Arduino Based Smart Irrigation System in Environment Monitoring

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***Abstract*- Agriculture has a great control on the economy of the country since it is the cause of living of typical Indians. India is the crop growing based country. In ancient days, people totally depended on the agricultural reaping. In dry areas or in case of insufficient rainfall, irrigation becomes problematic. So, it needs to be controlled remotely for farmer safety. Mounting energy costs and decreasing water supplies reveal the need for healthier water management. Irrigation management helps to control when and how much water is essential to a growing crop. The farmer will not be noticed of existing environments if he is far-off from the agricultural land. A low cost alternative solution for efficient water monitoring currently in use is drip irrigation systems that consist of programmed processor to turn on & off the control values, which in turn helps the farmers by managing the water supply to the crop fields and supplementary keeps the humidity levels of soil that helps in better crop production. In this proposed system, it probes into the design of the mindless irrigation system based on Arduino and IOT technology. It uses temperature and soil moisture sensors to detect the water quantity present in agriculture. Arduino board is used to processes the information and acts according to the data.**

Index Terms- Water-reduction irrigation, Wireless device, efficient management, Time reduction

I. INTRODUCTION

Even in the modern span of industrialization, agriculture is the key area that decides the economic growth of the country. India is basically the agricultural country, and all its resources depend on the agricultural output. It also accounts for 8.56% of the country's total exports. Agriculture is the most significant meadow as compared to others in India. The ground water level is leisurely falling down and as well as rainfall is also reduced owing to deforestation. With the intention of getting maximum yield in agricultural process, it is necessary to supply the optimum quantity of water, and it should be supplied periodically. This is achieved only through a systematic irrigation system. Irrigation is the science of planning and designing a proficient, low-cost, economic irrigation system in trade and industry designed in such a way to fit natural conditions. By the edifice of proper distribution system and providing of adequate water supply will increase the yield of crops. The different methods of supplying water to the fields are: Surface irrigation, Sub-surface irrigation and Sprinkler irrigation.

The evolution of information technology has paved way to numerous impossibilities. Over years, our cell phones, tablets, automobiles, the mount of smart technology have consumed the market and have become the novel standard in the industries. Smart irrigation is one such technology which has attracted interest of many researchers and is evolving and improving from about a decade. Here smart irrigation industry where water waste is minimized and no longer sustainable socially, economically and conventionally. The thought and development of smart irrigation is basically focused onto reduce human efforts as well as diminish resources (water) and power consumption (electricity). 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 infect made another confront on researchers to develop and approach a excellent 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 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 farmer up to date and also aware before any adverse situation come in. Thus helping the farmer to have control on the field 24x7. Embedded systems are computer systems that are fraction of larger systems and they carry out some of the requirements of these systems. Some examples of such systems are auto mobile control systems; industrial processes control systems, mobile phones, or small sensor controllers.

Embedded systems cover a huge range of computer systems from ultra small computer-based devices to large systems monitoring and controlling intricate processes. The overwhelming number of computer systems belongs to embedded systems: 99% of all computing units belong to embedded systems these days. Most of such embedded systems are also characterized as real time systems, which mean that the real-time properties such as response time, worse case execution time, etc., are important design concerns. These systems usually must meet rigorous specifications for safety, reliability, availability and other attributes of dependability. Due to undersized size and requirements for mobility, but also extremely low production costs these systems require small and controlled resource consumption, and have limited hardware capacity.

II. OBJECTIVE

There is a vital want for a system that makes the agricultural process easier and burden free from the farmer's perspective. With the modern advancement of technology it has become necessary. The ability to produce fine quality crops is one of the main aims of incorporating such technology into the agricultural domain of the country. It is an intricate decision making process to determine when and how much water to apply to a growing crop to meet specific management objectives.

To enlarge the annual crop production output entirely agro-centric economy. The major objective of the proposed system is to conserve the natural resources as well as giving a splendid boost to the production of the crops and to save farmer's effort, water and time, Irrigation management. User can also able to monitor and manage the Drip Irrigation from anywhere via Android mobile.

