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Automated Solar Irrigation System by Using Many Different Plants

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Abstract - *In the field of agriculture, proper irrigation is critical, and it is well recognized that drip irrigation is both cost-effective and productive. In a traditional drip irrigation method, the farmer must keep track of the irrigation schedule, which varies depending on the crop. The irrigation will be automated as a result of the project. The use of low-cost sensors and simple circuitry makes this project a low-cost product that even a poor farmer can afford. This project is ideally adapted for locations where water is scarce and must be used sparingly. This project will make use of the ATMEGA328U controller. The microcontroller is attached to a 16×2 LCD display that shows the water level and moisture level. Individually set solenoid valves regulate the water flow to the area, and four pushbuttons are given to set the limits of water flow. The moisture and water levels are displays the LCD and Blynk mobile application by using of IoT module. The IoT module sends the data to mobile application. Four relays are provided for controlling three solenoid valves, which controls the flow of water to three different parts of the field.*

Key Words: *Automation, Arduino, Relay, Solenoid Valve, IoT Module, Moisture Sensor, Float Sensor.*

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I. Introduction

Agriculture is critical to our country's growth. The economy is often hampered by agricultural issues [1]. India's population has surpassed 1.3 billion people and continues to grow. Food scarcity and water use will become major issues if current trends continue. In addition, the farmers are now using an antiquated paddy irrigation system that is proven to be inefficient [2]. Until now, most farmers have relied on traditional farming irrigation methods. They use a concept known as flood irrigation, in which water is left standing during the growing season, particularly for paddy. Nearly half of the water percolates into the soil, another twenty percent evaporates, and the remaining thirty percent is needed by the crop. The primary focus of this paper is on the issues of over-irrigation, under-irrigation, and manual labour. It also saves time, money, and electricity for the farmer. Most of the challenges in agriculture have been solved using electronics and computing knowledge in recent years. [3-4]. The microcontroller was at the top position of the electronic revolution.

The microcontroller, in conjunction with various sensors, is used to measure and track physical quantities such as temperature, humidity, heat, and light. This paper proposes a solar-powered IoT-based paddy irrigation system, which is a clever way of performing labor-intensive tasks and even water management systems. The main goal is to discourage conventional watering methods in favour of genuine water use methods that improve the irrigation system. Using abundantly available solar energy as a source of energy for the proposed concept also leads to the process's continuous operation.

In the last decade, researchers have proposed various automatic irrigation systems based on GSM and SPRS [5]. The proposed systems have many significant flaws, including an automatic drip system that is prone to clogging, high costs, and human error in setting control values.

II. Literature Review

Because of the signal lag, the GSM module sends the command sms. As a result, the IOT module has been replaced. IoT stands for "internet of things," which means "internet of things." “The Internet of Things (IoT) includes many new intelligent concepts that will be used in the near future, such as smart homes, smart cities, smart transportation, and smart farming.” To improve efficiency and excellence, the technique can be used to apply precise amounts of fertilizer, water, pesticide, and other chemicals. Sensors are a promising technology for smart agriculture. The crop lifecycle is influenced by real-time environmental parameters such as soil moisture level, temperature, and tank water level. A successful monitoring of water regulation in agriculture can be accomplished by forming a sensor network [6-7].

The AT89952 microcontroller replaces the Arduino Uno (ATmega328P) advanced functionality. The device uses Arduino technology to monitor the green house's watering and roofing. It makes decisions based on statistical data collected from sensors (such as temperature, humidity, and moisture sensors) and the weather forecast [8-9].

Temperature, moisture sensors, and fuzzy inference are used to input data from sensors in the Agriculture System. On the LCD and through the Android app, the system monitors the sensor data. Every second, the sensor data is displayed on the LCD and in the Android application [10].

We also have moisture and temperature sensors in this irrigation system. Then, using IoT and an Android application, we added a float sensor to show the water level in the sump. To keep the motor from running dry when the water level is low [11].

Already the systems consist of single plant irrigation or manually operated to control the flow of water to the irrigation plants. Now we improve the method to control the water for three more plant. We avoid the manual flow control system. Then we using fully automatic flow control system using different plants at different timings with the help of Solenoid valve. The solenoid valve can be controlled by the timer relay circuit board with the help of real time clock (RTC). Then we can easily reset the timer relay circuit time for solenoid valve. The time setting is the value how time is open and how time is closed is manually resettable [12-26].

Solar energy is used to power the irrigation system. What form of solar collector is most efficient in capturing the most solar energy, and what is the safest region. There studied the article in all type of solar collect. Finally choose the photovoltaic cell type solar collector [27].

