International Journal of Research
Available at https://edupediapublications.org/journals
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 03 Issue 10
June 2016

ARM Based Remote Monitoring and Control System for Environmental Parameters in Green House

B.N. Srinivas[1], S. Sai Thanmai[2]

[1]Associate Professor, ECE Department, MLRIT-M, Hyderabad, India

[2]M.Tech Student, Embedded Systems, MLRIT-M, Hyderabad, India

[1]svs.410@gmail.com, [2]sttanmai@gmail.com

***Abstract*—** Controlling Home appliances (AC Loads) based on environmental parameters like temperature, light, humidity and Co2. In my proposed solution, I have connected sensors, AC Loads and GSM connected to the ARM7 (controller of my project), when user sends '?' to processor it sends you back with all sensors values and if user wants to turn ON or OFF the LOADS, user simply sends LOAD ON message through GSM to processor, when processor receives message from static number then it turning OFF the respected loads. On the other hand user can also monitor all the sensors values on the internet even. Here I've uploaded all the sensors values into thingspeak using internet of things.In my project I've introduced two ways which user can control and monitor the environmental parameters.

***Keywords*— Embedded C, ARM Processor, XBEE, Sensors and Internet of Things.**

I. Introduction

Monitoring and controlling of environmental parameters using different sensors. Monitoring has done by in two ways one by SMS and other by Internet. In previous, monitor and control of green house environment parameters in rural areas, master-slave distributed measurement and control system has designed. In which PC is taken has host. The system consists of host. The consists of PC, soil moisture measurement and control module, temperature, humidity, and Co2 monitoring and control module. . In the system, PC has large amount of data storage which is easy to make use of fuzzy control expert

system, configuration software-KingView is used to develop software for PC, by which the development cycle is shorten and a friendly human-computer interaction is provided. Each monitoring and control module consists of STC12 series of microcontrollers, sensors, relays etc. Different modules are select based on the need of system to achieve control of greenhouse in partition and block.

In the above scenario environment parameters control by PC, that means monitoring and controlling done by PC only. This system for who can always stay at PC, and he monitors continuously. In my system, no need to monitor or control at a particular place, you can go anywhere but still you can monitor the environment parameters.

In this system, I've taken controller as ARM7 (LPC2148), and to monitor the environment variables I've taken different sensors that can detect the different environmental parameters respectively. I have connected those sensors to ADC channels of ARM7.

Controlling Home appliances (AC Loads) based on environmental parameters like temperature, light, humidity and Co2. In my proposed solution, I have connected sensors, AC Loads and GSM connected to the ARM7 (controller of my project), when user sends '?' to processor it sends you back with all sensors values and if user wants to turn ON or OFF the LOADS, user simply sends LOAD ON message through GSM to processor, when processor receives message from static number then it turning OFF the respected loads. On the other hand user can also monitor all the sensors values on the internet even. Here I've uploaded all the sensors values into thingspeak using internet of things. In my project I've introduced two ways which user can control and monitor the environmental parameters.

A greenhouse is a building in which plants are grown. These structures range in size from small sheds to very large buildings. For the large rural distract, the greenhouse production has become a way of being rich. The growth of crop in greenhouse depends on temperature, CO2, humidity, light intensity and other parameters in greenhouse. So it is important to real-timely and properly measure and adjust the temperature, CO2, humidity, light intensity and other parameters in the greenhouse. With the continued expansion of production scale, the disadvantages of traditional wire monitoring system are more and more prominent, such as complicated arrangement, difficult maintenance and so on. Then the Remote monitoring system is developed, which based on wireless communication technology, does not need cables, adds or reduces configuration at random, possess simple system construction. Moreover, it is characterized by its low power consumption. Therefore, it proves to be simple and of practical significance.

Greenhouse environment parameters monitoring system based on wireless communication technology has been developed to control remotely, which realizes the measurement, summary and control of temperature, CO2, humidity, light intensity and the other parameters.

