ACSIJ Advances in Computer Science: an International Journal, Vol. 4, Issue 3, No.15 , May 2015
ISSN : 2322-5157
www.ACSIJ.org

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Cloud Based Cultivation Management System

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Abstract

In India, Agriculture is one of the most important areas of human activity. Most of the population depends on agriculture and farming. Indian economy directly depends upon agricultural production. Proper cultivation is very important to increase the production. The cultivation of plants includes various steps such as to analyze the environmental factors, analyze the soil moisture, temperature, and manage the water supply for proper cultivation of plants. A traditional way is very slow and unreliable for above steps. This paper proposes Cloud based Cultivation Management System. The system architecture allows user to achieve the above mentioned activities in real time so that farmers can view their farm details from anywhere (and do not need to go to farm) within range. System mainly includes Hardware module that placed in farm or farm field that contains various sensors, devices, ICs for data conversion and transfer. Then Cloud implemented as Software as a Services (SaaS) so that user can access the information from anywhere within range and finally the Android application through user can monitor system details, farm details and control the farm hardware remotely from anywhere within range. The advantage of this system is, it is not only specific to green house but it is also applicable to normal farm field. Using this system the environmental factors monitored and controlled correctly there will be improvement in the productivity.

Keywords: *Agriculture, Cultivation, Farm Field, Cloud, SaaS*

1. Introduction

Agriculture is the backbone of India, and plays an important role in economic development. It is the science or practice of farming, including cultivation of the soil for the growing of crops. Cultivation is most often used to talk about the ways that farmers take care of crops. However, it consists of various phases that are depends on the environmental factors such as Temperature, Soil moisture and water level. Farmers need to keep the records of these environmental factors manually (or on paper) to cultivate crops properly. In general, agricultural lands are so far away from farmer's home so farmers need to go there and analyze the soil, write the records of these environmental factors on paper which is so tedious work to maintain and remember it. Furthermore, farmers need to know about these factors for some period of time so that they can take appropriate actions such as to manage hardware (i.e. to switch on/off water motor), to spray pesticides, to keep records of factors; to achieve these activities farmer have to go to the farm field which is normally very far from farmer's home and it causes inconvenience in hectic work. To avoid such burden from farmer, and to achieve such functionality farmers require a System which will be able to gather the information, from farm (or farm field) such as Temperature level, water level and soil moisture via various sensors. Furthermore, system should process this information to provide functionality to the farmers [1]. To enable system accessible from anywhere it needs to be centralized and connected to Internet. Here, the concept of Cloud Computing comes [3].

Thus, to manage all these functions Cultivation Management System comes into picture. This system

allows farmers to view farm (or farm field) information such as sensors values, devices connected, etc. Apart from this, system allows farmers to control the farm hardware remotely such as to switch on/off bulb, to switch on/off motors, etc with the help of microcontroller. All this information can be accessed via Android enable mobile phone, tabs, etc by farmers.

2. RELATED WORK (Literature Survey)

The different systems that provide the various functionalities to the farmers related to cultivation and crop management systems[2]; but different technology. The details of such systems are as below. Apart from the systems mentioned below, the proposed system uses the Cloud i.e. SaaS so that the multiple users can access the same application in simple way instead of using any external software or other GMS system architecture.

2.1 Intelligent Crop Management System for Greenhouse Environment [4]

It uses Embedded Systems, Microcontroller, GSM Modem so that the user can monitor information and control system for multiple greenhouses. The System architecture has sensors, data acquisition system, microcontroller, two GSM modem and central monitoring and control system. It can be controlled using Software Application from any location. The parameters for the particular crop can be set from any location using Software Application and sent to the central GSM modem to the GSM modem at green house wirelessly. It can also be applied for other small/medium automation system.

