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INTELLIGENT AGRICULTURAL IRRIGATION SYSTEM BASED ON INTERNET OF THINGS

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ABSTRACT

A new developing technology, the internet of things, allows us to capture information from multiple devices like sensors, buildings, and homes. This information is stored in the Cloud and can be used in order to improve a service or enhance decision making. Internet of Things supports a Smart City vision; enhance the quality of public services and the life of its habitants. Smart Farming plays an important role and represents an essential component in Smart Cities. Moreover, the need of decreasing the waste of water has opened new research directions in finding solutions that help in saving water. In this paper, it has been proposed a solution for the intelligent irrigation of any type of crop, taking into account new technologies such as Internet of Things in order to improve irrigation systems. In order to show the feasibility of this proposed, an application of this solution has been presented.

Keywords: Internet Of Things (Iot), Smart Agriculture, Advanced Agriculture Practices, Urban Farming, Automation, Agriculture Robots, Moisture Sensor, Temperature Sensor, GSM.

I. INTRODUCTION

Latest technology using various sensors for precision agriculture has become popular research. The advantages of embedded system put into monitoring and control system for agriculture framework is being utilized by people these days.. The traditional way of analyze the soil parameters is doing an on-the-spot evaluation, which is always requires additional labor which is very inconvenient method. In order to overcome these problems, we designed a monitoring system which is Arduino based. Irrigation is the process of artificially watering the plants which helps for its growth. The wireless sensor monitoring system for drought was capable monitoring for extended periods on real–time basis and also capable of identify drought conditions at the earliest as possible and therefore we can take corrective measures accordingly. The soil conditions are monitored by the sensors and sends SMS accordingly.

The evolution of information technology has opened door to many impossibilities. Over years, our cell phones, tablets, automobiles, the rise of ”smart” technology have consumed the market and have become the new standard in the industries. Smart irrigation is one such technology which have attracted interest of many researchers and is evolving and improving from about a decade. This smart irrigation industry where water waste is minimized and is no longer sustainable socially, economically and conventionally as well. The idea and development of smart irrigation is basically focused onto reduce human efforts as well as reduce resources (water) and power consumption (electricity). Insatiable appetite for convenience and comfort and also to overcome natural barriers, there is a constant pull-on technology to develop more and more. On the other hand, growing demands for food due to population expansion put farmers to face many issues regarding the quantity and quality of crops which in fact made another challenge on researchers to develop and approach a fine smart irrigation system that would provide farmer a smart tool which support them in yielding quality crops. Although smart irrigation has developed but so far, no solution is obtained to measure accurate flow of water along with availability of data’s over website which could be fetched from anywhere in the world. Hence our prime move throughout the project work have been to design an irrigation system which provide all the above features along with conventional features available in smart irrigation such as measuring moisture profile of the field in order to prevent crops from water logging issues, temperature sensing is done so that one can check the temperature of the surrounding because crops are temperature sensitive too. The calculations are done by using different sensors. Further another advantage of the designed irrigation system is that it would keep the

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farmer up to date and also aware before any adverse situation come in. Thus helping the farmer to have control on the field 24x7

India occupies second rank in rice export and as rice crop require huge amount of water for irrigation purpose, hence smart irrigation has immense importance in India. In smart irrigation project we use different types of sensors to make a farmer up to date about the field. Sensors used are - soil moisture sensor, water flow sensor and temperature sensor (DHT11) like a sensor which can calculate the amount of water used in the field, a soil moisture sensor which can calculate the moisture profile of the field in order to prevent crops from water logging issues and a temperature sensing sensor so that one can check the temperature of the crops because crops are temperature sensitive too and if the smart system aware the farmer before then farmer can use sprinklers in order to cool down temperature of the crops it would save both crop and farmer. our approach is to make this system accessible from even far distance so that farmer have the information and control on the field 24x7 throughout a year. the whole setup is controlled by an Arduino which is a microcontroller and the data is sent and received by a Wi-Fi module i.e., NodeMCU.

OBJECTIVE

To improve and stabilize the crop yields of smallholder olive farmers through the implementation of sustainable irrigation systems. To promote water management practices that optimizes the volume and timing of water distribution. To generate positive economic consequences for farmers and their families. To minimize year to year yield fluctuations, leading to higher and more stable farm income.

