DESIGN AND MONITORING OF REAL-TIME PARAMETERS IN PRECISION AGRICULTURE BASED ON GPRS-SMS

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***Abstract* --- In past few years, agriculture management system has seen a rapid growth in terms of technology. At present cost saving technology, labor-saving are the addressing key issues in agriculture management system. This proposed work gives a review of these systems based on existing technologies and also proposes an economical and generic management system based on sensors with GPRS modem for agriculture system controller and remote monitoring system. Sensors are the hopeful devices for precision agriculture. By forming sensor network we can make good monitoring system in the agriculture field.**

In Agriculture industry the farm environment condition such as soil moisture content, depth of water, soil water tension and device capacity etc. are continuously monitored by sensors. To maintain the optimal conditions of the environment, the sensor network informs user via SMS from the GPRS modem to the farmers mobile and actions are taken accordingly by the farmer. By monitoring and understanding individual crop and its requirements, farmers can potentially identify the various fertilizers, irrigation and other requirements.

***Keywords*--GPRS, Sensors, PIC Microcontroller, Solenoid valves, Relay.**

I. INTRODUCTION

Sensors are the hopeful devices for precision agriculture. By forming sensor network we can make good monitoring system in the agriculture field. This proposed system involves monitoring the parameters of agriculture field without man power. The fundamental concept of this project is to provide a highly enabled monitoring of agriculture field. In this all the different sensor values such as ph sensor, moisture sensor sends value through GPRS modem and the values are sensed and processed and if any of the sensor value exceeds the minimum or maximum value, a alarm is activated and the farmer gets a message on his mobile phone [1] [3].By using the sensor network we can get real time data such as moisture and PH value of soil [2]. The proposed system has several types of nodes deployed in the agriculture field. It captures the physical phenomenon such as water level, PH can be monitoring in an agriculture field monitoring.

II. AGRICULTURE SYSTEM DESIGN PROCESS

There are two types of designing methods, one is Top-down method and the other is Bottom-up method. This work adopts the Top-down method. The design is a solution, the translation of requirements into the way of meeting them. The design will determine the success of the system. Based on the proposed system objectives, the major modules are identified and the operations to be carried out are determined. In the design phase of the system the data flow diagrams, flowcharts, data base tables, inputs, outputs and screen are designed by using all the necessary fields in a compact manner.

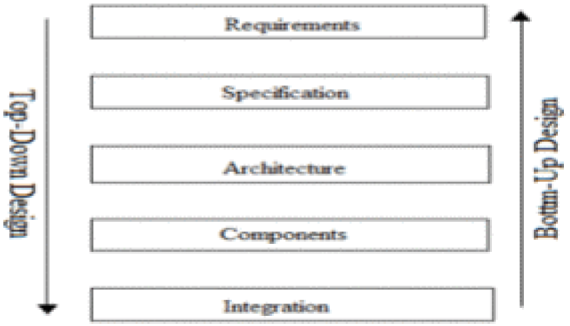


Fig. 1 Major levels of abstraction in the design process

A. Requirement Analysis

The requirement phase is the first level in which the functional and non-functional requirements like performance cost, physical size and weight and power

consumption for developing the proposed system were analyzed.

1) Functional Requirements

- Sensing requirements like PH level of soil, Moisture of field, and water level of Water Tank.
- Alarm Monitoring requirements [If water level is very low].
- Signal conditioning requirements.
- Actuator control Requirements [Relay ON/OFF].
- Man-Machine interaction Requirements [Select automatic and manual mode for irrigation].
- Data Collection Requirement [Maintain database about sensing data].

2) Non-Functional Requirements

Typical non-functional requirements include performance of agriculture management system process, cost of H/W, physical size of component also weight and how the power may be consumes for the field station.

B. Specification Level

The specification level reflects the requirements specified in the first level, it says only what the system does and not how to implement. In this proposed work the specification of the agriculture management system includes,

- Data received from GSM Modem
- User interface
- Sensor data to the Microcontroller
- LCD Display
- Message Delivery

C) Architecture Level

The hardware of the system mainly includes an 8-bit microcontroller chip, a GSM modem, a GPRS modem and RS232 interface. The microcontroller is interfaced with different sensors for controlling different applications. Moisture sensor and PH sensor is used to sense the moisture and PH value of soil are in analog form is converted to digital using A/D converter [5] [6]. EEPROM is used for recording the data provided by the sensors. It provides this data to the microcontroller for analysis when requested and in emergency conditions depending upon this data an SMS is send to the farmers mobile. Even routinely recorded these data can help in making remote and control module of automatic irrigation system. GPRS provide distance based control over agriculture parameters.

