

Staff Attendance System Using RFID

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Abstract— Attendance system University Tun Hussien Onn Malaysia is the system to record, and monitor the staff attendance to the daily work. This project is to design develop and implement attendance system using radio frequency identification technology. This technology is divided into two types which are system passive and system active. The proposed system used the system passive to record staff attendance. Frequency identification technology will read the staffs tag and the attendance are recorded automatically and store it in database. The proposed system has several securities feature that can prevent security breaches which is captcha and audit trail. The advantage of proposed system is can differentiate between the human input and robot input and record all the user activity when access to the system.

Keywords— Attendance system, Radio frequency identification technology, Captcha, Audit trail.

I. INTRODUCTION

Attendance is an action of particular person present on event at work. Attendance can be recorded manually or by using automated system. Manual system uses the paper card to record the staff attendance such as the Bundy Clock a stamping machine. Automated system uses a device to verify the identity of the person such as electronic tags or barcode badges. Faculty of Computer Science and Information Technology (FSKTM) need the attendance system to monitor the staff present in working hours and keep tracks on when the staff are not working.

FSKTM has two categories of staff namely academic staffs and non-academic staffs. Both academic and non-academic staffs need to record their attendance twice a day. Time recording for academic staffs is flexible. Time recording for non-academic is fixed which is before eight am and after five pm. FSKTM use the Radio Frequency identification (RFID) system passive to record the staff attendances. So that each staff is provided a tag and each tag has their own unique ID.

Every working day, all staff are required to record their attendance by sliding their attendance at the provided machine. All staff require to record their attendance. If any staffs forget to record their attendance more than three time, the staff will be given warning letter. It will give a big impact to the working performance for the staff. For example, not be able to get promotion or increase the salary annually. Hence for those who forgot the record the attendance, they have to provide

proof that they had presented. After that, they need to get the approval by the head of department or dean. One major problem is the head of department and dean have to verify the information given by the staff.

The existing system, administrator can only view update add delete and edit the staffs' information and attendance record. If some of the private data has been modified and change by another user, administrator cannot trace which user perform that action. So that this will against the integrity of the data. Data should be altered or modify by the authorized user only. Besides that, when the staff want to access the system user just need username and password to gain authorized access to the system. The attacker can use brute force attack to gain access to the system. The attacker can try and error many time in accessing the existing system. The existing system will not block or freeze the account for the fault tries. Hence there is a need to have a freeze account feature to ensure the security of the system. For example, when the staff enter wrong password more than five times, the system will block the staff account. To activate the account, the staff need to contact the administrator system.

II. LITERATURE REVIEW

RFID system consists various components that are connected to one another by a dedicated communication path. As shown in Fig. 1 the components of the RFID technology. Each component is integrated into the system to implement the benefit of RFID solution. The list of components is tag, reader and database [1-3].

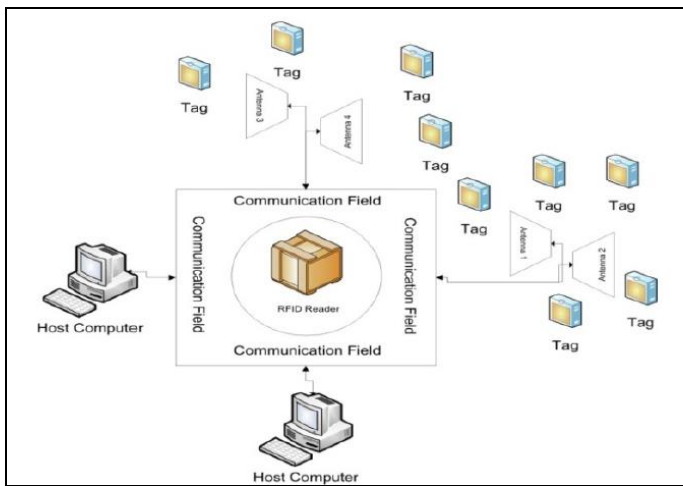


Fig. 1 RFID components [1]

A. Tags

Tag is the object attached to any product and uses an unique sequence for the tracking of radio waves [1]. The tag consists of a microchip that stores the unique sequence identifier that is useful in identifying objects individually. The sequence is in a numeric serial which is store in the RFID memory. The memory tag can be permanent or re-writable. Table 1 shows the type of tags.

