

Students' Attendance Management System Based On RFID And Fingerprint Reader

Moth Moth Myint Thein, Chaw Myat Nweand Hla Myo Tun

Abstract: Today students' (class) attendance is become more important part for any organizations/institutions. The conventional method of taking attendance by calling names or signing on paper is very time consuming and insecure, hence inefficient. This paper presents the manual students' attendance management into computerized system for convenience or data reliability. So, the system is developed by the integration of ubiquitous computing systems into classroom for managing the students' attendance using RFID and fingerprint reader. The system is designed to implement an attendance management system based on RFID and fingerprint reader which students need to use their student identification card ID and their finger ID to success the attendance where only authentic student can be recorded the attendance during the class. In this system, passive RFID tag and reader pairs are used to register the student ID cards individually, and fingerprint reader is used for attendance. This system takes attendance electronically with the help of the RFID and finger print device, and the records of the attendance are stored in a database. Students' roll call percentages and their details are easily seen via Graphical User Interface (GUI). This system will have the required databases for students' attendance, teachers, subjects and students' details. This application is implemented by Microsoft Visual Studio and Microsoft SQL Server as IDE. C# language is used to implement this system.

Keywords: RFID Tag and Reader, fingerprint reader, Microsoft Visual Studio, Database

I. INTRODUCTION

Attendance management is the act of managing attendance or presence in a work setting to minimize loss due to employee downtime. Attendance control has traditionally been approached using time clocks and timesheets, but attendance management goes beyond this to provide a working environment which maximizes and motivates employee attendance [10]. The existing conventional attendance system requires students to manually sign the attendance sheet every time they attend a class. As common as it seems, such system lacks automation, where a number of problems may arise. This includes the time unnecessarily consumed by the students to find and sign their name on the attendance sheet; some students may mistakenly or purposely sign another student's name. Also, the attendance sheet may get misplaced [1]. As for system development and implementation, it should be able to help the lecturers to managing their student attendance systematically. The system must have database that contains student information and it must be able to help lecturer to manipulate data, update database, alert lecturers accordingly, and also nice interface to make it easier to use. Finally, the attendance system must be user friendly for commercial purpose. This system will focus on MTU regulation about attendance to class, and implement it to develop the system that will do all the attendance management automatically. By using RFID technology, it is easier and faster to detect students handling at that time and reduce assets losses. In this system the fingerprint recognition is also adopted to enable the process of identifying of student more reliable and secure for facilities management. RFID and fingerprint based attendance management system was developed to provide a faster, more secure, and more convenient method of user verification than passwords and tokens can provide for a reliable personal identification.

II. SYSTEM DESIGN

The aim of this system is to transform manual management system to automatic system with the help of Microsoft Visual studio 2012, Microsoft SQL Server 2012, RFID and fingerprint technology. C # language is used to implement this system. This system could be used by two categories of people mainly admin/teacher and student. In admin category, admin can register/save/delete/update teachers and students profiles, and details to the database and find the teachers/students details (if any). In this system, admin may register to every student with specific RFID card ID and finger ID to attend the lecture. Whenever a new student is registered to attend the lecture, an RFID tag is attached into the student ID card and his/her fingerprint is registered and saved in database, and the information of students such as student name, his/her card ID and finger ID, and personalities of student are also captured in the computer database. All information of teachers/students in that attendance lecture are stored in the computer database. Each teacher is registered and supplied with a username and password by the administrator as identification data for them. In this system, if teachers want to calculate students' attendance, they don't need to use manual roll call calculation. System will automatically calculate students' attendance by reading students' unique ID card with RFID tag number and finger ID number and comparing this RFID card ID number and finger ID number with information stored on the DBMS according to their ID's that we have assigned to them. In student portion, the use of attendance management software that is interfaced to a RFID and fingerprint device. The student bio data (Matriculation number, Name, Gender and Date of Birth), card ID number and finger ID number is enrolled first into the database. Our aim is to create a system with one server to which PC's are connected, so all data will be saved in one data base, marking the monitoring of the information effortless. All classes must have a PC with a connected RFID reader that can read student RFID-cards, as well as a fingerprint reader that take their fingerprints. The fingerprint reader is meant to prevent a student from giving his/her RFID-card to classmate who attends the lecture, scanning the other student's RFID-card to make it appear as if he/she had also attended. When a student enters class, this RFID reader reads his/her student

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ID, and his/her finger must press on fingerprint reader. These RFID tag and fingerprint data send to a PC with a connected RFID-reader and fingerprint reader. The PC, in turn, sends all the data it has collected to the server database form Graphical User Interface (GUI).

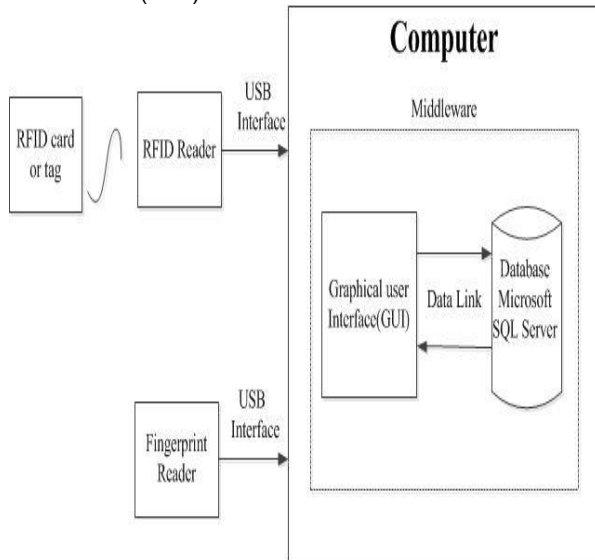


Fig 1: Block Diagram of the Student Attendance System

III. SYSTEM ARCHITECTURE

A. CR10M RFID Reader

In this system, CR10MRFID reader is used. The RFID reader communicates with the RFID tag via radio waves and passes the information in digital form to a computer system. A reader contains an RF module, which acts as a transceiver of radio frequency signals. RFID reader receives RF transmissions from an RFID device and transmits to a host system for processing. The reader is a device that has one or more antennas that emit radio waves and receive signals back from the tag.



