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## RFID and its applications

Abhishek D Kulkarni

[abhishekkulkarni1106@gmail.com](mailto:abhishekkulkarni1106@gmail.com)

Vivekanand Education Society's  
Institute of Technology, Mumbai,  
Maharashtra

Adesh A Chavan

[adeshchavan625@gmail.com](mailto:adeshchavan625@gmail.com)

Vivekanand Education Society's  
Institute of Technology, Mumbai,  
Maharashtra

Sairaj S Kshirsagar

[stevekira55@gmail.com](mailto:stevekira55@gmail.com)

Vivekanand Education Society's  
Institute of Technology, Mumbai,  
Maharashtra

### ABSTRACT

*RFID (Radio Frequency Identification) technology is used on a large scale these days, this technology can be used to identify various objects very easily. There are mainly three components in RFID. They are transceiver, transponder and antenna. The RFID transceiver plays an important role of transmission of power in case of passive tags and it also does reception of information present in the RFID tag. The transponder does the work of receiving frequency signal and then transmitting an another signal. The antenna does the work of establishing connection between the reader and tag. The RFID system can be made with different frequencies, so depending on the range the antenna must be selected. One of the application of RFID in real life is "Smart Bus Route Indicator". Basically, in this application of RFID, TX-433 which is a ASK transmitter and RX-433 which is a ASK receiver are used as one of the main components. These transmitter and receiver are tuned to 433MegaHertz. The encoder IC does the work of converting parallel inputs into serial output, this serial output is transmitted using transmitter antenna to the receiver antenna. Now the decoder will convert serial input into parallel output and give it to output pins of the microcontroller. The data then can be displayed on the LCD display. So RFID modules can be used to send the data so as to specify the location and arrival time of a bus.*

**Keywords:** RFID, Reader, Antenna, Smart Bus Route Indicator, Smart Canteen.

### 1. INTRODUCTION

RFID (radio frequency identification) is a technology that incorporates the use of electromagnetic coupling in the radio frequency (RF) portion of the electromagnetic spectrum which is used for identification process. An RFID system consist of three components i.e. an antenna, transceiver and transponder. The entire paper is organized as follows, Section II describes different components of RFID system .Section III discuss various applications of RFID system. Section IV describes the results obtained after implementation of Smart Canteen System. Section V describes the conclusion of the paper.

### 2. COMPONENTS OF RFID SYSTEM

#### A. Reader

An RFID reader, as the name suggests reads the RFID tag. It is also known as an interrogator. Reader is a device which is used to provide a connection between the data which is stored inside a RFID tag data and the system software which requires the information. But for proper communication between the reader and the tag, the tags need to be inside the area known as field of operation. The reader captures the data from the tag with the help of an antenna. It then passes the data to a computer for processing. RFID tags come in different sizes and shapes, the same goes for RFID reader. Readers can be installed in schools, stores or factory, or they can be integrated in portable devices such as mobile phones. Fig. 1 shows RFID reader. [1]

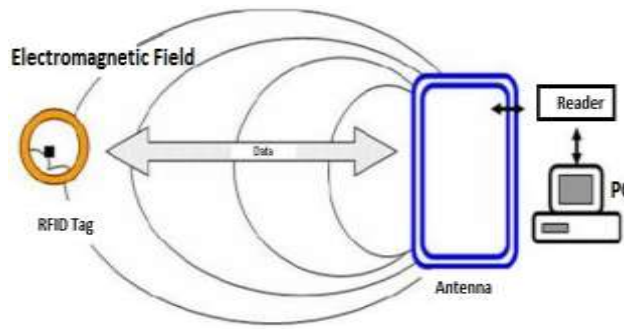


Fig. 1. The RFID Reader

## B. Tags

RFID System Consists of RFID Tags and RFID reader are used to read that tags. RFID tags are the heart of the system as they stored the information of the system. RFID tags are classified into two types, they are active tags and passive tags. The information about both the tags is given below.

### 1.1 Active Tags

Active RFID tags are the tags which required external power supply for the operation. Active tags are also called as battery operated tags and they actively transmit the signal. Active tags have the longest range for communication which is more than 100 meters. The energy to activate this card is transmitted from the RFID reader. These tags are bulky in size and have more cost as compared to passive tags. Fig. 2 shows active RFID tag.



