Controlling of Environmental Parameters under Polyhouse Farming using GSM

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Abstract: *Agricultural field is playing a vital role in Indian economy. In this, irrigation mechanism is of key concern. Irrigation is the process of artificially supplying water to land where crops are cultivated. Our paper aims to control the wastage of water in the field and to find the exact field condition for farming. Traditionally natural rainfall, canal water and hand pumps were a major source of water supply for irrigation. But this method has led to severe drawbacks like under irrigation, over irrigation which in turn causes leaching and loss of nutrient content of soil. For the monitoring and controlling of the agriculture field, different types of sensor were used. Those are temperature, humidity, soil moisture, level sensor and light sensor. GSM technology is used for communication purpose to inform the end user about the exact field condition. We are using motor for soil module and level sensing applications.*

Keywords: GSM MODEM, PIC16F876A, RS232 converter (MAX232N) serial port, sensors.

1. Introduction

Irrigation is a scientific process of artificially supplying water to the land or soil that is being cultivated. The advances in the technologies related to wireless communication has led to the emergence of several engineering design to aid the human requirements. As we all know agriculture play a significant role in developing country like India and implementing mobile communication for facilitating farmers is the basic idea of our project. In dry areas or in case of inadequate rainfall, irrigation becomes difficult. So it needs to be automated for proper yield and handled by remote for farmer safety and it is also beneficial for farmer. If the farmer is far from the agricultural land, he will not be noticed of current conditions. So, efficient water management plays an important role in the irrigated agricultural cropping systems. A GSM based farm irrigation system has two major technologies, primary being the GSM and secondary is the controller or processor. This processor or controller works as a central core for functioning of the automated process after it has been initiated by the GSM based device and finally presents the output to the device. PIC16F876A microcontroller is used for designing the proposed system. This microcontroller continuously receives the data from sensor in the form codes. And after this, the data is displayed on the LCD. LCD is used for the display purpose of field condition. Here motor is also used. Once the motor is started, a constant monitoring on soil moisture and water level is done and once this moisture is reached to sufficient level, the motor is automatically turned off and for this the message is send to subscriber that the motor is turned off. In this project we are using some sensors like level sensor, temperature sensor, humidity sensor and light sensor. Level sensor is used to monitor the soil condition. If the soil is dry means, it is harmful to plants. So it immediately release the water into the soil and make it wet. Temperature and humidity sensor is useful to monitor the weather condition. Water level sensor is use to monitor the water level. Now everything is going to be automated using this technology, using this technology we can access the devices remotely. Motor Starter for irrigation in Agricultural Applications encompasses lighting, security, telecommunications, access and safety, information and entertainment systems and thermal comfort systems. This is done through a mobile device making this system truly global. This project can be developed by us as a multipurpose project which can be used for controlling of lights and other electronic devices in home, offices etc. and for various time saving and manual effort preserving tasks that can be accomplished via SMS.

2. Literature Review

Nilesh S. Bhaltadak, Hemant T. Ingale, S. K. Chaudhari (June 2015) [1] Irrigation is the process of artificially supplying water to land where crops are cultivated. Traditionally rainfall, canal water and hand pumps are major sources of water supply for irrigation. Automated irrigation system which automates the irrigation of land by combining various software and hardware for field irrigation. Here WSN is used to monitor the environmental condition, wireless sensor network (WSN) refers to a group of sensors for monitoring and recording the physical conditions of the environments and organizing the collected data at a central location. This paper gives detailed survey of various automated farm irrigation systems. GSM serves as an important part also it is responsible for controlling the irrigation facility and sends them to receiver through coded signal.

R.suresh, S.Gopinath, K.Govindaraju, T.Devika, N.Suthanthira Vanitha (February 2014) [2] The green house based modern agriculture industries are the recent requirement in every part of agriculture in India. In this technology, the humidity and temperature of plants are precisely controlled. Due to the variable atmospheric conditions sometimes may vary from place to place in large

farmhouse, which makes very difficult to maintain the uniformity at all the places in the farmhouse manually .The proposed system implemented GSM is used to report the detailed about irrigation. The report from the GSM is send through the android mobile. The keil software is used for simulated the result.

Prathyusha.K, G. Sowmya Bala , Dr. K. Sreenivasa Ravi (August 2013) [3] Agricultural sector is playing vital role in Indian economy, in which irrigation mechanism is of key concern. Our paper aims to find the exact field condition and to control the wastage of water in the field and to provide exact controlling of field by using the drip irrigation, atomizing the agricultural environment by using the components and building the necessary hardware. For the precisely monitoring and controlling of the agriculture filed, different types of sensors were used. To implement the proposed system ARM LPC2148 Microcontroller is used. The irrigation mechanism is monitored and controlled more efficiently by the proposed system, which is a real time feedback control system. GSM technology is used to inform the end user about the exact field condition. Actually this method of irrigation system has been proposed primarily to save resources, yield of crops and farm profitability.