If the farmer is far away from the agricultural land he will not be noticed of existing conditions. So, proficient water management plays an important role in the Irrigated agricultural cropping systems. Scheduling is achieved by monitoring soil, water status with tension meters underneath drip irrigation by the automation controller system in sandy soil mainly in several of the irrigation system. A real time efficient feedback control system for monitoring and controlling all the behavior of drip irrigation system in the design of Micro-controller based drip irrigation mechanism is proposed. Control values of the Irrigation system are measured using automated controller that allows the farmer to supply the accurate amount of water at the right time, regardless of the availability of the labor to turn valves. Different types of irrigation systems are used to implement dexterous irrigation scheme for the field having different crops with efficient management. The drip irrigation system can be further enhanced by using fuzzy logic controller. The accuracy of the measured value and assists in decision making is enlarged using fuzzy logic scheme. In India the greenhouse based modern agriculture industries are the sources of modern requirement in every part of agriculture. The humidity and temperature of plants are precisely controlled and monitored using the proposed smart irrigation system.

III. LITERATURE SURVEY

GEORGE MOIS, research titled "Analysis of Three IoT-Based Wireless Sensors for Environmental Monitors" proposed, Increase in the importance of wireless sensor networks for Gathering data about the environment have changed due to the climatic factor. Recent advancements, such as the transmission and management of enormous amounts of data regarding the trends observed in environmental parameters provide support for the vision of the Internet of Things (IoT), the cloud computing system, and

cyber-physical systems. In this context, the current work presents three different IoT-based wireless sensors for environmental and ambient monitoring: one employing User Datagram Protocol (UDP)-based Wi-Fi communication and next communicates through Wi-Fi and Hypertext Transfer Protocol (HTTP), and third one uses Smart Bluetooth. All of the presented systems provide the opportunity of recording data at isolated locations and of visualizing them from every device with an Internet connection, enabling the monitoring of geographically bulky areas. The development particulars of these systems are described, along with the major differences and similarities between them. The possibility of the three developed systems for implementing monitoring applications, taking into account their energy autonomy, ease of use, solution complexity, and Internet connectivity facility, was analyzed, and they make enhanced candidates for IoT-based solutions.

VEENADIVYA.K, AYUSHAKHOURI "A Real time implementation of a GSM based Automated Irrigation Control System using drip Irrigation Methodology" deal GSM based Irrigation Control System, the facilities of maintaining uniform environmental conditions is provided in this methodology. A software system known as Android is employed for mobile devices that embrace an operating system, middleware and key applications for the purpose of monitoring. The Android SDK provides the tools and APIs that are essential to initiate developing applications on the Android platform by means of the Java programming language. Mobile phones have virtually become an integral part for serving multiple wants of humans. This Automated Irrigation System application makes use of the GPRS aspect of mobile phone as a result for drastic irrigation control system. This system lined with lower range of agriculture land and not economical value.

MANSOUR, "Impact The Automatic Control Of Closed Circuits Raingun Irrigation System On Yellow Corn Growth And Yield" a customized irrigation system on yellow corn crop vegetative and yield parameters underneath (KSA) Saudi Arabia conditions at Al-Hasa region deals with the automatic control of closed circuits and drip irrigation system. The field experiment passed out under automatic irrigation system for three irrigation lateral lines 40, 60, 80 m below the following three drip irrigation circuits (DIC) of: a) one manifold for lateral lines or closed circuits with another one manifold of drip irrigation system (CM1DIS); b) closed circuits with two manifolds for lateral lines (CM2DIS), in order to pay compensation for salt leaching requirement and acquire more power with the circuits.

M. GUERBAOUI,"PC Based Automated Drip Irrigation" said that the main contribution of Automated drip irrigation is to develop the greenhouse fabrication in Morocco. The proposition involves the management of an integrated system for the automation of the drip fertilizing irrigation control system in green house. Which adopts the involvement of a data acquisition card (PCL-812PG) controlled by computer system for the production of good quality crops. A hydraulic circuit based on an electric pump is irrigation is generated in this system. The amount of Water needed for the crop is tested by measuring soil water status by soil humidity sensor.

PURNIMA,"Design of Remote Monitoring and Control System with Automatic Irrigation System using Bluetooth" proposed, artificially supplying water to land where crops are cultivated. Traditionally hand pumps; canal water and rainfall were a major source of water supply for irrigation. This method has led to severe pitfalls like under irrigation, over-irrigation which in turn causes leaching and loss of nutrient content of soil. Changing environmental circumstances and shortage of water have paved the need for a system which efficiently manages irrigation of fields. Automated irrigation system is a machine based system, which automates the irrigation of land by merging various software and hardware approaches together for field irrigation.