In greenhouse more number of the parameters is to be control because, the varieties of the crops are large. They are increasing day by day because of the development in agriculture technology. The automation is possible with simple hardware by using microcontroller where only the controlling is possible but user (farmer) will not get information about the greenhouse. On progress towards the improvement to monitor and control, an attempt was made using wireless technology. There are many technologies can be used for wireless application. It was tried to adopt the wireless communication like Infrared, Bluetooth, Zigbee and RF technology. But the attempt has failed because of technology constraints. In this situation, the wireless sensor network with additional hardware and software is a solution for greenhouse control. If parameters still increase, then for WSN technology bandwidth may not be sufficient [1]. A Control System of Environment Parameters of Greenhouse based on CAN Bus is existing and requires wired system [2]. The Wireless Measurement and Control System for Environmental Parameters in Greenhouse [3], overcomes the disadvantages of wired monitoring system, such as complicated wiring & difficult maintenance.

This project is designed to overcome the above mentioned disadvantages, using which the environmental parameters in every greenhouse can be measured and controlled by microcontroller remotely. The Parameters settings can be made in two modes i.e. by using push button keys or by GSM communication mode remotely. A user can know the greenhouse status or control the system at any time by sending the commands through the GSM technology.

The user can use mobile phone to set the sensor parameters from any place by sending a setting command message to the GSM modem. Also the monitoring device will send the environmental conditions to the user on request at any time. The system can be switched ON or switched OFF just by sending a power ON/OFF command.

II. SYSTEM ARCHITECTURE

The system architecture of this proposed system is divided into two different blocks.

ARM7 END: Hardware implementation for this proposed system is shown below with the simple blocks. Power Supply block is designed and developed to generate power source for the ARM processor and its relevant components. Reset Circuit is designed and developed to reset the program whenever necessary and interfaced to the ARM processor for greater stable response. Clock Circuit is designed and developed to generate oscillationsand interfaced to the ARM processor for needy response. LCD Display can also interface to the ARM processor for displaying the status of the system for better understanding. A simple block diagram shown below:

The simple flow chart of this project would be:

Sensors → ARM7 →GSM

ARM7→ AC LOADS

ARM7 →WEB SERVER → THING SPEAK

BLOCK DIAGRAM

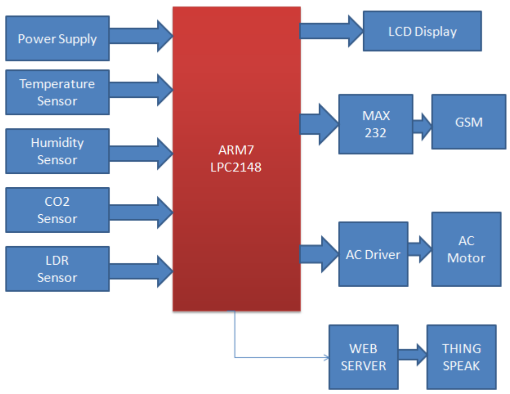

Figure – 1: Block Diagram

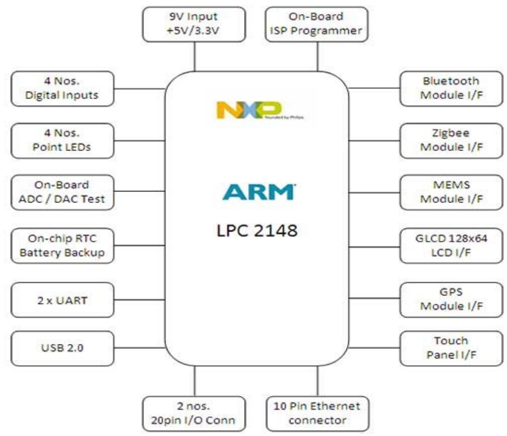

Figure – 2: ARM Overview [LPC2148]

III. IMPLEMENTATION

HARDWARE:

In hardware implementation, ARM processor plays a key role in monitoring and controlling the security system. Low-power consumption ARM processor (LPC2148) operating at 3.3V, 50uA is designed and mounted on a PCB along with Reset Circuit and a Clock Circuit. LPC2148, a 32-bit microcontroller with advanced RISC architecture and having 48 GPIO lines with a program memory of 32KB and a data memory of 512Bytes.

