ISSN: 2277-3754
ISO 9001:2008 Certified
International Journal of Engineering and Innovative Technology (IJEIT)
Volume 4, Issue 2, August 2014

Management of Home Appliances with Variation in Environment

Aisha Jilani, Sahar Sultan, Intesar Ahmed and Sajjad Rabbani

Abstract*— Aim of this research is to help a remote user to remain in touch with what is happening at his home/office. To achieve this goal first we have selected two environmental variables to be monitored i.e. temperature and light. Sensors are used for this particular purpose which will sense temperature and intensity of light to forward and then if it goes above from a defined value, the user is then informed by SMS through GSM Modem (SIM900). A SIM is inserted in GSM modem whose number is programmed in the microcontroller. The appliances are controlled through GSM protocol because remote user has unlimited access i.e. he can communicate with home appliances sitting in any part of the world. His SMS will be received by GSM modem and appliance will get switched on/off accordingly as needed. We have connected sensors through appropriate circuit with microcontroller. However, microcontroller is programmed in such a way that it continuously monitors the temperature and intensity of light and also displays the current status of temperature and intensity of light.

I. INTRODUCTION

In this research project, a **GSM modem (SIM900)** is selected to connect to a remote user via AT commands for sending and receiving SMS rather than SIM300 or any other mobile phone. Basically environmental variables (e.g. Temperature & light) are monitored continuously and information of any change in environment i.e. increase in temperature or decrease in light intensity is sent via SMS using GSM network. When the user replies in a specific format using SMS, the information is processed and proper actions are taken accordingly. For example if temperature increases to a specified limit, then an SMS is sent to the remote user regarding the situation. The user then replies for switching on the appliance as required. This research can act as a commercial product in automatic street lightning, in factories which need a low temperature all the time etc.

.

II. PURPOSE

Purpose of this project is to make it possible for a remote user to remain in touch with what is happening at his home/office. Basically any change in environment is sensed and occurrence of an event is informed to the remote user via GSM modem (SIM900). For temperature we have selected a temperature sensor named as LM35 and microcontroller is programmed in such a way that as temperature increases above 35°C, a message of "OVER TEMPERATURE" is displayed on an LCD attached with the microcontroller and same message is sent to GSM modem via SMS which forwards the message to the remote user. Similarly we have selected light sensor named as "Light Dependent Resistor (LDR)" microcontroller is programmed in such a way that as light intensity goes below a value of 15, a message of "DIM LIGHT" is displayed on an LCD attached with the microcontroller and same message is sent to GSM modem via SMS which forwards the message to the remote user. Then from an appropriate response in the form of text message, appliance can be switched ON/OFF. The present temperature and light is continuously displayed on an LCD connected with microcontroller and GSM modem (SIM900). Hence in this way, the purpose of the remote user to remain in touch with what is happening at his home/office is successfully fulfilled.

III. SCOPE

Analog networks of 1G were evolved into digital networks of 2G giving rise to Global System for Mobile Communication (GSM) cellular technology which is used to communicate with any part of the world. GSM uses time division multiplexing (TDMA) [1]. This research uses both teleservices and data services of GSM to communicate with the user. GSM services are provided by GSM modem (SIM900) whose range is unlimited. A user can communicate with the SIM in the GSM modem regardless of place and time. Current status of temperature and intensity of light is continuously displayed on LCD and is monitored via microcontroller. This can research can make a remote user to remain in touch with what is happening at his home/office. It can be a commercial product in the years to come.

IV. OVERVIEW

Our project "Management of home appliances with variation in environment using GSM modem" uses AT commands to inform remote user. AT commands are actually the attention commands which are specified for every GSM modem. When the user replies in a specific format using SMS, the information is processed and proper actions are taken.