IV RESEARCH METHODOLOGY

4.1. Research Technologies:

The term Internet of Things appears to have been coined by a member of The RFID development community around 2000, who referred to the opportunity of discovering information about a tagged object by surfing an Internet address or database entry that correspond to a particular RFID. Visionaries have seized on the phrase "Internet of Things" that time to refer to the general idea of things, especially everyday substance that are readable, recognizable, locatable, addressable, and/or controllable by means of the Internet- whether via

RFID, wireless LAN, wide-area network, or other means.

The Arduino Uno is a microcontroller board that depends on the ATmega328. It comprises of 14 digital Input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything desirable to Support the microcontroller; simply attach it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to embark. The Uno differs from all prior boards in that it does not use the FTDI USB-to-serial driver chip. The Arduino Uno and version 1.0 will be the reference versions of Arduino, heading forward. The Uno is the most recent series of USB Arduino boards, and the reference model for the Arduino platform; for contrast with previous versions.

4.2. Proposed Work

The insecticide quantity decrease is lectured by capitals of a pioneering mishmash of the wireless sensor system. The future solution introduces the approximation of the latitudinal supply of the optimum dosage. The devotion to the environmental sustainability of agriculture and to the bargain of insecticide use for organic tilling is rapidly increasing. However, the adeptness limits of the mass making require the minimization of yield losses due to impurities. New disease control tactics are required to find the best trade-off between commercial and ecological aspects.

A minor prototype is designed which consist of some plants linked to a multi sensor. Multi sensor is a grouping of temperature sensor, humidity sensor, motion sensor, light sensor, vibrating sensor and UV sensor. A logical scheme which roles to study a example for the company of a definite multiple is known as sensor. The humidity and pH value spotted by the multi sensor is taken by interfacing arduino which is permitted to the planters mobile using GSM.GSM (Global System for Mobile communication) is a digital mobile telephony system that is broadly used in all parts of the world. GSM uses a inequality of time division multiple access (TDMA) and is the most widely used of the three digital wireless telephony machineries (TDMA, GSM, and CDMA).By noticing the level of pesticide we can accordingly reduce its measure.

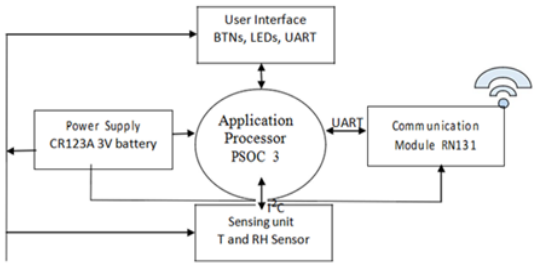

Fig. 4.2.1 Automation System Architecture

The current changes in climate have improved the significance of environmental monitoring, making it a topical and highly vigorous research area. This field is based on remote sensing and on wireless sensor networks for congregation of data about the environment. Modern advancements, such as the vision of the Internet of Things (IoT), the cloud computing model, and cyber-physical systems, provide support for the transmission and management of huge amounts of data regarding environmental parameters.

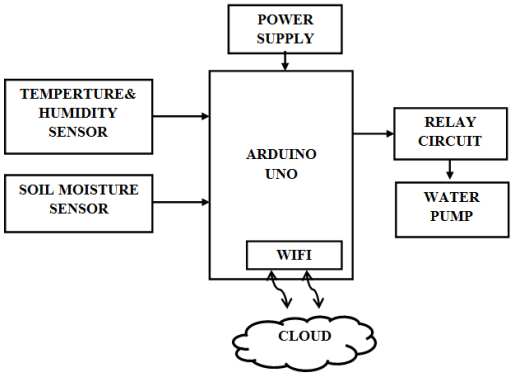

Fig. 4.2.2 Smart Irrigation System Architecture

The smart irrigation system is comprised of major units (ref. fig. 4.2.2) one is wireless sensor unit (WSU) and another is Wireless information unit (WIU). The transmission section which transmits the sensor data to the wireless information unit is mainly carried out by the Wireless sensor unit. Wireless information unit is the section which consists of sensors that receives the sensor data from wireless sensor unit. A Wireless Sensor Unit (WSU) is comprised of a RF transceiver, different sensors (namely, soil moisture, temperature, and humidity sensors), a micro-controller, and power sources. Each unit is based on the microcontroller system that controls and processes information from the soil-moisture sensor, temperature sensor and water level sensor.

The sensor data from different sensors in this wireless sensor unit or transmission unit (Soil moisture, temperature, humidity) are collected and processed in the main controller. The transmission section consists of LCD display which shows the sensed data from various sensors. Arduino controller is programmed to provide some threshold values of temperature and soil moisture which displays the sensed values in LCD, the transmission section of Smart Irrigation System.