Fig 2: CR10M RFID Reader

Specifications of CR10M RFID Reader

- Frequency : 13.56 MHZ
- Read Range : Up to 10 cm / Up to 5 cm
- Communication : USB Host
- Operating temperature : -10°C to +70°C
- Power / Current: USB 5V DC/Max. 100mA
- Features : Audible Buzzer, LED Green and Red

B. RFID Passive tag



Fig 3: Passive RFID Tag

A passive RFID tag without a battery. When radio waves from the reader reach the chip's antenna, it creates a magnetic field. The tag draws power from the field and is able to send back information stored on the chip. Passive tag collects hundreds of tags within 3 meters from a single reader and then it collects 20 tags moving at 3 mph or slower.

C. ZK 4500 Fingerprint Reader

Fingerprint reader which captures the image and a personal computer which houses the database, runs the comparison algorithm and simulates the application function. The fingerprint scanner is connected to the computer via its USB interface. Basically this work does not involve the development of hardware. Using the ZK4500 Fingerprint Reader, the ZKFinger Software Development Kit (SDK) toolbox provided by the ZK finger SDK development Guide (will explain the detail) can be used as an interface between the fingerprint reader and the attendance software.



Fig 4: ZK4500 Fingerprint Reader

Specifications of ZK4500 Fingerprint Reader

- Fingerprint Sensor- ZK4500 optical sensor(no film)
- Resolution- 500 DPI/ 256 gray
- Sensing Area-15 x 8 mm
- Image Size-280 x 360 pixel
- Interface- USB 1.1 / 2.0
- Operating Temperature-0-55°C / 32-131°F
- Operating Humidity-20%-80%
- USB Cable -150 cm
- Weight – 0.24kg
- Dimension (W x H x D)-53 x 80 x 66 mm

D. Host Computer

Host Computer or PC provides an interface between the RFID and fingerprint reader hardware, and application based system, which is the "brain" of any RFID and fingerprint reader system. They are used to network multiple RFID interrogators together and to centrally process information. The controller in

any network is most often a PC or a workstation running database or application software, or a network of these machines [4].

E. Middleware

The middleware is an interface required to manage the flow of data from the reader and to transmit it efficiently to the backend database management systems. The middleware monitors the number of tags present in the system and extracts relevant information from the readers [8].

F. Backend Database

The backend database primarily deals with the storage of relevant information recorded by the reader and communicated by the middleware. For example, the middleware in an automated security control system will store all tag readings taken by the reader in the database. This helps create log entries for the system [9].

IV. Software Design

To complete this system, the choosing of software for database and type of RFID and fingerprint reader are very important. The Microsoft SQL Server 2012 is used for database and Microsoft Visual Studio 2012 is used for GUI design. The C sharp language is used to implement the system. The C# language is familiar with many users and suitable for GUI design.

A. Microsoft Visual Studio

Microsoft Visual Studio is an integrated development environment (IDE) from Microsoft. It is used to develop computer programs for Microsoft Windows superfamily of operating systems, as well as web sites, web applications and web services. Visual Studio uses Microsoft software development platforms such as Windows API, Windows Forms applications, Windows Presentation Foundation and Windows Store. This IDE can connect with database by using query language. The C# language is used to write the program.

B. Microsoft SQL Server

Microsoft SQL Server is a relational database management system developed by Microsoft. As a database, it is a software product whose primary function is to store and retrieve data as requested by other software applications, be it those on the same computer or those running on another computer across a network (including the Internet).

C. C# language

C sharp is a programming language that is designed for building a variety of applications that run on the .NET Framework. C# is simple, powerful, type-safe, and object-oriented. The many innovations in C# enable rapid application development while retaining the expressiveness and elegance of C-style languages.

D. Flowchart of the system

The system can be recognized easily by seeing the flow chart of the overall system shown in figure 5 and 6. This system is used by two categories of people mainly admin/teacher and student. Firstly in this system, admin and teacher must use admin/teacher mode and student must use student mode. Admin/Teacher needs to create own username and password

to log in this system. If admin/teacher inputs the username and password wrongly, the login program will not success and neither admin page nor teacher page will not display by the system. Either admin's page or teacher's page will appear for the correct name and password. Therefore, admin/teacher needs to key in the correct username and password to access this system. This system will identify admin/teacher according to their username and password. When admin/teacher enters from admin/teacher mode, admin can make teacher and student registration. Moreover, admin can update and delete teacher/student profiles. Admin/teacher can also be seen students list and daily/monthly attendance reports selected by student name, date and month. When students enter from student mode, system will take their RFID tag from RFID reader. If student's ID tag number is valid stored in database, system will show their details. Then, if students want to get attendance for lecture, they need to press their finger on fingerprint reader. If these card ID and finger ID are matched with data stored in database, student will get roll call percentage for today subject. After attendance, students' attendance will be shown in teacher screen. Here, if student clear off after pressing finger on fingerprint reader, teacher can erase his/her attendance. Moreover, students can also be seen their overall roll call percentages in each subject.

