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Department of AI & DS

Course Name – Internet of Things & AI III Year / V Semester

CONNECTIVITY TECHNOLOGIES AND COMMUNICATION PROTOCOLS



INTRODUCTION TO RFID

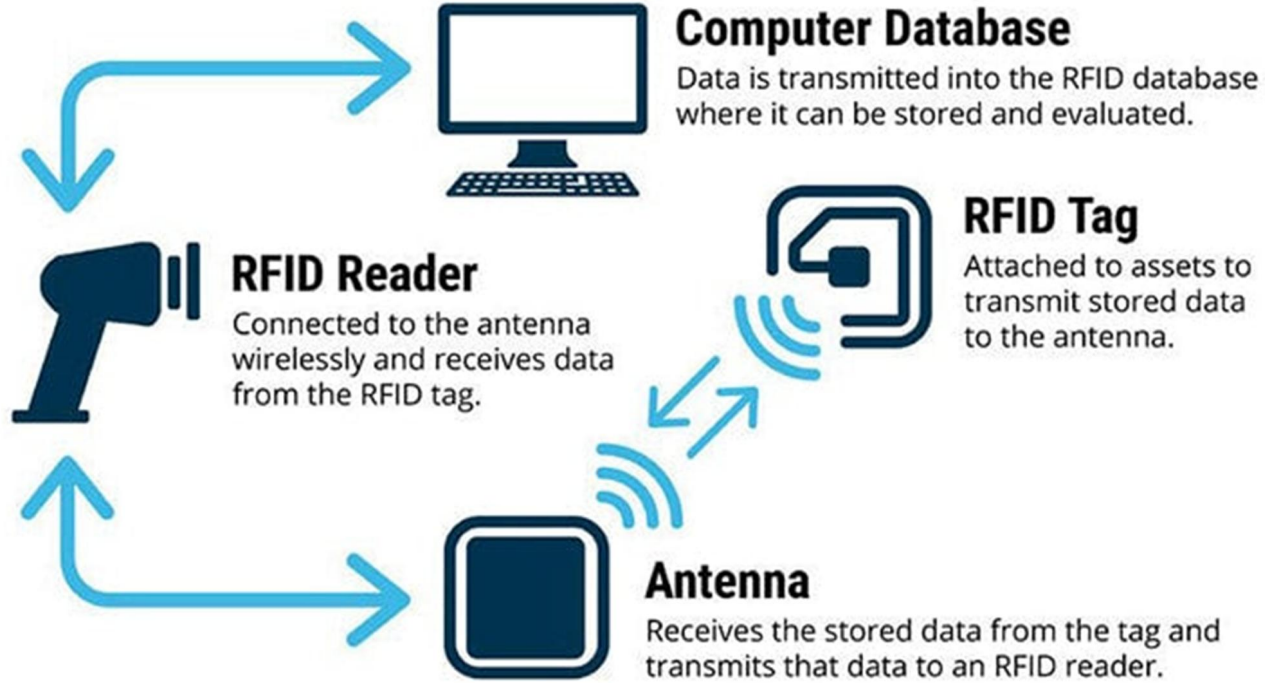


- Radio-frequency identification (RFID) technology is a way for retailers to identify items using radio waves. It transmits data from a RFID tag to a reader, giving you accurate, real-time tracking data of your inventory.

Radio Frequency Identification (RFID) refers to a wireless system comprised of two components

1. readers

2. tags





- The reader is a device that has one or more antennas that emit radio waves and receive signals back from the RFID tag
- tags, which store a serial number or unique identifier, use radio waves to send their data to nearby readers.
- They contain RFID chips, also known as integrated circuits (IC), which communicate data to the reader.



How RFID works

- RFID belongs to a group of technologies called . AICD - automatic identification and data collection
- AIDC tools to identify items, collect data about them, and send that data to a computer system, with little human interaction.
- For retailers that need to track stock accuracy, an RFID system that integrates with your inventory can increase efficiencies significantly.
- RFID is fast ,reliable ,and doesnot require physical sight or contact between reader/scanner and tagged item



RFID Technology

What is RFID ?

- **R**adio **F**requency **I**dentification
- A micro-chip in a label used to transmit data when the label is exposed to radio waves





- RFID systems use radio waves at several different frequencies to transfer data. In health care and hospital settings, RFID technologies include the following applications:
 - Equipment tracking
 - Personnel tracking
 - Ensuring that patients receive the correct medications and medical devices
 - Preventing the distribution of drugs and medical devices
 - Monitoring patients
 - Providing data for electronic medical records systems



- There are two types of RFID readers:
- **Fixed readers**-when the reader and antenna are installed in a specific place where RFID tag data passes.
- For example, you can check out at Amazon Go without going to a cashier. You just walk through an RF zone and the reader receives the tag data.
- **Mobile readers**, which are handheld devices that can be carried anywhere.



- Information is stored on a RFID tag and is attached to an item like your product
- An antenna recognizes the signal of a nearby RFID tag
- A reader is connected wirelessly to the antenna and receives the information stored on a tag
- The reader then sends the RFID data to a database, where it is stored and evaluated.



RFID TAGS TYPE

- **Active RFID tags:** tags that have their own power source and can read in a range of 100+ meters
- **Passive RFID tags:** tags that don't have a power source. Electromagnetic energy from the reader powers a passive RFID tag. This gives them a read distance from close contact to 25 meters.
- passive tags are most often used in RFID applications. You can embed them into an adhesive label or into the object itself. Passive tags are low-cost, so they are better in situations where you won't reuse them.
- Passive tags are used to scan at a distance from a few inches to a few feet.



