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Smart Irrigation System

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A B S T R A C T

Smart irrigation system is an application which uses Internet of Thing (IoT) devices, Mobile application development and solar power technology which uses a soil moisture sensor which detects the level of moisture in the soil and supplies water to the soil if the level of moisture is below the given level set for the crop. The mobile application of the product allows the user to check the level of moisture in soil and turn the water motor ON or OFF as per the user's requirement. This product uses a solar panel which means that the whole irrigation system works on solar energy saving electricity. This system will help farmers to manage their fields with ease and efficiency. It is an empirical concept because IoT sensors can provide information about their crops and making irrigation automated using Internet of Things.

Keywords: IoT device, sensor, irrigation, application, solar panel

1. Introduction

1.1 In today's date one of the greatest problems faced by us is water scarcity and agriculture is a demanding occupation which consumes plenty of water for the growth of crops. Therefore, a system is required which uses water relevantly, the Smart Irrigation system is a very effective system which helps to reduce the wastage of water. This system uses the Internet of Things (IoT which is network of physical objects that are embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the internet), the Android Application Development(a mobile app which is connected to the physical device) and a solar panel(it is used to convert solar energy into electrical energy and use it to power the physical device) when these components are combined it builds a system which enables users to learn the amount of moisture in their fields and supply moisture to the fields with respect to moisture level. This technology will primarily improve traditional agricultural practices by using modern technologies. The Internet of Things (IoT) plays an important role here because IoT sensor the soil moisture sensor can provide information about farmers' or users' crops and make irrigation automated. Unlike the traditional irrigation controllers which operate on a pre-set programmed schedule and timers, smart irrigation controllers monitor the soil moisture in crops and automatically adjust the watering schedule to the actual needs of the site which reduces wastage of water. In this system, the sensor will detect the level of moisture in the field then that data will be sent to the microcontroller board which then examines whether the moisture level is high or low according to the minimum value set to its functionality. If the level of moisture is below the minimum value, then the microcontroller will send signal to the transistor to switch on the water pump, else if the level of water is equal to or higher than the minimum value set for the function the microcontroller will send signal to transistor to keep the water pump switched off. The user will aslo be able to see the status of his field via a mobile application where the level of moisture will be display on the app and the user will be able to supply water to his fields through his mobile which makes the system effective. This system is an intelligent automatic plant irrigation system which concentrates on watering plants regularly without human monitoring using a moisture sensor. The system uses a hardware component, which is subjected to variation with the environmental conditions. Proper scheduling of irrigation is critical for efficient water management in crop production, particularly under conditions of water scarcity. To improve water efficiency there must be a proper irrigation scheduling strategy. This system helps root level farmers to manage their fields efficiently. This system will be effective in both large scale and small scales. Proper irrigation of soil would ensure consistent distribution of water to the roots which is necessity for better productivity and quality of crops. This method will reduce the wastage of water. The project will engross the interest of farmers towards technology in terms of agriculture, which will provide great service in lowering manpower. This product devices a simple system, using a microcontroller to automate the irrigation and watering of small potted plants or crops with minimal manual interventions.

1.2 IMPORTANCE OF IRRIGATION

The rainfall in our country depends on monsoons. Rainfall controls agriculture, but agriculture is said to be "the gambling of the monsoon" as the monsoon rainfall is uncertain, irregular, and uneven or unequal. So, irrigation is essential for agriculture. In INDIA there are 80% of the total annual rainfall occurs in four months, i.e., from mid-June to mid-October. So, it is very necessary for the irrigation of farm fields during the rest of the eight months. One of the

