The design of Intelligent Building Control System

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***Abstract*—the design of the system considered PC as control center, communicated through the RS232/RS485 modular converter, the RS485 bus, single-chip, and multi-sensors. The various subsystems monitored the single-chip as core and realized the real-time monitoring of anti-theft systems, fire protection systems, and emergency lighting circuit system. The system made use of Embedded C in Kiel compiler to establish a friendly man-machine interface of the monitoring system.**

In this paper we are using the two microcontrollers. ZIGBEE, fire sensor and home appliances are interfaced one microcontroller, ZIGBEE transceiver, switch, and Buzzer is connected to the microcontroller. Whenever the fire occurs in any building then the signal will go through the ZIGBEE transmitter and received by the ZIGBEE receiver which is located in the main block. And the buzzer should be on. At the same time if we want to control the electrical appliances in the building from the main block we can press the switch. Then the home appliances can be controlled automatically. This we can control through the computer system.

I. INTRODUCTION

Intelligent Building Automation describes the advanced functionality provided by the control system of a building. A building automation system (BAS) is an example of a distribution control system. The control system is a computerized, intelligent network of electronic devices designed to monitor and control the mechanical and lighting systems in a building. The BAS functionality reduces building energy and maintenance costs when compared to a non-controlled building. A building controlled by a BAS is often referred to as an intelligent building system. This system can also be implemented as a security control system.

In this paper we are using two microcontrollers. ZIGBEE, fire sensor and home appliances are interfaced with one microcontroller, ZIGBEE transceiver, switch, and Buzzer are connected to the microcontroller. Whenever the fire occurs in any building then the signal will go through the ZIGBEE transmitter and received by the ZIGBEE receiver which is located in the main block. And the buzzer should be on. At

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II. BLOCK DIAGRAM OF THE SYSTEM

A 5volt DC supply drives the ARM microcontroller. The ARM microcontroller at the building monitors the three main peripherals of this project: Fire Sensor, Intruder Detector and Loads. Detection by any of the above peripherals sends an analog signal to the microcontroller, on which further operations take place. The detection is based on the following:

- When a fire accident occurs, the heat sensor in any unit of the building detects a rise in temperature and sends a signal to the microcontroller.
- When an intruder is detected i.e. trespassing detected, the IR sensor in any unit of the building signals the microcontroller about it.

These signals alert the ARM7 in the building. Digital signals from the ARM microcontroller are sent to the ZigBee through which communication takes place. ZigBee is a transceiver that aids wireless communication. We have two ZigBee transceivers: One in the building and the other at the control station. The data received from the ARM7 related to the detection is sent to the other ZigBee in the form of a 10-bit data. The first bit is a '1' and the last bit is a '0' which act as flag bits indicating start and stop of the data and the remaining 8 bits are the information. The ZigBee at the control station receives the 10-bit data and sends it to the ARM7 of the control station. The ARM7 decides the action to be taken based on the program written to it. The baud rate of ZigBee is 9600 bits/sec. The range of communication of ZigBee in this project is 100m-250m.
The ARM7 at the control station sends the security related information to the PC where the information is displayed. The decision as to what information is to be sent to the PC is taken by the microcontroller based on the program written to it. The following is displayed on the PC in various situations:

- When a fire detection signal is received by the ARM7 at the control station, the related information is sent to the PC which displays: "FIRE DETECTED".

