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# Classroom Surveillance System based on ZigBee Technology

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**Abstract: This paper introduces a classroom surveillance system based on wireless standard. This system consists of a network device working as transmitter with some interfacing buttons and a coordinator working as receiving module with display. The network device transmit the information through wireless sensor network by ZigBee module structure which uses IEEE'S standard named 802.15.4. After getting the input of ongoing lectures detail the receiver will beep a buzzer and will display the information on LED screen .The results of output shows that the system can satisfy the need of automated surveillance of ongoing lectures.**

## I. INTRODUCTION

The past several years have witnessed a rapid growth of wireless networking. However, up to now wireless networking has been mainly focused on high-speed communications, and relatively long range applications such as the IEEE 802.11 Wireless Local Area Network (WLAN) standards. The first well known standard focusing on Low-Rate Wireless Personal Area Networks (LR-WPAN) was Bluetooth. However it has limited capacity for networking of many nodes. There are many wireless monitoring and control applications in industrial and home environments which require longer battery life, lower data rates and less complexity than those from existing standards. For such wireless applications, a new standard called IEEE 802.15.4 has been developed by IEEE. The new standard is also called ZigBee.

As the technology has grown in India as a widespread most of the institutions are focusing on how every system in their respective institutions will get automated, but only few institutions can implement actually this as cost of implementations and maintenance is quite high. In class room surveillance using ZigBee technology, there are three kinds of modules, which are transmitting module and receiving module. Those modules communicate with wireless device (ZigBee), and a self-organized network. The transmitting module will transmit data using zigbee device which will get received by receiver which can be placed in 1.5km range. As the data get received by the receiver it will send an acknowledgement to the transmitter that the data is received this acknowledgment will only in the form of beeping of buzzer. The organization of this paper is as follows. In section II, the architecture of WSN-based PGIS is introduced. In section III, the design of WSN is introduced, which includes the design of sensor nodes, the architecture of network and non-standard protocol. In section IV, we will introduce the information and management center. The performance of the system will be presented in this section followed by conclusion in section V.

## II. SYSTEM ARCHITECTURE

The system architecture is with two working modules for transmitter and receiver as in fig II.i and fig II.ii respectively.

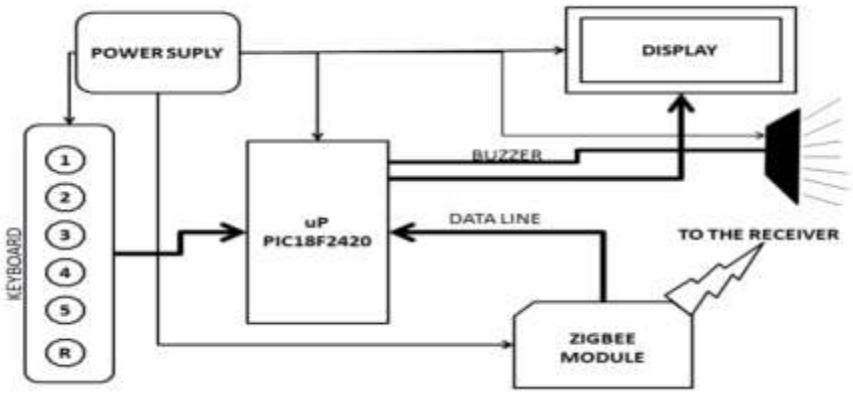


**Figure II.i: transmitter module**

### A. modules

The transmitter module and receiver module have component as shown in fig II.i and II.ii.

**ZigBee Module**: XBee and XBee-PRO ZB embedded RF modules provide cost-effective wireless connectivity to devices in ZigBee mesh networks. Utilizing the ZigBee PRO Feature Set, these modules are interoperable with other ZigBee devices, including devices from other.

**µp PIC18F2420**: It is the microprocessor which is responsible for processing the zigbee signals so that those signals can be used in the developed embedded system.

**Buzzer**: The main purpose of buzzer is to beep and provide information to the user of system and zigbee device itself that the data is received.

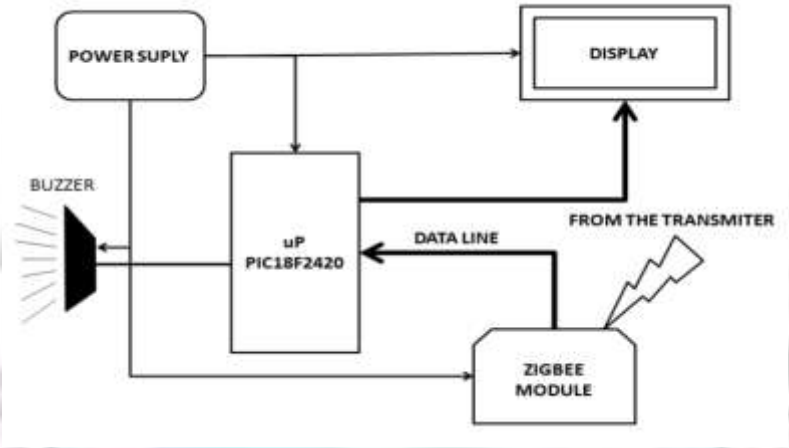


**Figure II.ii: receiver module**

**Power supply**: provides direct power to system when it is not running on the battery.

**Display**: On receiver side it provides visual display to the user which gives information about the ongoing lecture. On transmitter side the display is used for testing purpose.

