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Research on RFID Antenna in Convocation Management System

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Abstract

Radio Frequency Identification (RFID) is one of the technologies that can improve the management accuracy and efficiency; RFID technologies also can reduce human power and the tightness of management schedule such as an RFID for Convocation Management System in Polytechnic Port Dickson. The Antenna is one of the important parts for RFID system. The main intention of this research is to know a type of antenna, the bandwidth and the applicable range of systems. This RFID antenna is from a type of single-fed patch antenna. It's also known as a rectangular micro-strip antenna. Patch antenna is a type of radio antenna that can be mounted on a flat surface with a low profile. A patch antenna consists a flat rectangular sheet or metal and it's mounted over a ground plate; a large sheet of metal. Electrically large ground planes create stable patterns and lower environmental sensitivity, but it makes the larger antenna. The patch antenna will be inside a plastic Radom to protect the antenna structure from damage.

Key-word: - RFID, patch antenna, micro-strip antenna, antenna

1. Introduction

Radio Frequency Identification (RFID) is a new technology and an intelligent system of radio frequency communication. According to Bob Violino (2005), the definition of Radio frequency identification (RFID) is a term that is used to describe a system that can transmit the identity, such as in the form of codes or unique series of an object or person using radio wave frequency. Its new technologies in management system that can detect objects or person and this system also have grouped under the broad category of automatic identification technologies [1]. RFID uses the radio transfer waves to transfer data and tags as a data collecting for storing data. RFID tags carry a unique code and to be detected data using RFID detector or RFID reader. An RFID reader does not require a line of sight to read an RFID tag's data. RFID tags can detect to 32 Mega Bytes of data making the information more difficult to counterfeit than barcodes, they offer the possibility for reading, writing, transmitting, storing and updating information [2]. The RFID system in Convocation management helps organizer of convocation ceremony to smooth running of the event within the stipulated time. In convocation management, the most important things are to ensure the delivery of graduate's scroll awarded to run smoothly. All graduates will authorize with a passive RFID tag. This RFID tag contains integrated circuit that is used for storing and process information of the radio frequency signal that can be transmitted. In every each of the RFID tag works by getting the unique codes and to be detected data using RFID detector or RFID reader. The system will read the data and display the graduates name's on the main screen of the stage. Even the graduates are absent from convocation ceremony or not in there are own faculty track, the system still can be progressed without failure. RFID system consists of a reader, tag and data processing unit [3]. They are variety of tags forms such as cards, labels, bangle or watches and even embedded or install in equipment [4]. There are three types of RFID; passive, semi passive and active RFID tags. Christopher (2006) stated that there are main differences between active and passive tag, active tags have an internal battery while passive tags have no internal battery [5]. In Convocation management system, the passive tags are suitable to use, the power for passive tags is supplied by the reader. The reader supplies the power and when the tag encounters a radio signal from the reader. Then the tags will form a magnetic field from the coil antenna inside the tags and will energize the circuit.

Passive tags, also known as a pure passive, reflective or beam powered. The advantages using passive tags are simpler in structure, cheaper than semi passive and active tags, lighter in weight, more generally used in harsh environmental conditions, and operation without lifetime limits. The success of the RFID systems cooperate is their communication between data processing units with an antenna are from responding from the tags. RFID technology for Convocation management systems used an UHF Reader 1802 SDK series. The main intention of this research is to know what type of antenna, the bandwidth of the antenna and the applicable range of the antenna for the convocation management system.

The first micro strip patch antennas were found by the scientist's name Decamps in 1953[6]. The patch antennas are most popular useful because they can be printed directly onto a circuit board. The patch is normally made of a conductor which can appear in any shape possible. Based on Figure 1, basically the structure of micro strip antenna consists of 4 parts; a metallic patch, dielectric substrate, ground plane and feeding structure [7]. A common occurrence is that the radiating patch and the feed lines are photo etched on the dielectric substrate. The micro strip patch antenna is normally for narrow-band microwave wireless link application which is required semi-hemispherical coverage, such as Radio Frequency Identification (RFID) system.

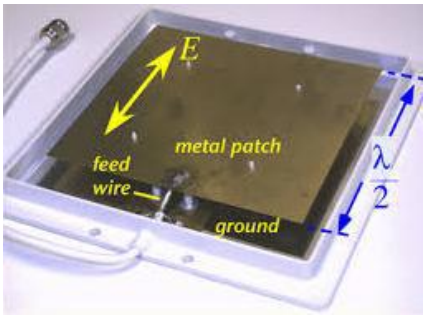


Figure 1: Example of Micro strip patch antenna [7]

2. Methodology

RFID technology for Convocation management system uses a UHF Reader 1802 SDK series. The Antenna is one of the important parts for RFID System. Result from the optimized antenna design will give the advantage in longer reading range, low cost of antenna fabrication, good accuracy, implementation and system configuration [8].The micro strip patch antenna is a well-liked printed resonant antenna for narrow band microwave wireless links which are in need of semi hemispherical coverage.

