Research Article

Radio Frequency Identification (RFID) Based Employee Monitoring System (EMS)

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Abstract

RFID Based Employee Monitoring System (EMS) would allow complete hands-free access control, monitoring the whereabouts of employee and record the attendance of the employee as well. The access tag can be read up to 5 (~16 feet) meters from the RFID reader, which usually eliminates the need to handle the tag or to walk very close to the reader. This freedom is particularly important to handicapped workers, staff carrying packages. The proposed system is based on UHF RFID readers, supported with antennas at gate and transaction sections, and employee identification cards containing RFID-transponders which are able to electronically store information that can be read / written even without the physical contact with the help of radio medium. This paper presents the experiments conducted to set up RFID based EMS.

Keywords: UHF Readers, EPC GEN 2 RFID Passive Tags, RFID, GUI, API

1. Introduction

RFID-based equipment monitoring and tracking system is an integrated system that offers an effective solution of managing items especially for large scale environment. It combines the RFID technology and security devices to ensure the items are always been monitored and secured. The system enable the organization to track and monitor selected individual to access locations, permit movement, record the important data and also enable the viewing of record via internet. This paper introduces the distinctive components of RFID technology and focuses on its core competencies, scalability and security. It will be then supplemented by a detailed synopsis of an investigation conducted to test the feasibility and practicality of RFID technology.

RFID is a wireless automatic identification that is gaining attention and is considered by some to emerge as one of the pervasive computing technologies in history. As the technology grows very rapidly, RFID has received considerable worldwide attention and widely used in monitoring and tracking ranging from human identification to product identification. Previous research has successfully indicated that RFID has been increasingly expanded in various fields such as retail supply chain, asset tracking, postal and courier services, education, construction industry, medical etc.

Developments in RFID technology continue to yield larger memory capacities, wider reading ranges, and faster processing. It is highly unlikely that the technology will ultimately replace barcode. However, RFID will continue to grow in its established niches where barcode or other optical technologies are not effective, such as in the chemical container industry and livestock industry.

RFID enables tracking and monitoring of items over distances that range from about a centimeter to hundreds of meters. RFID can track inventories, mobile equipment, and people in real time as the tagged item travels around the organization. Tracking of mobile equipment can include wheelchairs, infusion pumps, and blood supplies. Given that organization personnel fail to locate such mobile assets anywhere from 15 to 20 percent of the time because of misplacement, the value of RFID tracking can be seen. Information storage capacity is much less limited than with bar codes, with as much as 2 kilobytes of data stored by a microchip in a RFID tag.

2. RFID vs Bar code

RFID technology is more sophisticated than the bar code. This is because of the following facts:

- It will be embedded and read with no requirement for line of sight
- Tags can be reprogrammed easily
- Capable of working in suitable and harsh environments
- Ready to carry 96 bits of information – compare with 16 bits for bar code
- Fraud controlling increases
- Cloning become non existence
- Improves antitheft protection
- Better efficiency
- Cost saving

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- Simultaneous multi-tag reading
- High speed data capture
- Possibility of having a unique ID
- Portable database
- Profit enhancement
- Better supply chain and inventory management
- Reducing counterfeiting
- Tracking work-in progress
- Reducing administrative errors
- Reducing rework

3. RFID System Components and Connectivity

A conventional RFID system is made up of four components mainly,

1. RFID Reader
2. RFID Antenna
3. RFID transponder (or tag) electronically programmed with unique data
4. Host computer with appropriate application software

RFID systems consists of an antenna and a transceiver, which read the radio frequency and transfer the information to a processing device, and a transponder, or tag, which is an integrated circuit containing the RF circuitry and information to be transmitted . The system requires the usage of RF active readers able to communicate with the main station using 3 different communication mediums: serial cable, LAN cable, and WLAN antenna. Fig.1 shows the basic components and connectivity of an RFID System.
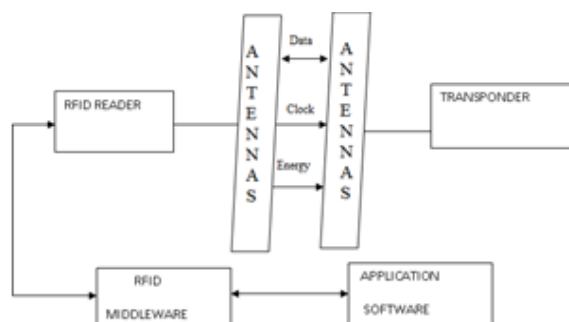