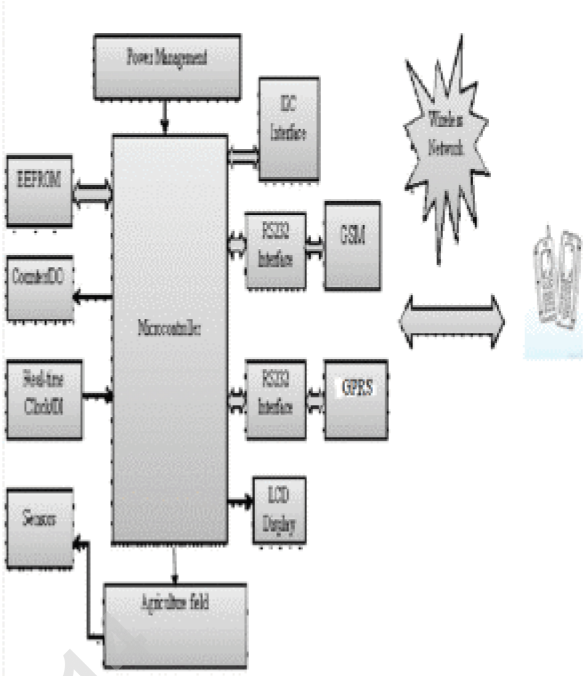


Fig. 2 Block Diagram of Remote Monitoring and Control System of Agriculture Management System using GSM

Real time clock/calendar helps in proper day-by-day recording of data. The measured values and the status of the devices are displayed on the LCD. The GSM and GPRS modems which are the most important part of this system are interfaced with the microcontroller using RS232 interface. It acts like an interface between the controller and GSM network. The GSM Modem must have a SIM (Subscriber Identity Module) card to make the network identify the user. The microcontroller communicates with the GSM modem using the AT commands [5]. These AT commands are used to send and receive SMS. The programming code for the microcontroller is written in some high level language. When a user sends an SMS requesting the status of devices and measured value by the sensors, the GSM modem sends the data stored in EEPROM as a response via SMS. The use of a PC as a monitoring and base station provides for control of devices which are located far away from farmer's house, in the proposed system it is an important part of the internet based systems.

The Architecture level is a plan for overall system that will be used to design the components that make up the architecture. The schematic diagram of the proposed work is shown in figure 3. The system architecture further refined in to Hardware and

software architecture to ensure all specifications. The hardware and software architecture is shown in figure 3 and figure 4 respectively. It shows the components required to build the system. The architecture should satisfy the functional and non-functional requirements.

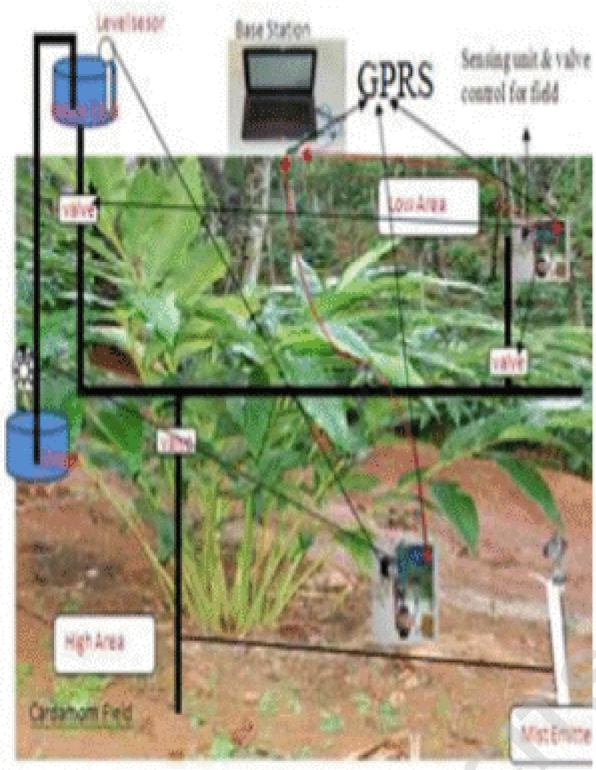


Fig. 3 Schematic Diagram of the Proposed System

Figure 4 shows the hardware part in which the sensors and GSM modem send the signals to the base station, the base station process the signal and send the control signals to the field station and then switches the relay according to the irrigation conditions for ON/OFF the solenoid valves [5]. The GSM modem connected to the microcontroller which sends the data from the field station through the GSM modem transmitter using UART to the base station and the receiver GPRS at the base station receives the data and displays the output and then resends the control signals to the field station.

