Agricultural Field Monitoring using IoT

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***Abstract*— This paper entitled "Agricultural Field Monitoring using Internet of Things" makes a major development in the agricultural domain. Issues concerned with agriculture hinders a country's development. Modernizing the current traditional methods will provide a solution to the existing problems. Hence a ARDUINO based smart agriculture aims at improvising the production with the art of making use of automation and Internet of Things. This enables monitoring, selection and irrigation decision support. A crop development for managing water to the field in an efficient manner and less complexity in the circuit. Implementation of an Précised Agriculture will optimize the fields water usage and special features that focuses on the security mechanisms of the field using cloud computing technologies. The optimal temperature range is also concentrated for the better yield.**

Keywords*— *WLAN, PIR, DC, IR, USART, PA, GHz, Silicon On Chip, RTD, LED

I. INTRODUCTION

Mobile devices are powerful tools that computes, senses, and provides other connectivity with proper resources and Apps are made to run for multiple purposes. The device characteristics commonly possess a low-power consumption with high performance processor at, running frequencies. This frequency is over 1 GHz, and is of high memory, also contains a spacious memory. It contains graphic related touchscreens with highest resolutions. These mobile devices does multitasking in the operating system that runs first and third-party Apps and it has diverse connectivity. This results in a attractive platform developed for different domains with specific applications, these devices provide sensing applications with additional external sensors.

II. EMBEDDED SYSTEM

A. LAYERED DESCRIPTION

An embedded system is a printed circuit board that includes busses and semiconductors in the lower layer. The upper layer is called as the application layer. Between these two layers, another two essential layers called the device drivers and communication protocols. The embedded systems are relatively static due to these features. However, requirement for low cost, negligible electrical/electronic radiation and energy consumption.

B. GENERAL DESCRIPTION

It is an compact component to perform desired function with the hardware and software combinations that also includes additional mechanical or technical elements.

III. ARDUINO

These systems have from 8 bits to 32 bits since a long time. ARDUINO is a open-source electronics platform. It is a miniature sized computers that can be handled easily in place of computers. This is very useful in projects and for many things where desktop PC is used. This is very needful in case where physically made to work in extreme temperatures and to resist shocks and vibrations to external interferences of electrical and electronic devices. The state of art in cheap, consumer single board computers in the beginning. Invariably embedded systems are having limited resources of memory in case of CPU, screen size and a limited set of key inputs. These features plays a major part in the development of product and its design. This is mainly due to the limitations in the resources.

Fig. 1. Arduino Uno Microcontroller

IV. WIRELESS TECHNOLOGY

Wireless connectivity reduces power by implementing it on SOC. The IoT refers to the network featuring an IP of physical objects that resolves connectivity issues, and does provide the communication between the objects without enabling internet and other internet-enabled objects.

V. INTERNET OF THINGS

There has been a much hype about the "Internet of Things". This an general idea of a globally interconnected continuum of objects and devices that has emerged with the RFID technology. This envisages a excess of objects interacting with the environment. There are a large number of different means are used to enable communication between devices. They are somewhat external that represent vertical silos that do not support on all basis of operational ability. Obviously this leads to the slowing down of devices. They just provide a scalability requirement that are envisioned as foundations for fostering the emerging Internet of Things. Overall it is a design and architectural principle for prototyping and exploring the technical consequences of the desired project.

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VI. LITERATURE SURVEY

A. RANGING AND IMAGINING

Agricultural vision is to produce the maximum yield of goods by 2050.This vision is more concentrated to meet the expectations of fast growing population and their major demands for food. Thus by proper usage of resources Precision agriculture becomes the key to productivity and efficiency improvisation. Thus helping to face the diverse agricultural challenges. To face these challenges, they mainly focus on to climate changes, land degradation, availability of farmable land, labor force shortage and increasing costs. This presents a statistical report of the optical visible and near-visible spectrum sensors. These techniques are made to estimate phenol-typing intensity and spectral with cubic volumetric measurements. The sensing methodologies: (i) Plant structures and its characters (ii) Detection of Plants and Fruits (iii)Assessment of Plant Physiology. This provides data processing methods and thus faces the current challenges that are oprn in agriculture in which there is a creative development of sensing methodologies of pruning, harvesting and automated monitoring.