N. Priyanka, Aravind (Sept – Oct 2012) [4] Project is used to find exact field information and to provide instant across the field. This involves some sensors, LCD display, GSM and ARM processor. All the sensors will give analog output but our processor will accept only the digital data. So we have to connect all the sensors to the ADC channel pins which are in-built to the processor.LCD will be on field display purpose. GSM module will contains a Subscriber Identity Module (SIM) user can communicate with this SIM-Number. When the particular command activated or given by the user, immediately the corresponding sensor will activates and reads the present reading and immediately sends results to the same user mobile and displays in the LCD panel in the field. Immediately user will take the necessary action if required. Here we are using total seven sensors to monitor the field condition. Those are Temperature, Humidity, Soil moisture, Leaf sensor, PH sensor, Level sensor, Phase sensor. All these devices are connected to the ARM processor.GSM is used for communication purpose, with the help of AT (attention)-Commands we can communicate with the components. For soil module and level sensing applications we are using motors. One motor is used to store water and another is for releasing the stored water into the soil.

Indu Gautma, S.R.N. Reddy (June 2012) [5] In past few years controlling and monitoring the machines remotely has seen an interesting field of study among researchers. This paper mainly focuses on reviews in the field of remote monitoring and control, the technology used and their potential advantages. The paper proposes an innovative GSM/Bluetooth based remote controlled embedded system for irrigation.

3. Methodology

Methodology is the systematic, theoretical analysis of the methods applied to a field of study. It comprises the theoretical analysis of the body of methods and principles associated with a branch of knowledge. Typically, it encompasses concepts such as paradigm, theoretical model, phases and quantitative and qualitative techniques. A methodology does not set out to provide solutions – it is, therefore, not the same as a method.

3.1 Concept of real – time irrigation system

By using the concept of modern irrigation system a farmer can save water up to 50%. This concept depends on two irrigation methods those are: conventional irrigation methods like overhead sprinklers, flood type feeding systems i.e. wet the lower leaves and stem of the plants. The area between the crop rows become dry as the large amount of water is consumed by the flood type methods, in which case the farmer depends only on the incidental rainfalls. The crops are been infected by the leaf mold fungi as the soil surface often stays wet and is saturated after irrigation is completed. Overcoming these drawbacks new techniques are been adopted in the irrigation techniques, through which small amounts of water applies to the parts of root zone of a plant. The plant soil moisture stress is prevented by providing required amount of water resources frequently or often daily by which the moisture condition of the soil retains well.
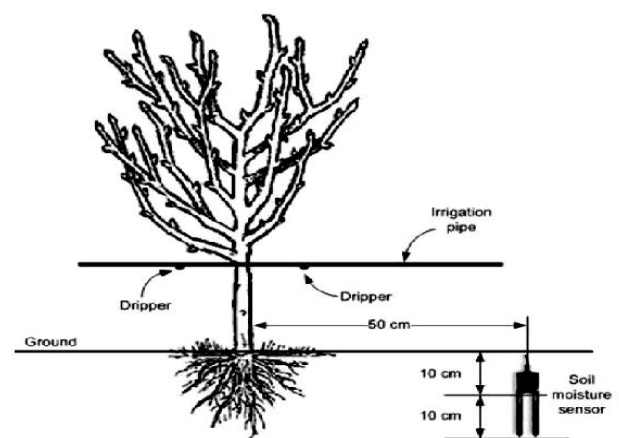

Figure 1: Drip Irrigation

The diagram above shows the entire concept of the modern irrigation system. The traditional techniques like sprinkler or surface irrigation requires / uses nearly half of water sources. Even more precise amounts of water can be supplied for plants. As far as the foliage is dry the plant damage due to disease and insects are reduced, which further reduces the operating cost. The dry rows between plants lead to continuous federations during the irrigation process.

