



Wireless sensor network based automation system using ZIGBEE and ARDUINO

T.Manickam¹, S.Dheebika Rane², L.Nithya³, S.Ponpriya⁴

¹Associate Professor, Department of Electronics and Communication Engineering,

^{2,3,4}UG Students, Department of Electronics and Communication Engineering,

Nandha Engineering College (Autonomous), Erode-52, Tamil Nadu, India.

Mail id:dheebikasenthilkumar@gmail.com.,svppriya31@gmail.com

Abstract-Minimizing the unnecessary usage of appliances is the great task that has to be met in this current world. Reducing energy demand in the residential and industrial sectors is an important challenge in day to day life. In particular, in closed area like auditorium where many number of lights and fans will be present it is necessary to stop the working of unwanted appliances. Light-Emitting Diode (LED) lights are more efficient than traditional lights. This project proposes a low cost, wireless, easy to install, adaptable, and smart system to automatically adjust the light intensity and fan speed to save energy and maintaining user satisfaction. The system combines motion sensors and light sensors in a low-power wireless solution using Zigbee communication. This proposed system aims at automatic dimming of light and adjustment of fan speed based on the surrounding and presence of people at that particular area.

Keywords:Arduino, ZigBee, PIR Sensor, LDR Sensor

I. INTRODUCTION

1.1 COMPANY NAME

Our project “Wireless Sensor network based automation system using ZigBee and Arduino” has been done under the guidance of experts at *Xavy Technologies*, Coimbatore. It is a company that mainly aims at manufacturing Home appliances.

Xavy Technologies has the main mission on automation.

1.2 WIRELESS SENSOR NETWORK

In this modern world there should be continuous improvement in everything and it should meet the needs of people. The objective of the project is to automatically control the appliances in a more efficient way. It also provides low cost system with more accuracy and scalability. It is the more required way for energy conservation by reducing the unnecessary glowing. The variation of the light intensity and control of the lighting system is also provided through PWM. Moreover, with the rapid expansion of the Internet, there is the potential for the remote control and monitoring of such network enabled devices.

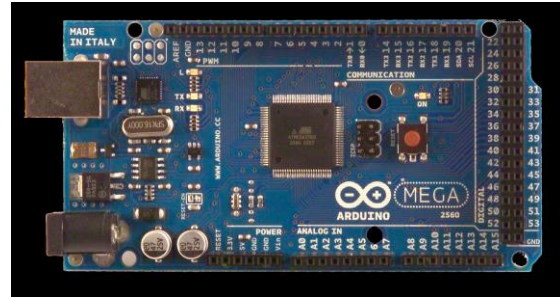
II. PROBLEM DEFINITION

In this project, the proposed concept is to replace the automation using Bluetooth and Wi-Fi. The Conventional method is to control the light and the fan manually. But as time goes on and the attitude of people changes they wanted the work to be

completed on ease. Many automation techniques came into scene. Bluetooth wireless technology has become more popular standard in the communication arena. Bluetooth technology handles the wireless part of the communication channel; it transmits and receives the data wirelessly between these devices. The existing system architectures incorporate a personal computer for the management. This adds additional complexity to the system, hence increasing the overall fiscal expense. It requires intrusive installation. It also lacks network interoperability that is both home networks and the home automation systems which utilise them have been developed and adopted in an unplanned and ad-hoc manner. Finally, security and safety: the existing approaches have not focused on security and safety problems that may arise from their implementation. This proposed System is a novel, stand alone, low-cost and flexible ZigBee based home automation system. The architecture is designed to reduce the system's complexity and lower fiscal costs. Hence, the system endeavors not to incorporate complex and expensive components, such as a high end personal computer, where possible. The system allows home owners to monitor and control connected devices in the home, through a variety of controls, including a ZigBee based remote control.

2.2 WORKING OF ARDUINO

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2



(Arduino mega)

2.3 WORKING OF LIGHT SENSORS

Light sensors are connected to the MCU through I2C interface which observe light status in lux. A light sensor measures the brightness of the sunlight and adjusts the light intensity of the lamp to keep the light intensity up to 200 lux. The purpose of this measurement is to ensure a minimum level of illumination of the outdoor lights. Based on the sunlight intensity, the MCU drives the lamp to maintain a constant level of illumination, that is, minimum horizontal and vertical illuminance of 15 lux and 50 lux, respectively. Thus, the lamp will be turned on when the sun-light will fall below this illuminance level. This action is obviously not required during daylight time.

2.4 WORKING OF MONITORING SYSTEM

The monitoring system installed consists of several modules: the light sensor, temperature sensor, and occupancy sensor, power metering IC, MCU, ballast etc. Sensors are attached with ZigBee RCM nodes to continuously monitor the situation of the lamps. The sensors are used to observe the main parameters such as lamp-housing temperature, power consumption, and illumination condition of the place. These devices work together and transfer all of the information to MCU which processes the data and automatically sets the appropriate course of action.

2.5 WORKING OF ZIGBEE

ZigBee is a radio frequency (RF) communications standard based on IEEE 802.15.4. Figure 2 depicts the general architecture of a ZigBee based home automation network. The ZigBee coordinator is responsible for creating and maintaining the network. Each electronic device (i.e. Washing Machine, Television, Lamp etc) in the system is a ZigBee

device managed by the coordinator. All communication between devices propagates through the coordinator to the destination device. The wireless nature of ZigBee helps overcome the intrusive installation problem with the existing home automation systems identified earlier. The ZigBee standard theoretically provides 250kbps data rate, and as 40kbps can meet the requirements of most control systems, it is sufficient for controlling most home automation devices. The low installation and running cost offered by ZigBee helps tackle the expensive and complex architecture problems with existing home automation systems, as identified earlier.