And we have 2 UART ports i.e. UART0 and UART1. In this project GSM/GPRS connected to the UART0 port of ARM7 (LPC 2148). And 1 Analog to Digital channels, though I connected one Analog sensor to ADC channels of ARM7, so that it converts Analog Values to Digital Values. Those values i have uploaded into ThingSpeak.

ARM7 (LPC 2148) internal architecture overview has shown below as well ARM7 (LPC 2148) with LCD has shown below.

Figure – 3: LPC2148 Development Board

*TemperatureSensor:*The temperature sensor will give a variable output voltage with respect to the temperature variation. LM-35 is used as temperature sensor which is a precision integrated-circuit temperature sensor, Calibrated directly in ° Celsius (Centigrade), Linear + 10.0 mV/oC scale factor with accuracy O.soC (at +25°C) with rated for full -55° to +150°C range. Here we will set the minimum temperature value to 20° C and maximum temperature values to 30° C (for demo purpose, in real time the settings will vary with respect to plantation in the greenhouse). If the current temperature rises above the maximum threshold range relayl will be triggered and the cooler

p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 03 Issue 10
June 2016

connected to it will switched on. If the temperature falls below the minimum threshold, then relay2 will be triggered to switch on the heater. If the current temperature is from 20° C to 30° C both relayl and relay2 will be switched off.

The Temperature Sensor which I have used in this project has shown below:

Fig –4: Temperature Sensor

*Humidity Sensor:*Humidity is the quantity of water content in atmosphere. The sensor output will be a variable voltage with respect to the humidity level. Humidity will be measured in percentage. The SY-HS-220 humidity sensor is used which converts relative humidity to the output voltage with operating humidity range 30% - 90% RH and accuracy is ± 5% RH (at +25°C). In nonnal condition the humidity will be around 50% to 70%. In our module we will be setting minimum level to 50% and maximum level to 65%. If the current reading falls below the minimum level the relay3 will be triggered to switch ON the water sprinkler, which will spray water to raise humidity level. Similarly if the humidity rises above maximum limit relay4 will be triggered which in turn OFF the water sprinkler or connect drier fan to it.

The Humidity Sensor which I have used in this project has shown below:

Fig –5: Humidity Sensor

*CO2 Sensor:*This sensor is used to sense the concentration of CO2 in a greenhouse. MQ-7 sensor is used as CO2 sensor which is high sensitivity to LPG, natural gas, sensitivity to alcohol, smoke. The C02concentration detection range is 200ppm to 10000ppm. The concentration of C02can be measured in PPM or %.If the concentration of CO2 is above the upper threshold level the relay5 will be triggered to open the ventilator. Similarly, if the concentration of CO2 falls below the minimum threshold level, the relay6 will be triggered to close the ventilator. This sensor is also used as gas sensor to detect the smoke if occurs in greenhouse.

relay2 will be switched off.

The CO2 Sensor which I have used in this project has shown below:

Fig –6: CO2 Sensor

International Journal of Research
IJR
International Journal of Research
Available at https://edupediapublications.org/journals
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 03 Issue 10
June 2016

*LDR Sensor:*Light sensors are nothing but the light dependent resistors in which the resistance will vary with respect to the light intensity falls on it. This is a variable resistor and the concept of voltage divider is used to read the light intensity. The output will be read in terms of Lux. The light dependent resistor is used to detect the light intensity. It has two cadmium sulphide (cds) photoconductive cells with spectral responses. The cell resistance falls with increasing light intensity and it can detect the minimum light intensity i, e moonlight O.l lux. Here we will be using artificial lights to maintain the light intensity as the sun light falls below the required quantity as it becomes evening and night. If the light intensity is above the maximum threshold level, the relay7 will be triggered to tum lights OFF. Similarly, if the light intensity is falls below the minimum threshold level, the relay8 will be triggered to turn lights ON

The LDR Sensor which I have used in this project has shown below:

