

Automation of Green House Using ARM7 with Zigbee Wireless Communication

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Abstract: Agriculture has been one of the primary occupations of man since early civilizations and even today manual interventions in farming are inevitable. Greenhouses form an important part of the agriculture and horticulture sectors in our country as they can be used to grow plants under controlled climatic conditions for optimum produce. Automating a greenhouse envisages monitoring and controlling of the climatic parameters which directly or indirectly govern the plant growth and hence their produce. The proposed system is an embedded system which will closely monitor and control the microclimatic parameters of a greenhouse. The system consists of five sensors which monitor temperature, humidity, light, soil moisture and gas inside the green house. Greenhouse status can be observed on PC, located away from the greenhouse due to use of ZIGBEE technology. The measurement results obtained from the circuit have shown that the system performance is quite accurate.

Keywords: Arm7, Zigbee.

1. Introduction

India is the one of the fastest growing country in the world which provides most of the agricultural raw material to the world. The greenhouse technology in India has benefitted by the advanced technology implemented. To expedite the commercialization of agricultural in India it is necessary to develop cost effective sophisticated greenhouse controller with latest technology. The study undertaken is the technology which observes and regulate the condition in the greenhouse by controlling various parameters like temperature, humidity, soil moisture, light and gases.

2. Requirements of system

The system consists of

- Sensors (Data Acquisition System)
- Temperature Sensor (Pt100)
- Humidity Sensor (Hs2000)
- Light Sensor (Ldr)
- Moisture Sensor
- Gas Sensor (Mq7) Arm7 Lpc2148
- Liquid Crystal Display (Hitachi's Hd44780)
- Actuators Relays

- Devices Controlled
- Water Pump (Simulated as a bulb)
- Cooler (Simulated as a fan)
- Artificial Lights (Simulated as 2 bulbs)

Transducers (data acquisition system): This part of the system consists of various sensors, namely soil moisture, humidity, temperature and light and Gas. These sensors sense various parameters- temperature, humidity, soil moisture and light intensity and Gas are then sent to the analog to digital converter.

- *Humidity sensor block:* The humidity sensed using humidity sensor. The output voltage of humidity sensor varies in linear proportion with respect to change in humidity is applied to AD1CHO for measurement purpose.
- *Temperature sensor block:* The temperature is sensed by thermistor, rtd sensor. The signal conditioning block is inserted to achieve appropriate linear measurement of temperature. Output voltage of temperature block is applied to ADC1C1 of arm controller for measurement purpose.
- *Moisture sensor block:* The moisture sensed using NPN transducer. The output voltage of sensor varies in linear proportion with respect to change in humidity is applied to AD1CH2 for measurement purpose.
- *Light sensor block:* The light is sensed by LDR sensor. The signal conditioning block is inserted to achieve appropriate linear measurement of light. Output voltage of light block is applied to ADC1CH3 of arm controller for measurement purpose.
- *Gas sensor block:* Measurement of gas pollutants in atmosphere is always a challenging job due to the accuracy required in its measurement. Among the various gas sensors available in the market semiconductor sensors are considered to have fast response, high stability, low cost, long life, low dependency on humidity, low power consumption, and compact size etc.

3. Experimental setup

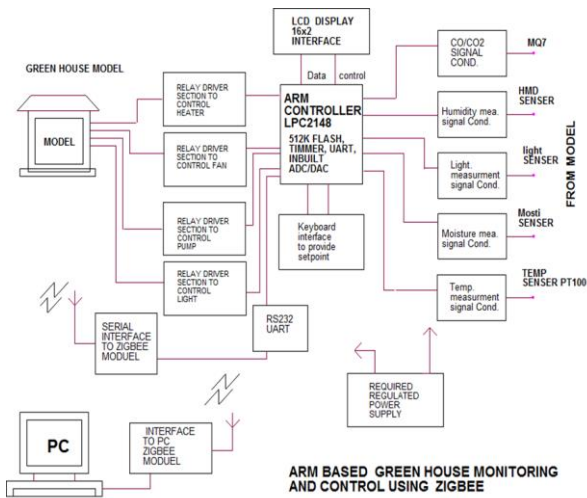


Fig. 1. Block diagram of ARM based Greenhouse monitoring and control using ZigBee