- Problem of manual switching is solved
- All the control is in user's hand
- Home appliances can also be controlled as required

V. FEATURES

- Simple user interface i.e. uses standard text messages
- Low Power Consumption
- Almost unlimited range using GSM network
- 1 mobile phone can monitor and control many remote units
- Reduced man power
- Automatically sends alarm messages when go above threshold value

ISSN: 2277-3754
ISO 9001:2008 Certified
International Journal of Engineering and Innovative Technology (IJEIT)
Volume 4, Issue 2, August 2014

- Interrogate on demand functions

VI. BLOCK DIAGRAM

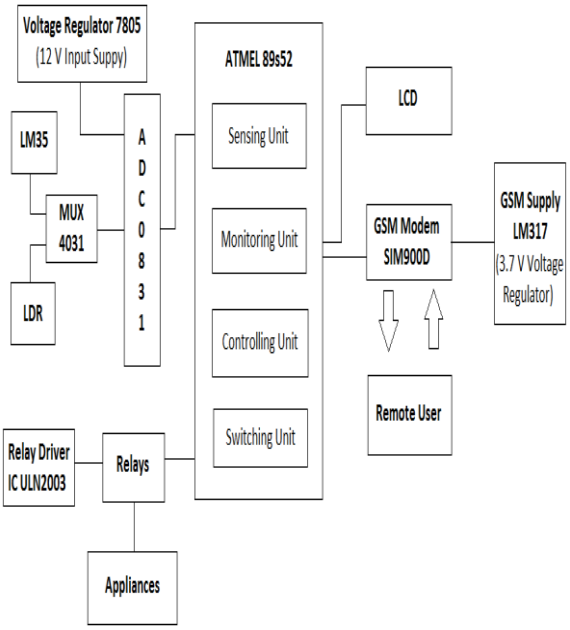

Fig:1 Block Diagram

VII. MODIFICATIONS

A previous research used two microcontrollers of 8051 but this research aims on working with 89s52 microcontroller and uses one microcontroller instead of two. 8051 and 89s52 have difference in the size of RAM and ROM. 89S52 have RAM of 256bytes and ROM of 8KB while 8051 has RAM of 128bytes and ROM of 4KB [2]. Secondly a GSM modem sim900D is used for communicating with the user instead of any mobile phone. Also more than one appliance can be switched on using relays needed accordingly.

VIII. IMPLEMENTATION

This research project is made successful by its hardware and software implementation. Hardware implementation is done via PCB layout made from ARES using Proteus software.

A. SOFTWARE IMPLEMENTATION:

We have done our software implementation on Keil µvision2 and then finally on Proteus 7. Keil µvision2 is suitable software for running, executing debugging and hence final simulation of the program. A PCB layout of ISIS schematic capture is produced successfully through Proteus software. A 16 X 2 LCD is used which has 16 columns and 2 rows i.e. there are total of 2 lines and it can display 16 characters per line. Other devices such as AT89s52, ULN2003 and ADC0831 etc. can be taken from option of "pick devices" in ISIS.

