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Application and Evaluation of IoT Based Wireless Sensor Network in Water Irrigation Control Monitoring System

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ABSTRACT: This project demonstrates the concept of “IoT Based Wireless Sensor Network in Water Irrigation Control Monitoring System”. Currently it is time consuming and need of manual application on a irrigation system to control the pumping the water to the farm filed. Using this IoT based wireless technology we can control the pumping of the water according to condition of the soil at the remote location. In irrigation field, soil moisture and humidity sensors are placing and microcontroller handles the sensor information and transmits data. Water level sensor is placed inside the tank to monitor the water level. The threshold values of temperature and humidity given by the humidity sensor and soil moisture sensor that was programmed into a microcontroller to control water quantity .Sensors sense water level continuously and give the information to farmer through thingspeak site. Farmer controls the motor using the site without going in paddy field. If the water level reaches at danger level, automatically motor will be off without conformation of farmer.

KEYWORDS: Temperature sensor and humidity sensor, Moisture sensor, Water level sensor, Irrigation system

I. INTRODUCTION

India is the country of villages and agriculture plays an important role for development of country. In our country, agriculture depends on the monsoons which has insufficient source of water. In Irrigation system, depending upon the soil type, water is provided to plant. In agriculture, two things are very important, first to get information of about the fertility of soil and second to measure moisture, humidity content in soil. Now a days, for irrigation, different techniques are available which are used to reduce the dependency of rain. And mostly this technique is driven by electrical power and on/off scheduling. In this technique, water level indicator placed in water reservoir and soil moisture , humidity sensors are placed in the field and the nodeMCU unit handles the sensor information and transmit data to the controller which in turns control the flow of water through the valves[1].

II. LITERATURE SURVEY

India’s major source of income is from agriculture sector and 70% of farmers and general people depend on the agriculture. In India most of the irrigation systems are operated manually. These outmoded techniques are replaced with automated techniques. The available traditional techniques are like ditch irrigation, terraced irrigation, drip irrigation. The global irrigation scenario is categorized by increased demand for higher agricultural productivity, poor performance and decreased availability of water for agriculture. These problems can be appropriately rectified if we use automated system for irrigation. India is one of the scarce water resources in 13 countries in the world, due to low utilization of the water resources our country is facing the risk of overheating. In order to effectively scale back the

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impact of inadequate water resources on India's economy from fashionable agricultural cultivation and management perspective, in line with the essential principles of web, with device technology, this text proposes exactitude agriculture irrigation systems supported the net of things (IOT) technology, and focuses on the hardware design, specification and code method management of the exactitude irrigation system. Preliminary tests showed this system is rational and practical [1].

Agriculture is the major backbone of Indian Economy. Most of the available fresh water resources are used in Agriculture. In India most of the irrigation systems are operated manually which is not automated. In the recent years automated and semi- automated technologies been deployed for irrigating the field which has replaced the traditional Agricultural mechanism. The available traditional methods of irrigation are drip irrigation, ditch irrigation, sprinkler system. This problem can be easily rectified by making use of the automated system rather than the traditional systems. The current irrigation methodology adopted employ uniform water distribution which is not optimal. So accordingly technologies being applied towards agricultural monitoring which is required by farmers. Agriculture is the unquestionably the largest livelihood provider in India. With rising population, there is a need for increased agricultural production. In order to support greater production in farms, the requirement of the amount of fresh water used in irrigation also rises [1].

Currently, agriculture accounts 83% of the total water consumption in India .Unplanned use of water inadvertently results in wastage of water. This suggests that there is an urgent need to develop systems that prevent water wastage without imposing pressure on farmers. Over the past 15 years, farmers started using computers and software systems to organize their financial data and keep track of their transactions with third parties and also monitor their crops more effectively. In the Internet era, where information plays a key role in people's lives, agriculture is rapidly becoming a very data intensive industry where farmers need to collect and evaluate a huge amount of information from a diverse number of devices (eg., sensors, faming machinery etc.) in order to become more efficient in production and communicating appropriate information .With the advent of open source Arduino boards along with cheap moisture sensors, it is viable to create devices that can monitor the soil moisture content and accordingly irrigating the fields or the landscape as an when needed. The proposed system makes use of microcontroller ATMEGA328P on Arduino uno platform and IOT which enable farmers to remotely monitor the status of sprinklers installed on the farm by knowing the sensor values thereby, making the farmers' work much easier as they can concentrate on other farm activities [3].