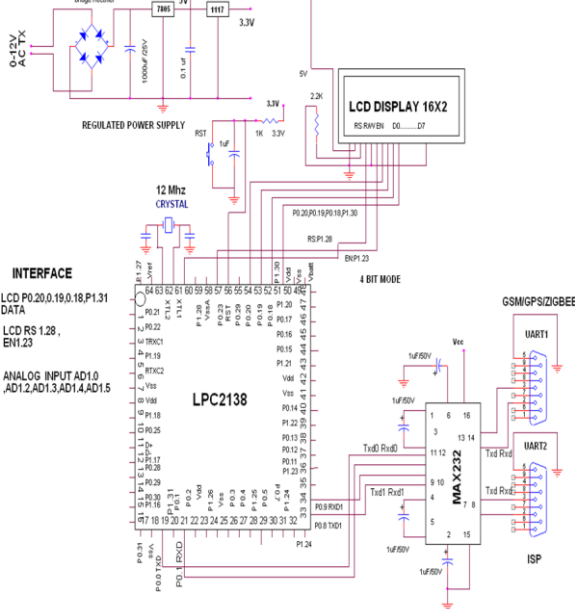


Fig. 2. Pin configuration of arm board LPC 2148

Different parameters to be monitored, their range

1. Temperature: 0-100°C
2. Humidity: 0%-100 %
3. Light concentration: 0% -100%
4. Moisture measurement: 0% -100%
5. Gas conc.measurement: 20 to 2000ppm

Zigbee communication is specially built for control and sensor networks on IEEE 802.15.4 standard for wireless personal area networks (WPANs), and it is the product from Zigbee alliance. This communication standard defines physical and Media Access Control (MAC) layers to handle many devices at low-data rates. These Zigbee's WPANs operate at 868 MHz, 902-928MHz and 2.4 GHz frequencies. The data rate of 250 kbps is best suited for periodic as well as intermediate

two-way transmission of data between sensors and controllers.

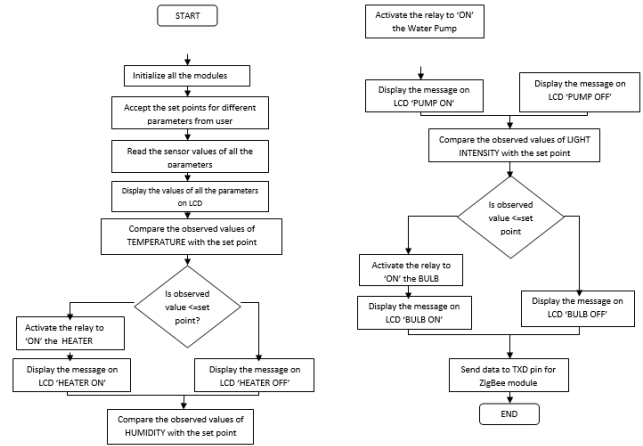


Fig. 3. Flowchart

4. Result

By collecting data from Zigbee module data is observed on PC's monitor with GUI developed with Visual Basic.

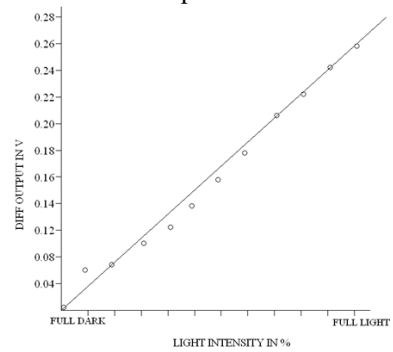


Fig. 4. Different output (V) vs light intensity

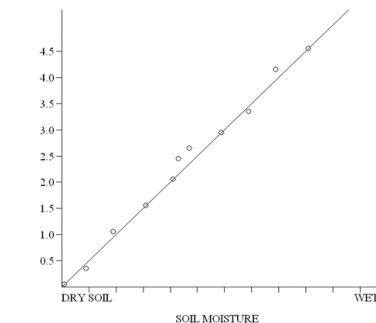


Fig. 5. Change in soil moisture recorded

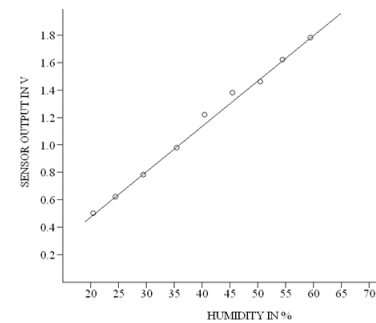


Fig. 6. Sensor output (V) vs humidity (%)

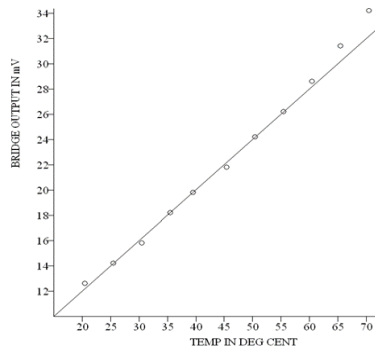


Fig. 7. Bridge output (V) vs temperature (°C)

5. Conclusion

The ARM based control panel technology is used to regulate

the five parameters viz., temperature, humidity, soil moisture, gas and light intensity. The ZigBee communication protocol is used due to its a low data rate, low power consumption, low cost, wireless protocol for automation and remote control. The observed results and data collected are quite accurate with high precision.

References

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