# GREENHOUSE AUTOMATION SYSTEM USING PSOC 3

*[1] SENGUNTHAR GAYATRI R.*

**[1] Department Of Electronics and Communication Engineering, L.J Institute Of Engineering & Technology , Gujarat Technological University, Ahmedabad, Gujarat, India.**

***gayatriece18@gmail.com***

***ABSTRACT :*** *Greenhouse Automatic control is necessary for the plants to grow properly in the controlled manner. This paper mainly reviews the present Greenhouse Monitoring and control systems. It proposes a generic architecture which can be applied for many other automation applications. It also proposes a system which uses a Psoc 3(8051 core) which integrates analog and digital peripherals. The kit senses the temperature and humidity of the greenhouse environment and check with the defined limit. If the parameters are not within the range the actuators will turn on using relays.*

***KEYWORDS: Automation, Psoc 3 , Generic Architecture, Actuators, Relays.***

## 1. INTRODUCTION

Greenhouse Automation System is the technical approach in which the farmers in the rural areas will be benefitted by automatic monitoring and control of greenhouse environment. It replaces the direct supervision of the human. In this paper the different papers have been reviewed and developed the proposed system based on the limitation in the present monitoring system. It also focuses on the Generic Architecture which can be applied for many other Automation Application.

Greenhouse is a building where plants are grown in a controlled manner. Nowadays due to urbanization and lack of land availability there is a great need to construct the Greenhouses which will be reserved mainly for growing crops.

With the advancement of technology we can control and monitor the multiple Greenhouses from the central location wirelessly.

In this paper the different Greenhouse monitoring and control systems are reviewed and based on that the proposed Architecture is developed for better controlling of Greenhouses.

## 2. TECHNOLOGY AND APPLICATION

Different papers have different Architecture, Technology and the monitoring systems used [1] to [9].

Table 1 shows the classification of existing system based on the different criteria:

Purna Prakash Dondapati proposed an Automated Multi Sensored Green House Management[1] which explains how to overcome the effect caused by the disadvantages in the normal cultivation without any human observation. It also explains the effective working of sensors which help the project to become automated to yield more useful results in cultivation.

Uday A. Waykole proposed Greenhouse Automation System[2] in which the WSN and Zigbee was used for the communication purpose. A wireless sensor network can be used to gather the data from point to point. The data from the greenhouse will be measured by the sensor and the data that are collected will be sending to the receiver. The data that has been read will be displayed on the LCD screen.

Sumit A. Khandelwal proposed an Automated Green House Management Using GMS Modem[3] which describes the design of fully automated green house management system. It not only provides automatic control over the devices like shade, light, motor pump but also tackles with the critical conditions like fire, absence of light and rain. Thus this construction, productivity of cropping can be continuously increased so it can handle famine

problem around the world. It also introduces the facility that provides remote access control to user.

Indu Gautam in Innovative Gsm Bluetooth based Remote Controlled Embedded System for Irrigation[4] proposes the design of the innovative GSM Bluetooth based remote controlled embedded system for irrigation. The proposed system is a low cost system where information is exchange via SMS on GSM network. The system has advantage of using Bluetooth if the user is within the 10m range of designed system. The use of Bluetooth technology cuts down the cost of SMS if the user is within the limited range of designed system. The availability of the GSM network is a prerequisite for the system implementation. The system is highly beneficial for precise irrigation in farm fields and thus responsible for efficient utilization of water resource and men power.

K. Rangan in an Embedded Systems Approach to Monitor Green House[5], based on the measuring of parameters like Humidity, Water pH, Soil wetness, Light intensity and temperature by sensors are located at different places, where measured, processed, controlled and updated to owner through SMS using GPS modem.

Kiran Sahu and Mrs. Susmita Ghosh Mazumdar in Digitally Greenhouse Monitoring and Controlling of System based on Embedded System[6] proposes a simple automatic system for a small scale agriculture.

