ARDUINO-BASED AUTOMATED IRRIGATION SYSTEM

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Abstract: In India, the vast majority of the population lives in villages and relies on agricultural farming for a living. These days, designing or farm watering exercises are the most common social activity and the most time-consuming mission. Whatever the weather conditions are, whether hot, dry, shady, or wet, you must be able to regulate the amount of water that reaches your plants. Watering systems that are currently in use could be used to efficiently water plants when they are in need. Nonetheless, this manual watering system necessitates the consideration of two major factors: when and how much water. A programmed automated irrigation system is created to replace manual tasks and make work easier. It makes use of the production to determine the dampness level of the soil and water the plant naturally when no dampness is detected in the dirt. This device can be used on large agricultural farms as well.

INTRODUCTION

The use of regulated proportions of water to plants at required ranges is referred to as irrigation. In dry areas and during seasons of unusual precipitation, water frameworks assist in the development of scenes and the revegetation of disturbed soils. Water structure is also useful for increasing yield, suppressing weed growth in grain fields, and preventing soil union. Water framework systems of this kind are also used for cooling creatures, dust concealment, sewage expulsion, and mining. This proposed scheme is based on the moisture content of the soil. The soil moisture sensor is a device that measures the moisture content of the soil. If the soil moisture falls below a certain level, irrigation will begin automatically. If the soil moisture level rises above the setpoint, irrigation will be turned off automatically. Via Bluetooth, the user can control and monitor the whole machine. Arduino is attached to a Bluetooth module. The Arduino board is also connected to the LCD. In which the moisture content of the soil is shown. This system is simple to use, dependable, and inexpensive. This cutting-edge technology has the ability to dramatically improve economic growth. This form of technology has the ability to enhance both efficiency and quality.

Various Types of Automatic Irrigation Systems
Drip irrigation system:

A drip water system is a kind of small water system that allows water to drip slowly to the foundations of plants, either saving water or supplementing it. The main aim is to bring water directly into the root zone while limiting dissipation. If properly operated, this drip water system has efficiency and effectiveness of 80-90 percent. The spill water system is often combined with plastic mulch in flow cultivation, further limiting dissipation, and is the form of compost conveyance. Fustigation is the name of the device. If a stream structure is worked for a prolonged period or if the transport rate is extremely high, profound permeation will occur, in which water passes underneath the root zone.

Spill water framework structures range from cutting-edge and computerized to low-tech but equally inventive practices. Aside from low-essential network turn structures and surface water framework systems, lower water pressures are required, and the structure can be designed for consistency across a field or precise water transport to specific plants in a scene with a mix of plant creature gatherings.

Micro Irrigation System:

A micro water system is an advanced water system technique in which water is inundated through drippers, sprinklers, foggers, and other producers on the land's surface or subsurface.

Sprinkler irrigation system:

Water is funneled to a minimum of one focal space within the sector and disseminated by overhead hard-hitting sprinklers in a sprinkler or overhead water device.

A powerful set water system structure is generally described as one that uses sprinklers or splashes mounted overhead on well-mounted risers. Sprinklers may be installed on moving stages that are linked to the water supply. Moving sprinklers are naturally moving wheeled devices that can spray areas such as small areas, sports fields, and parks. The sprinkler is pushed around the field while the tubing is twisted on the drum by the water system or a small gas engine. When the sprinkler returns to the reel, the framework comes to a halt.

Many people refer to this form of structure as a "water reel" voyaging water system sprinkler, and it is commonly used for dust concealment, water system, and wastewater land utilization.

ADVANTAGES OF WATER IRRIGATION SYSTEM
Decrease Weed Development:

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Only zones that need water will obtain it if you present a water framework structure specifically built for your scene. As a result, you'll be able to accurately predict your future weed growth. Spill water framework systems are especially effective at this: instead of sprinkling water over the entire land, the system organizes water specifically to each plant's essential establishments.