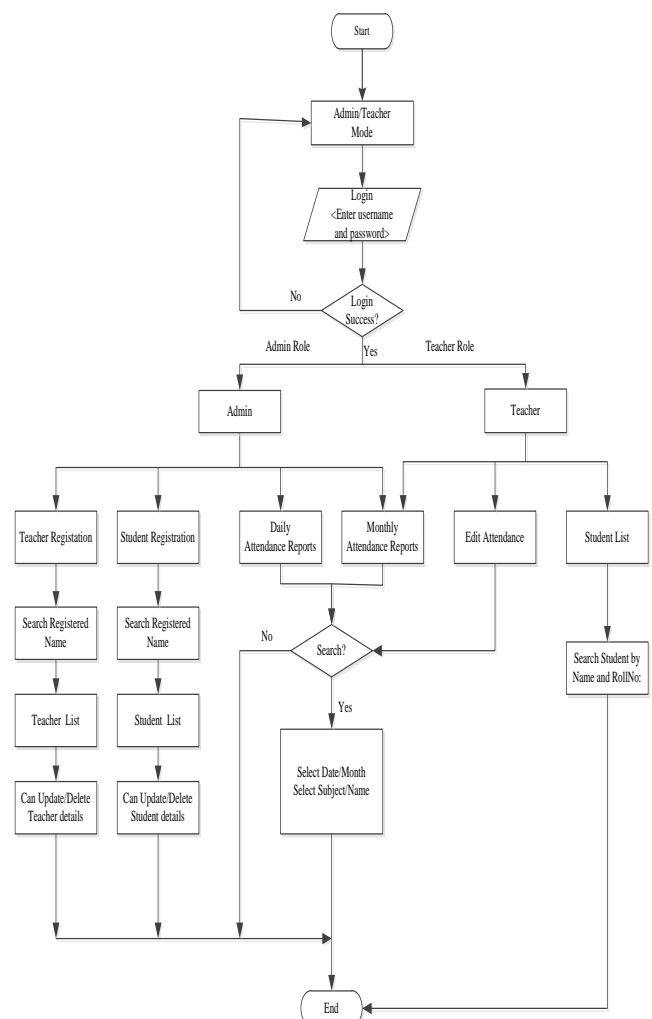


Fig 5: Flowchart for the Admin/Teacher System

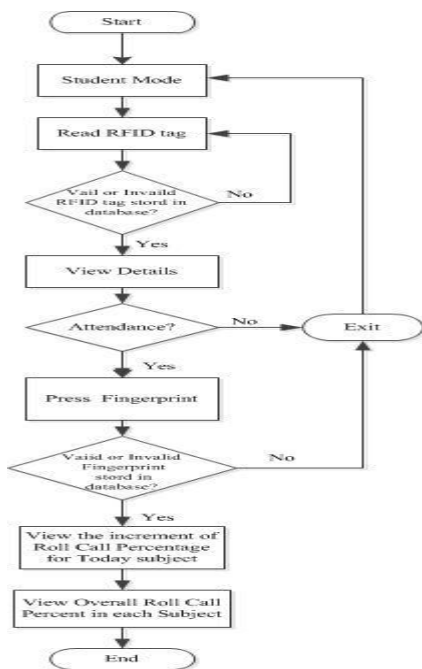


Fig 6: Flowchart for the Student Attendance System

V. EXPERIMENTAL RESULT

In this experiment, ZK 4500 fingerprint reader, passive RFID tag and reader pairs are used. The host computer with Microsoft Visual Studio and SQL Server are also needed. The GUI design and the result are shown in fig 7 to 21 as follows.

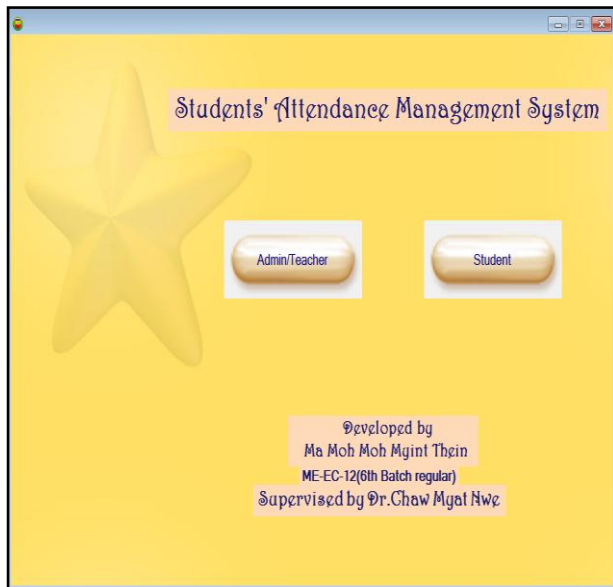


Fig 7: Main page of Students' Attendance Management System

In this page, admin/teacher must use admin/teacher mode and student must also use student mode for entering in this system.