greatest advantages of a smart irrigation system is its ability to save water. Traditional watering methods can waste as much as 50% of the water used due to inefficiencies in irrigation, evaporation and overwatering. Smart irrigation systems use sensors for real-time or historical data to inform watering routines and modify watering schedules to improve efficiency. There are two important aspects of smart irrigation: control types -- the way the irrigation is controlled -- and delivery types -- the type of water delivery systems used. There are also two basic types of control for smart irrigation systems, weather-based and soil-based, each varying in its technical method of sensing and supplying information. Weather-based smart irrigation systems use local weather information drawn from reliable weather sources, sensors, or historical data to support informed decisions about watering schedules. A weather-based irrigation system is also called an evapotranspiration, or ET, system, referring to the loss of water through evaporation from the land and transpiration from plants. Water schedules are determined using an analytical assessment of the combination of local temperature, humidity, insolation and wind. Soil-based smart irrigation systems use local soil moisture data drawn from sensors in the ground to support informed decisions about watering schedules. Users can configure these systems to manage irrigation on demand, for example, when a particular land area is too dry and starting an irrigation routine or to stop irrigation when a particular saturation point is met because a soil moisture level has been reached. Controlling these two set points reduces the amount of water used by linking it to the moisture level needed in the soil for a particular crop. One of the other major advantages of a smart irrigation system is that precision watering in smart irrigation also deals with efficiencies in the delivery of water. There are generally four types of delivery: surface, sprinklers, trickle and subsurface methods. Surface irrigation is the most traditional method, and it distributes water through irrigation ditches, letting gravity do the work. Sprinklers distribute water through the air like rain and can be fixed or mobile. Trickle irrigation spreads water very locally to the ground surface. Subsurface methods are buried next to the plant's root zone and apply water below the ground. Trickle systems and subsurface methods generally save the most water given their ability to reduce loss to evaporation.

1.3 Hardware Specification

- ESP8266 -Microcontroller
- Soil Moisture Sensor
- Mini water motor
- Transistors
- Connecting wires
- Solar panel
- Battery 3.7V

1.4 Software Specification

- Arduino Compiler
- Microcontroller programming language – C/C++
- Android Studio

2. Proposed work

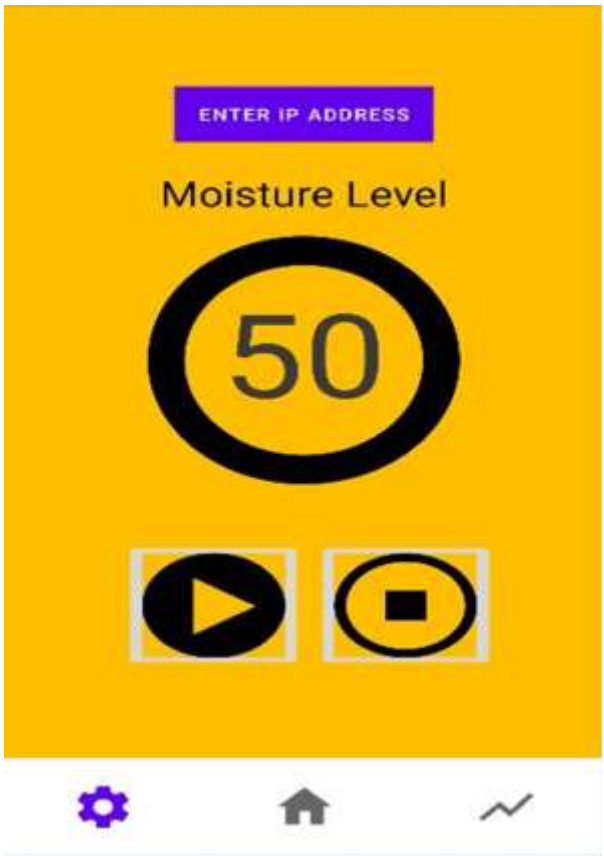
The Smart irrigation system is divided mainly into 2 parts:

2.1 Hardware

In the hardware of our product, we have used a soil moisture sensor which detects the level of moisture in the soil the digital input from the soil is converted into analog data and the data is set to a range from 0 to 1024. The sensor is connected to ESP8266 board which is used to read inputs and display outputs. The transistor is connected between the water motor and the microcontroller so that the water pump can be turned on and off many times. A minimum level of moisture is set according to the crop requirement, if the level of moisture is lower than the minimum level a signal is send in order to start the water motor else if the level of moisture is higher or equal to the minimum level a signal is sent to keep the water motor switched off. The microcontroller is connected with solar power supply, a battery management system is used where the electrical energy from the solar panel is stored and is used by the ESP8266. By using the ESP8266 board we have built a HTTP server by using which the data is sent to other apps and can be used by the user from remote area. The ESP server builds an IP address and domain name which is used to call functions like motor ON, motor OFF or moisture Level.

2.2 Software

In the software part of the product be have created a mobile application using android development, here we have provided the user with login id and password, after logging in the user will be led to the main page of the app where the user will be able to see the level of moisture in the soil, the user will also be able to control the water motor from the app by using buttons provided. When user clicks on the play button a http request is send to start the water motor whereas when the stop button is clicked http request to keep the water motor turned off is sent.