TABLE I
TYPE OF TAGS

Feature	Type of tags	
	Passive [4]	Active [5]
Read range	Short (approximately 17m)	Long (20-100 m)
Battery	No	Yes
Lifespan	Up to 20 years	Between 3-5 years
Frequency	902-928 MHz	455 Mhz, 2.45 Ghz, or 5.8 Ghz
Availability	Only in field of reader	Continues
Storage	128 bytes read/read	128 Kbytes read/read

B. Reader

The interaction between the reader and tag is depends on type of tag used. The different tag carries different information about the specific target. The communication may be a simple ping or be more complex multi round protocol [6]. The reader will transmit a beam of impulses. This means gives commands to the tag and waiting for response. The reader will communicate with many tags at a certain time. So the reader need to perform a collision protocol to ensure that the communication conflict between the tags can be avoided.

C. Database

Database is the collection of the information that is organized so that easily to access, manage and update. In the propose system use the Microsoft SQL Server 2014 to store all the information for example staff information and tag information.

D. Type of RFID

1) *RFID System Passive*: RFID system-passive is the most popular technology used in the world. In RFID system-passive, the reader sends the radio signal to the tag. Then the tag is use the signal to activate and send energy or signal back to the reader [7]. This RFID passive-system ranges is limited by the power of the tags which is less than 10 meter. Passive tags do not have own power source and just need a tag chip and reader.

2) *RFID System Active*: In RFID system-active, tags have their own power supply and transmitter. The tags usually use the battery. RFID tags has their own signal to transmit the data or information on the microchips. The active tags are divided into the two types which is transponders and beacons. The function of the transponder is to conserve battery life. The transponders will active if and only if they receive a radio signal from the reader. If the transponder does not receive any radio signal, the tag will be deactivating and it will save battery energy. Beacons are used in Real Time Locating Systems (RTLS).

3) Operating frequency

TABLE II
RFID OPERATING FREQUENCY [8]

Frequency Range	Frequency	Passive read distance
Low Frequency (LF)	120-140 KHz	10 cm - 20 cm
High Frequency (HF)	13.56 MHz	10 cm – 1 m
Ultra-High Frequency (UHF)	868-928 MHz	3 meters

Low Frequency (LF)

The LF frequency is the lowest frequency which is between 120 KHz to 140 KHz and usually RF system works at 125 KHz [8]. This range frequency provides a short read range between 10 cm to 20 cm. LF read speed is the slowest compare to the other Frequency range but not very sensitive to the radio wave interference.

High Frequency (HF)

HF frequency is the intermediate frequency which is 13.56 MHz [8]. This range frequency provides more wide read range compare to LF between 10 cm to 1 m. HF has the high data read rate but not good as LF in proximity to metals o liquid.

Ultra-High Frequency (UHF)

UHF has the high frequency compare to LF and HF frequency which is between 868 - 928 MHz [8]. UHF has wide read range compare to LR and HR which is between three meter. UHF provide a high speed data read compare to other but UHF experience interference proximity to liquid and metal.

TABLE 4
WORKFLOW ACTIVITIES

Phases	Activities	Output
Requirement Specification Phase	The users' requirements are collected.	List of detailed problem and user requirement
System Analysis Phase	All the data collected are analysed to identify the best method to create a new system that fulfil all the user requirement.	List of detail input and output specification.
System Design Phase	Perform design the interface design, classes and database design	- Data Flow Diagram (DFD) - Entity Relationship Diagram (ERD) - Unified Modelling Language (UML)
Implementation Phase	Create and build the database, user interface and classes.	Attendance system with RFID
Testing Phase	Perform functional testing each part of the new system	Testing report
Deployment Phase	The system is installed on the user computer	User feedback
Maintenance Phase	New system is monitored and controlled	High performance system

4) Comparison with new system and existing system

TABLE III
COMPARISON BETWEEN THE PROPOSED SYSTEM AND EXISTING SYSTEM

Detail	Staff attendance using a RFID system passive [9]	Manual punch card system at FSKTM [10]	Outing system (KMNS) [11]	System propose
Characteristic				
• Admin module	Yes	No	Yes	Yes
• User Module	Yes	No	No	Yes
• Output display	Yes	Yes	Yes	Yes
• Control functionality	Yes	Yes	Yes	Yes
• RFID technology	Yes	No	No	Yes
Programming languages	Visual Basic.Net		Personal Home Page (PHP)	Visual Basic .NET
user Friendly	Yes	No	No	Yes
Captcha code	No	No	No	Yes
Audit Trail	No	No	No	Yes

Table 3 displays the comparison between the three related systems for producing useful comparative decision to develop the proposed system. In terms of use of the databases, all the existing systems use the database except for the manual punch card system. The characteristics studied are based on the administrator module and user module. All systems studied just have the administrator module. The administrator can manage and monitor all the process in the system.

