Automated Irrigation System: A Survey

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Abstract- *The Internet of Things (IoT) has been denoted as a new wave of information and communication technology (ICT) advancements. The IoT is a multidisciplinary concept that encompasses a wide range of several technologies, application domains, device capabilities, and operational strategies, etc. The ongoing IoT research activities are directed towards the definition and design of standards and open architectures which is still have the issues requiring a global consensus before the final deployment.*

This paper gives over view about IoT technologies and applications related to agriculture with comparison of other survey papers and proposed a novel irrigation management system. Our main objective of this work is to for Farming where various new technologies to yield higher growth of the crops and their water supply. Automated control features with latest electronic technology using microcontroller which turns the pumping motor ON and OFF on detecting the dampness content of the earth and GSM phone line is proposed after measuring The temperature, humidity, and soil moisture.

Keywords- Internet of things, temperature, humidity, irrigation system, Arduino Mega.

I. INTRODUCTION

There are many techniques available for the precision agriculture to monitor and control, environment for the growth of many crops. Due to unequal distribution of rain water, it is very difficult to requirement needed farmer to manage the water equally to all the crops in whole farm it requires some irrigation method that suitable for any weather condition, soil types and variety of crops. Irrigation management is a important factor in agriculture allows the farmer to improve the cultivation in a way the plants need. According to the requirement of the crops the threshold will be set, if the any environmental condition like temperature, soil conditions and humidity goes below or above the threshold value, then IoT sense the changing in parameters are monitored simultaneously and all the data will be transmitted to farmers, according to that farmer will take the controlling decision and send to the system. The system will run the actuator and control the parameter. Types of sensor used and controlling action that are taken according to them

Temperature control **-** Growth of plantation depends on photosynthesis methods that is depends upon the radiation from the sun.

Humidity control **-**Water vapour is main problem that's affecting the growth of crops. Because of high humidity, chances of disease are increasing.

Soil control**-** Soil water also affects the crop growth. Therefore, the monitor & control of soil condition have a specific interest, because the good condition of a soil provides the proper yield.

The Proposal of the project is to develop a smart irrigation monitoring system using Arduino. Focus area will be parameters such as temperature and soil moisture. Traditional farming method is substitute to this system. We will develop such a system that will help a farmer to know his field status in his home or he may be residing in any part of the world. It proposes an automatic irrigation system for the agricultural lands.

II. LITERATURE SURVEY

The soil moisture sensor, temperature sensors placed in root zone of plant and gateway unit handles the sensor information and transmits data to a mobile application. The temperature sensor and soil moisture sensor threshold value can be measured by One algorithm that was programmed into a microcontroller to control water quantity.

The following survey describes the prior working methodology of the proposed approach.

H. Navarro-Hellín et al (2016) an automatic Smart Irrigation Decision Support System, SIDSS, is proposed to manage irrigation in agriculture.

Roussel N et al (2015) analyzed the time variations of signal-to-noise ratio(SNR) measurements linked to the dielectric constant of the surrounding soil, we use a method to recover the local fluctuations of the soil moisture content.

Bing Fu (2012) introduced a number of new technologies using as RFID, sensors and so on. This system contains three platforms. The decision is made through the mathematical model set up that capture the data of the growing melons

Alnaimi et al(2014) introduced a novel system by focusing through a solar concentrator which is then absorbed by the absorber of the stirling engine that increase the temperature for the fluid at one side. the sunlight absorbed is increased by installing the solar tracker on the solar concentrator sensors such as: temperature sensor and IR sensor are used for detecting temperature level variations and to calculate the rotational speed of flywheel in stirling engine respectively. Another one flow sensor is used to determine the water flow rate water pump.

Kavianand et al (2016) gives a novel complete automated drip irrigation system with ARM9 processor for controlling and monitoring purpose, for this same purpose GSM module is utilized which monitor PH content and the nitrogen content of the soil frequently. This proposed system alert user about any abnormal conditions such as temperature rise, less moisture content and, even concentration of CO2 via SMS through the GSM module.