2.2 Green House Automation Using Zigbee and Smartphone [5]

It uses Embedded Systems, Microcontroller, Zigbee or wireless technology and Team viewer software, Android. It is a wireless monitoring and control system for greenhouse based on Zigbee device. It consists of Visual Basic Software Web Server which communicates with the other devices such as Android mobile phone which is synchronized with TEAM VIEWER software. This software keeps all the devices in synchronized with the server. A wireless camera is attached to monitor in real time Also the devices can view the required information anywhere as these devices are connected via Internet enabling owner to check and control in real time manner .The information is also updated to the user through SMS service.

2.3 Innovative GSM Bluetooth based Remote Controlled Embedded System for Irrigation [6]

It uses an innovative GSM-Bluetooth based remote controlled embedded system for irrigation. The interface and communication between user and system is done via SMS on GSM network or by Bluetooth if the user is within the range of 10m of designed system. The system informs users about many conditions like status of electricity, dry running motor, increased temperature, water content in soil and smoke via SMS on GSM network or by Bluetooth.

2.4 An Automated Multi Sensored Green House Management [7]

This uses various sensors for cultivation and also explains how to overcome on the disadvantages of the cultivation without human any human observation which causes bad effect on plants or cultivation process. It uses various sensors in real time in order to
Control the light, aeration and drainage process efficiently inside a greenhouse by actuating a cooler, fogger, dripper and lights respectively according to the necessary condition of the crops. It also uses an Integrated Liquid Crystal Display (LCD) to display the real time acquired data from sensors, the status of various sensors and devices.

3. METHODOLOGY (BLOCK DIAGRAM)

The Cloud based Cultivation Management System is module into three such as Hardware, Cloud (SaaS), Android Application. The block diagram or the architecture of our system is as shown in below “Fig.1” –

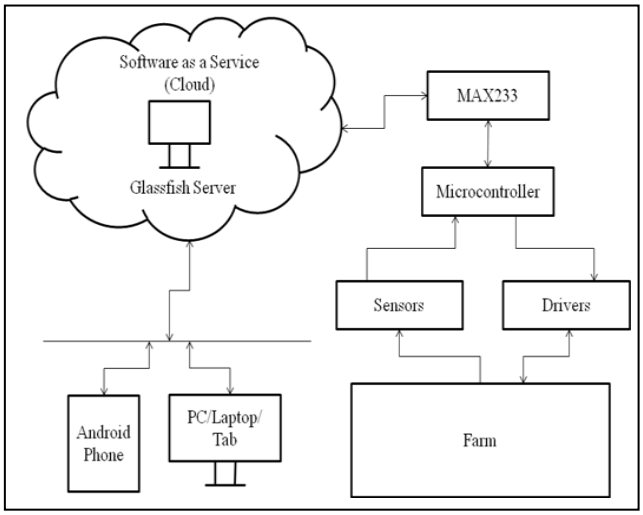

Fig. 1 System Architecture.

3.1 Hardware:

The circuit diagram or block diagram of our hardware module is as shown below "Fig.2". The ICs are programmed using embedded C with the help of Keil and uCFlash.