3. Literature review

- In GSM Based Automated Irrigation Control using Rain gun Irrigation System. R.sureshS.Gopinath K. Govindaraju, T. Devika , N.SuthanthiraVanitha [1] mentioned about using automatic microcontroller based rain gun irrigation system in which the irrigation will take

place only when there will be intense requirement of water that save a large quantity of water. This system brings a change to management of field resources where they developed a software stack called Android is used for mobile devices that include an operating system, middleware and key applications. The Android SDK provides the tools and APIs necessary to begin developing applications on the Android platform using the Java programming language. Mobile phones have almost become an integral part of us serving multiple needs of humans. This application makes use of the GPRS feature of mobile phone as a solution for irrigation control system. This system covered lower range of agriculture land and not economically affordable. The System Supports Excess Amount of water in the land and uses GSM to send message and an android app is been used they have used a methodology to overcome under irrigation, over irrigation that causes leaching and loss of nutrient content of soil they have also promised that Microcontroller used can increase System Life and lower the power Consumption. There system is just limited to the automation of irrigation system and lacks in extra ordinary features.

- In GSM based Automatic Irrigation Control System for Efficient Use of Resources and Crop Planning by Using an Android Mobile Pavithra D. S, M. S Srinath. [2] States features of their system. The system continuously monitors the water level (Water level Sensor) in the tank and provide accurate amount of water required to the plant or tree (crop). The system checks the temperature, and humidity of soil to retain the nutrient composition of the soil managed for proper growth of plant. Low cost and effective with less power consumption using sensors for remote monitoring and controlling devices which are controlled via SMS using a GSM using android mobile.
- In Irrigation Control System Using Android and GSM for Efficient Use of Water and Power - LaxmiShabadi, NandiniPatil, Nikita. M, Shruti. J, Smitha. P & Swati. C [3]. Automated irrigation system uses valves to turn motor ON and OFF. These valves may be easily automated by using controllers. Automating farm or nursery irrigation allows farmers to apply the right amount of water at the right time, regardless of the availability of labor to turn valves on and off. In addition, farmers using automation equipment are able to reduce runoff from over watering saturated soils, avoid irrigating at the wrong time of day, which will improve crop performance by ensuring adequate water and nutrients when needed. Those valves may be easily automated by using controllers. Automating farm or nursery irrigation allows farmers to apply the right amount of water at the right time, regardless of the availability of labor to turn valves on and off. They lack in a featured mobile application developed for users with appropriate user interface. It only allows the user to monitor and maintain the moisture level remotely irrespective of time.
- Remote Sensing and Control of an Irrigation System Using a Distributed Wireless Sensor Network Yunseop (James) Kim, Member, IEEE, Robert G. Evans, and William M.Iversen [4]. The setup of technical system describe in this paper is broad based and is relatively one of the efficient systems that has developed windows application to monitor the field. Field is equipped with wireless communication sensors that avails better facilitated sensor communication and covers wider field area. Detailed description on site field sensors and Internet technology is described briefly. The statistical data provided is measured to be efficient and used for research work.

4. Advantage and disadvantage

The advantages of the smart irrigation system include flexibility, economical, easily configurable, robust, portable, reduced human intervention, reduced wastage of water, better productivity of crops, timely irrigation, enhanced landscape health, user friendly, time saving, saves money, maintaining is easier, management of higher flow rates, accurate cut-off of water, reduced costs for vehicles used to check irrigation, reduced runoff-off water and nutrients. Few disadvantages in this system include the costs for purchasing, installing and maintaining, increased maintenance of channels and equipment or the funding, very good cameras of high definition are required, poor image quality may effectiveness of the system, by the size of the image it becomes difficult and harder to recognize the face in small images and minute pics, Face symmetric are reliability, have massive storage to required system to work appropriately.

5. Conclusion

Our intention for this research was to establish a flexible, economical, easily configurable, and most importantly, portable system which can solve the problem of water wastage. It is a robust system and minor in size. It is capable of automatically controlling the water motor based on the feedback from the soil moisture sensor. This system can be used for small scale areas and will be beneficial for plant nurserys. By using the automatic irrigation system, it optimizes the usage of water by reducing wastage and reducing human intervention for farmers. It saves energy by using the solar panel which also helps the enviroment and is a user friendly system as it provides user to monitor the field by using mobile application also because it automatically controls the irrigation of the soil.

6. References

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