Rajeev G Vishwakarma and Vijay Choudhary in Wireless Solution for Irrigation in Agriculture[7] shows how mobile technology can benefit millions of farmers in rural India by providing a solution for the irrigation problems caused by intermittent electrical power supply.

Vandana Pandya and Deepali Shukla in GSM Modem Based Data Acquisition System[8] uses AVR microcontroller ATmega 644P interfaced with GSM Modem. The system monitors the conditions of the different parameters continuously and sends message to mobile numbers using SMS

G.K. Banerjee and Rahul Singhal, in Microcontroller based Polyhouse Automation Controller[9] designs an autonomous control for temperature and relative humidity in a close environment of the single polyhouse unit.

## 3. PROCESSOR USED AND MONITORING STATION

In the above explained application , different processors are used based on the needs[1] to [9].

The system [1] and [6] uses a AT89C52 and AT89C51 controller respectively which is a 8 bit controller and the wired technology is used and the output is displayed on the LCD display.

The system [7] uses a AT89C51 controller based on GSM and the monitoring station is the LCD display and the Mobile.

The system [9] uses a PIC 16F877A controller which has an inbuilt ADC and wired technology in which the output is displayed in the LCD.

The system [4] and [5] uses a PIC 16F877A controller which has an inbuilt ADC based on GSM technology in which the output is displayed on the mobile. The paper[4] has an extra feature that bluetooth technology is used when the user is within the range of 10 meter.

The system [8] uses a ATmega 644P Arduino microcontroller which has the inbuilt ADC and the data is continuously stored in the PC based on the GSM technology.

## 4. ANALYSIS OF EXISTING SYSTEM

All these systems [1]-[9] are well suited for remote control and monitoring applications depending upon the requirement of the system.

Some of the systems are for small scale agriculture which is only based on the sensors, actuators and the controllers [1],[6],[9]. In this systems the controller is only the main unit in which the sensors will sense the parameters and if the set parameters are not within the range then the actuators will turn on. This has the limitation that it does not update the user and the user has to check it after every particular interval.

A hard-wired system from in-field sensing station to monitoring station takes extensive time and costs to install and maintain. It is not practically feasible to hard wire the system for long distances and may also be not acceptable to farmers because it can Interfere with normal farming operations. All these problems are solved by GSM based remote monitoring and control systems. The paper [4],[5],[7],[8] is based on GSM-SMS method in which the user is continuously updated with the

information and can also control it. Only the difference in this is the processor or controller used in this.

cost, reasonable range and average data rate. Zigbee supports data rate of 250kbps which is more than enough for SMS, it is not intended for voice and data streaming because it consumes a large bandwidth and consumes power quickly and thus makes the technology unsuitable for real time applications.

WSN based remote monitoring and control systems is explained in [2] .The wireless sensor network eliminates the need of hard wire sensor station across the farm land and in this way reduces the installation and maintenance cost. WSN uses ad hoc network (mobile wireless network) that has advantages for agricultural applications because of its unique features like mobility and self configurability. But the communication distance is limited among wireless sensor nodes and ability of signal through wall is very poor.

Another Zigbee based technology used for remote monitoring and control systems is given in [2]. It provides easy wireless installation of sensors at a lower

From the above discussion it is concluded that every system has its own merits and demerits. The system should be such that it can satisfy the maximum needs of the user. So the proposed system has the control of multiple greenhouse which reduces the man power and human intervention.

Table 1 shows the existing monitoring systems.

