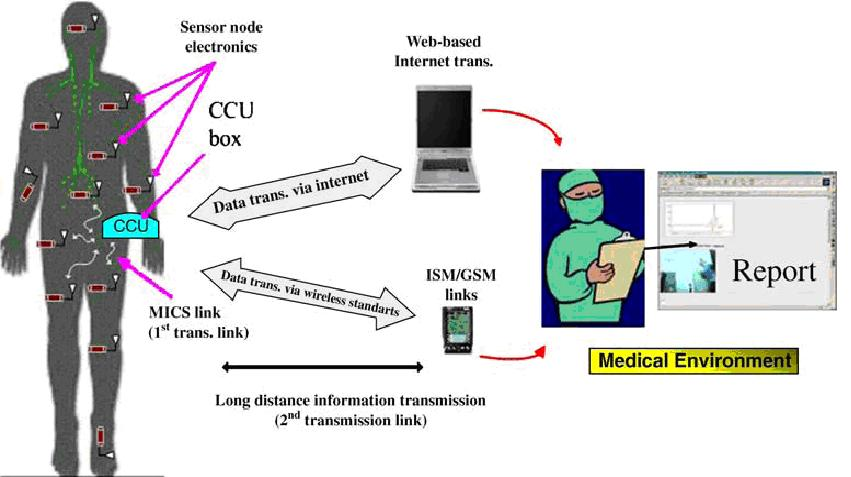
RFID BASED TELEMEDICINE SYSTEM



Coming along with the urgent development of wireless technology, wireless devices have invaded the medical area with a wide range of capability. Not only improving the quality of life of patients and doctor-patient efficiency, wireless technology enables clinicians to monitor patients remotely and give them timely health information, reminders, and support – potentially extending the reach of health care by making it available anywhere, anytime.   
In this survey paper we discuss advantages of wireless medical devices and challenges involved in this technology. We focus on Wireless Personal Area Network technologies, WiMAX, WiFi and Zigbee. We have also investigated standards being used in wireless medical applications and location of wireless network in a healthcare system. Finally, we identify innovative medical applications of wireless networks developed or being developed in research, projects and research groups on wireless medical application, and commercial products.  .

**INTRODUCTION TO RFID**

Radio-frequency identification (RFID) is an automatic identification method, relying on storing and remotely retrieving data using devices called RFID tags or transponders. The technology requires some extent of cooperation of an RFID reader and an RFID tag.

An RFID tag is an object that can be applied to or incorporated into a product, animal, or person for the purpose of identification and tracking using radio waves. Some tags can be read from several meters away and beyond the line of sight of the reader.

An RFID tag is an object that can be applied to or incorporated into a product, animal, or person for the purpose of identification and tracking using radio waves. Some tags can be read from several meters away and beyond the line of sight of the reader.

**What is RFID?**

A basic RFID system consists of three components:

a) An antenna or coil

b) A transceiver (with decoder)

c) A transponder (RF tag)

Electronically programmed with unique information. There are many different types of RFID systems out in the market. They are categorized according to there frequency ranges. Some of the most commonly used RFID kits are as follows:

1) Low-frequency (30 KHz to 500 KHz)

2) Mid-Frequency (900KHz to 1500MHz)

3) High Frequency (2.4GHz to 2.5GHz)

These frequency ranges mostly tell the RF ranges of the tags from low frequency tag ranging from 3m to 5m, mid-frequency ranging from 5m to 17m and high frequency ranging from 5ft to 90ft. The cost of the system is based according to there ranges with low-frequency system ranging from a few hundred dollars to a high-frequency system ranging somewhere near 5000 dollars.

**How RFID Is Changing the Business Environment today**

Radio frequency identification (RFID) technology has been in use for several decades to track and identify goods, assets and even living things. Recently, however, RFID has generated widespread corporate interest as a means to improve supply chain performance. Market activity has been exploding since Wal-Mart's June 2003 announcement that its top 100 suppliers must be RFID-compliant by January 2005. Mandates from Wal-Mart and the Department of Defense (DoD) are making many companies scramble to evaluate, select and implement solutions that will make them compliant with their customers' RFID requirements and additional retailers and other large supply chain channel masters are likely to follow suit.