Fig. 2 The Active RFID Tag

### 1.2 Passive Tags

Passive RFID tags do not require external power supply for the operation. They are called as self operated tags. These tags don't transmit any signal as transmission of signal takes place in active tags. Passive tags are used for short distance communication having range of 10 centimeter to a few meters. The main advantage of passive card is that they are light in weight and have low cost as compared to active tags. Fig. 3 shows passive RFID tag. [2,3]

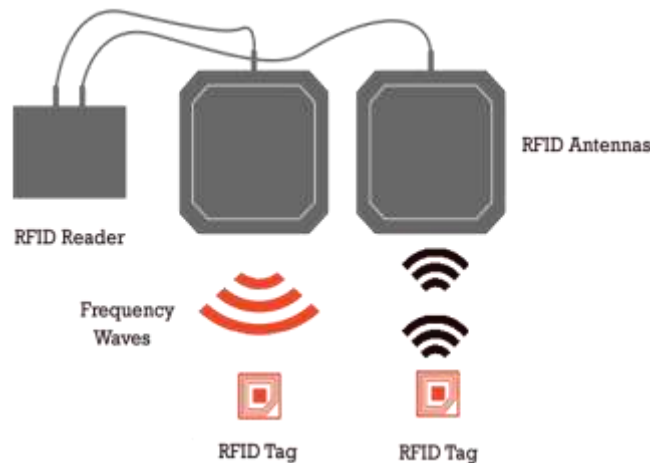


Fig. 3 The Passive RFID Tag

## C. Antenna

RFID readers and reader antennas are used to read tags. Polarized antennas are used to read RFID tags. Linear and circular polarized antennas are the two most common antenna types used. The two types of antenna used in RFID system are linear and circular antennas, that radiate linear electric fields have long ranges, and high levels of power that enable their signals to penetrate through different materials to read tags. Linear antennas are sensitive to tag orientation; this sensitivity depends upon placement

and tag angle. One of the drawback of linear polarized antenna is that they have very difficult time reading the tag. While circular antennas cannot deliver as much power as linear antennas. Fig. 4 shows antenna used for RFID.



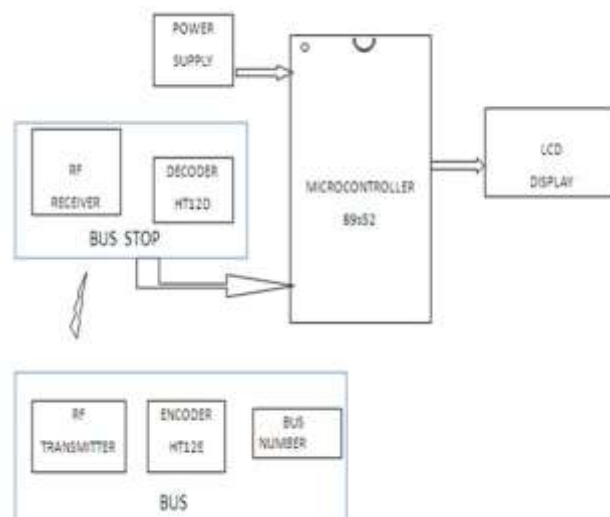
**Fig. 4 The RFID Antenna**

Now, selection of proper antenna can be determined by accumulating the distance between RFID tags and RFID reader. This distance between RFID tag and RFID reader is called read range. These reader antennas operate in far field or near field. If the read range is less than 30 centimeter, then it is called as near field application, while far field applications include read range more than 30 centimeter. These near field and far field techniques uses inductive and capacitive couplings respectively. [4]

