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A Novel Application of RFID in Hospitals for Involuntary Administering to Incorporate Authentication and Tracking

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ABSTRACT
Today many hospitals use RFID system to monitor the health records for patient to update the patient information to doctors and patients relatives. In this system Customers can view and update their personal medical information via the web site, which seamlessly sync with one another. RFID is a total system, as opposed to a single product. It provides electronic identity to any object. Electronic information about the object is stored in RFID chip embedded of attached to the object. With an RFID reader the electronic identity can be read wirelessly. We have analyzed completely about the various applications of the RFID and we have come to a conclusion that the RFID can be effectively implemented in the hospitals to manage and monitor various systems of the hospitals automatically. This project is too costly to be implemented now, but the rates of the RFID accessories are expected to come down in the near future. For this automated administering the project needs a Central Monitoring Unit which we have decided to be controlled by software made in a high level language (C). For the reference of the reader we have attached the implementation files with this paper. This paper explains the basics of RFID, its working and our contribution towards RFID.
Keywords: RFID , Central Monitoring Unit , Electronic Information , Health Records

I. INTRODUCTION

Radio Frequency Bar codes have been with us so long, and they're so ubiquitous. Bar coding is a cost effective and low risk method of encoding information that helped start sophisticated identification systems. But bar code's days are numbered. There's a new technology in town, Radio frequency identification (RFID), which enables users to collect and encode information for many items simultaneously by way of radio frequency as opposed to the optical systems used to read bar codes. Though not as widely used, RFID is quickly becoming the preferred scanning solution throughout the world. Radio frequency identification is a dynamic alternative thanks to increased data storage, ease of automation and tracking, higher throughput, and its ability to be written and rewritten. RFID is the utilization of the electromagnetic spectrum to transmit information without contact and without line of sight.

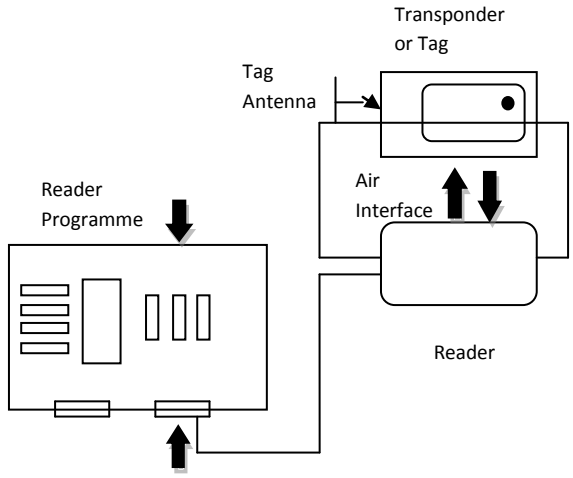
RFID is a combination of radio-frequency and microchip. RFID chips are of particular interest, because they have become smaller and smarter to the point where they can be added every kind of document and can be read and updated from a distance [1]. The data capacities of transponder normally range from a few bytes to several kilobytes. There are also 1-bit transponder (without chip) to fulfill monitoring and signaling functions called Electronic Article Surveillance (EAS). In writable transponders, the reader can write data to the transponder in three procedures. Inductively coupled RFID system uses EEPROMs, FRAMs and microwave systems commonly use SRAMs. The important feature of power supply to the transponder is drawn either from the field of reader (Passive tag) or from the battery incorporated in the tag (Active/Semi-active tag).

II. RFID SYSTEM IMPLEMENTATION:

2.1 A BASIC RFID SYSTEM CONSISTS OF THREE COMPONENTS:

- An antenna or coil
- A transceiver (with decoder)
- A transponder (RF tag) electronically programmed with unique information

RFID System Components



i. **Antenna**

The antenna emits radio signals to activate the tag and read and write data to it. Antennas are the conduits between the tag and the transceiver, which controls the system's data acquisition and communication [2]. The electromagnetic field produced by an antenna can be constantly present when multiple tags are expected continually. If constant interrogation is not required, the field can be activated by a sensor device.

ii. Transceiver (Reader)

The transceiver emits radio waves in ranges of anywhere from one inch to 100 feet or more, depending upon its power output and the radio frequency used [2]. When and RFID tag passes through the electromagnetic zone, it detects the transceiver's activation signal. The transceiver decodes the data encoded in the tag's integrated circuit (silicon chip) and the data is passed to the host compute for processing.

iii. Transponder (RF tag)

The object of any RFID system is to carry data in suitable transponders, generally known as tags, and to retrieve data, by machine-readable means, at a suitable time and place to satisfy particular application needs, Additional data can be included for supporting applications through item specific information or instructions immediately available on reading the tag [3]. Tags can be electronically programmed with unique information on each. Tag is composed of an integrated electronic chip and an antenna coil that includes basic modulation circuitry and non-volatile memory. The tag is energized by a time-varying electromagnetic radio frequency wave that is transmitted by a RFID tag reader [4].