# COMPONENTS OF RFID

A basic RFID system consist of three components:

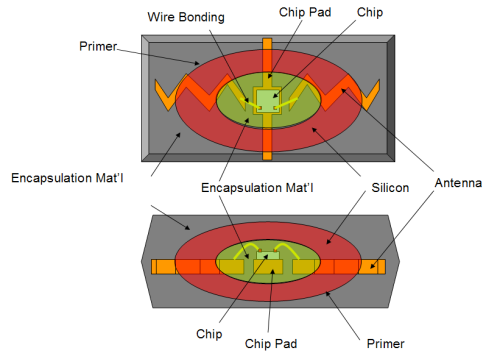
* An antenna or coil
* A transceiver (with decoder)
* A transponder (RF tag) electronically programmed with unique information

These are described below:

1. **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. Antennas are available in a variety of shapes and sizes; they can be built into a door frame to receive tag data from persons or things passing through the door, or mounted on an interstate tollbooth to monitor traffic passing by on a freeway. The electromagnetic field produced by an antenna can be constantly present when multiple tags are expected continually. If constant interrogation is not required, a sensor device can activate the field.

Often the antenna is packaged with the transceiver and decoder to become a reader (a.k.a. interrogator), which can be configured either as a handheld or a fixed-mount device. The reader 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. When an RFID tag passes through the electromagnetic zone, it detects the reader's activation signal. The reader decodes the data encoded in the tag's integrated circuit (silicon chip) and the data is passed to the host computer for processing.



1. **TAGS (Transponders)**

An RFID tag is comprised of a microchip containing identifying information and an antenna that transmits this data wirelessly to a reader. At its most basic, the chip will contain a serialized identifier, or license plate number, that uniquely identifies that item,

similar to the way many bar codes are used today. A key difference, however is that RFID tags have a higher data capacity than their bar code counterparts. This increases the options for the type of information that can be encoded on the tag, including the manufacturer, batch or lot number, weight, ownership, destination and history (such as the temperature range to which an item has been exposed). In fact, an unlimited list of other types of information can be stored on RFID tags, depending on application needs. An RFID tag can be placed on individual items, cases or pallets for identification purposes, as well as on fixed assets such as trailers, containers, totes, etc.

**Tags come in a variety of types, with a variety of capabilities. Key variables include:**

**"Read-only" versus "read-write"**

There are three options in terms of how data can be encoded on tags: (1) Read-only tags contain data such as a serialized tracking number, which is pre-written onto them by the tag manufacturer or distributor. These are generally the least expensive tags because they cannot have any additional information included as they move throughout the supply chain. Any updates to that information would have to be maintained in the application software that tracks SKU movement and activity. (2) "Write once" tags enable a user to write data to the tag one time in production or distribution processes. Again, this may include a serial number, but perhaps other data such as a lot or batch number. (3) Full "read-write" tags allow new data to be written to the tag as needed—and even written over the original data. Examples for the latter capability might include the time and date

of ownership transfer or updating the repair history of a fixed asset. While these are the most costly of the three tag types and are not practical for tracking inexpensive items, future standards for electronic product codes (EPC) appear to be headed in this direction.

****

**RFID TAGS**

**Data capacity**

The amount of data storage on a tag can vary, ranging from 16 bits on the low end to as much as several thousand bits on the high end. Of course, the greater the storage capacity, the higher the price per tag.

# Form factor

The tag and antenna structure can come in a variety of physical form factors and can either be self-contained or embedded as part of a traditional label structure (i.e., the tag is inside what looks like a regular bar code label—this is termed a 'Smart Label') companies must choose the appropriate form factors for the tag very carefully and should expect to use multiple form factors to suit the tagging needs of different physical products and units of measure. For example, a pallet may have an RFID tag fitted only to an area of protected placement on the pallet itself. On the other hand, cartons on the pallet have RFID tags inside bar code labels that also provide operators human-readable information and a back-up should the tag fail or pass through non RFID-capable supply chain links.

**Passive versus active**

“Passive” tags have no battery and "broadcast" their data only when energized by a reader. That means they must be actively polled to send information. "Active" tags are capable of broadcasting their data using their own battery power. In general, this means that the read ranges are much greater for active tags than they are for passive tags—perhaps a read range of 100 feet or more, versus 15 feet or less for most passive tags. The extra capability and read ranges of active tags, however, come with a cost; they are several times more expensive than passive tags. Today, active tags are much more likely to be used for high-value items or fixed assets such as trailers, where the cost is minimal compared to item value, and very long read ranges are required. Most traditional supply chain applications, such as the RFID-based tracking and compliance programs emerging in the consumer goods retail chain, will use the less expensive passive tags.

