ELECTRIC POWER MANAGEMENT USING ZIGBEE WIRELESS SENSOR NETWORK

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ABSTRACT

The world passing the biggest problem of power. Because the production of power is less than the demand power of consumer side. In many countries the increase in demand is growing at a faster rate than transmission capacity and also the cost of providing power is also increasing due to the higher coal prices and deficiency of fuel. Also the reason of not getting the full power to consumers side is that the growing population of countries. To overcome the problem of power distribution this paper provides an overview of wireless sensor network by managing the equal power distribution by using zigbee network sensor.

KEYWORDS: *ARM7IC, MOBILE NET. ZIGBEE SENSOR NET. POWER MEASUREMENT IC*

I. INTRODUCTION

The world today's facing the most critical Problem of not getting the regular power. In many countries .peoples had not getting at least the primary needs of lights, fans, TV etc. In nearly every country, researchers expect existing energy production capabilities will fail to meet future demand without new sources of energy, including new power plant construction. However, these supply side solutions ignore another attractive alternative which is to slow down or decrease energy consumption through the use of technology to dramatically increase energy efficiency.

To manage the available power more often the power is cut for particular area, and that area goes in dark i.e. not even a single bulb can work. Instead, we can use available power in such a way that only low power devices like Tubes, Fans, and Desktops TV. Which are primary needs should be allowed and high power devices like heater, pump-set, A.C. etc should not be allowed for that particular period. To achieve this, system can be created which will differentiate between high power and low power devices at every node and allow only low power devices to be ON.

To achieve this system we create a wireless sensor network having number of nodes which communicate with each other in full duplex mode. The communication will consist of data transfer, controlling node operation. We are using zigbee protocol for the wireless communication. The main advantage of using ZigBee protocol is that the nodes require very less amount of power so it can be operated from battery. And in this way we have managing the available power by using wireless sensor network working on zigbee protocol. Each node is measuring the power, which is being consumed by the appliance. The appliance is controlled by the end device i.e. node. An overall operation of the system controlled by the control device. Main purpose of the project is that the wireless sensor network will differentiate and control the devices in the network on the basis of power consumed by appliances to make the efficient use of power.

The basic parts of the project include a Control Unit, End Device Unit having ZigBee interface. Power Measurement IC.ARM7 and GSM modem.

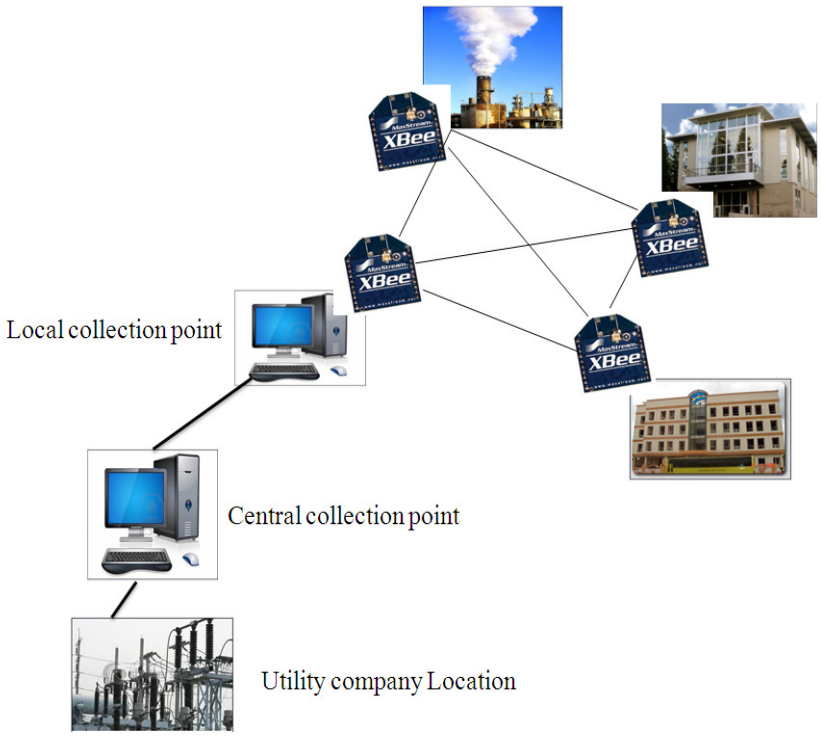

Figure 1. Concept diagram

II. IMPLEMENTATION

The block diagram of the system is shown below. Here controller will wirelessly communicate with end devices to control them. The power threshold will be set by the controller. The end device will compare this threshold with the power being consumed by the device connected through it and will take the appropriate action.

