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Secured Wireless Communication For Industrial Automation And Control

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***Abstract*--**. The Zigbee Based Wireless Network for Industrial applications standardized nowadays. In this paper, we are implementing new design techniques for wireless industrial automation. The personal computer based wireless network for industrial application using Zigbee can be adopted at micro and macro Industries. This system has various types of Processors and Microcontrollers, further various sensors such as Temperature Sensors, LDR sensor, smoke sensor and Voltage regulators are used. The Personal Computer has full control over the entire system. The Personal computer is interconnected to all processor and controllers through Zigbee. The Personal Computer will continuously monitor and control all the data from remote processing unit. Here star topology three node Zigbee network is tried. The first Zigbee is connected to the personal computer it acts as full function devices and is used to send and receive data from other nodes. The second and third Zigbees are reduced function devices and they are used to control the speed of DC motor, temperature control ,lamp illumination control and smoke detection respectively. All the Zigbee's are interconnected with processing unit through RS232 protocol.

Keywords: Wireless Communication; Zigbee Network; Secured data transmission; D.C Motor Control; Closed loop temperature control; Illumination control.

I.INTRODUCTION

Now a days, wireless sensor networks are increasing in many areas including industrial data transfer and process control applications .In the case of Industrial Automation, data acquisition systems more than one receiver is a viable model. The data broadcast algorithms for the 802.15.4 based Zigbee network standard and their applicability are examined .

The Unique characteristics of a wireless sensor networks are Limited power they can harvest or store, Ability to withstand harsh environmental conditions, Ability to cope with node failures, Mobility of nodes,

Dynamic network topology, Heterogeneity of nodes, Large scale of deployment, Node capacity is scalable.

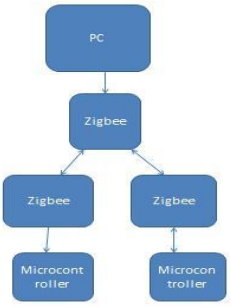

Figure 1 Block Diagram of Entire System

Here the data broadcast algorithms for the 802.15.4 based Zigbee network standard and their applicability

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are examined. Figure1 shown that three independent Zigbee trans receiver star network, One Zigbee is connected to personal computer which is used to receive and transmit data from the remaining two Zigbees. All Zigbees are communicating to external devices through serial port by using RS232 protocol[2] . User can control and monitor the entire network by using computer.

II.RELATED WORK

Wireless communication is the transfer of information between two or more points that are not connected by an electrical conductor. The distances involved may be short (a few meters as in television remote control) or long (thousands or millions of kilometers for radio communications).It encompasses various types of fixed, mobile and portable two-way radios, cellular telephones, personal digital assistants (PDAs), and wireless networking. Here we use the wireless network for industrial data communication.

A. Zigbee Protocol

ZigBee protocols are intended for embedded applications requiring low data rates and low power consumption. The resulting network will use very small amounts of power individual devices must have a battery life of at least two years to pass Zigbee certification. The applications that uses Zigbee protocol are building automation networks, home security systems, industrial control networks, patient monitoring, remote metering etc . Zigbee uses the IEEE 802.15.4 physical and MAC layers to provide standard-based, reliable wireless data transfer[3].

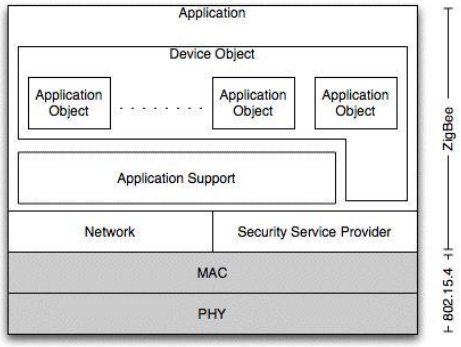

Figure 2 Zigbee Protocol Stack

B. Zigbee Protocol Features

1)Data rates of 250 kbps with 10-100 meter range. Power management to ensure low power consumption

