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Review on Radio Frequency Identification Technology

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Abstract — **This paper presents a review on radio frequency identification (RFID) technology. The paper explains the current technology, including the frequency ranges used and standards. With the increasing ubiquity of RFID tags, however, privacy became a concern. The paper summarizes possible attacks against one's privacy and it also describes counter measures. The RFID technology did not stop at item-level tagging. The paper also presents current research that focuses on locating and tracking labeled object that move. Since the uses for RFID tags are so widespread, there is a large interest in lowering the costs for producing them. It turns out that printing tags might become a viable alternative to traditional production. The paper reviews the current progress.**

Key Words — **Radio Frequency IDentification, RFID, RFID tags, Electronic Product Codes, EPC, Supply Chain Management, Security, organic printing, Location and Tracking**

I. INTRODUCTION

RFID is a flexible technology that is convenient, easy to use, and well suited for automatic operation. It combines advantages not available with other identification technologies. RFID can be supplied as read-only or read/write, does not require contact or line-of-sight to operate, can function under a variety of environmental conditions, and provides a high level of data integrity. In addition, because the technology is difficult to counterfeit, RFID provides a high level of security.

Radio waves transfer data between an item to which an RFID device is attached and an RFID reader. The device can contain data about the item, such as what the item is, time for which device traveled through a certain zone, perhaps even a parameter such as temperature. RFID devices, such as a tag, can be attached to virtually anything – from a vehicle to a pallet of merchandise.

Radio Frequency Identification. An ADC (Automated Data Collection) technology uses radio-frequenc y waves to transfer data between Radio-frequency identification (RFID) is the wireless non-contact use of radio-frequency 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 and read at short ranges (a few meters) via magnetic fields (electromagnetic induction). Others use a local power source such as a battery, or else have no battery but collect energy from the interrogating EM field, and then act as a passive transponder to emit microwaves or UHF radio waves (i.e., electromagnetic radiation at high frequencies). Battery powered tags may operate at hundreds of meters. Unlike a bar code, the tag does not necessarily need to be within line of sight of the reader, and may be embedded in the tracked object.

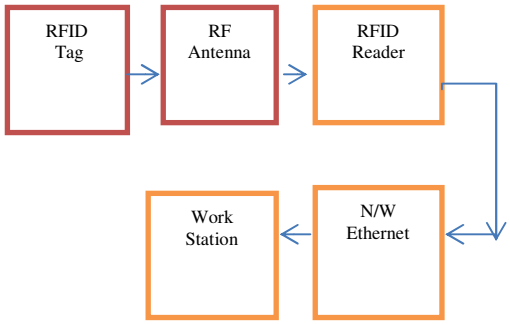

Figure 1: Block diagram of RFID

1.1RFID Tags:

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.

1.1.1 Active Tags:

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. Battery powered has higher storage capacities (512 KB),Longer read range (300 feet).
Typically can be re-written by RF Interrogators,
Cost around 50 to 250 dollar.

1.1.2 Passive Tags: A passive tag is cheaper and smaller because it has no battery. Operation of passive tags starts by illuminating a power level by three magnitudes stronger than for signal transmission. That makes a difference in interference and in exposure to radiation, do not require power, draws from Interro- gatorr Field, lower storage capacities (fewbits to1KB),Shorter read ranges (4 inches to 15 feet).Usually Write-Once-Read-Many/Read-Only tags,Cost around 25 cents to few dollars.

Tags may either be read-only or may be read/write. In read-only a factory-assigned serial number is used as a key into a database. In read/write tag object-specific data can be written into the tag by the system user. Field programmable tags may be writing-once, read-multiple; "blank" tags may be written with an electronic product code

by the user. A tag with no inherent identity is always threatened to get manipulated.

II. RFID TAG

RFID tags contain at least two components: 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 programmed or programmable data processor for processing the transmission and sensor data or chip-wired logic.

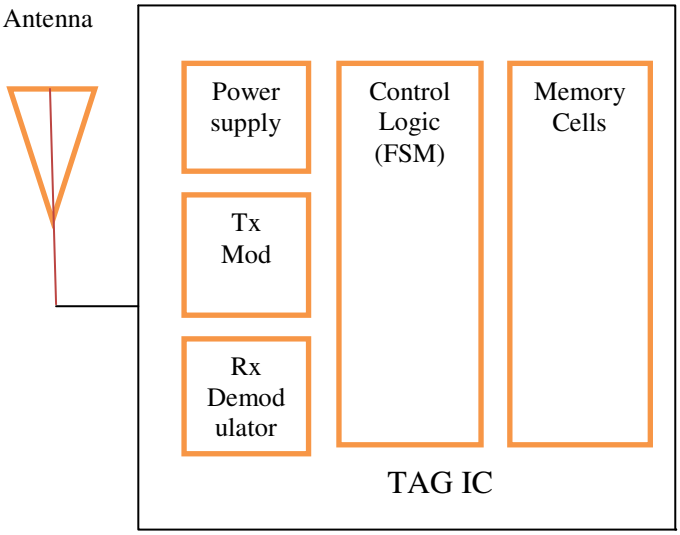

Figure 2: Block Diagram of RFID Tag

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 like 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. RFID tags are used in many industries.

