

Home Monitoring System

Dinesh Kumar Sharma*, RikitaMaheshwari**, AyushiKhandelwal***, Himanshu Solanki****

*Department of Electronics & Communication Engineering, Anand International College of Engineering, Jaipur,India

**Department of Electronics & Communication Engineering, Anand International College of Engineering, Jaipur,India

***Department of Electrical Engineering, Anand International College of Engineering, Jaipur,India

****Department of Electronics & Communication Engineering, Anand International College of Engineering, Jaipur,India

Abstract- In today's world safety and security plays an important role; hence in this paper we propose a realistic automation and monitoring system for our homes and living places. It includes centralize control of lighting, temperature and other resources to provide better convenience, comfort and energy efficiency with reliable automation. It is the arrangement of electronics and computer technology that fulfills all the requirements for a monitoring system. The application of serial communication is provided in the system to enhance the reliability and feasibility of the system.

IndexTerms- Automation,monitoring system,resources,computer,electronic technology.

I. INTRODUCTION

The home monitoring system is the application of embedded system where the combination of physical world takes place with digital world. In recent year science and technology has developed broadly and still developing now. The technology has provided many resources that made our life easy and efficient but sometimes these resources become perilous when we are using them. The Home monitoring system prevents the hazards of use of these resources and gives indication of them. This includes the home automation and monitoring of the home that provide easy controlling of home appliances and monitoring of the environment of home.

II. INPUT TERMINAL

The input terminal of the system contains various devices i.e. CCTV camera, gas sensor, temperature sensor LM35, DS1307 others. A closed-circuit television (CCTV) camera is a type of input device for monitoring system that can produce images or recordings which are accessible for observation purposes. This device will monitor all the activities in the home and provide the data to the digital video recorder (DVR) for recording and displaying the data to the monitor. MQ-5 gas sensor is used for sensing combustible gas leakage. When the combustible gases exist in environment, the sensor's conductivity becomes higher along with the gas concentration increases. We have used a simple circuit that converts change of conductivity to corresponding output signal of gas concentration. The sensitivity of MQ-5 gas sensor is very high for detection of Propane, Methane and Butane. The output of the sensor fed to the microcontroller and if the sensor sense the combustible gas leakage and gives output to the led board and buzzer than the exhaust fan start to through the leakage gas outside the home. The LM35 is an integrated circuit sensor that can be used to measure temperature with an electrical output proportional to the temperature (in °C). The temperature of the home is calculated by the following equation

$$\text{Temperature} = (4.8828 * \text{adc_reading}) \text{ } ^\circ\text{C}. \quad (1)$$

The sensor is connected to the microcontroller. The microcontroller performs operation on the adc value taken by the temperature sensor LM35. The reading of the adc and the calculated temperature will be display on the display.

The laptop is the main input device of the system. Personal computer (PC) can also be used instead of the laptop. The laptop is controlling device which will control the appliance according

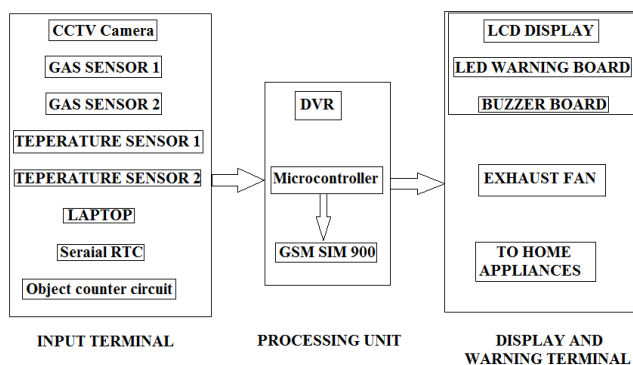


Fig.1. Architecture of Home monitoring system

Fig. 1 shows the basic architecture of the system. This system involves various component i.e. input terminal, processing unit, control unit and display & warning wizard. The input terminal includes many devices that provided to processing and control unit. The processing unit also includes the GSM module to

to the output. The laptop is connected to the microcontroller using the USB to serial cable. A software X-CTU is used for the serial input purpose which is a Windows-based application provided by Digi. This software was designed to interact with the firmware files found on Digi's RF products and to provide a simple-to-use graphical user interface to them. When the serial input fed to the microcontroller through the USB to serial cable the appliance controlled using predefined inputs. The DS1307 serial real-time clock (RTC) is a low-power, full binary-coded decimal (BCD) clock/calendar plus 56 bytes of NV SRAM. Address and data are transferred serially through an I2C, bidirectional bus. The clock/calendar provides seconds, minutes, hours, day, date, month, and year information. The end of the month date is automatically adjusted for months with fewer than 31 days, including corrections for leap year. The clock operates in either the 24-hour or 12-hour format with AM/PM indicator. The DS1307 has a built-in power-sense circuit that detects power failures and automatically switches to the backup supply. Timekeeping operation continues while the part operates from the backup supply. The DS1307 is connected to the microcontroller and the microcontroller gives real time clock output which is fed to the display.

