International Journal of Enhanced Research in Science, Technology & Engineering
ISSN: 2319-7463, Vol. 5 Issue 6, June-2016

WSN based Smart light control System using android

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ABSTRACT

Recent studies have bring to light that a preconfiguration part of the electrical energy dissipation in residential and corporate buildings is due to an improper use of electrical appliances. In this perspective, preset power management system is intercepted using android, which is capable of reducing energy waste. The System is one of the most emerging trends in modernization of home appliance control. We solicit a WSN based artiste system that monitors the energy consumption and automatically controls the behavior of appliances used in a building or at home. The control of power is through android it is capable of reducing energy consumption and not compromising user comfort. In This system we propose to manage the light remotely by switching ON/OFF, Lumination control (dimmer), Timer, Flash. Electric appliances are controlled using Android.

Keywords: Wireless sensor network, Zigbee, Android, Remote.

NOMENCLATURE: WSN- Wireless sensor networks. OS- Operating System. GUI- Graphical User Interface.

1. INTRODUCTION

Recent research has advanced the wireless communication development on computers; Wireless sensors and smart mobiles allow us to the new miles of development. Accessing equipment and other services without wire or cable connection, which provides flexibility and mobility. Wireless will become more and more popular in elderly or disable people. Wireless can monitor, control various intelligent devices can be great advantage in Industry, environmental monitoring Wireless sensor networks increasingly used in homes for saving electricity, which provides benefit to house owner as well as electricity supplier

As todays development of equipment's every individual needs electricity and continuous requirement with limited resources generation of electricity has become very expensive. Methods of generation like thermal, hydro suffers most due to basic coal supply and scarcity of rainwater due to global warming. Nuclear generation recently found risky with Japan Incident. Today's environmental need is to save electricity even bit by bit's is very useful for this purpose. As we mostly waste power due to our error and laziness. We forget to switch OFF our equipment's/Appliances after the use. Lights remain ON continuously even if not needed. If the system develops to control all this remotely will save major amount of energy.

Moving towards smart building management will require controlling mechanism of appliances in different ways. Conventional hardware switches are transformed into intelligent remote operation. Wireless Sensor Network is a technology which is used for wide range of communication, which works on low power, low data rates used for smart homes or smart cities. Wireless Sensor Networks allows managing and saving the energy consumption of home appliances. The system provides basic data for gathering information on user behavior and its communication with home appliances. Now wireless sensor network automatically controls home appliances according to users need. It is possible due to nodes present in wireless sensor network where each node consist of a processor, memory that is program, data and flash memory, where these nodes communicate wirelessly with the system. They are used for monitoring temperature, Humidity, vehicle movement, lightning condition, pressure etc. where all power can be managed wirelessly.

In smart home system based on ZigBee low voltage appliances can be best controlled where home becomes smart monitoring without any additional wired connections. Various sensors can sense light intensity, Brightness, Temperature and Humidity and by hooking it up with android we can have control with security and it becomes user friendly.

A switchboard in every room controls the lights, Mixer, Ovens, Air conditioner and Fans etc. Any elder person or sick person has to walk additional to operate the electrical appliance switches. Automation System can help them to control the same from mobile wherever they are, User no longer need to get up and switch off the device. Through android user can switch off the device automatically. Hence control of light is wireless.

The main idea of project is designed for wireless monitoring and controlling the parameters from home using Zigbee. Nowadays-home automation is a trending technology that uses mobile-based application to control various loads of the home. This project comprises a controlling unit and monitoring unit. Control unit is placed at home whereas the monitoring unit can be operated through PC or mobile in this we are using android device.

II. ZIGBEE TECHNOLOGY

Zigbee are used to improve energy that is lighting condition, improve efficiency of the system and power management is done to create smart homes. [6] Presently Used in Japan's smart home wireless system. Zigbee technology is popular for smart homes due to its low power, short-range area networks. While android is widespread that is can be used for long-range wireless communication. In this system we are enabling Zigbee and android combine so that energy that is power management can be done from anywhere with no range limitation and long-range wireless communication can be enabled.