Save Time and Water:

Sprinkler and dribble water system frameworks can be programmed for each day or week with week watering, as well as for specific hours during the day or night. While the water gadget technique is being completed, the device will also shut off the water. You don't want to be a physical gift for the water framework to thrive if you're using a robotized framework to disperse the water flexibly. The programmed shut-off would reduce your water use and lower your costs because much less water will be used.

Plant Development:

Plants can grow faster and greener if they are watered with smaller amounts of water over a longer period, which is exactly what water framework systems are designed to do. Presenting a water framework system will dramatically boost your plant growth.

Hold Soil Supplements:

Watering by hand daily results in a bounty of water being absorbed into the soil. Waterflood soaks up nutrients from the earth and redirects them to your plants. Using a water framework system will save your soil structure while also keeping your plants from absorbing floodwater.

MATERIALS AND METHODS

An automatic irrigation system is shown as a block diagram. This is a method for watering plants; it can also be used to irrigate farms. The irrigation time interval is not set in this method. The irrigation is regulated by the soil. Irrigation/watering is initiated when the soil becomes dry. There are two probes in this device. One probe is used to sense soil moisture, while the other probe is used to activate the relay switch based on the basic dryness value. These relays can be connected to any watering system or fogger system for cooling any farm shed, allowing the system to turn on automatically and water the plants. In **Fig.1.** A Block diagram of this system is showing. The sensor in the device tests soil moisture and sends the data to the Arduino board. The entire device is regulated by the Arduino Board. When the moisture value is sensed by the sensor and sent to Arduino, if it falls below a certain threshold, the relay module activates the water pump. A certain amount of water is delivered to the crops as a result of this. If the moisture rate exceeds a certain threshold. To stop the watering, the Arduino sends another signal to the relay module. Soil –Moisture displays are often shown on an LCD monitor that is attached to an Arduino. Via an Android application on a mobile device, the user can track or set a soil-moisture threshold value. The Arduino board is connected to the Bluetooth Module.
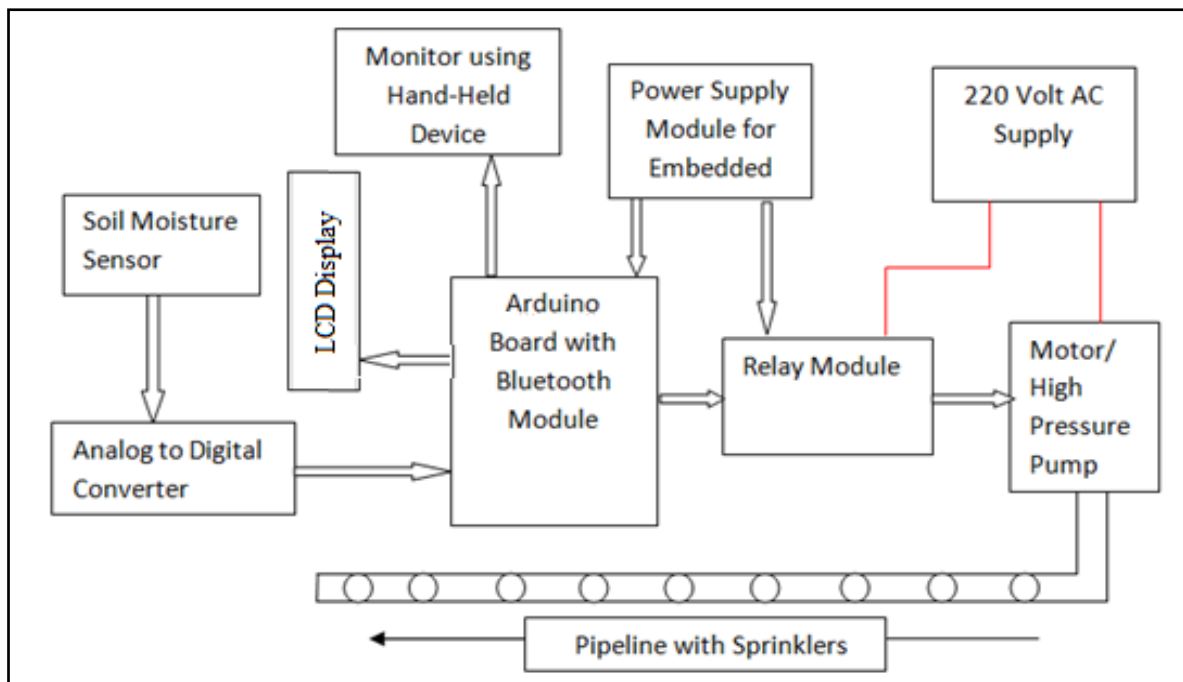
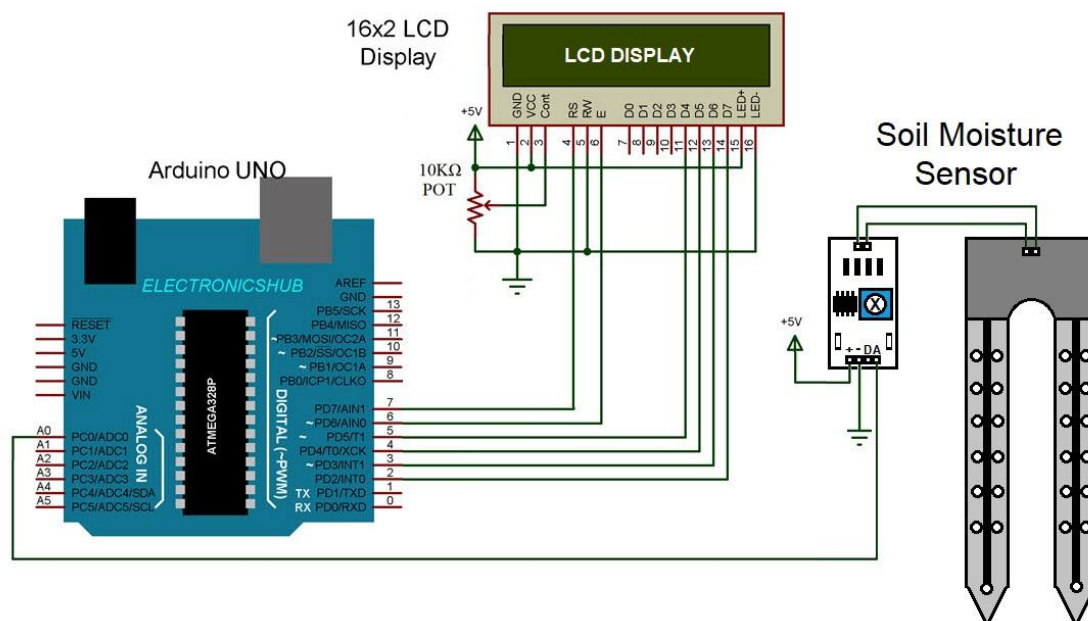**Fig 1**. Block Diagram of Proposed Automatic Irrigation System