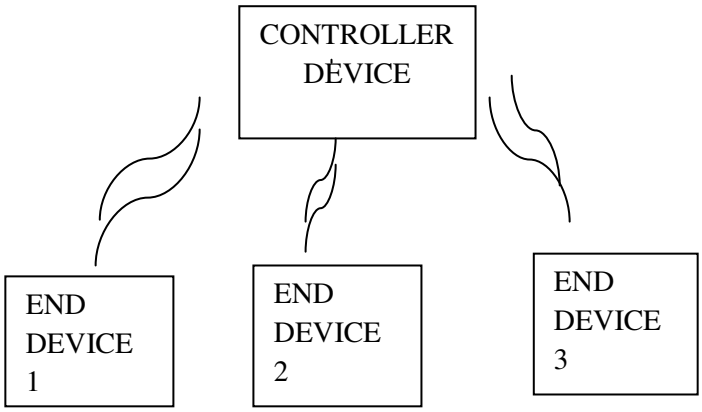

Figure 2.System block diagram

2.1 End device

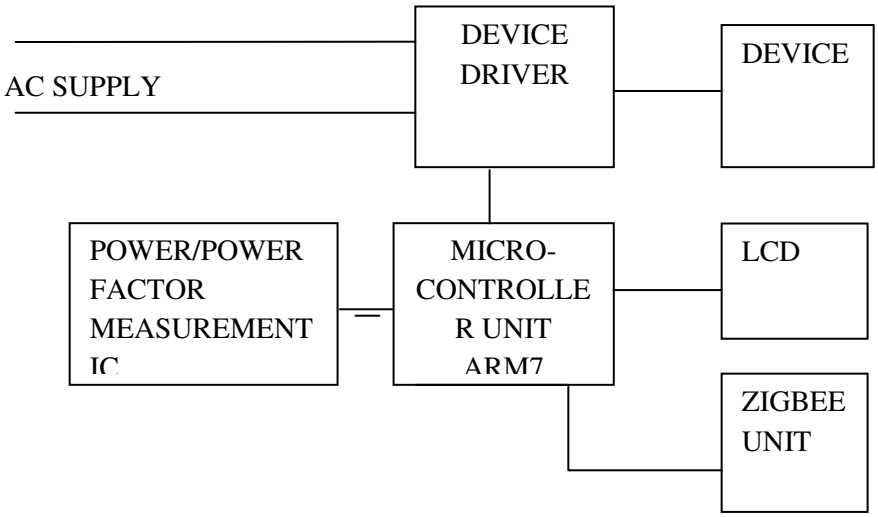

Figure 3. End Device block diagram

2.1.1. Power/power factor measurement IC**:** IC calculates the power used by the device which is to be controlled. IC also calculates power factor which can be maintained closer to unity by switching capacitive bank for power saving.

2.1.2. ARM7:It takes the power value from the power measurement IC and compares it with the threshold value set by the control unit and accordingly takes the controlling action like whether to keep device ON or switch it OFF. It also takes corrective action for power factor improvement.

2.1.3. Device driver**:** It is series pass element to switch on/off the device. It is nothing but relay to have make and break contact. It is driven by ARM7.

2.1.4. ZigBee module: It uses the ZigBee protocol to communicate with the control unit. It consists of transceiver, ARM7 and ZigBee stack implemented in it. This very small battery operated which provides full duplex communication with mesh networking.

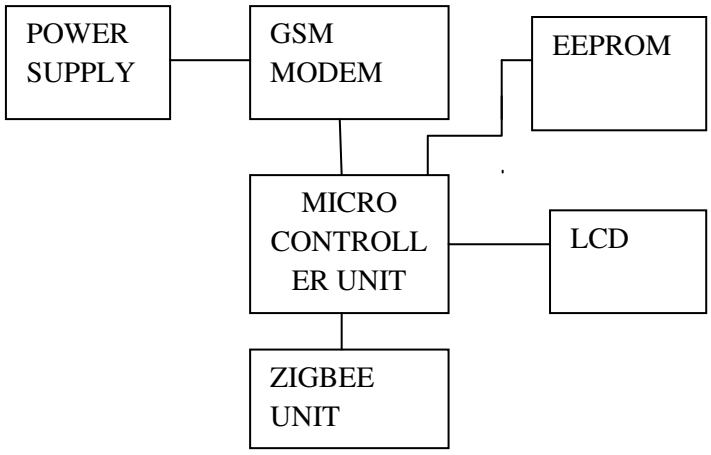

Figure 4. Control unit block diagram

2.2. Control Unit

It includes the ARM7 family microcontroller board, ZigBee, GSM modem interface. ARM7 sets the threshold for the end devices through the wireless communication using ZigBee module interface or simply it distributes power within the home. This control unit can be remotely programmable through GSM. GSM can also be used to send data to utility. Utility sets threshold for the control unit that is

power for particular house. This threshold will be set to smaller value during peak period and vice versa.

2.3. Result

Utility companies sending the message of power available to the control device unit. Control device unit receive the message and display the available power on LCD. The control unit will divided the available power to the end devices connected to the control device. If the load will be more than the available power then automatically cut of the high devices of the end devices and only to ON the low devices. In this way the system will be managing by availability of power as shown in following figure no.5.

