SMART ATTENDANCE SYSTEM BY USING RFID

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Dedicated to:

For my family, who offered me unconditional love, supervisor and friends that give me support throughout the course of this thesis.

ABSTRACT

"SMART ATTENDANCE SYSTEM (SAS)" is a system that will take an attendance by using information extracted from the RFID Database Handling System. The system will record student attendance to an attendance server located at University Data Center. The system also will be loaded with other additional system module for lecturer and student. The information from the RFID Database Handling will be use for the university administration to better manage classroom statistics, warning for unattended student via letter, e-mail or SMS, reminder for student, report for an authorized parties such as parents, the lecturer for notes, assignment, grading (quiz, test, etc...), and also for students so that they can track their performance. Smart Attendance System has been developed using PHP programming languages. The database support for this software is using MySQL. In order to have complete system functionality, Smart Attendance System is needed to integrate with RFID Database Handling System. SAS will fetch the appropriate data from RFID Database in order to execute the attendance taking process. Furthermore, SAS is also equipped with other rich additional modules to help lecturers and students in the class such as notes distribution and reminder. SAS can be deployed in Apache Server or Internet Information Server and viewed by the client using today's internet browsers such as Internet Explorer 7.0 or Firefox 2.0.

ABSTRAK

"SMART ATTENDANCE SYSTEM (SAS)" merupakan satu sistem untuk mengambil kedatangan pelajar ke kelas dengan menggunakan data yang terdapat di dalam salah satu lagi projek tahun akhir iaitu RFID Database Handling System. Sistem ini akan merekodkan kedatangan pelajar dan rekod kedatangan ini disimpan di pusat data Universiti. Sistem ini juga akan dilengkapi dengan beberapa modul lain yang dibangunkan bagi menyelesaikan beberapa masalah biasa yang wujud untuk kegunaan pelajar dan pensyarah. Maklumat daripada RFID Database Handling System juga akan digunakan untuk kegunaan bahagian pentadbiran bagi mengemaskini maklumat seperti statistik pelajar, untuk menghantar surat amaran, peringatan tugasan, dan laporan kepada penjaga. Smart Attendance System telah dibangunkan menggunakan bahasa programming PHP. Manakala bagi sokongan pengkalan data, SAS menggunakan pengkalan data MySQL. Bagi mendapatkan fungsi yang menyeluruh, SAS memerlukan integrasi dengan perisian RFID Database Handling. SAS akan mendapatkan maklumat yang perlu sahaja daripada RFID Database bagi menjalankan proses pengambilan kehadiran pelajar. SAS juga telah dipasang beberapa modul tambahan yang dapat membantu pensyarah dan pelajar didalam bilik kuliah seperti pemberian nota dan peringatan. SAS boleh dipasang pada server Apache atau Internet Information Server dan boleh dilayari menggunakan pelayar web terkini seperti Internet Explorer 7.0 atau Firefox 2.0.

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LIST OF ABBREVIATIONS

PHP	-	Hypertext Preprocessor
ASP	-	Active Server Pages
JSP	-	Java Server Pages
MySQL	-	My Structured Query Language
RFID	-	Radio Frequency Identification
UHF	-	Ultra High Frequency
SAS	-	Smart Attendance System
SMS	-	Short Messaging System
MHz	-	Megahertz
GHz	-	Gigahertz
KHz	-	Kilohertz
RTLS	-	Real Time Locating System
ISO	-	International Standard of Organization
HTML	-	Hypertext Markup Languages
CSS	-	Cascading Style Sheet
CGI	-	Common Gateway Interface
WWW	-	World Wide Web
IIS	-	Internet Information Server
SOA	-	Service Oriented Architecture
CFML	-	ColdFusion Markup Language
XML	-	EXtensible Markup Language
GUI	-	Graphical User Interface
PMON	-	Process Monitor
SMON	-	System Monitor
SGA	-	System Global Area
ODBC	-	Open Database Connectivity

CHAPTER I

INTRODUCTION

1.1 Project Background

Nowadays, due to the easy availability of almost all information on the internet these days, students are less motivated to attend the lecture. This project is to simplify attendance recorded system by using Radio Frequency Identification (RFID) technology. SMART ATTENDANCE SYSTEM (SAS) is a web based application that was been developed to overcome this problem. With the RFID kit from Mifare Corp, the system has been developed by using PHP programming languages and MySQL for database support. The system also has been integrated with the RFID Database Handling System for a full functionality system. The information from the RFID Database Handling System has been used for most part of this SAS system.

Smart Attendance System also equipped with other interactive modules for lecturer and students. Therefore, the system functionality is not only recorded the student attendance, but also solved other common problem encounter during class session. These problems are such as notes distribution, assessment reminder, assignment paper distribution, and grades results.

1.2 Objective Of Project

The objectives of this project are to simplify the attendance recorded system, and solve several problems that occurred during class session. The system is capable to display the student attendance status during class session. The student also can see their name been displayed on screen. The system will provide additional functions such as warning for the unattended student, distribution of the lecture notes, and reminding the dateline of the assignment. Besides, the system is also capable to generate report for an authorized party which is useful for University administrative to have better database record.

