

Importance of IOT based smart irrigation system in agriculture

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Abstract

Agriculture play key role in growth of developed countries. it uses 85% of available fresh water resources worldwide this percentage continuously in water consumption because of population growth and food demand. due to which is system that uses water wisely is required . as a result the study provides and idea for smart watering system the management of irrigation can be improved by using automatic irrigation system it technology that allows a farmer to monitor the status of his crops from the comfort of his own home. the system not only provides compactness but also reduces energy , increasing efficiency and time savings. the system uses two sensors soil moisture sensor and rain sensor for the implementation of the system Arduino IDE 1.8 12 and uploading into Arduino Mega the data from sensor sends to data to the mobile by using Wi-Fi modem based on the moisture content pump will automatically starts and after reaching the required soil moisture content pump will stop. different laboratory test can be performed according to different soils such as red soil, laterite soil and black soil and result obtained is compared with the sensor reading which are approximately equal based on the system we can conclude that water can be diminished can overcome the own irrigation and under irrigation which are major problems in a surface irrigation by using this IOT based smart irrigation system we can supply fertilizers in the form of liquids and other system also developed by using Uno microcontroller . the irrigation system consist soil moisture sensor to monitor the soil and potentiometer to set the required moisture content compared to Systems by plotting moisture deflation curve and conducted that are almost same.

Index Terms- IoT, irrigation Microcontroller, Sensor, soil moisture soil moisture sensor, Wi-Fi module

Introduction

A agriculture is India's main source of income and is known as the country's backbone, Farmers, on the other hand, have recently faced a host of problems in the agricultural industry. As a tool, efficient water management tea mare challenge in many arid and semi-arid farming systems. An automated irrigation system is necessary to optimize water consumption for agricultural crops. An automated irrigation system's purpose is to prevent overwatering and flooding Over irrigation occurs as a result of inefficient water distribution or management. Irrigation enhances soil salinity in areas with significant evaporation, resulting in a deposit of toxic salts on the soil surface.

A smart watering system was installed to address these difficulties and save labour. By lowering production casts, improving irrigation efficiency can help the industry become more competitive and sustainable With proper irrigation, average crop y yields can be maintained (or increased) while limiting environmental concerns caused by excess applied water and subsequent agrichemical leaching. As a result of recent technological breakthroughs, soil water sensors are now available, allowing irrigation systems to work more elsciently and autonomously. Automatic irrigation based on soil water sensors attempts to maintain a specified soil water range in the root zone that is suitable for plant growth.

LITERATURE SURVEY

Understanding the existing methodologies, understanding the needs, and building an abstract for the system are all steps of the primary study. In this study, soil moisture sensors, temperature, and humidity sensors are implanted in the plant's root zone, and data is went to an Android app. To manage water quantity, the threshold value of a soil moisture sensor was programmed into a microcontroller. Temperature, humidity and soil moisture values are displayed via the Android app The goal of I of this project, dubbed Automatic Irrigation System on Soil Moisture Content, is create an automated irrigation system that detects the earth's wetness content and turn the pumping motor ON and OFF This study just looks at the soil moisture value, however, the suggested project adds temperature and humidity dats to the present project. This research cultural plantations that is put in a remote location and dis presents an Arduino-based remote irrigation system for agri tributes required water to the plantation when soil humidity fails below a set-point value. However, because we were unaware of the soil moisture level at the time, the suggested sys tem contained an additional feature of soil moisture value. which was presented on the farmer's mobile application

LITERATURE REVIEW

10.48047/jocaaa.2024.33.08.285

[1] G.Parameswaran and K.Sivaprasath (2016) proposed a smart drip irrigation system using IOT in which humidity, temperature and soil sensors are used. Irrigation status is updated to the server or local host using personal computer. on Root Zone Sensors for Irrigation Management in Intim (2) Alberto l'ardosi, Luca Incrocci (2009) published a paper intensive Agriculture which dealt with sensors in different root zones for different crops.

[3] Archana and Priya (2016) proposed a paper in which the zone of the plant. Based on the sensed values the micro humidity and soil moisture sensors are placed in the root controller is used to control the supply of water to the field.