III. System Architecture

The overall system architecture of the scheme is presented in automated irrigation system architecture, where sensors such as soil moisture sensor and float sensor are integrated in the agriculture sector, and the sensed data from sensors is processed by a signal conditioning circuit and compared to pre-determined threshold values of various soil and specific crops. The data from the sensors in the agriculture field is fed into the Arduino processor, which is connected to the user's Android smart phone IoT module. Moisture sensor tests the moisture level in this automatic irrigation device, and if the moisture level is found to be low, Arduino sends a command to the mobile application and LCD monitor. The Blynk mobile application is used to turn on and off the water pump. Refer in Fig-1.

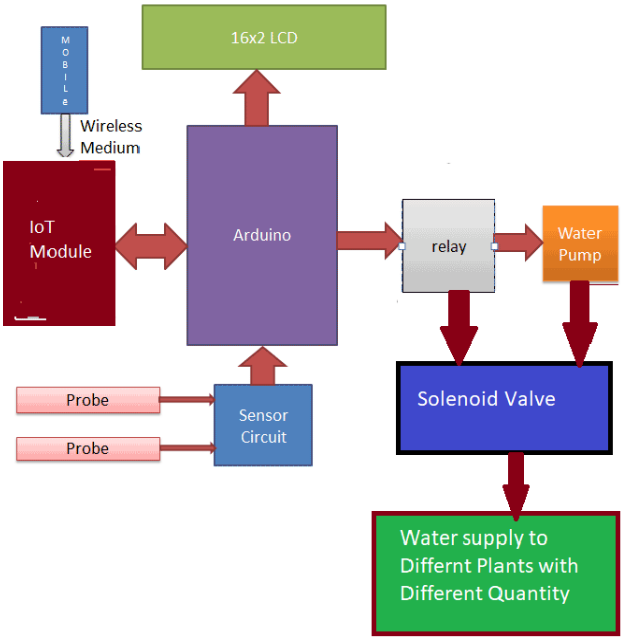

Fig-1: Architecture of automated irrigation system

IV. Component

The components of automated solar irrigation system are as follows

1. Solar panel
2. 12v Dc battery
3. 12v Dc motor pump
4. Drip line pipes
5. Arduino with LCD

6. Relay coil
7. Solenoid valve
8. Micro controller
9. IoT module
10. Moisture and float sensors
11. Model plant layout

V. Hardware Requirement

Arduino Uno controller with LCD

The Arduino Uno is an open-source microcontroller board designed by Arduino.cc and based on the Microchip ATmega328U microcontroller. The board has a number of digital and analogue input/output (I/O) pins that can be used to connect to different expansion boards (shields) and other circuits. The board has 14 digital I/O pins (six of which are capable of PWM output), 6 analogues I/O pins, and is programmable via a type B USB cable using the Arduino IDE (Integrated Development Environment). It can be powered by a USB cable or an external 9-volt battery, with voltages ranging from 7 to 20 volts. It's identical to the Arduino Nano and Leonardo microcontrollers. On the Arduino website, the hardware reference model is available even under Copyright Law Attribution Share-Alike 2.5 licence. Some versions of the hardware have layout and production files available as well.

In embedded device applications, LCDs (Liquid Crystal Displays) are used to monitor various system parameters and status. The LCD 16x2 is a 16-pin unit that has two rows of 16 characters each. The LCD 16x2 will work in either 4-bit or 8-bit mode.Refer in Fig-2.

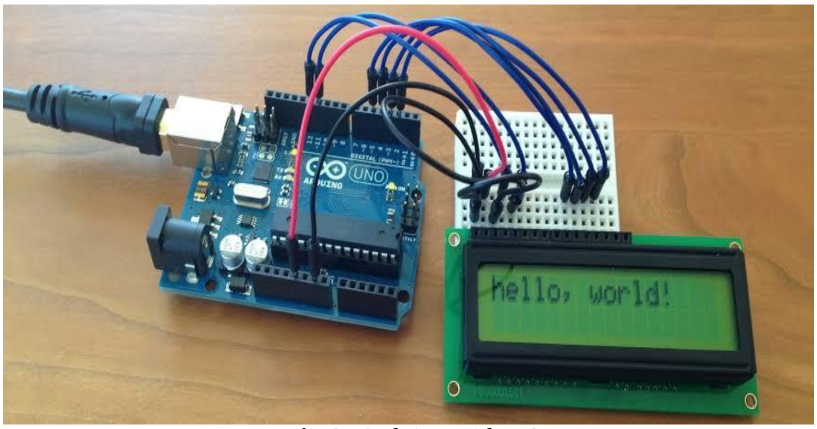

Fig-2: Arduino with LCD

Real time clock

A real-time clock is an electronic timepiece that displays the current time. While RTCs are most commonly associated with personal computers, servers, and embedded systems, they can be found in almost any electronic device that requires accurate timekeeping. Refer in Fig-3.