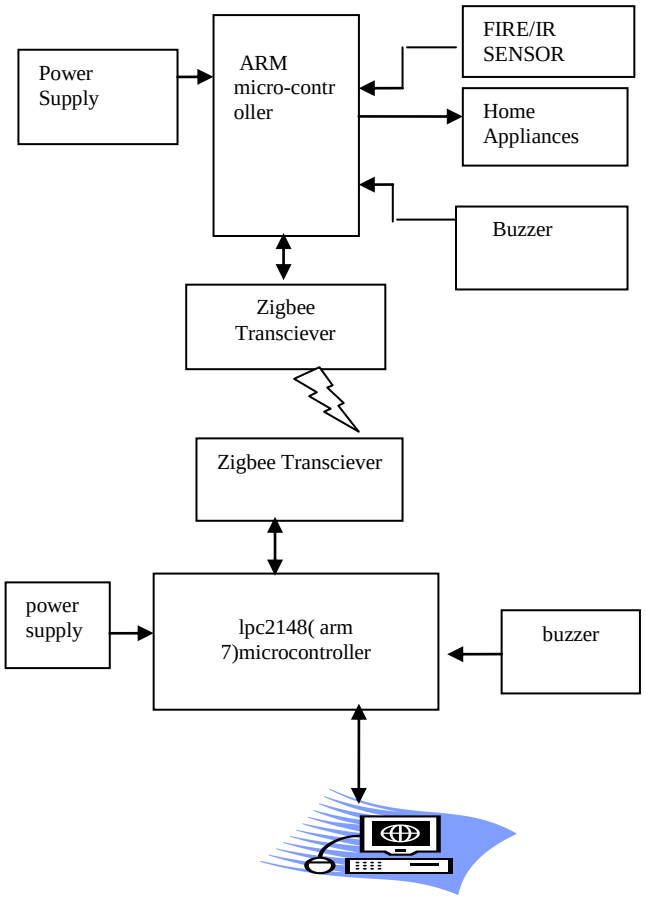

Fig 1 Block Diagram Of The System

- When an intruder detection signal is received by the ARM7 at the control station, the related information is sent to the PC which displays: "INTRUDER DETECTED".
- The loads in the building can also be controlled from the control station PC that displays the related control information.

The detection leads to the activation of the buzzer. When the buzzer at indicates a security related problem in the building be it fire or intrusion.

Power supply is a reference to a source of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a power supply unit or PSU. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others.

The term "power supply" is sometimes restricted to those devices that convert some other form of energy into electricity (such as solar power and fuel cells and generators). A more accurate term for devices that convert one form of electric power into another form (such as transformers and linear regulators) is power converter. The most common conversion is from AC to DC.

Ac regulated power supply or stabilized power supply is one that includes circuitry to control the output voltage and/or current to a specific value. The specific value is closely maintained despite variations in the load presented to the power supply's output, or any reasonable voltage variation at the power supply's input.

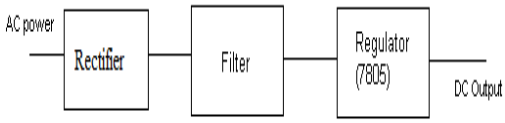

Fig 2 Power Supply Block diagram

The micro controller and other devices get power supply from AC to DC adapter through voltage regulator. The adapter output voltage will be 12V DC non-regulated. The 7805/7812 voltage regulators are used to convert 12V to 5VDC.

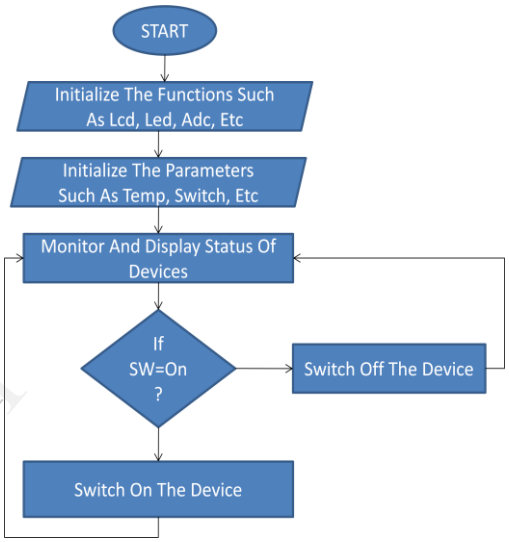

Fig. 3 Flow Chart For Transmitter

A. *Algorithm*

STEP1: Initialize the parameters such tmod, temp, sw_led, timer, tmr0 etc.
STEP2: Declare and Define the functions and invoke them one by
one such as delay, timer, LCD, LED, uart (for serial communication), ADC etc.
STEP3: Monitor the status of loads / devices and display on monitor.
STEP4: Check for switch pressed continuously, whenever detected, look for the signal.
STEP5: If signal is ON, switch on the particular device; else it is OFF, switch off the device.
STEP6: Display the status of device.
STEP7: JUMP to STEP3.

3.2 At Receiver

The flow chart and algorithm for receiver side is shown below

3.2.1 Algorithm

STEP1: Initialize the parameters such tmod, temp, sw_led, timer, tmr0 etc.
STEP2: Declare and Define the functions and invoke them one by one such as delay, timer, LCD, LED, uart (for serial communication), ADC etc.