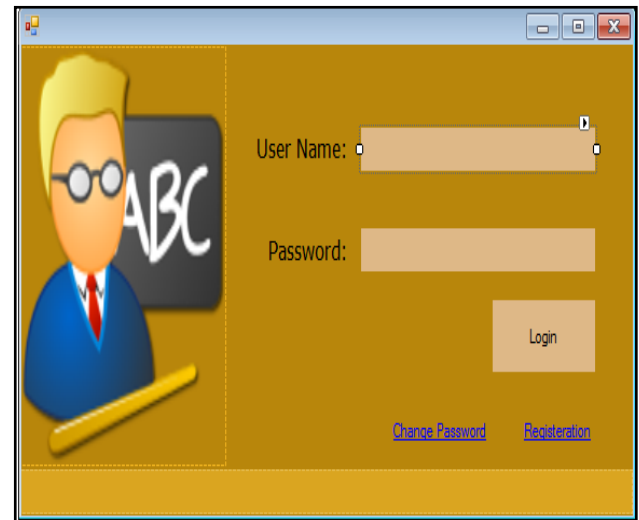


Fig 8: Login Screen for admin and teacher

Admin/Teacher needs to create own username and password to log in this system. This system will identify admin/teacher according to their username and password. Therefore, the admin/teacher needs to key in the correct username and password to access this system. Admin may register to every student with RFID card ID and finger ID. At this position, the user needs to press finger three times. These registered ID number save in SQL server database shown in figure 9 and 10.

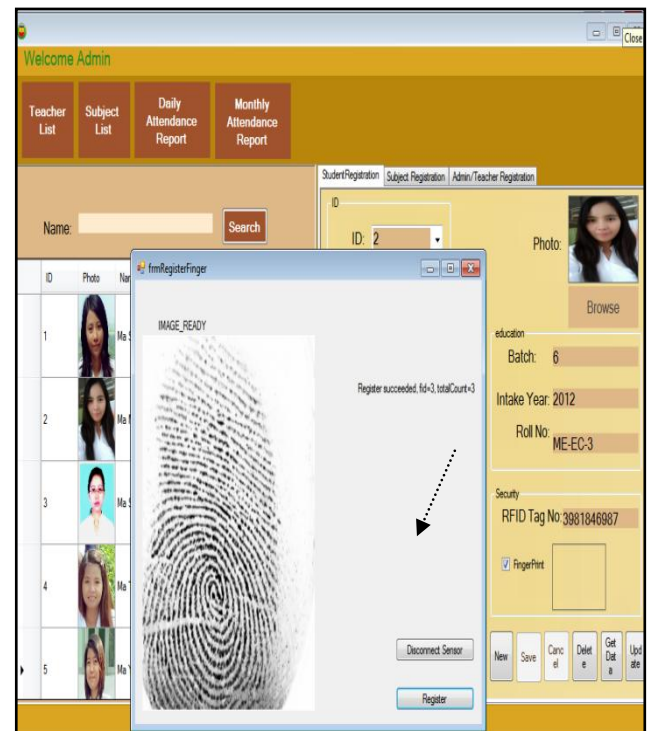
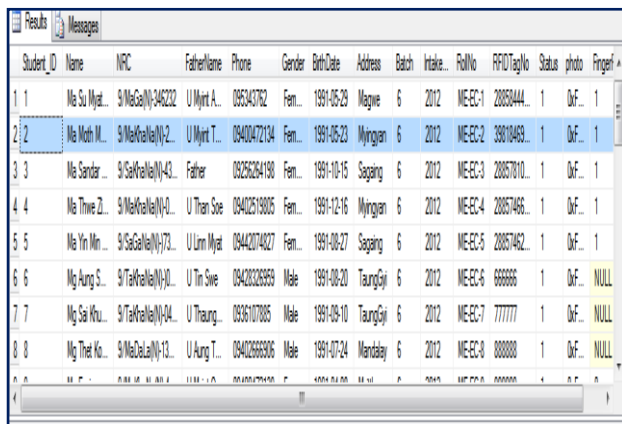
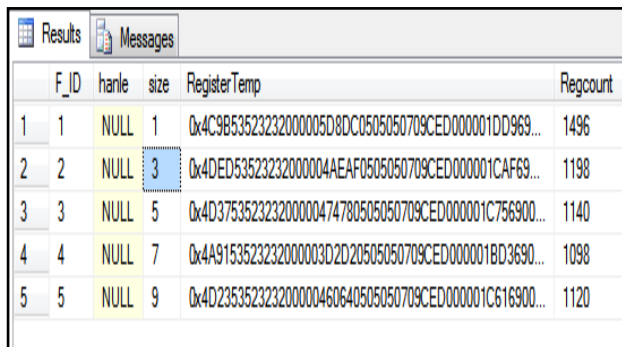


Fig 9: Admin screen



Student ID	Name	NRC	Father Name	Phone	Gender	Birth Date	Address	Batch	Intake	Roll No	RFID Tag No	Status	Photo
1	Ma Su Myat	9/MaSaNa(N)-345232	U Myint A.	095343762	Fem...	1991-05-29	Mingyan	6	2012	ME-EC-1	20030444...	OkF...	1
2	Ma Moth M.	9/MaKhaNa(N)-2	U Myint T.	09400472134	Fem...	1991-05-23	Mingyan	6	2012	ME-EC-2	39818469...	OkF...	1
3	Ma Sander	9/MaKhaNa(N)-43	Father	09256264198	Fem...	1991-10-15	Sagang	6	2012	ME-EC-3	20037010...	OkF...	1
4	Ma Thwe Z.	9/MaKhaNa(N)-40	U Thant Sae	09402519005	Fem...	1991-12-16	Mingyan	6	2012	ME-EC-4	20037466...	OkF...	1
5	Ma Yin Min	9/MaKhaNa(N)-73	U Lin Myat	09442074027	Fem...	1991-08-27	Sagang	6	2012	ME-EC-5	20037462...	OkF...	1
6	Ma Aung S.	9/MaKhaNa(N)-10	U Tin Swe	09420320359	Male	1991-08-20	Taunggyi	6	2012	ME-EC-6	666666	OkF...	NULL
7	Ma Sa Khu.	9/MaKhaNa(N)-04	U Thang	0936107885	Male	1991-06-10	Taunggyi	6	2012	ME-EC-7	777777	OkF...	NULL
8	Ma Thei Ko	9/MaKhaNa(N)-13	U Aung T.	0940266906	Male	1991-07-24	Manday	6	2012	ME-EC-8	888888	OkF...	NULL