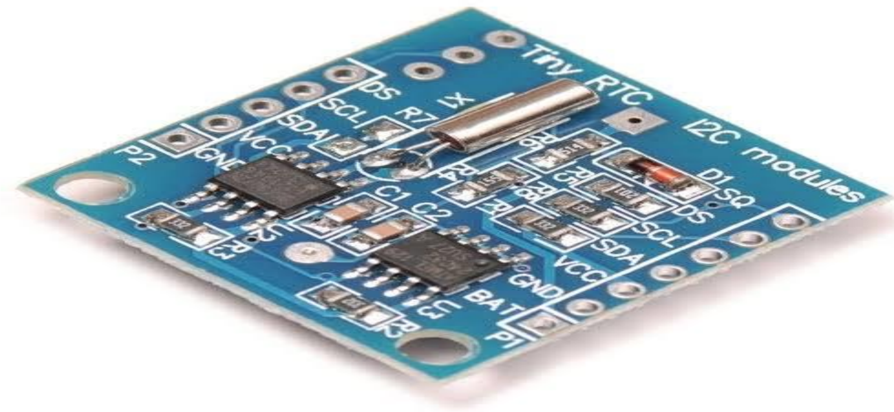

Fig-3: Real time clock

IoT module

An IoT module is a small electronic system that sends and receives data and is embedded in objects, computers, and items that are linked to wireless networks. Refer in Fig-4.

Fig-4: IoT module

Moisture sensor

The moisture of the soil is detected using this soil moisture sensor module. It outputs the moisture level after measuring the volumetric content of water within the soil. There are digital and analogue outputs on the module, as well as a potentiometer for adjusting the threshold level. Refer in Fig-5.

Fig-5: Moisture sensor

Float sensor

A float switch is a type of level sensor that measures the amount of liquid in a tank. The switch may be used to power a pump, as well as an indicator, an alarm, and other devices. A mercury switch is used within a hinged float in one form of float switch. Refer in Fig-6.

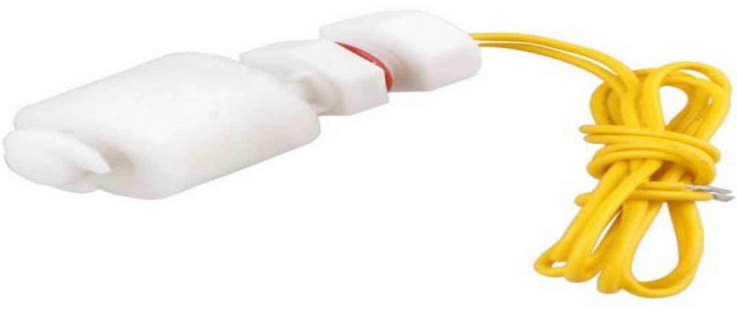

Fig-6: Float sensor

Solenoid valve

A solenoid valve is a valve that is regulated by electricity. The characteristics of the electric current they use, the strength of the magnetic field they produce, the mechanism they use to regulate the fluid, and the form and characteristics of fluid they control all vary between solenoid valves. Refer in Fig-7.

Fig-7: Solenoid valve

Relay module

An electromagnet operates a power relay module, which is an electrical switch. A separate low-power signal from a microcontroller activates the electromagnet. The electromagnet pulls to open or close an electrical circuit when triggered. Refer in Fig-8.