Information is transmitted back to the reader though the same radio wave. Identification is decoded from the information by the reader and this information is propagated to a host system connected to the reader.

2.2 Tag Types

RFID tags are categorized as either active or passive.

Active RFID tags are powered by and external battery and are typically read/write, i.e., tag data and be rewritten and/or modified. An active tag's memory size varies according to application requirements; some systems operate with up to 1MB of memory. They usually contain a cell that exhibits a high power-to-weight ratio and are usually capable of operating over a temperature range of –50 C to +70 C. They have finite lifetime [6]. The trade-off is greater size and greater cost compared with passive tags.

Active transponders allow greater communication range the can be expected for passive devices, better noise immunity and higher data transmissions rates when used to power a higher frequency response mode.

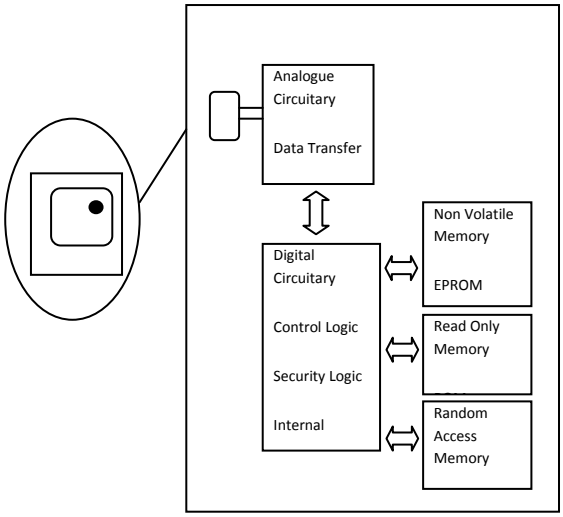
Passive RFID tags operate without a separate external power source and derive the power to operate from the field generated by the reader. Passive tags are consequently much lighter than active tags, less expensive, and offer a virtually unlimited operational lifetime [5]. The trade off is that they have shorter read ranges than active tags and require a higher-powered reader. Passive tags are also constrained in their capacity to store data and the ability to perform well in electro magnetically noisy environments. Sensitivity and orientation performance may also be constrained by the limitation on available power. Despite this, they have an almost indefinite lifetime and are generally lower on price than active transponders. Read-only tags are typically passive and are programmed with a unique set of data (usually 32 to 128 bits) that cannot be modified.

2.3 Basic Features of RFID Transponder

The transponder memory may comprise read-only (ROM), random access (RAM) and non-volatile programmable memory for data storage depending upon the type and sophistication of the device [7].The ROM-based memory is used to accommodate security data and the transponder operating system instructions which, in conjunction with the processor or processing logic deals with the internal "house-keeping" functions such as response delay timing, data flow control and power supply switching. The RAM-based memory is used to facilitate temporary data storage during transponder interrogation and response [8].

The non-volatile programmable memory may take various forms, electrically erasable

programmable read only memory (EEPROM) being typical. It is used to store the transponder data and needs to be non-volatile to ensure that the data is retained when the device is in its quiescent or power-saving "sleep" state. Data buffers are further components of memory, used



to temporarily hold incoming data following demodulation and outgoing data for modulation and interface with the transponder antenna. The interface circuitry provides the facility to direct and accommodate the interrogation field energy for powering purposes in passive transponders and triggering of the transponder response.

2.4 Communication between Transceiver and Tag

Communication of data between tags and a reader is by wireless communication. Two methods distinguish and categorize RFID systems, one based upon close proximity electromagnetic or inductive coupling and one based upon propagating electromagnetic waves [9]. Coupling is via 'antenna' structures forming an integral feature in both tags and readers.

Transmitting data is subject to the vagaries and influences of the media or channels through which the data has to pass, including the air interface [10]. Noise, interference and distortion are the sources of data corruption that arise in practical communication channels that must be guarded against in seeking to achieve error free data recovery.

III. OUR IMPLEMENTED SYSTEM

In this paper we design an authentication and Tracking System using RFID for a hospital.

The components required are

- **RF Tag**
- **RF Transceiver**
- **Microcontroller**
- **PC**

3.1 RF Tag

We are using passive tags, read only, which are very minute in size, has no self power, receives power from transceiver, has a small memory which could be used to store a 26 bit number, and is unique. It is of low frequency, has minimum read distance and data is read by inductive coupling.

3.2 RF Transceiver

We use low frequency transceivers. It can detect tags at close proximity at about 4 to 5 inches.