### 3. APPLICATIONS

#### A. Smart Bus Route Indicator

The Smart Bus Route Indicator is a concept which can be used in day-to-day life, it is a concept which makes use of RFID modules. This concept can help people a lot. The problem of less frequency of buses which results in excess amount of people gathering at the bus stops can be reduced to a great extent using this concept. The location and the time remaining for the arrival of bus can be displayed on the LCD display, this LCD display will be present at the bus stop. The transmitter module will be mounted on the bus and the receiver module will be present at the bus stop, the data will be wirelessly transmitted by the transmitter to the receiver. However, the RF modules used in this concept are limited to a short distance because it is just a prototype. The RF modules tx-434 and rx-434 (ASK transmitter and receiver, with 433MegaHertz tuned frequency) are used for wireless communication. The transmitter module needs DC power supply for its working, the transmitter module can accept linear as well as digital inputs. The receiver module operates on DC supply (between 4.5 to 5.5Volts), the receiver has both linear as well as digital outputs. The transmitter and receiver both operate on 434MegaHertz frequency. Fig. 5 shows the block diagram of smart bus route indicator.



**Fig. 5 The block diagram of Smart Bus Route Indicator**

Now there are encoder and decoder ICs (HT12E and HT12D respectively), these ICs play a vital role in the transmission and reception process, these ICs are generally used in applications related to the radio frequency. The HT12E IC does the work of conversion of 12 bits of parallel input data into serial output which is transmitted using transmitter module (tx-434). The antenna pin of receiver module (rx-434) will receive the serial data transmitted by the antenna pin of transmitter module. Now the HT12D IC present at the receiver side will decode the serially obtained data and will convert it into parallel data. These parallel data is then sent to the output pins. Now these output pins are connected to the microcontroller, the microcontroller programming is done

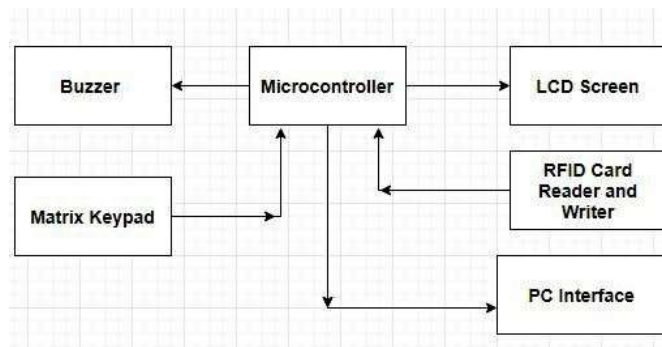
so as to send the received data to the LCD display. Finally the LCD display (16\*2) will display the data related to the location and the arrival timing of the buses. [5]

**B. Smart Canteen**

Almost all institutes, organizations, universities, companies, schools etc. have their own canteen. Nowadays all these canteen has started printing coupon system. Instead of saving time this system is wasting valuable time; also lot of paper gets wasted in making these coupons. Hence the Common practice of printing coupons for any student or any employee in any organization or any institution is time consuming process. Each time the Students of any institution or any employee has to take a coupon for the order he or she want to place. So every time the canteen management has to keep record of every student or any employee for the order he has placed in one month and this increases the paper work.

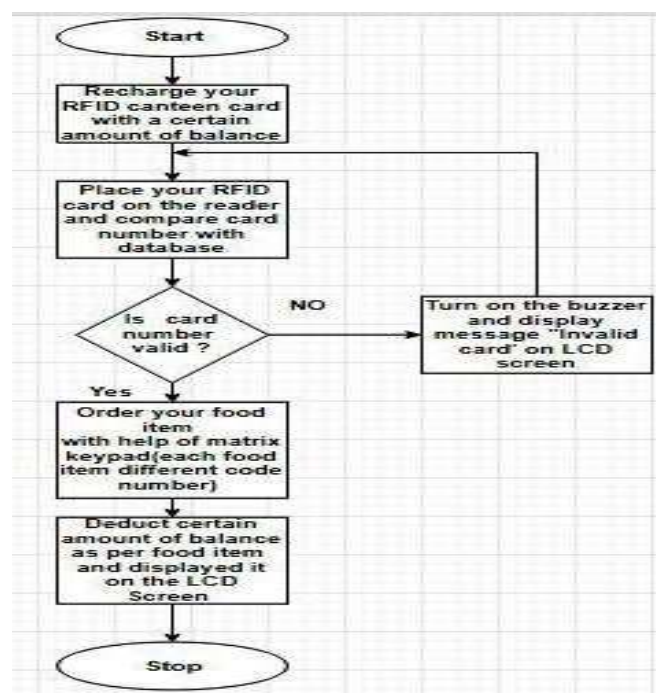
In various institution or any company canteen facility is provided to the students and employees. For this purpose students or employees has to take coupons from canteen. Every time they need to provide coupon while taking the food. This typical system has many disadvantages like you have keep that coupon with yourself carefully, limited food and paper wastage. So this typical system can be replaced by implementing the concept of smart canteen using RFID.

