The Design of Advanced Industrial or Building Area Network Control Using Zigbee

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Abstract—

The paper describes the zigbee building Area Network to cater for high traffic communication in Building Area Network(BAN), The Existing Method of reference paper has the framework designed to co-ordinate the operation between multiple interfaces based on newly define tree based mesh which is a following zigbee topology and it is named as MIZBAN with experiment carried in Five Floor Building but we are implementing the similar process and demonstrating with a prototype having two zigbee nodes communicating on point to point basis the ZigBee BAN is recommended because they are low power consuming devices and the supports the communication up to One Kilo meter Range. In light of the development of BAN, a generic architecture of ZigBee BAN (ZBAN) is proposed in this paper. The proposed ZBAN may be easily, accurately, and efficiently deployed in high-density-traffic BANs, such as in high rises..

Keywords— ARM7; temperature; LDR ;XBEE

I. INTRODUCTION

ZigBee belongs to the class of wireless sensor networks whose adoption bears a crucial meaning. It was discussed that, because of the inherent nature of scalability and mesh capability of ZigBee, ZBAN for AMI can be established and set up quickly in most existing buildings at a lower cost. Such an adaptive and scalable wireless structure will certainly help to build up an efficient demand response smart metering infrastructure for various smart grid applications.

A good demand and response smart metering system will help the gross domestic product (GDP) grow healthily (less carbon emission) to a great extent. Attention should be drawn to the fact that traffics in a BN in a high-rise BAN is a few hundred times more than in a traditional

II. SYSTEM ARCHITECTURE

The system architecture of this proposed system is divided into two different and independent 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 oscillations and interfaced to the ARM processor for needy response. LCD Display is interfaced to the ARM processor for displaying the status of the system for better understanding..
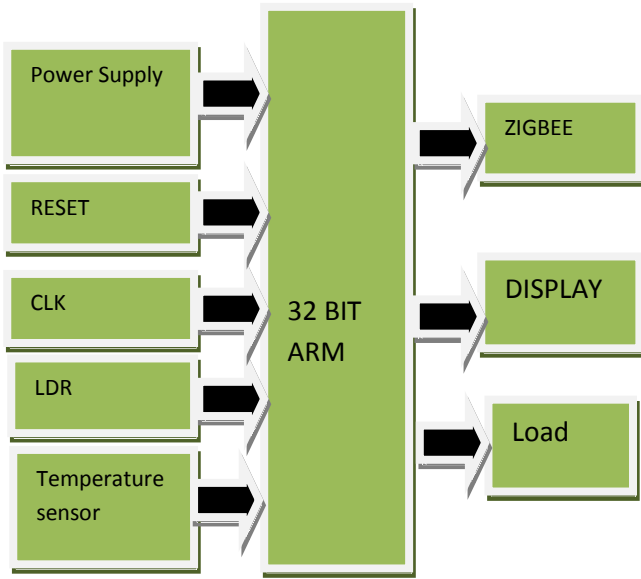
Figure – 1: Block Diagram of ARM7 END

8051 END (ROUTER END): This is fixed in between ARM End other 8051 END , simply it will works as a router between two nodes.
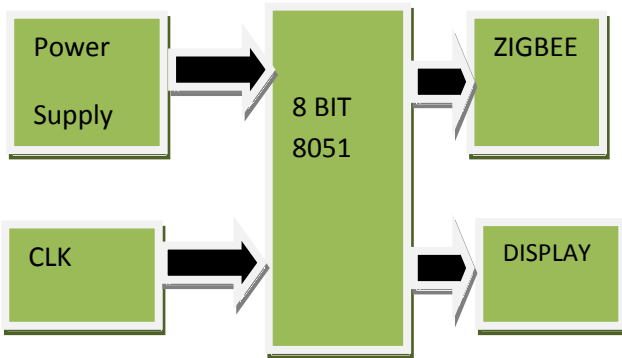
Figure – 2: Block Diagram of 8051 END

