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Web Based Intelligent Irrigation System Using Wireless Sensor Network

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ABSTRACT: intelligent irrigation system consists of a wireless sensor network that monitors the weather and soil conditions. Wireless sensor network is used for the monitoring purpose. The monitored data is analyzed using the Raspberry Pi and the controlling action is taken, also the data is provided to the farmers through the cloud on their Web. Agriculture sector being the base of Indian economy should be protected and maintained. Security not only for resources only but also agricultural products needs security and protection at very initial stage. The binding of conventional approach with modern technologies such as Wireless Sensor Networks results into agricultural modernization. Wireless Sensor Network (WSN) based device which has ability of analyzing the sensed information and then transmitting it to the user. This Project can be handled and monitored from distant areas and it can be used in agricultural fields. This paper is oriented to accentuate the methods to solve such problems like identification of crop, whichcrop is suitable for soil according to pH & temperature in the surrounding, level of water in soil, pH of water content in soil, PIR sensor for security of crops.

KEYWORDS: Soil moisture sensor, pH sensor, PIR sensor, Raspberry Pi 3.

I. INTRODUCTION

Agriculture playing a major role in monetary development of most nations, agricultural production has been experiencing the continuous improvement of its processes and techniques. Advances in embedded electronics, local wireless connectivity, and efforts in developing communication protocols and hardware for interconnecting networks to IP (Internet Protocol) based Internet has paved the way for the wide scale distribution of IoT (Internet-of-Things) network.

The objective of this project is to improve products quality, and to maintain a sustainable agriculture, by collecting real-time data from the environment. So, there is the need for optimizing the resources employed in the agricultural processes, mainly in the irrigation system. For every crop the water required is different according their growth. The water provided by pump is not enough for the plants for their healthy growth.

So as per the crop requirement it provides the water by monitoring the moisture level of the crop. Currently, agriculture put away about 70% of the fresh water. This percentage can be decreased by performing adequate water management when it comes to irrigation. This project uses the water efficiently, in right proportion and covers the entire field. It brings wide benefits, i.e. water savings, money savings plus the improvement of crop quality. The most important agricultural process, which can be well ordered and adapted to better suit the plants growth, is related to irrigation. Crop selection for the soil is important concept for this. In this project pH sensor is useful in recognizing the soil quality for crop growth. The users then control the entire agriculture system using their phone through web.

II. EXISTING SYSTEM

At present, the requirement of water is rising as more than dualistic as the rate of population increases. Due to the shortage of water resources, there is a necessity for water saving irrigation technology for agriculture. The arid regions having very little shrimp of water and that has to be utilized very efficiently. In conventional water irrigation system the misuse of water is very high. Therefore, the conventional method can be replaced by drip irrigation technology.

A new thought for saving each drops of water by testing the soil conditions before supplying water to the crop field. This functioning will cut down the task at hands of the cultivator and help to maintain suitable soil conditions for the

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progress of crop production. With this technology up gradation is possible to design systems that eradicate the direct participation of the cultivator in the irrigation field. For the sustainable utilization of water and its resources, the rainwater is hoarded in a tank and it is utilize for irrigation or directed to recharge groundwater. The rainwater is utilized for agriculture in rainy seasons and the well or bore well water is consumed for other times. The entire sensor network is analyzed by the micro- controller and the sensors data to irrigation control center (ICC).
In ICC, the whole drip irrigation is controlled by the electromagnetic actuators. The ICC has two technologies one is GSM and secondary one is the ARM controller. The GSM serves as the major part for handling the drip irrigation which sending the information to the cultivator using SMS to a mobile device. Then the user controls the entire agriculture irrigation system through SMS.

A. Existing System Architecture

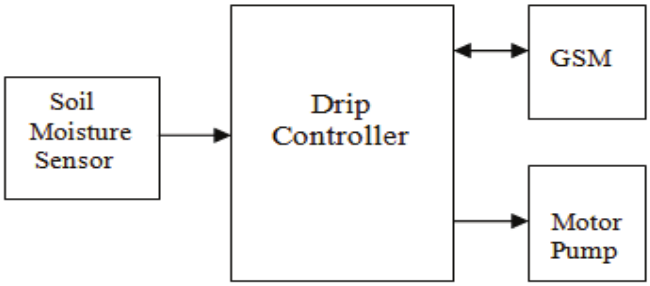

Fig.1 Block diagram of Wireless Sensor Based Control system

III. PROPOSED SYSTEM

A. Problem statement

The objective of this project is to improve products quality, as well as maintain a sustainable agriculture by collecting real-time data from the environment. There is need for water saving irrigation technology for agriculture and security for the crops.