**Frequencies**

Like all wireless communications, there are a variety of frequencies or spectra through which RFID tags can communicate with readers. Again, there are trade-offs among cost, performance and application requirements. For instance, low-frequency tags are cheaper than ultra high-frequency (UHF) tags, use less power and are better able to penetrate non-metallic substances. They are ideal for scanning objects with high water content, such as fruit, at close range. UHF frequencies typically offer better range and can transfer data faster. But they use more power and are less likely to pass through some materials. UHF tags are typically best suited for use with or near wood, paper, cardboard or clothing products. Compared to low-frequency tags, UHF tags might be better for scanning boxes of goods as they pass through a bay door into a warehouse. While the tag requirements for compliance mandates may be narrowly defined, it is likely that a variety of tag types will be required to solve specific operational issues. You will want to work with a company that is very knowledgeable in tag and reader technology to appropriately identify the right mix of RFID technology for your environment and applications.

**EPC Tags**

EPC refers to "electronic product code," an emerging specification for RFID tags, readers and business applications first developed at the Auto-ID Center at the Massachusetts Institute of Technology. This organization has provided significant intellectual leadership toward the use and application of RFID technology. EPC represents a specific approach to item identification, including an emerging standard for the tags themselves, including both the data content of the tag and open wireless communication protocols. In a sense, the EPC movement is combining the data standards embodied in certain bar code specifications, such as the UPC or UCC-128 bar code standards, with the wireless data

communication standards that have been developed by ANSI and other groups.

1. **RF Transceiver:**

The RF transceiver is the source of the RF energy used to activate and power the passive RFID tags. The RF transceiver may be enclosed in the same cabinet as the reader or it may be a separate piece of equipment. When provided as a separate piece of equipment, the transceiver is commonly referred to as an RF module. The RF transceiver controls and modulates the radio frequencies that the antenna transmits and receives. The transceiver filters and amplifies the backscatter signal from a passive RFID tag.

**Typical Applications for RFID**

* Automatic Vehicle identification
* Inventory Management
* Work-in-Process
* Container/ Yard Management
* Document/ Jewellery tracking
* Patient Monitoring

**The Advantages of RFID Over Bar Coding**

* 1. No "line of sight" requirements: Bar code reads can sometimes be limited or problematic due to the need to have a direct "line of sight" between a scanner and a bar code. RFID tags can be read through materials without line of sight.
  2. More automated reading: RFID tags can be read automatically when a tagged product comes past or near a reader, reducing the labor required to scan product and allowing more proactive, real-time tracking.

3. Improved read rates: RFID tags ultimately offer the promise of higher read rates than bar codes, especially in high-speed operations such as carton sortation.

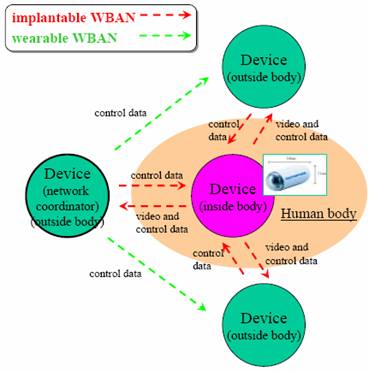
1. Greater data capacity: RFID tags can be easily encoded with item details such as lot and batch, weight, etc.

5. "Write" capabilities: Because RFID tags can be rewritten with new data as supply chain activities are completed, tagged products carry updated information as they move throughout the supply chain.

#### Common Problems with RFID

Some common problems with RFID are reader collision and tag collision. Reader collision occurs when the signals from two or more readers overlap. The tag is unable to respond to simultaneous queries. Systems must be carefully set up to avoid this problem. Tag collision occurs when many tags are present in a small area; but since the read time is very fast, it is easier for vendors to develop systems that ensure that tags respond one at a time. See Problems with RFID for more details.

BLOCK DIAGRAM OF PROJECT



**References-:**

1. Epcglobal inc., EPC radio-frequency identity protocols class-1 generation-2 UHF

RFID protocol for communications at 860 MHz – 960 MHz, version 1.0.9. Online,

September 2005. http://www.epcglobalinc.org/standards\_technology/

EPCglobal2UHFRFIDProtocolV109122005.pdf.

2. CCC-TV lightning talks day 1. Online, 2005. http://media.ccc.de/browse/

congress/2005/22C3-911-en-lightning\_talk\_day\_1.html.

3. J. H. Conway. *On Numbers and Games*. Academic Press, 1976.

4. Y. Desmedt, C. Goutier, and S. Bengio. Special uses and abuses of the Fiat-Shamir

passport protocol. In *CRYPTO*, pages 21–39, 1987.

5. B. Dolev. Laying the groundwork for electronic elections in Israel (in Hebrew).

Invited Talk, CPIIS IDC/TAU Workshop on Electronic Voting, May 2009. http:

//www.cs.tau.ac.il/voting/.

6. S. Drimer and S. J. Murdoch. Keep your enemies close: distance bounding against

smartcard relay attacks. In *Proceedings of 16th USENIX Security Symposium*,

pages 1–16, Boston,