

# An Energy Efficient Power Usage Controlling and Monitoring using Wireless Sensor Network

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## Abstract

**Background/Objectives:** This paper mainly focuses on efficient power usage. Now a day's power usage is a critical issue in home appliances. Mainly concentrating on to reduce power consumption in home appliances. The goal is to develop a centralized control, monitoring and power consumption calculation. To have the single centralized point provides connecting to all building services for cost reduction by using a wireless sensors network. Data transferred from the sub systems to centralized controlling point. **Methods/Statistical Analysis:** For analyzing the data in the proposed system by using visual basic technology. Previously we have only the monitoring system and now we are controlling by using the different sensors like PIR, IR, Temperature, LDR, and Humidity adding to the controller. The appliances will work in the presence of human beings and controlled automatically. **Findings:** The proposed system having multi sensors and wireless communication technology in order to control light, fan and air conditioner to the surrounding situations. Home appliances are connected through a wireless communication sensor network to centralized control. Not only considering the external sources calculation of power usage also monitored. Along with these in this proposed solution we can able to monitor and control and maintain the large structures and power usage bill proving system with a simple digital automation system and it can be able to manage very large area with a single monitoring system architecture proposed by an embedded decision making and automatic controlling unit and for effective monitoring a software application on visual basic and it can be practically implementable architecture in real time usage. **Applications/Improvements:** Applicable to use in industries and as well as home also for efficient usage of power and reducing the power consumption.

**Keywords:** ARM, Energy Efficient, Home Automation Control, Visual Basic, Wireless Sensor Network, ZigBee

## 1. Introduction

Building automation services deals with different services those are monitoring and controlling like as air conditioning systems, heating control ventilation, temperature monitoring and humidity. Building automation services were initially developed to control air conditioning and heating<sup>1</sup> systems on that time we have gone through more kinds of controllers e.g., microprocessors, pneumatics, analog circuits, etc. In this proposed system we are using ARM microcontroller used to control heating, humidity and air condition in different indoor environments. For this monitoring of this building automation services

displaying on software application visual basic platform. The interface between the visual basic display and micro-controller by using wireless sensor network i.e., ZigBee.

ZigBee is most comfortable technology in the field of home automation system. ZigBee protocol is separated into two parts those are home automation control unit and user control unit<sup>2</sup>. ZigBee communication was established in August, 2001, it supports for full wireless networking capable of sixty four devices in a single network. It is designed to connect the broad vary of devices, in any commercial business, into a single management network<sup>3</sup>. The ZigBee networks have 2 application choices those are Feature Set ZigBee and ZigBee professional. The first one

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is supported to lesser networks with minor devices in a very single network. The ZigBee Feature Set application is the most familiar to the developers and facilitates ease-of-use and advanced support for broad networks combination of thousands of devices. So ZigBee Feature Sets are developed to integrate with one another, making certain long use and stability.

Visual basic is an artificial language that derive from the evolved DOS generation known as BASIC. It suggests that Beginners All-purpose Symbolic Instruction Code. Several companies developed different generations of BASIC; those are Microsoft QBASIC, QUICK BASIC, GW BASIC, and IBM BASICA. But maximum developers are widely using one Visual Basic 6.

Visual Basic is a third generation programming language and it is evolved from integrated development environment. A programmer can accumulate the components in visual basic itself programming also done also use the windows application peripheral but it requires declaration functions. Previously stated that building services are usually controlled separately, making building automation the set of control and communication technologies which link those different subsystems and make them work from a centralized monitoring and control centre. Generally energy meter reader goes to every premise and takes the reading manually then issues the bill. In manually reading human error possible and not provide reliable meter reading<sup>4</sup>. Wireless sensor network is ZigBee protocol used for the communication. The main convenience is it requires very less power<sup>5</sup>.

The usage of Wireless Networks is extremely vast, this may be utilized in major areas like military, physical security, automation management, building and structural automation<sup>6</sup>. wireless sensor networking placed a vital role in a present generation. Used for controlling, monitoring, and centralized controlling point. Sensors used more power or energy to detect the data but the wireless sensor networks are used with very low power, sensor networks are designed like that work with low power batteries<sup>7</sup>.

Wireless communication sensor networks provide reducing the cost for their base stations. In wireless networks mainly base stations using more power and centralized control point also. By using these base stations we are reducing the power for home appliances if the person present than only appliance will working<sup>8</sup>. Building automation is mainly concentrating by using wireless sensor networks. Power saving by appliances is

minimized by the detecting persons and if the person present appliances will consume the power otherwise just switch off<sup>9</sup>. In proposed system we are combining these monitoring, control, power consumption bill provide at any time and bill will send to a provided mobile number.

## 2. Proposed System

In proposed system main having of user terminal and ZigBee module connected to computer through UART (Universal Asynchronous Receiver/Transmitter) port. If any person presented in the room then only takes the light intensity and temperature and depending upon the present temperature light intensity only the lights and fans will turn ON and turn OFF. Present power displayed on LCD status number of persons present, lights, fans, in individual rooms is displayed clearly on PC through visual basic platform. Power usage bill displayed on monitoring section and able to send bill to customer through SMS using GSM technology, depending on the persons presented in the room the fan speed will changing.

