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A NOVEL APPROACH OF CONFINING STUDENTS USING ZIGBEE TECHNOLOGY

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Abstract— **In the present contemporary world confining our belongings is a big challenge. This is a simple project to reprieve the students in campus using ZigBee. The main principle is that Zigbee can be used to send and receive data over a wide distance. With the help of zigbee concept we earmark a trans-receiver in a hub and each student is assigned a reader. So with the help of this we sense the objects using a reader and computer. This system consists of Zigbee tag, a reader, and a user-interface computer. These tags are used for STUDENT tagging, asset tracking, access control applications, etc. When the tag is energized by the RF field, it transmits back the contents of its memory by modulating the incoming RF field. The reader detects and demodulates the signal and identifies the tag. For wireless data transmission and networking between sensor nodes, the project uses ZigBee modules. Every node after transmitting waits for an acknowledgment from the server to make data transfer reliable. The ZigBee and ZigBee-PRO OEM RF Modules are engineered to meet IEEE 802.15.4 standards and support the unique needs of low-cost, low-power wireless sensor networks. The modules require minimal power and provide reliable delivery of data between devices. The modules operate within the ISM 2.4 GHz frequency band. This same principle can be applied to confine our pet animals also.**

Index Terms—**ZigBee, RF field, RF module, ISM, confine**.

I. INTRODUCTION

The two major problems faced by organizations are time consuming manual attendance and wastage of electrical power. Our project is going to solve these problems by using RFID technology. For wireless data transmission and networking between sensor nodes, the project uses ZigBee modules. The project is designed for 256 rooms and it can store upto 512 card IDs but it is easily scalable upto 65000 card IDs but for that it requires external memory. Radio Frequency Identification is an automatic identification method, relying on storing and remotely retrieving data using devices called RFID tags or transponders. So the RFID is a wireless identification. Normally the RFID system comprises of two main parts: RFID Reader and RFID Tag. RFID Reader is an integrated or passive network which is used to interrogate information from RFID tag. The RFID Reader may consist of antenna, filters, modulator, demodulator, coupler and a microprocessor

II.THEORY

A. RFID CARD

Radio-frequency identification (RFID) is the wireless use of electromagnetic fields to transfer data, for the purposes of automatically identifying and tracking tags attached to objects. The tags contain electronically stored information. Some tags are powered by electromagnetic induction from magnetic fields produced near the reader. Some types collect energy from the interrogating radio waves and act as a passive transponder. Other types have a local power source such as a battery and may operate at hundreds of meters from the reader. Unlike a barcode, the tag does not necessarily need to be within line of sight of the reader, and may be embedded in the tracked object. Radio frequency identification (RFID) is one method for Automatic Identification and Data Capture (AIDC). A radio-frequency identification system uses *tags*, or *labels* attached to the objects to be identified. Two-way radio transmitter-receivers called *interrogators* or *readers* send a signal to the tag and read its response. RFID tags can be either passive, active or battery-assisted passive. An active tag has an on-board battery and periodically transmits its ID signal. A battery-assisted passive (BAP) has a small battery on board and is activated when in the presence of an RFID reader. A passive tag is cheaper and smaller because it has no battery. However, to start operation of passive tags, they must be illuminated with a power level roughly three magnitudes stronger than for signal transmission. That makes a difference in interference and in exposure to radiation. Tags may either be read-only, having a factory-assigned serial number that is used as a key into a database, or may be read/write, where object-specific data can be written into the tag by the system user. Field programmable tags may be write-once, read-multiple; "blank" tags may be written with an electronic product code by the user. RFID tags contain at least two parts: an integrated circuit for storing and processing information, modulating and demodulating a radio-frequency (RF) signal, collecting DC power from the incident reader signal, and other specialized functions; and an antenna for receiving and transmitting the signal. The tag information is stored in a non-volatile memory. The RFID tag includes either a chip-wired logic or a programmed or programmable data processor for processing the transmission and sensor data, respectively. An RFID reader transmits an encoded radio signal to interrogate the tag. The RFID tag receives the message and then responds with its identification and other information. This may be only a unique tag serial number, or may be product-related information such as a stock number, lot or batch number, production date, or other specific information.