Zigbee consist of three sections they are

Coordinator- Which is a powerful device. There is a single coordinator in each network. It is the node which creates the network and the other nodes simply join in.

Router- They can relay packets for other nodes. They join a network, which is already present.

End Devices- These is the simplest device. They cannot forward packets they are used to save energy.

It is expected that 65 million households will equip with smart homes by 2018 in the United States, and it is a realistic estimate of the size of the home energy management market [7].

A. Lighting Control Systems

Modern Lighting: Dream lighting with happiness and control. With the help of wireless sensor network that is Zigbee and android-based smartphone this dream is made possible. Light control means

- We can remotely switch ON/OFF the device.
- Brightness of the light can be dimmed.
- Time control means every evening to early morning can be ON and in daytime can be switched off automatically.
- Group of lights can be ON together for some meeting room or working area.
- The light can be ON/Off with the help of sensor as per user occupancy.
- If the lights are of various colours the same can be controlled remotely eg. Disco lights, fountain lights etc.

B. The System

In this proposed system, we introduce Android based power management control system used as in smart city as well as in intelligent buildings. By using wireless sensor network the sensors that are present are smart since they have built in processor hence they are used to manage, control power of the home appliances. Parameters like voltage, current and power will be measured and stored in processor so that the measured power of the home appliances can be checked easily. Zigbee is used for home energy to reduce wastage of power and to control the power of the devices that is household appliances.

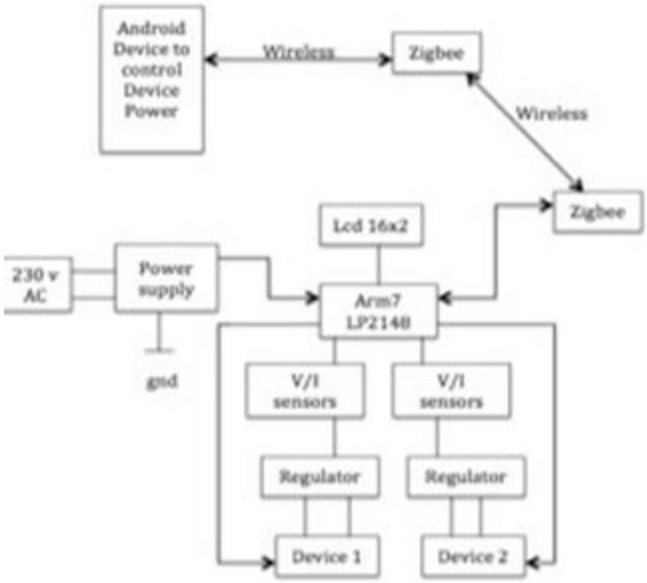

Figure 1- Diagram of the system

With the global experience of remote control the smart building becomes a new experience. The light, The Zigbee and android make the automation control. As explained in Fig 1. Light device can be ON/OFF, dim, Flash, colour change. The regulator connected to the device controls the power of the equipment. Traic used inside the regulator reduces the consumption of power by supplying pure DC voltage. The light can be dimmed with the help of ARM 7 by monitoring voltage and current parameter.

This device consists of a Zigbee hub, a server and automatic standby power cutoff outlet. The central hub where all the information are collected and kept. Hub can control and manage the channels or nodes through zigbee module. When usage is present hub first sends the current usage of the device or information of the device to the server and then user can check the information of the device or total power consumed of the home appliance which user can control it remotely. A user can also know about low power in the device or appliance so that by using a wattmeter he can increase the power means regulation of power is maintained.

Wireless Sensor Networks- Zigbee links with mobile that is android unit, which wirelessly controls the light and makes the home automation. We can control from wherever we are. If we are at workplace or outside we can set brightness, timer, change colour and switch ON/OFF the lights.

