Design and Implementation of GSM Based Fertigation System

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Abstract:

The objective behind Implementation and Design of GSM based Fertigation System is to make and analyze the need of water in the crop field as agriculture is the main source of production which usually depends on the water availability. In growing countries like India Economy is largely based on the agriculture which scarcely depends on the climate conditions and Borewell. Irrigation of water is usually done by manual method. To ease the work of the farmer GSM based automatic Fertigation system can be implemented so that water wastage can be reduced and also the fertilizer can be added accordingly. Also the Soil Salinity can be checked and reduced if exceeds certain limit. By using GSM system, Start and stop action of the motor that feeds the field with water can be controlled only by sending the GSM command through GSM mobile.GSM is used as a control of the whole process and backbone of whole system.. This system can be used to control irrigation from any distance.

Keywords: Irrigation; Soil Salinity; Microcontroller; LCD display; GSM Module

1. INTRODUCTION

The aim behind this paper is to develop a smart fertigation system for any agriculture field. At present time, the farmers use manual irrigation technique in which requires visiting the field at regular intervals. This technique leads to loss of water and excess of water in the field which can make crops dried & also results into slow growth of crop and less production. This issue can be resolve if farmers will use automatic and remote drip irrigation technique. Irrigation is an essential process that affects the crop production. Here automatic irrigation system provides solution for the farmers where presence of farmer in his field is not mandatory to do irrigation process. This system is also programmed to control mechanical devices like water pumping motor for the irrigation in the field. Now a day's mobile phones are very common. The user communicates with centre unit through SMS. This unit communicates with the system with the use of SIM card in the GSM module. The Commands sent through the mobile which will be received by the GSM with the help of the SIM card. The GSM sends this data to microcontroller which is receiving the data from the salinity sensor in the form of salt percentage present in the soil. After processing, this data is displayed on the LCD. So whenever the system receives the command from the GSM subscriber it checks all the field conditions and gives a detailed feedback to the user and waits for another command to start the motor. The motor is controlled by the microcontroller. When the motor is on, readings of soil will be on monitoring. If the soil salinity reaches to the exceed level, the motor is automatically turned off & a massage is send to subscriber that the motor is turned off. Also the motor can be started by giving command from the GSM mobile.

1.1 Literature review

Over so many years wireless network technology is increasing rapidly with the success rate in remote monitoring. Accordingly a system is designed to monitor irrigation in the land using the diverse measure of canopy temperature. With the use of the thermal imaging and with the assist of embedded sensors and microcontroller irrigation is scheduled automatically [1]. The other system is enhanced with zone specific irrigation which optimize the water usage as well as increases the crop yield. A precision irrigation based on closed loop zone specific data is used to provide an effective usage of water. Soil, crop and climate are monitored to provide a decision support system in the field. This is able to deliver the necessary action according to the monitored data [2]. The distributed field sensor based irrigation increases the productivity while saving the water. This paper explains the detailed design of variable rate irrigation with wireless sensor network and software for real time field sensing and control of site specific precision linear move irrigation system. The Bluetooth wireless technology offers a plug and play module which saves the time as well as inexpensive [3].The GSM based drip irrigation methodology gives the facilities of maintaining uniform environmental conditions all over the green house. This system covers only lower range of agriculture land. The cost spend to develop the system is high for such low covering area. Hence it's not economically benefit [4]. WSN in climatic parameter monitoring is the energy efficient inexpensive technology. In case of long distance or impossible transport to check the actual environment conditions these networks are deployed to provide a data about the environment. Any physical parameter can be converted to electrical signal using WSN and the multihop network would transfer the data to the destination [5].sumeetha et al.[6] provided a remote control application to control the irrigation motor using mobile phone. The system is developed using PIC16F877A microcontroller which integrates sensors, GSM and motor. The microcontroller controls the operation of motor based on the feedback of sensors. When the temperature decreases beyond normal or when voltage level is low or when there is no flow of water in the pipe due to insufficient water level in the well the motor gets off automatically and the problem is intimated to farmers through SMS. Mobile phone is used to control the motor using missed calls. Jothipriya and saravanabava [7] presented a GSM based embedded system for the automation of drip irrigation. The developed system ensures that water is distributed to field by automatic switching on/off of main gate valves whenever a normal voltage condition exists. Information is exchanged in form of SMS

