for monitoring soil humidity in plants and controlling the amount of water for irrigation [6]. In this system this sensor connected to Arduino and inserted in the soil to send the signal to Arduino when soil wet or dry to ON/OFF water pump.

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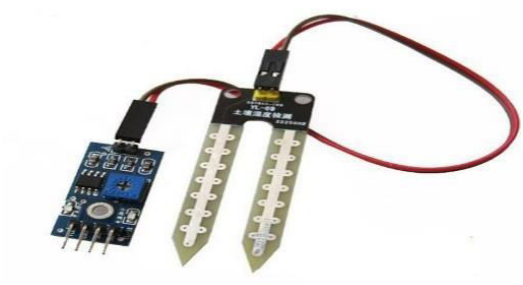

Fig.3 (Moisture Sensor)

Relay Module

Relay Module is an electrically operated switch of mains voltage, it can be turned on or off, letting the current go through or not, the relay depended relay module is shown in fig. 4. In the proposed system, relays used between the Arduino board and the water pump, which operate by supplying 5V DC and work as a switch for 220V AC by getting a trigger from an Arduino board [6].The Arduino board's I/O pins can control the relay, which in turn can operate the water pump.

Fig. 4 (Relay module)

Water Pump

Low voltage water pumps for Arduino watering projects. Using the same 5V voltage that powers the Arduino will simplify dramatically the electric design of your automatic watering system, 5V DC water pump is a miniature water pump use 5V DC power supply, in this system it is uesd to supplies water through pipes by mechanical action, used to supply the soil with water. It is connect to Arduion through the relay module. This device operation based on moisture level in soil and gives result as STOP/START irrigation.

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Fig. 5 (5V DC PUMP)

LCD 16*2

LCD stands for liquid crystal display it mostly used in different electronic projects and devices to display different values. LCD uses liquid crystals for the production of visible image. 16 x 2 liquid crystal display is a basic LCD module used in DIy electronic projects and circuits. In this LCD module, there are two rows every row consists of sixteen numbers. With the two rows in this module, there are sixteen columns, in system used to show status of condition in plant.

Fig. 6 (LCD 16*2)

Jumper Wire

A jump wire is an electrical wire, or group of different or similar color in a cable, with a connector or pin at each end, which is normally used to interconnect the components of a breadboard, here it is used to complete wiring of proposed system.

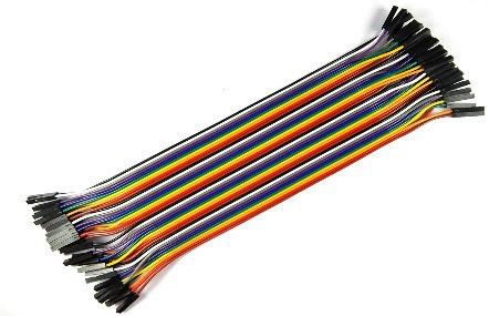

Fig. 7 (Jumper Wire)

AC/DC Adapter

An AC adapter or AC/DC adapter is a type of external power supply, AC adapters are used with electrical devices that require power but do not contain internal components to derive the required voltage and power from mains power. In this system it is used to gives 5V of supply to adruino and also for further connected interfaces.

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III. WORKING OF MODEL

Moisture sensor measures soil moisture content in root zone.
Arduino reads moisture sensor output to measure soil moisture. Threshold Comparison, Arduino compares sensor reading to moisture threshold value to indicate irrigation is needed, Arduino decides whether to activate irrigation system based on moisture level.

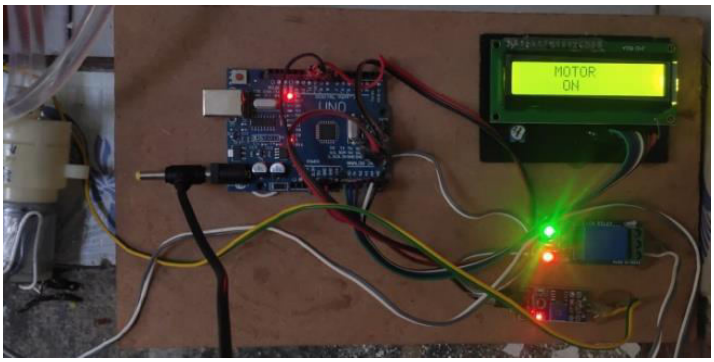

Fig. 8 (Proposed Prototype)

Fig. 9 (Circuit diagram)

The Arduino sends signals to control the irrigation system to ensure water is delivered to the plants. The Arduino monitors the irrigation process and stops it when the duration is complete. Arduino delays irrigation cycle to prevent overwatering. Arduino repeats process to maintain desired moisture level in soil. The Arduino can be connected to additional components to provide visual feedback about the system's operation, sensor readings, or irrigation status, which can be useful for monitoring and troubleshooting.

IV. CONCLUSION

This system offers several advantages over manual irrigation methods, including the main benefit or goal of this project being achieved by water conservation, improved plant health, time and effort savings, precision and accuracy, scalability and flexibility, and cost effectiveness. This system is a highly effective and efficient solution for managing and optimizing. It is a useful tool for encouraging sustainable and responsible water use in modern farming and gardening practices.

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V. FUTURE SCOPE

The paper highlights the potential benefits, challenges, and areas of improvement for automated irrigation systems. Furthermore, it discusses emerging trends such as the integration of advanced technologies like Internet of Things (IoT), artificial intelligence (AI), and machine learning (ML) to enhance the functionality and performance of these systems. The research paper concludes by outlining the potential impacts and opportunities that automated irrigation systems offer for sustainable agriculture and water management.

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