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Data Acquisition for Effective Agriculture using Field Sensors

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Abstract:
In current generation most of the countries do not have sufficient human factor in agricultural sector and it affects the growth of developing countries. So it's time to automate the sector to overcome this problem. In India, there are 70% people dependent on agriculture. This system is mainly based on minimizing man power and cost of the equipment, which can be affordable to all farmers. We emphasizing on the fact that every here knows to do agriculture but they don't know when to do and what is the optimal conditions for doing it. The designing of the agricultural automated system will sense the field parameters conditions in real time, we are analyzing the field parameters such as Temperature, soil Moisture etc. The soil moisture, Temperature sensor and pH sensor is interfaced with the Pic controller, the sensor will sense the data and it will pass the information to pic controller so that it will compare the sensed data with the optimal conditions which are predefined for particular crop breed and send message to the user as mobile updates.

Keywords: Sustainable agriculture, web interface, fertigation, energy conservation, green sensor technology.

I. INTRODUCTION

A stable agricultural sector ensures the food security of a county. However, it still remains a conservative sector, where innovation takes place at a slower pace than in other sectors, primarily due to the high costs involved with smart agriculture. The previous models make use of expensive sensors which can be replaced by cost effective ones without compromising on the efficiency. For instance, many open source smart agri-products use expensive soil pH sensors to measure the fertility of the soil while our system uses cheap color sensors to identify the nutrient deficiency in crops simply by recording the color of the leaves, thereby reducing the cost of the overall system. Furthermore, our proposed system provides an integrated network of multiple sensors to sense almost every parameter concerned with the growth of plants and a web-based customizable application which allows the user to monitor the farm from anywhere. Certain flaws in the sensing methodology of older models are also identified and corrected. The communication between the base station and the nodes are established using a WiFi module(ESP8266) whereas in other models it is done through expensive modules like Zigbee, Xbee, etc.

II.BENEFITS OF CROP MONITORING

Sustainable approach to agriculture with the help of automation and sensor technology, benefits the society in the following ways

- conservation of water
- optimization of energy resource
- Reduces the pressure on a small number of agriculturalists to provide more food.
- better crop yield
- pollution prevention
- economically beneficial for farmers
- eliminates human error
- time saving, accurate diagnosis of nutrient deficiency
- automation with low power consumption components

On the whole, smart farming refers to data gathering, data processing, analyzing and automatic control systems which when jointly orchestrated; optimize the farm productivity and profitability.

III. PROPOSED MODEL

The health of a plant is influenced by many factors such as humidity, soil moisture content, nutrient availability, exposure to light, amount of water/rainfall received, colour of the leaves, etc. The proposed system aims at conserving water and energy by using drip irrigation method and to monitor the plants by maintaining the optimum temperature and light intensity. Different sensors and actuators are being used to detect various parameters of the soil like moisture, temperature, pressure, humidity and light. The Pic controller will receive the data and it will send to mobile web page via in build Wi-Fi The soil moisture sensor is interfaced with the raspberry pi, the sensor will sense the data and it will pass the information to Pic controller so that complete information and update can be viewed on the web page. Further, GSM will send message to the user in case any abnormal activity happens.

A. Temperature sensor

It is a precision integrated-circuit temperature sensor and gives an output voltage proportional to temperature. Every 10mV increase denotes an increase in temperature 1 degree on Celsius scale. All plants need an optimum temperature for photosynthesis and growth. Temperature also affects seed germination, respiration, transpiration, flowering, dormant period, etc. The sensor reads the values and sends them to the user"s webpage. The user can make efforts to control the temperature such as setting up a greenhouse or choose a cooler location for the grow space. **LM35** is a precision IC temperature sensor with its output proportional to the temperature (in ^{o}C). The circuitry of the LM35 sensor is sealed and air tight and therefore with respect to other objects and environments it cannot be oxidized without interaction. Using **LM35**, temperature could be measured accurately than using a thermistor. It also possess low self heating and does not cause more than 0.1 ^{o}C temperature rise in still air. The operating temperature range is from -55°C to 150°C. There is a variation in the output voltage by 10mV as response to every $^{\mathbf{o}}$C rise as well as fall in ambient temperature of the measured event, i.e. to a scale factor of 0.01V/ $^{\mathbf{o}}$C.