2.1. Antenna of RFID System

Antenna for this RFID convocation management system is from a type of single-fed patch antenna. It's also known as a rectangular micro-strip antenna. Patch antenna is a type of radio antenna that can be mounted on a flat surface with a low profile. It's consist a flat rectangular sheet or metal and it's mounted over a ground plate; a larger sheet of metal. The patch antenna will be inside a plastic Radom to protect the antenna structure from damage. In RFID for convocation system, the patches are used as a simplest application system. The structure and dimension of the rectangular micro strip antenna are shown in Figure 2.0. The biggest plate work as a ground plane of the antenna and it is connected with a coaxial probe. The inner of the coaxial cable is connected with the small metal patch and the outer of coaxial is connected to the ground of antenna as shown in Figure 2.1.

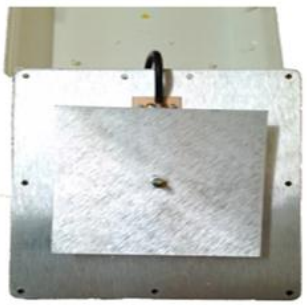


Figure 2: Structure of rectangular micro strip patch antenna

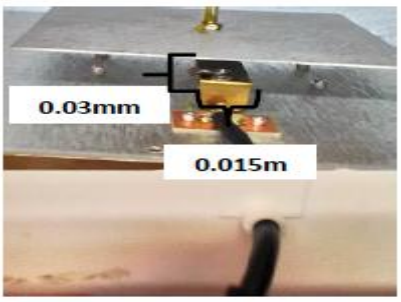


Figure 2.1: Connection of coaxial cable and small **patch**

Figure 2.2 below is shown the antenna cover of RFID system that been used in Polytechnic Port Dickson Convocation Management system. The cover is used to protect the rectangular patch antenna from damage.

Figure 2.2: patch antenna with plastic Radom cover

The return loss and frequency of the RFID antenna is analyzed by using the Network Analyser and Spectrum Frequency. Return loss is way to find the loss of the power in the signal. The power losses based on the signal returned or reflected from discontinuity in a transmission line. Discontinuity is from a terminating load or from device inserted in a line [9].

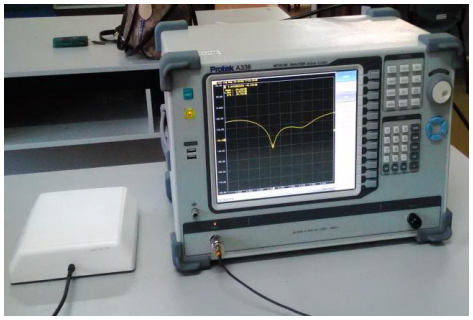


Figure 2.3: Analysis antenna using network analyser

2.2 RFID tags and card reader

The RFID tag type EPC Class 1 Gen 2 compliant is used for this project. Figure 2.4 shows the RFID tag and reader used in the Convocation Management system. The tags have been chosen based on lower price than another and also low in maintenance; not use the battery or power for its system. The capability of the tag memory is 96 bits. As shown in Figure 2.5, RFID tags characteristic are large range and orientation sensitivity. Another advantage of the tag is the data retention is about 100000 cycles. The operation frequency of this RFID tag is 860 – 960MHz with sensitivity is minimum 2.3V/m. [10]

Figure 2.4: RFID tags and card reader

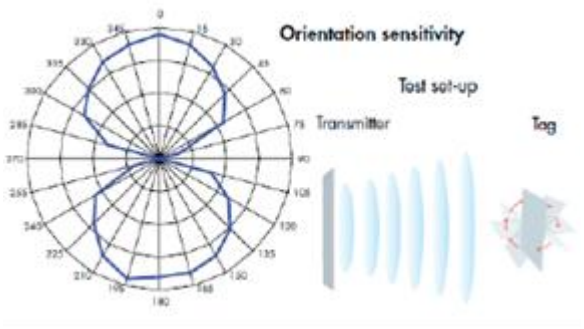


Figure 2.5: RFID tag orientation sensitivity of UPM Raflatag DogBone

2.3 RFID Data Processing Unit

RFID Data Processing Unit (DPU) complete set of convocation system is using UHF Reader 18002B SDK. The frequency of this RFID reader is 902 to 928MHz with the carrier frequency in hopping spread spectrum. Figure 2.6 shows the RFID Data Processing Unit of this project. This DPU has 4 ports for antenna and its communication interface is RS232 or RS485.

Figure 2.4: RFID Data Processing Unit

3. Results

The antenna was measured using network analyzer and spectrum analyzer. The Analysis antenna is to ensure the actual frequency range of the RFID antenna. The dimensions of the antenna are L_1=0.21mm, L_2= 0.18mm, and L_3=0.12mm.

