RFID-Based Monitoring And Access Control System For Parliamentary Campus

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ABSTRACT: This paper is to implement monitoring and access control system based on RFID and Zigbee technology, which can be used at Parliamentary Campus. Nowadays, RFID technology is widely used for access control system because it is cheap, waterproof and easy to use as well as it contains unique EPC (electronic protect code) .In addition, Zigbee wireless module is cost-effective and can be reliable for security. So,this system consists of RFID tag, RFID reader, Arduino Uno and Zigbee. This system can also be used for industrial & commercial and security HVAC closures. This paper describes the results of point-to-point connection and point-to-multipoint connection using Zigbee and RFID technology.

Keywords: RFID, Zigbee, Arduino, Monitoring

I. INTRODUCTION

Nowadays, an access monitoring system becomes a popular topic and research field. Access control systems using Zigbee are developed for many applications such as industrial & commercial, consumer electronics, home automation, and HVAClighting closures. These systems use wireless technologies to transmit vital signs for access. This paper describes the wireless sensor network based on ZigBee technology and is mainly used for that clients are authorized or not at each senor node.[1] Wireless sensor networks application for access control system has many technologies e.g., Bluetooth and Wi-Fi modules etc. Wi-Fi is available for wider range than Zigbee but it is more expensive than ZigBee. And even though Bluetooth is better than ZigBee for transmission rate, but ZigBee has lower power consumption. Hence, ZigBee is generally used for 24 hours monitor of communication transmission systems**.** Compared to Bluetooth, ZigBee provides a larger number of nodes, and a better transmission range with low power consumption. Large number of nodes enables the expansion of such kinds of system. Recently, ZigBee-based wireless networks were tested in various applications.[1] This system generally contains two parts;

A. Hardware design
B. Software design

A. HARDWARE DESIGN

In this journal, hardware used in the system is Zigbee, RFID and Arduino Uno.

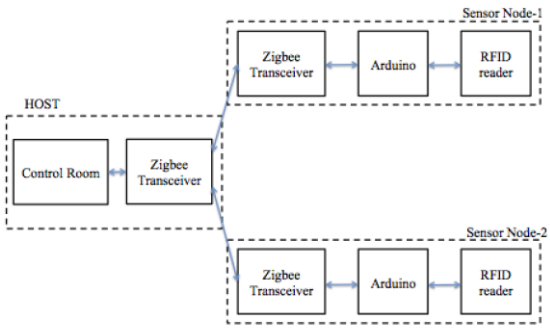


Fig. 1 *system configuration*

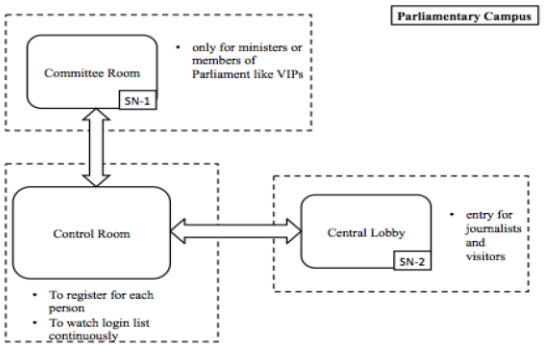


Fig *Functional block Diagram of the system*

In this system, journalists and visitors can enter only Central Lobby and they don't have access to enter Committee Room and they are restricted by the admin. Only VIPs (ministers and members of parliament) can enter the Committee Room. And only admin is allowed to enter the Control Room. If a person who doesn't have permission enters to the Committee Room, it will display at the Control Room and the door will not open. For VIPs, they can also enter Central Lobby. The admin can watch and control the whole system from the Control Room.

A. ZigBee Networking Topologies

The network information is managed by the ZigBee networking layer .The network must be in one of two networking topologies specified in IEEE 802.15.4: star and peer-to-peer. In the star topology, shown in Fig. 2 every device in the network can communicate only with the Zigbee coordinator. A typical scenario in a star network formation is that an FFD, programmed to be a PAN coordinator, is activated and starts establishing its network. The first thing this PAN coordinator does is to select a unique PAN identifier that is not used by any other network in its radio sphere of influence—the region around the device in which its radio can successfully communicate with other radios. In other words, it makes it sure that the PAN identifier is not used by any other nearby network.