2)16 channels in the 2.4GHz ISM band Low latency

3)Low duty cycle - Provides long battery life Up to 65,000 nodes on a network

4)Support for multiple network topologies: Static, dynamic, star and mesh

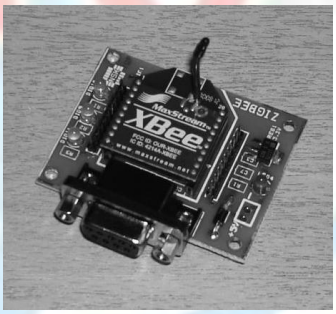

Figure 3 Photo Image of Zigbee Module

C. Collision Avoidance

Zigbee specifies a collision-avoidance algorithm similar to 802.11b, each device listens to the channel before transmitting in order to minimize the frequency of collisions between Zigbee devices. Zigbee does not change channels during heavy

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interference, instead it relies upon its low duty cycle and collision-avoidance algorithms to minimize data loss caused by collisions. If Zigbee uses a channel that overlaps a heavily used Wi-Fi channel up to 20% of all Zigbee packets will be retransmitted due to packet collisions.

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III. HARDWARE PLATFORMS OVERVIEW

An evaluating hardware was developed with Max streem, Zigbee pro Zigbee module, it consumes only 2mW and 1.25 mW power at active and sleep mode. It is compatible to transfer data upto 400 Meter range at 250Kbps. Zigbee pro is very suitable to Mesh, point-to-point and point-to-multipoint networks. It can be interfaced to External devices like, microcontroller, sensors and etc. Zigbee pro manufacturer provide XTU software package to program the Zigbee module.

Here LPC2148microcontroller is used to process individual systems and personal computer is used in monitoring and control station[3]. Both of the microcontrollers and personal computer are interfaced with Zigbee module through UART port. ULN 2003 driver is used to control the speed, direction of DC motors and also it saves motor from high current and short circuits.

Figure 4 Photo Image of Working Model

IV. INDUSTRIAL AUTOMATION AND CONTROL

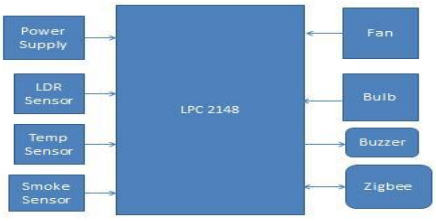

Figure 5 NODE 1(SLAVE 1)-Transmits the status of control devices to PC(MASTER) through Zigbee

Here NODE 1 shows that Temperature sensor, LDR sensor, smoke sensor are connected to Microcontroller which sense the information of control devices and communicates to the personal computer through Zigbee transceiver. Here Special focus is made on secure communication between Personal Computer and NODE 1.

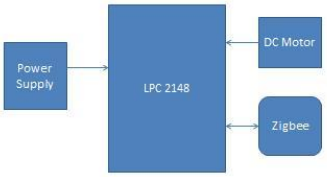

Figure 6 NODE 2(SLAVE 2)-Speed of DC Motor is controlled by PC(MASTER) through Zigbee

Node 2 shows that the DC motor is connected to Microcontroller where its speed and directions are controlled by Personal computer through Zigbee transceiver.

V.SYSTEM IMPLEMENTATIONS AND RESULTS

Figure 7 Monitoring And Control Section

In Implementation of system, as shown in Figure 7, the user can vary the speed and direction of the DC motor at NODE 2 through the Zigbee transceiver and can monitor the entire system at NODE1, the Zigbee which is at NODE1 transmits the information to the PC through Zigbee transceiver. These two processes will continue simultaneously without any disturbances. So the user can continuously control and monitor the data.

CONCLUSION AND FUTURE SCOPE

Industrial users should consider the type of monitoring and control applications that are suitable for LR-WPAN technology such as Zigbee. Reliability. Zigbee provides proper network topology, and it overcomes all problems in industries caused due to environmental issues[4]. We tested Zigbee networks in various environmental conditions by using three node star network for industrial applications. It was seen that error free proper communication was established between the processing unit and monitoring nit. In future we can also test other Zigbee networks for proper wireless data communication.

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