All the systems have the control functionality. Based on the use of the RFID technology, all the systems use this technology accept the punch card system and Outing system KMNS. This is because manual punch card system only uses the card to record the employee attendance and outing system KMNS use the barcode to differentiate each student. Based on the programming languages, only two system use visual basic which is staff attendance using RFID system passive and the system propose. Outing system in KMNS used PHP as a platform.

All three existing systems do not have a captcha code and audit trail. These two components are important to protect the system from being attack by the unauthorized user. This two component will be implement to the propose system in order to protect the system from the security breach

III. METHODOLOGY

To complete this project, object oriented software development process is followed. There are seven phases in this object oriented software development process. There is requirement specification phase, system analysis phase, system design phase, implementation phase, testing phase, deployment phase and maintenance phase [12]. The details activities for each phase is shown in Table 4.

IV. OBJECT ORIENTED ANALYSIS AND DESIGN

A. The Use Case Diagram

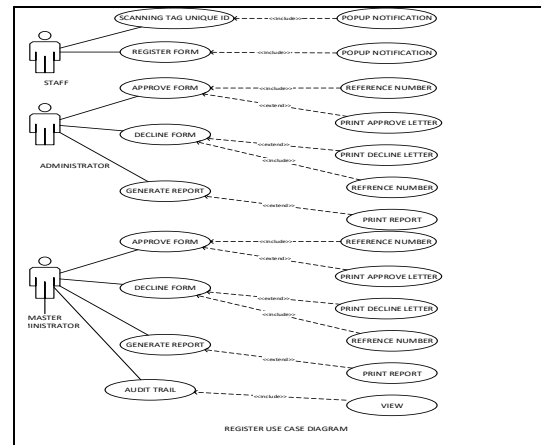


Fig. 2 Staff attendance use case diagram

The use case diagram shows there are three main users, namely staff, administrator, and master administrator (see Fig. 2). The common activities are describing as below.

1) *Registration Form*: The registration form is to register new staff. The staff fill up the form and submit for approval by the administrator. After the form is successfully submitted the form, the pop up notification is displayed on the monitor.

2) *Approve Form*: Approve form can only can be accessed by the administrator. The administrator needs to perform a task which is to approve the staff registration form. If the staff registration form is followed all the criteria needed, the administrator can approve the registration form

3) *Decline Form*: Decline form only can be accessed by the administrator. Administrator needs to perform a task which is to decline the staff registration form. If the staff registration form does not follow all the criteria needed, the administrator can decline the registration form.

4) *Generate Report*: The administrator can generate a report about the staff registration at the end month or year. After generation of the report is complete, the administrator can print the report for the future action or present it to the dean.

5) *Scanning Tag Unique ID*: When the staff walk through the RFID reader with the tag, the staff needs to scan the tag. The system compares the unique id in the database to get the id information. Then the system displays a pop up notification at the monitor to inform that the attendance has been recorded.

6) *Audit Trail*: Master administrator can view and delete user activities when access to the system.

