CSC 521
Computer System Architecture
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RFID-Radio Frequency Identification

Introduction

RFID is a wireless communication which uses radio waves to identify and track objects. It uses barcodes for

a) Unique identification of product.

b) Identify items without them being in direct line of sight.

c) Identify multiple items simultaneously.

RFIDs use Readers and Tags which are two main components which facilitate the working of this technology.

Tags

Tags are small and can be used with labels. They are normally printed, etched, stamped or vapoured onto a mount. This mount is a paper substrate or Polyethylene Terephthalate (PET). They do not use battery to store information and exchange information with reader. It is easy and cheap way of tagging and keep track of items.

Readers

Readers read data from tags. They take this data from tags and forward them to the computer on which a software is used to process this information. This information is then helpful in fulfilling the main function for which RFID was implemented.

Enterprise Software

This software is used to command and control the RFID tags and readers. The tags and readers are slave to this software and can be used to serve different purposes.

Working

The working solution of the RFID consists of two main components

   a) Tags- Chip & Antenna

   b) Readers- Antenna & Reader control and application software

Tag Chip

The tag chip is an integrated circuit(IC) which is connected to the tag antenna. The antenna attached itself to the item being tracked. The tag chip has a unique Tag identification(TID).

Examples: labels, security tags, clothing

It has memory to store product's electronic product code(EPC).

Electronic product code

Electronic product code is written in tag chip memory by RFID printer. It is a 96-bit string of data

Header	Organization number	Object class	Unique serial number
8 bits	28 bits	24 bits	36 bits

Header- determines the protocol being used

Organization number- identifies product manufacturer

Object class- defines kind of product

Unique Serial number- defines the actual item

Tag Antenna

The tag antenna collects energy and channels it to the chip to turn it on. Bigger the antenna more the energy.

Reader

The reader sends power, data and command to tags. It is also known as interrogator. It provides connection between the tag and enterprise software. It takes tag data and passes on a computer for processing. It is either stationary i.e. factory setup having stations or it is portable i.e. mobile devices.

Reader Antenna

The reader and the reader antenna work together to read tags. Reader antennas convert electrical current into electromagnetic waves that are radiated into space. Tag antennas receive them and convert it into electrical current. There are two types of Reader Antennas

Linear	Circular
1. More Power	1. Less Power
2. Long range	2. Short range
3. More sensitive to orientation	3. Less sensitive to orientation

Reader Control and Application Software

It is a middleware to connect the RFID reader with enterprise software.

Diagram
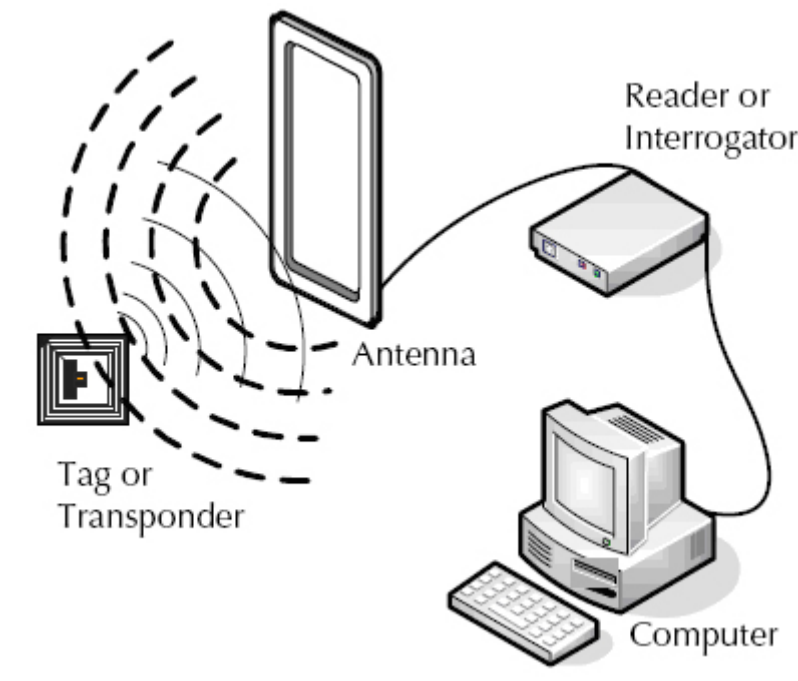
Applications

1. Asset Tracking- Track location and movement of package.

2. Supply chain management- Manage inventory levels in the warehouse

3. Anti-theft- Unusual movement and location of goods and trigger alarms

4. Cargo/Freight Monitoring- It the freight movement deviates from its usual route or takes more than the estimated time it can help in detecting threats.

Examples

RFID is used in a lot of modern day services like

a) Passport- logging of travel details of passengers

b) Smart card- hotel rooms use this technology for room keys.

c) Airplane luggage-reduces the work of airport staff to keep track of luggage for a flight

d) Automobile key and lock- each key sends and receives unique signals for the designated car and their remote central locking.

Advantages

1. It is cheap to implement RFID technology because it is easy to print large number of RFIDs at one time and therefore cost is low.
2. Hundreds of RFID can be read at a single time.
3. RFID tags can be read even if they are far, covered and not visible.
4. It has enough memory to store adequate information about products.

Disadvantages

1. Privacy is a major concern in implementing RFID as it can leak sensitive data about an individual with his/her consent.
2. Location of any personnel can be disclosed and this can put national security at threat as some products still send out location even after they are purchased or are delivered and this can reveal locations of military cargos which can prove dangerous.
3. Passive monitoring and surveillance can be carried out in similar ways which is a big risk.
4. Liquid and metal products reflect radio waves which makes tags unreadable.

Future Scope

1. Make RFID secure by using multiple levels of security like locks and passwords which can be implemented using microcontrollers.
2. Avoid privacy issues
3. More information can be stored and exchanged between RFID tags and customer using an app in their mobile which can give them shopping list, colour, size, return policy about a product online just by scanning the RFID using mobile camera.
4. Increase the use of RFID in different domains of commerce based on human creativity.