III. SYSTEM ANALYSIS

3.1 PROPOSED SYSTEM

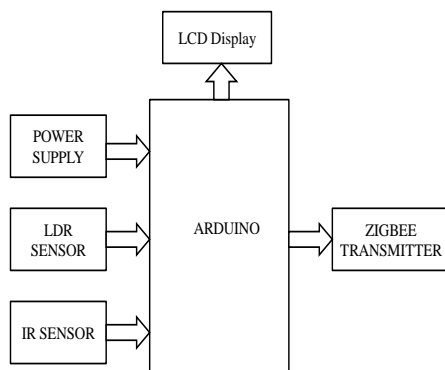
In this proposed system, LDR Sensor is used to sense the light intensity of the environment and PIR Sensor is used to sense the motion. Both the values of PIR sensor and LDR sensor are fed to Arduino which calculates the corresponding PWM signal. The PWM signal is used to encode the level of the LED brightness. In Wireless Sensor Networks, ZigBee is used to transmit and receive the sensor values. For further development we can also control the speed of the fan and temperature of AC accordingly.

IV. PROJECT DESCRIPTION

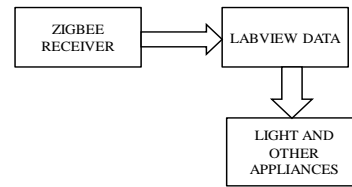
4.1 BLOCK DIAGRAM

It is of two sections:- Transmitter and Receiver

TRANSMITTER:



RECEIVER



The transmitter section is the unit for obtaining the input from the surrounding. It senses the temperature and the presence of human in that particular area. Here two sensors are used. LDR which is used to detect the atmospheric light intensity. The light will be converted into corresponding voltage in that sensor. Then the PIR sensor which stands for passive infrared sensor detects the motion thereby find the presence of human in that area. These are the inputs to the arduino. In the arduino the inputs will be converted into PWM. This PWM output will be transmitted through ZigBee module. These steps take place in the transmitter section. In the Receiver section the transmitted output has to be received and is compared with the labview data then sent as the command for the appliances. Labview data is a graphical programming language that is developed to allow the user to acquire and analyse the data simultaneously in a single environment. Thus the appliances can be controlled.

V. PROTEUS SOFTWARE

6.1 PROTEUS

Proteus is software for microprocessor simulation, schematic capture, and printed circuit board (PCB) design. It is developed by Labcenter Electronics. PROTEUS combines advanced schematic capture, mixed mode SPICE simulation, PCB layout and auto routing to make a complete electronic design system. The PROTEUS product range also includes our revolutionary VSM technology, which allow

you to simulate micro-controller based design, complete with all the surrounding electronic.

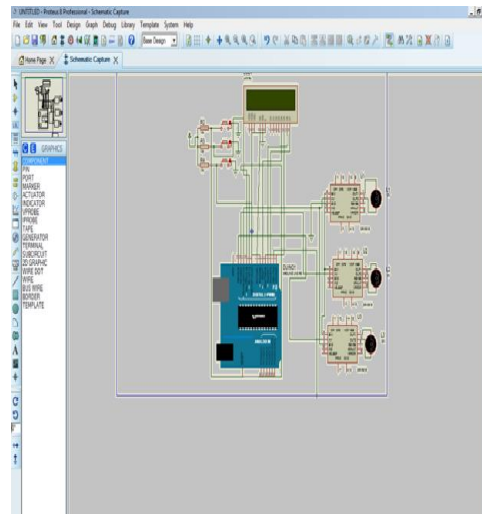
6.2 PROTEUS FEATURES

- ISIS Schematic Capture an easy to use yet and extremely powerful tool.
- PROSPICE Mixed mode SPICE Simulation industry standard SPICE3F5 simulator upgradeable to our unique virtual system modeling technology
- ARES PCB Layout
- Modern Graphical User Interface standardized across all modules
- Runs on Windows 98/ME/2000/XP or Later
- Technical Support direct form the author
- Rated best overall products

6.3 SYSTEM COMPONENTS

- ISIS Schematic Capture** - a tool for entering designs.
- PROSPICE Mixed mode SPICE simulation** - industry standard SPICE3F5 simulator combined with a digital simulator.
- ARES PCB Layout** - PCB design system with automatic component placer, rip-up and retry auto-router and interactive design rule checking.
- VSM** - Virtual System Modeling lets co-simulate embedded software for popular microcontrollers alongside hardware design.
- System Benefits** Integrated package with common user interface and fully contextsensitive help.

VII. SIMULATION OUTPUT



VIII. CONCLUSION

It is a novel system to control the appliances with a low cost and low power wireless sensor network. The use of a light sensor and a PIR sensor in combination with the user preferences allows the distributed intelligence to save energy. It is flexible and scalable due to the Zigbee radio. In future, if this system is implemented in all buildings, the electricity expenses of the consumers would be reduced to a great extent. This paper has reviewed the existing state of home automation systems, and identified and discussed five areas that have hindered consumer adoption of such technologies. A novel architecture for a home automation system is proposed and implemented, using the relatively new communication technology ZigBee. The feasibility and appropriateness of the proposed architecture and technologies in the creation of a low cost, flexible and secure system has been successfully evaluated both through experimentation and user trials. Experimentation has highlighted the stability of the novel architecture adopted, including the minimal impact of the inclusion of the virtual home on system's performance.

IX. REFERENCE

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