III. PROPOSED SYSTEM

In irrigation field, soil moisture and humidity sensors are placing and microcontroller handles the sensor information and transmits data. Water level sensor is placed inside the tank to monitor the water level. The threshold values of temperature and humidity given by the humidity sensor and soil moisture sensor that was programmed into a microcontroller to control water quantity .Sensors sense water level continuously and give the information to farmer through thingspeak site. Farmer controls the motor using the site without going in paddy field. If the water level reaches at danger level, automatically motor will be off without conformation of farmer.

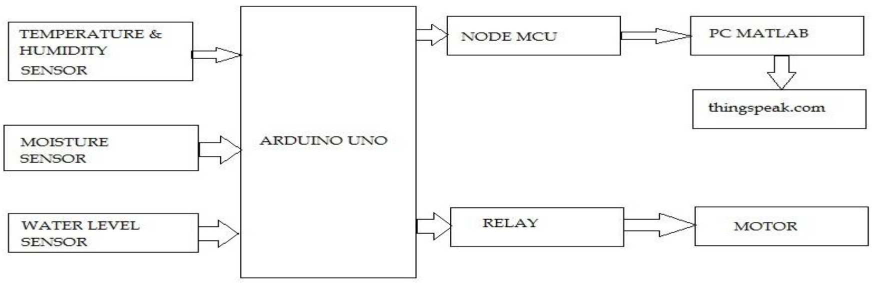

Fig 1: Block Diagram

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In this project we are using the microcontroller arduino. Arduino is probably the best starting point for embedded based IoT. Basic Arduino boards don't come with Ethernet shield or Wi-Fi shield and for Arduino to be able to work as IoT device, their need to select Arduino with Ethernet shield or Wi-Fi shield. Arduino Yuno on the other hand is a board that comes ported with Ethernet shield. The Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. Each of the 14 digital pins can be used as an input or output, using pinMode(), digitalWrite(), and digitalRead(); functions. They operate at 5 volts. Each pin can provide or receive 20 mA as recommended operating condition and has an internal pull-up resistor (disconnected by default) of 20-50k ohm. A maximum of 40mA is the value that must not be exceeded on any I/O pin to avoid permanent damage to the microcontroller.

NodeMCU is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The term "NodeMCU" by default refers to the firmware rather than the dev kits. The firmware uses the Lua scripting language. It is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as lua-cjson and spiffs.

The FC28 moisture sensor can read the amount of moisture present in the soil surrounding it. It's a low tech sensor, but ideal for monitoring an urban garden, or your pet plant's water level. This is a must have tool for a connected garden. This sensor uses the two probes to pass current through the soil, and then it reads that resistance to get the moisture level. More water makes the soil conduct electricity more easily (less resistance), while dry soil conducts electricity poorly (more resistance). DHT11 digital temperature and humidity sensor is a composite Sensor contains a calibrated digital signal output of the temperature and humidity. Application of a dedicated digital modules collection technology and the temperature and humidity sensing technology, to ensure that the product has high reliability and excellent long-term stability. The sensor includes a resistive sense of wet components and an NTC temperature measurement devices, and connected with a high-performance 8-bit microcontroller. The water level sensor here uses is REES52 and it is exposed through a series of parallel wire line mark to measure the water droplets and 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. Solenoid valve can be usd for the pumping and for controlling the motor the relay is used.

IV. BASICS OF IoT

The Internet of Things (IoT) is the interconnection of uniquely identifiable embedded computing devices within the existing Internet infrastructure. The “Internet of Things” connects devices and vehicles using electronic sensors and the Internet. The Internet of Things (IoT) is the network of physical objects devices, vehicles, buildings and other items embedded with electronics, software, sensors, and network connectivity that enables these objects to collect and exchange data. The IoT allows objects to be sensed and controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer based systems, and resulting in improved efficiency, accuracy and economic benefit, when IoT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber physical systems, which also encompasses technologies such as smart grids, smart homes, intelligent transportation and smart cities. Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the existing Internet infrastructure [2].