B. Class Diagram

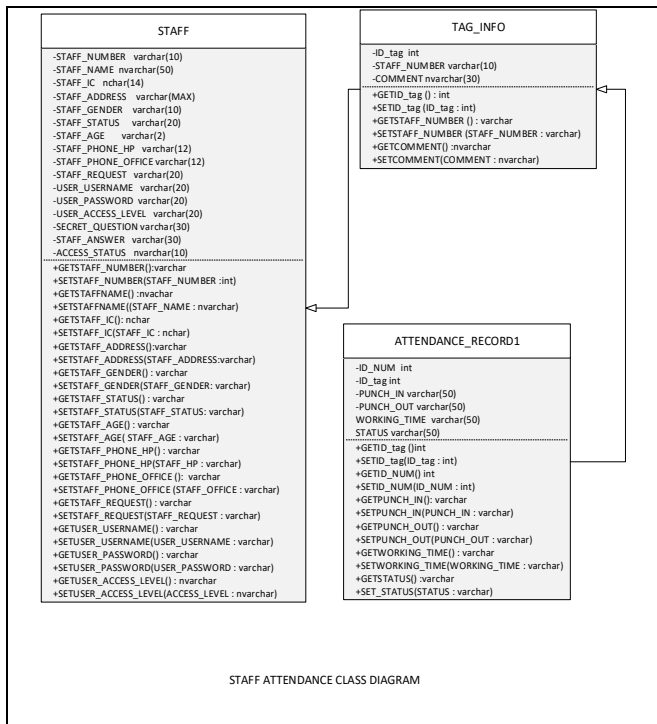


Fig. 3 Class diagram for staff attendance

Class diagram is static model that describes classes and their relationship of the system. Figure 3 shows the class diagram of the staff attendance. It shows that the proposed system has three class which is class STAFF, class TAG_INFO and ATTENDANCE_RECORD1.

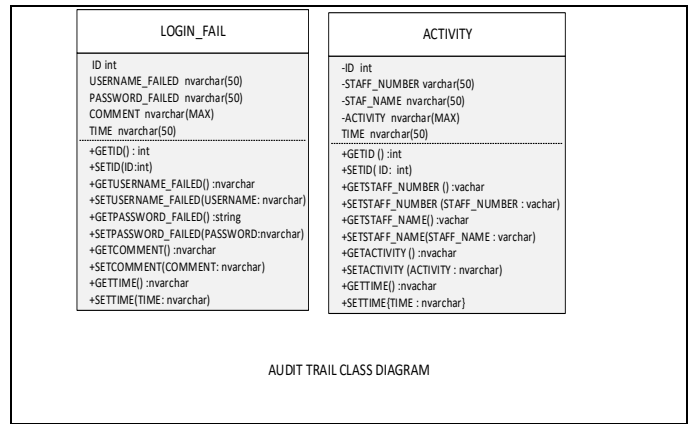


Fig 4: class diagram for Audit Trail

Figure 4 shows the class diagram for audit trail. It shows that the system has two class which is LOGIN_FAIL and ACTIVITY.

C. Database Design

The database design is important to give an initial overview of the tables of a database is developed. Specifications for each table described to explain in detail which is on an entity such as entity and attribute definitions involved and a description of each attribute. Figure 4 and Figure 5 shows the database design for the propose system.

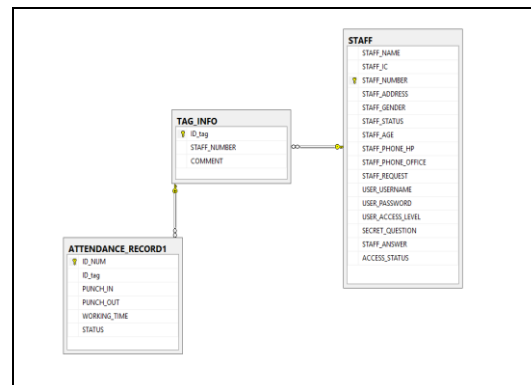


Fig. 4 Database design for the purpose system

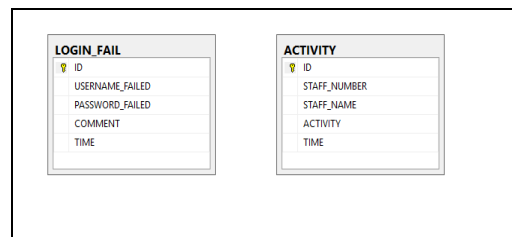


Fig. 5 Database design for Audit Trail

V. SYSTEM IMPLEMENTATION AND TESTING

1) Creating and connecting database

```
Public Const cnString As String = ("Data
Source=DESKTOP-
87SQ4GU\SQLEXPRESS;Initial
Catalog=STAFF_ATTENDANCE1;User
ID=sa;Password=thariq9694hebat")
Public Const cnString21 As String = ("Data
Source=DESKTOP-
87SQ4GU\SQLEXPRESS;Initial
Catalog=AUDIT;User
ID=sa;Password=thariq9694hebat")
```

Fig. 6 Database Connection Command

Staff Attendance System used SQL Server 2014 for system database. This system used SQL command for connection between database and system interface. Fig. 6 shows the command used to connect database to the system.