The digital object counter system counts all the visitors or persons which are coming inside and gives indication at the display and warning terminal. This is based on the light dependent resistor. If the resistance of LDR decreases by the disturbance due to the person which is coming inside the counter counts the disturbance and gives output of the number of disturbance at the display.

III. PROCESSING UNIT

The processing unit is the backbone unit of the system. This performs all the necessary tasks with the help of microcontroller to control and monitor the home. The processing unit includes three main devices those are DVR, microcontroller and GSM module. A digital video recorder (DVR) is used which is a consumer electronics device that records video in a digital format to a disk drive, USB flash drive, SD memory card, SSD or other local or networked mass storage device. The DVR is connected to the CCTV camera and stores all the data of CCTV and displays on monitor. The recorded data can be access whenever we required to access or to view the recorded videos. A microcontroller is a mini computer that consists of ALU, memory, input and output ports on a single chip. The AVR core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontroller. Here we are using ATmega16 microcontroller. AT stands for ATMEL and is a company which manufactures microcontroller. The ATmega16 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega16 achieves throughputs approaching 1 MIPS per MHz allowing the system designed to optimize power consumption versus processing speed.

In this system the microcontroller is the main device which performs all the operation based upon the predefined programs which are stored in the memory of the microcontroller. The microcontroller is directly connected to the gas sensor, temperature sensor, USB to serial, serial RTC. It gives out to the display and warning terminal in accordance of the input. GSM (Global System for Mobile Communications: originally from Groupe Special Mobile is the most popular standard for mobile telephony systems in the world. GSM differs from its predecessor technologies in that both signaling and speech channels are digital, and thus GSM is considered a *second generation* (2G) mobile phone system. This also facilitates the wide-spread implementation of data communication applications into the system. GSM also pioneered low-cost implementation of the short message service (SMS), also called text messaging, which has since been supported on other mobile phone standards as well. The standard includes a worldwide emergency telephone number feature. This GSM module is built with the advance SIM900 engine, works on frequencies EGSM 900 MHz, DCS 1800 MHz and PCS 1900 MHz. This module is connected to the microcontroller. The GSM module is used to share the warning of the system with the user if user is outside the home. The GSM module is send messages when the warnings are critical.

IV. DISPLAY AND WARNING WIZARD

This terminal gives information's and outputs of the input terminals. The display and warning terminal consist of LED board, buzzers and exhaust fan, LCD display and monitor. LED board contains 12 led for indications of warning. For each sensor three led are used to indicate minor, major and critical fault. When LED is glowing, this indicates the leakage of LPG gas and increase in temperature. It is 1.2 V DC operated LED. When buzzer is blowing, this indicates the leakage of LPG gas and high temperature. It is 12 V DC operated buzzer. Exhaust fan is used to send out the LPG to space and then the concentration of LPG is reduced. When the gas sensor detects the leakage gas and sends instruction to the microcontroller than the exhaust fan starts to run and reduce the concentration of leakage gas.

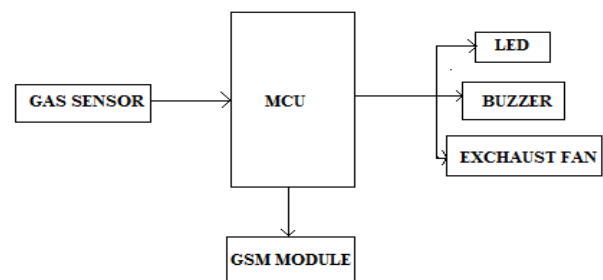


Fig.2. Working of exhaust fan

The LCD display is used to indicate the warning of leakage of gas as well as temperature readings also. We can also use graphical LCD instead of other alphanumeric LCD display. The monitor is used to the data recorded by DVR. We can also use the laptop as monitor with controlling the appliances.

V. EXECUTION OF SYSTEM

Accordingly programming structure when system start the MCU sends AT commands to the GSM MODULE which is basically a attention for GSM. If GSM replies OK than the system works according to the flowchart and sends warning messages to stored mobile number in microcontroller unit. The serial RTC and digital object counter also executed through the microcontroller unit. With the execution of the system serial RTC shows the real time on the display which is connected to the MCU. The digital object counter will be executed separately where the counting of persons coming in the home will displayed on seven segment display. In this system we allocated room numbering from A, S, D, F, G, H and J to control the lighting of appliances. The order is provided in such manner for flexible use of the system. The control keys of rooms are Z, X, C, V, B, N and M respectively. So to control the lighting and other appliance of room 'A' we have to open X-CTU and than just type 'A' and then appliances of room 'A' starts. If we want to off all the appliances of room 'A' we have to use keyword 'Z' in X-CTU. In same manner we can control the all appliances by using the control key in X-CTU software.