B. Proposed System Architecture

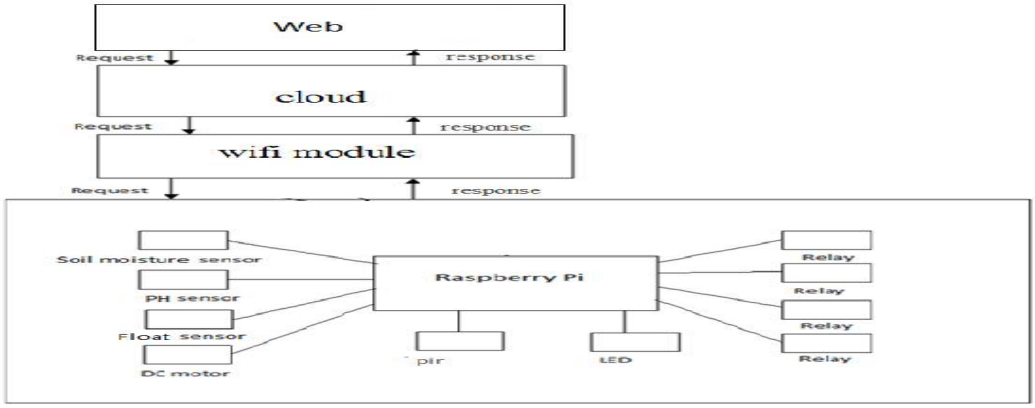

Fig.2 Block diagram of Proposed System.

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C. Proposed System Implementation

Our system uses, soil moisture sensor to measure the moisture content in soil, pH sensor is used to check the acidic level of the soil due to this we can select which crop is suitable for sowing in the field, flow sensor is used to determine the amount of water in the tank, wells etc. and prevent damage of motors.

DC motor is used to indicate the stream of water given to crop. It also supervises and control the real time trailing and switching of all their electrical devices through an web based application. The system is affiliated to this application using internet connectivity for communication.

The model has an option of controlling devices by either sending tap- to-toggle system. It is Raspberry Pi certificated and structured to be hardware, software, and pin compatible with large range of Raspberry Pi shields. The app is android /web based which is joined to the internet through Wi-Fi.

It connects to the putty based server which is linked to cloud server over the internet and lets the users to monitor with the aid of an internal web apps and toggles the switching by tap-to-touch.The web application controls the agricultural fields by performing various actions. It checks the level of the water in the tanks, wells, displays various sort of readings and gives notifications regarding it. The main task of these project is to give information, such as which crop is suitable for which types of soil and what sort of crops can be sown according to the the pH values of soil and control various mechanisms.

D. Modules

D.1.1 Raspberry Pi3 B

The Raspberry Pi 3 is here to endow you with the same Pi as before but now with dualistic ram and a much accelerated processor. It is minute sized computer which is proficient of performing similar things like desktop/PC it also performs high-definition video and games. It can run certain types of Linux OS and windows also. It is meant for teaching kids all over the globe, to learn how to program. Oh yeah, and it still does all that for under $50.

The mysterious nerve that makes this computer so minute and drastic is the Broad-com BCM2836, an ARMv8 Quad Core Processor (SOC), running at 900MHz, and a Video core 4 GPU. Raspberry Pi 3 when plugged into our HDTV, we can watch Blu-Ray quality video, using H.264 at 40MBits/s. The topmost change that has been on the up with the Raspberry Pi 3 is an elevation to the main processor and ram of 1GB. The RPi3 uses a micro-SD card to hold system capacity. Many of the Linux distributions for the Pi 3 will work on a 4GB micro-SD card but larger cards are also supported.RPi3 has 802.11n Wireless LAN with Bluetooth 4.1& Bluetooth low energy(BLE).

D.1.2 Wi-Fi module

Wi-Fi module Wi-Fi is defined as an acronym for wireless fidelity. In Wi-Fi we can access or connect to a network using radio waves, without using wires. An example of Wi-Fi is when you go to Starbucks and can join on their network to get on the Internet without having to connect your computer to any wires. WiFi permit computers, PDA 's and other devices to access the wired connection in a wireless mode. The 802.11 standard defines the wireless communication operating via electromagnetic waves.