[4]Rayyan Wah-Shun Li Sheng-Ya Chang aml Fiat main (2017) proposed a paper for Modeling of Mixed Crop field Water demand and a Smart irrigation system which indicated that the field storage in the block of the study areas was lower than the silting point under the 50%and irrigation water scenario. The original irrigation plan can be reduced to be more efficient in water us age, and a 50% reduction of irrigation can be applied as a solution of water shortage when drought occurs.

PROBLEM STATEMENT

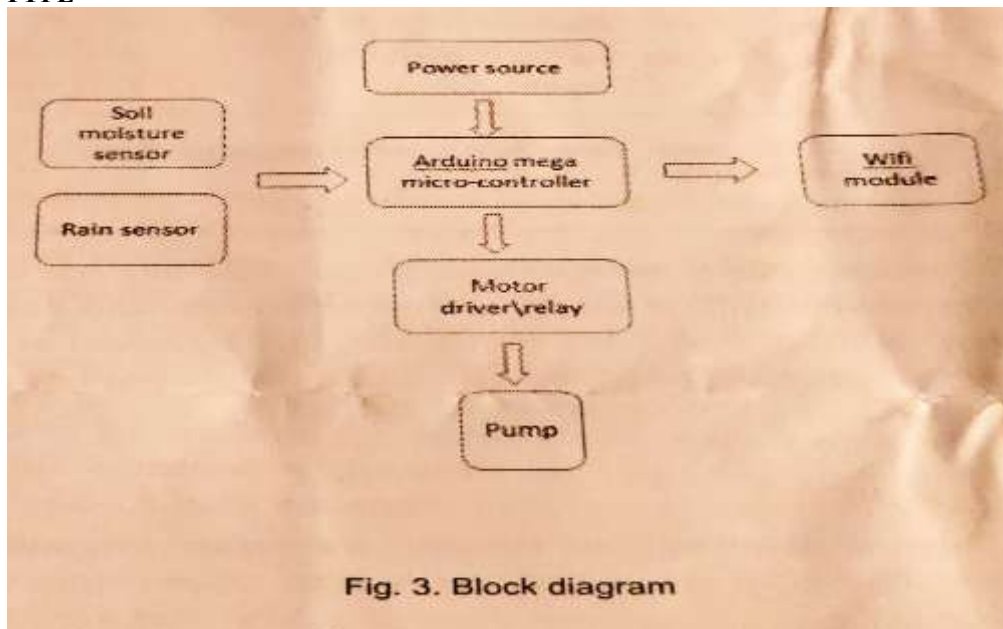
The traditional irrigation method is operated by hand and is based on manually Observed real-time weather and soil Conditions, Water schedule is determined by heuristics based on the farmer, experience which is heavily reliant on manual work. Farmers biggest bone is water shortages as a result of lower rainfall. Due to supply fluctuations farmers are sometimes forced to water the field at strange hours. Due to human mistake, there is a danger of over Watering and under watering in a few situation.

PRINCIPLE

A soil sensor controls the smart irrigation system, which is controlled by the seil moisture content. The soil moisture sensor is linked to the Arduino microcontroller's input pins in this configuration. Chi the Smartphone, the sensors seemed values are displayed, If the measured value exceeds the pro gram's threshold settings, the motor driver will automatically tum the pump ON/OFF A Smartphone application will keep the farmer up to date on the current field state, which will also be updated on the website. Using this technology the farmer can get information about the state of the field at any time.

In the smart irrigation system soil sensor used to control controlling which is controlled by soil moisture content microcontroller and soil sensor are linked Together by input pins in this configuration with the help of smart phone sensor and sensor data values are displayed if the measured value exceeds the as per program threshold sitting value motor driver wheel automatically turn the pump on our of immediately.

ROTOTYPE



the prototype of Wi-Fi based smart irrigation system and prototype of iot based Marathi irrigation system with Potentiometer are connected.

COMPONENTS

1. Arduino: A physical programming circuit board (Microcontroller) as well as software are included in this open source platform Integrated development Environment). The microcontrollers utilized in this project are the Arduino UNO and Arduino MEGA. This is a microcontroller-equipped board. The UNO and MEGA may be programmed using the Arduino software.

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2. Soil Moisture Sensor : A soil moisture sensor is used to determine moisture The Soil Moisture Sensor (SMS) is an irrigation system wens that measures sol moisture in the root zone prior to each planned watering event, bypassing the cycle if moistures above a user-defined set threshold.