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B. MICROCONTROLLER

89C51 is the member of 8051 family. AT89C51 is a low power, high performance CMOS 8-bit microcontroller with 4Kbytes of Flash programmable and erasable read only memory (PEROM). This device is compatible with the industry standard 8051 instruction set and pin outs. The on-chip Flash allows the program memory to be quickly reprogrammed using a nonvolatile memory programmer. By combining an industry standard 8-bit CPU with Flash on a monolithic chip, the 8951 is a powerful microcomputer which provides a highly flexible and cost effective solution to many embedded control applications. The 8951 provides the following features:

• 4 Kbytes of Flash
• 128 bytes of RAM
• 32 I/O lines
• Two16-bit timer/counters
• Five vector, two-level interrupt architecture
• Full duplex serial port ~ on chip oscillator and clock circuitry

C. ZIGBEE

ZigBee is a wireless communication technology based on the IEEE802.15.4 standard for communication among multiple devices in a wireless personal area network (WPAN). ZigBee is designed to be more affordable than other WPANs (such as, for example, Bluetooth) in terms of costs and, above all, energy consumption. A ZigBee personal area network (ZBPAN) consists of at least one coordinator, one (or more) end device(s) and, if required, one (or more)router(s). The network is created when a coordinator selects a channel and starts the communication, henceforth, a router or an end device can join the network. The typical distance of a ZigBee transmission range, depending on the environment conditions and the transmission power, shifts from tens to hundreds of meters, and the transmission power is deliberately kept as low as possible to maintain the lowest energy consumption.

III.SYSTEM METHODOLOGY

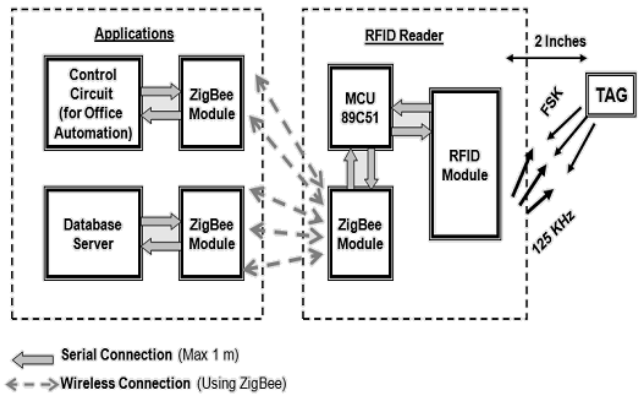

Fig.1.BLOCK DIAGRAM

A. METHODOLOGY

a. RFID READER

• Reader consisting of RFID module and microcontroller will be designed
• The microcontroller will verify valid tag number by comparing it with predefined tag numbers already stored in the microcontroller ROM
• If the tag is valid it is stored on the microcontroller's RAM for further processing (10 bytes tag mapped to 2 bytes), 2 bytes are then broadcasted

b. TRANSMISSION

• Transmission from RFID reader to the control circuitry and database server is wireless (using ZigBee modules)
• For serial communication RS232 standard is used.

c. DATABASE SERVER

• The mapped tag is received by the database server (PC)
• Application does some data analysis against that tag
• Data analysis includes marking of attendance and updating the record of that particular tag holder

d. CONTROL CIRCUITRY

• At the same time mapped tag is also received by the control circuitry
• Control circuitry automates office equipments (light, fan etc.) against the valid tag number based on the defined profile of tag holder .