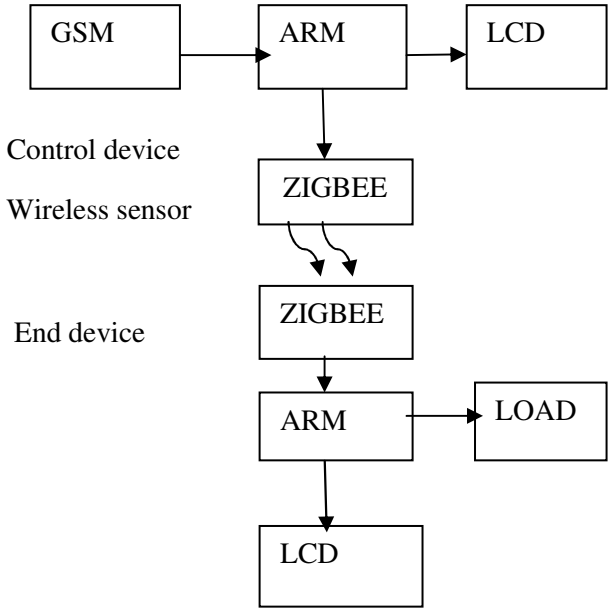

Figure.5 Wireless communication of system.

III. WHY ZIGBEE?

ZigBee was developed by the ZigBee Alliance, a world-wide industry working group that developed standardized application software on top of the IEEE 802.15.4 wireless standard. So it is an open standard.[38]

The power measurement application encompasses many services and appliances within the home and workplace, all of which need to be able to communicate with one another. Therefore, open standards architecture is essential. Open standards provide true interoperability between systems. Open standards also help to future-proof investment made by both utilities and consumers. [40]

Using an open protocol typically reduces costs in implementing: there are no interoperability problems to solve, and manufacture costs tend to be lower.

ZigBee also provides strong security capabilities to prevent mischief, and is extremely tolerant of interference from other radio devices, including Wi-Fi and Bluetooth.

ZigBee- enabled meters form a complete mesh network so they can communicate with each other and route data reliably. And the ZigBee network can be easily expanded as new homes are built or new services need to be added.

3.1. ZigBee Vs Bluetooth

Bluetooth

• targets medium data rate continuous duty
• 1 Mbps over the air, ~700 kbps best case data transfer

• Battery life in days only
• File transfer, streaming telecom audio
• Point to multipoint networking
• Network latency (typical) New slave enumeration-20s Sleeping slave changing to active-3s
• Uses frequency hopping technique
• 8 devices per network
• Complexity is higher

ZigBee

• targets low data rate, low duty cycle
• 250 kbps over the air, 60-115 kbps typical data transfer
• Long battery life (in years)
• More sophisticated networking best for mesh networking
• Network latency (typical) New slave enumeration Sleeping slave changing to active
• Mesh networking allows very reliable data transfer
• Uses direct spread spectrum technique
• 2 to 65535 devices per network
• Simple protocol.

IV. SCOPE

Even though smart meter solutions seems to be more expensive to implement up-front than traditional meters, the long-term benefits greatly outweigh any short-term pain.

Utilities are able to track peak usage times (and days), which provides them with the ability to offer consumers greater range of rates and programs, such as time-based pricing. Demand response can enable utilities to keep prices low by reducing demand when wholesale prices are high. In recent trials, this has been shown to provide significant saving to all consumers. Not just those who adjust their usage habits. Utilities can post meter readings daily for consumers to view, which enables consumers to track and modify their energy usage. this provides more timely and immediate feedback than traditional monthly or quarterly statement. Utilities can not only notify consumers of peak demand times. but also monitor the extent to which those notifications cause consumers to change their habits and reduce their load during these periods.

Utilities and consumers both benefit from more accurate billing that is available, thanks to the increased granularity of usage information, for example, for individual floors, apartments, or offices within a building. This gives consumers better control of their power and water usage, and passes on the biggest savings to those who use these services most efficiently. It also helps to reduce the number of billing enquiries, and helps to make those enquiries easier to resolve. [20]

4.1 Future Work

On-demand meter reading and remote troubleshooting allow utilities to provide better and more timely consumer support. Utilities have more at hand about outages and restorations, and are able to provide consumers with good information about when power will be restored. During emergencies, utilities can create "partial outages" in non-exempt buildings to ensure the power remains available where it is most needed. Partial outages are more economically efficient than full rotating outages, because the effects are limited to the reduction of a single discretionary service such as air conditioning rather than the elimination of all services. Also power factor improvement can result in a lot of power saving for industrial sector. Power demand and usage, allowing utilities and consumers alike to do their part to ensure continued and affordable supply of essential services into the future.

V. CONCLUSION

The most challenges and "green" legislation that utilities are facing today, combined with increased demand from consumers for more flexible offerings and cost savings, make a solution like smart meters both timely and inevitable. ZigBee's wireless open standard technology is being selected around the world as the energy management and efficiency technology of choice. Implementing smart meters with an open standard such as ZigBee helps to keep costs down, ensure interoperability, and future-proof investments made by both utilities and consumers. Consumers and businesses will see changes they never dreamed possible. [27]

The information collected through smart energy meters provides unprecedented insight into energy demand and usage, allowing utilities and consumers alike to do their part to ensure continued and affordable supply of essential services into the future. The "tipping point" is indeed here and much bigger than ever imagined.

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