
Radio Frequency Identification System (RFID)

RFID 101

Technical Whitepaper V1.0.1

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This white paper describes the various benefits and applications of the Radio Frequency Identification Technology. Information contained herein this document should be used only for educative purpose only and not for any sort of commercial application without the prior written consent from KCP Technologies Ltd.

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History of RFID

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Radio frequency identification (*RFID*) first appeared in tracking and access applications during the 1980s. Dr. Charles Walton is considered as the father of today's RFID systems. He is basically a ham radio enthusiast with deep knowledge about the working and behavior aspects of radio waves.

Walton continues till date to maintain a working model of the door lock reader that uses a passive RFID card, which runs without any battery power and was awakened when it reaches within six inches of a reader. The prototype has a 36-square-inch circuit board loaded with coiled wires and other components common in the 1970s. But there were no microchips that could house the entire RFID circuitry, which came later, with the progress of chip fabrications.

He patented the technology way back in the 1970's and he approached GM for the implementation of RFID for vehicle identification. The board of directors of GM rejected the proposal made by Dr. Walton. He made about \$3 million from patenting RFID technology. His patent expired in the mid 1990's meaning that he can't share the potential of the market and now the heat is rising for the need for the RFID system to be adopted for identification, security and authentication applications.

So the next time you wave a card to unlock the door to your office building, think of Charles Walton - One of Silicon Valley's unsung inventors.



RFID Technology



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Introduction

Radio Frequency Identification (RFID) technology uses wireless radio communications to uniquely identify objects and is one of the fastest growing automatic data collection (ADC) technologies.

RFID creates an automatic way to collect information about a product, place, time or transaction quickly, easily and without human error. It provides a contact less data link, without need for line of sight, for example articles inside a cardboard box, or concerns about harsh or dirty environments that restrict other auto ID technologies such as bar codes.

RFID System components

A typical RFID system consists of following components:

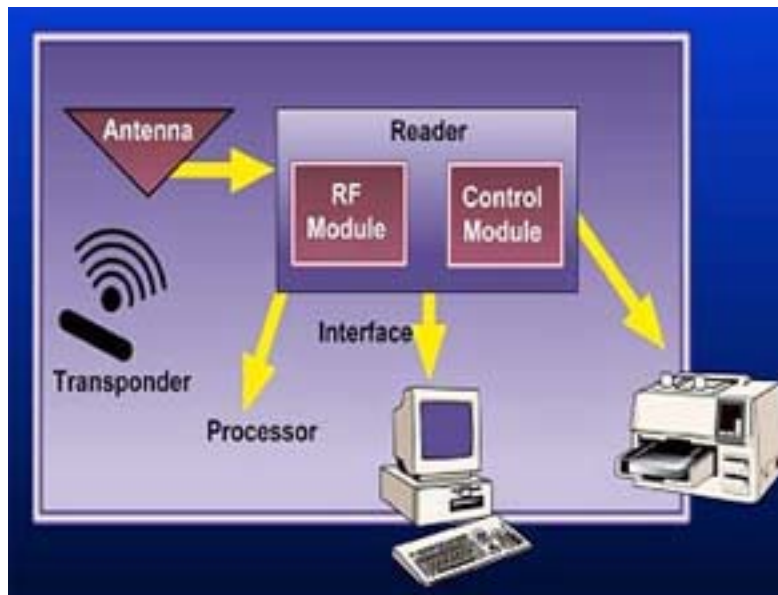
1. Transponders
2. Antenna
3. Readers
4. Application Software.

The Transponders or tags are used to identify objects, which can be uniquely programmed with information about the objects. These tags may be of active or passive type. Active tags have a power source or battery inside the tag and passive tags doesn't carry any power source. They are in the form of a card, key chain, disk or a glass capsule.

A RFID Reader comprises of a transmitter, receiver, and control module and communication functions, sometimes called a transceiver in radio terms for it to link to a controlling PC.



The physical connection from the reader to the computer is via serial communications RS232 or RS422/485. An Ethernet connection or a USB interface can also be used for communication.



The Reading process

When a tag is placed within the magnetic field created by the reader, it draws energy from the magnetic field. This is used to power the tag circuitry and thereby the tag wakes up and sends the data it contains to the reader. Generally the coupling between the reader and the tag is relatively weak and this may result in the generation of noise and other modulation errors.

