

HOW RFID TECHNOLOGY SUPPORTS E-BUSINESS PROCESSES

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ABSTRACT

RFID is a technology of automated data collection (ADC) that uses radio frequency waves to transfer data between a reader and a movable item to identifying, categorizing, tracking a specific data required. RFID implementation is very fast and not require physical touch or sight between the reader or scanner and the tagged item. Increasing usage of RFID technology has a favorable impact related to the optimization of resources, increased efficiency in business processes, customer service warranty and implementation of business and healthcare operations. Radio frequency identification (RFID) tag is expected to contribute and thrive in an automated warehouse management applications and computing world.

Keywords: Data, E-Business, RFID.

1. INTRODUCTION

Technology of Automatic Identification (Auto-ID) and Data Collection (AIDC) has been widely used and implemented in the business system at the supermarket, credit card applications, bank systems, ID card, car keys, house keys, parking cards and others. AIDC technologies in the early 1930s to the 1940s used magnetic stripes, in the 1950s and 1970s used barcode and universal product code (UPC), whereas in 1949 until now use radio frequency identification technology (RFID) (Garcia, 2007 dan Guerrero, -).

RFID is a technology of automated data collection (ADC) that uses radio frequency waves to transfer data between a reader and a movable item to identify, categorize, and track a specific data required. RFID implementation is very fast and does not need physical touch or sight between the reader / scanner and the tagged item. Display operation of RFID is low cost components and has unique features and systems integration that has wide applications (Gaukler, -). Barcode and optical character recognition (OCR) is also an ADC technology which often used. In 2006, sales of RFID reached 1.02 billion, and the estimated sale of hardware, systems, and services will increase by a factor of usefulness until 2017 (European Commission, 2007).

The use of RFID for short range does not require high power consumption and does not require a lot of cost in operation. Security of the data used in RFID implementations using cyclic redundancy check (CRC) for checking data validation and transmission. Implementation of security systems have been using cryptography to protect from eavesdropping or modification of data practices. High data rate capability has been applied in a variety of objects, such as animal ID for the reading of tags around 6 Kbps, while the data transmission from the tag to the reader is about 500 bps; close-coupled cards require about data rate of 9.6 Kbps; vicinity coupled card is about 1.65, 6.62, and 26.48 Kbps; coupled proximity card has a data rate of approximately 106, 204, 408, 816 Kbaud, and global tag around 10 and 40 Kbps. RFID tag has the advantage that it may be read and written many times by the transponder and can be used repeatedly, the probability of failure in reading data is low because the radio frequency-based, portability, degradation and resistance is quite low as resistant to external conditions such as temperature, and other mud-factor, free from the closure / blockage, direction and position (Harmon, 2003). So, RFID supports effective storage to be applied as an integrated system for all application data. While privacy considerations from the user perspective is not so clearly regulated, so some companies usually have low credibility because they

have something to hide and beside that there are no laws that protect people from abuse and security technology.

2. THEORETICAL BACKGROUND

Radio frequency identification (RFID) technology is not new technology which has been used in military applications, aircraft, library, security, health, sports, farming and many other fields. Industries using RFID for a variety of applications such as private access control or vehicle, store security, tracking tools, luggage, fast food service, logistics, and so on. Increasing usage of RFID technology has a favorable impact related to the optimization of resources, increased efficiency in business processes, customer service warranty and implementation of business and healthcare operations. Developing implementation of RFID consists of three main components which are tags, antenna and reader (Ahsan, 2010).

In Italy, some companies invested their funds for using of RFID, although some of the information technology (IT) decision-making are determined by the capability of RFID. If IT decision makers who determine the ability of the RFID are more valueable then the resulting profits will increase. IT decision makers are only dwell on the discussion of the accuracy and error reduction, their views were limited to the new available services despite the fact that the ability of RFID is able to significantly influence the core competencies (Knebel, 2006).

Radio frequency identification (RFID) tag is expected to contribute and thrive in an automated warehouse management applications and computing world. Problems error protocol efficiency can reduce execution time to avoid disruption to normal inventory operations (Luo, 2011). Every computing device development will open infrastructure that is faced with the challenge of new forms of communication including the side of safety (Fishkin, 2004, O'Neill, 2008). The components of RFID consist of two main interfaces i.e. RFID tag and RFID reader/writer. But in the application, need for supporting other systems like the desktop

displays, networking and the database system.