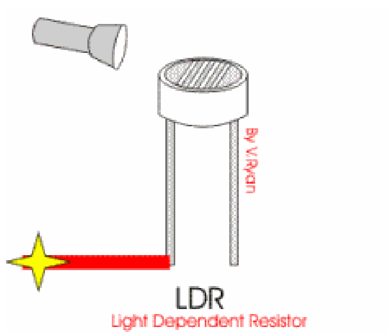

Fig –7: LDR Sensor

Control Module: The user can use GSM mobile phone as a remote control module to monitor the greenhouse and can set/control the sensor parameters from any place by sending a setting command message to the GSM modem which is at the greenhouse monitoring system. Also the monitoring device can send the environmental conditions to the user on request any time. The system is implemented with password privilege to protect from unauthorized users.

Specifications:

TABLE I. TEMPERATURE SPECIFICATIONS

Optimal values of air temperature in °C						
Vegetable Name	Germination process	Development process		Harvesting process		Young Plants
		Day	Night	Day	Night	
Watermelon	17-18°C	22-30°C	17-18°C	25-30°C	18-20°C	13-15°C
Tomato & Beans	10-12°C	20-27°C	10-13°C	22-28°C	15-17°C	8-10°C

TABLE II. HUMIDITY, CO_2 AND LIGHT INTENSITY PARAMETERS SPECIFICATIONS

Vegetable Name	Relative Humidity (%)	CO2 Concentration (1000 PPM)		Light Intensity (Lux)	
		Min	Max	Min	Max
Watermelon	65-75%	0.01%	0.03%	45Lux	50Lux
Tomato & Beans	50-60%	0.01%	0.03%	45Lux	50Lux

Fig – 8: Sensors characteristics

*L293D:*The L293 and L293D are quadruple high-current half-H drivers. The L293 is designed to provide bidirectional drive currents of up to 1 A at voltages from 4.5 V to 36 V. The L293D is designed to provide bidirectional drive currents of up to 600-mA at voltages from 4.5 V to 36 V. Both devices are designed to drive inductive loads such as relays, solenoids, dc and bipolar stepping motors, as well as other high-current/high-voltage loads in positive-supply applications.

All inputs are TTL compatible. Each output is a complete totem-pole drive circuit, with a Darlington transistor sink and a pseudo- Darlington source. Drivers are enabled in pairs, with drivers 1 and 2 enabled by 1,2EN and drivers 3 and 4 enabled by 3,4EN. When an enable input is high, the associated drivers are enabled and their outputs are active and in phase with their inputs. When the enable input is low, those drivers are disabled and their outputs are off and in the high-impedance state. With the proper data inputs, each pair of drivers forms a full-H (or bridge) reversible drive suitable for solenoid or motor applications. On the L293, external high-speed output clamp diodes should be used for inductive transient suppression. L293D pin diagram has shown below:

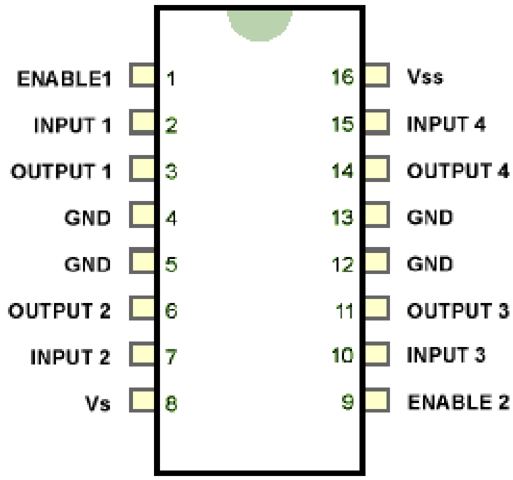

Fig –9: L293D Pin diagram

Final Schematic Diagram of this Project has shown below:

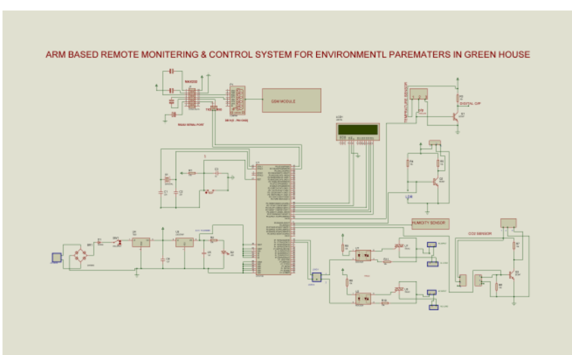

Figure – 10: Schematic Diagram

SOFTWARE:

Here, to program ARM processor Keil uVision 4 was used as a cross-compiler and Flash Magic was used as a programmer. ThingSpeak is an open source Internet of Things application and API to store and retrieve data from things using HTTP over the internet or via a local area network.