3.2 Operation of real-time automation of Indian agricultural system

Before going to the operation of the circuit, first we have to give the necessary power supply to all the components. The designed components need 5v supply to work whereas the

arm processors need 3.3v supply. So we are giving 3.3v from the LM317. This is the device can provide 3.3v to the processor. For remaining devices get supply from our power supply circuit gives 5v output. MCU-based home wireless control centre is used along with one WSN centre node module and several data collecting nodes, GSM module, GSM network and mobile phone. The WSN data collecting node modules are connected with different types of sensors. When the components are activated, all the components read and give the output signal to the controller, when the user want to get the information then user should have to send a message from his mobile and immediately corresponding readings send short message to the users through the GSM module and GSM network immediately. Here we use only GSM for prototype development. The sensor readings are analog in nature so the ADC pin in the controller converts the analog signals into digital format. Then the controller access information. The operation of the circuit is given as, when we want access our field information then we have send a message to GSM modem, that modem consists of SIM (Subscriber Identity Module) and another is user mobile. When user want to access the field information, then user should send message to the GSM. Then the particular sensor is activated and reads the present condition of the field and gives the same information to the user number. User can analyze the results, if the results are seems to be very bad, then user should provide necessary fertilizers or any other precautions they have to follow.

3.3 Overview of message passing

Message Passing is a form of Inter-Process Communications (IPC) that can be implemented as part of a programming language or as a service provided by an operating system. Message passing is usually considered to be more scalable with the number of processes. This IPC can be used both within a single processor and across multiple processors; when used across multiple processors, it is sometimes called Distributed Message Processing. There are three major aspects of Message Passing:

- Locating (addressing) of receivers of messages
- Sending messages
- Receiving messages

The ability to locate the recipient of a message at run-time provides a great deal of flexibility in building applications. For example, an application may start on a single processor system that becomes incapable of supporting a larger usage, so by adding a second processor and splitting the application across the two processors, more computing resources can be applied. Of course, this requires structuring the application as more than one independent threads of execution. A writer or sender thread can send a message to another reader or receiver thread after locating the address of the desired thread. Sending a message is typically done by supplying a buffer to a method that uses the destination address to determine how to transfer the buffer contents to the receiver. For efficiency"s sake, this should be done with minimal (hopefully zero) copies. The receiver of the message retrieves the message by calling another method that either retrieves a buffer or copies the contents of a buffer into the receiver"s buffer.

3.4 Algorithm

The algorithm used for this project is as given below:
```
void main()
{
initADC(); // setup ADC
serialInit(); // setup 9600 serial communication
while(1)
{
printf("AT\n");
delayms(2000); // 2 sec delay
printf("AT+CMGF=1\n");
delayms(2000); // 2 sec delay
printf("AT+CMGS=\"09825858509\"\n");
delayms(2000); // 2 sec delay
printf ("CH#1=%bu ", getADC(1)); // sends ADC value as SMS
putchar(26); // Ctrl-Z indicates end of SMS and transmit message
delayms(2000); // 2 sec delay
```

4. Hardware Methodology

The below figure is the block diagram of agricultural system. The device consists of GSM modem, microcontroller, motor starter, relays, memory and display.
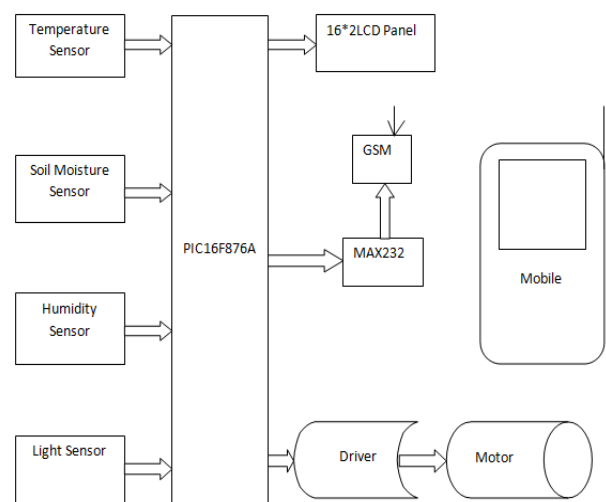


Figure 2: Block diagram of proposed system

The total circuit arrangement is shown in the above figure. Here we are using sensors, they are temperature sensor, soil moisture sensor, humidity sensor and light sensor. If the user wants to control some device in his house, he have to send the SMS indicating the operation of the device and then the system password, while the MODEM embedded with the system microcontroller receives SMS. The microcontroller will read SMS and check for the password user had sent with the SMS. Hear the commands are sent to moter starter for irrigation in agricultural applications system through user mobile as data through SMS (short message service) providing a cost effective reliable far reaching access to user.