3.3 RF Microcontroller

It communicates with the RF tag to get the information stored in it and then transfers this information to the PC.

3.4 PC

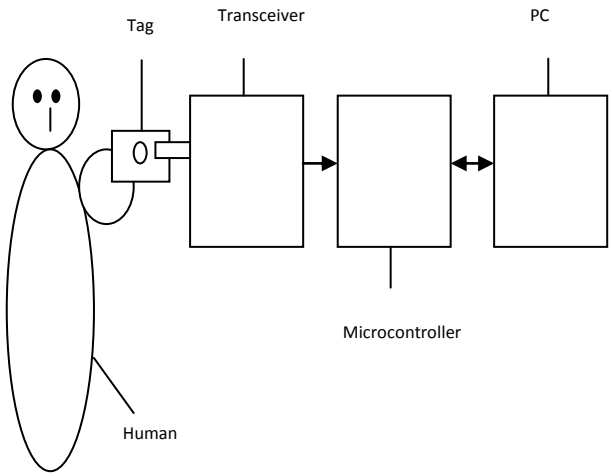
It maintains the information in the database against the code in each tag. It constantly updates the database by polling each microcontroller present at various locations.

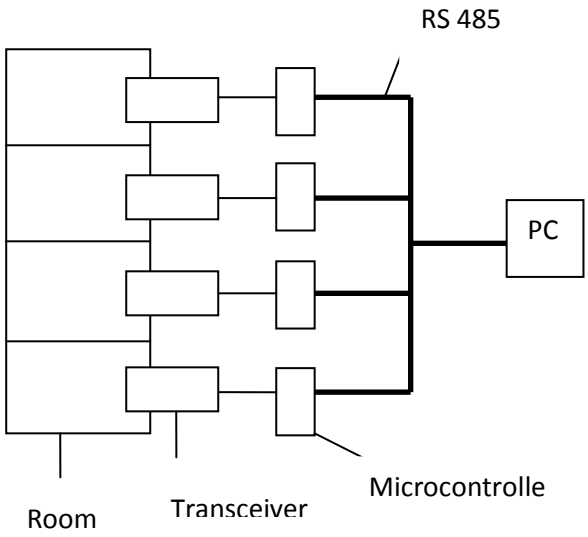
IV. FUNCTIONALITY

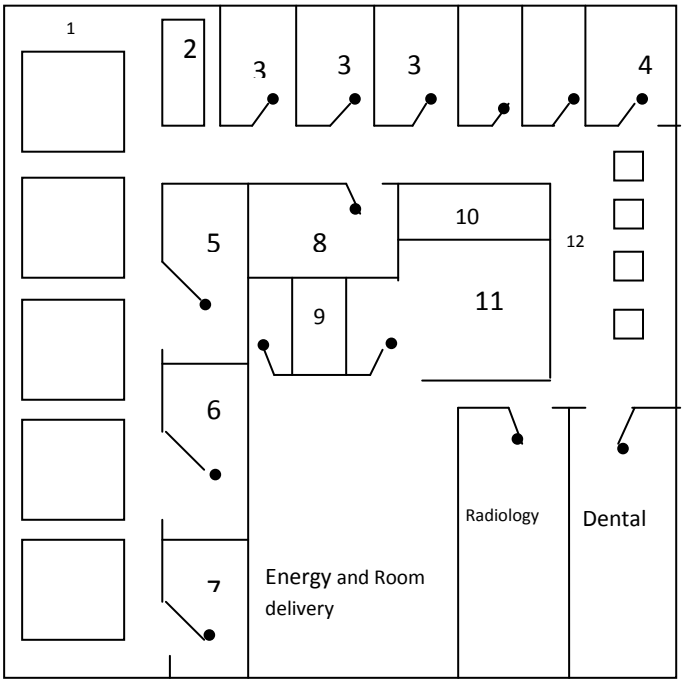
We provide all staffs in the hospital with a RF Tag. This is used for their identification. At the entrance of each door there is a transceiver which can read tag data. A Microcontroller is connected with the Transceiver. Microcontrollers of all rooms are connected to a central computer. These are connected through a RS485 network. The staffs have to register with the Transceiver at the entrance of each door. This transceiver is placed in the slit of the door. Persons entering and leaving a room should register with the Transceiver. They have to show their RF tags nearby to the transceiver, transceiver detects and sends the unique number to the Microcontroller connected to it. Microcontroller has all RF values stored and authenticates the person. If the person is authorized person to enter he is allowed inside the door, also the information is passed to a central computer in the hospital. The central computer polls all Microcontrollers periodically (for 1 sec) and collects information. This information is stored in the PC. This information can be easily accessed with a Front End attached to the database. Whenever the location of a doctor is needed it is enough to search the PC.