2.1. RFID Tag

RFID chart that is used for labeling in the form of code (unique identifier) for the data stored is the RFID tag. The principle of the RFID implementation mechanism is shown in the figure 1.

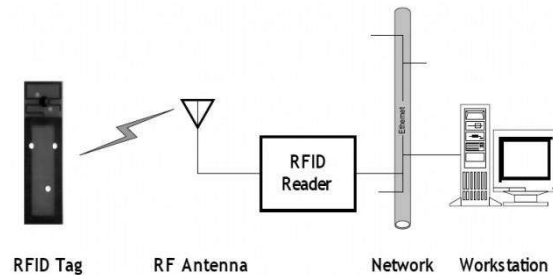


Figure 1. RFID Implementation Diagram Block (Iyer,2005)

Tag attached to an object that has a unique identity. Identifying an object that implements sending code from the embedded tags, thus the reader will get a message in the formatted code and the code will be processed to implement an object that sends a code of embedded tag, then the RFID reader will get a message and the code will be processed.

AIDC technology uses radio frequencies and consists of RFID tags, RFID reader, characteristics of radio waves and a computer network. RFID tag in the form of chips used to storing data and it has an antenna. Some types of tag have an active/passive/semi-passive, read/write and various frequencies shown in the figure 2.



Figure 2. RFID tag [i]

RFID tags consist of two types that are active and passive tags and could be embedded at almost everything stuffs. Passive tags require no power, low storage capacity of only a few bits up to 1 KB, shorter read ranges is about 4 inches to 15 feet, and usually have a tag write-once-read-many / read-only principles and its price is very cheap. The active tags have some caharacteristics that are powered by battery,

the storage capacity is higher about 512 KBs, longer read range is about 300 feet and usually can be rewritten using the radio frequency (RF) interrogator and the price is quite expensive compared to passive tags (Harmon, 2003). Tag memory can be made by the factory or field programmed forms. It can be partitioned and selected into locked state permanently. Byte that is not locked can be rewritten more than 100,000 times. RFID according to the frequency range is divided into four types i.e. low frequency (LF), high frequency (HF), very high frequency (VHF), ultra high frequency (UHF) and microwave (OECD, 2008). The higher the frequency, the higher the RFID reading range. Table 1 shows the types and frequency ranges.

Table 1. Types and frequency ranges.

Types frequency	Range frequency
Low frequency	30 KHz – 300 KHz
High frequency	3 MHz – 30 MHz
Very high frequency	30 MHz – 300 MHz
Ultra high frequency	300 MHz – 3 GHz
Microwave	2 – 30 GHz

2.2. RFID Reader

Function of RFID reader is used as a tag to remote bi-directional data links, inventory tags, filters, communicate with network server, and read 100-300 tags per second. The reader or interrogator might be in the form of fixed-point or mobile / hand-held (see figure 3).



Figure 3. Types of RFID Reader (Iyer,2005)

Network Electronic Product Code Global (EPCglobal) based on five main parts, the Electronic Product Code (EPC), system identification (ID), EPC Middleware, discovery service (Object Naming Service (ONS)) and EPC Information Service (EPC IS). EPC has a unique object identifier, 96-bits, and the extension of Universal Product Code (UPC). EPC system ID contains of EPC tags and EPC reader. The process of data communication between the RFID tag and reader is described as a power of the radio frequency (RF) field energy emitted by

the RFID reader to activate the RFID tag, RFID reader along with it also sends the command tag, then from the command, the tag will respond to the results that will be executed by the RFID reader. Data communications and RFID tag reader is shown in figure 4.

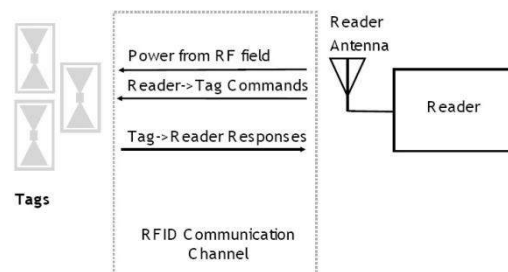


Figure 4. RFID data communication (Iyer,2005)

Some of the emerging challenges associated with the use of RFID, is lower price of tag, information technology (IT) infrastructure including data processing consists of online handling of large amounts of data flow, data storage, network bandwidth, system and associated database integration, data warehousing, and applications company. A global standard consists of the use of the frequency tag and reader which are some countries using different frequencies.