IV. ALGORITHM & FLOWCHART

ALGORITHM:

Step – 1: Initialize ARM, LCD, and GSM.

Step – 2: Wait until you see WELCOME on LCD.

Step – 3: Connect the Web server and open thing speak

Step – 4: If the temperature sensor detects, display the values into LCD and send the modified values to the user using GSM and as well upload the sensor values into thinkgspeak.

Step – 5: If the user wants to controls the AC loads, user simply sends a message to the system which connected to the AC loads and user can operates whenever user wants.

Step – 6: If the Humidity sensor detects, send those values to thingspeak using web server as well show them on LCD and send those values to the static user mobile number.

Step – 7:If the CO2 sensor detects, send those values to thingspeak as well show them on LCD and send updated values to user's static mobile number via GSM

Step – 8: If the LDR sensor detects, send those values to the thingspeak as well show them on LCD and send upgraded values to user's static mobile number via GSM

Step – 9:By seeing changes of different sensors, one user can monitor sensor values and second user can control the AC loads accordingly.

Step – 10: user can monitor via internet also by using thingspeak.

Step – 11: System operates until it goes power off.

p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 03 Issue 10
June 2016

FLOWCHART:

The flowchart of this paper is shown below.

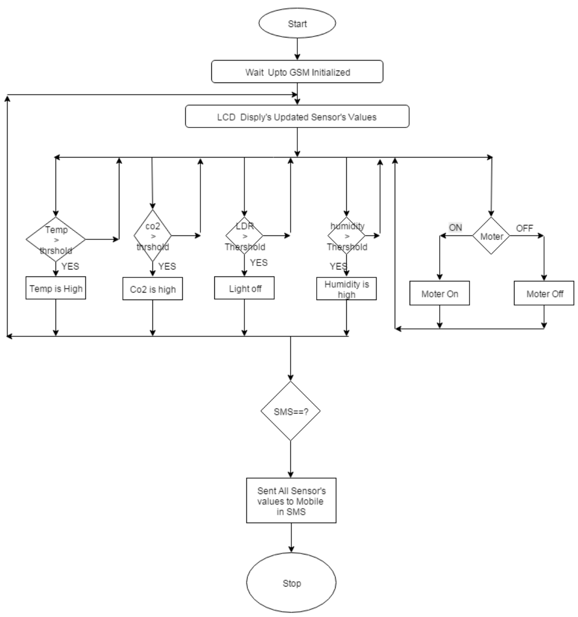

Figure – 11: Flow Chart

V. RESULTS

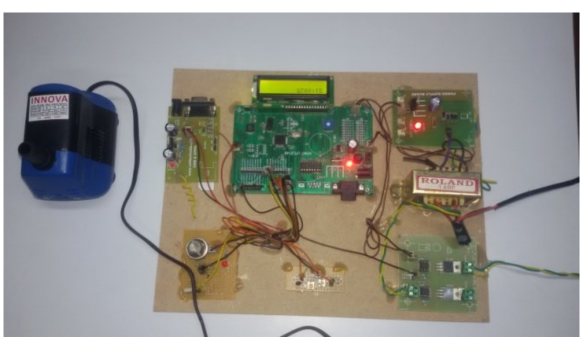

Fig – 12: Final Prototype 1

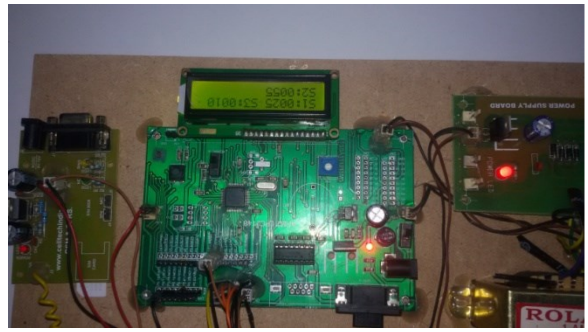

Fig – 13: Final Prototype 2

Fig – 14: Final Prototype 1

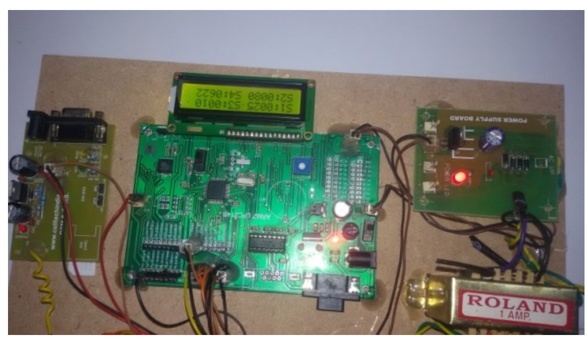

Fig – 15: Final Prototype 1

Fig – 16: Final Prototype 1

Fig – 17: Final Prototype 1

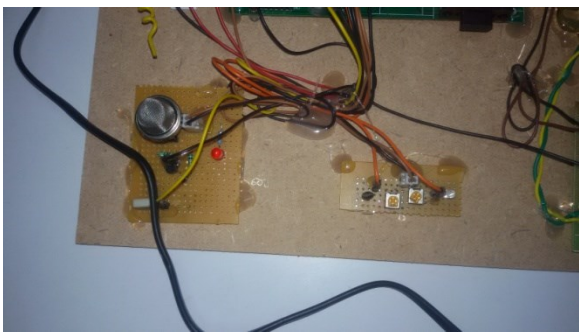

Fig – 18: Final Prototype 1

Fig – 19: Final Prototype 1

Fig – 20: Final Prototype 1

Fig – 21: Final Prototype 1

Fig – 22: Final Prototype 1

Fig – 23: Final Prototype 1

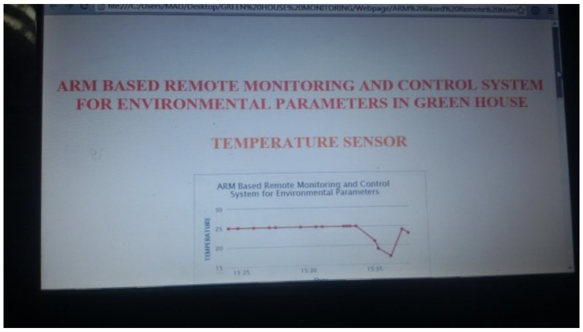

Fig – 24: Final Prototype 1

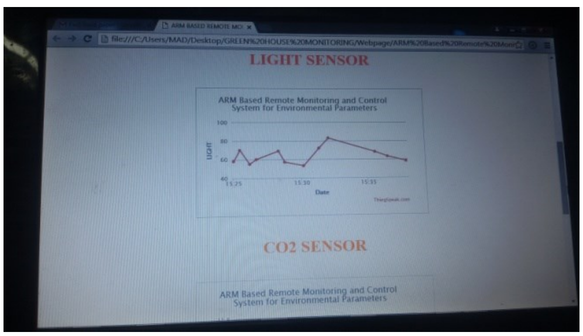

Fig – 25: Final Prototype 1

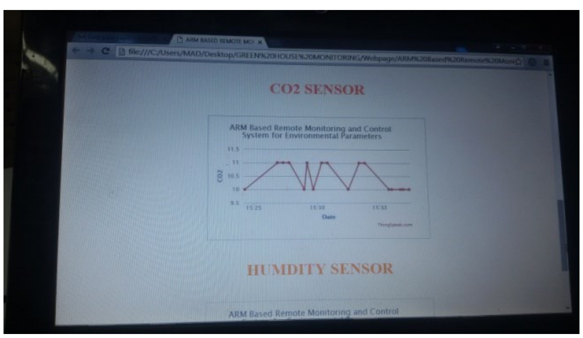

Fig – 26: Final Prototype 1

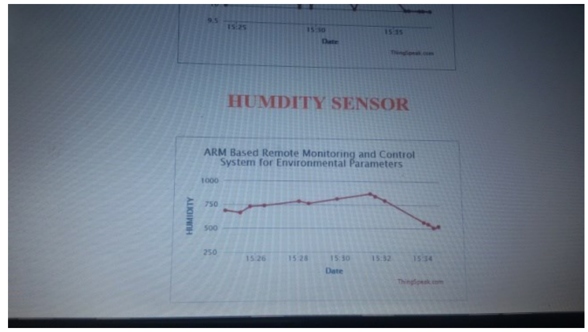

Fig – 27: Final Prototype 1

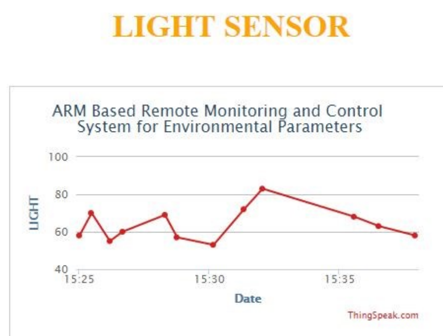

Fig – 28: Final Prototype 1

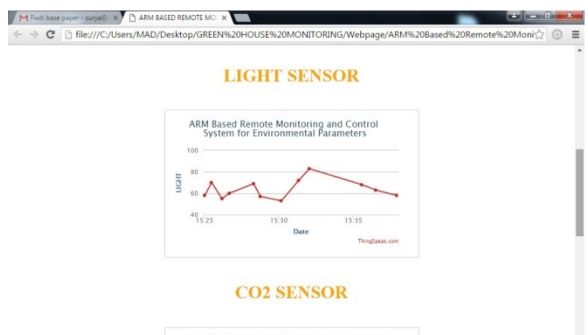

Fig – 29: Final Prototype 1

Fig – 30: Final Prototype 1

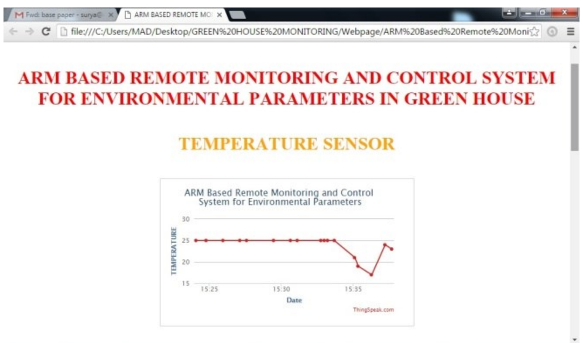

Fig – 31: Final Prototype 1