8051 END: At this end the load switches are interfaced to this end, based on the LDR, Temperature we can control the loads at ARM end.
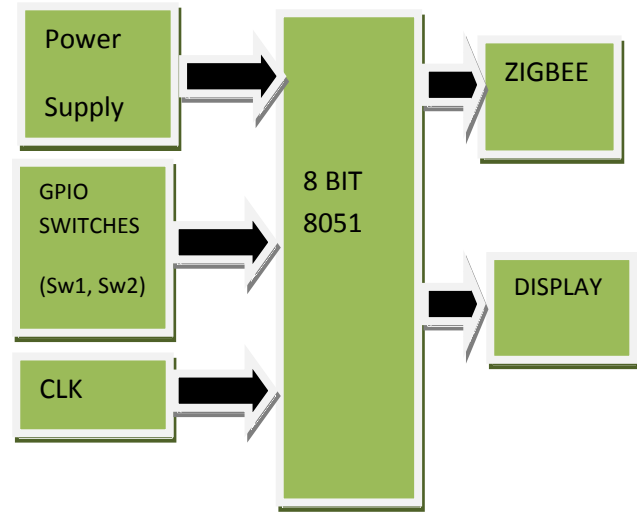
Figure – 3: Block Diagram of 8051 END

III. **IMPLEMENTATION**

HARDWARE:
In this project Hardware implementation has divided into two different parts, one was at ARM7 end and other was 8051. Let's see individual hardware implementation.

At ARM7 End 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.

For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30 % with minimal performance penalty. Due to their tiny size and low power consumption, LPC2141/42/44/46/48 are ideal for applications where miniaturization is a key requirement, such as access control and point-of-sale. Serial communications interfaces ranging from a USB 2.0 Full-speed device, multiple UARTs, SPI, SSP to I2C-bus and on-chip SRAM of 8kB up to 40kB, make these devices very well suited for communication gateways and protocol converters, soft modems, voice recognition and

low end imaging, providing both large buffer size and high processing power. Various 32-bit timers, single or dual 10-bit ADC(s), 10-bit DAC, PWM channels and 45 fast GPIO lines with up to nine edge or level sensitive external interrupt pins make these microcontrollers suitable for industrial control and medical systems.
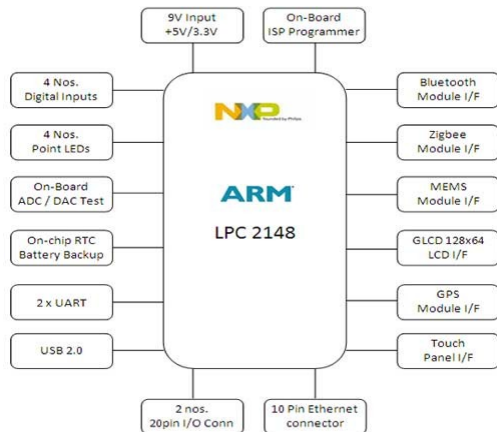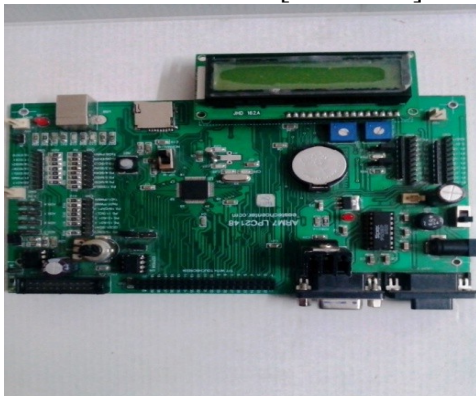

Figure – 4: ARM Overview [LPC2148]

Figure – 5: LPC2148 Development Board

Here, in the above figure the clock circuit and reset circuits were assembled along with the LCD display circuit. A 16 X 2 LCD display is used for displaying the status of the system.

Temperature Sensor: The Temperature sensor (LM 35) is interfaced at ARM7. LM35 series are precision integrated-circuit temperature. The LM35 requires no external calibration since it is internally calibrated. The LM35 does not require any external calibration or trimming to provide typical accuracies of ±1⁄4°C at room temperature and ±3⁄4°C Over a full -55 to +150°C temperature range.

The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supplies, or with plus and minus supplies. As it draws only 60 μA from its supply, it has very low self-heating, less than 0.1°C in still air. The characteristics of LM35 sensor shown below:
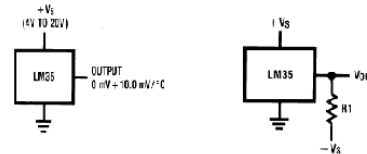

Figure – 4: LM35 characteristics

For each degree of centigrade temperature it outputs 10 milli volts.