2.3. .NET Framework

In July 2000, Microsoft announced the entire software development framework (software) for Windows called .NET in the Professional Developers Conference (PDC). Microsoft also launched the PDC version for developers. After initial testing and Beta 1 of .NET launched, it received much attention from the developer community. When Microsoft released Beta 2, much improved by the community and internally. After that in March 2002, Microsoft launched the final version of .NET framework. At that time, Microsoft has put a great effort in this new platform, they even gave a statement that its future depends on the success of .NET. Development. Framework of .NET is one of the important things that are similar to DOS to Windows transition era. All development and new versions of the products only dwell around .NET. So as to know Microsoft

technologies should know .NET (India Community Initiative, -).

Many applications can be developed using .NET, because .NET has a complete software development kit (SDK). Application of .NET Framework SDK provides classes, interfaces and compilers for programming .NET languages. Application of .NET Framework SDK is free tool and can be downloaded from the MSDN website. Now if .NET framework and a text editor (like notepad) has been installed then anyone can develop .NET. Development of applications that require the integration of software and notepad can be done, but for some cases, it still requires some Integrated Development Environment (IDE) that allows Rapid Action Development (RAD). A new Visual Studio .NET includes application of .NET development that can make productive on the ability to drag and drop design, IntelliSense feature, which is in the syntaxes highlighting and auto-checking, the tool has capable to debug, integrated with version control software such as Visual Source Safe (VSS) and easily manage the project. When installing Visual Studio .NET, .NET framework will be downloaded and installed automatically on computer applications (India Community Initiative, -).

reader / writer. RFID reader / writer is used manifold SL500 to read a card / RFID tag.

This paper observes the communication between the embedded values in the RFID tag to be changed and read. The interface is programmed by implementing Microsoft Visual C# that comprises several stages, i.e. connect / disconnect the data on the RFID readings by specifying port and baud rate used for communication with the RFID reader/writer. Figure 6 shows the appearance of the graphical user interface (GUI) which is built using Microsoft C# to interfacing RFID and Mifare 1k card.

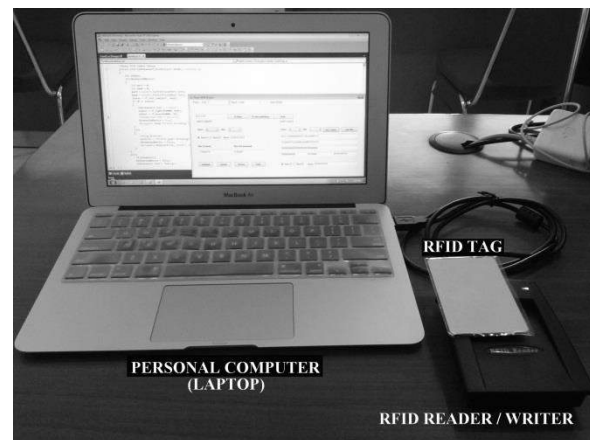


Figure 5. Global Design of RFID System

3. RESEARCH METHOD

Integrated system is a collection of integrated data on an RFID tag which are detected using RFID reader thus it will show on the application of personal computers (PCs) of C# .Net based. Required tools in this paper is a set of RFID tags, RFID reader, a computer and software Visual C# .Net.

3.1. Global Design

Global design of an integrated automated system of data collection based on radio frequency identification (RFID) and framework .NET is shown in figure 5. RFID reader / writer connected to the personal computer (PC) that is installed microsoft visual C# 2010 Express and framework .NET. Microsoft Visual C# 2010 Express used to create applications that are used to read and write commands from the RFID

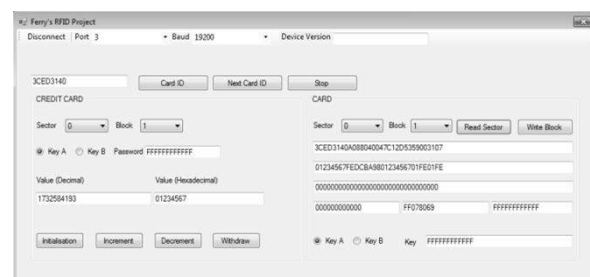


Figure 6. GUI between RFID and Mifare 1k card

RFID can be used in the process of ticketing, credit card, and the identity of the owner embedded in a card. In this paper shows two kinds of RFID usage approach namely for a credit card shown in left side on figure 6 and the owner's identity card for regular card shown in right side on figure 6. Communication for SL-500 RFID reading or writing library type uses .DLL taken from MasterRD.dll. This library is implemented in RFID programming operation. Invoking a library of kernel32.dll and MasterRD.dll programmed in Microsoft Visual C# programming.