F_ID	hanle	size	RegisterTemp	Regcount
1	1	NULL	1	1496
2	2	NULL	3	1198
3	3	NULL	5	1140
4	4	NULL	7	1098
5	5	NULL	9	1120

Fig 10: Student Card ID and Finger ID database

For attendance, student RFID card ID firstly read from RFID reader. According to their RFID card ID that have stored in database, system will show student details. Then student must connect fingerprint sensor for attend the lecture. For verification, student must press his/her finger on fingerprint reader. If these RFID card ID and finger ID are valid, student will get roll call percentage for today subject. Moreover student can also be seen all roll call percentages in each subject from *Show All Roll Call* button. These attendance steps are shown in step by step as following figure 11 to 15.



Please Insert RFID tag and press finger print sensor

RFID Tag No: 3981846987

Connect Finger Print Sensor

Attendance

Show All Roll Call

Month: March

Subject: Digital Signal Processing

Show Roll Call

Name: Ma Moth Moth Myint Thein

RFID Tag No: 3981846987

Roll No: ME-EC-2

Batch: 6

Intake Year: 2012

NRC: 9/MaKhaNa(N)-219082

Father Name: U Myint Thein

Phone: 09400472134

Gender: Female

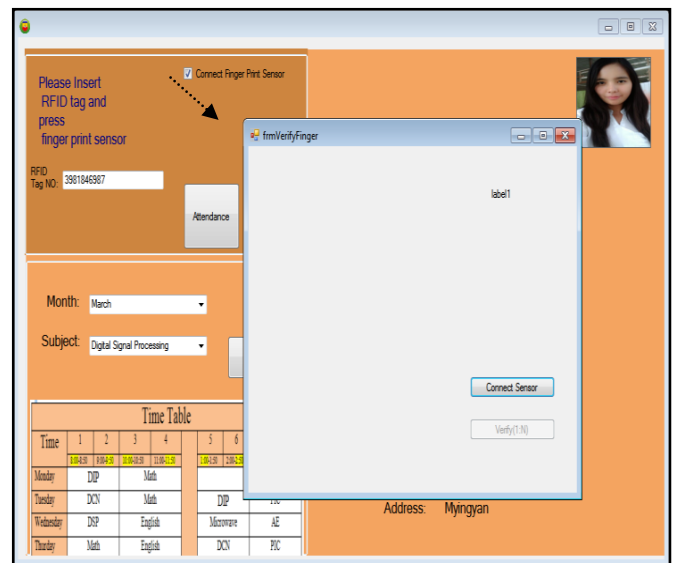
Birth Date: 23/05/1991

Address: Myingyan

Time Table

Time	1	2	3	4	5	6	7	8
Monday	DSP	Math						
Tuesday	DCN	Math						
Wednesday	DSP	English						
Thursday	Math	English						

Fig 11: Student Attendance Step1



Please Insert RFID tag and press finger print sensor

RFID Tag No: 3981846987

Connect Finger Print Sensor

Attendance

Month: March

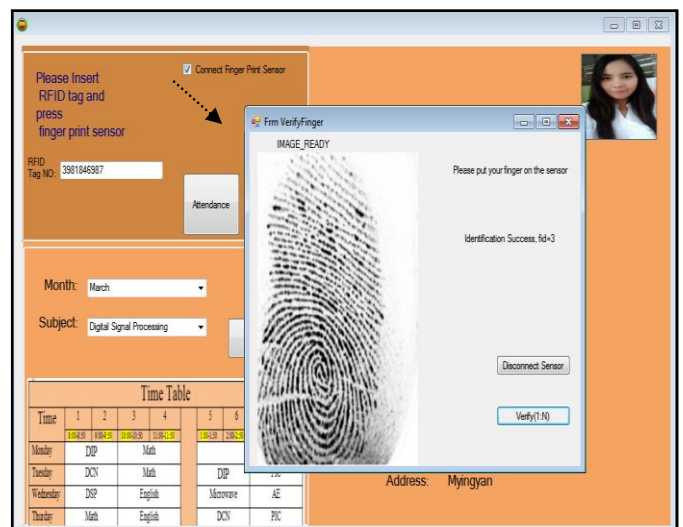
Subject: Digital Signal Processing

Time Table

Time	1	2	3	4	5	6
Monday	DSP	Math				
Tuesday	DCN	Math				
Wednesday	DSP	English				
Thursday	Math	English				