3.Wi-Fi Module: It was a Wi-Fi model that was used. The ESP8266 self-contained system on chip (SOC) with an inbuilt IP/TCP protocol stack that allows any microcontroller to connect to any Wi-Fi network. This preprogram used ESP82sé module can easily be attached be an Arduino device to enable Wi-Fi capabilities. The ESP8266 module has a wide on-boarding development space and a lot of storage, so it's perfect for sensors and other application specific devices.

4 Submersible Water Pump: An electric submersible pump (sometimes referred to as a submersible pump or a sub pump) is as pump that has a hermetically sealed motor that is tightly connected to the pump body. The setup is completely submerged in the fluid that will be pushed. The main advantage of this type of pump is that it prevents pump cavitation, which is a problem produced by an elevation difference between the pump and the fluid surface. A small submersible DC water pump, unlike jet pumps that pull fluid to the surface, pushes the fluid to the surface. face. Submersible pumps are more efficient then Jet pumps it's usually turn the on when voltage between 3 and 12 volts

DESIGN OF SMART IRRIGATION SYSTEM

software used:

Arduino ID 1.8.12

This application is free opens or software or writing and debugging programs and it was used to create smart irrigation systems application.

TCP server

This is an Android application and app app is really available in app store.

Working

A sensor powers the prototype, which is real-time. The soil sensor detects the moisture in the soil. A threshold is calculated in the prototype based in the soil and crop type. The system turns on the pump and delivers water to the crop when the moisture in the soil falls below the predetermined threshold, when the moisture in the soil rises over the threshold the water supply is cut off. There is no need for human interaction because the entire system is automated. The device will automatically supply water based on the moisture content of the soil. We may view all of the data using an app on our smartphone

INTEGRATION WITH CONVENTIONAL SYSTEM

At no additional cost, the Smart Irrigation System may be readily connected into an existing traditional irrigation sys tem As a result, farmers will be able to employ it with ease in Choir crops. The system can be connected to a drip irrigation system, a sprinkler system, or a surface irrigation system for the most efficient use of water resources. In surrounding fields, we put sprinkler and drip watering system prototypes to the test.

1) Clean and dry the weighing tin-lid before weighing to a precision of 0.01g (W1). In the amount required by a test,select a typical quantity of damp soil. If nothing else is stated, use at least 30 g. Replace the lid on the weighing tin and place the sample inside. Weigh the tin and its contents to a precision of 0.01g (W2)

2) Remove the lid and place the tin in the oven, along with the contents and lid, to dry to a consistent weight between 105°C and 110°C

3) Take the tin with the contents out of the oven, replace the lid, and cool everything in the desiccators

4) Weigh the tin and its contents to a precision of 0.01 g. (W3).

The moisture content present in soil $= (w2-w3)/(w3-w1) * 100$

Where

W1-Weight of tin (g)

W2-Weight of moist soil + tin

(g) W3-Weight of dried soil + tin (g)

Gravimetric Test Results

The test was conducted for red soil. Black soil and laterite soil in three trials and the results are given in the below table(s)

The Test was conducted for three different type of soils)

BLACK SOIL

Trial-1	W1(gm)	W2(gm)	W3(gm)	Soil moisture content (%)
1	20	95	82	20.96
2	20	90	75	27.27
3	20	85	71	27.45
			Average	25.22

RED SOIL

Trial-2	W1(gm)	W2(gm)	W3(gm)	Soil moisture content (%)
1	20	100	85	23.07
2	20	95	90	21.42
3	20	90	75	27.27
			Average	23.92

LATERITE SOIL

Trial-3	W1(gm)	W2(gm)	W3(gm)	Soil moisture content (%)
1	20	95	78	29.71
2	20	100	80	33.33
3	20	105	82	37.10
			Average	33.24

Sr. No	Soil type	Sensor reading(%)	Moisture content by gravimetric test(%)
1	Black soil	26	25.22
2	Red soil	24	23.92
3	Laterite soil	35	33.24

The prototype was put to the test on three different types of soil red soil, black soil, and laterite soil, To check that the prototype worked property, the sensor readings were compared to the results of gravimetric experiments. To acquire reliable findings, the sensor was inserted in the soil at the same time as the sample was obtained for the gravimetric test. Because the sensor is real-time, it provided immediate findings. The results shown were noted down. It was also noted that the pump supplied water at specified threshold for these three soils.