2) Development of record staff attendance

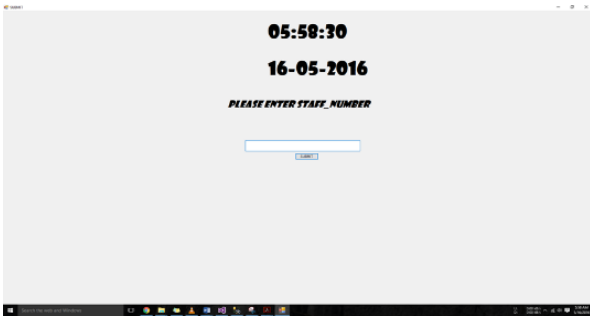


Fig. 7 Interface for record staff attendance

staff need to bring tag RFID every day to work. Staff needs to swipe their tags with a RFID reader so that the reader can collect the tag ID and send it to the system. Fig. 7 shows the interface for record staff attendance. Fig. 8 shows the code segmentation for record staff attendance.

```
Dim connection As SqlConnection
Dim adapter, adaptere As New SqlDataAdapter
Dim As New SqlDataAdapter
Dim sql As String
connection = New SqlConnection(cnString)
sql = " INSERT INTO [dbo].[ATTENDANCE_RECORD1]
([ID_tag],[PUNCH_IN],[PUNCH_OUT],[WORKING_TIME],[STATUS])
VALUES (" & TextBox1.Text & "," & Label4.Text & ",NULL,'" &
Label1.Text & "','LEWAT)"
Try
connection.Open()
adapter.InsertCommand = New SqlCommand(sql, connection)
adapter.InsertCommand.ExecuteNonQuery()
```

Fig. 8 Code segmentation for record staff attendance.

3) Development of Login page process

Staff Attendance System consists of three types of users which are master administrator, administrator, and staff. Fig. 9 shows the interface of user login. Users must enter username, password and code captcha before can access to the system. After users enter username and password successfully, the system automatically identifies the type of users and then redirect to the specific page.

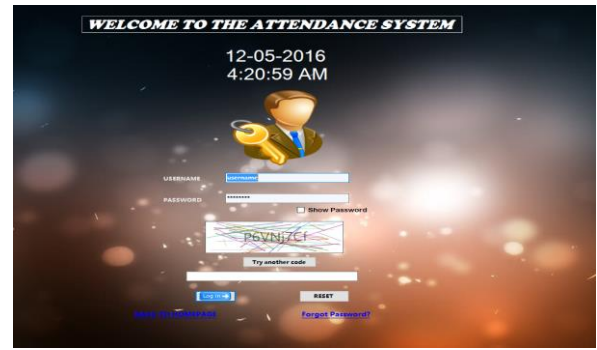


Fig. 9 Interface of user login

Fig. 10 shows the code segmentation for user to login to the system.

```
ElseIf txt_username.Text = username And Encrypt(txt_password.Text)
= password And level = "ADMINISTRATOR" And status =
"ACTIVE" And status = "TRUE" Then
MsgBox("Variable sama dol :" & TextBox2.Text)
ProgressBar1.Visible = True
MsgBox("LOGIN SUCCESS.LOGIN AS
ADMINISTRATOR", MsgBoxStyle.Information, "LOGIN")
Dim Obj As New ADMINISTRATOR
Obj.PassedText2 = txt_username.Text
Obj.Show()
```

Fig. 10 Code segmentation for user login

VI. CONCLUSIONS

The proposed system basically achieved the objective which is to design, develop and test the record staff attendance using the RFID technology.

1) System advantage

The advantage of this proposed system are:

- I. Provides the platform to staff FSKTM to record their attendance every morning and evening.
- II. Staffs can view their attendance record at any time.
- III. Allow faculty to monitor the staff attendance record.
- IV. Master administrator can view the staff activity record if necessary.
- V. System has a captcha code to differentiate between human and robot.
- VI. System can block user account if the user failed enter correct password more than five times.

2) System weaknesses

This disadvantage of this proposed system:

- I. System cannot record what data has been modified by the user
- II. User cannot upload their profile picture
- III. System do not have a session timer which is automatically logout if user do not perform any activity at certain time.

3) recommendation for improvement

Attendance record needs to enhance its functionality so the system can give more advantage to the user and can fight with other assessment system on the market.

The suggestion as follows:

- I. The system can record the data change if the user perform update, add, delete and modify activity.
- II. System can allow user to set up their profile picture if needed.

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