WSAN Based Smart Agriculture Monitoring System

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Abstract— Agriculture monitoring has the advantage of protecting the plants from outside harsh conditions and providing suitable conditions for plant growth; it can effectively improve the crop yield and quality. But the traditional monitoring/control system of Agriculture construction costs a lot and the traditional control interface is not friendly (some are just manual setting) therefore not very cost-effective, friendly and high-productive. With the advent of the cloud computing and low-cost Internet-of-Things (IoT) systems, we can apply these low-cost and effective technologies to monitor environment conditions/plant growth and control the facilities. In addition to conveniently monitor/control Agriculture facilities, a real-time platform to dynamically analyzing the collected data can greatly improve the efficiency of Agriculture cultivation, maintenance costs and decision making. In this study, a low-cost Agriculture monitoring system is developed for small-sized and medium-sized Agriculture installations with real-time data analysis. With DHT11, PIR sensor, raspberry pi, soil moisture sensor, water level sensor, soil temperature monitoring and water motor we develop an efficient-and-effective Agriculture system to achieve the above goals. This system design acts as a promising solution/bridge toward the final precise agriculture.

Keywords: DHT11, sensor network, agriculture monitoring water level, water motor

I. INTRODUCTION

Monitoring is employed in various applications including temperature, humidity, soil moisture, water level and soil temperature. The Web-Based Climatic condition monitoring system that can be accessed anywhere and anytime through the internet is built. With this system user can remotely monitor the climatic conditions from anywhere which could save the human expenses. Web-Based climatic condition monitoring is one type of recorder that monitors temperature, humidity, water level, moisture and light in a greenhouse room and stores the data into a database and displays the current climatic conditions of the field on the website through a web server. The system will continuously monitor the temperature, humidity, water level, soil moisture and light condition of the environment and the data can be monitored at anytime and anywhere from the internet. Proposed design is of a system consisting of various sensors, namely soil moisture, water level sensor, temperature sensor, soil temperature sensor, humidity sensor and light sensor. These sensors sense various parameters and the monitored data are then sent to the Raspberry pi. After studying this, the program has been written on to the raspberry pi for specific environment conditioning. The desired temperature and humidity are maintained by turning on heater/cooler. The moisture level within soil can also be controlled by turning the water valve on/off. Desired light intensity for that environment can also be controlled by emergency lights when necessary. Hence the agricultural environment is controlled automatically. The purpose of this project was therefore to make it easier to grow crops at any condition. This can be achieved with the use of a smart agricultural monitoring system. A smart agricultural monitoring system makes it possible to replicate a different climate and consequently grow crops that would not typically grow in the area. Additionally, making the smart agricultural monitoring system automated enables people to grow their own crops or plants at any climate without having to constantly look after them. It can be reassuring to know that the plants are taken care of while one is on vacation or not around the house for a longer period of time. Another objective was to implement sustainable agricultural practices so that the environmental resources, such as water for irrigation, are not overused or wasted.

II. LITERATURE SURVEY

In the era of Information Technology today, the role of IT sector has entered every aspect of human life. IT has become a very important agenda in various sector. But as far as the agriculture sector is concerned, India still lacks the proper implementation of IT in this sector.

In the present scenario, the Economic Survey of India shows that the agriculture sector employs nearly half, i.e. 49% of the workforce in the country. However, it contributes only to 17.5% of the GDP. This shows that the input given to this sector is much more than the obtained output. This sector is most affected by "Disguised Unemployment" which is characterized by additional hands to do a job without additional returns in terms of productivity.

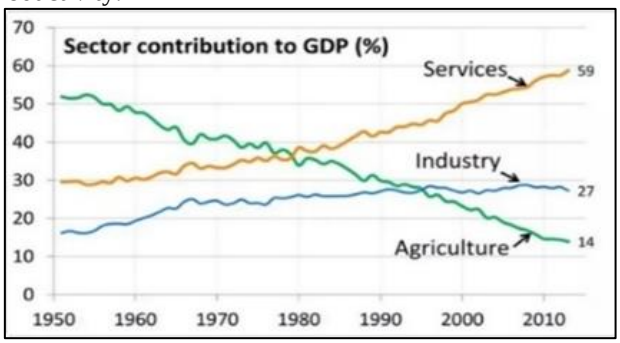

Fig. 1: Sector contribution to GDP

It is believed that IT can produce a competitive advantage for the user who implement it. So, us traditionally being an agrarian economy, must use the technological advancements in the field of agriculture as well, so as to get the optimum output without using the unnecessary input, that is, the workforce. Electronic Farming (E-Farm) is an approach to promoting agricultural information and development of agricultural modernization. The modern IT infrastructure facilitate the integration of all types of information and resources through technical facilities of modern networks, communication tools, etc. Some activities of automation in this sector is a soil sampling and variable-

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level fertilization (VRF), field and mapping results, scouting crops, harvesting, data management traceability, systems implementation and application.