It is online interface connects with android and Internet provided. With android phones, tablets we can control these lights if not mobile the smart switches also can trigger this application. This system is based on Zigbee light link a low power safe and reliable technology to control the lights. Software updates can be done wirelessly directly to control the lights and make home, Buildings the true automation. Here we have created a dummy image as patient details. The image is a gray scale image and it is converted to binary form before it is embedded into the original image as a watermark. The purpose of choosing an image with written details is to serve the need of storing patient record as a watermark in the given colored medical image.

III. DATA FLOW CHART OF THE SYSTEM.

In this paper we have given two data flow charts that is for ARM processor and second for mobile to connect with the device. It is done so that the system is co ordinated with ARM as well as mobile through ZigBee. When the command is given signal starts from the processor it initializes all the variables and will monitor the watts consumed by the device and will transmit through ZigBee to mobile. Monitoring watts are the packets which will received in mobile device so that we can see the watts consumed of the devices in mobile entire results were obtained with the help of GUI. Feedback from the mobile device is given to processor back through ZigBee. The flow chart as follows

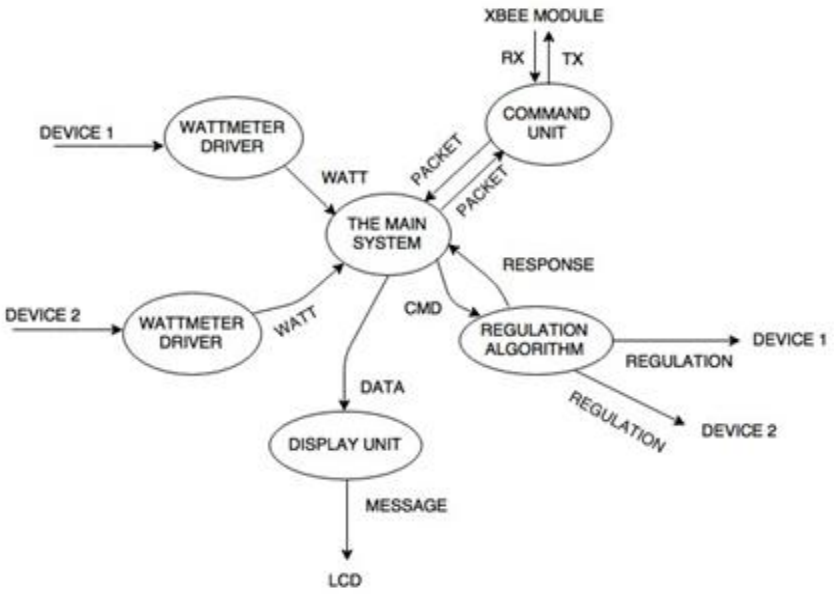

Figure 2: Data Flow chart for ARM.