11 MOISTURE DEPLETION IN SOIL

A patch of land in an open region on our college campus was chosen and moisture depletion was checked. At the same time that the soil was watered, sensor readings were taken. Sensor measurements were taken at hourly intervals to monitor soil moisture loss. The sensor reading is as follows. The Below Graph shows the moisture depletion in the selected area. The moisture level dropped swiftly due to the tiny size of the pacity all play a role. We set the moisture threshold at 30%, and the pump kicked in as soon as the moisture level dropped below that targeted region. The soil type, evaporation rate, and field ca

MERITS

As a result implementing this technique may result in water conservation

Flexible: the system is totally automated, no human intervention is required. No human Intervention Because the smart irrigation

Helps in conservation of water- There is an even distribution of water, there is no overwatering or under watering. As a result, implementing this technique may result in water conservation

Flexible: The system is adaptable and can be used with water drip irrigation or sprinklers. It can be used on a wide range of crops and soil types. Depending on the kind of soil, a water supply threshold can be set

Affordable- It is less expensive and requires very little maintenance because open source technology is used. It can be easily connected into an existing irrigation system at no further cost.

Low power consumption- The system can operate at 5 volts (excluding pump). Solar energy can be used to power the system. It can also be connected to a power source in the house or to batteries.

Low maintenance- Because the system is automated, mu tine inspections are required to ensure that it runs smoothly. It does not necessitate a lot of upkeep. Remote Operation The device can be controlled remotely via a smartphone app., and the data can be viewed via the internet from anywhere

APPLICATIONS

The smart irrigation system can be used in agricultural areas, greenhouses, vineyards, and plantations It's compatible with both drip and sprinkler watering systems. It's also appropriate for tiny backyard gardens and parks. It can also deliver time data to the user. The technique can improve sugarcane, tobacco, and other economic crops. It can also help indoor gardens and potted plants. It would help with water Conservative by giving the crops the right quantity of water and eliminating overwatering. It will automate the irrigation systett, decreasing the need for manual labour and enhancing overall

CONCLUSIONS

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Irrigation is considered the country's backbone because it is the most critical prerequisite for human civilization. In the current environment, water conservation is a key priority. By continuously monitoring soil conditions, controlling water flow, and lowering waste, this project strives to protect natural resources. By cutting labour costs and increasing farming efficiency, this technology has the potential to greatly aid farmers. By modernising farming processes, we are able to provide outstanding harvests and increase farmer living standards. It will be useful in dry and semi-arid environments

We believe that, with a little more research and development this system can be implemented in our country based on the results of the testing and the prototype's use in various locations. It will be beneficial to the farmers.

SCOPE FOR FUTURE DEVELOPMENT

Additional sensors, such as a pH sensor, temperature sensor, humidity sensor, and moisture sensor, can be connected to the prototype to help with irrigation based on varied situations and requirements. The prototype might be connected to a weather forecasting them, allowing it to account for rainfall and weather fluctuations when irrigating.

The device can also be connected to the data cloud to collect field data. The Smart irrigation system can benefit small-scale farmers because it can be mass produced at a lower cost. It might also be tweaked to work in a wide range of soil and crop situations.

References

1. Anchana and Priya Design and Implementing a Plant Watering System presented at International Journal of Ad 2016
2. Irrigation System Using IT presented at International Journal of Engineering Science and Computing UIESCL May 2016 Cramewaran and K.Sivaprasath, "Arduino Based Smart Drip
3. Sonali D Gainwar and Dinesh. V Ragathat. Soil Parameters Monitoring with Automatic Irrigation System" presented at International Journal of Engineering and Technology Research (IJETR), vol 04, Issue 11, Nov 2015.
4. Allen, K. G. Pereira, L.S., Fears D. and Smith, M. (1999) "Crop Evapotranspiration Guidelines for Computing Crop Requirements Irrigation Paper No. 36, FAO, Rome, Italy
5. Irrigation Association (IA) (2007) "Landscape irrigation scheduling and water management Irrigation Association Water Management Committee, Falls Church, VA.