1.3 Scope Of Project

Firstly, the system extracted the useful information such as the class schedule, student enter time and student id code from the RFID Database Handling System. Secondly, the system displayed student attendance status during class session. Thirdly, the system stored the data into SAS database appropriately. Fifth, the system runs either on Internet Information System from Microsoft operating system or Apache web server from Linux operating system. For database support, the system use MySQL database server platform. The system also executed, view and run on Windows, Linux, and Mac operating system platform.

1.4 Method Of Project

Firstly, the study of the theory about the overall of this project is done. Next, the most suitable RFID study kit is been selected. Then the web developer server suite environment consists of application and database server technology is installed. Then, the system will be developed, testing, debugging and troubleshooting under this server environment. Next phase is to design the database for five different modules of the system. Finally, the system integration with the RFID Database Handling System will be done.

1.5 Problem Statement

Today attendance software based system has several problems to be deployed and use especially in large environment such as Universities. There is lots of attendance based software especially in windows platform used by universities. Unfortunately, the need for wide distribution presents an especially challenging problem. The traditional Windows approach of installing software has the following problems involved such as software must be installed on each desktop. Furthermore, software upgrades are problematic thus the software that changes frequently must be reinstalled on each desktop. Other problems also covered a network-based installation which can be difficult to upgrade if users are running the software on a 24x7 basis.

The solution to all of the above problems lies in using Web-based technologies and intranet. With web-based solutions, each end user accesses the attendance software through a web browser. Because all desktops now come standard with either Microsoft Internet Explorer or Firefox as browsers, each desktop already has the tools needed to access a variety of applications.

CHAPTER II

LITERATURE REVIEW

2.1 Introduction

Radio Frequency Identification (RFID) is a generic term that is used to describe a system that transmits the identity of an object or person wirelessly (in the form of a unique serial number), using radio waves. It's grouped under the broad category of automatic identification technologies. RFID is a technology that incorporates the use of electromagnetic or electrostatic coupling in the radio frequency (RF) portion of the electromagnetic spectrum to uniquely identify an object, animal, or person. RFID is coming into increasing use in industry as an alternative to the bar code [1].

The advantage of RFID is that it does not require direct contact or line-of-sight scanning. An RFID system consists of three components: an antenna and transceiver which often combined into one reader and a transponder that usually the tag. The antenna uses RF waves to transmit a signal that activates the transponder. When activated, the tag transmits data back to the antenna. The data is used to notify a programmable logic controller that an action should occur. The action could be as simple as raising an access gate or as complicated as interfacing with a database to carry out a monetary transaction.

2.2 The Basics Of RFID Technology

RFID is the next wave in the evolution of computing [3]. Essentially, it's a technology that connects objects to Internet, so they can be tracked, and companies can share data about them. The concept of this technology is very simple; firstly by placing a transponder which has a microchip with an antenna embedded in it on an item and then use a reader which is a device with one or more antennas to read data off of the microchip using radio waves. The reader passes the information to a computer, so that the data can be used to create business value.

There are many different types of RFID systems, and it's important to choose the right type of RFID system for a particular application [4]. The vast majority of RFID tags or transponders use a silicon microchip to store a unique serial number and usually some additional information. There are two broad categories of RFID systems - ***passive*** and ***active*** systems.

"***Passive***" tags have no power source but use the electromagnetic waves from the reader to energize the chip and transmit back (backscatter) their data. Passive tags can cost less than a quarter and be read up to approximately 10 feet from the reader's antenna.

"***Active***" tags have a battery that can transmit up to 300 feet indoors and more than a thousand feet outdoors. Active tags cost more than passive tags and they periodically transmits a signal for readers to pick up or may lie dormant until they sense the reader's signal.

2.2.1 Active RFID Systems

Active tags are used on large assets, such as cargo containers, rail cars and large reusable containers, which need to be tracked over long distances such as in a distribution yard, for example [5]. They usually operate at 455 MHz, 2.45 GHz, or 5.8 GHz, and they typically have a read range of 60 feet to 300 feet (20 meters to 100 meters).

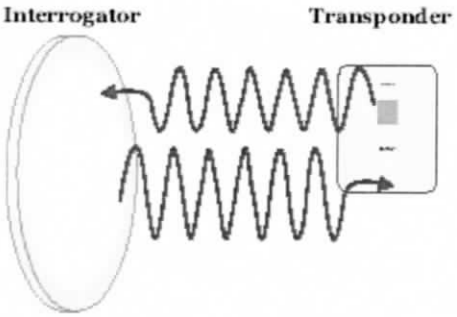

Figure 2.2: Active RFID System

There are two types of active tags which is a transponders and a beacons. Active transponders are woken up when they receive a signal from a reader. These are used in toll payment collection, checkpoint control and other systems. When a car with an active transponder approaches a tollbooth, a reader at the booth sends out a signal that wakes up the transponder on the car windshield. The transponder then broadcasts its unique ID to the reader. Transponders conserved battery life by having the tag broadcast its signal only when it is within range of a reader.