Figure 1 shows proposed architecture and having ARM controller, sensors like PIR&IR: Passive Infrared and Infrared, Both the PIR and IR sensors combined to count the number of persons entering in to the room. The count will be displayed on the LCD display<sup>10</sup>. PIR sensor will detect only persons while IR sensor will detect persons and objects by combining these two sensors if person is entering into the room PIR sensor detect while IR sensor count will increase. Person going out IR sensor decrease the count. Accordingly appliances will work either turn off or turn on<sup>11</sup>. LDR: Light Dependent Resistor it works depends upon the light intensity if the intensity is low than LDR sensing and automatically light

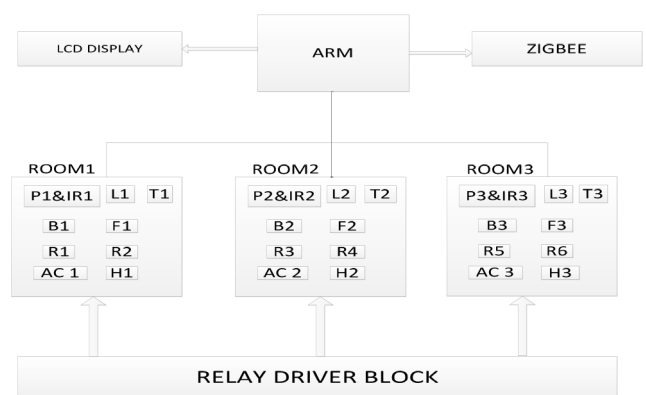


Figure 1. Proposed architecture

will turn on. Humidity sensor<sup>12</sup>, humidity is that the presence of water in air. the quantity of water vapour in air will have an effect on human comfort. If the humidity is increasing that means human comfort is disturb that means sweating then automatically AC will TURN ON<sup>13</sup>, T: Temperature sensor if the room temperature sensor is exceeds the normal temperature 27 degrees then automatically AC will turn on.

wireless sensor network ZigBee to interface between microcontroller and visual basic platform. To the ARM controller we are connecting all these sensors to control the home appliances like F: Fan, B: bulb, and AC: Air Conditioner. R: Relay driver block is connected to the all the rooms. These are main hardware components used in this system. Sensors are sensing and it will be sending to the monitoring section via wireless network ZigBee.

Proposed system can work expeditiously within the following climate things.

- If the person entering in to the room fan will turn on and light will Turn On according to light intensity. For the 2 or 3 people normal fan speed will be enough.
- If 2 or 3 members present in the room fan speed will be enough if more number of persons entering in to the room than automatically AC will turn on. Persons are going out i.e., decreasing AC will turn off.
- If 2 or 3 members present in the room the temperature is increasing than automatically AC will turn on. While temperature is normal AC will turn off automatically.
- Even though 2 or 3 members are present in the room humidity is increasing than automatically AC will turn on.

Figure 2 shows monitoring section we have the status of the rooms i.e., number of persons in a room, temperature, humidity, power used, and automatic energy meter reading and send bill service to the particular number. Moreover we have the status of the sensors and measurements. If we want bill at any time by sing GSM technology give a number and it will send to that number instantly. All the data received from the sensors will displayed on monitoring section by visual basic platform. Automatic energy meter reading will calculate the amount for power consumption and it will send this information in the form of SMS<sup>14</sup>. This method is an efficiently usage of power in home, offices and industries.

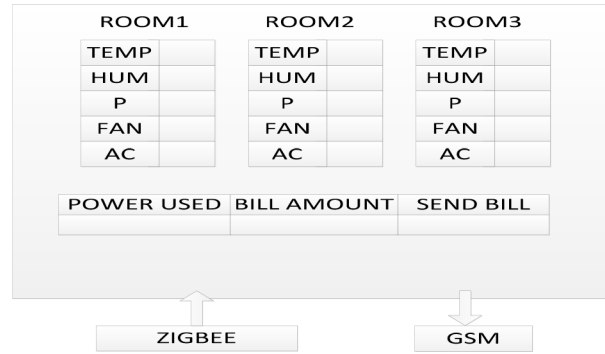


Figure 2. Monitoring section

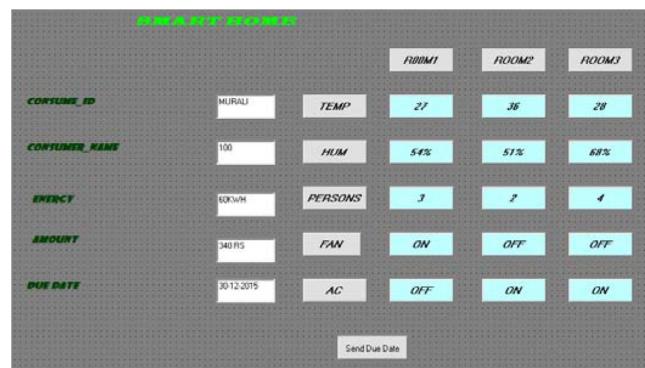


Figure 3. Simulation results

### 3. Simulation Results

Simulation results will work when the persons present in the room than it will display in visual basic technology. Simulation results we will find that status of the rooms and number persons present in a room. According to the surroundings it will work. If the persons leaving the room air-condition will be TURN OFF. If no one present in a room appliances are TURN OFF automatically. Figure 3 shows simulation results by using visual basic platform in room1 humidity is normal temperature is also normal so no need of AC, fan is in on position. In room2 only one person is present humidity is normal whereas temperature is high so AC in ON condition. Whereas in room 3 temperature is normal while number of persons are less but humidity is high so AC in on condition. Whereas same day different situations are not possible but for the sake of observation we done these values for explanation purpose. Simulation results also shows having the observation how much power is consumed and amount for that power consumption and this information will be send to the particular number by using GSM module in the system.

## 4. Conclusion

By using this system power will be saved. By using Centralized controlling points we able to monitor and controlling is made simple. For the future work it will be increased to the number of rooms. And providing bill to the different numbers to specified room owners.

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