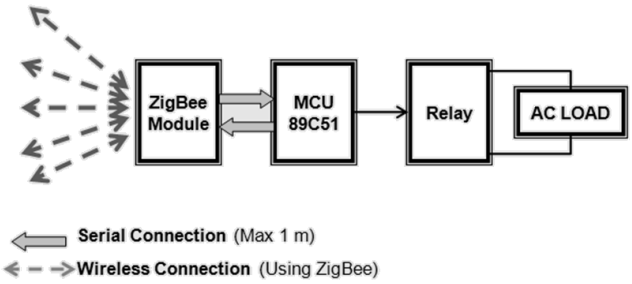

Fig.2.CONTROL CIRCUITRY

e.)NETWORK BLOCK DIAGRAM

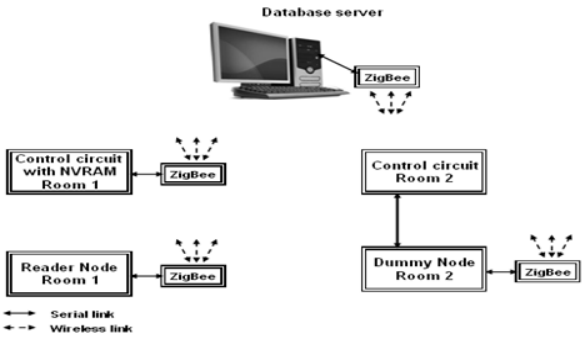

Fig.3.NETWORK BLOCK DIAGRAM

B.STEPS

• Reader will detect the RFID card and forward that ID to microcontroller and generate specific number
• This specific number is then forwarded to the ZigBee transceiver via serial link from where it is broadcast to receiving nodes

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• One of the receiving node is the database server where attendance record is managed
• At the same time control circuit node receives the broadcast and automates the office equipments based on that specific profile. The profiles can be modified from the server as they are stored in NVRAM
• In order to simulate the multi node environment, there is a dummy node that simulates the working of the RFID reader
• A separate control circuitry (labeled as room 2) is attached with it. This is a hard wired link

IV. WORKING MODEL

A. RFID READER WORKING

• An RFID module typically contains a transmitter and receiver, a control unit and a coupling element (antenna).
• The reader has three main functions: energizing, demodulating and decoding. Information is sent to and read from RFID tags by a reader using radio waves.
• Passive RFID tags have no internal power supply. The minute electrical current induced in the antenna by the incoming radio frequency signal (125 KHZ) provides just enough power for the CMOS integrated circuit in the tag to power up and transmit a response.
• Most passive tags signal by backscattering (Backscatter is the reflection of waves, particles, or signals back to the direction they came from) the carrier wave from the reader, as shown in figure 4

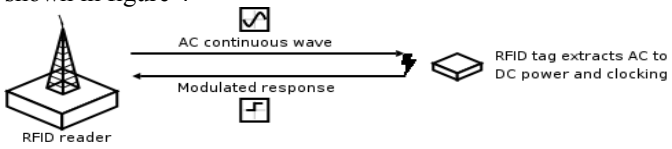

Fig 4 RFID backscatter

• Passive tags have practical read distances ranging from about 10 cm (4 in.)
• Data collected from tags (10 bytes) is then passed through communication interfaces (cable or wireless) to host computer systems in the same manner that data scanned from bar code labels is captured and passed to computer systems or interpretation, storage, and action.

B. MICROCONTROLLER WORKING

• *TAGGING*

- ❖ After ID authentication microcontroller will map 10 byte card ID on a 2 byte tag# so that it can efficiently utilize the transmission time
- ❖ Transmission time at 9600 baud rate of 10 bytes: T= (1/9600)*80=8.33 msec, 2 bytes: T= (1/9600)*16=1.6 msec So it means we are saving more than 80% of the transmission time by using tagging technique
- ❖ In multi node environment transmission time is directly related with the system performance. More the transmission time higher will be the probability of data collision and vice versa
- ❖ Like RFID cards, tag numbers are also unique
- ❖ In microcontroller's ROM these IDs are saved in a 12 byte fashion as illustrated in fig 5

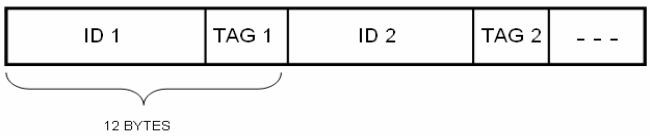

Fig 5 Tagging

V. SIMULATION RESULTS

ZTR is designed for resource constrained ZigBee devices to choose multi-hop routing path without any route discovery procedure, and it works based on hierarchical block addressing scheme. With the hierarchical addressing scheme, we can easily identify whether the destination is descendant of each source or intermediate node. The destination with address D is descendant of the node with address A. In ZTR, each source or intermediate node sends the data to one of its children if the destination is descendant; otherwise, it sends to its parent. where a packet is routed through several hops towards the destination even though it is within the range of sender's 2-hop transmission range.