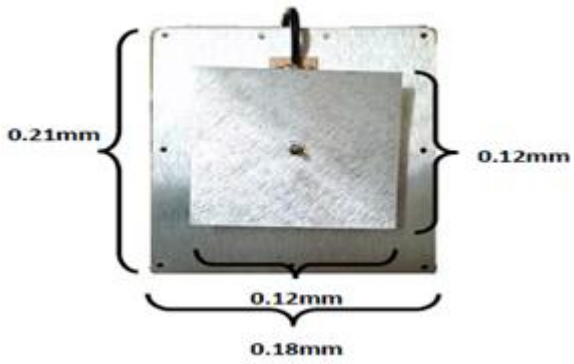


Figure 3.1: Dimension of the antenna

Simulation result return loss of the antenna is as shown in figure 3.2. Return loss is the loss of power in the signal reflected at a line discontinuity. Based on the result, the resonance of the antenna is 1.96GHz. The range of the antenna is between 900 to 960 MHz. Based on the Figure 3.3 is the results of the frequency of the RFID antenna. The reader on the RFID system can only detect the RFID tags between the ranges of the frequencies. Distance of the RFID antenna with the RFID tags are within 5 meters. The best reflected of the RFID tags should be done within a predetermined distance. By adjusting suitable distance and avoidance of sources that interfere with the system such as cell phones, this system will operate successfully. Table 3.1 shows the use of RFID cards in the convocation management system by percentage (%). These analyses are an improvement on using RFID system from the previous problem.

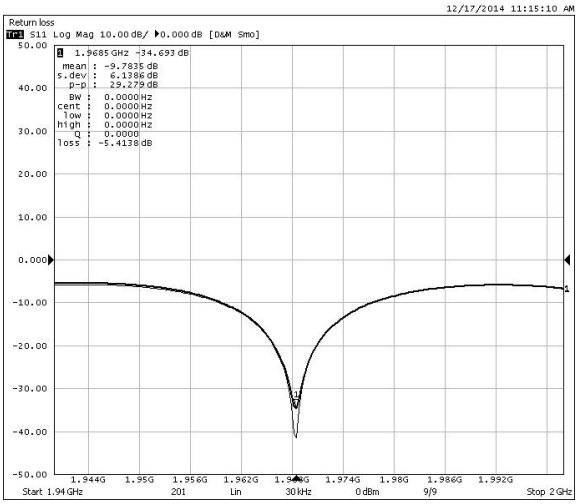


Figure 3.2: Simulation of the return loss by using a spectrum analyser

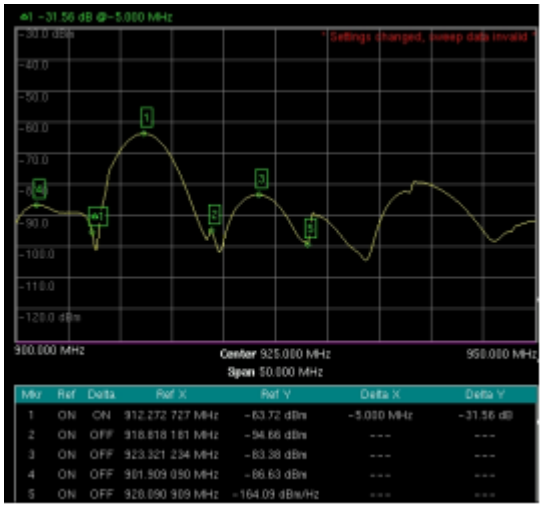
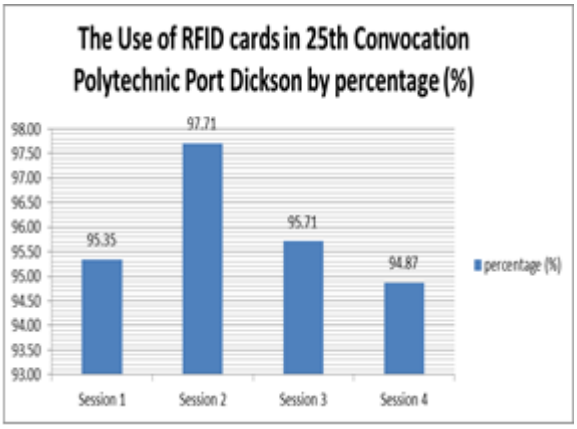


Figure 3.3: Frequency range of the RFID antenna

Table 1: Percentage of RFID cards in 25th Convocation Polytechnic Port Dickson.



4. Conclusion

In this research paper, antenna of RFID have been described and its most likely applications in the convocation management system. The distance and frequency of the RFID antenna also have been studied. Based on the results it is shown that the distance and the frequency of the RFID card should be in line with the frequency of the RFID system. This paper will help UIDM and organizers in this RFID system to be well understood and prepared for RFID system for convocation management implementation.

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