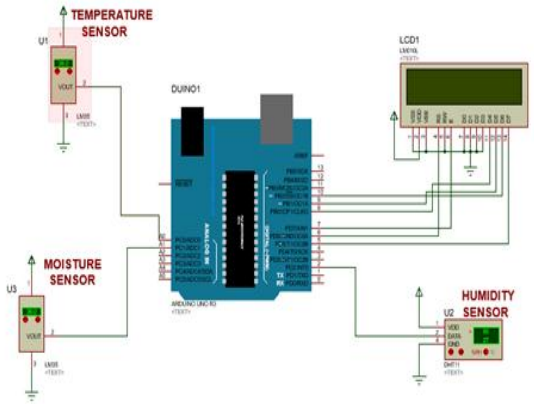

Fig. 4.2.3 Circuit Diagram

4.3. Units of Proposed System

The block diagram of the proposed system comprises of identifying unit such as Soil Moisture Sensor to measure water gratified of soil.

Arduino uno - An exposed source podium which involves of both a physical programming circuit board (Micro controller) and a piece of software (Integrated development Environment).

Relay - Switches that open and close circuits electronically and electro magnetically. Control of the electrical circuit is by opening and closing contacts in another circuit.

Soil Moisture Sensor - The Soil Moisture Sensor(SMS) is a sensor associated to an irrigation system director that computess soil moisture value that contented in the active root zone ahead of each scheduled irrigation event and by passing the cycle if sogginess is above a user defined set point.

Temperature sensor& humidity sensor- A calibrated digital signal output is featured by the DHT11Temperature and Humidity Sensor with the complex values of temperature and humidity sensor. This smart irrigation system ensures the drastic reliability and admirable long-term stability of the measured sensor content. A high- performance 8-bit microcontroller is associated to the Sensor which is programmed to obtain the sensor values. A sense of wet NTC temperature measuring devices and a resistive element is included in this component. The merits are listed such as excellent quality, fast response, anti-interference ability and high cost performance and increased productivity.

LCD Display A liquid-crystal display (LCD) is a flat panel display, electronic visual display, or video display that uses the light modulating aspects of liquid crystals. Liquid crystals do not emit light directly. LCDs are accessible to display arbitrary images (as in a general-purpose computer display) or fixed images with stumpy information content which can be displayed or hidden, such as preset words, digits, and seven-segment displays as contained in a digital clock. They use the equivalent basic technology, excluding that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

V CONCLUSION

This proposed technique is designed to control a water pump based on the soil moisture sensors value in fields. The switching mechanism can be done with the aid of GSM with microcontroller via relays. The proposed controller eliminates the on-place switching mechanism followed by the farmers to ON/OFF the irrigation system. Integrating features of all the hardware components included in this have been developed in it. Presence of each module has been articulated out and placed carefully, thus contributing to the finest working of the unit. Secondly, using extremely advanced IC's with the help of budding technologies, the project has been successfully implemented. The smart irrigation system implementation was found to be feasible and cost effective for optimizing water resource for efficient agricultural production and time saving process. This irrigation system allows cultivation of various crops in the places with water scarcity in that way for improving sustainability and crop production. The developed smart irrigation system proves that the consumption of water can be diminished for a given amount of fresh biomass production and management. In this smart irrigation system, pertinent and drastically important for organic crops and other agricultural products that are

geographically secluded, where the investment in electric power supply would be expensive. The irrigation system can be accustomed to a variety of specific crop needs and requires least amount of maintenance. The modular configuration of the micro irrigation system architecture allows it to be scaled up for larger greenhouses or open fields. In addition to that other applications such as temperature monitoring in manure production can be easily implemented. The Internet controlled duplex communication system provides an authoritative decision making device concept for adaptation to several cultivation scenarios.

VI FUTURE ENHANCEMENT

Furthermore, the Internet link allows the supervision all the way through mobile telecommunication devices, such as a smart phone. Besides the monetary savings in consumption of water, the importance of the preservation of this natural resource justifies the use of this kind of irrigation systems. Due to the variability in the nature of the soil, the number of soil water sensors and location may be crucial and a specific calibration should be included in the future work. Solar panels can be used as a source of power supply which can be an added advantage of the smart irrigation system. Addition of extra sensors like gas sensor, voltage sensor, pH sensor helps to identify which crop grows well in the particular soil.

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