Common network topologies are

i. Ring
ii. Mesh
iii. **Star**
iv. Tree
v. Bus

This system uses Star network topology because it is reliable even one connection fails and it doesn't affect other users as well as very few data collisions as each workstation has its own cable to server.[2]

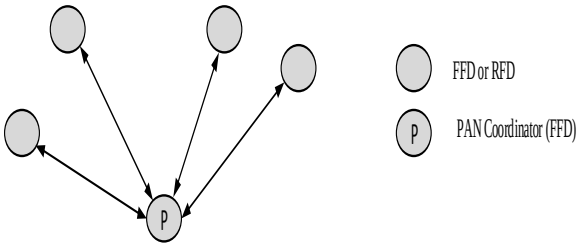


Fig. 2 *A star network topology*

Zigbee cc2530 Module

Fig. 3 shows the Zigbee module, which is placed at each senor node, is to transmit and receive. In this system, it used three Zigbee modules, two for transmitter and one for receiver. It is a wireless point-to-multipoint data communication between sensor nodes and Control Room. Fig. 4 shows Zigbee transceiver module with baseboard and it is placed at the Control Room. The advantage of using Zigbee baseboard is that it can easily interface with Zigbee transceiver and computer.

Fig. 3 *Zigbee Transceiver module*

Fig. 4 *Zigbee Transceiver Module with Baseboard*

Core2530 Specifications

Absolute maximum range	Over 350 meters
Stable Communication	Over 250 meters
Auto connecting	Over 120 meters
Supply-voltage range	2V-3.6V
Serial Port Baud Rate	38400bps (default)

B. Zigbee/IEEE 802.15.4 Architecture

Fig. 5shows the architecture of Zigbee, which consists of Application, Network, IEEE 802.15.4 MAC and PHY layers.

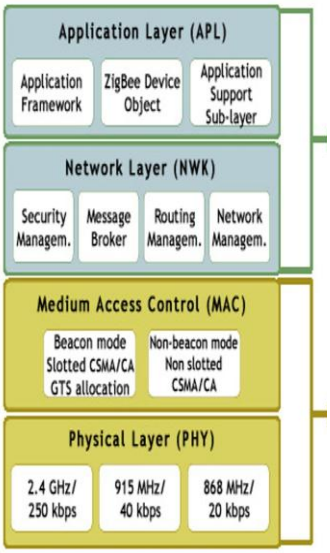


Fig. 5 *Architecture of Zigbee/IEEE 802.15.4*

1. Network (NWK) Layer

The NWK layer interfaces between the MAC and the APL and is responsible for managing the network formation and routing. *Routing* is the process of selecting the path through which the message will be relayed to its destination device. The ZigBee coordinator and the routers are responsible for discovering and maintaining the routes in the network. The NWK layer of a ZigBee coordinator is responsible for establishing a new network and selecting the network topology (tree, star, or mesh). The ZigBee coordinator also assigns the NWK addresses to the devices in its network.

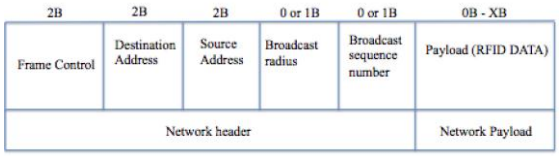


Fig: *Network frame structure of Zigbee*

C. HF RFID (Passive Tag)

- Data size – 4 bytes to 8 KB
- Energy transfer from the reader via RF
- Only within field of reader
- Short range (up to 4cm)
- Ability to read and transfer sensor values only when tag is powered by reader

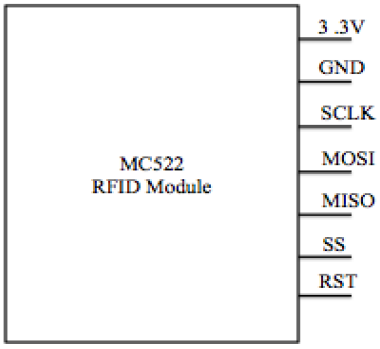


Fig: *Block Diagram of MC522 RFID*

D. ARDUINO UNO

The Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everythingneeded to support the microcontroller; simplyconnect it to a computer with a USB cable or power it with anAC-to-DC adapter or battery to get started.

C. SOFTWARE DESIGN

i. System flowchart
ii. Graphical User Interface (GUI)

i. System Flowchart

At first, each client has to have RFID tag to enter the buildings respectively according to their roles. Personnel data of each person is already recorded in database while registering. If the person is authorized, the green light will turn on and the door will open and if not, the red light will turn off and the door will remain closed. The admin can watch all of the data lists from the control room and can shut down all the gates immediately when in emergency situation.

