

FINAL YEAR PROJECT REPORT
RFID Based Security System



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Abstract

Radio Frequency Identification (RFID) technology is a non-contact, non-line of sight based technology. The main object of the RFID technology is the verification of an object or person to which a tag is attached too.

Each tag consists of a unique code which differentiates between different objects and person. It is the only technique that is practical in environmentally challenging conditions where other optical or contact based technologies would be useless. Essentially an RFID is a portable database and a wireless extension of information systems.

This project consists of such a security system which allows the passage of authorized cards only. All unauthorized cards will be detected and will cause the RFID system to generate a SMS to the head of security.

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Chapter 1 Introduction

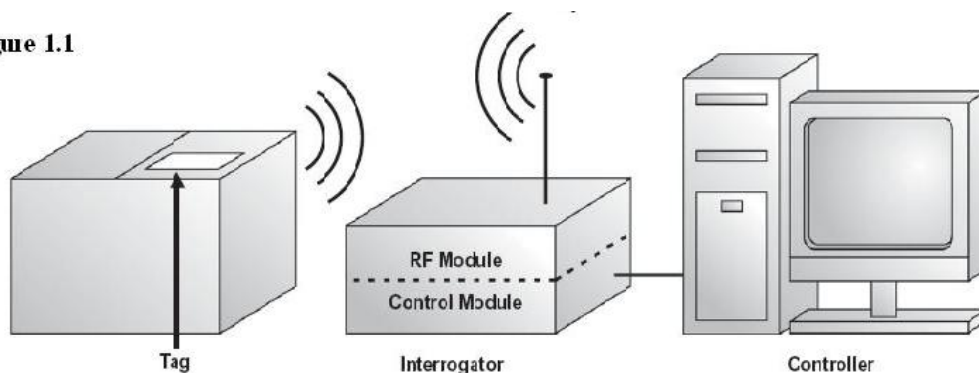
1.1 What is RFID?

RFID is an acronym for radio frequency identification, which is a wireless communication technology that is used to uniquely identify tagged objects or people. It has many applications. Some present-day examples include:

- Supply chain crate and pallet tracking applications
- Access control systems, such as keyless entry and employee identification devices
- Point-of-sale
- Automatic toll collection systems, such as those increasingly found at the entrances to bridges, tunnels, and turnpikes
- Animal tracking devices, which have long been used in livestock management systems and are increasingly being used on pets
- Vehicle tracking and immobilizers
- Wrist and ankle bands for infant ID and security

It is a system in which short range radio frequency communication takes place between a movable device and a host computer to exchange data. The moveable piece of equipment is called a ‘transponder’ and it holds data within its non-volatile memory. The device that retrieves this data through an electromagnetically coupled wounded wire (antenna) from a transponder is called a ‘transceiver’. Once the transceiver gets hold of data it passes on the data to a PIC Microcontroller. The controller makes sense of the data and saves it into a database table. A simplified diagram of RFID system is shown in Figure 1.1.

Figure 1.1



1.2 Components of RFID Security System

As explained in section 1.1, a RFID security system consists of following major components:

1. Transponder
2. Transceiver
 - a. Antenna
3. PIC Microcontroller
 - a. SMS Generation

1.2.1 Transponder

The basic function of the transponder is to transmit a stored data to the transceiver. At its most basic, a tag consists of an electronics chip and an antenna. This data storage is either permanent or rewritable. In a passive transponder in which there is no onboard power source on the transponder, the transceiver provides the power to it.

When the transponder circuit is powered up the transmission of data is activated that continues to transmit asynchronously until it is powered down. The transponder identification code may be read automatically without line of sight, through non-conducting material such as cardboard or paper, at a rate of several hundred reads per second and from a distance of several meters. Some tags also contain batteries, and this is what differentiates active tags from passive tags.

1.2.1.1 Active Transponder

RFID tags are said to be active if they contain an on-board power source, such as a battery. When the tag needs to transmit data to the interrogator, it uses this source to derive the power for the transmission, much the way a cell phone uses a battery. Because of this, active tags can communicate with less powerful interrogators and can transmit information over much longer ranges, up to hundreds of feet. Furthermore, these types of tags typically have larger memories, up to 128 Kbytes. However, they are much larger and more complex than their passive counterparts too, making them more expensive to produce. The batteries in active tags can last from two to seven years.

1.2.1.2 Passive Transponder

Passive RFID tags have no on-board power source. Instead, they derive power to transmit data from the signal sent by the transceiver, though much less than if a battery were on-board. As a result of this, passive tags are typically smaller and less expensive to produce than active tags. However, the effective range of passive tags is much shorter than that of active tags, sometimes less than two feet. Furthermore, they require more powerful interrogators and have less memory capacity, on the order of a few kilobytes.

Some passive tags do have batteries on-board but do not use these batteries to assist in radio signal transmission. These types of passive tags are called battery-assisted tags and they use the battery only to power on-board electronics.

1.2.2 Transceivers

An RFID transceiver is a key component of RFID system and acts as a bridge between the RFID tag and the controller. RFID transceivers are essentially small computers. They are also composed of roughly three parts: an antenna, an RF electronics module, which is responsible for communicating with the RFID tag, and a controller electronics module, which is responsible for communicating with the controller.

The transceiver performs multiple functions. The first function is that of activating the transponder circuit. This is because RFID system is based on transfer of energy between two close-coupled resonant circuits. The 555 timer onboard the transceiver generates a digital signal at the required frequency, the current passes into the transceiver antenna, which resonates at the system frequency and creates a RF signal. If a transponder is present within the RF field area, the transponder will energize and as a result it will transmit data back to the reader. It is the responsibility of the transceiver circuit to decode the incoming signal and finally send the decoded identification number to a PIC microcontroller.

The transceiver, as mentioned above has been divided into three parts. First is the antenna which modulates a digital signal and receives the incoming signal. The second part is the electronic modules which demodulates the incoming signal, filters it and amplifies it to transmit it to the microcontroller. The third and final part is the microcontroller. It receives the incoming Manchester data stream and decodes it while transmitting it to the database. The first and the second part can be understood as the analog part of the RFID