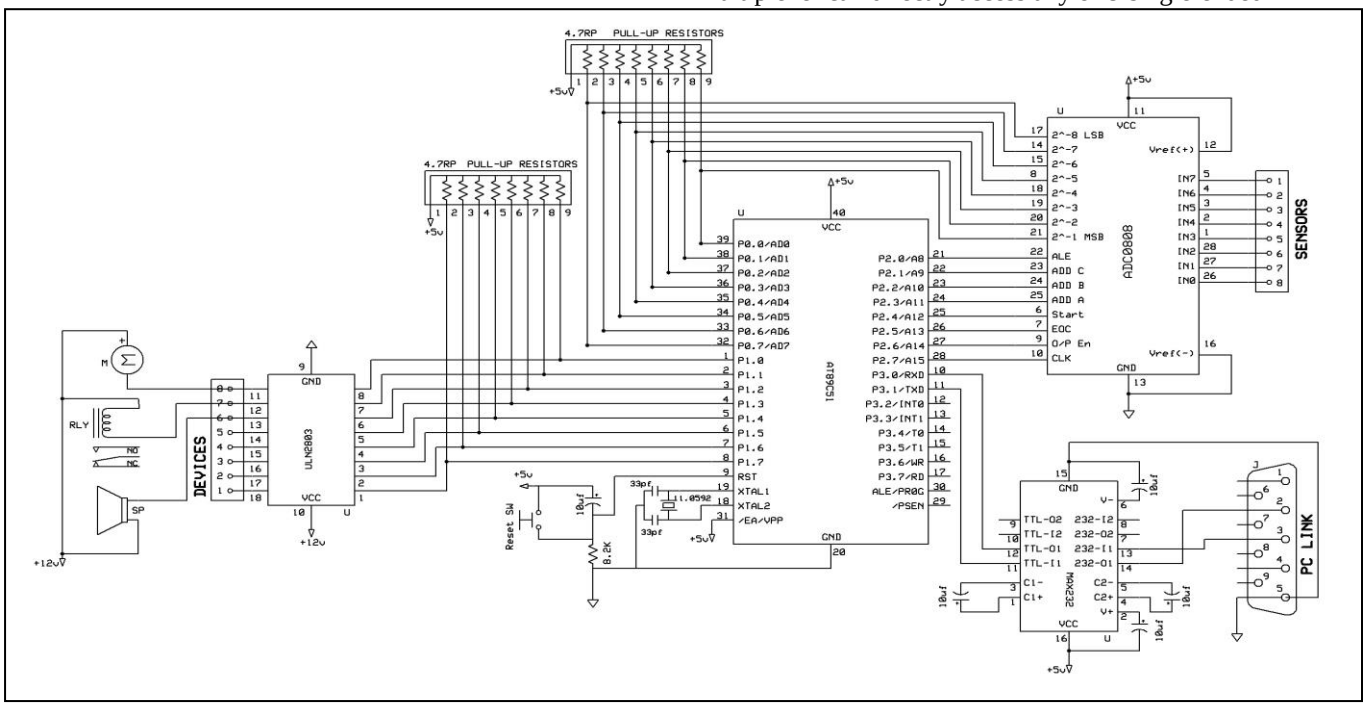

Fig. 2. Block diagram of Circuit Layout.

It consists of the following ICs and Controller:

3.1.1 Sensors:

A sensor is a transducer whose purpose is to sense (that is, to detect) some characteristic of its environs. It detects events or changes in quantities and provides a corresponding output, generally as an electrical or optical signal. We are using Temperature sensor, Soil Moisture Sensor and Light sensor.

3.1.2 Microcontroller (89C51):

AT89C51 is an 8-bit microcontroller and belongs to Atmel's 8051 family. 89C51 has 4KB of Flash programmable and erasable read only memory (PEROM) and 128 bytes of RAM. It can be erased and program to a maximum of 1000 times.

3.1.3 ADC0808:

The ADC0808 data acquisition component is a monolithic CMOS device with an 8-bit analog-to-digital converter, 8-channel multiplexer and microprocessor compatible control logic. The 8-bit A/D converter uses successive approximation as the conversion technique. The converter features a high impedance chopper stabilized comparator, a 256R voltage divider with analog switch tree and a successive approximation register. The 8-channel multiplexer can directly access any of 8-single-ended analog signals. The ADC0808 offers high speed, high accuracy, minimal temperature dependence, excellent long-term accuracy and repeatability, and consumes minimal power. After conversion the data is passed to the microcontroller.

3.1.4 MAX232:

The MAX232 IC is used to convert the TTL/CMOS logic levels to RS232 logic levels during serial communication of microcontrollers with PC. The controller operates at TTL logic level (0-5V) whereas the serial communication in PC works on RS232 standards (-25 V to + 25V). This makes it difficult to establish a direct link between them to communicate with each other. The intermediate link is provided through MAX232. It is a dual driver/receiver that includes a capacitive voltage generator to supply RS232 voltage levels from a single 5V supply. Each receiver converts RS232 inputs to 5V TTL/CMOS levels. These receivers (R1 & R2) can accept ±30V inputs. The drivers (T1 & T2), also called transmitters, convert the TTL/CMOS input level into RS232 level.