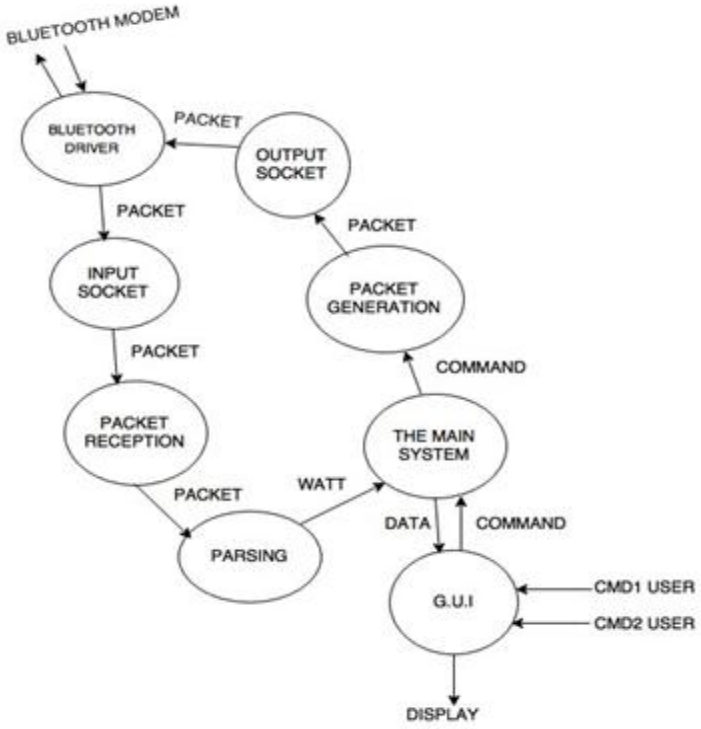

Figure 3- Data Flow chart for mobile

Figure 2 shows data flow chart for ARM the working of the system will be as- two devices that are connected as device 1 and device 2 which will be connected to wattmeter circuit. Where work of wattmeter is to check the power consumed by the two devices and given to the main system. The main system is a processor, which processes all the data from the regulation unit and the command unit. After monitoring watts the given watts are sent through packets to mobile through zigbee so that monitoring is done on mobile that is android. Sending and receiving of the data is through packets. Any modification to be done this gives command to the main system through zigbee receiver and the main system changes the data as per the command given from the mobile. And the message will be displayed on the unit. This command can be reducing watts, ON and OFF of the devices and using dimmer so that power can be controlled.

IV. STRUCTURE OF SYSTEM

Figure 4: Structure of System.

Above figure shows the structure of the system where description of the system is as follows- We have used power supply +5V-+12V. Input is 6V to 15V DC/AC. Variable power supply Input 5V output 3.3V using preset we get desired voltage as output. We have used ARM 7 processor in the system, which can monitor power of the device. Regulates watt of the device. And can switch ON/OFF of the devices. Regulator is used to regulate the voltage of the device. It can reduce and increase the power or voltage of the device. Wattmeter is used which is connected to ARM 7 at port 0.2 the work of wattmeter is that it monitors total amount of wattage of the two devices and this command is provided by the processor. ARM 7 is a central processing unit, which commands all the section in the above system. Opto coupler circuit is used to Wattmeter to interface with ARM processor.

For serial communication we have used Bluetooth connected with zigbee and interface to mobile wirelessly. The working of the system is that it monitors the power of the device, Regulates the power of the device and switching ON/OFF of the devices through android. So zigbee that is used as mesh network helps for communicate the device with the system through android. The entire control element is through application wirelessly. The system describes activating the home appliances without conventional switch but by using a smart phone is known as home automation.

V. CONTROL OF HOME APPLIANCES

Various home appliances like water heater, mixer, fan, lights, microwave oven, television etc. that are likely to remain ON after the use which tends to consume electricity and life of home appliances reduces. Wireless remote control mechanism will solve these problems. One can view the status of appliances and can switch off from their mobile and save electricity.

Remote control is available along with the regular conventional switches to keep normal operation as it is. One need not go to device if they physically want to operate mixer or so, can be operated at your fingertips using android device. Thereby this remote control system will not affect the regular users life instead controlling power would be more and wastage of power will get reduced.

Saving of energy consumption by smart control

We have seen the lamps can be control with intensity with dimmer for brightness. If we use this with daylight intensity and time we can minimize the energy consumption. Some huge meeting room, Railway station, Airports where so many lamps are used to light up the area. If we control this with reference to natural light that is during day as per sunshine in particular area morning and evening this lamps we can light with minimum intensity.

Zones where we need more light that appliance with bright light is to be kept and at night time may be all the lamps can be used with 100% intensity.

This programmed can be useful in huge parking corridors where person walks from lift to car, corridor lights can be switched ON-OFF as per persons movement wherever he walks those two lights will be ON and others will be OFF same can be utilize for staircase lights. This power can be monitor and controlled through mobile app. By use of Zigbee it is possible to link the appliance with the mobile and can switch ON-OFF the device through android which saves energy as well as user can monitor how much units is his devices are consuming and how much he can save energy.