D.1.3 Soil moisture sensor

Soil moisture sensor These sensor determine the volumetric water content in soil. The gravimetric amount of free soil moisture requires removing, airing, and weighting of a sample, it measures the volumetric water composition indirectly by using some additional property of the soil, such as electrical resistance, dielectric constant, or interaction with neutrons,pH as a proxy for the moisture content. The alliance between the deliberate property and soil moisture must be calibrated and may fluctuate depending on environmental aspects as follows soil type,temperature, or electric conductivity. Reflected microwave radiation is pretended by the soil moisture and is spent for distant sensing in hydrology and agriculture. Handy probe instruments can be expended by farmers or gardeners. Soil moisture sensors is a sensor that is used to determine the volumetric water content in the soil. Another class of sensors measure another asset of moisture in soils called water potential.

D.1.4 pH sensor

A pH Meter is a technical tool that is used for measuring the hydrogen-ion concentration (or pH) in a solution, referring its acidity or alkalinity. The pH meter means the difference in electrical potential between a pH electrode and a reference electrode. It consists of a glass electrode and a calomel reference electrode, or a combination electrode. A special probe is used to measure the pH of semi-solid substances.

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D.1.5 Level sensor

Water Sensor is simple and easy to use, and high cost performance, water/water identification detection sensor. Exposed through a series of parallel wire line mark to measure the water droplets/size to determine water level.Easy to complete the water to the conversion of the analog signal, output of the simulation values can be read directly by Arduino board, to achieve the effect of water level alarm.

D.1.6 Relay

Typically,many of the high end industrial functional devices have relays for their efficient operation. Relays are easy switches which are explored both electrically and mechanically. Relays are made up of a n electromagnet and also a set of contacts. The switching operation is done with the aid of the electromagnet. There are also other managing ideals for its operation. But they differ according to their applications. The majority of the devices have the claim of relays. The key process of a relay is used in places where only a low-power signal can be used to operate a circuit.

Relays are also used in places where a single signal is used to control a clump of circuits. The application of relays started during the discovery of telephones. They deceived a major role in switching calls in telephone exchanges. Relay were also used in long distance telegraphy. Relay were used to send the signal coming from one source to another destination. After the discovery of computers relay were used to carry out Boolean and other logical operations. The high-end claim of relays need high power to be driven by electric motors. Such relays are called contactors.

D.1.7 Buzzer

A buzzer or beeper is an audial signaling tool, which may be mechanical, electro-mechanical, or piezoelectric. Typically use of buzzers and beepers involve alarm devices, timers and verifying user input,that is mouse click or keystroke.

D.1.8 PIR sensor

A PIR-based motion detector is used to sense movement of people, animals, or other objects. They are commonly used in burglar alarms and automatically-activated lighting systems. They are commonly called simply "PIR", or sometimes "PID", for "passive infrared detector". Infrared radiation enters through the front of the sensor, known as the 'sensor face'. At the core of a PIR sensor is a solid state sensor or set of sensors, made from pyroelectric materials—materials which generate energy when exposed to heat. Typically, the sensors are approximately 1/4-inch square (40 mm^2), and take the form of a thin film. Materials commonly used in PIR sensors include gallium nitride (GaN),Caesiumnitrate ($CsNO_3$), polyvinyl fluorides, derivatives of phenyl pyridine, and cobalt phthalocyanine. The sensor is often manufactured as part of an integrated circuit.

IV. IMPLEMENTATION & RESULTS

Fig 4.1 Hardware Circuit setup of proposed system.

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In this proposed wireless sensor based control system in agriculture field. We are using wireless sensors are used to sense the moisture level of the soil, pH of water in soil, temperature, Security of crops without manpower. There is a sensor unit i.e. a soil moisture sensor, which helps to identify the moisture level of the soil by inserting it into the soil, pH helps to determine the pH of water in the soil is suitable for growing the crop or not, PIR provides security to crops. Hardware test bench set up of the system is shown in Figure 4.1. The sensor contents are sensed and it is given to the Raspberry Pi controller which controls the entire system. The Raspberry Pi controller gives a pulse to the Wi-fi module which is used here as a communication interfacing unit. The Wi-fihelps in send and receive the information which the user send or receive.

The cultivator present far away from the agriculture field can easily control the field. From the Raspberry Pi module provided in the field, user gets an alert when the moisture sensor output is less than that of the threshold moisture level that there is a need of water (Low Water Turn on PUMP) it gives an alert to the user as ‘’Pump ON’’. When the soil moisture level is greater than threshold value the system automatically turn off the motor pump and at the same time it also informs the user though another message ‘’Pump OFF’’ without delay on the web portal. This entire system works in fraction of seconds without any delay. The system also works on crop identification based on temperature and pH, which crop is suitable for growing in that soil according to climatic condition. PIR sensor provides security to crops.