The coded SMS is sent to the motor starter for irrigation in agricultural application base station controller that receives the message, decodes the message, initiates required automation operations and responds to the successful initiations by a reply to the user. Such a way the project works. This project can be developed by us as a multipurpose project which can be used for controlling of lights and other electronic devices in home, offices etc. And for various time saving and manual effort preserving tasks that can be accomplished via SMS. Irrigation is the process of artificially supplying water to land where crops are cultivated. Traditionally hand pumps, canal water and rainfall were a major source of water supply for irrigation. This method has led to severe drawbacks like under irrigation, over-irrigation which in turn causes leaching and loss of nutrient content of soil. Changing environmental conditions and shortage of water have led to the need for a system which efficiently manages irrigation of fields. Automated irrigation system is a machine based system, which automates the irrigation of land by combining various software and hardware approaches together for field irrigation. This paper deals with a detailed survey of various GSM based automated farm irrigation systems. GSM serves as an important part since it is responsible for controlling the irrigation facility and sends them to receiver through coded signal. Our study is concentrated on comparison of various GSM approaches.

5. Result

PCB layout for motherboards and daughter cards are as following:-

To initialize testing first PCB has been inspected as per layout diagram. This is called as bare board inspection. After this it needs to be tested for power supply conditions and smoke fest with timing constraint.
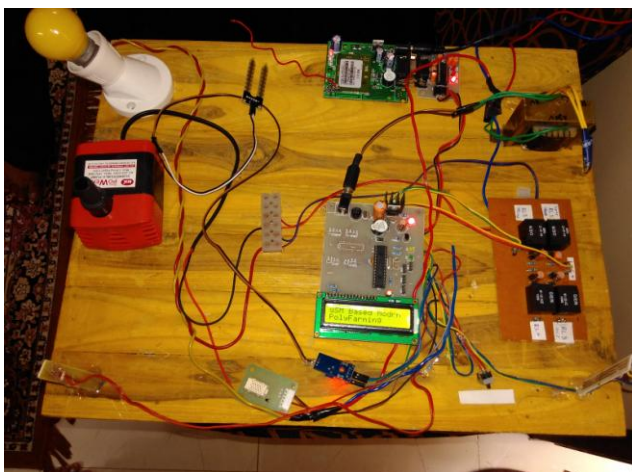
This is done simply by applying power supply to board and testing voltages of various test points and IC pins. Suppose it is not found ok then hardware needs to be verify essentially, unless it work properly no software can be tested on it. Here in our project first we have to switch on the power supply and the project starts. Now „GSM Board Modem Polyfarming‟ is displayed on screen. After that we have to set one value like 115 30 35 06 and send this value through

SMS. Then the screen displays "SMS FRM 95********". After that we have to operate the sensors in the project and the get the different reading. This readings are as shown in below hardware pictures. This readings shows variations in sensors reading.

Figure 3: Result displaying on hardware

Here, In the above hardware pictures there are four readings. They are Light, Temperature, Humidity and Soil Moisture respectively. In the above four hardware pictures there is variations in the first reading i.e. variation in the Light reading because of the Light sensor used in the project. Means if the brightness of light is different than the set value then it gives variations to us on display. So, for this hardware testing report is as follows:

Table 1: Hardware testing report

Sr No	SMS For	Condition	Status On Relay1	Status On Relay2	Status On Relay3	Status On Relay4
1	Temperature	OK	0	0	0	0
2	Light	OK	0	0	0	0
3	Humidity	OK	0	0	0	0
4	Soil Moisture	OK	0	0	0	0
5	Temperature	Fault	1	0	0	0
6	Light	Fault	1	1	0	0
7	Humidity	Fault	1	1	1	0
8	Soil Moisture	Fault	1	1	1	1

5.1 Specifications

Table 2: Specifications

Items	SY-HS-220
Rated voltage	DC 5.0V
Rated power	=<3.0nA
Operating temperature	$0\sim60^0c$
Operating humidity	30-90%RH
Storage humidity	Within 95%RH
Storage temperature	$30\sim85^0c$
Standard output	DC 1,980mV(at 25^0c, 60%RH)
Accuracy	±5%RH(at 25^0c, 60%RH)
Remarks	PCB unit containing thermistor or diode for temperature compensation.

5.2 Advantages

1. Real - time response, monitoring and controlling.
2. Checking the weather conditions and intimating to user.
3. It will protect each and every issue regarding plant growth.
4. Controlling and managing whole system through GSM.