III. EXISTING SYSTEM

With the increase in population in the global world, there is a need to meet the increasing food demands, this rise of food demands can be met through technological advanced and sustainable agricultural practices. There has been a number of attempts for acknowledging this issue, IoT is being implemented in agricultural fields. Various sensors are plated on the agricultural fields to monitor the varying soil and other environmental parameters, these sensors are quite useful for gathering the prevalent environmental parameters.

This data is sent through Cloud Computing to the farmers, Also the control system present on the fields can act upon this data like providing the flow of water required for the Crops. But this current technology is useful only for the monitoring of already sown crops, there is no such system to guide farmers as to what Crop they must sow for producing a rich output. There is a need to use the various sensors to monitor, actuate and also to propose the type of crops to be sown as per the climatic and soil factors Also the security aspect of the agricultural fields has been missing in the current IoT systems, The use of sensors or cameras and alarm systems is required to alert the farmer of any theft or animal attacks on the fields.

IV. PROPOSED SYSTEM

The agricultural monitoring makes use of different types of sensors to help regulate plant cycles and give the user useful information to further aid the growing process. The sensors for such process are DS18B20 Temperature, DHT11 Humidity, soil moisture and LDR as transducers water level sensor, soil temperature sensor and water motor the sensor while the PIR sensor is used to monitor trespassing which sends alert to the user and can be controlled through the website. Each sensor has either a digital or analog output. Once the sensor output data is successfully read, the data will be thoughtfully presented in graphs and tables to the user.

V. BLOCK DIAGRAM

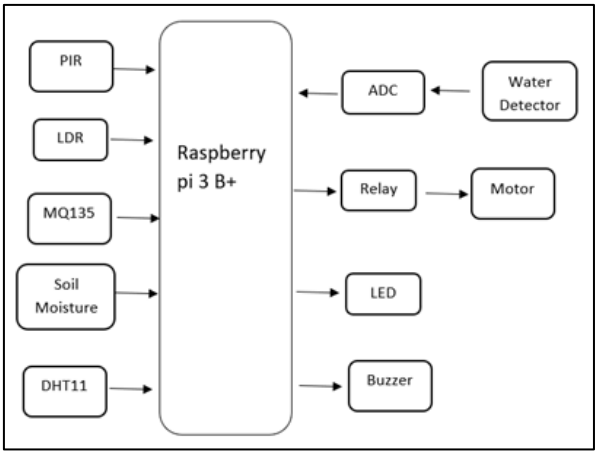

Fig. 2: Block Diagram of WSAN Based Smart Agriculture Monitoring System.

VI. HARDWARE AND SOFTWARE

A. Hardware

1) DHT11

DHT11 humidity sensor feature a humidity sensor complex with a calibrated digital signal output. By using humidity sensing technology, it ensures high reliability and excellent long-term stability. This sensor incorporates a resistive measurement part that associate with execution of 8-bit microcontroller, putting forth fantastic quality, quick response, anti-interference capacity and cost effectiveness. Each DHT11 element is strictly calibrate in the laboratory that is extremely accurate on humidity calibration. The calibration coefficients are stored as programs in the OTP memory, which are used by the sensor's internal signal decreasing process. The signal-wise serial interface makes system integration quick and easy. Its little size, low force utilization and up-to 20-meter sign transmission settling on it those best decisions for Different applications, including the most demanding ones requesting ones. The component is 4-pin signal row pin package. For measuring humidity, DHT11 has two electrodes with moisture holding substrate between them. So as the humidity changes, the conductivity of the substrate transforms alternately those safeties between these electrodes transforms. This change in resistance is measured and processed by the IC which makes it ready to be read by raspberry-pi's GPIO pins.

2) Soil Moisture Sensor

A soil moisture sensor can read the amount of moisture present in the soil around it. It is a low-tech sensor, perfect for monitoring a small garden, alternately your pet plant's water level. This is a must have tool for a connected garden. The Soil Moisture Sensor uses capacitance to measure dielectric constant of the surrounding medium. In soil, dielectric constant is a function of the water content. The sensor creates a voltage proportional to the dielectric constant, and therefore the water content of the soil.

3) Light Dependent Resistor

The Light Subordinate Resistor (LDR) is fair another extraordinary sort of Resistor and subsequently has no extremity. Meaning they can be associated in any course. They are breadboard inviting and can be effortlessly utilized on a perf board too. The image for LDR is fair as comparable to Resistor but includes to internal bolts as appeared underneath. The bolts demonstrate the light signals. It can be utilized to sense light, it is a little, cheap and effectively accessible, Accessible in PG5, PG5-MP, PG12, PG12-MP, PG20 and PG20-MP arrangement.

when light falls on the LDR then the resistance decreases, and increases in the dark. When a LDR is kept in the dark place, its resistance is high and, when the LDR is kept in the light its resistance will decrease.