**Keyboard**: On transmitter side the keyboard is present. Which consists of six buttons among which the first five are for different subjects and last button is for resetting purpose.

## III. DESIGN OF THE NETWORK

### NETWORK ARCHITECHTURE

In any communication system its network plays an important role. In this system of class room surveillance using ZigBee technology, the management of network is based on the IEEE's standard named802.15.4. The network topology and architecture described in that standard is as follows.
Architecture

ZigBee is a home-area network designed specifically to replace the proliferation ofindividual remote controls. ZigBee was created to satisfy the market's need for a cost-effective, standards-based wireless network that supports low data rates, low power consumption, security, and reliability. To address this need, the ZigBee Alliance, an industry working group (www.zigbee.org), is developing standardized application software on top of the IEEE 802.15.4wireless standard. The alliance is working closely with the IEEE to ensure an integrated, complete, and interoperable network for the market. Forexample, the working group will provide interoperability certification testing of 802.15.4systems that include the ZigBee software layer. The ZigBee Alliance will also serve as the official test and certification group for ZigBee devices. ZigBee is the only standards-based technology that addresses the needs of most remote monitoring and control and sensory network applications.

## Topology

Different topologies as illustrated below: star, Peer-to-Peer, mesh

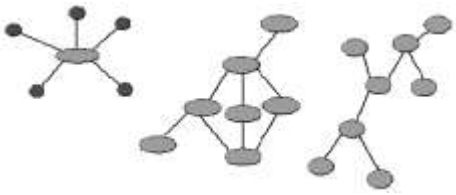

**Fig. II.ii: ZigBee Topologies**

## III. TRAFFIC TYPES

ZigBee/IEEE 802.15.4 addresses three typical traffic types. IEEE 802.15.4 MAC can accommodate all the types.

1. Data is periodic. The application dictates the rate, and the sensor activates, checks for data and deactivates.
2. Data is intermittent. The application, or other stimulus, determines the rate, as in the case of say smoke detectors. The device needs to connect to the network only when communication is necessitated. This type enables optimum saving on energy. 3. Data is repetitive, and the rate is fixed a priori. Depending on allotted time slots, called GTS (guaranteed time slot), devices operate for fixed durations.