**Table 1 Existing Remote Monitoring and Control System**

| References | Technology | Processor | Monitoring Station |
|---|---|---|---|
| 1] | Wired | AT89C52 | LCD Display |
| 2] | Zigbee, WSN | PIC | LCD Display |
| 3] | GSM Modem | (-) | PC |
| 4] | GSM Modem, Bluetooth | PIC 16F877A | Mobile |
| 5] | GSM Modem | PIC 16F877A | Mobile, LCD |
| 6] | Wired | AT89C51 | LCD Display |
| 7] | GSM | AT89C51 | Mobile, LCD |
| 8] | GSM | ATmega 644P | Mobile, PC |
| 9] | Wired | PIC 16F877A | LCD Display |

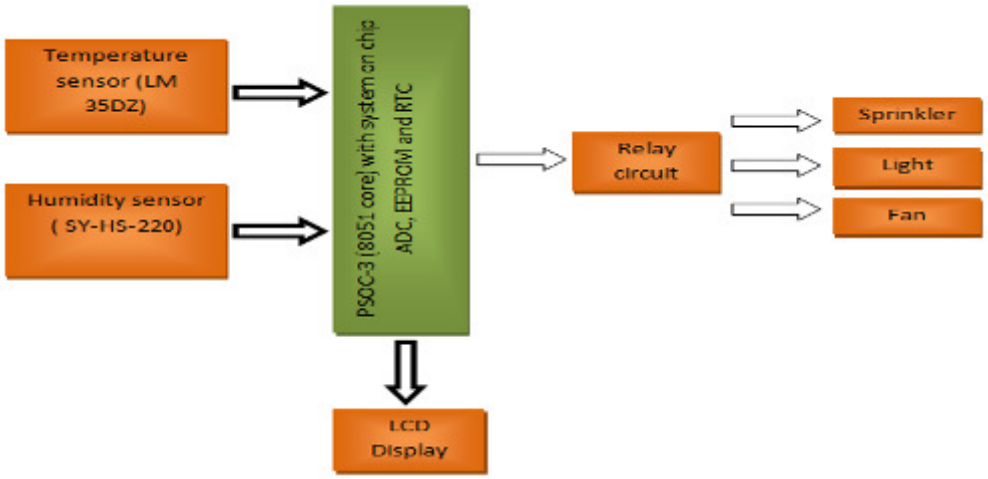


Fig. 1 Block Diagram of Proposed Architecture

## 5. PROPOSED SYSTEM

The proposed architecture consists of the sensors, Psoc 3, relay circuit and the actuators which is as shown in fig. 1. The system consists of hardware and software requirements. The sensors used in this system are Temperature Lm 35DZ and for humidity SY- HS-220 sensor which is suitable for the greenhouse Environment.

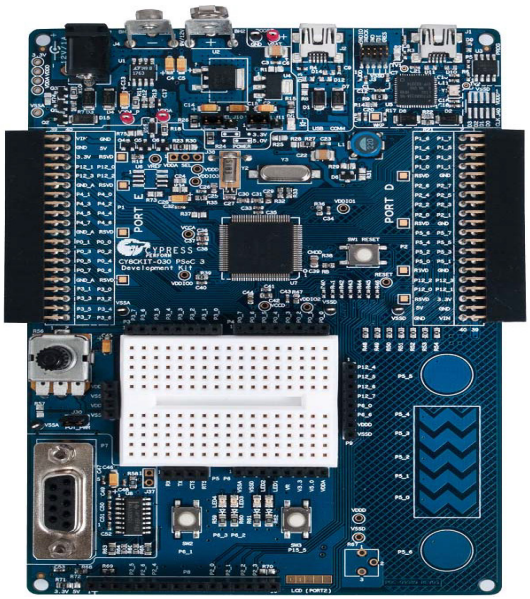

Fig. 4 Psoc 3 Kit

### 5.1 HARDWARE REQUIREMENTS

The hardware required for the Greenhouse control are:

**1] Transducers:** The transducer are the sensors which converts the physical quantity into electrical quantity. Two sensors used in the system are:

**a) Temperature sensor(LM 35DZ)** - It calibrates directly in degree celcius. It is as shown in fig.

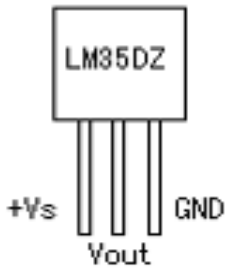


Fig. 2 LM 35DZ

**Features of LM 35DZ:**

- It has an output voltage that is proportional to the Celsius temperature.
- The scale factor is .01V/ºC
- The LM35 does not require any external calibration or trimming and maintains an accuracy of +/- 0.4 ºC at room temperature and +/- 0.8 ºC over a range of 0 ºC to +100 ºC.
- Another important characteristic of the LM35DZ is that it draws only 60 micro amps from its supply and possesses a low self-heating capability. The sensor self-heating causes less than 0.1 ºC temperature rise in still air.
- The sensor has a sensitivity of 10mV / ºC.