Fig 2. Circuit Diagram

Main Components of This System
Soil Moisture Sensor:
A soil moisture sensor of the hygrometer type is used to measure the soil's dryness and wetness in this device. This sensor is made up of two components, or we might suggest that this sensor configuration is made up of two bits. The first is an electronic board, while the second is a collection of fork-shaped probes with a conductor that detects soil moisture. This fork-shaped probe behaves in the same way as a variable resistor. These probes' resistance varies depending on the amount of water in the soil. The soil moisture has an opposite relationship with resistance. When there is a lot of water in the soil, it induces strong conductivity and lower resistance. When the amount of water in the soil is low, it results in poor conductivity and high resistance. We can calculate the moisture level using the voltage output from this sensor, which is based on the resistance.
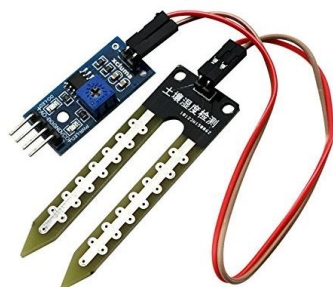

Fig 3. Soil Moisture Sensor

This sensor, which connects the probe to Arduino, is also attached to this electronic module. The O/P voltage is produced by this electronics module. A comparator is included in this electronic module, which converts the analog output voltage to a digital output voltage. Depending on the amount of water in

the soil, this digital output can be high or low. A potentiometer can be used to set the threshold value. The production is poor when the soil moisture reaches this threshold value. The production is high if the soil moisture is below the threshold value.
Arduino:
Arduino is made up of a physical programmable board as well as software. It's a free and open-source electronic circuit board. We can upload the code here. It's essentially a microcontroller package. This is a combination of analog and digital I/P and O/P. The electronic module of the Soil Moisture Sensor is connected to Arduino in this device.