In this project I've connected LM35 TO ARM7 (LPC 2148). The output of LM35 would be in the form of Analog, to convert analog to digital I've used ADC. The output of LM35 given to the ADC and the output of ADC is in the form of digital..

LDR (Light Dependent Resistor): The LDR sensor is very useful especially in light/dark sensor circuits. Normally the resistance of an LDR is very high, sometimes as high as 1,000,000 ohms, but when they are illuminated with light, the resistance drops dramatically. The LDR sensor is shown below:
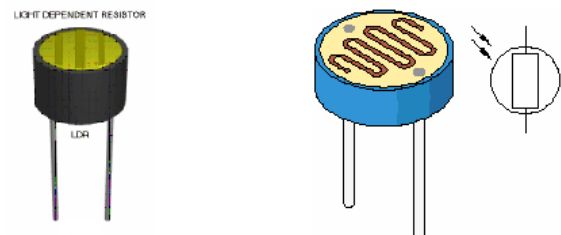

Figure – 6: Light Dependent Resistor Sensor

In this project, LDR has used in a switching the lights based on the intensity of light, i.e. if the intensity of light is high, then the lights will be in OFF condition, if the intensity of light is less, then the lights will be in ON condition. However, when light shines onto the LDR its resistance falls and current flows into the base of the first

transistor and then the second transistor. The circuit connection of LDR is shown below:
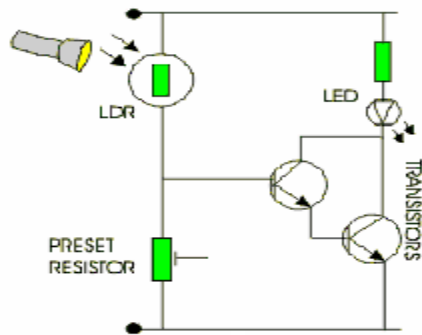

Figure –7: LDR Sensor Circuitry

LCD: LCD has used in this project for display status of the system. Interfacing LCD to LPC 2148 has shown below:
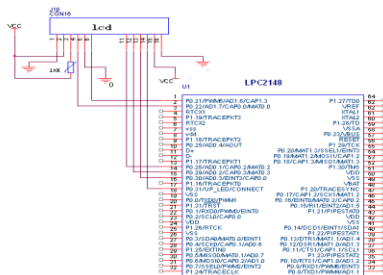

Figure – 6: LCD Display Interfacing

XBEE: ZigBee is an IEEE 802.15.4 standard for data communications with business and consumer devices. It is designed around low-power consumption allowing batteries to essentially last forever. The ZigBee standard provides network, security and application support services operating on top of the IEEE 802.15.4 Medium Access Control (MAC) and Physical Layer (PHY) wireless standard. It employs a suite of technologies to enable scalable, self-organizing, self-healing networks that can manage various data traffic patterns. Architecture of XBEE module has shown below:
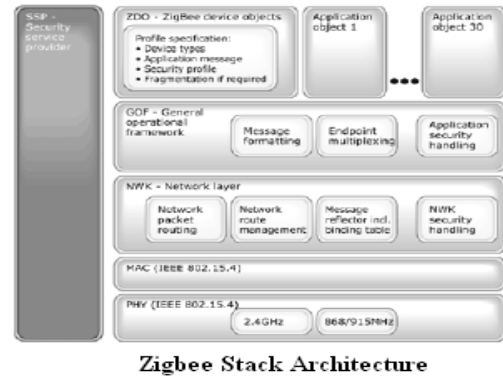

Figure – 7: ZigBee Architecture

8051 End: 8051 is an 8-bit processor, meaning that the CPU can work on only 8 bits of data at a time. Data larger than 8 bits has to be broken into 8-bit pieces to be processed by the CPU. 8051 is available in different memory types such as UV-EPROM, Flash and NV-RAM.8K Bytes of Re-programmable Flash Memory. RAM is 256 bytes.4.0V to 5.5V Operating Range. Fully Static Operation: 0 Hz to 33 MHz's Three-level Program Memory Lock.256 x 8-bit Internal RAM.32 Programmable I/O Lines. Three 16-bit Timer/Counters. Eight Interrupt Sources. Full Duplex UART Serial Channel.Low-power Idle and Power-down Modes. Interrupt recovery from power down mode. Watchdog timer.Dual data pointer. Power-off flag. Fast programming time.Flexible ISP programming (byte and page mode). Pin diagram of 8051 has given below:
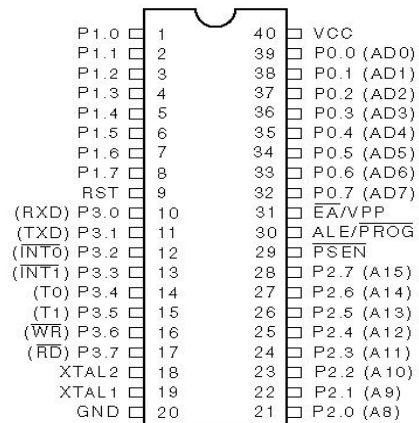