**b) Humidity sensor(SY-HS-220)** - The humidity sensor is of capacitive type, comprising on chip signal conditioner which is as shown in fig. 3. However, it is mounted on the PCB, which also consists of other stages employed to make sensor rather more smart. The PCB consists of CMOS timers to pulse the sensor to provide output voltage. Moreover, it also consists of oscillator, AC amplifier, frequency to voltage converter and precision rectifiers. Incorporation of such stages on the board significantly helps to enhance the performance of the sensor. Moreover, it also helps to provide impediment to the noise.

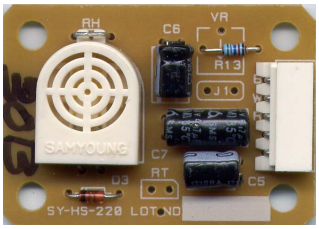


Fig. 3 SY-HS-220

The humidity sensor used in this system is highly precise and reliable. It provides DC voltage depending upon humidity of the surrounding in RH%. This work with +5 Volt power supply and the typical current consumption is less than 3 mA. The operating humidity range is 30% RH to 90% RH. The standard DC output voltage provided at 250C is 1980 mV . The accuracy is ± 5% RH at 250C. As shown in the fig 3, it provides three pins recognized as B, W and R.

**2] Psoc 3 Kit:** It is the programmable system on chip which integrates analog and digital peripherals, memory and microcontroller(8051 core), shown in Fig. 4.

**3] Relays:** A relay is a simple electromechanical switch made up of an electromagnet and a set of contacts.

**4] Actuators:** It is a device which is used to control the parameter to the desired level. The actuators used in the system are:

- Fan
- Light
- Sprinkler

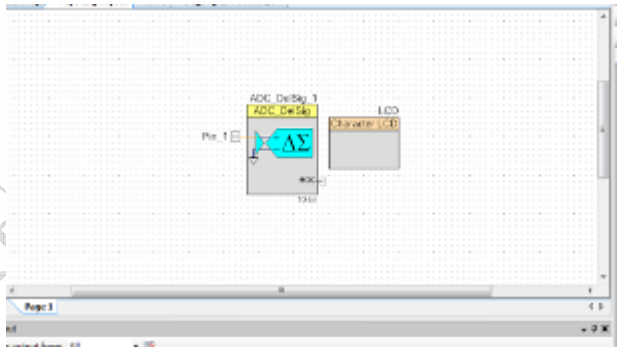


Fig. 5 Schematic Window

**2) Ports/Pin Assignment Window:** The window where the pin number are assigned to the components and the system configuration can be changed.

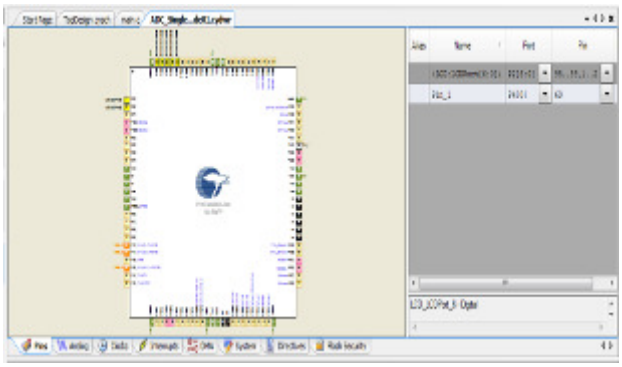

Fig. 6 Ports/Pin Assignment Window

## 5.2 SOFTWARE REQUIREMENTS

The software required to implement the code is Psoc Creator. It has updated versions. For this system Psoc Creator 2.2 is used to code, Debug and program the device. The Communication between the PC and the device is done through the USB.