2. METHODOLOGY

The irrigation controller developed in this study is designed to work autonomously without hard-wire connections between individual control units. For site-specific irrigation implementation, a field is typically divided into irrigation management units based on soil characteristics, crop water requirements, and/or economic factors prior to the installation of the control system. An irrigation controller is installed in each irrigation management unit to autonomously control the soil moisture and salinity in the crop root zone between field capacity (FC) and management allowed deficit set by the user. Each controller is programmed to process the feedback information received from two salinity sensor that is installed in the root zone within the irrigation management unit. When two of the sensors indicate that the salinity is more than the management allowed deficit, the irrigation controller opens a solenoid valve, triggering irrigation of the management unit. Here we are using microcontroller which is interfaced with salinity sensor to monitor the crops. The A/D converter converts the analog data of sensors to digital data. Memory records the data provided by sensors. This data is analyzed by microcontroller & according a SMS is sent to subscriber mobile through GSM .When a user sends an SMS requesting the status of devices and measured value by the sensors, the GSM module sends the data stored memory. When the data received by the sensor and sent to the microcontroller exceeds the limit Salt =30% then this automatically sends SMS to the farmer so that irrigation can be stopped and fertilizers can be added to the field according to the requirement.

Also the Reverse osmosis method can be implemented to make soil salinity in permissible limit. . Overall management can be done by the GSM System. Microcontroller give a command to GSM module, this module ask to controller that which message may be sent, then controller again give a command and the module sent a message according to level to particular mobile number which is coded in controller. The GSM board has a valid SIM card with sufficient recharge amount to make outgoing SMS.As the GSM modem gets the applicable signal about the threshold water level of the tank from Microcontroller its send that packet of data to user mobile in the form of SMS, thus the user gets the current status of the level of water and now user either switched ON or OFF the both motor as per requirement. Also it provides the data base station through ZigBee module. When soil salinity is higher than the required limit motor pump will be OFF otherwise motor will be ON