B. FIELD MONITORING AND AUTOMATION

It is an Agricultural Frameworks that makes decisions that are Profitable through the framing cycle.. This includes real time information that is gathered from various places such as level of production with the available crop knowledge. It gets automated replacement of manual procedures, since it is efficient in managing energy and hence minimal man power is engrossed. This proposes advancement in ICT in Indian Agricultural sector, to replace some of the convectional methods. It overcomes the limitations of traditional agricultural methods by low power consumption and efficient use of water resources.

C. IOT BASED SMART IRRIGATION SYSTEM

The farm activities with the desired automation has become the major transformation of agricultural domain from being manual and static to intelligent and dynamic. This is a way to reduce human supervision. It is an automated irrigation system which keeps a continuous monitoring over the entire field. This in-turn maintains the soil moisture level via automatic pumping of water. The devices enables the system with the appropriate quantity of water. This is designed using the ARDUINO UNO platform with a help of few sensors to avoid over or under irrigation. The information of the sensors is kept updated to the farmers with help of IoT.

D. SMART IRRIGATION SYSTEM

This project is from the idea of farmers who solely depend on the nature for earn food for their livelihood. This idea is based on the rains and bore wells for irrigation of the cultivated land areas. The farmers have been using the irrigation techniques through the manual control in which to irrigate the land at regular intervals. This is done by turning the motor ON/OFF when required. For indicating the power they have been provided with a glowing blub. If a phase deduction occurs in any other phases, the farmer will not be able to know the low supply of power. So obviously, this can cause a sudden diffuse in the motor circuit. They have to travel a longer distance for the SWITCHING of the motor.

VII. SENSING FOR DETECTION

To improvise the agriculture by **precision agriculture** aiming to provide precise measuring and monitoring. To overcome the issues concerned with agriculture to provide **sustainable agriculture** to increase the productivity of the crops. To provide ease of access through updated **automation techniques** by saving time and meeting the demands immediately. To get an overall information of the entire field by combining various modalities using cloud computing with **IoT**. Ease of billing systems saving human labor and considerable amount of time and provides **remote access** to the field. An **efficient water management system** results in increased profitability and reduced environmental impacts.

VIII. FEATURES

The proposed idea has various features in it which are meant to monitor the agricultural field and aims at the following

(i) Precision agriculture for accurate measuring and monitoring.
(ii) Monitoring the Crop Growth and proper selection of the Crop.
(iii) Water–Capital Measurements and Making profitable decisions .
(iv) Optimization and maximization of yield with usage of water and fertilizers.
(v) Analyzing the weather conditions.
(vi) IOT enables PA with cloud computing to collect the relevant data is posted on the cloud.
(vii) IR Fencing for the animal and unauthorized human intervention with the appropriate knowledge.
(viii) It is monitored using a web application.
(ix) Ease of access to the field.
(x) Farmer friendly product.

IX. BLOCK DIAGRAM

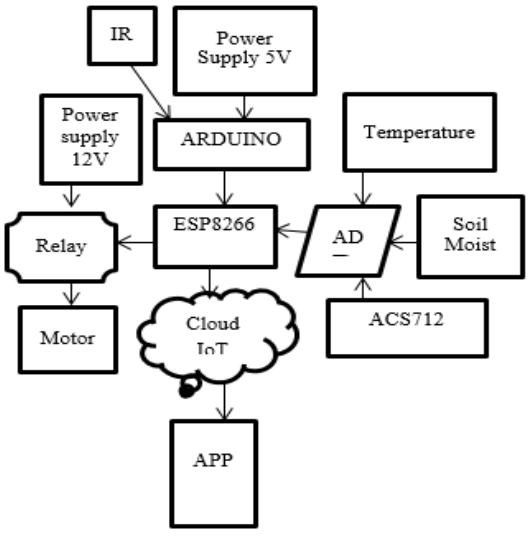

Fig. 2. Block Diagram

X. SOIL MOISTURE SENSOR

The volumetric content of water is measured by the soil based moisture level sensor. It measures the water by using properties such as resistance to electrical interface, constant of dielectric, or by the neutron interaction. The difference between the measured data and the standard data is calibrated. There are variations that depends on the factors of the environment. Water potentiometers and even tensiometers based on the soil are used. The soil moisture sensors consists of anode and cathode that senses the proxy of water content in the soil and it in-turn is set up with a threshold value and it is connected to an A/D sensor to post the digital values to the controller. This is connected with a motor for letting in the water into the field. This usually connected to a relay which is given a separate power supply of 12V.