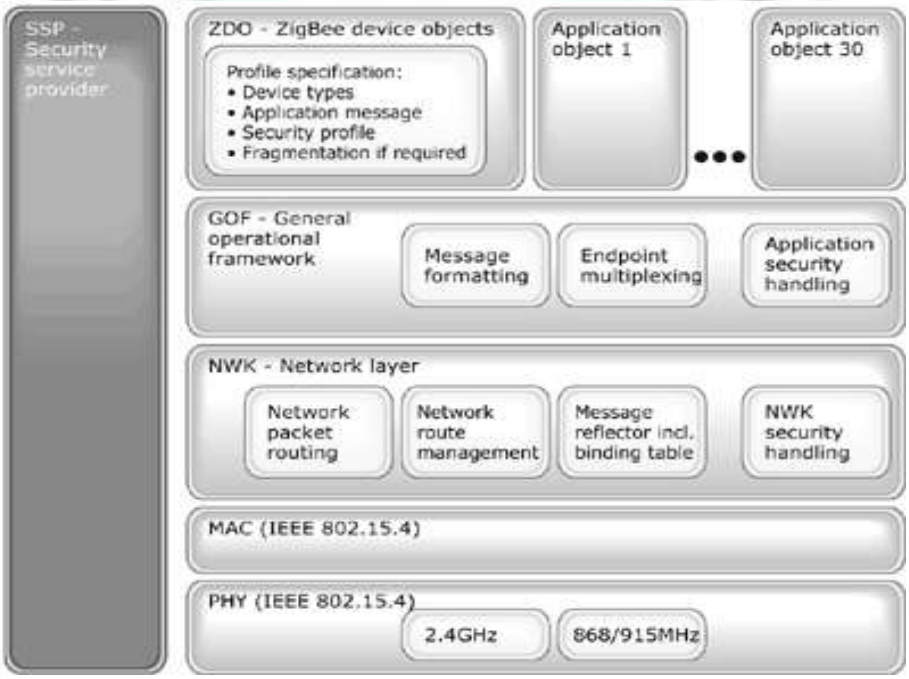


**Fig.II.iii ZigBee protocol stack architecture**

ZigBee employs either of two modes, beacon ornon-beacon to enable the to-and-fro data traffic.Beacon mode is used when the coordinator runs onbatteries and thus offers maximum power savings,whereas the non-beacon mode finds favor whenthe coordinator is mains-powered.In the beacon mode, a device watches out for thecoordinator's beacon that gets transmitted atperiodically, locks on and looks for messagesaddressed to it. If message transmission iscomplete, the coordinator dictates a schedule forthe next beacon so that the device ‘goes to sleep'; infact, the coordinator itself switches to sleep mode. While using the beacon mode, all the devices in a mesh network know when to communicate with each other. In this mode, necessarily, the timing circuits have to be quite accurate, or wake upsooner to be sure not to miss the beacon. This inturn means an increase in power consumption bythe coordinator's receiver, entailing an optimalincrease in costs.

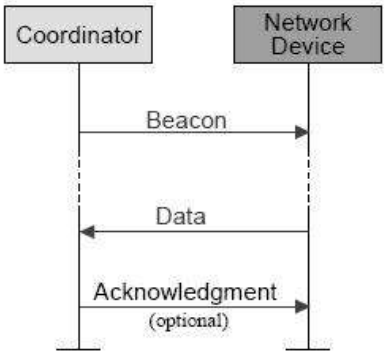


**Figure III.i: Beacon Network Communication**

The non-beacon mode will be included in a system where devices are ‘asleep' nearly always, as in smoke detectors and burglar alarms. The devices wake up and confirm their continued presence in the network at random intervals. On detection of activity, the sensors ‘spring to attention', as it were, and transmit to the ever waiting coordinator's receiver (since it is mains powered).However, there is the remotest of chances that a sensor finds the channel busy, in which case the receiver unfortunately would ‘miss a call'.

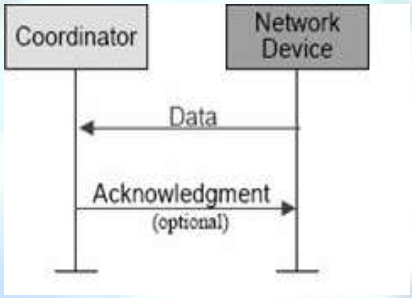


**Figure 3: Non-Beacon Network Communication**

## IV. IMPLEMENTATION

In this system we have considered the syllabus of computer engineering branch of RTMNU University Nagpur. The number of transmitters depending upon the number of classes containing the name of subjects will be implemented in the transmission section. This transmitter can transmit the details of ongoing lecture by using zigbee Transceiver. A signal receives by receiver module which will have a graphical display to display the name of ongoing lecture. It also displays the present system date and time due to presence of RTC controller in receiver module. Thus the different working screens is as follows.

**Figure IV.i : circuit of transmitter module**

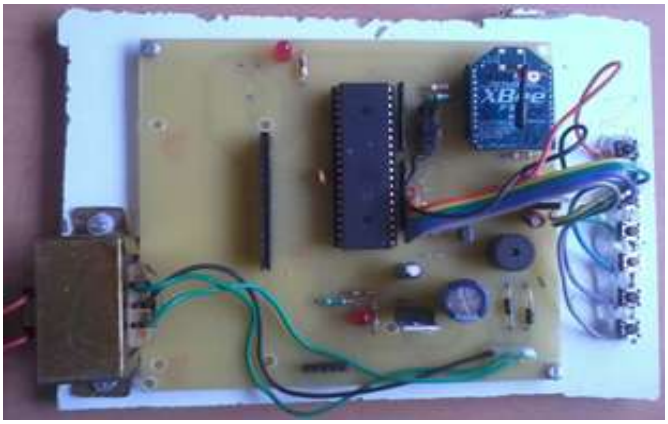

**Figure IV.ii circuit of receiver module**

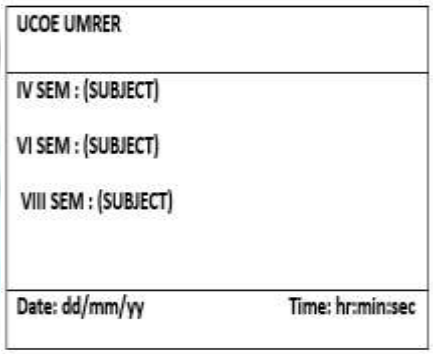


**Figure IV.iii : model of regular display showing ongoing lectures**

## V. CONCLUSION

We believe that there is definitely a place on the market for ZigBee, since no global standard exists today in the wireless sensor network area. If the ZigBee interoperability work between different brands of ZigBee devices, the ZigBee standard may be the dominating standard for wireless sensor networks in the Future. Two fully functional ZigBee/802.15.4 modules have been developed. It is possible to design a module with RF parts on a low cost FR-4 PCB substrate. By using a four layer PCB the size is reduced significantly. Finally it is shown that class surveillance can be integrated with the developed ZigBee-ready modules.

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