RESULTS AND DISCUSSION

Table 1 is showing suitable crops for an automatic irrigation system. We observed approx 8-9 crops for few months. This automatic irrigation is used to reduce water wastage. **Table 2** is showing the effect of automatic irrigation on some crops. It showing how much water is saved and also showing improvement in yields of crops. This system is specially designed for farmers and gardeners who don't have sufficient time to watering. We had also discussed few previous research works. As compared to other seasons, a large amount of rain falls during one single time of the year (Hassan et al. 2018). Plants that can only thrive in extremely wet soils can succumb to a dry spell. This issue can be settled by the water system framework. The executives of the water system decide about the amount of water that must be siphoned. Water machine booking determines when and how much water is delivered. We have several types of water system frameworks, such as sprinkler and dribble water networks. The trickle water method relies on precise water delivery to plant roots. Sprinkler water system framework is

put between the plants and it sprinkles water to all the plants around it. Working on the sprinkler framework involves agreeing on the wetting style, application rate, and sprinkler decrease. Sprinkler framework is of two kinds: splash type and rotor type. This system is based on the L8051F microcontroller and operating system (Li J. et al. 2011). They are using a handheld water system detection device to establish the specifications of the saving water system for the harvests planted close to the karst slant zone. The provincial climate in this region is characterized by rapid shifts and tremendous contrasts. This device has a few advantages, such as basic operation, ease of setup, low cost, remote control, and so on. The entanglements can be coordinated between manual and programmed control using this system. The entanglements can be coordinated between manual and programmed control by using this system. The mobile phone is an example of a portable device. Human demands for materialistic assets grow as we grow (Mat I. et al. 2018). One such asset is water. It is the most widely utilized asset. There is a need to take a step toward water conservation by implementing a compact water system management structure. The goal of micro water system control framework is to supply water for a specific time span relying on the distance through which water needs to go through the line,sort of soil, crop, and so on Execution of this can help locales that have scant water and needs quick help with water preservation methods. This research on "Research of Automatic Monitoring System of Reservoir Based on Embedded System", (Wen N. et al. 2011). This system is built on top of an embedded system. This device provides automated reservoir control. There are three sub-systems in this system. Data collection, Transmission, Data management. This system handles data storage, processing, and maintenance across all three levels of management. It maintains efficiency, low cost. This research work is on "Water Saving Irrigation Control System based on STC89C52MC (Zhang C. et al. 2008). This device avoids water waste by using switches and valves to communicate between the PC and the Microcontroller. To connect with MCUs and controllers, a serial port is used. MCU's software receives the signal PC as soil moisture levels increase or fall in this device. Then, after obtaining the irrigation period, begin irrigation. When the moisture value exceeds a predetermined level, irrigation is turned off. This system involves saving water and accuracy.

Table 1. Crops Suitable For Automatic Irrigation System

S. No.	Crop Types	Example
1.	Oil Seed	Sunflower, Oil palm, Groundnut, etc.
2.	Plantation	Tea, Rubber, Coffee, Coconut etc.
3.	Orchard Crops	Grapes, Orange, Mango, Lemon, etc.
4.	Forest Crops	Teakwood, Bamboo, etc.
5.	Spices	Turmeric, Cloves, Mint etc,
6.	Vegetables	Tomato, Chilly, Capsicum, Cabbage, Onion, Pumpkin etc.
7.	Cash Crops	Sugarcane, Cotton, Strawberry
8.	Flowers	Rose, Carnation, Gerbera, Orchids, Jasmine etc.