3.1.5 RS232:

The RS 232 IC is a driver IC to convert the µC TTL logic (0-5) to the RS 232 logic (+/-9v). In order to communicate with devices we have to bring the logic levels to the 232 logic (+/-9v). Communication as defined in the RS232 standard is an asynchronous serial communication method. The word serial means, that the information is sent one bit at a time. Asynchronous tells us that the information is not sent in predefined time slots. Data transfer can start at any given time and it is the task of the receiver to detect when a message starts and ends. The RS232 standard describes a communication method where information is sent bit by bit on a physical channel. The information must be broken up in data words. The length of a data word is variable. On PC's a length between 5 and 8 bits can be selected. This length is the net information length of each word. For proper transfer additional bits are added for synchronization and error checking purposes. It is important, that the transmitter and receiver use the same number of bits. Otherwise, the data word may be misinterpreted, or not recognized at all.

3.1.6 ULN2803:

A ULN2803 is an Integrated Circuit (IC) chip with a High Voltage/High Current Darlington Transistor Array. It allows you to interface TTL signals with higher voltage/current loads. In English, the chip takes low level signals (TLL, CMOS, PMOS, NMOS - which operate at low voltages and low currents) and acts as a relay of sorts itself, switching on or off a higher level signal on the opposite side.

3.2 Cloud SaaS Server: [8]

In the SaaS model, cloud providers install and operate application software in the cloud and cloud users access the software from cloud clients. The cloud users do not manage the cloud infrastructure and platform on which the application is running. This eliminates the need to install and run the application on the cloud user's own computers simplifying maintenance and support. SaaS is one of the methodologies of Cloud Computing, which is based on a "one-to-many" model whereby an application is shared across multiple clients. Software as a service can be characterized as "Software deployed as a hosted service and accessed over the Internet. “Software as a service (or SaaS) is a way delivering applications over the Internet-as a service. Instead of installing and maintaining software, you simply access it via the Internet, freeing yourself from complex software and hardware management.

a) The actual hardware used to host the cloud can be single PC or a network or a cluster of PC’s or even a super computers. But from clients (Cloud User) prescriptive it is a single IP address which hosts the required web services.

b) If a cloud server has a local network IP address, we get as called Private cloud. In case server has a static IP address we get a Public cloud.

c) SOAP/XML is what makes cloud so special. The server sends or receives data via XML, This helps in implementing universal services on cloud without worrying about client side platforms/language/machine architecture. XML acts as a common language between cloud server and clients.

d) Cloud clients can be android phones, Tabs, PC’s. Client side applications can be implemented in Java, .net, Android SDK, etc. Client side applications can be designed to have unique GUIs making use of native (Hardware and OS) libraries and APIs.

e) While communication with cloud server though the data has to be converted into SOAP/XML or vice versa, when SOAP/XML data is received from cloud server, the client side application converts them into required data structure or data type etc.

f) Hence, though clients may have different OS’es or hardware architecture, a common XML interface ensures that all clients can make use of the same cloud service irrespective of their hardware or software designs.

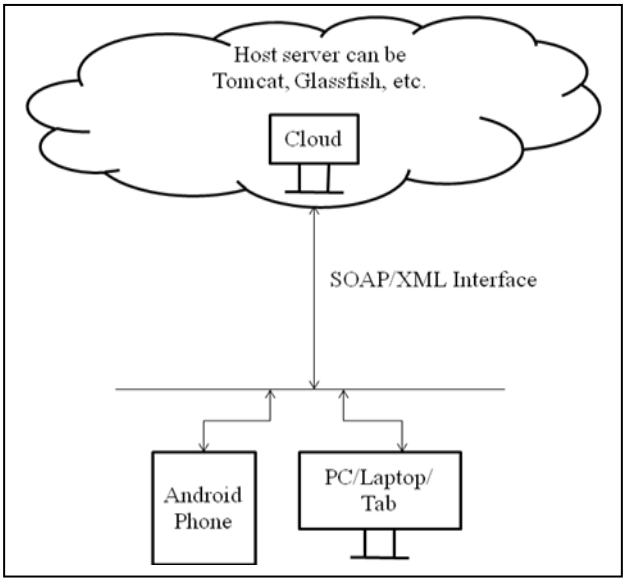

Fig. 3. SaaS Implementation Details.