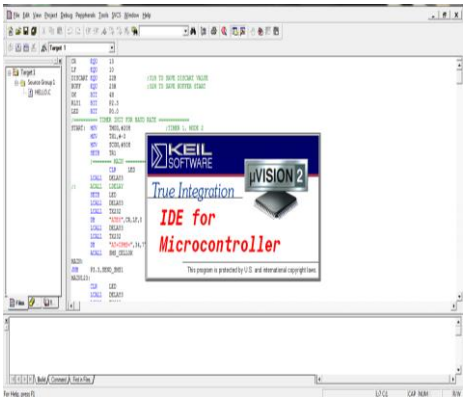

Fig: 2 Keil µvision2 Software

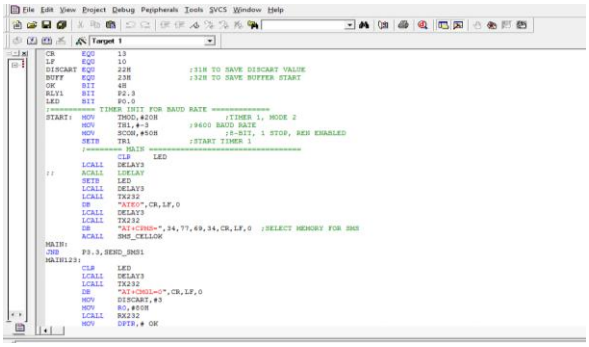

Fig:3 Running of code on Keil µvision2 Software

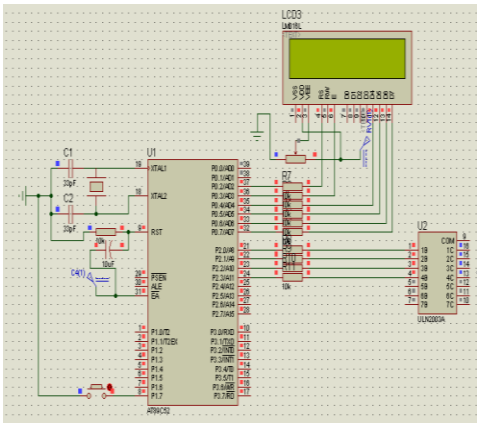

Fig:4 Software Implementation on ISIS

B. HARDWARE COMPONENTS

a. SENSORS

Two sensors used are:

i. Temperature Sensor (LM35)

Here temperature sensor LM35 is used rather than thermistor or thermocouples because thermocouples usually generates low output voltage and their output voltage is needed to be amplified but LM35's output voltage does not need to be amplified as it is always of higher value. Secondly circuitry of LM35 is totally integrated and sealed therefore there are much less chances of oxidation than in thermistors and thermocouples. In our project microcontroller is programmed in such a way that as temperate increases from 35°C, a message "OVER TEMPERATURE" is displayed on LCD. Same message is also sent to the remote user via SMS who can reply with "FAN ON" to switch on the fan.

ISSN: 2277-3754
ISO 9001:2008 Certified
International Journal of Engineering and Innovative Technology (IJEIT)
Volume 4, Issue 2, August 2014

LM35 has three terminals:

- V_c
- Ground
- V_{out}

ii. LIGHT SENSOR(LDR)

Light Dependent Resistance (LDR) is a light sensor whose resistance decreases with the increased intensity of light i.e. when the resistance with decrease then current will start flowing through the device. In our project microcontroller is programmed in such a way that as light intensity goes lower than value of 15, a message "DIM LIGHT" is displayed on LCD. Same message is also sent to the remote user via SMS who can reply with "BULB ON" to switch on the bulb.

b. GSM modem SIM900D

A GSM modem accepts a SIM card in the same way as a cell phone and is a cost effective method of sending and receiving SMS. Besides supporting various GSM features, this modem is capable of integrating TCP/IP stack.

This research is made successful by using SIM900 rather than SIM300D. SIM300. Both SIM900 and SIM300 operating range is 3.4V to 4.5V. Also both modems use same AT commands for SMS and call. The difference lies in operating frequency range of both modems. SIM300 operates on three frequencies band i.e. it is a tri band device [3]. Its operating frequency bands are 900MHz, 1800MHz and 1900MHz. SIM900 is an improved quad band version of SIM300 i.e. it operates on four frequency bands rather than three. Its operating frequency bands are 850MHz, 900MHz, 1800MHz and 1900MHz. Also SIM900 has given us improved GPRS features and functionalities which are also useful in web enabled applications.

SIM900 has 68 pins and provides current consumption as low as of just 1mA, when it is sleep mode, which is a successful power saving technique. Its temperature range of normal operation is -30°C to +80°C. It is useful for data transfer applications because it is capable of integrating TCP/IP protocol as well as extended TCP/IP AT commands [5].