Beacons are used in most real-time locating systems (RTLS), where the precise location of an asset needs to be tracked. In an RTLS, a beacon emits a signal with its unique identifier at pre-set intervals which it could be every three seconds or once a day, depending on how important it is to know the location of an asset at a particular moment in time. The beacon's signal is picked up by at least three reader antennas positioned around the perimeter of the area where assets are being tracked.

2.2.2 Passive RFID Systems

Passive RFID tags have no power source and no transmitter. They are cheaper than active tag and require no maintenance, which is why retailers and manufacturers are looking to use passive tags in their supply chains [6]. They have a much shorter read range than active tags which is a few inches to 30 feet.

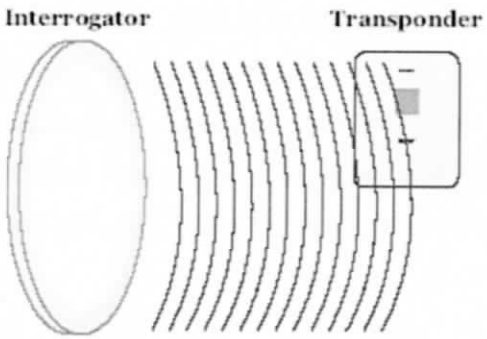

Figure 2.3: Passive RFID System

A passive RFID transponder consists of a microchip attached to an antenna. The transponder can be packaged in many different ways. It can be mounted on a substrate to create a tag, or sandwiched between an adhesive layer and a paper label to create a printable RFID label, or smart label. Transponders can also be embedded in a plastic card, a key fob, the walls of a plastic container, and special packaging to resist heat, cold or harsh cleaning chemicals. The form factor used depends on the application, but packaging the transponder adds significantly to the cost.

Passive tags can operate at low frequency, high frequency and ultra-high frequency. Low-frequency systems generally operate at 124 kHz, 125 kHz or 135 kHz. High-frequency systems use 13.56 MHz, and ultra-high frequency systems use a band anywhere from 860 MHz to 960 MHz. Some systems also use 2.45 GHz and other areas of the radio spectrum.

2.3 A Summary Of RFID Standards

Standards are critical for many RFID applications. A great deal of work has been going on over the past decade to develop a standard for different RFID frequencies and applications [7].

ISO has created standards for tracking cattle with RFID. ISO 11784 defines how data is structured on the tag [8]. ISO 11785 defines the air interface protocol. ISO has created a standard for the air interface protocol for RFID tags used in payment systems and contact less smart cards (ISO 14443) and in vicinity cards (ISO 15693). It also has established standards for testing the conformance of RFID tags and readers to a standard (ISO 18047), and for testing the performance of RFID tags and readers (ISO 18046).

The Auto-ID Center was set up in 1999 to develop the Electronic Product Code and related technologies that could be used to identify products and track them through the global supply chain. Its mission was to develop a low-cost RFID system; because the tags needed to be disposable. It had to operate in the ultra-high frequency band, because only UHF delivered the read range needed for supply chain applications, such as reading pallets coming through a dock door.

The classes changed over time, but here is what was originally proposed.

i. Class 1: a simple, passive, read-only backscatter tag with one-time, field-programmable non-volatile memory.
ii. Class 2: a passive backscatter tag with up to 65 KB of read-write memory.
iii. Class 3: a semi-passive backscatter tag, with up to 65 KB read-write memories; essentially, a Class 2 tag with a built-in battery to support increased read range.
iv. Class 4: an active tag that uses a built-in battery to run the microchip's circuitry and to power a transmitter that broadcasts a signal to a reader.
v. Class 5: an active RFID tag that can communicate with other Class 5 tags and/or other devices.

ISO has developed RFID standards for automatic identification and item management. This standard, known as the ISO 18000 series, covers the air interface protocol for systems likely to be used to track goods in the supply chain. They cover the major frequencies used in RFID systems around the world [9]. The seven parts are:

i. 18000? : Generic parameters for air interfaces for globally accepted frequencies.
ii. 18000? : Air interface for 135 KHz.
iii. 18000? : Air interface for 13.56 MHz.
iv. 18000? : Air interface for 2.45 GHz.
v. 18000? : Air interface for 5.8 GHz.
vi. 18000? : Air interface for 860 MHz to 930 MHz.
vii. 18000? : Air interface at 433.92 MHz.

2.4 RFID Business Applications

The Radio Frequency Identification is an enabling technology, which means it doesn't provide much value on its own, but it enables companies to develop applications that create value. The Internet is another enabling technology, and just as the Internet enables companies to communicate, collaborate, educate, sell, entertain and distribute products, RFID enables companies to do many different things [10].

2.4.1 Asset Tracking

It's no surprise that asset tracking is one of the most common uses of RFID. Companies can put RFID tags on assets that are lost or stolen often, that are underutilized or that are just hard to locate at the time they are needed. Just about every type of RFID system is used for asset management. NYK Logistics, a third-party logistics provider based in Secaucus, N.J., needed to track containers at its