5.3 Applications

1. Industrial automation system
2. Weather Station
3. Home automation system

6. Conclusion

The project is thus carried out using **pic16f** core with the help of GSM technologies. This project finds application in domestic agricultural field. In civilian domain, this can be used to ensure faithful irrigation of farm field, since we have the option of finding out moisture level of soil in a particular area. The project is a clear indication of a multipurpose control done via sms reducing the manual efforts and time required while paying individual attention for controlling each device. For farmers who need to switch on the water motors at night due to water supply problems with most of the Indian villages this system will surely be very helpful and reduces the risk of night visit to the farm, saves time and energy of the individual. The system requires less design and implementation cost. For handicapped people it may be really not entertaining to involve much in manual work and this system helps them to locate themselves in a place and operate the lights of their room, switch on the fan etc…

6.1 Future Work

Farmers can make use of this system for controlling motor, sprinklers, tanks and also several other devices necessarily operated in the agricultural lands. This is clearly presented in our video as how farmers will make use of our system. As our project turned out into a multipurpose project, we found many device control operations and applications existing out of it.

References

[1] Nilesh S. Bhaltadak, Hemant T. Ingale, S.K. Chaudhari "GSM based Remote Sensing and Control of an Irrigation System using WSN: a Survey" on IJIRSET Vol. 4, Issue 6, June 2015.
[2] R.suresh1, S.Gopinath2, K.Govindaraju3, T.Devika4, N.SuthanthiraVanitha "GSM based automated irrigation control using Raingun irrigation system" on IJARCCE *Vol. 3,* Issue 2, February 2014.
[3] Carvallo N, Stefanelli R., Trinchero D., "Wireless interfaces for sensor networks embedded in tough environments", URSI – EMTS, Hiroshima, Japan, May 20-25, 2013.
[4] Prathyusha.K1, G. Sowmya Bala2, Dr. K. Sreenivasa Ravi, "A real – time irrigation control system for precision agriculture using WSN in Indian agricultural sectors" on(IJCSEA) Vol.3, No.4, August 2013.
[5] Indu Gautma, S.R.N. Reddy, "*Innovative GSM Bluetooth Based Remote Controlled Embedded System for Irrigation*", on IJCA, June 2012.
[6] Purnima, S.R.N Reddy, *"Design of Remote Monitoring and Control System with Automatic Irrigation System using GSM-Bluetooth"*, on IJCA,2012.
[7] Kalyan Mohan Goli, Karthik Madidipatla, Thentu Sravani, *"Integration of Wireless Technologies for Sustainable Agriculture"*, on IJCST,2011
[8] Vasif Ahmed, Siddharth A. Ladhake, *"Design of Ultra Low Cost Cell Phone Based Embedded System for Irrigation",* on International Conference on Machine Vision and Human Machine Interface,2010.

[9] Mahesh M. Galgalikar, "*Real-Time Automization Of Agricultural Environment for Social Modernization of Indian Agricultural System*", on IEEE Proceedings,2010.

[10] Irrigation Security of Reclaimed Water Based on Water Quality in Beijing by Luxuan Yang and Jinfeng Deng,2010 IEEE.

[11] Real-time automation of agricultural environment for modernization of Indian agricultural system. 2010 International Journal of Computer Applications (0975 - 8887) Volume 1 – No. 22.

[12] Control and Communication Challenges in Networked Real-Time SystemsBy John Baillieul, Fellow IEEE, and Panos J. Antsaklis, Fellow IEEE 5. David E. Simon, An Embedded Software Primer, fifth edition, 2007.

[13] Suri, Ankur, S. Sitharama Iyengar, and Eungchun Cho. "Ecoinformatics using wireless sensor networks: An overview." Ecological Informatics 1, no. 3 (2006): 287-293

[14] F.H. Tani, S. Barrington. "Zinc and copper uptake by plants under two transpiration rates.Part I. Wheat (Triticum aestivum L.)," Environmental Pollution, 138. pp. 538-547, 2005.

[15] Burrell, Jenna, Tim Brooke, and Richard Beckwith. "Vineyard computing:Sensor networks in agricultural production." Pervasive Computing, IEEE 3, no.1 (2004): 38-45

[16] Langellier, F., and L. Panigai. "A climatic synthesis: meteo network in the Champagne vineyard (France)." Vigneron Champenois (1999).

[17] N.Priyanka1, Aravind2 " Modern Indian agricultural system using gsm" on IJESAT Volume-2, Issue-5, 1354 – 1356.

[18] M. Nagendra Babu, Indira Priyadarshini S. *"Real Time Automation of Indian Agricultural System"*.

[19] Raynal, M., S. Guittard, C. Debord, A. Davy, T. Plancq, M. Vergnes, S. Codis, and O. Hebrard. "Decision Support Systems in viticulture: Current situation and perspectives."

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