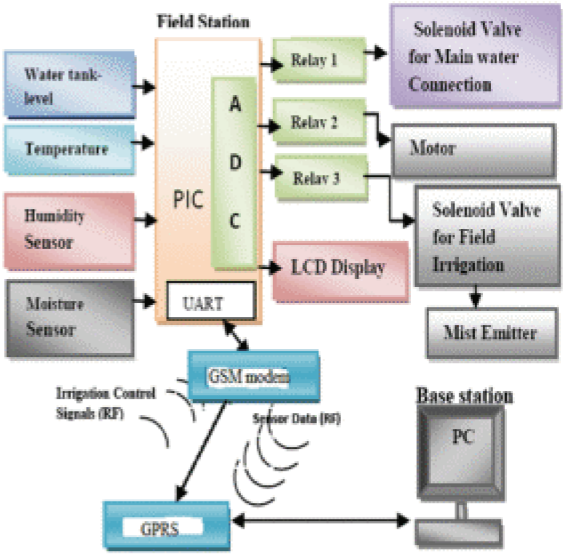


Fig. 4 Hardware Architecture of the Proposed System

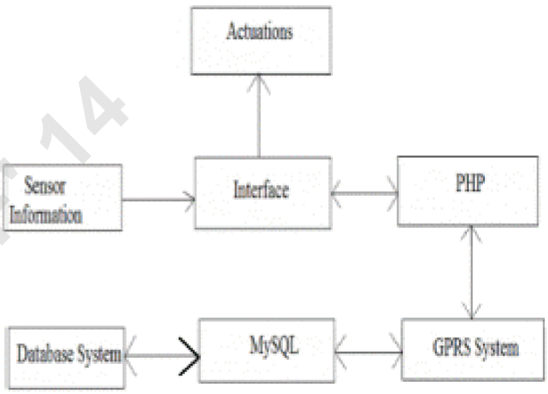


Fig. 5 Software Architecture of the Proposed System

Figure 5 shows the software architecture which is interfaced with the hardware components. The schematic diagram and hardware architecture of the proposed system is shown in figure 3 and 4 respectively. The field sensor signals such that soil moisture and PH sensor values are fed to the microcontroller through data collection interface. Then input analog signals are converted into digital and these signals are processed using PIC16F877A microcontroller and displays the sensed readings in the LCD. This information is transmitted to the base station using GPRS technology. Base station receives the data from field using by GPRS and checks whether the limits are exceeding the set point or not. We can manually adjust the set points according to the climate to provide proper irrigation to different aged and different areas of farm land. Base station also maintains the database and displays the current sensor readings.

SYSTEM INTEGRATION

The System Integration is not simply plugging everything together but also finding the bug at this stage. In Embedded system, the system integration is a challenging task, since it is difficult to find why things are not work properly. Due to limited facility at the target system, we have to go to host system for testing. This proposed system has two modules, one is Field station and the other is Base station. Figure 6 shows the field station and figure 8 shows the base station. Field station sensed the parameters like temperature, and Soil moisture from different areas of the cardamom plantation and display those parameters in LCD. Then these parameters are sent to the base station. The base station analyzes these parameters with set points for proper irrigation.

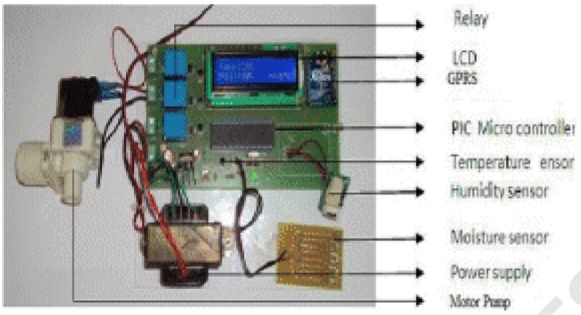


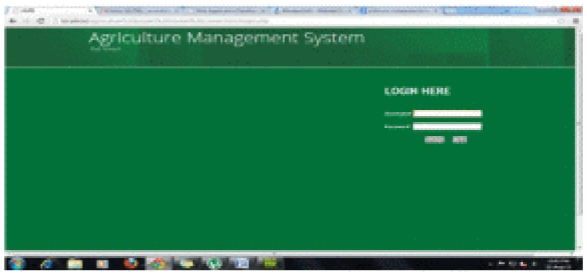
Fig. 6 Connection of the system at field station

The VB front end which is shown in figure 7 displays the graphical display of the parameters such as temperature and Soil moisture. And the status of main valve and pipe line irrigation valve also displayed. This system supports both manual and automatic mode in which we can select the mode at the base station itself.

