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IoT BASED FARM AUTOMATION AND CLOUD INTEGRATION

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ABSTRACT

SPROUT is the integrated system which execute several operation simultaneously to resolve the issues of farming, which are causing a huge trouble now a days in the society of farmers. In India, agriculture plays an important role for development of food production. Agriculture depends on the monsoons which is not sufficient source of water. So the irrigation is used in agriculture field. In irrigation system depends upon the soil type, water availability, moisture content, etc. In this paper automatic irrigation system which is based on IoT setup. The model shows the basic switching system mechanism of water motor using sensors from any part of field by sensing the moisture, water source, etc. In present days especially farmers are facing major problems in watering their agriculture fields, it's because they have no proper idea about when the power is available so that they can pump water. Even after then they need to wait until the field is properly watered, which makes them to stop doing other activities. Here is an idea which helps not only farmers even for watering the gardens also, which senses the soil moisture and switches the pump automatically why the power is 'ON'. Every hour a SMS notification is sent to the farmer's mobile about the present condition of the farm. Current temperature, pH(potential of Hydrogen) level of the soil & possibility of rain data can be accessed the Web-interface.

Key words: IoT, Sprout, Agriculture, Automation, Cloud, Irrigation

1. INTRODUCTION

IoT is a great and wide concept evolved in recent years with robotics and today the internet giants like Google, Microsoft etc strongly support and work for this new field. Artificial intelligence or automations are the blessed gifts of this killing concept. Main objective of internet of things is to connect internet with our daily using things and to reduce human efforts by the help of cloud and networks. The idea is to connect the agriculture sector to the world of internet. India is a large country with a much population, more than 50% of Indians are farmers or depending on agricultural sectors and every year we loses a lot of farmers because of they fed up with the field of farming and even they compelled to do suicides due to sudden weather changes and floods causes them a big loss. The system is totally eco-friendly and produces 0% waste. Along with this it is connected to the Google weather API 's and so it will also take care about water consumption and can water the plants by rain prediction, if it is a rainy day it will not water the plants, and whenever the humidity or the water content of the soil reduces it gives the enough amount of water, or even pH value or the minerals of soil reduces it will inform the farmer or it is done automatically if the raw materials are provided. Before the weather changes and heavy rains and floods, farmers get alert and security measures. A web interface is existed so that the client can access it from any part of this world with only a net connected device. Cameras on the system allows them to watch their farm from anywhere and they get a live telecast on the site, it helps to observe and show their farm lands to others, or to the agriculture scientists without visiting it directly. There is also a text messaging service, it informs the client about his farm and activities there with a time record.

2. LITERATURE SURVEY

An automatic irrigation system to provide water to the farms based on water level conditions using an android application, WSN and GPRS modules. Methods/statistical Analysis: An algorithms is developed such that sensor values are continuously fed to ARDUINO microcontroller. The sensor information is compared with the threshold values

and based on that, decision will be taken to water the crops[1].

Irrigation system uses valves to turn irrigation ON and OFF. These valves may be easily automated by using Arduino and solenoids. In this project an attempt has been made to automate farm or nursery irrigation that allows farmers to apply the right amount of water at the right time, regardless of the availability of labour to turn valves on and off. The proposed system implemented GSM is used to report the detailed about irrigation [2].

With the automated technology of irrigation, the human intervention can be minimized. There will be moisture sensors installed on the field. Whenever there is a change in water content of soil these sensors sense the change gives an interrupt signal to the microcontroller. For capturing the images, the phone camera is used and after processing the captured image the PH value of the soil is determined and accordingly crops or plants are suggested that can be grown in that field [3].

This automated irrigation project brings into play an Arduino board ATmega328 microcontroller, is programmed to collect the input signal of changeable moisture circumstances of the earth via moisture detecting system intended to create an automated irrigation mechanism which turns the pumping motor ON and OFF on detecting the moisture content of the earth [4].

This system to develop a smart wireless sensor network (WSN) for an agricultural environment. Monitoring agricultural environment for various factors such as soil moisture, temperature and humidity along with other factors can be of significance a remote monitoring system using RF module. These nodes send data wirelessly to a central server, which collects the data, stores it and will allow it to be analyzed then displayed as needed and can also be sent to the client mobile[5].

The data from sensors are sent to Web server database using wireless transmission. In server database the data are encoded in JSON format. The irrigation is automated if the moisture and temperature of the field falls below the brink. In greenhouses light intensity control can also be automated in addition to irrigation. The notifications are sent to farmers' mobile periodically. The farmers' can able to monitor the field conditions from anywhere. This system will be more useful in areas where water is in scarce[6].