**1) Block Diagram**



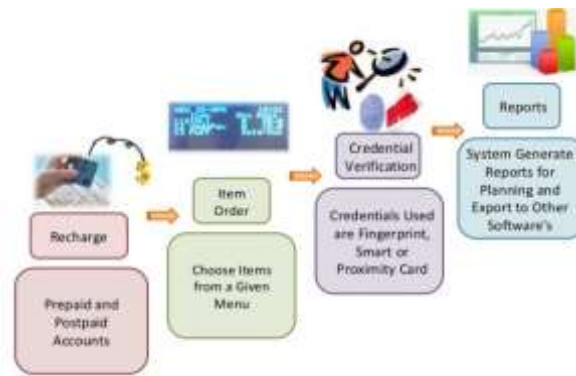
**Fig. 6 The block diagram of smart canteen system**

Fig. 6 is the block diagram of RFID based Smart Canteen system. The system consists of Microcontroller which is the heart of the project. RFID tags and smart reader are used as input devices and are used to enter data into microcontroller. Hex Keypad is used to enter the code number of every food item assigned by canteen management by every employee or any student. Buzzer is used for indication purpose and used as output device. LCD is used to display the data enter by student or employee and is used to display the amount of balance left is his or her own individual RFID card. PC interface is used to maintain record of each and every student or employee. The figure 7 describes the working of Smart canteen system.



**Fig. 7 The Working of Smart Canteen system**

## 2) Canteen System Process



**Fig. 8 The canteen process system**

The above Fig. 8 shows the overall canteen process. At first the student or employee has to recharge his or her own RFID card through canteen management. The canteen management system would set certain code for each food items available in canteen. After that user has to place that card on the RFID reader which results in display of available balance, after that it will ask to enter the code of specific food item assigned by the canteen management system. Then the LCD will show list of food items available in the canteen along with the code list associated with each food item. This causes LCD to display cost of the food item and will ask to finalize the order. At last order will be approved by the system and a deducted amount will be displayed on LCD and order number will be given to you and as per the order number your food item would be served. Once the card recharge is zero again he or she has to recharge his or her own card from the canteen management.

## 4. RESULTS

- No manual reconciliation of Vendor transactions is required. The System maintains the Vendor transactions in real-time in the Back-end. Online reports are available using a web-based front for instant access to these transactions down to the last level of detail. A complete audit log of all transactions is available.
- The System ensures considerable savings for the company or any organization by ensuring a tight control on when and how-much of the meal entitlement is consumed.
- The System also ensures that the employees or students understand that the System is fair and reasonable as it facilitates the complete and timely consumption of the meal entitlement to their entire satisfaction. At the same time the System ensures that the meal entitlements are not unduly carried forward.
- Exact Business unit-wise billing is available which allows the Canteen expenses to be accurately debited/ appropriated to the right Business, leaving no chance of disputes and/or denials.
- The employee or student can now use their ID Cards across all locations and avail of their meal entitlements as per their base location.
- Works on existing ID cards, no additional cost on cards and/or readers.
- Daily tracking of cost.
- Multiple counters to smoothen the canteen operations.
- No need to wait for receipt of paper coupon.

## 5. CONCLUSION

The RFID has a wide range of applications. The Smart Bus Route Indicator is one such application which can assist the people (passengers) waiting at the bus stops, the people will be getting an idea about the arrival time of a bus at a specific bus stop. So accordingly these people can decide whether to stop at the bus stop or to use some other transport means so as to reach to their destination immediately. Second application is the Smart Canteen which can replace the old cash system with easy payment using a card.

## 6. ACKNOWLEDGEMENT

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