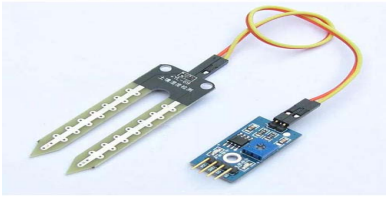

Fig. 3. Soil Moisture Sensor for Moisture Detection

XI. PUMP MOTOR

The pump motor is based on the simple electromagnetism. A current-carrying conductor generates a magnetic field and this in turn will experience a force proportional to the current. This force turns the blades of the motor. Here it is actually attached with the soil moisture sensor and once the moisture level in the soil is low then the motor is initiated with the power supply by a Relay, which actually acts as a switch providing the power to the motor. This action turns on the motor and after the desired level of the moisture as designed is reached it is turned off automatically.

Fig. 4. Pump Motor for Water inlet into the Field

XII. TEMPERATURE SENSOR

There are a series of temperature sensor, here the proposed project uses a LM35. The LM35 is a analog temperature sensor. This is built with a series of integrated circuits that senses the surrounding temperature of the field in degree Celsius. This is given to the analog pin of the controller for continuous monitoring.

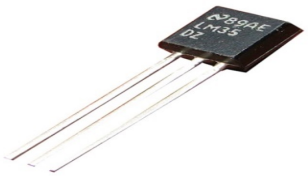

Fig. 5. Temperature Sensor LM35

XIII. ESP8266

The ESP8266 is the Wi-Fi module is a self-contained solution that provides networking. It has a external flash memory for boot up process. It acts either as a host or offloads the other host applications. Here the ESP8266 is used to store the relevant information such as the temperature, moisture detection and IR detection onto the memory and serves to post this on the cloud server for the ease of access. It has 16 GPIO pins, and its memory is about 32KiB RAM.

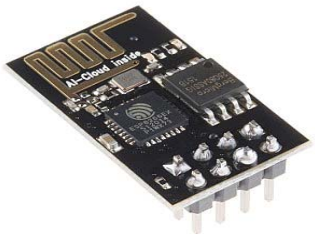

Fig. 6. Wi-Fi Module for establishing Server Connection

XIV. IR SENSOR

The IR is Infra-Red Sensor that is usually positioned with a arrangement of two sensors. One acts as the receiver and the other acts as a transmitter and there will continuous signal radiation passing between these sensors. Once the signal between them is disconnected or intervened by an obstacle such as human or animal then it gives a alert message to the user of the field.

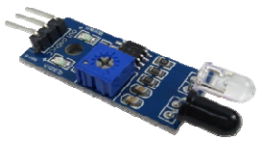

Fig. 7. IR Sensor for Animal and Human Intervention

XV. CONCLUSION

The controller is interfaced with the soil moisture sensor and a pump motor, the sensor is programmed in such away to detect the soil moisture content. The threshold is set for the moisture level sensor. A Pump motor with a tube inlet has been interfaced with the controller. Here the soil moisture sensor detects the moisture level and automatically turns the motor ON/OFF. The temperature displays the accurate temperature in degree/Celsius and the IR sensor is mainly used for the security purposes. To give a alert or warning message to those who have enter the field without

the proper acknowledgement. Then all the relevant information is stored in the memory of the controller and it is given to theESP8266 module which acts as a host in establishing a connection between the field and the server and posts all this on a open-source cloud computing system. This is further posted to the website or an mobile application for frequent measuring and monitoring.

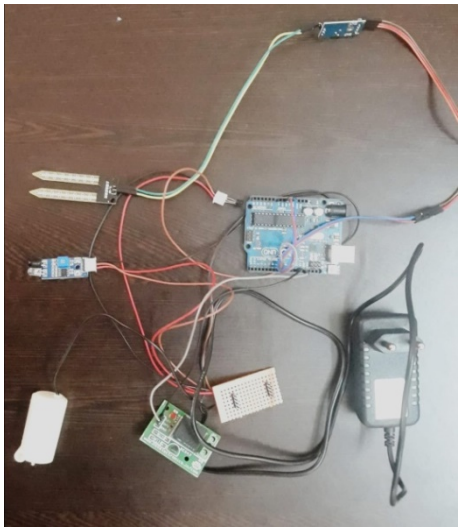

Fig. 8. Controller connected with all Sensors

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