The prototype design of microcontroller based automatic irrigation system which will allow irrigation to take place in zones where watering is required, while bypassing zones where adequate soil moisture is indicated[7].

The system provides a web interface to the user so that the user can control and monitor the system remotely. Raspberry Pi is used as an embedded Linux board which is designed based on the ARM11 microcontroller architecture. Embedded Linux board makes the communication with all distributed sensor nodes placed in the farm through ZigBee protocol and itself act as a coordinated node in the wireless sensor network. The goal of coordinator node is to collect the parameters like soil moisture and soil temperature wirelessly. Each sensor node consists of soil moisture and soil temperature sensor and one ZigBee RF antenna device for communication with the coordinator node. Raspberry Pi stores collected data in the database and analyzes the stored data[8].

3. PROPOSED WORK

It has a very user friendly interfaces, even the farmer can configure every works from the system through the voice commands in local language, through Google Voice and assistant here to do this. A farmer may not be literate always so it allows them to communicate with his local language by the cell phone. The sensors of the product always fetches information from the farms such as humidity, temperature, moisture, ph etc. and it is live in web as digital and analog values and even in statistical graphs/gauges, It helps agricultural scientists and those who want to take researches in farms. Its damn sure that this product will reduce the human efforts and makes farming with more fun.

Because this system can automatically sets the best conditions for the current crop cultivated there by analyzing temperature, humidity , mistyre values, even he is not to miss his sleeps to water plants in nights and prevent farm from birds, bats and creatures, it can produce ultrasonic sounds to block them. With this product they can secure their farm and make a very good profit than earlier. The product aims both the agriculture experts as well as the common people

In this model, Automated Irrigation System based on Raspberry pi and Arduino, using wireless sensing network which was developed for improving irrigation system and reduced cost of irrigation water. Sensors are placed in the arm and sense continuously ad collect the information. This information stored in the monitor and also passes to data collection interface and then transmits to wireless sensor node. Using this information system was controlled automatically using internet.

The sensors are used to monitor farm conditions. The automation is based on artificial intelligence. The corresponding notifications can are send based on SMS, Web interface, etc. The main purpose of the system of smart farms are for easier by automation, efficient, climate independency ,maximum crop yield, environmental friendly, etc. for the farmer(by my SQL Database) and the message can be read by farmer in his own handheld devices or the required information is updated. In this paper, the main sensors used are temperature sensor, humidity sensor, moisture sensor & also the ph level detector. The sensors corresponding that are placed each by each detects the each factors like moisture, humidity, temperature, etc. and those sensors makes the respected motor to run which is driven by the motor driver. The gateway unit handles the sensor information and transmit data to a web application. The motor thus pumps required quantity of water to the field and automatically stopped whenever need to stop.

This paper consist of four stages namely sensor circuit, microcontroller circuit, motor driver circuit & data collecting circuit. Sensor circuit senses the condition of the soil and compares the voltage with the reference voltage. If the condition of the soil is less than the reference voltage, i.e. dry then the IC timer send the high signal(logic 1) to microcontroller. This will turn 'ON' the motor driver circuit.(I293d) which is connected and make motor pump to pump water to the required field. When the soil becomes wet i.e., greater than reference voltage(5v) the timer send logic '0' signal to microcontroller which will turn 'off' the motor driver circuit and stop pumping water to the field. Whenever there is a change in moisture level of the soil of the sensor senses the change and gives the reading to the microcontroller as interrupt. thus the controller gives the signal to the pump or sprinkler or motor to pump the water. The condition of the motor and soil can be viewed through our SPROUT Web-interface.

Node to node communication is used for better results and more area will be covered. The system has a distributed wireless network of soil moisture sensor and temperature sensor placed in the root zone of the plants and sense the condition and transfer the information to centralize node and other nodes. When nodes are receiving the information then system will be started automatically. The main purpose of the moisture acoustic based technique is developed for measuring soil moisture in seek time method. The microcontroller programmed using Arduino and raspberry pi provides the required message need at each interval of time. Thus he can be useful in any kind of such situation arise in irrigation project.