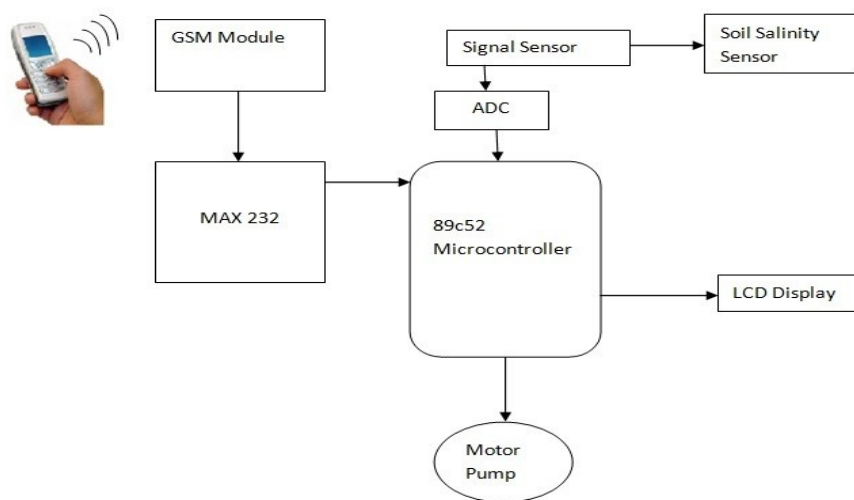## 3. CONFIGURATION BLOCKS OF GSM BASED FERTIGATION SYSTEM

Figure 1. Block Diagram of GSM Based Fertigation System

3.1 GSM MODULE

GSM (Global System for Mobile) / GPRS (General Packet Radio Service) TTL -Modem
is SIM900 Quad-band GSM / GPRS device, works on frequencies 850 MHZ, 900 MHZ, 1800 MHZ and 1900 MHZ. It is very compact in size and easy to use as plug in GSM Modem. Then Modem is designed with 3V3 and 5V DC TTL interfacing circuitry, which allows User to directly interface with 5V Microcontrollers (PIC, AVR, Arduino, 8051, etc.) as well as 3V3 Microcontrollers (ARM, ARM Cortex XX, etc.). The baud rate can be configurable from 9600-115200 bps through AT (Attention) commands. This GSM/GPRS TTL Modem has internal TCP/IP stack to enable User to connect with internet through GPRS feature. It is suitable for SMS as well as DATA transfer application in mobile phone to mobile phone interface. The modem can be interfaced with a Microcontroller using USART (Universal Synchronous Asynchronous Receiver and Transmitter) feature (serial communication). It has built in Network status LED which shows that the GSM module is in network range or not. If the Network LED is glowing Green without any blink then it is in network and if the LED is blinking after two-three seconds it means that the GSM module is not placed in the network range.

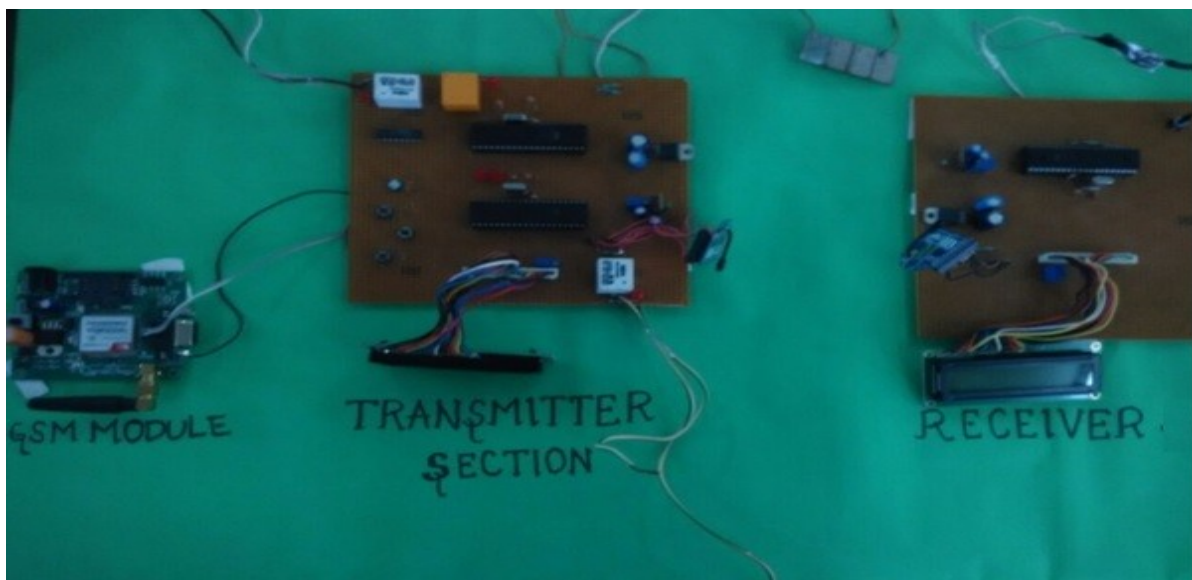**Figure 2: Configuration Overview of GSM System**

Figure 3: Configuration Overview of Fertigation System

3.2 Micro-Controller

Microcontroller AT89C205[8] is used in RFID attendance and security system it functions as a brain of the computer. Its main task is to make decision of input and gives the result output.it is a high performance CMOS 8 bit microcontroller having 8K bytes of memory and requires low power to operate. It has 32 I/O lines. LCD is interfaced with the microcontroller. It also devides how and when the output should be sent to the LCD display. It has memory on which progrmming commands are saved.Sensors are coneected to the Microcontroller through Analog to digital converter which converts the analog input into the language which is understood by the Micro Controller.