In this paper, the port obtained is port 3 connected to USB and the used baud rate is selectable of 9600, 14400, 19200, 28800, 38400, 57600, and 115200 bps. But in this paper used 19200 bps. Usage of port on PC interface can vary, it is able to be checked on the control panel at device manager in the Windows operating system.

4. RESULT AND DISCUSSION

4.1. RFID Implementation

The Card ID of RFID is used to read the card ID number which is embedded in the RFID tag card, whereas if there is more than one card is stacked, the next card reading can be done. This is caused by chip that is integrated on the card Mifare MF1 IC S50 which is an intelligent anticollision function allows to operate more than one card simultaneously. Anti-collision algorithm chooses any card and sure the execution of transactions with the correct chosen card without collisions.

Radio Frequency Identification (RFID) reader of SL-500 accordance with protocol ISO14443, ISO14443B and ISO15693. In this paper the used card is Mifare_1k. Mifare_1k has the characteristics of the 13.56 MHz frequency, the protocol used is ISO / IEC 14443A, 32-bit unique ID, 1024 byte EEPROM size, the operating distance is about 100mm, the data storage is life longer about 10 years, and has about 100,000 times of the write endurance. Mifare_1k memory organized in 16 sectors with 4 blocks each consist of 16 bytes. In the Mifare system, MF1 S50 IC connected to the coil with a few turns and then placed in a plastic card to form the passive contactless smart card and do not require batteries. When the card is placed on the antenna read write device (RWD), the radio frequency (RF) communication interface allows to transmit high-speed data at 106 kbit/s. In terms of security has three authentication in accordance with ISO / IEC DIS 9798-2 and each has a unique serial number (Philips, 2007). Mifare 1k memory organized in 16 sectors with 4 blocks.

Each sector of Mifare 1k have a sector consisting of secret keys A and B. Access conditions for the four blocks are stored in a byte sectors from 6 to 9, these bits also determine the type of access read / write or

the value of the data block. If key B is not needed, 6 bytes end of block 3 can be used as a data byte. Default sector of the card depicted in figure 7.

0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Key A						Bit Access				Key B					
F	F	F	F	F	F	F	0	8	6	F	F	F	F	F	F
F	F	F	F	F	F	F	7	0	9	F	F	F	F	F	F

Figure 7 New card default sector

Key A could not be read (return 0 when read), can be changed and have the ability to read, write, increment, and decrement. While key B may be read, can not provide for authentication. Additionally, write command master key only to designers using a key only and not use the key B. If desired to write in block 3 offset sector accurately, can use a block 3 data write command. An example key of using an A and B keys shown in the figure 8.

0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Key A						Bit Access				Key B					
						0	7	8	0						
						8	7	F	0						

Figure 8. Use Key A and Key B

Key A could not be read and changed, but it has the ability to read and write blocks. Key B also could not be read and changed, but has the ability to read, write, increment, and decrement. When programming an SL-500 RFID reader, it will show some errors if there is some conflicts and this needed concerning due to the performance of RFID system. The error codes generated from the RFID reader and its means written in table 2.

Table 2. Error code and its meaning

Error Code	Meaning
10	General error
11	Does not support this command
12	Command parameter error
20	Request failed
21	reset failed
22	Authentication failed
23	Reading failed
24	Writing failed

The error code of 10 shows that the coding has error in such command and need to be fixed. The error code of 11 shows that the syntax code is unknown, and if the syntax code is true but the parameter is false, then it will generate error code of 12. If

the data of card ID want to be pushed and fail then it show the error code of 20. For reset and authentication fail, the error code will generate 21 and 22 respectively. The error code for reading and writing fail, it will generate 23 and 24 respectively. These error codes make programming more easier to detect the mistaken program.

5. CONCLUSION

The data management of RFID has shown to be highly valuable to support business. This paper shows that an RFID card could be used to store set of data like card ID that is needed to generate database and also as unique ID. The RFID reader can read stacked cards/tags more efficient and easier because there is an anti-collision algorithm embedded on card. The encryption on the card is useful to protect the code, so it can be used as debit card or payment card.

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