Fig.1 Block Diagram of RFID System

4. Principle of Operation

A radio-frequency identification system combines inexpensive, programmable tags with a computerized radio detector. When the tag comes to within a few feet of the detector, the detector reads data carried in the tag via radio waves. A detector can work in a system with any number of tags, from a handful to millions. RFID equipment has myriad uses including inventory tracking, secure building access and retail-theft control.RFID methods utilize radio waves to accomplish this. At a simple level, RFID systems consist of three components: an RFID tag or smart label, an RFID reader, and an

antenna. RFID tags contain an integrated circuit and an antenna, which are used to transmit data to the RFID reader (also called an interrogator). The reader then converts the radio waves to a more usable form of data. Information collected from the tags is then transferred through a communications interface to a host computer system, where the data can be stored in a database and analyzed later. A RFID reader is a network connected device (fixed or mobile) with an antenna that sends power as well as data and commands to the tags. The RFID reader acts like an access point for RFID tagged items so that the tags' data can be made available to several applications. Fig.2 shows the basic principle of an RFID system.
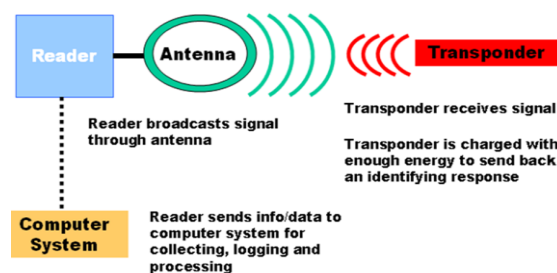

Fig.2 Working Principle of an RFID System

5. System Architecture

The basic architecture of an RFID system consists of a tag that includes an antenna and a chip, a reader equipped with antenna and a transceiver, and a workstation to host the Middleware and database. System architecture comprises of
i.   Hardware Architecture
ii.   Software Architecture

5.1 Hardware Architecture

To satisfy the system functional and non-functional requirements, the Electronic Product Code (EPC) Gen2 passive RFID tag and Ultra High Frequency (UHF) reader will be selected.
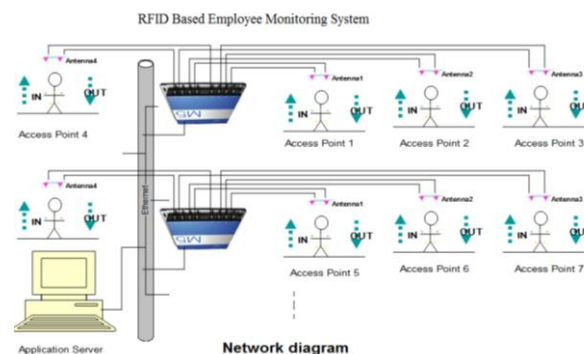

Fig.3 Proposed Hardware Architecture of RFID System

The wireless access point that links the tag reader with the monitoring station and database server will also selected. Fig. 3 shows the arrangement of readers and antennas and
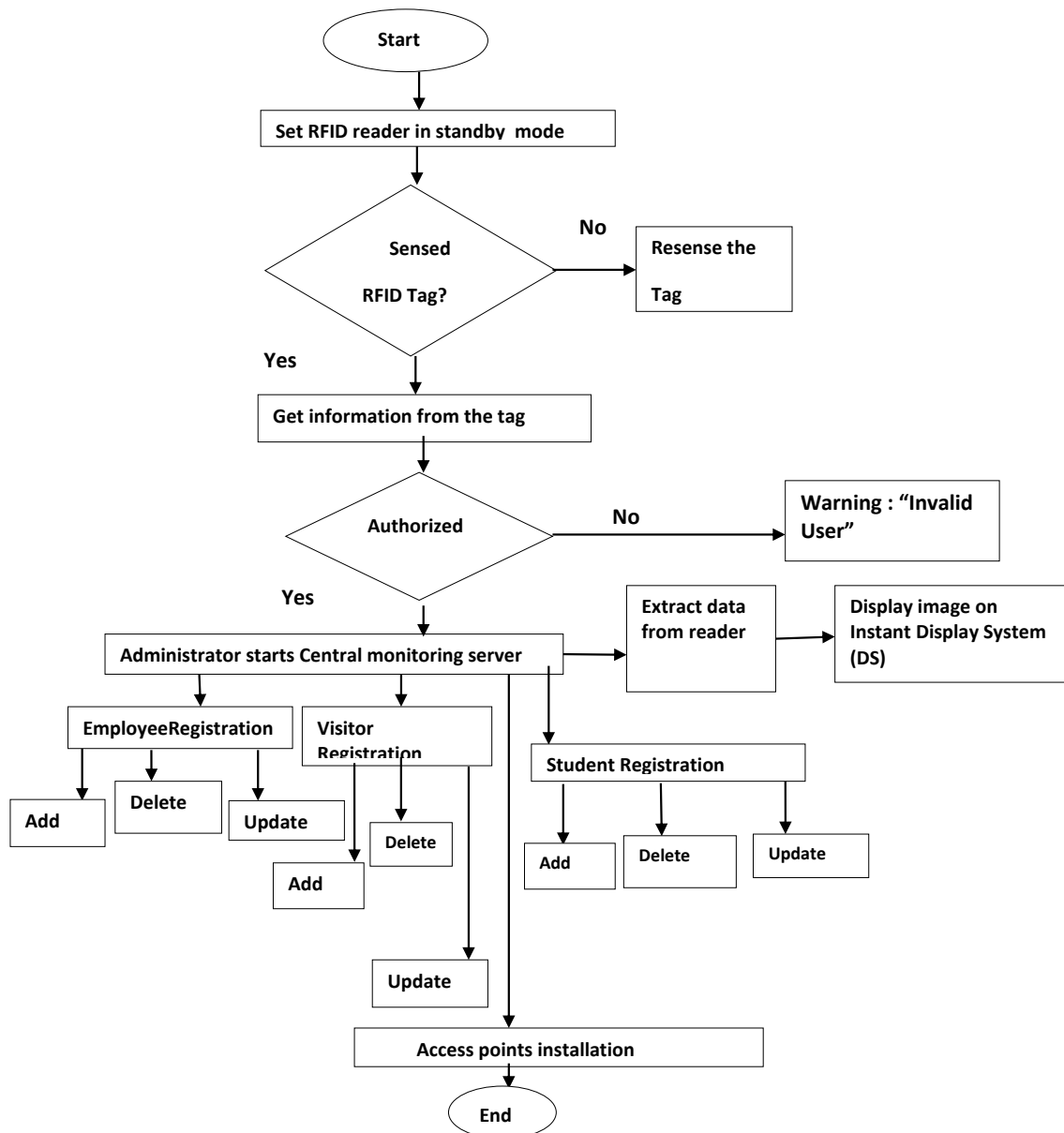
Fig.4 Flow Chart of the Proposed RFID System