Modules:
1. Topology Formation
2. Tree structure(Parent child identification)
3. shortcut tree routing

1. Topology Formation:
Constructing Project design in NS2 should takes place. Each node should send hello packets to its neighbor node which are in its communication range to update their topology.

2. Tree structure(Parent child identification)
The names of relationships between nodes are modeled after family relations. The gender-neutral names "parent" and "child" have largely displaced the older "father" and "son" terminology, although the term "uncle" is still used for other nodes at the same level as the parent. A node's "parent" is a node one step higher in the hierarchy (i.e. closer to the root node) and lying on the same branch. "Sibling" ("brother" or "sister") nodes share the same parent node. A node's "uncles" are siblings of that node's parent. A node that is connected to all lower-level nodes is called an "ancestor". The connected lower-level nodes are "descendants" of the ancestor node

3. shortcut tree routing
The main idea of STR is that we can compute the remaining tree hops from an arbitrary source to a destination using ZigBee address hierarchy and tree structure as discussed in previous section. In other words, the remaining tree hops can be calculated using tree levels of source node, destination, and their common ancestor node, because the packet from the source node goes up to the common ancestor, which contains an address of the destination, and goes down to the destination in ZTR.

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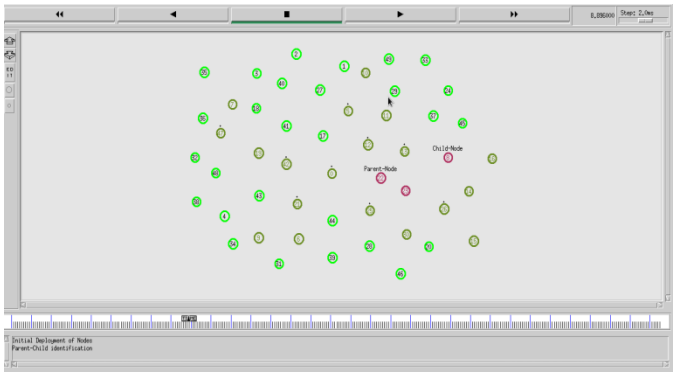

Fig 6. Topology Formation

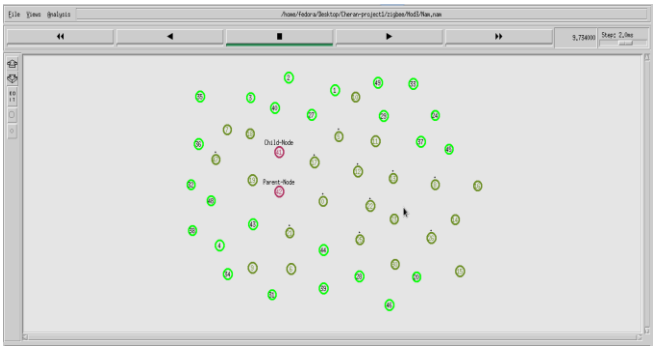

Fig 7. Tree structure(Parent child identification)

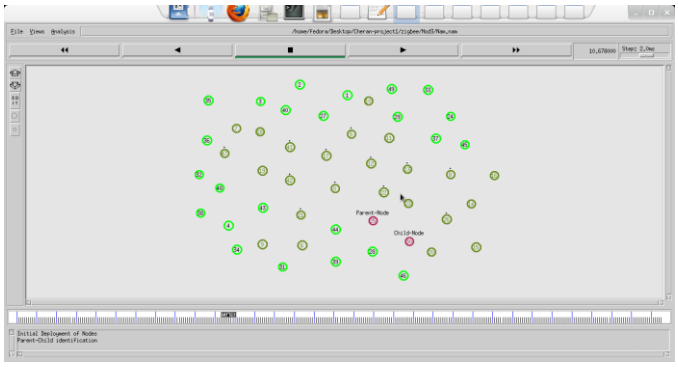

Fig 8. Parent shortcut tree routing

VI.CONCLUSION

In the recent time use of digital is increasing day by day due to their accuracy and feasibility. The use of RFID technology in confining students in campus is not feasible and reliable, Hence a new evolving technology namely Zigbee technology is used. This system is time saving, portable, affordable, consumes less power and can be made easily available so that the user can use this system whenever and wherever.

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