Address: Myingyan

Fig 12: Student Attendance Step2



Please Insert RFID tag and press finger print sensor

RFID Tag No: 3981846987

Connect Finger Print Sensor

Attendance

Month: March

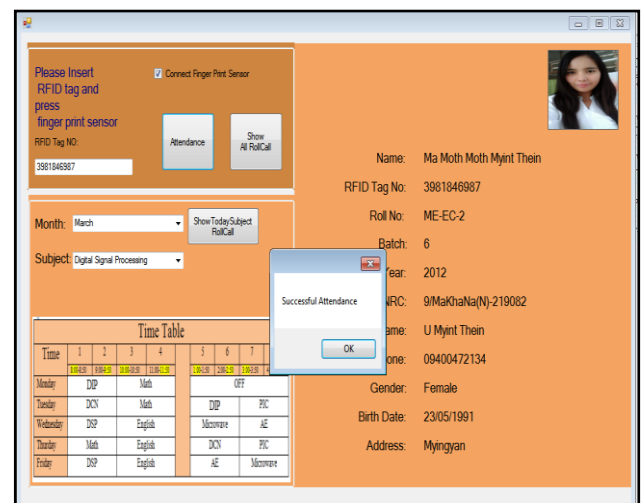
Subject: Digital Signal Processing

Time Table

Time	1	2	3	4	5	6
Monday	DSP	Math				
Tuesday	DCN	Math				
Wednesday	DSP	English				
Thursday	Math	English				

Address: Myingyan

Fig 13: Student Attendance Step3



Please Insert RFID tag and press finger print sensor

RFID Tag No: 3981846987

Connect Finger Print Sensor

Attendance

Month: March

Subject: Digital Signal Processing

Time Table

Time	1	2	3	4	5	6	7	8
Monday	DSP	Math						
Tuesday	DCN	Math						
Wednesday	DSP	English						
Thursday	Math	English						
Friday	DSP	English						