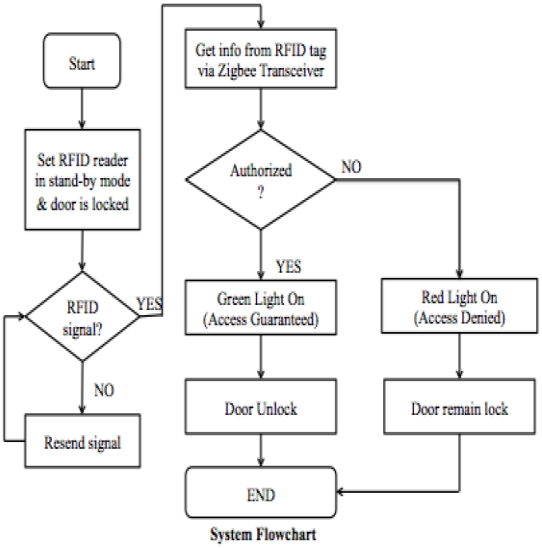


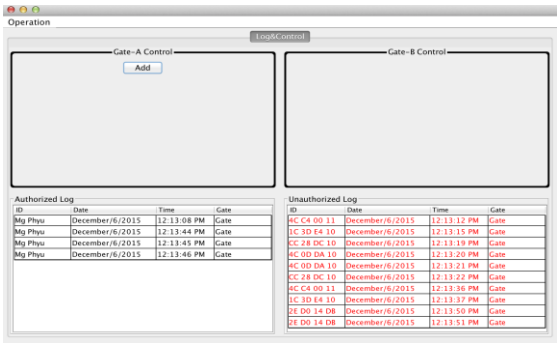
Fig. 6 *System Flowchart*

ii. Graphical User Interface (GUI)

The graphical user interface displays In-and-Out list continuously and record that data to review as well as to control each gate when something is wrong. It is a software related to you to interact with clients whether they are allowed or not to access for each building. We can create professional interfaces with minimal effort. Graphical User Interfaces have been around for many years. Java provides a powerful and flexible development environment for creating Microsoft Windows-based and Microsoft.Net-based applications. Here we use Java in an integrated development system.

EXPERIMENTAL TESTS

The following figure is shown for design and construction of RFID-based Monitoring and Access Control system using ZigBee technology.



TEST and Results (Point-to-Point Connection)

Connection	Range (meter)	Time Delay (Second)	Condition	Types of Construction materials	Data successfully sent
P2P	3m	0.2-0.3	Different rooms in the same building	Brick wall & Plywood	YES
P2P	35m	1-2	From each side of only one building	Brick wall & Plywood	YES
P2P	100m	0.4-0.6	No obstacle	-	YES
P2P	150m	4-7	No obstacle	-	YES
P2P	300m	4-8	No obstacle	-	YES
P2P	330m		No obstacle	-	NO

TEST and Results (Point-to-Multipoint Connection)

Connection	Range (meter)	Time Delay (Second)	Condition	Types of materials	Data successfully sent
P2MP	70m	0.5-0.7	Main Building to EC Department	Trees and Buildings	YES
P2MP	150m	0.2-0.4	Nuclear Department to EC Department	Only trees	YES

- EC Department – Control Room
- Main Building – Sensor Node A
- Nuclear Department – Sensor Node B

- **Signal strength is depending on environmental characteristics (e.g , types of construction materials) and line-of-sight.**

CONCLUSION

In this paper, the system is a wireless monitoring and access control system, which is used at the Parliamentary Campus. This system is based upon wireless Zigbee technology IEEE 802.15.4 providing low cost effective solution.Here the cooperative communication also plays animportant role to make sure that Zigbee nodes are always in the range of ZigbeeCoordinator. Thesystem is convenient and efficient innature andthus increases interaction between sensor nodes at each building and coordinator at the Control Room. This system will widely be used in Campus as point-to-multipoint network. This Zigbee supports 255 nodes in a single network. The database can be stored more than two sensor nodes data in GUI. For further extend, the Zigbee can connect more than 2 nodes in the same network. Moreover, gateway module is needed to interconnect for different network. Adding more sensing device will get a lot of benefit either to the security system. Therefore, the access control monitoring system will be more convenient in Parliamentary Campus.

REFERENCE

[1] Ms. Amruta Nagarkar, Prof.M.N.Kakatkar **"**ZIGBEE BASED WIRELESS PATIENT MONITORING" International Journal of Science, Engineering and Technology Research (IJSETR) Volume 2, Issue 2, February 2013

[2] Shahin Farahani "Zigbee Wireless Networks and Transceivers"

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[4] http://www.waveshare.com/product/modules/wireless/zigbee.htm