II. LITERATURE SURVEY

Different types of implementations have been carried out in this area. Darshna et al., [2] present a prototype for monitoring an amount of soil moisture and temperature. There, a predefined range of soil moisture and temperature are set, and can vary with soil types or crop types. 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 activates the irrigation system and pumps water for watering the plants. However, this solution does not have an additional rain sensor in order to determine if there is a quantity of rain which alters the humidity of the layers of the soil and the quantity of water to be dispensed. Likewise, Feng [7] discusses the design of a wireless sensor network and an Internet technology of farmland automatic irrigation control method. They emphasize on an analysis of the routing protocol of sensor network nodes to achieve the system hardware and software design, middleware, a applications such as mobile phones or wireless PDAs of Internet of Things. However, the authors use a database which is hosted on a local server connected to Internet that does not take the advantages of cloud computing (e.g., high availability, pay-as you-go, measured service, elasticity, scalability) which can be used to improve the irrigation system. Moreover, Rahul Mishra et al.,2013;John, B., 2012 proposes a design for home automation system using ready-to use, cost effective and energy efficient devices including raspberry pi, Arduino microcontrollers, xbee modules and relay boards. Their design can be used in big agriculture fields as well as in small gardens via just sending an email to the system to water plants. They use ultrasound sensors and solenoid valves make a smart drip irrigation system. However, in ISD2017 CYPRUS their study the authors do not emphasize the way in which they automate the irrigation. Moreover, that solution does not include historical information about the system actions performed. Then, that solution does not use cloud computing and its advantages mentioned above. Besides, in Zaier et al., [6], authors present a fully automated and wireless irrigation control system that avoids subjective decisions about irrigation volumes and timing. In their contribution, all fields in the farm are accessible via TCP/IP protocol. Each farm has a Single Collecting Node for data collection connected to a host computer. Moreover, all nodes in a crop are connected to Xbee network and considered as Slave Nodes except one termed Master Node. Their irrigation control and monitoring program are implemented in the host computer in the farm, which monitors the states of all crops and controls the valves using a threshold and timers. The smart irrigation system has been installed in 14 farms. However, this solution does not use cloud computing and the processing of data should be in a master node in each crop, which makes the system dependent on the master node.

In this paper, data mining algorithms are used on agriculture data. They collected the dataset from agriculture university which contain various attributes like sample no., block no., soil type, pH value, EC, NPK. Initially datasets were in excel sheets are converted in .CSV file format to be accessed in WEKA. They used WEKA tool

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which is open-source software for data mining. Data sets contain instances with missing attribute value, noisy data and miss-match therefore they used WEKA filter techniques. Now the soil sample will be classified into two classes either suitable soil or non-suitable soil. The major condition for this classification is if the value of pH is greater than 8.5 then soil is non-suitable otherwise it is suitable for crop cultivation. Now they apply four different classification algorithms on preprocessed dataset and compare all the results and choose one classifier which gives best result. According to their system, J48 classifier gives best result with highest accuracy. Here we conclude that data mining plays a major role to improve the crop prediction in agriculture [9].

In this paper Many agricultural parameters are being monitored remotely to improve quality of farming. One of the most important parameters in farming is soil fertility i.e., ratio in which various nutrient essential for crop is present in soil. The system will analyze soil nutrient content at real time and make crop prediction. System will be built on Arduino. System will also suggest the crops on basis determined PH of soil(Bhambulkar, A.V. ,2011;Ganorkar R. A. et al. ,2014).

III. RESEARCH METHODOLOGY

Proposed irrigation system mainly consists of 3 modules- Sensor Module, pumping module and IoT module. The soil sensor sends signal to the controller - if the soil is DRY then pump, we use 5V DC submersible pump will start using relay and if the Soil is wet then pump will off be using relay. The logic is done in the programming to work

The temperature and humidity sensor we are using DHT11 which is connected to NodeMCU and we program it to send data to the cloud server. If temperature will rise then the pump automatically starts to maintain the temperature. The cloud server, we use MySQL database and PhP programming to see the data in the table format online

The primary goal of this system is to apply an optimum amount of irrigation throughout the fields. Sensor based irrigation has the potential to increase both the water use and economic efficiencies. The potential economic benefit of this irrigation system lies in reducing the cost of inputs or increasing yield for the same inputs. The traditional farm- land irrigation techniques require manual intervention. With the automated technology of irrigation the human intervention can be minimized. The benefits of this technology can be seen as follows:

- **Water savings**

It is reported by many researchers that this system is the most likely means of achieving significant water savings. It has been reported that the use of sensors with drip and sprinkler irrigation system can improve application efficiency of water up to 80-90% as against 40-45% in surface irrigation method. Blonquist et al., concluded that 16% of water could be saved in this irrigation practice.

- **Yield and profit**

It is reported that proper timing of irrigation is an important factor for production while delaying irrigation can result in losses of between US$ 62/ha and US$ 300/ha. The experimental studies were carried out by Sherine et al.

IV. PROPOSED SYSTEM

The proposed work will primarily help farmers improve yield rates by properly sensing temperature, humidity, moisture content and required moisture based on crop needs., protect fields without human intervention. Utilizing this IoT [9] will make the system more efficient.

The system primarily uses wireless sensors installed on farmland to collect data in real-time values. A master controller is built in to receive data and send it to the required controllers for timely action. Each sensor uses a GSM module to send data related to temperature, soil moisture and humidity to a processor and relay switching unit. Data received from the controller is stored on the cloud server. The cloud server acts as a decision maker to take necessary actions by comparing the received data with predefined data. Once the data is processed, the necessary actions are taken by the wireless sensor. A microcontroller controls the switching action of the relays and sends the final information to the user. This architecture was developed using Adriano-based technology to provide the highest scalability for the network. The work uses an Atmega microcontroller, and the agricultural system is primarily aimed at intelligent water use and improved crop quality and quantity. This proposal brings

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the maximum benefit to the user. By providing real-time information on soil conditions and using water intelligently and systematically, remote monitoring reduces human intervention and also reduces power consumption of irrigation pump sets. The proposed system has the following blocks.