Address: Myingyan

Fig 14: Student Attendance Step4

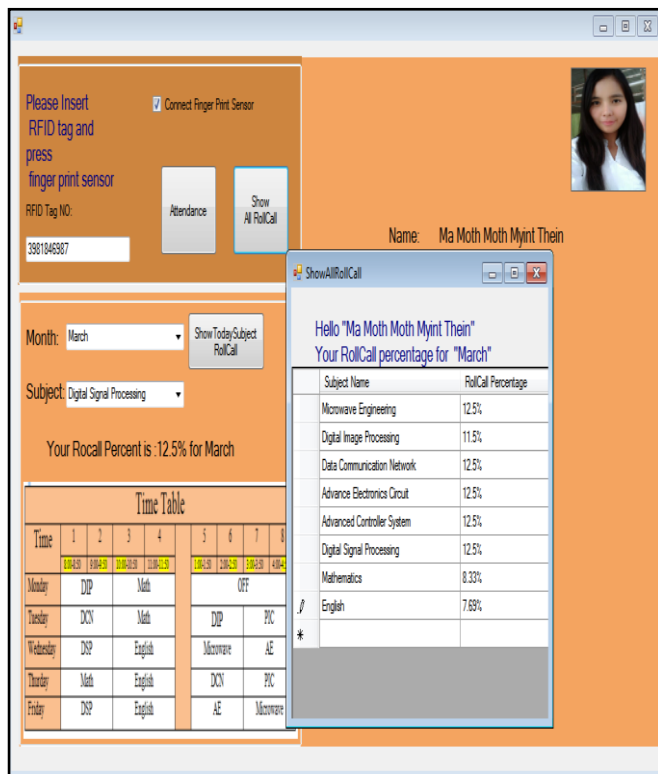


Fig 15: Student Roll Call percentage

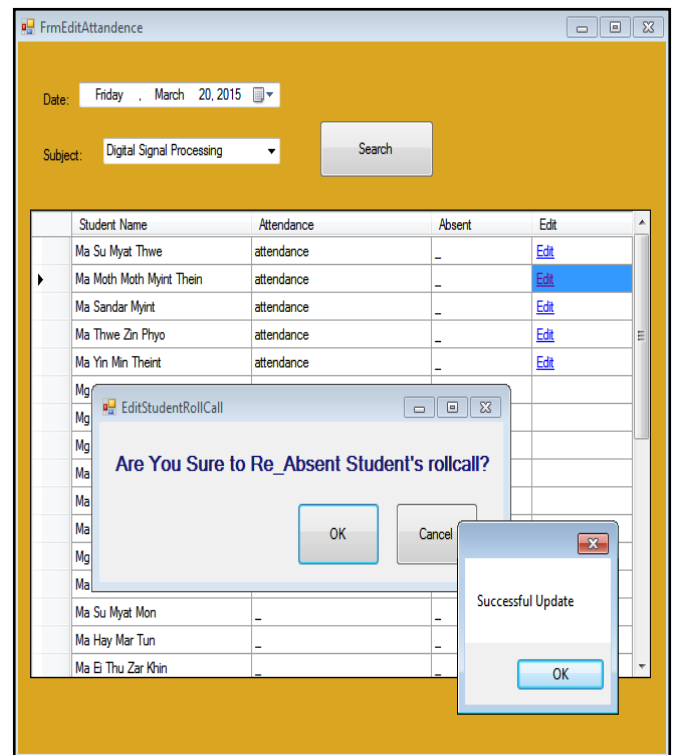


Fig 17: Edit Attendance

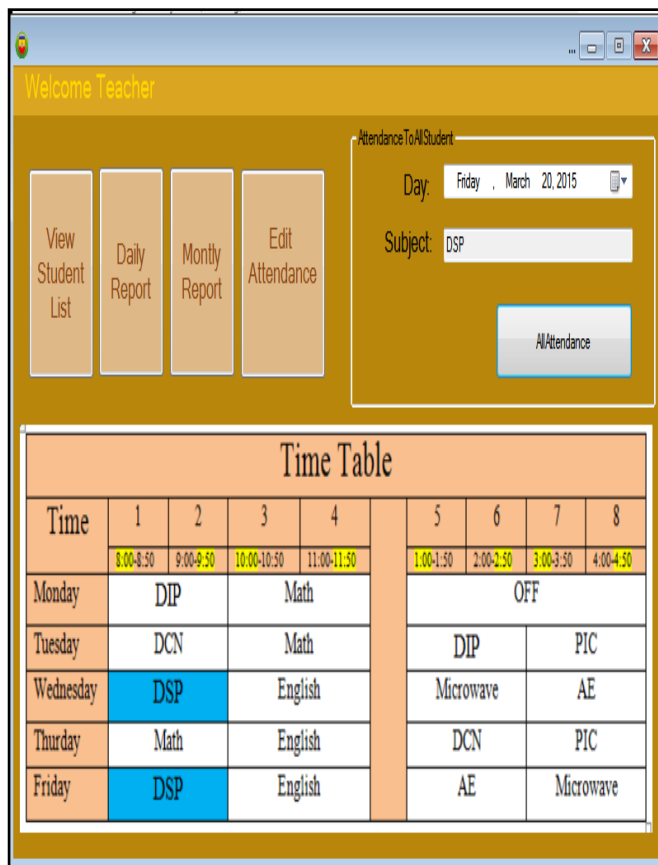


Fig 16: Teacher screen

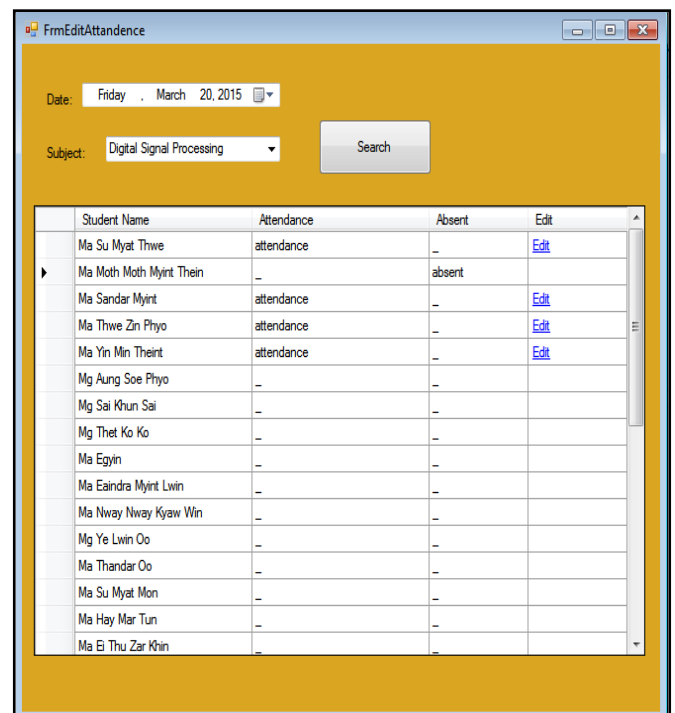
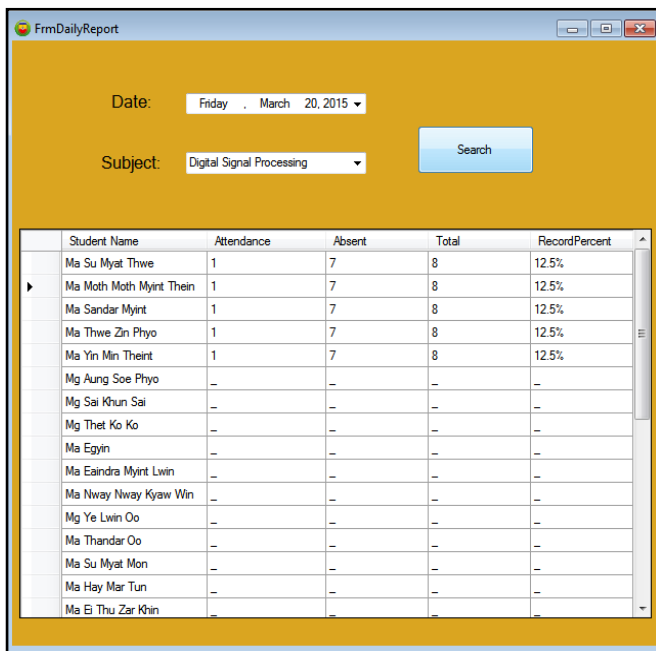


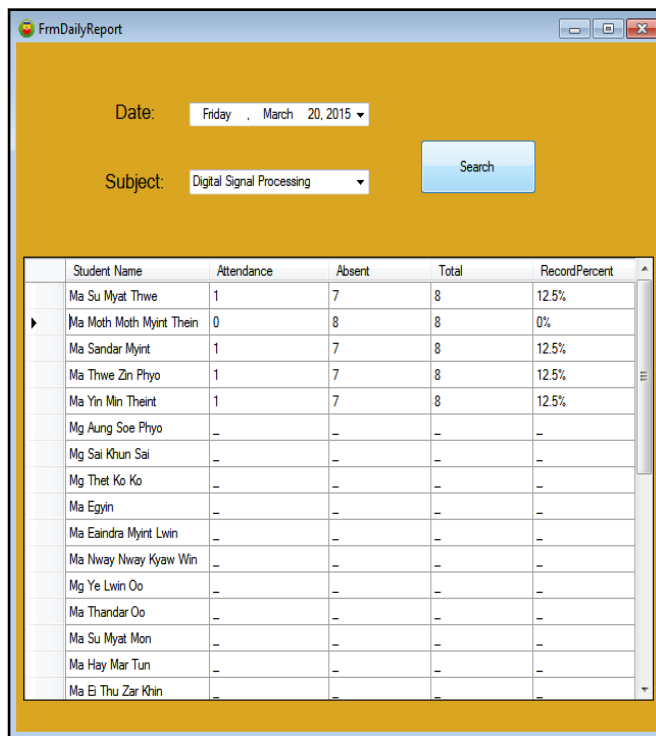
Fig 18: Modify Edit Attendance

After attendance, student attendance will be shown in teacher page. Here, if student clear off after pressing finger on fingerprint reader, teacher can edit his/her attendance. These results are shown in Figure 16 to 18.