Fig 4.2 Notification about low water level & Motor ON.

The indication from the Raspberry Pi module to the cultivator. If the moisture level is low i.e. below threshold. The Motor ON message is displayed on the web portal and the farmer gets the notification on screen that the Motor is switch ON. The fig 4.2 shows the Automatic mechanism of motor to switch on & off upon the moisture level.

Fig 4.3Motor OFF Notification &Sensors mechanism.

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The indication from the Raspberry Pi module to the cultivator. If the moisture level is Highi.e. Above threshold. The Motor OFF message is displayed on the web portal and the farmer gets the notification on screen that the Motor is switch OFF.
The current surrounding temperature is displayed in the above fig 4.3. The PIR sensor detects the birds, animals and give notification regarding it on the portal such as Detected or Not Detected. Water level increases as the sensor is dipped in the water. Moisture value on the portal decreases when there in increase in water level in the soil & increases when the water level decreases in the soil.
According to the temperature and pH value the system displays the crop suitable for growing in that soil based on current climatic condition as shown in fig 4.2. The crops display in the fig 4.2 are for summer season or Kharif season.

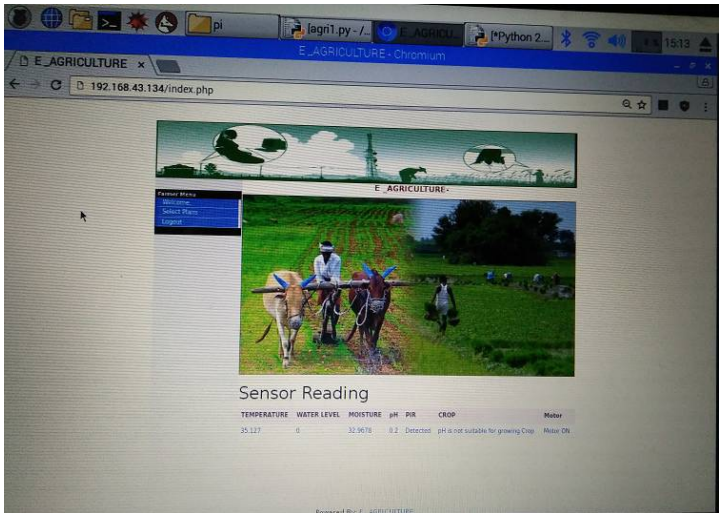

Fig 4.4 Low pH alert message.

If the pH value detected by the sensor is below threshold value and too low then it displays the notification regarding pH value, that it is not suitable for growing crops.
In proposed, we made sensor network for monitoring the crop field area by deploying sensors in the field. From those results, we decided which crop is to be sown, what is the temperature, pH of the water in soil, moisture content. From the above methodology, we can conserve water and minimize the problem of water logging in the land.
In present irrigation system, the fertilizer level is increasing, which affects people. Using pH sensors, we get the information about the soil and analyze the acid content, by which we can apply required fertilizers to the place where it needs, and avoid over fertilization of the field area. Temperature is a randomly varying quantity in the environment of farm. Using temperature sensors, we can detect the temperature, and provide water to the crop in cultivated area.
This system will be very economical in terms of the hardware cost and power consumption. This helps in precious saving of water and electricity, reduces manpower and eases the job of the person. It can be implemented in large agricultural areas. By the use of the Raspberry Pi the user can control the field from remote places.

V. CONCLUSION & FUTURE SCOPE

In this paper, we planned a Wireless Sensor Network system which has many applications in diverse areas. It has been matured for Smart Irrigation System. The study has incorporated major WSN based automated agriculture monitoring system. This system hand-out the design of intelligent farming using WSN. By using this system, the farmers can get the information& notification of various mechanism performed in the farm, through various sensors. There are some problems found in WSN and Smart irrigation. New technologies could help to minimize them by achieving the better security & authentication concept along with soil quality and unwanted desolation of water.

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This system presents the problems and challenges that could come. Various existing condition such as Raspberry Pi kit, Wi-Fi module, soil moisture sensor, pH sensor, Float sensor, PIR sensors are currently used for monitoring the field. In future, we will work on developing a web based intelligent irrigation system which will work on water excavation problems in the field/water logging problem. We will also focus on developing mobile application for these projects.

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