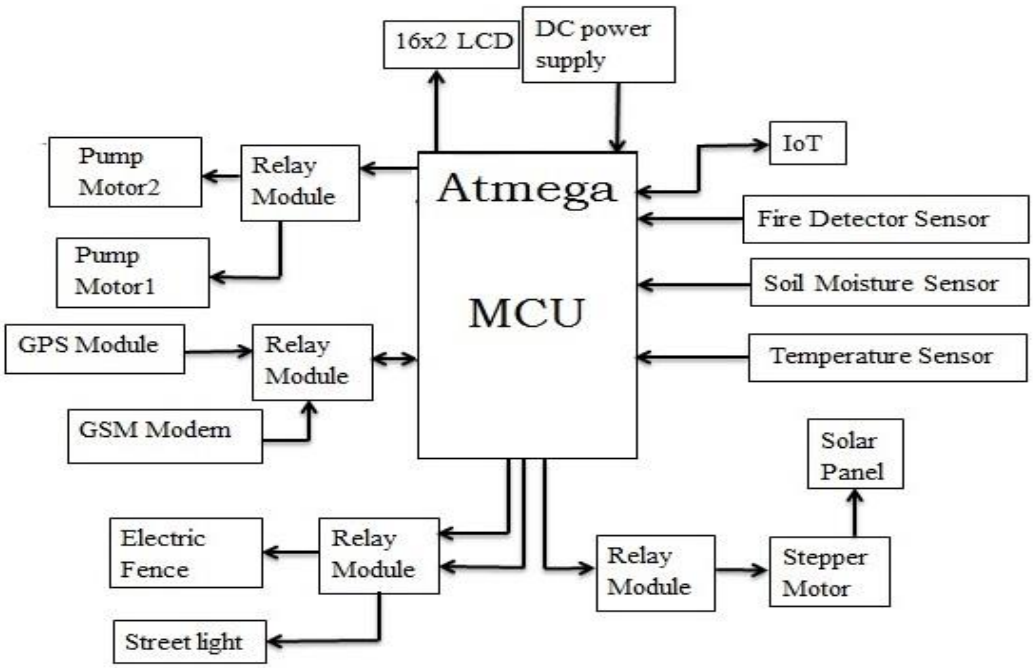

Fig.1 Block Diagram of the proposed Mobile integrated smart irrigation system using IoT

Microcontroller:- Atmega is the microcontroller used in this system for its simplicity, acting as the main controller for the entire system.

Soil Moisture Sensor: This sensor is used to detect the availability of water in the soil. It basically consists of two electrodes that generate electromagnetic field lines across this sensor and reach a range of about 3 cm with the help of waves. These sensors are designed to produce a voltage proportional to dielectric constant and are primarily used to measure soil resistance. High resistance means low humidity.

Smart Sensors:- These sensors are built into the microcontroller to perform the required sensing activities. Sensors can be temperature sensors to microcontrollers, fire alarm sensors, etc.

Fire Alarm Sensor: - This is a highly sensitive sensor, used to detect accidental fires in the field to be detected, the O/P of the sensor is passed to the microcontroller.

Relay Module: A separate hardware device used to remotely switch devices.

16x2 LCD: -This is an output display device that connects to the microcontroller's output pins to display data.

GPS Module: -The main function of this module is to send and receive messages to your smartphone. This module can only send messages to the farmer's phone, and the system is also integrated with a microcontroller, which can send a signal to the fire brigade in case of a fire incident.

IoT:- This is a cloud server whose main purpose is his IoT. Reference values are always preloaded based on these inputs sent by the microcontroller. Compare pre-installed parameters, compare actual values and send signals to farmers.

Motor: -This is a prototype design and uses a DC motor to pump water. (Refers to engine power)

V. WORKING MODEL DESCRIPTION

The block diagram in Figure 1 above shows the proposed system. It mainly consists of a sensor, an Atmega microcontroller, a GSM module and a relay switching unit. Parameters such as soil moisture, temperature and humidity are adjusted according to plant requirements. A microcontroller executes control actions through the server to control irrigation. The received data is sent over the internet to the cloud for final computational action. The master controller receives control actions from the cloud server and sends them to each controller, and the microcontroller performs the required actions. Here the cloud is responsible for making decisions at the right time Depending on the crop type, thresholds for soil moisture, temperature and humidity are set and

watering times can be changed based on these conditions. Model developed for proposed work. This model is a practical example of the proposed intelligent irrigation system. In this work, farmland is surrounded by an electric fence. The power required for the proposed system, farmers, and electric fences will be covered by solar power generation. The system powers street lights and fence lighting at night and automatically turns off during the day. Users can fully monitor activities without any intervention in the environment.

VI. CONCLUSION

The proposed work is a simple design that consumes less power and manages water consumption well, provides maximum yields together with intelligent crop protection, and offers maximum flexibility to your needs. is a cost-effective and intelligent irrigation system. of a farmer without his intervention.

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