Table 2. Effect of Automatic Irrigation System on Crops

S. No.	Crops	Water-saving Through Irrigation (%)	Improvement in yield (%)
1.	Onion	35	95
2.	Sweet lime	61	50
3.	Gram	68	59
4.	Jowar	55	34
5.	Cotton	36	50
6.	Wheat	35	25
7.	Groundnut	40	152
8.	Chilly	65	32
9.	Sunflower	40	52

CONCLUSIONS

The use of an automated irrigation method reduces water waste. Mainly this system is designed for farmers and gardeners who have lean time to water their crops. This system is user-friendly. This system can contribute to the economic development of India by reducing water waste throughout irrigation. As we have a tendency to all apprehend "If there's water, there's life". The main objective of this automatic irrigation system is to make it more efficient more reliable, user friendly than the previously existing

systems. In this irrigation system, water is directly transferred to the roots of crops or plants; it maintains the soil moisture ratio. Therefore this method is additionally economical and reliable to the setting. This method reduces the manual work of the farmer. Improve agricultural quality.

ACKNOWLEDGMENTS

REFERENCES

Almusaed, Chapter (2011). Introduction to Irrigation Systems, *Springer-Verlag London Limited.* doi: 10.1007/978-1-84996-534-7_7.

Chunfeng, L. and Xiang, Z. (2012). Design and Study on Hardware Circuit of Agriculture Automatic Micro-irrigation Control System Based on Single Chip Model AT89S52. *In: Zhang W. (eds) Software Engineering and Knowledge Engineering: Theory and Practice. Advances in Intelligent and Soft Computing, Springer, Berlin, Heidelberg.* 162: 103-108.

Hassan, Aslinda, Sheng, Siah, Md Shah, Wahidah and Bahaman, Nazrulazhar (2018). An Automated Irrigation System Using Arduino Microcontroller. *In Book Internet of Thing; uses and Application.* 3-13.

Li, J., Tu W., Fu J. and Wang Y. (2011). A Handheld Testing System for Irrigation System Management. *In: Qi L. (eds) Information and Automation. ISIA 2010. Communications in Computer and Information Science, Springer, Berlin, Heidelberg.* 86: 418-423.

Mat, I., Kassim, M.R.M., Harun, A.N. and Yuso, I.M. (2018). Smart agriculture using internet of things. *In: 2018 IEEE Conference on Open Systems (ICOS), IEEE, New York.* 54–59.

Li, F., Wang B., Huang Y., Teng Y. and Cai T. (2011). Study on the Management System of Farmland Intelligent Irrigation. *Computer and Computing Technologies in Agriculture IV. CCTA 2010. IFIP Advances in Information and Communication Technology. Springer, Berlin, Heidelberg.* 345: 682-690.

Sayyed-Hassan, Tabatabaei, Rohollah, Fatahi, Nafchi, Payam, Najafi, Mohammad, Mehdi, Karizan and Zohreh, Nazem. (2017). Comparison of traditional and modern deficit irrigation techniques in corn cultivation using treated municipal wastewater. Springer. 6: 47-55.

Wen, N., Li D., Ma D. and Ding Q. (2011). A Wireless Intelligent Valve Controller for Agriculture Integrated Irrigation System. *Computer and Computing Technologies in Agriculture IV. CCTA 2010. IFIP Advances in Information and Communication Technology. Springer, Berlin, Heidelberg.* 347: 659-671.

Xiao, J. and Liu D. (2012). Water-Saving Irrigation Intelligent Control System Based on STC89C52 MCU. *Future Control and Automation. Lecture Notes in Electrical Engineering, vol 173. Springer, Berlin, Heidelberg.* 173: 223-230.

Zhang, C., Zhang, J., Liang, Y., Zhang, Y. and Yin, G. (2008). Research of Automatic Monitoring System of Reservoir Based on Embedded System. *Computer And Computing Technologies In Agriculture, Volume I. CCTA 2007. The International Federation for Information Processing. Springer, Boston, MA.* 258: 503-513.