Hao Wu et al (2016) A light-weight data encryption transmission solution based on SSL at the TCP/IP layer is designed to ensure the security of data transmission. A practical testbed based on Ali-Cloud is established to carry huge load of communication and data from an actual deployed agricultural IoT application. this framework is realized at low cost and easy to deploy.

Abrisqueta et al (2015) grouped different irrigation treatments two categories. These categories depend on the soil water status conditions and those scheduled on the basis of the atmospheric demand. Under the Mediterranean conditions the proposed model provides the guide for irrigation scheduling of early-maturing peach trees.

Campos et al (2016) introduced an enhanced algorithm for calibrating the soil water balance model (SWB) in terms of total available water (TAW) in the soil root zone. The TAW value is used after the calibration to estimate the actual evapotranspiration and water stress processes at canopy scales.

Giusti et al (2015) proposed a novel Fuzzy Decision Support System (FDSS) to enhance the irrigation, given the information on the crop and site characteristics. It combines a predictive model of soil moisture and an inference system that provides the most appropriate irrigation action to maintain a prescribed “safe” level. corn, kiwi, and potato are the three crops were used for testing this system. This system is compared with an existing agricultural model and data-base (IRRINET). The sensitivity of the proposed approach is tested with random rainfall.

Zwart et al(2004) specific locations, with specific cultural and water management practices. The CWP ranges for the four crops investigated are large as indicated by the high CV of 28–40% and are a logical consequence of the low correlation between ETact and crop yield (r2 = 0.09−0.39). This variability was mainly ascribed to: (1) climate; (2) irrigation water management and (3) soil (fertility) management, although more explanatory variables prevail.

Soulis et al (2015) proposed a investigation study on soil moisture sensors positioning and accuracy, which affect the performance of soil moisture. This system analyzed based on the surface drip irrigation scheduling systems by applying several conditions. The experimental evaluation provides clear evidence that irrigation efficiency is affected by soil moisture sensors positioning and accuracy based on drip irrigation scheduling systems.

Navarro-Hellín et al (2015) introduced a novel approach for the user to access the information obtained by different sensors from any device. The author used different wireless nodes equipped with GPRS connectivity. The entire node used in this approaches are completely autonomous and makes use of solar energy, giving it virtually unlimited autonomy. Remote server is used to send and stores the information of the sensors in a database, allowing further consultation and analysis of data in a efficient way.

Maton et al (2005) proposed a typologies from the three farming sub-systems and from irrigation strategies. Finally analyzed the links between the different typologies. Algorithm such as linear regressions multivariate analyses, cluster analyses, and regression trees were used in this approach. However, irrigation strategies is clearly explained by the theoretical irrigation capacit.

Ruiz-Canales and Ferrández-Villena proposed a methodology for assessment of the predictive ability of regression. This models is obtained via subset selection procedures, that is totally difficult to evaluate by normal approaches. The author obtain the Cross-validatory assessments of predictive ability.

S.no	Paper Title	Methodology	Benefits	Limitations	Ref
1	The Technology System Framework of the Internet of Things and Its Application Research in Agriculture	RFID, ZigBee, sensors, Cloud Computing	This system can realize the automatic configuration and self organized transmission of information collected node, realized the real-time collection, transmission, expression and storage of agricultural environmental information	soil PH value, light intensity and CO2 concentration measurement is not accurate	[16]
2	Modeling Agility in Internet of Things (IoT) Architecture	Complex and ever-evolving business requirements demand adoption of agile services in Internet of Things	intends to leverage the benefits offered by Agile Services in the application fields of Internet of Things ranging from smart agriculture and intelligent transportation	Delivery and Quality of service is poor	[17]
3	IOT Based Crop-Field Monitoring And Irrigation Automation	system is developed to monitor crop-field using sensors (soil moisture, temperature, humidity, Light) and automate the irrigation system	92% more efficient than the conventional approach. The notifications are sent to farmers' mobile periodically. The farmers' can able to monitor the field conditions from anywhere	Poor Performance in wastage reduction , effective usage of fertilizer	[18]
4	Application of the Inter Precision Agriculture IRrigation Systems	basic principles of Internet, with wireless sensor technology	reduce the impact of inadequate water resources	Limited support of automatic water irrigation due to basic technology	[19]
5	Design and implementation of the span greenhouse agriculture Internet of Things system	agricultural intelligent frequency conversion irrigation function, and automatic control function of greenhouse	the farmer achieved good economic and ecological benefits	Performance accuracy is low when compare to intelligent level of comprehensive agricultural zone	[20]
6	Regulation of water in agriculture field using Internet Of Things	ecosystem control technology	No day or night restrictions. This is helpful at any time.	Lack of exact information and communication leadsto the loss in production	[21]