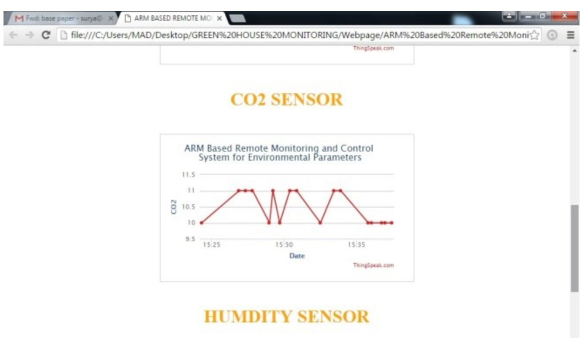

Fig – 32: Final Prototype 1

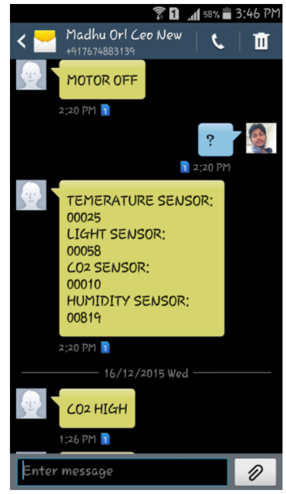

Fig – 33: Final Prototype 1

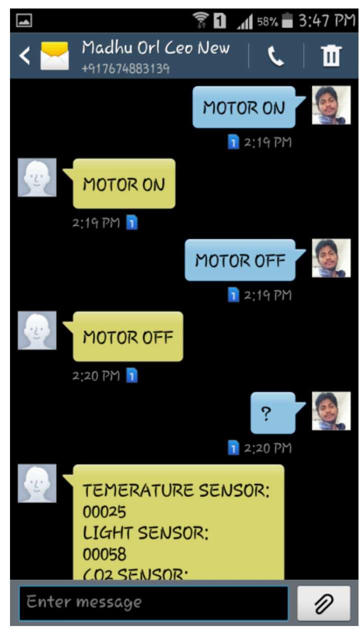

Fig – 34: Final Prototype 1

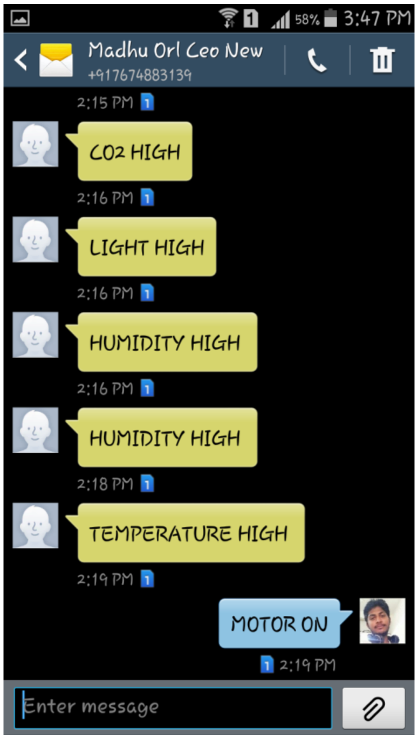

Fig – 35: Final Prototype 1

VI. CONCLUSION

The remote monitoring and control system for environment parameters in greenhouse based on global system for mobile communications technology is developed and initially experimented. The experimental results indicate that the system has some features as follows: 1) It can be used in agriculture vegetable greenhouse to monitor and control the environmental parameters to overcome the disadvantage of traditional measuring and controlling. 2) It can be kept long distance, real time monitoring for parameter of greenhouse and the information can be obtained of greenhouse at any time. 3) It has the advantages of GSM technology , not needing cables, low power consumption, cheap cost, good robustness, flexible extension, convenient installing over the traditional measurement and control system.

ACKNOWLEDGEMENT