When a person enters a room, it is stored in the PC. For Example if a doctor enters into Operation Theatre, this information will be automatically sent to the PC. Therefore searching for the doctor is easy. Not only location of the doctor but all staffs can be found. In additional all visitors are also given the tag. This enables us to monitor their visiting times. They could be allowed into the rooms only in the visiting hours. This will help us to prevent unauthorized persons into the patient's rooms.

Sample Plan
The Idea







- Indicates RFID location in a sample hospital plan

1.Patient Ward , 2.Nurse station, 3.Adult Exam, 4.Pediatric Exam, 5,6.Medical Store, 7, Operatory, 8.Laboratory, 9.ECG Center, 10.Pharmacy,

Advantages

- Could be used to check the availability of the doctor when there is an emergency.
- Could be used locate all staff.
- Could be able to monitor the routines of the doctor, nurses and other staff.
- Authentication based on tags helps to provide security.
- Restrict access to high-threat areas to authorized staff.
- Visitors could be useful at the time of investigation of some crime.
- Unauthorized persons could be prevented from entering into the patients' room.
- RFID tags are resistant to scratches.
- RFID systems could not be damaged under extreme pressure and temperature conditions.
- Facilitate triage processed by restricting access to authorized staff and "approved" patients during medical emergencies, epidemics, terrorist threats, and other times when demands could threaten the hospital's ability to effectively deliver services.

V. CONCLUSION:

RFID is growing each day with each successful application. To continue this growth towards better ways to produce better products, it is increasingly important for the end users to become more knowledgeable about the used and applications of RFID. As applications are becoming more and more widespread, soon all identification systems will be replaced by RFID systems. This will also have the effect of reducing the cost of an already very economical system.

Although RFID cannot compete with other means cost wise at this stage of optically read technologies such as bar-coding, its advanced

features are rendering it indispensable in a wide variety of automated data collection and identification applications that would otherwise not be possible. The idea we have specified will be a successful one. It would be widely used in the near future. If the enhancements specified are also implemented, the system would be an efficient one for not only the hospital but also for all institutions and places where security is highly essential.

REFERENCES

[1.] Dave Brich at Consultant Hyperion. url:www.chyp.com as visited on 1-2-2005. As quoted in "News Comment – Contact less crazy" in Journal: Card Technology; pub by Elsevier. p2, February 2005.

[2.] Nellipudi.Siva Rama Krishna Prasad1, Arepalli Rajesh " RFID-Based Hospital Real Time Patient Management System" *International Journal of Computer Trends and Technolog-,volume3Issue3 ,pp 509-517 , 2012*

[3.] Elisabeth ILIE-ZUDOR et.al " The rfid technology and its current applications " *In proceedings of The Modern Information Technology in the Innovation Processes of the Industrial Enterprises-MITIP 2006, ISBN 963 86586 5 7, pp.29-36*

[4.] Kamran AHSAN et.al " RFID Applications: An Introductory and Exploratory Study " IJCSI International Journal of Computer Science Issues, Vol. 7, Issue 1, No. 3, pp 1-7,January 2010.

[5.] Mohsen Attaran" Critical Success Factors and Challenges of Implementing RFID in Supply Chain Management " Journal of Supply Chain and Operations Management, Volume 10, Number 1, pp 144-167, February 2012.

[6.] Shang-Wei Wang" RFID applications in hospitals: a case study on a demonstration RFID project in a Taiwan hospital " Proceedings of the 39th Hawaii International Conference on System Sciences, pp 1-10, 2006.

[7.] H. A. Nahas and J. S. Deogun, "Radio frequency identification applications in smart hospitals," in *Proceedings of the 20th IEEE International Symposium on Computer-Based Medical Systems*, 2007, pp. 337-342.

[8.] A. Lahtela, "A short overview of the RFID technology in healthcare," in *4th International Conference on Systems and Networks Communications*, 2009, pp. 165-169.

[9.] I. K. Mun, A. B. Kantrowitz, P. W. Carmel, K. P. Mason, and D. W. Engels, "Active RFID system augmented with 2D barcode for asset management in a hospital setting," in *IEEE International Conference on RFID*, 2007, pp. 205-211.

[10.] B. Chowdhury and R. Khosla, "RFID-based Hospital Real-time Patient Management System," in *6th IEEE International Conference on Computer and Information Science (ICIS)*, 2007.

[11.] B. S. Ashar and A. Ferriter, "Radiofrequency Identification Technology in Health Care: Benefits and Potential Risks," *The Journal of American Medical Association (JAMA)*, vol. 298, pp. 2305-2307, 2007.

[12.] Wen Yao,et.al" The Use of RFID in Healthcare: Benefits and Barriers ",Proceeding of 2010 IEEE International conference on RFID-Technology and Applications, pp 128-134, june 2010.

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