4. SYSTEM ARCHITECTURE

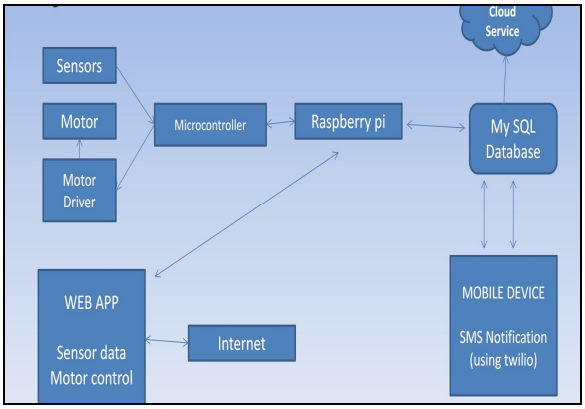

Figure 1: System Architecture

The figure 1 shows about the system architecture of the overall project. The architecture shows the module connections embedded for the project.

Sensors

Sensors are sophisticated devices that are frequently used to detect and respond to electrical or optical signals. A Sensor converts the physical parameter (for example: temperature, blood pressure, humidity, speed, etc.) into a signal which can be measured electrically.

Motor

A DC motor is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields.

Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current flow in part of the motor.

Motor Driver

Motor drives are circuits used to run a motor. In other words, they are commonly used for motor interfacing. These drive circuits can be easily interfaced with the motor and their selection depends upon the type of motor being used and their ratings (current, voltage).

Microcontrollers

A microcontroller is a compact integrated circuit designed to govern a specific operation in an embedded system. A typical microcontroller includes a processor, memory and input/output (I/O) peripherals on a single chip.

Raspberry Pi

The Raspberry Pi is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. It is a capable little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python.

Web Interface

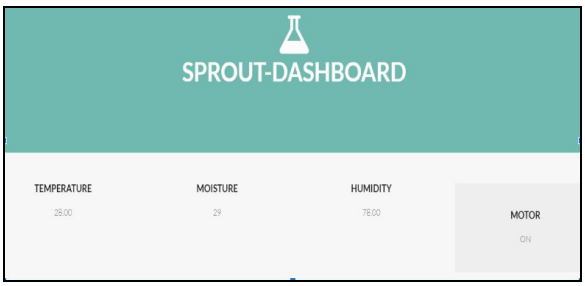

Figure 2: Dashboard Units

The web interface is the interaction between a user and software running on a Web server. The user interface is the Web browser and the Web page it downloaded and rendered**.** Here in the interface (Figure 2) consist of dashboard units to get the output readings of the units such as temperature, moisture, humidity and the motor power.

5. RESULTS

Temperature Graph

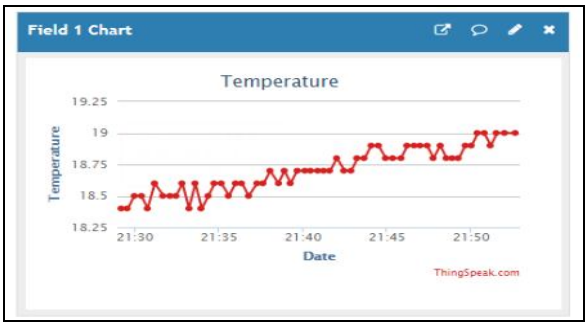

Figure 3: Output Reading

The temperature reading graph (Figure 3) gives the output reading of the corresponding changes obtained in the atmosphere.

Humidity Graph

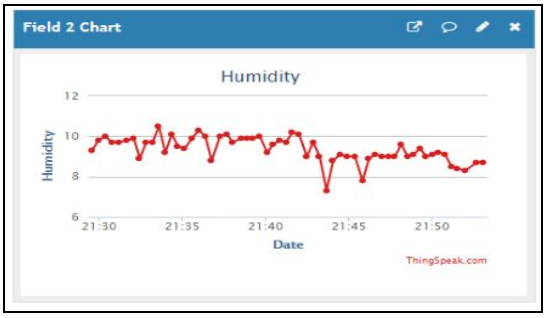

Figure 4: Output Readings

Here the humidity graph (Figure 4) represents the corresponding output readings when the sensor detects if there are changes.

HARDWARES

1.Arduino UNO Microcontroller
2.Raspberry Pi 3 Development Board
3.Moisture Sensor
4.Humidity Sensor
5.Pump DC 12V
6.Motor Driver
7.Soil Moisture sensor
8.PH level detector
9.GSM Module for Arduino

SOFTWARES

PHP
Web interface
GUI

6 CONCLUSION

The user can manage farm from mobile device and control the functions with handheld device. The highlighted application of this project are for farmers and gardeners who do not have enough time to water their Crops/plants. The collected data can be later used for reference when future crops are to be planted. By implementing this idea, improve the way of agriculture and irrigation system in different region of India with minimal water usage.
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