Figure – 8: 8051 Pin Diagram
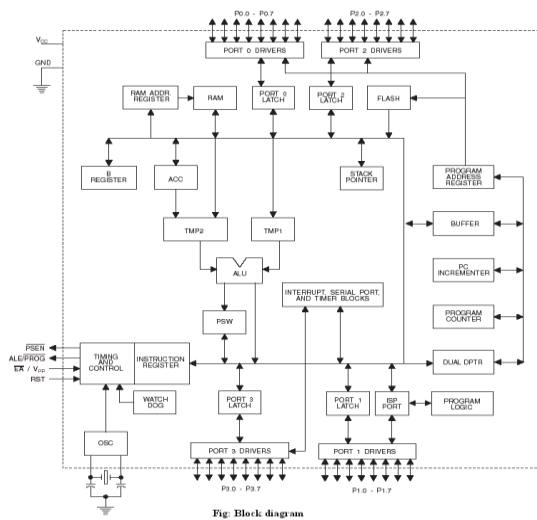
The architecture of 8051 has shown below:

Figure – 9: 8051 Architecture

The remaining modules like Switches, Temperature sensors, LDR Sensor were assembled.

SOFTWARE:

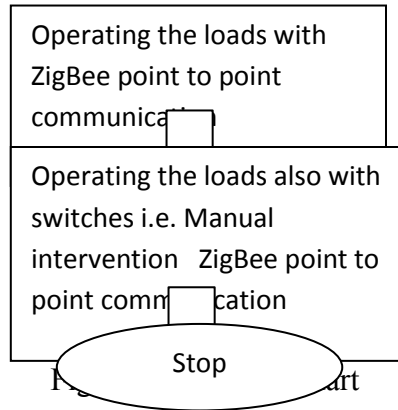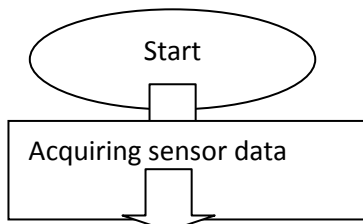Here, to program ARM processor KeiluVision 4 was used as a cross-compiler and Flash Magic was used as a programmer.

ALGORITHM & FLOWCHART

ALGORITHM:

Step – 1: Initialize ARM, LCD, XBEE
Step – 2: Press Button in 8051 End
Step – 3: Transmit message data from 8051 End to router End (8051 END) using XBEE Communication.
Step – 4: Router end transmits data to the ARM End using XBEE communication.
Step – 5: XBEE Transceiver in ARM End will receive information, and loads will be on or off.

FLOWCHART:

The flowchart of this paper is as shown below:

Operating the loads with ZigBee point to point communication

Operating the loads also with switches i.e. Manual intervention ZigBee point to point communication

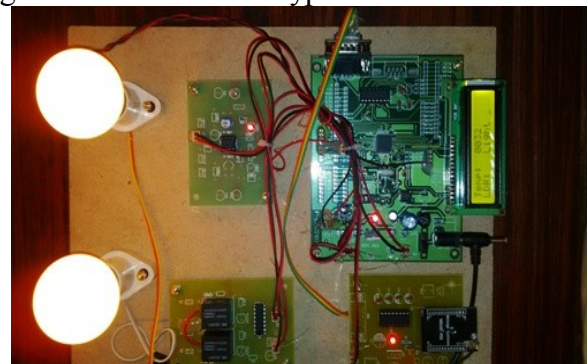Stop

IV. RESULTS

Figure – 11: Final Prototype

Figure – 11: ARM END

Figure – 12: Router End

Figure – 13: 8051 End

V. CONCLUSION

Here,*The Industrial/building area network control using Zigbee* communication is designed and proposed and it is widely used in security and safety applications

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BIOGRAPHY:

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