However software testing of GSM modem is done using HyperTerminal and AT commands. A voltage regulator LM317 is used to supply 3.7 V to GSM modem.

c. MICROCONTROLLER ATMEL 89S52

Atmel 89s52 is an 8-bit microcontroller having RAM of 256bytes and ROM of 8KB. It has a total of 40 pins with a maximum operating frequency of 24MHz. It consists of four I/O ports. Each port is 8 bits wide i.e. it can be said that 89s52 has maximum 32 I/O ports. The operating voltage of this microcontroller ranges from 4 V to 5 V. Programming in this microcontroller is aided by its three 16-bit Timer/Counters and eight interrupts. Programming can easily be done on this microcontroller by using Assembly language [6].

d. MULTIPLEXER 4051

Multiplexer 4051 (MUX 4051) is used in this project so that it can successfully take the input from LM35 and LDR at one time and pass it on to ADC0831 which converts the analog input to digital form. MUX 4051 has 8 channels which can aid in multiplexing as well as in demultiplexing [7].

e. ADC0831

Analog and digital convertors are used to convert analog input into digital codes. Analog to digital convertor is used in this project because microcontroller cannot read analog input and therefore it is necessary to convert the analog input into digital data. Analog to digital IC are of two types:

- Parallel ADC
- Serial ADC

In parallel ADC, output can be taken from 8 pins or more while in serial ADC chip, output can only be taken from one pin [2]. In our research project we have use ADCO831 which takes analog data from MUX4051 and converts it into digital form which is read by microcontroller 89s52. ADC0831 is a serial ADC which works successfully with 8-bit. It operates on VDC of 5V. It is operated in single ended or differential mode. It takes conversion time of 32µsec [8].

C. HARDWARE IMPLEMENTATION:

Our design circuit constitute of four units:

- Sensing unit
- Monitoring unit
- Controlling unit
- Switching unit

a. SENSING UNIT

The function of this unit is to sense environmental variables as we have implemented temperature and light sensing unit. It basically takes analog data from temperature sensor and light sensor (one at a time depending upon our selection) and analog to digital converter (ADC) takes that analog data and convert it in digital format which further processes in microcontroller and microcontroller display that data on LCD. This circuit monitors the temperature or light intensity of a particular place. LM35 measures the temperature and LDR monitors the light intensity which are displaying on the LCD continuously. LM35 and LDR give the analog input to the ADC which converts it into digital pulse and sends to the microcontroller. AT89s52 is connected to the LCD so temperature or light display on the screen. A MUX is connected before ADC whose two inputs are temperature and light. The select line of MUX is connected to an analog switch which is handled manually for the selection of environmental variable.

ISSN: 2277-3754
ISO 9001:2008 Certified
International Journal of Engineering and Innovative Technology (IJEIT)
Volume 4, Issue 2, August 2014

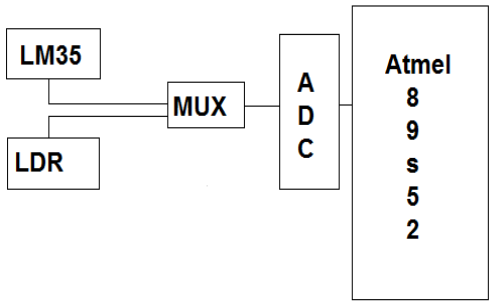

Fig: 5 Block Diagram of sensing unit

b. MONITORING UNIT

The monitoring unit utilizes GSM services for communications.

The functions of monitoring unit are to:

- Compare data (which is coming from sensing unit) with the defined values.
- If it reaches above from the defined values, then sending a text message to the remote user by using GSM Network connection provided by SIM.
- Current status of temperature and light will be displayed continuously on LCD.

When the SMS is received by the remote user then remote user replies with a command to take appropriate action.

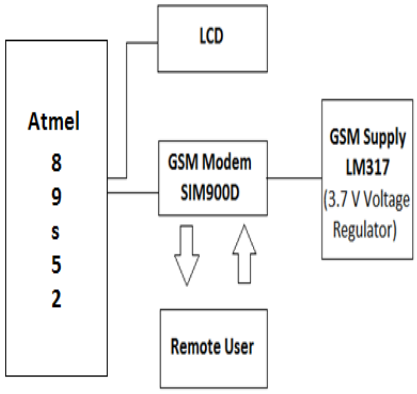

Fig: 6 Block Diagram of monitoring unit

c. CONTROLLING UNIT

All the control is in user's hand. User can monitor the appliance according to his will. Although current temperature and light intensity is continuously display on the LCD attached with microcontroller.

d. SWITCHING UNIT

Switching Unit switches ON and OFF the respective appliance on receiving control input signal giving by microcontroller. We have implemented this as by connecting one port pin of microcontroller with the switching circuit. When relay is operated at 5 V, then the relay's NO (normally open) terminal gets close. In this way, appliance will get 220V supply and is switched on.