B. Soil moisture Sensor

Soil moisture sensor measures the volumetric water content of the soil. Measuring soil moisture can help in efficient management of irrigation systems and can also help in increasing yield and quality of the crops. When the magnitude of the soil moisture exceeds a threshold value, the water flow is stopped or decreased depending on the value. Water is made available to the plants when the moisture content in soil goes below the threshold by initiating water supply using the relays/reed switches through the microcontroller HR202 humidity Sensor resistance utilises the polymer materials made of organic which is a new type humidity sensor and can sense of the wet range, stability and long-term performance, can be applied to car, warehousing, building automation, research fields medical, indoor air quality control, industrial control systems and a wide range of applications.

***C.* pH sensor**

The pH Sensor used is just as you would a traditional pH meter along with the additional advantages of automatable graphing, data collection, and data analysis. Typical activities using our pH sensor include 1) Acid-base titrations. 2) Studies of household acids and bases. 3) Monitoring pH change during chemical reactions or in an aquarium as a result of photosynthesis. 4) Investigations of acid rain and buffering. 5)Analysis of water quality in streams and lakes. We use pH sensor to track the acid and base nature of the soil to support the crop.

D. Microcontroller: PIC microcontrollers are a family of specialized microcontroller chips produced by Microchip Technology in Chandler, Arizona. The acronym PIC stands for “peripheral interface controller”. A microcontroller is a compact microcomputer designed to govern the operation of embedded systems in motor vehicles, robots, office machines, medical devices, mobile radios, vending machines, home appliances, and various other devices. A typical microcontroller includes a memory, peripherals, and processor.

E. Wi-Fi module

ESP8266 is an impressive, low cost WIFI module suitable for adding WIFI functionality to an existing microcontroller project via a UART serial connection. The module could even be reprogrammed to act like a standalone WIFI connected device just as to add power! The feature list is impressive and includes: 802.11 b/g/n protocol Wi-Fi Direct (P2P), soft-AP Integrated TCP/IP protocol stack. The guide is designed to assist you to get started with your new WIFI module and le us start! The hardware connections required to connect to the ESP8266 module are fairly straight-forward but there are a couple of important items to note related to power: The ESP8266 requires 3.3V power–do not power it with 5 volts. The ESP8266 wants to communicate through serial port at a voltage of about 3.3V and does not have 5V tolerant inputs. ESP8266 on-board processing and storage capabilities allow it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. With its high degree of on-chip integration, which includes the antenna switch balun, power management converters, it requires minimal external circuitry, and the entire solution, including front-end module, is designed to occupy minimal PCB area.

F. Block Diagram

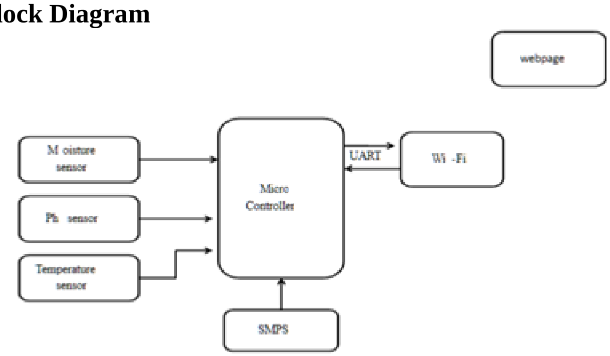

Figure.1.Block Diagram for proposed model

IV. CONCLUSION

The proposed system is open architecture so any one can make this type of system using any way or path. The system uses moisture sensor to observe the moisture level which increases further accuracy of the system as it identifies the moisture level very accurately than human. The system also observes different environmental conditions such as Ph level and temperature which human cannot measure accurately by open eyes to decide the plant health so the accuracy of the system is high. It also involves monitoring mechanism which reduces human labor and crops can be monitored to produce high yield by maintaining optimal conditions

1. It can be implemented in gardens or nurseries with minimum cost and resources. Also helps in proper utilization of the available resources and helps in avoiding wastage of electricity and water.
2. Can be easily configured and scaled up to work on larger fields.
3. Provides a user-friendly interface hence will have a greater acceptance by the technologically unskilled workers. The system is more compact compared to the existing ones, hence is easily portable and low cost

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