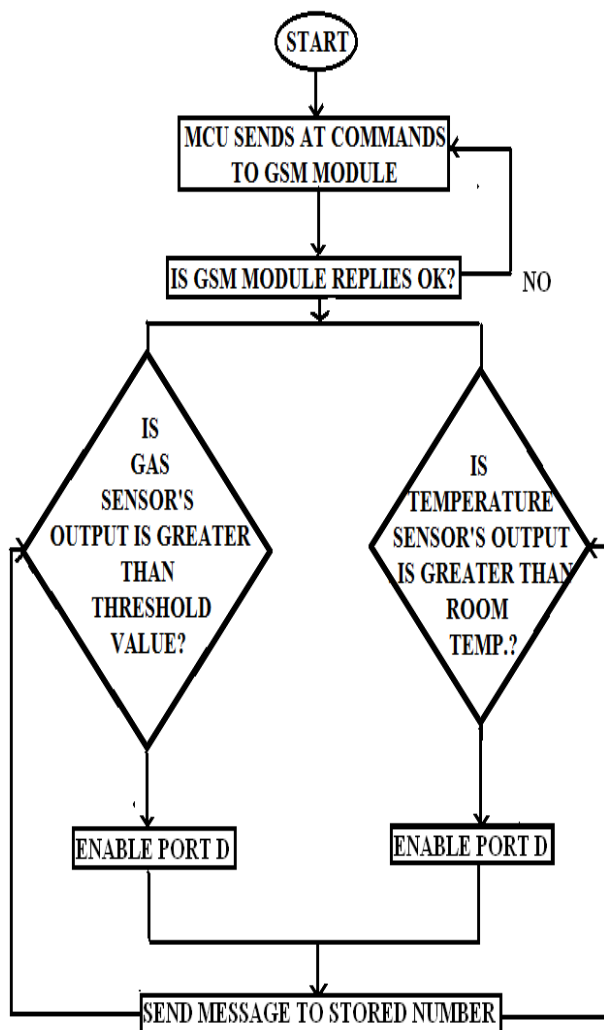


Fig.3. Flow chart of execution of Gas and Temperature sensor

VI. RESULTS

The first testing of the system was executed on 8.15AM and following results are obtained.

TABLE I. TESTING OF SYSTEM I

S.No.	Parameter	Warning status		
		Physical status	Position of LED glowing	Status of buzzer
1	Gas sensor 1	Gas leakage YES	1	ON
2	Gas sensor 2	Gas leakage NO	1	OFF
3	Temperature sensor 1	30.3°C.	2	OFF
4	Temperature sensor 2	27.5°C	1	OFF
5	Serial RTC	8.15AM	-	-
6	Digital Object Counter	2	-	-

The second testing of the system was executed on 1.45PM and following results are obtained.

TABLE II. TESTING OF SYSTEM II

S.No	Parameter	Warning status		
		Physical status	Position of LED glowing	Status of buzzer
1	Gas sensor 1	Gas leakage NO	1	OFF
2	Gas sensor 2	Gas leakage NO	1	OFF
3	Temperature sensor 1	32.3°C.	2	OFF
4	Temperature sensor 2	35.9°C	3	ON
5	Serial RTC	01.45PM	-	-
6	Digital Object Counter	5	-	-

VII. CONCLUSION

By implementing the idea of affordable low cost automation and monitoring system, a reliable and versatile embedded system has been developed which control and monitor the home and the system also sends an alert message to stored number through GSM module 900 The developed system is greatly helpful to avoid accidents if the resources are not handled properly.

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AUTHORS

First Author – Dinesh Kumar Sharma is currently pursuing Bachelors degree from Anand International College of Engineering, Jaipur, India. E-mail: dineshindianon@gmail.com

Second Author – Rikita Maheshwari is currently pursuing Bachelors degree from Anand International College of Engineering, Jaipur, India. E-mail: rikita.maheshwari@gmail.com

Third Author – Ayushi Khandelwal is currently pursuing Bachelors degree from Anand International College of Engineering, Jaipur, India. E-mail: ayushi.khandelwal1305@gmail.com

Fourth Author – Himanshu Solanki is currently pursuing Bachelors degree from Anand International College of Engineering, Jaipur, India. E-mail: himanshu.solanki214@gmail.com