An RFID tag attached to an automobile during production can be used to track its progress through the assembly line. Pharmaceuticals can be tracked through warehouses. Livestock and pets may have tags injected, allowing positive identification of the animal. On off-shore oil and gas platforms, for example, RFID tags are worn by personnel as a safety measure, allowing them to be located 24 hours a day and to be quickly found in emergencies.

III. RFID READERS

RFID systems can be classified by the type of tag and reader. Remotely power tags, establish a bidirectional data link. Inventory tags, filter results, Communicate with networked server(s),can read 100-300 tags per second. Readers (interrogators) can be at Entrance/exit point of sale ,readers can also be mobile/hand-held.

3.1 A Passive Reader Active Tag (PRAT):

System has a passive reader receives radio signals from active tags (battery operated, transmit only). The reception range of a PRAT system reader can be adjusted from 1–2,000 feet (0.30–609.60 m), allowing flexibility in applications such as asset protection and supervision.

3.2 An Active Reader Passive Tag (ARPT):

System has an active reader, transmits interrogator signals and also receives authentication replies from passive tags.

System uses active tags awoken with an interrogator signal from the active reader. A variation of this system could also use a Battery-Assisted Passive (BAP) tag which acts like a passive tag but has a small battery to power the tag's return reporting signal.

Fixed readers are set up to create a specific interrogation zone which can be tightly controlled. This allows a highly defined reading area for when tags go in and out of the interrogation zone. Mobile readers may be hand-held or mounted on carts or vehicles.

IV.RFID COMMUNICATION TAGS

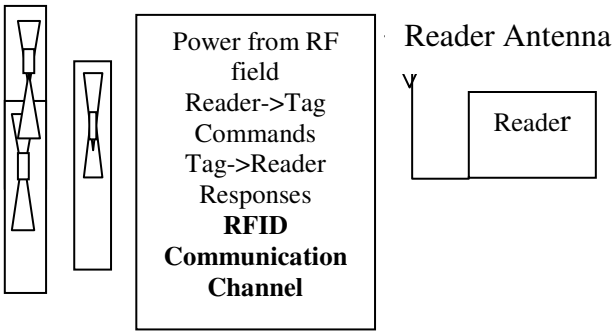

Figure 3: Block Diagram of RFID Communication

Host manages Reader(s) and issues Commands.Reader and tag communicate viaRF .Carrier signal sent out through the antennas generated by the reader. Carrier signal hits tag(s).Tag receives and modifies carriersignal“sends back” modulated signal (Passise Backscatter / “field disturbance device”.Antennas receive the modulated signal and send them to the Reader.Reader decodes the data.Results returned to the host application.

V. OPERATIONAL FREQUENCIES

Table 1. Parameters of Tag.

1) 5.1Signaling

Depend on the frequency band used by the tag. Tags

Frequency Ranges	**LF 125 K Hz**	**HF 13.56 MHz**	**UHF 868 - 915 MHz**	**Microwave 2.45 GHz & 5.8 GHz**
Typical Max Read Range (Passive Tags)	Shortest 1"-12"	Short 2"-24"	Medium 1'-10'	Longest 1'-15'
Tag Power Source	Generally passive tags only, using inductive coupling	Generally passive tags only, using inductive or capacitive coupling	Active tags with integral battery or passive tags using capacitive storage, E-field coupling	Active tags with integral battery or passive tags using capacitive storage, E-field coupling
Data Rate	Data Rate	Moderate	Fast	Faster
Ability to read near metal or wet surfaces	Better	Moderate	Poor	Worse

operating on LF and HF bands are, in terms of radio wavelength, very close to the reader antenna because they are only a small percentage of a wavelength away. The tag is closely coupled electrically with the transmitter in the reader. The tag can modulate the field produced by the reader by changing the electrical loading the tag represents. By switching between lower and higher relative loads, the tag produces a change that the reader can detect. At UHF and higher frequencies, the tag is more than one radio wavelength away from the reader, requiring a different approach. The tag can backscatter signal. Active tags may contain functionally separated transmitters and receivers, and the tag need not respond on a frequency related to the reader's interrogation signal.[1]

An Electronics product code (EPC) is one common type of data stored in a tag. The tag contains a 96-bit string of data; when written into the tag by an RFID printer.

Table 2. Tag 96- Bit.

8-bits identifies header (protocol version)	28-bits identifies organization	24-bits object class, identifying kind of product	36-bits are a unique serial number

Two different types of protocols are used to "singulate" a particular tag, allowing its data to be read in the midst of many similar tags. In a slotted Aloha system, the reader broadcasts an initialization command and a parameter that the tags individually use to pseudo-randomly delay their responses. When using an "adaptive binary tree" protocol, the reader sends an initialization symbol and then transmits one bit of ID data at a time; only tags with matching bits respond, and only one tag matches the complete ID string.[12]

RFID ADVANTAGES OVER BAR-CODES

The big difference between the two is bar codes are line-of-sight technology. RFID tags can be read as long as they are within range of a reader. Bar codes have other shortcomings as well. Bar codes are inexpensive and effective for certain tasks, but RFID and bar codes will coexist for many years. So it will not replace barcode.

CONCLUSION

No line of sight required for reading. Multiple items can be read with a single scan. Each tag can carry a lot of data (read/write).Individual items identified and not just the category. Passive tags have a virtually unlimited lifetime. Active tags can be read from great distances can be combined with barcode technology.

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