VI. MEASUREMENTS OF PARAMETERS

1) Voltage Measurement: The voltage transformer used in our paper is the 44 127 voltage step-down transformer Manufactured by MYRRA [7]. The actual voltage is thus obtained as follows:

Vact = m1 × Vmeasured voltage (1)

Where m1 is the scaling factor, Vact is the actual voltage, and Vmeasured voltage is the measured sensing voltage.

2) Current Measurement: For sensing current, we used ASM010 current transformer manufactured by Talema [8].

IAct = m2 × Vmeasured voltage for current (2)

Where m2 is the scaling factor, different values of m2 to be used for different current transformers. Iact is the actual current; Vmeasured voltage for current is the measured sensing voltage for current.

3) Power Measurement: In order to calculate power of a single-phase ac circuit, the product of root mean square (RMS) voltage and RMS current must be multiplied by the power factor as given in (3). Pact=Vrms×Irms×Pf (3)

Where Pact is the actual power, Vrms and Irms are the RMS values of voltage and current, respectively, and Pf is the power factor equation:

Pcal = Vact × Iact × Cf (4)

Where Pcal is the calculated power; Vact the output voltage as given in (1); Iact the current value as given in (2); and Cf is the correction factor. In this project we have kept two devices. 1] LED, 2] Fan. By controlling voltage and current we can dim LED and change the fan speed. By using android we can switch ON/OFF both the devices remotely.

VII. EXPERIMENTAL SETUP

A room with Two bulbs, Two Fan, A mixer, water heater, Vacuum cleaner And iron are placed. The bulb will consume 90W of power in normal system. In the proposed system it will take 40W to glow at full intensity. Figure below shows the power consumed by the device, which is compared to the proposed system, which is considered. Remember to operate for the proposed system minimum 2000W is necessary. This appliances watts are displayed on the android through it device are monitored and controlled. ON OFF of the device is present so that power is not consumed more

Normal System	Device	Power Indicated	Total Hrs Used	No. Of lights	Energy Consumed per Day	Total energy Consumed
	Bulb	90W	6	2	1080W	5400Wh/Day
	Fan	100W	6	2	1200W	6000Wh/Day
	Mixer	600 to 750W	1	1	600W	
	water heater	4000W	1	1	4000W	
	Vacuum cleaner	500W	1	1	500W	
	Iron	1100W	1	1	1100W	
Proposed System	Bulb	40W	6	2	480W	2400Wh/Day
	Fan	80W	6	2	960W	4800Wh/Day
	Mixer	550W	1	1	550W	
	water heater	3000W	1	1	3000W	
	Vacuum cleaner	300W	1	1	300W	
	Iron	900W	1	1	900W	

Figure 4: Experimental setup details. Energy saved in bulb for two devices is 3000Wh/Day.

VIII. LIMITATION AND FUNCTIONS

These limitations can be overcome by making some changes in reviewed system, like in first case if we use the sensing and load driver as per the power rating of appliances then we can controlled different devices other than household appliances. In second case we can change the value of threshold power consumption according to the requirement of consumers, which is technically done by making particular changes in programming. If we consider the third case then it may overcome by giving the flexibility for the power consumption and variable tariff of electricity.

Functions of the Smart home power monitoring and controlling systems:

- Collect actual amount of data that is kilowatt of every home appliances.
- Control ON/OFF of appliances.
- Water heater, Oven, mixer can be used in sequence instead all on at a time.
- Provide a link to the utility and/or Internet for smart remote control.

CONCLUSION AND FUTURE SCOPE

WSN based smart light control system using android is very effective for domestic household appliances that effectively controls the equipment remotely. It Is a Boon to elderly people who need not have to get up to switch ON the light (device). Through android household electrical equipment's status can be viewed from users cellphones or from Internet. This can save life of appliances as well as power.

More Application with WSN-Android can be developed in future for the smart building [9]

- Flow meter connection for water
- Speed meter connection for motor-fan, mixer
- Photo sensor application for security
- Temperature sensor application for Air conditioner and refrigerator. Temperature with smoke detector application for fire control
- Odor sensor application for cooking gas control

Above application can be controlled through personalized programs using android.

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