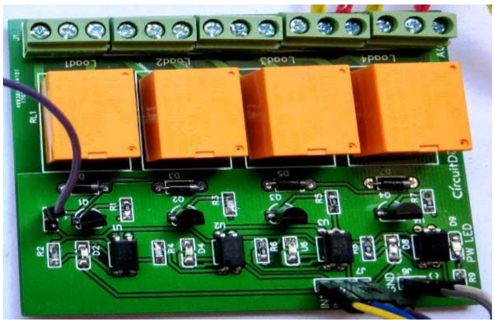

Fig-8: Relay module

VI. Result

Project Diagram

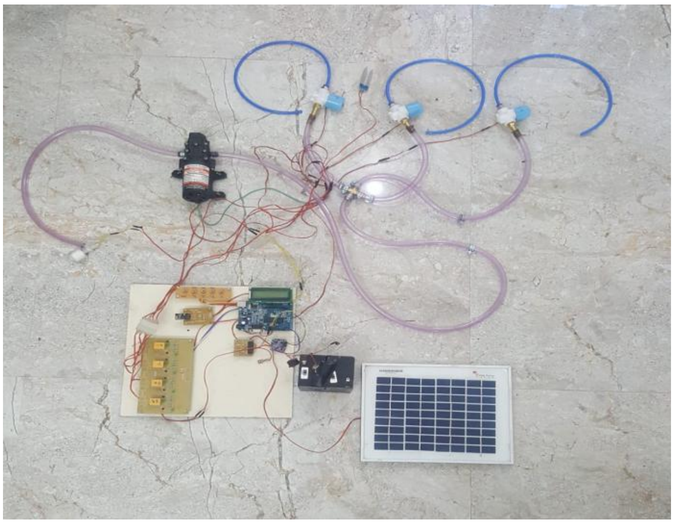

Fig-9: Project diagram

The Moisture sensor and float sensor are measure the soil moisture and water level then send to the command to Arduino LCD display and mobile application. Refer in Fig-11. The user makes decision to motor turn ON/OFF. The solenoid valve are automatically opening and closing by using relay coil. The relay coil time ,solenoid valve how time will be open and how time will be close set in the bush button keyboard.

3D Model diagram

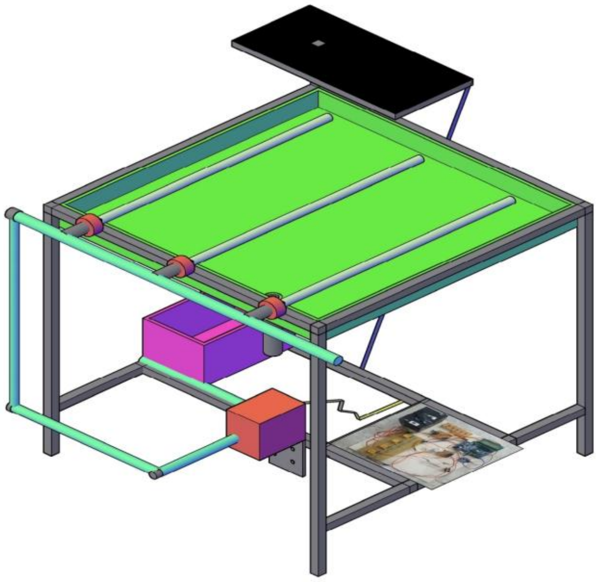

Fig-10: 3D Model diagram

Mobile application outcome

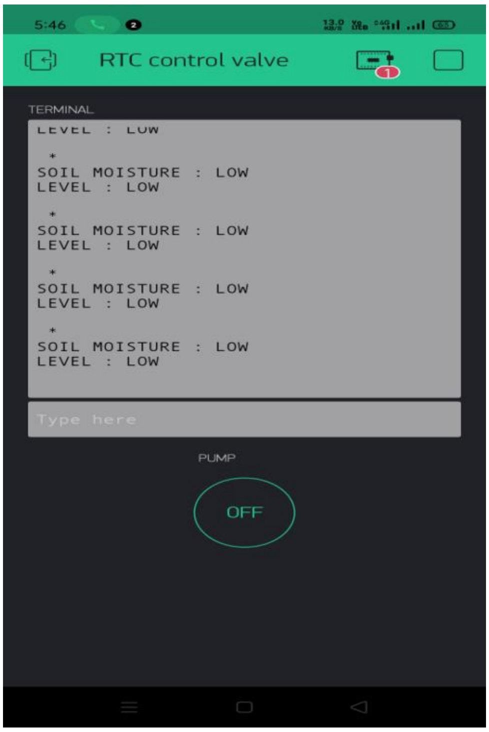

Fig-11: Mobile display

VII. Conclusion

This paper discussed irrigation system issues and suggested an innovative way for farmers to solve their problems. One of the most serious issues that paddy cultivators face is over- and under-irrigation. The proposed system emphasizes the use of drip irrigation, which, according to the above discussion, has been shown to increase yield by up to 50%, save up to 70% of water, and save energy because the system is solar powered. It has also been demonstrated that using drip irrigation in conjunction with sensors and IoT can increase yields even further, especially in the case of subsurface drip irrigation, which necessitates the use of a monitoring system. As the size of the field grows larger, the proposed system proves to be successful, as irrigating and controlling large fields takes a lot of time and energy. This device will assist farmers in saving time, money, energy, and water.

VIII. Future Scope

In future, we will run the motor also automated ON and OFF based on the condition. We have altered to the Arduino board program. The program is analysis the moisture, temperature, water level, and humidity and weather conditions. Then micro controller makes decision automatically.

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