STEP3: Display the message on LCD, "Intelligent Building Control System".
STEP4: Check for interrupt continuously, whenever detected, look for the signal.
STEP5: If signal is fire, fire is detected; transmit the message Receiver side (control station) through ZigBee, otherwise go to STEP7.
STEP6: Fire detected is displayed on the monitor.
STEP7: If signal is for intrusion, intruder is detected; transmit the message to Receiver side (in building) through ZigBee.
STEP8: Monitor the Switch. Goto STEP3.

B. Flow Chart

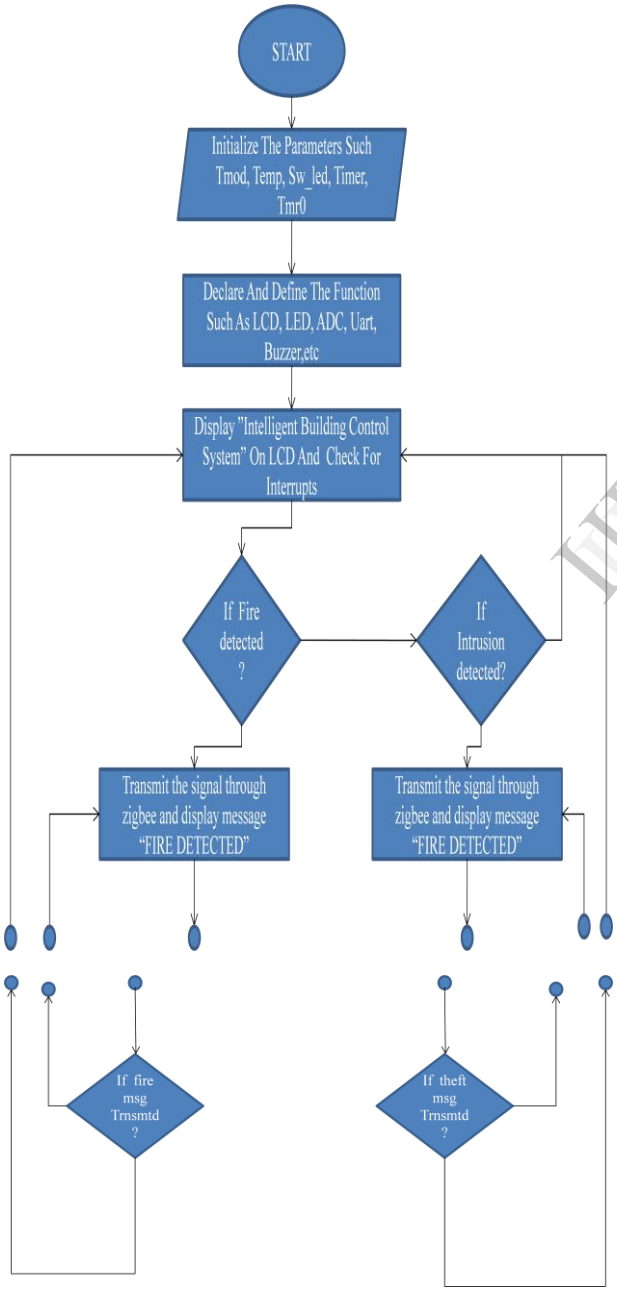

Fig. 4 Flow Chart For Receiver

III. APPLICATIONS

The paper mainly deals with three main applications:

- Protecting the units under control from fire accidents by alerting the control station so that appropriate safety measures can be taken in time.

  Ex: This application proves vital in industries where a minor fire mishap can lead to major and disastrous revenue, machinery and even human loss.

- Protecting the units under control from intruders. This basically is intended to avoid thefts that take place in the building by alerting the control station.

  Ex: This application proves vital in the units such as banks where intrusion into some sections of the building is prohibited.

- Controlling the loads of the units under control.

IV. PRACTICAL DIFFICULTIES

- Sensors needed increases as the units or rooms under the control increase.
- Load control becomes a bit complicated if the units under control are more as each unit can consist of a huge number of appliances/loads to be controlled.
- The placement of the IR sensors should be precise for an intrusion to be detected. The lack of precision can cost you gold's worth.

V. CONCLUSION

By using this system the fire accidents that occur at houses, factories, offices etc can be avoided. Also, any mishaps which occur due to illegal intrusion by any anonymous person in the premises which implements this system can also be avoided. Using this system the status of the loads/devices can be monitored on the monitor in control station. We also see that the microcontroller that we have used in our project i.e. ARM7 LPC2148 can be programmed for various application by dumping the codes as it has 256 bytes of memory space compared to that of 8051.It has ADC in built which gives desired throughput, thus making it cost efficient.

REFERENCES

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