the system hardware architecture. Multiple tag readers are added to enable the system track the employee while she/he is on the move.

5.2 Software Architecture

The software architecture consists of a communication driver that handles all communication functions done at the server side , an Application Programming Interface (API) that handles and analyzes the data, a friendly GUI and a database that saves all readings and client information.

The design also deals with the issues (reliable data transfer) of multi node environment. To make sure reliable data transfer between server and reader node . This project will facilitates the users in numerous ways like time saving in attendance procedure, security, employees attendance management and many more.

Building an automated tracking applications by integrating web services guarantee many benefits, such as

reduce clerical task and ease the management burden. The RFID-based equipment tracking system is an integrated system that offers an effective solution of managing items especially for large scale environment. It combines the RFID technology and security devices to ensure the items are always been monitored and secured. The system enable the university to give admission to selected individual to access locations, permit movement of items, record the important data and also enable the viewing of record via internet. The working procedure of the proposed RFID System is described below.

- To develop software this will act as a middleware between server and the reader.
- To develop the connection between server and the reader.
- To read/write the data onto the tags.
- To extract or read data from tags , decode that data and make it usable for further processing.
- To develop a graphical user interface (GUI) which will display the details of a person or employee by

displaying IN and OUT timings and on the basis of that not only it will be useful for attendance recording but also for report generation on daily and monthly basis.
▪ To store the data in database and create various input/output log files.

6. Work Flow

The system is developed in a modular-based method. The system software is mainly consists of following two modules.

▪ Recorder
▪ Administrator

Recorder module is responsible for controlling RFID readers, getting detected tags from readers, authorizing and storing them into Tag Log file.The recorder application is mainly responsible for controlling RFID Readers, taking the raw data from the authorized tags through RFID readers, filtering data & storing relevant data into the Tag Log file. This data would be used to generate various types of attendance report of employees. This also continuously monitors the presence of employees and displays the time and name of the tag holder. This application communicates with readers via LAN. All relevant events and faults are logged in the log file to enable system administrator to rectify the fault.
Administrator module is responsible for employee registration, visitor registration, student registration and access point installation. The administrator has the access to update, add and delete the records.Fig.4 shows the working flow of the proposed system.

Conclusion

The RFID Based Employee Monitoring System could automatically detect the identities of the employees and will perform the attendance recording. The system could automatically make a log of all the timings and as well as details of the employee. These will be the major achievements met in the project, among other objectives also achieved which include report generation part on daily and monthly basis and establish remote database connection. Reading items and objects in motion can be done accurately using RFID. A system developed with a log in windows enables security and the overall cost of implementing the system may seem high but after a year of running the system, very high benefits will be realized. The whole system is very convenient and saves much on time.

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