III. PROPOSED METHODOLOGY

This prototype monitors the amount of soil moisture and temperature. A predefined range of soil moisture and temperature is set, and can be varied with soil type or crop type. 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 will activate the irrigation system, pumping water for watering the plants. The block diagram of smart irrigation system is represented in Fig1. It consists of a microcontroller (ATmega328) which is the brain of the system. Both the moisture and temperature sensors are connected to the input pins of the controller. The water pump and the servo motor are coupled with the output pins. If the sensors depart from the predefined range, the controller turns on the pump. The servo motor is used to control the angular position of the pipe, which ensures equal distribution of water to the soil.

To reduce the amount of field work for the farmer the application also offers wireless switching on-off of pumps for watering, irrigating. Wireless sensor network of soil moisture sensor, soil pH sensor and soil temperature sensor is connected to an Arduino Mega 2560 microcontroller board. The android application controls the pumps over GSM network via SMS (which enables pump control over long distances) and Bluetooth (when in close proximity for real time diagnosis of the sensor readings). This system can be implemented on a large scale for farming purposes, which can further prove to be more advantageous. Owing to prevailing conditions and water shortages, the optimum irrigation schedules should be determined especially in farms to conserve water.

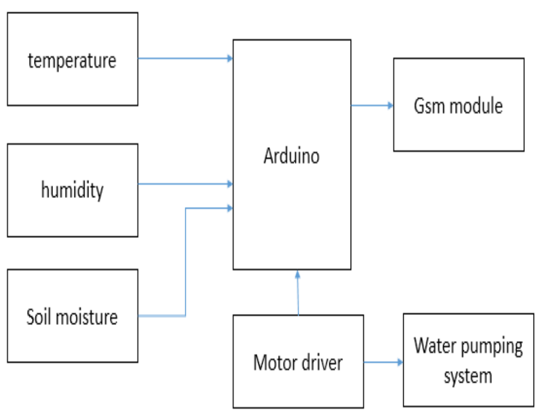

Fig 1. Architecture of proposed system

Benefits

- Real time information on the field irrigation.
- Supply of water based on the actual needs.
- Cost Reduction and resource optimization.
- Improves Environment quality and increases the irrigation.
- Reduce water logging and shortages.

IV. CONCLUSION AND FUTURE WORK

In the present era, the farmers use irrigation technique through the manual control, in which the farmers irrigate the land at regular intervals. This process seems to consume more water and results in water wastage. Moreover, in dry areas where there is inadequate rainfall, irrigation becomes difficult. Hence we require an automatic system that will precisely monitor and control the water requirements in the field. Installing Smart irrigation system saves time and ensures judicious usage of water. Moreover, this architecture uses microcontroller which promises an increase in system life by reducing power consumption. The entire system is monitored and controlled by the power full credit card sized microcontroller Arduino. It provides with several benefits and can operate with less manpower. The system supplies water only when the humidity in the soil goes below the reference. Due to the direct transfer of water to the roots water conservation takes place and also helps to maintain the moisture to soil ratio at the root zone constant to some extent. Thus the system is efficient and compatible to changing environment. Our Future work involves, a water meter installed to estimate the amount of water used for irrigation and thus giving a cost estimation. A solenoid valve can be used for varying the volume of water flow. Furthermore, Wireless sensors can also be used.

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