We would like to express my special thanks of gratitude to our HOD and Principal of MLRIT-M who gave us the golden opportunity to do this wonderful project on the topic (IoT), which also helped me in doing a lot of Research and i came to know about so many new things we are really thankful to them. And, secondly i would also like to thank my parents and friends who helped me a lot in finalizing this project within the limited time frame.

REFERENCES

[1]http://www.engineersgarage.com/arm-projects/introduction-to-arm-microcontroller-lpc2148

[2] https://www.pantechsolutions.net/microcontroller-boards/user-manual-arm7-lpc2148-development-kit

[3] http://www.nex-robotics.com/lpc2148-development-board/arm7-lpc2148-development-board.html

[4]http://www.futurlec.com/Philips/LPC2148FBD64pr.shtml

[5]http://www.engineersgarage.com/articles/temperature-sensor

[6]https://en.wikipedia.org/wiki/Humidity-sensor

[7]https://en.wikipedia.org/wiki/CO2-sensor

[8]https://en.wikipedia.org/wiki/LDR-sensor

[9] http://www.engineersgarage.com/articles/GSM

[10]http://www.developershome.com/sms

[11]https://thingspeak.org

BIOGRAPHY:

BN.Srinivas, who has specialization in M.Tech (DCSE) and working as an Associate Professor at MLRIT-M, Hyderabad and his areas of interest are Embedded Systems, RTOS, and Wireless Communications.

S Sai Thanmai, who has specialization in M.Tech and currently an M.Tech Student of Department of ECE, MLRIT-M.