Figure 4: Microcontroller

Figure 5: LCD

3.3 LCD Display

It is an electronic optical device used to display the output information of the the input data base given by the Soil salinity sensor and the command to On/Off the motor by the SMS commands fro the GSM mobile and direction sent from the microcontroller. It consists of 16 pins with inbuilt back light. It is very compact,easy to use and light , It consumes very less power which have no flicker as it depends upon the backlight technology. No geometrical distortion is needed for the LCD display. Here it is used to display the reading of salinity form the sensor and also the state of On/Off of the system.

3.4 Future Scope of the project

GSM Based fertigation system can also be used with the wireless sensor networks which can sense environmental conditions.Use of wireless sensors will open easier way for the action required in fertigation. For this we can also install wireless sensor network in the whole field where irrigation is required.It can also be used in another fields also. Such as it be used in the Robotics with the help of wireless sensor network which can be interfaced with the GSM system . it can be implemented with the RFID system through which it can also used to track monay laundring .it can be attched with the internet of things that can provide information on online source.which can be used to track all the movement and output value of any field throughout the year.

3.5 Software

The programme is written in assembly language and microcontroller 8051 is used to assemble. The programme is written such a way thay it is easy to understand. By using this microcontroller, new entry can be created and deleted. Software can be used to share the data through Serial port. Hence here User needs software to test GSM module. Realterm is such type of software which can be used for this.

5. CONCLUSION

The objective of the project was to design and implement a GSM based automatic Fertigation system. The GSM system setup receives the message from the mobile through GSM module and responds according to the task allocated .when message is regarding Stop the operation and start of the operation System successfully responded.Also the reading of the soil salinity done by the microcontroller got displayed on the LCD. If the salinity exceed than the set limited, operation gets stalled. Furthermore it can also be attached with the ZigBee System and both control of the system can be done in both ways by GSM and ZIgBee together. By using this system an intelligent system can be developed for their crop production which will lead to sufficient use of water and fertilizers. By this crop production can be increased. With this system farmer also saves time and meanwhile they can use it for another work as well.

REFERENCES

[1] Christos Goumopoulos, Berdan O'flynn, Achilles Kameas," Automated Zone Specific Irrigation with Wireless Sensor/Actuator Network and Adaptable Decision Support," IEEE TRANSACTION on Computers and Electronic In Agriculture, vol. 105, pp 20-33 March 2014.

[2] Xuezhi Wang,, Weiping Yang, Ashley Wheaton, Nicola Cooley, Bill ,"Efficient registration of optical and IR images for automatic plant water stress Assessment," IEEE

TRANSACTION Computers And Electronic In Agriculture., vol. 74, pp 230-237 August 2010.

[3] Yoseop (James) Kim, Robert G.Evans And William M.Iverson, " Remote Sensing And Control Of An Irrigation System Using A Distributed Wireless Sensor Network," IEEE TRANSACTION on Instrumentation And Measurement, Vol., 57, pp 7,july 2008.

[4] Sumeetha S and Sharmila D, "Embedded Based Remote Control Application using Mobile Phone in Irrigation", International Journal of Power Control Signal and Computation, Vol. 3, No. 1, pp. 76-79, 2012.

[5] Jyothipriya.A.N, Dr.T.P.Saravanabava, "Design of Embedded Systems for Drip Irrigation Automation", International Journal of Engineering Science Invention, Vol. 2, Issue 4, pp. 34-37, 2013.

[6] Sukhjit Singh and Neha Sharma, "Research Paper on Drip Irrigation Management using wireless Sensors", International Journal of Computer Networks and Wireless Communications, Vol. 2, No. 4, pp. 461-464, 2012.

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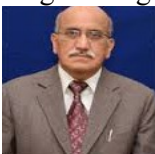
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