The Psoc Creator has 3 windows:

**1) Schematic Window**: The window where the components are dragged and dropped and connected through the wires.

## 6. IMPLEMENTATION

The Limit set for the two crops is done in the Psoc 3. If the temperature and humidity for the

particular crop is within the range then it shows the current values, if not in the range then actuators will be turned on/off as per the requirements. The crop details for the two greenhouse crops is as shown in table 2.

Table 2 Crop Details

| Greenhouse Crop | Temperature Required(in Celcius) | Humidity Required(in RH%) |
|---|---|---|
| Rose | 24 to 28 | 65-70 |
| Capsicum | 21 to 24 | 50-65 |

## 7. CONCLUSION AND FUTURE WORK

This paper shows the existing technology and processor used for the Greenhouse Applications. The Psoc 3 coding is done to set the limits of the parameters of the two crops. If the parameters are within the range then the value is displayed in the LCD. If it is not within the range the controller will turn on/off the actuators as per the requirements. Thus controlling the Greenhouse automatically without human intervention.

Further the details can be updated to the user's mobile through GSM Modem interfaced with Psoc 3.

## 8. REFERENCES

1] Purna Prakash Dondapati, " An Automated Multi Sensored Green House Management" International Journal of Technological Exploration and Learning (IJTEL) Volume 1 Issue 1 (August 2012) –Page no:21-24.

2] Uday A. Waykole , “Greenhouse Automation System” 1st International Conference on Recent Trends in Engineering & Technology, Mar-2012, Special Issue of International Journal of electronics, Communication & Soft Computing Science & Engineering, ISSN: 2277-9477-Page no:161-166.

3] Sumit A. Khandelwal, "Automated Green House Management Using GMS Modem" , International Journal of Computer Science and Information Technologies, Vol. 3 (1) , 2012, 3099 – 3102

4] Indu Gautam, “Innovative Gsm Bluetooth based Remote Controlled Embedded System for Irrigation” International Journal of Computer Applications (0975 – 888) Volume 47– No.13, June 2012,Page no:1-7 .

5] K. Rangan, Indian Institute of Technology Madras, Chennai, India, T. Vigneswaran, SRM University, Chennai, India " An Embedded Systems Approach to Monitor Green House" 978-1-4244-9182-7/10/$26.00 ©2010 IEEE, Page-61-65.

6] Kiran Sahu, Mrs. Susmita Ghosh Mazumdar " Digitally Greenhouse Monitoring and Controlling of System based on Embedded System " International Journal of Scientific & Engineering Research, Volume 3, Issue 1, January-2012 1 ISSN 2229-5518.

7] Rajeev G Vishwakarma, Vijay Choudhary Department of Computer Science, SVITS Indore, India " Wireless Solution for Irrigation in Agriculture" Proceedings of 2011 International Conference on Signal Processing, Communication, Computing and Networking Technologies (ICSCCN 2011).

8] Vandana Pandya, Deepali Shukla , Asst.Professor, Medicaps Institute of Technology & Management, Indore (M.P.), India " GSM Modem Based Data Acquisition System " International Journal Of Computational Engineering Research (ijceronline.com) Vol. 2 Issue.5.

9] G.K. Banerjee, Rahul Singhal, Electrical engineering dept., College of Technology G B Pant University Pantnagar, India " Microcontroller based

Polyhouse Automation Controller" 2010 International Symposium on Electronic System Design.

10] B.Chiranjeevini Kumari, K.Rajasekar, BVCEC, India "Implementation of SMS based Heartbeat monitoring system using PSoC Microcontroller" IJECT Vol. 2, SP-1, Dec . 2011 ISSN : 2230-7109(Online) | ISSN : 2230-9543(Print).