RFID TYPES

- According to the frequency, RFID can be divided into three types: LF, HF, UF:
- 1) **Low-Frequency** RFID (100~500KHz): low-frequency RFID has a shorter inductive distance, the reading speed is slower. Low-frequency RFID of 125KHz is commonly used, whose penetration ability is good.
- 2) **High-Frequency** RFID(10~15MHz): high-frequency RFID has a longer sensing distance, the reading speed is relatively high. A High-frequency RFID of 13.56MHz is mainly used.
- 3) **Ultra High-Frequency** RFID (850~950MHz~2.45GHz): Ultra High-Frequency RFID has the longest sensing distance and fastest reading speed, but penetration ability is bad.
- 4) **Microwave RFID systems**. These run at 2.45 Ghz and can be read from 30-plus feet away.



Working Principles of RFID

It is working under inductive coupling principle, based on a radio frequency or radio waves.

What is coupling in RFID?

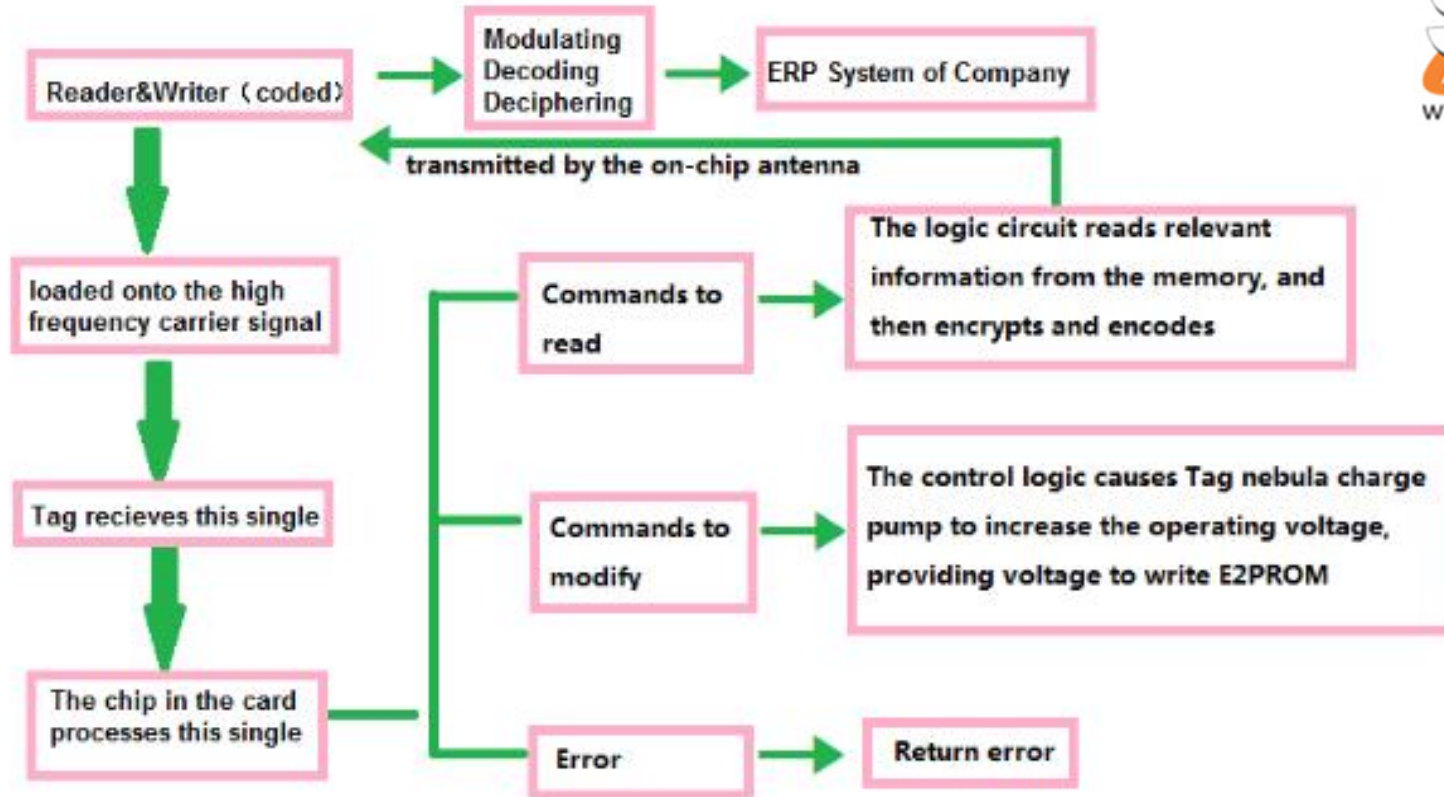
- Coupling refers to the method of linking or “coupling” the RFID tag and reader/antenna to one another.
- Coupling allows the reader to recognize and retrieve information from the tag
- low frequency and high frequency operation based on the **inductive coupling (near field coupling)**

Low frequency and high frequency (Inductive coupling)

- Inductive coupling is the transfer of energy from one circuit to another by virtue of the mutual inductance between the circuits
- RFID system that uses inductive coupling, the reader antenna and the tag antenna each have a coil, which together form a magnetic field.



- UHF tags working is based on the **electromagnetic coupling (far field coupling)**
- The electromagnetic coupling is a far field communication operates at the UHF, and Microwave frequencies where the reader antenna radiates electromagnetic waves used to activate the tag circuit.
- Once the circuit gets the activation Power it backscatters the wave in accordance with its data.



Schematic of RFID Basic Working Principle