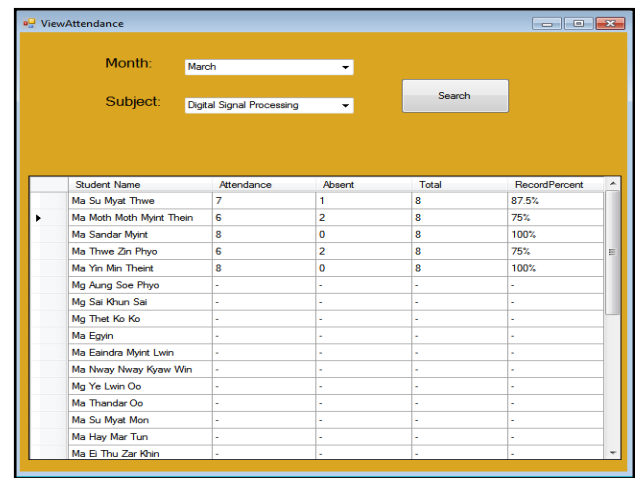
Student Name	Attendance	Absent	Total	RecordPercent
Ma Su Myat Thwe	1	7	8	12.5%
Ma Moth Moth Myint Thein	1	7	8	12.5%
Ma Sandar Myint	1	7	8	12.5%
Ma Thwe Zin Phyo	1	7	8	12.5%
Ma Yin Min Theint	1	7	8	12.5%
Mg Aung Soe Phyo	-	-	-	-
Mg Sai Khun Sai	-	-	-	-
Mg Thet Ko Ko	-	-	-	-
Ma Egin	-	-	-	-
Ma Eindra Myint Lwin	-	-	-	-
Ma Nway Nway Kyaw Win	-	-	-	-
Mg Ye Lwin Oo	-	-	-	-
Ma Thandar Oo	-	-	-	-
Ma Su Myat Mon	-	-	-	-
Ma Hay Mar Tun	-	-	-	-
Ma Ei Thu Zar Khin	-	-	-	-

Fig 19: Daily Report before Edit Attendance



Student Name	Attendance	Absent	Total	RecordPercent
Ma Su Myat Thwe	1	7	8	12.5%
Ma Moth Moth Myint Thein	0	8	8	0%
Ma Sandar Myint	1	7	8	12.5%
Ma Thwe Zin Phyo	1	7	8	12.5%
Ma Yin Min Theint	1	7	8	12.5%
Mg Aung Soe Phyo	-	-	-	-
Mg Sai Khun Sai	-	-	-	-
Mg Thet Ko Ko	-	-	-	-
Ma Egin	-	-	-	-
Ma Eindra Myint Lwin	-	-	-	-
Ma Nway Nway Kyaw Win	-	-	-	-
Mg Ye Lwin Oo	-	-	-	-
Ma Thandar Oo	-	-	-	-
Ma Su Myat Mon	-	-	-	-
Ma Hay Mar Tun	-	-	-	-
Ma Ei Thu Zar Khin	-	-	-	-

Fig 20: Daily Report after Edit Attendance



Student Name	Attendance	Absent	Total	RecordPercent
Ma Su Myat Thwe	7	1	8	87.5%
Ma Moth Moth Myint Thein	6	2	8	75%
Ma Sandar Myint	8	0	8	100%
Ma Thwe Zin Phyo	6	2	8	75%
Ma Yin Min Theint	8	0	8	100%
Mg Aung Soe Phyo	-	-	-	-
Mg Sai Khun Sai	-	-	-	-
Mg Thet Ko Ko	-	-	-	-
Ma Egin	-	-	-	-
Ma Eindra Myint Lwin	-	-	-	-
Ma Nway Nway Kyaw Win	-	-	-	-
Mg Ye Lwin Oo	-	-	-	-
Ma Thandar Oo	-	-	-	-
Ma Su Myat Mon	-	-	-	-
Ma Hay Mar Tun	-	-	-	-
Ma Ei Thu Zar Khin	-	-	-	-

Fig 21: Monthly Report after Edit Attendance

VI. CONCLUSIONS

In conclusion, this system mainly reviewed the research and development work with the help of passive RFID and ZK fingerprint reader. By developing this system, the knowledge of RFID and fingerprint reader system, the database construction, and GUI design using C# language are realized. In terms of performance and efficiency, this system has provided a convenient method of attendance marking compared to the traditional method of attendance system. By using databases, the data is more organized. Thus, it can be implemented in either an academic institution or in organizations. For this system, passive tags are better than the active tags because of low cost, low power consumption and also radio signals environmental factors. From a proper analysis of positive points and constraints on the component, this system can be safely concluded that the product is a highly efficient GUI based component. This application is working properly and meeting to all user requirements.

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Figure 19 and 20 are comparison of students' daily reports in attendance. Here, we attend lecture by 5 students. So, 5 students' daily reports are shown in GUI. Admin and teacher can search student's daily reports by selecting date and subject. Moreover, admin and teacher can only be seen monthly reports by selecting month and subject shown in Figure20 and 21.

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