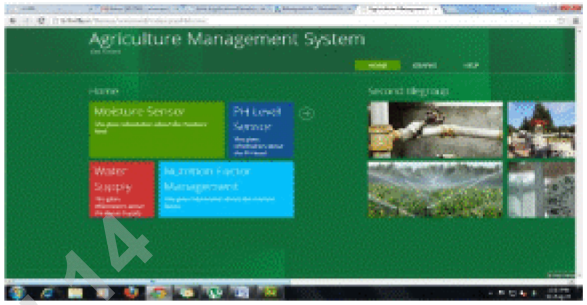
Fig. 7 Base station

III. EXPECTED OUTCOME

The proposed work has a number of results to be considered. The admin tries to login, the controls redirects to a page where it checks the username and password in the database. If both match, admin will see the main page. The data entered by the end user should be correct as per his knowledge. The system should provide guarantee that the user profile will not be misused.

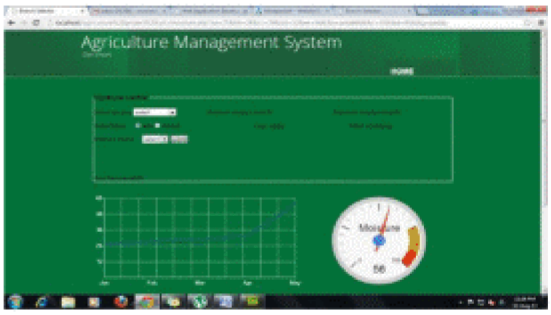


The main page of user contains following:



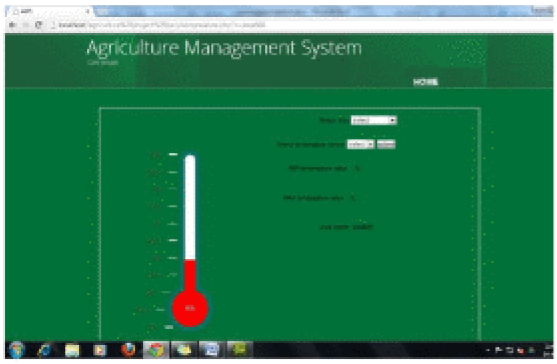
1) Moisture Sensor

Moisture sensor page contains graphical and gauge representation of the moisture value of the particular crop which is been evaluated.

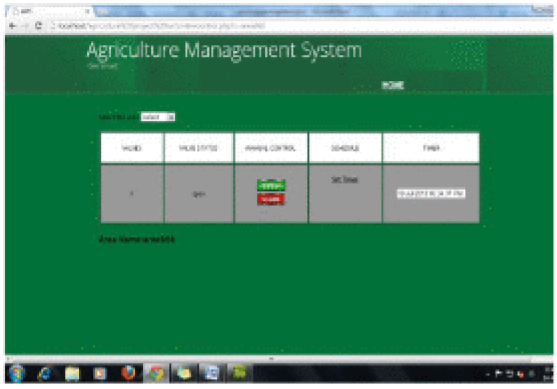


2) PH level sensor

PH level sensor page gives the gauge representation of the current PH level of the crop.

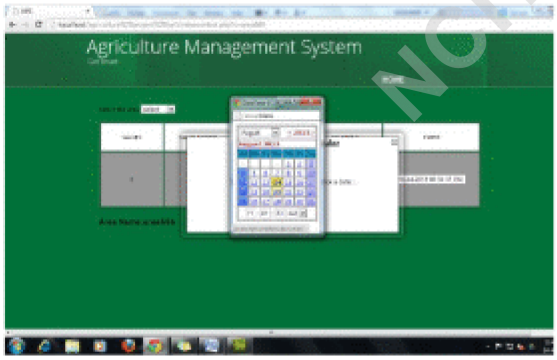


3) Nutrition factor management



Nutrition factor management page will help the user to view the current situation of the entire crop field.

4) Water supply management



Water supply management page can be used for opening /closing of the valves, for initiating timer to automatically open/close valve on a particular date, at a particular time.

A message will be sent to the farmer, if the current value of moisture sensor, PH sensor exceeds or is less than the maximum and minimum values permitted for the particular crop.

IV. CONCLUSION

Agriculture Management system is expected to play an important role in improving farming activities. During the past years, sophisticated farm management systems have emerged to replace outdated complex and monolithic farm systems and software tools. The latest trend is to enable these management systems to operate over the Internet.
In this proposed work we attempt to enable a farmer to step into a new reality, where he becomes an actual ''node in an agricultural worldwide web''. He as a user can monitor his farm land without actually being there through web. And also he will get timely alert messages on his phone if any of the sensor value deviates from the maximum and minimum value permitted for the particular crop so that he can take proper action.

V. FUTURE SCOPE

In further this work is to be expanded by using solar panels instead of battery for power supply. It reduces the cost and solves the problem of abnormal voltage conditions.

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