The error correction algorithms takes care of errors that are generated by the surrounding ambience and the electronic circuitry process the signals and the sidebands back to the original data that was replied by the tag. The upload and the download data stream have this kind of error correction routines that results in a balanced error free data transfer between the reader and the tag.



RFID Middleware



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Middleware is the part of the software that lies in between the RFID devices and the application and does primarily the routing of information between different transport protocols. This involves translation of the data in different formats, vital data filtering and making an integrated highway for the application to communicate with the RFID devices.

As companies test and deploy RFID solutions, they are realizing that the cost and complexity of creating a specialized hardware and middleware infrastructure prevents numerous RFID business benefits, such as reduced operating expenses and improved supply chain visibility. According to analysts, software companies of the future have to get involved in this area of the development process to support various cross-platform capabilities.

Many database Management system now supports RFID readers very well. Oracle® corporation has introduced sensor-based services to help companies deploy RFID initiatives and maximize Return on Investments (ROI). This sensor-based services has a set of comprehensive capabilities to capture, manage, analyze and respond to data from the RFID sensors.

This kind of support enable companies to quickly and effectively integrate RFID solutions into their enterprise systems to automate and optimize the business processes.

Savant technologies is also working on a similar concept. The data captured by the readers are mapped with the Online Naming System (ONS), which is similar to the DNS system that resolves an IP address.



Areas of Application

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RFID Technologies can be applied to a wide range of areas:



- Identity
- Time
- PC-Login
- Access control
- Library Management
- Canteen Management
- Animal tracking
- Asset Management
- Payments
- Vehicle Tracking & Mass Transit
- Logistics & Supply Chain



Advantages & Benefits



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Advantages of RFID devices over current automatic identification systems are:

- Frequency band available worldwide as an ISM frequency
- ISO 15693 and ISO 14443 and HF ePC standardization for the air interface
- Robust reader-to-tag communication
- Excellent immunity to environmental noise and electrical interference
- Well defined and localized label interrogation zones
- Minimal shielding effects from adjacent objects and the human body
- Water's damping effects relatively small, field penetrates dense materials
- No environmental reflections that can plague UHF and microwave systems
- Good data transfer rate
- High clock frequency and synchronous sub carrier
- On-chip capacitors for tuning transponder coil can be easily realized
- Cheap IC's, disposable tags
- Cost effective antenna coil manufacturing
- Low RF power transmission so EM regulation compliance cause no problems
- No user licenses for reader systems required (ISM band)
- Usage in industrial and hazardous environments



Resources

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Texas Instruments	http://www.ti.com/home_tirfid
Phillips Electronics	http://www.phillips.com
IBM	http://www.ibm.com/rfid
SONY	http://www.sony.com/rfid

RFID Hardware

Inside Contactless	http://www.insidefr.com
Rafsec, Finland	http://www.rafsec.com
Skytech	http://www.skytechsolutions.com
Cansec	http://www.cansec.com
Honeywell Omnitek	http://www.omnitek.com
HID	http://www.hidcorp.com

RFID Solutions

Oat Systems Inc.	http://www.oatsystems.com
Lenel International	http://www.lenel.com
3M Inc	http://www.mmm.com
Samsys Inc.	http://www.samsys.com

General Information

AIM Global	http://www.aimglobal.org
(Covering technologies such as barcode, RFID, magnetic stripe, etc.)	
RF ID Journal	http://www.rfidjournal.com
(Objective news and information about RFID and its many business applications)	
EPC consortium	http://www.epcglobalinc.org
(Developments of industry-driven standard EPC Network to support RFID)	



Conclusion & Future Trends

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Enterprises need to lay out a long-term strategy for dealing with RFID to support everything from RFID-enabling existing business processes today to transforming the business with RFID-centric processes of the future.

The wireless feature of RFID systems allow for non-contact reading and are effective in manufacturing and other hostile environments where bar code labels could not survive. RFID has established itself in a wide range of markets including livestock identification and automated vehicle identification (AVI) systems because of its ability to track moving objects.

Prodded by Wal-Mart, FDA and the Pentagon, manufacturers will soon be tagging everything from diapers to combat boots with RFID chips whose costs will continue to be lowered as the volumes increase.

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