So, Internet of Things or IoT is an architecture that comprises specialized hardware boards, Software systems, web APIs, protocols which together creates a seamless environment which allows smart embedded devices to be connected to internet such that sensory data can be accessed and control system can be triggered over internet. Also devices could be connected to internet using various means like Wi-Fi, Ethernet and so on. Furthermore devices may not needed to be connected to internet independently. Rather a cluster of devices could be created (for example a sensor network) and the base station or the cluster head could be connected to internet. This leads to more abstract architecture for communication protocols which ranges from high level to low level. Most interestingly, these devices must be uniquely discovered. [2] For unique discovery of the devices in a Network, they need to have unique IP address. IoT devices essentially have IPv6 addressing scheme. All these devices have either fixed or Subnet masked IP addresses of type v6. Unique IP addresses makes IoT devices discoverable in the internet as independent node.

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V. IMPLMENTATION USING IoT

According to its developers, "ThingSpeak is an open source Internet of Things (IoT) application and API to store and retrieve data from things using the HTTP protocol over the Internet or via a Local Area Network. ThingSpeak enables the creation of sensor logging applications, location tracking applications, and a social network of things with status updates". ThingSpeak was originally launched by ioBridge in 2010 as a service in support of IoT applications.

ThingSpeak has integrated support from the numerical computing software MATLAB from MathWorks, allowing ThingSpeak users to analyze and visualize uploaded data using Matlab without requiring the purchase of a Matlab license from Mathworks. ThingSpeak has a close relationship with Mathworks, Inc. In fact, all of the ThingSpeak documentation is incorporated into the Mathworks' Matlab documentation site and even enabling registered Mathworks user accounts as valid login credentials on the ThingSpeak website. The terms of service and privacy policy of ThingSpeak.com are between the agreeing user and Mathworks, Inc. It is an Internet of Things (IoT) platform that lets you collect and store sensor data in the cloud and develop IoT applications. The ThingSpeak™ IoT platform provides apps that let you analyse and visualize your data in MATLAB®, and then act on the data. Sensor data can be sent to ThingSpeak from Arduino®, Raspberry Pi™, BeagleBone Black, and other hardware [2].

Create a new channel by clicking on the button new channel. A channel is the source for your data. Where you can store and retrieve data. A channel can have maximum 8 fields. It means you can store 8 different data to a channel. Here we are creating channel to store data from DHT11 temperature and humidity sensor, FC28 moisture sensor,REES52 water level sensor and also the motor status. Then a Channel id is given. It is the identity of our channel. API (Application Programming Interface) keys are the keys to access to our channel. In simple language you can understand that these are password to access your channel. You can access your channel in two ways- To update channel / data logging : API Write Key will be used to access in this mode. To retrieve data : API Read Key will be used to access in this mode.

VI. RESULTS

Fig 2: Analysis Graph

The figure shows the results. According to the sensor given data the NodeMCU will transmit these sensor readings to the ThingSpeak . The graphs shows the corresponding readings, by placing the mouse pointer near to the each graph we get the reading of the corresponding sensor in the numerical form. Temperature, Humidity, Moisture and the Water level of the tank is shown in the graph. Also the motor status is there. By monitoring this site continuously the farmer can understand the condition of the soil and he can decide whether the irrigation is needed or not. Readings

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from the three sensors were also transmitted to a THINGSPEAK channel to obtain graphs. ThingSpeak is an open data platform and API for the Internet of Things that enables you to collect, store, analyse, visualize, and act on data from sensors or actuators, such as Arduino.

VII. CONCLUSION

A system to monitor moisture and temperature, humidity levels in the soil was designed and the project provided an opportunity to study the existing systems, along with their features and drawbacks. The proposed system can be used to switch on/off the water sprinkler according to soil moisture levels thereby automating the process of irrigation which is one of the most time consuming activities in farming. Agriculture is one of the most water-consuming activities. The system uses information from soil moisture sensors to irrigate soil which helps to prevent over irrigation or under irrigation of soil thereby avoiding crop damage. The farm owner can monitor the process online through a website. Through this project it can be concluded that there can be considerable development in farming with the use of IoT and automation. Thus, the system is a potential solution to the problems faced in the existing manual and cumbersome process of irrigation by enabling efficient utilization of water resources[4].

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