4) PIR Sensor

PIR sensors allow you to sense motion, almost always used to detect whether a human has moved in or out of the sensors range. They are small, inexpensive, low-power, easy to use and don't wear out.

5) Raspberry Pi

The Raspberry Pi 3 is the most recent form of the Raspberry Pi, a minor credit card estimate computer. Fair include a console, mouse, show, control supply, smaller scale SD card

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with introduced Linux Dispersion and you'll have a fully-fledged computer that can run applications from word processors and spreadsheets to diversions. As the Raspberry Pi 3 bolsters HD video, you can indeed make a media middle with it. The Raspberry Pi 3 Show B is the to begin with Raspberry Pi to be open-source from the get-go, anticipate it to be the de-facto inserted Linux board in all the gatherings. Technical Specification of raspberry pi:

1) Broadcom BCM2837 64bit ARMv7 Quad Center Processor powered single board machine running in 1. 2GHz.
2) 1GB RAM BCM43143.
3) Wi-Fi on board.
4) Bluetooth Low Energy (BLE) on board.
5) 40pin extended GPIO, 4 x USB 2 ports.

6) MQ135 Sensor

It is a hazardous gas detection apparatus for family and the environment, suitable for ammonia, aromatic compounds, sulphur, benzene vapour, smoke and other gases. Air quality sensor is for detecting a wide range of gases, including NH3, NOx, alcohol, benzene, smoke and CO2. Ideal for use in office or factory with simple drive and monitoring circuit.

7) Water Sensor

A brick is designed for water detection, which can be widely used in sensing the rainfall, water level, even the liquate leakage. The brick is mainly comprised of three parts: An Electronic brick connector, a 1 MΩ resistor, and several lines of bare conducting wires. This sensor works by having a series of exposed traces connected to ground and interlaced between the grounded traces are the senses traces.

B. Software

1) Python

Python is a powerful programming language that is easy to use (read and write) and easy to connect project to the real world.

2) HTML(Hyper Text Markup Language)

HTML is the most basic building block of designing web. It defines the meaning and structure of web content. Other technologies besides HTML are generally used to describe a web page.

3) PHP

PHP is a server-side scripting language that is used to develop static websites or dynamic websites or web applications. PHP, originally derived from Personal Home Page tools, now stands for PHP: Hypertext Preprocessor.

VII. Result

The field and atmospheric data is collected using various sensors and then it is sent to the processor which stores the data on cloud and shows it on the website. There is a button on the website which will be used to switch on/off the PIR sensor which will be controlled by the user.

Fig. 3: Gathered data from different sensors.

The website has a link which directly connects the user to the government official agriculture website which shows the official details about the market scenario of the crops.

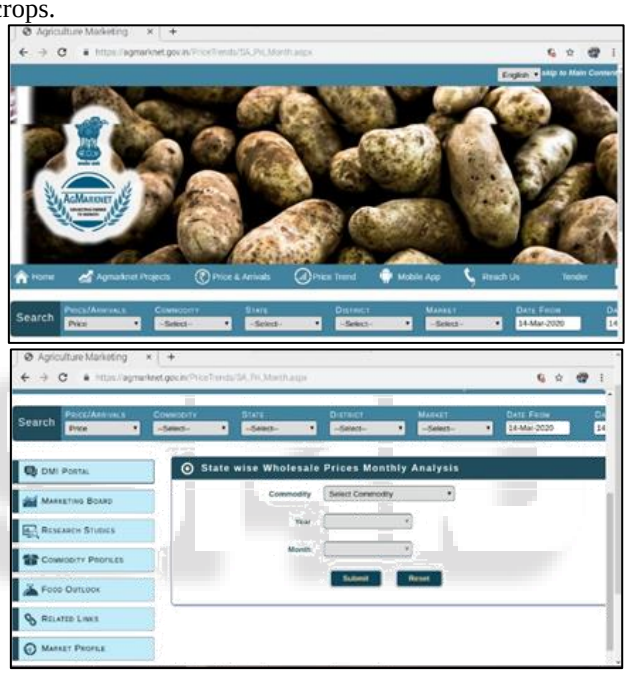

Fig. 4: Supplementary link for crops market details.

VIII. Advantages

1) Easy and quick to deploy.
2) Reduce energy wastes by proper humidity, ventilation, air conditioning control
3) The market flow about the crop which is harvested is known in advance which helps to understand the current market scenario.

IX. Conclusion

The system allows monitoring the condition of agricultural fields which is collected using various sensors and send the data to Raspberry-Pi and accordingly necessary actions are taken. There were four objectives set at the start of the project:

1) Take Temperature, Humidity, Light and Soil Moisture readings.
2) Display past and present sensor readings to the user.
3) Be able to update the settings for multiple plants.
4) Act upon sensor readings that deviate from the defined range.

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All the above objectives have been achieved/met and the automated greenhouse gives flourished plants.

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