3.3 Android Application: [9]

An android mobile phone can be used on the user end for monitoring and control in real time. The user will be able to observe the data from anywhere as the devices are connected through the Internet.

4. FLOW OF SYSTEM

Generally, the sensors sense the environmental factors in electrical signals and transfer this signals to analog to digital convertor. Then, from convertor to microcontroller and finally the digital information is stored in the SaaS cloud server for further processing. If user wants he can also able to access the information via his Android enable phone or PC itself. The flow of proposed system in detail is as shown in the figure "Fig. 4" below.

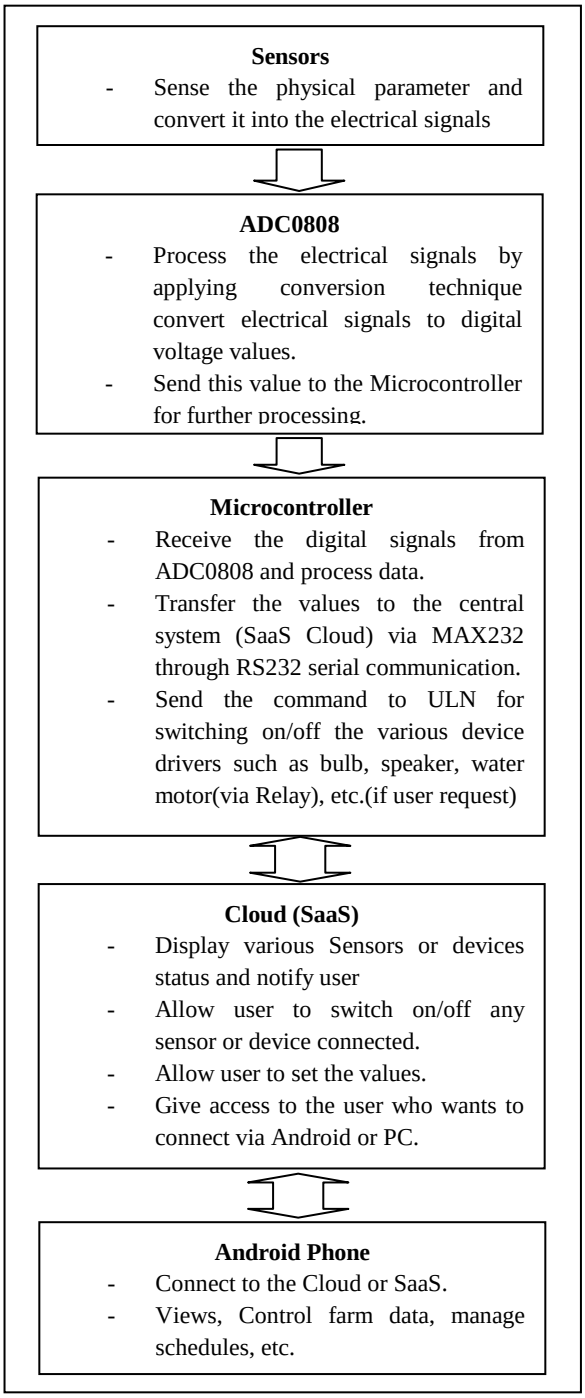

Fig. 4. Flow of System.

5. CONCLUSION

Cloud based Cultivation Management System is system for the user who cultivates plants in Green house or farm field. Farmer can monitor farm details from anywhere within the range. Farmer can also monitor the temperature, soil moisture details, water level, etc. If such environmental factors are monitored and proper actions such as to on/off water motor, etc. are taken, there can be increase in the productivity.

ACKNOWLWDGEMENT

Thanks to our project guide Prof. K.S. Balbudhe, Head of Department Prof. G. V. Garje and all staff members of Information Technology dept. from PVG's COET, Pune.

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