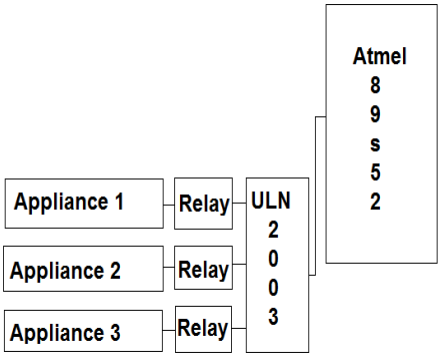

Fig: 7 Block Diagram of Switching Unit

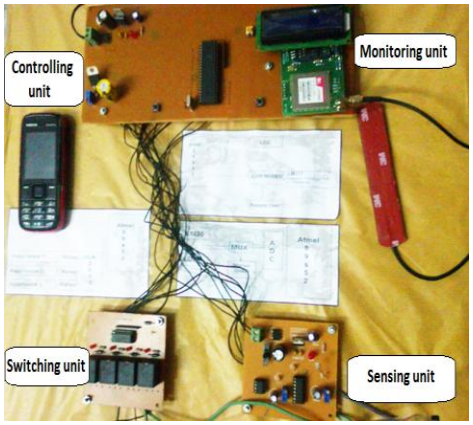

Fig: 8 Implementation of final hardware circuit design

IX. WORKING OF THE PROJECT

The sensing unit comprising of LM35 and LDR will act as environmental variables. They will sense the environment and will act accordingly i.e. information will be passed to the MUX 4051 which will forward the information to ADC0831. The information will be converted into digital codes and will go to the microcontroller AT89s52. The microcontroller will act accordingly as programmed and a SMS will be send to the user of "OVER TEMPERATURE" (an indicated by temperature sensor LM35) or "DIM LIGHT" (as indicated by light sensor LDR). The user will act accordingly and will give the command "FAN ON", "BULB ON" or "LIGHT ON" through cell phone to SIM number fed in the GSM modem. The GSM modem will forward the command to microcontroller and appliances will be switched on accordingly via relays. Relays are attached with the appliances for security purposes i.e. to avoid short circuiting and overloading. Here we have worked on three appliances which are bulb, fan and array of 3 X 3 LEDs. The command of "FAN ON" can be programmed in microcontroller to switch on the fan, command of "BULB ON" can be programmed in the microcontroller to switch on the light bulb and command of "LIGHT ON" can be programmed in controller to switch on array of 3 X 3 LEDs.

ISSN: 2277-3754
ISO 9001:2008 Certified
International Journal of Engineering and Innovative Technology (IJEIT)
Volume 4, Issue 2, August 2014

X. CONCLUSION

Since the evolution of 2nd generation from first generation, the world has grown up into a new direction with better communication services. But there is a need of higher data transferring rates so commercial products using 3G should be made.

REFERENCES

[1] Theodore s. Rappaport, Wireless Communications, Principles and practices, Second Edition

[2] Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay The 8051 Microcontroller and Embedded Systems Using Assembly and C, Second Edition,

[3] A. Alheraish, W. Alomar, and M. Abu-Al-Ela, "Remote PLC system using GSM network with application to home security system", King Saud University, Riyadh, Saudi Arabia

[4] Vandana Pandya, Deepali Shukla, "GSM Modem based Data acquisition system", Medicaps Institute of Technology & Management, Indore (M.P.), India

[5] Reference manual of SIM900

[6] Reference manual of AT89s52

[7] Reference manual of MUX4051

[8] Reference manual of ADC0831

[9] http://networkedblogs.com/FTd1G