DESIGN OF HIGH SECURITY LIBRARY MANAGEMENT SYSTEM FOR A TOWN

Aye Aye
(Department of Electronic Engineering, Technological University (Banmaw), Kachin State, Myanmar,
maayelay.ec@gmail.com)

ABSTRACT
A developing country becomes developed dramatically only when its people are educated having modern high technology, beautiful literature and culture, critical thinking and good morality, etc. All those things can get from reading and learning through a library. Therefore, libraries must be built in every towns. This paper is to design a high security small sized library for a small town or a village far away from a capital city. In this work, Radio Frequency Identification (RFID) technology with microcontroller is mainly applied to be a high security library management system. A user only with RFID card can enter through the entry/exit library doors and do issue/return of the chosen book through RFID based computerized system. A small sized library layout is also provided with detailed explanation of design idea.
Keywords *– Library, RFID, Microcontroller, Town*

1. INTRODUCTION
Nowadays, the very large sized libraries are more and more essential for every country all over the world as all people can get much knowledge from these libraries for their prosperous lives. But, the small sized libraries are also still necessary for small towns in developing countries. Most of the townspeople in small towns still need to know more things for their different kinds of sectors such as health, education, agriculture, history, politics, business, religious, society and culture, etc than before. Therefore, this paper work is design consideration especially for a small sized library in less developed area far away from a capital city. It can provide to build a library with high security and modern technology to get full satisfactory from readers and librarians. It includes RFID based management systems in entry and exit doors and in a counter for issue/return of books.

2. DESIGN CONSIDERATION
The proposed library design plan is shown in Fig.1. It consists of many sections: registration counter for any new library members, security check counter in entrance, lockers to store the library user's properties which are not allowed to bring inside the library, electronic resource center(six computers) to know details of every books, a counter for issue/return of books, book racks for different kinds of subjects, lounge chair and table for waiting something else, many tables and desks for reading the chosen books and CCTV cameras for theft detection. Among those, this paper work mainly gives the detailed explanation for theft detection system with CCTV, RFID based door security systems and RFID based book issue/return system.

3. DETAILED EXPLANATION
The proposed plan for library security system is shown in Fig.1. When a new member comes to library, it needs to read the rules and regulation of this library and fill the registration form at counter A2 shown in Fig.1. The staff from A2 gives the RFID member card to this new user. If this user brings his/her properties such as bag or backpack with him/her, he/she must keep these in a locker. And then, the security guard checks the user with hand held body scanner for the dangerous things such as weapons, guns etc which are not allowed inside the library. After checking well, the user can enter the library by using RFID member card which is read by RFID (1) to be able to open the entry door. Inside the library, he/she can easily search the required books through electronic resources with any one of the six computers which stores the detailed information of books such as book name, author name, issue date, rack number, etc. As electronic resource center, database for book details is already created in these computers by using a hand held RFID reader and book tags. After that, the user can take the chosen book from the book rack as mentioned in database. The user can read it inside the library as there are square tables, circular tables and desks for the readers. If not, he can borrow this book within the due date at counter A3. There are two library staffs at A3. Both staffs have responsibilities to keep the record of book issue/return by using RFID(3) and

RFID(4). When the user leaves the library, he/she must use RFID member card in RFID(2) to be able to open the exit door. After the user has taken her bags from the locker, he can go home with much satisfactory.

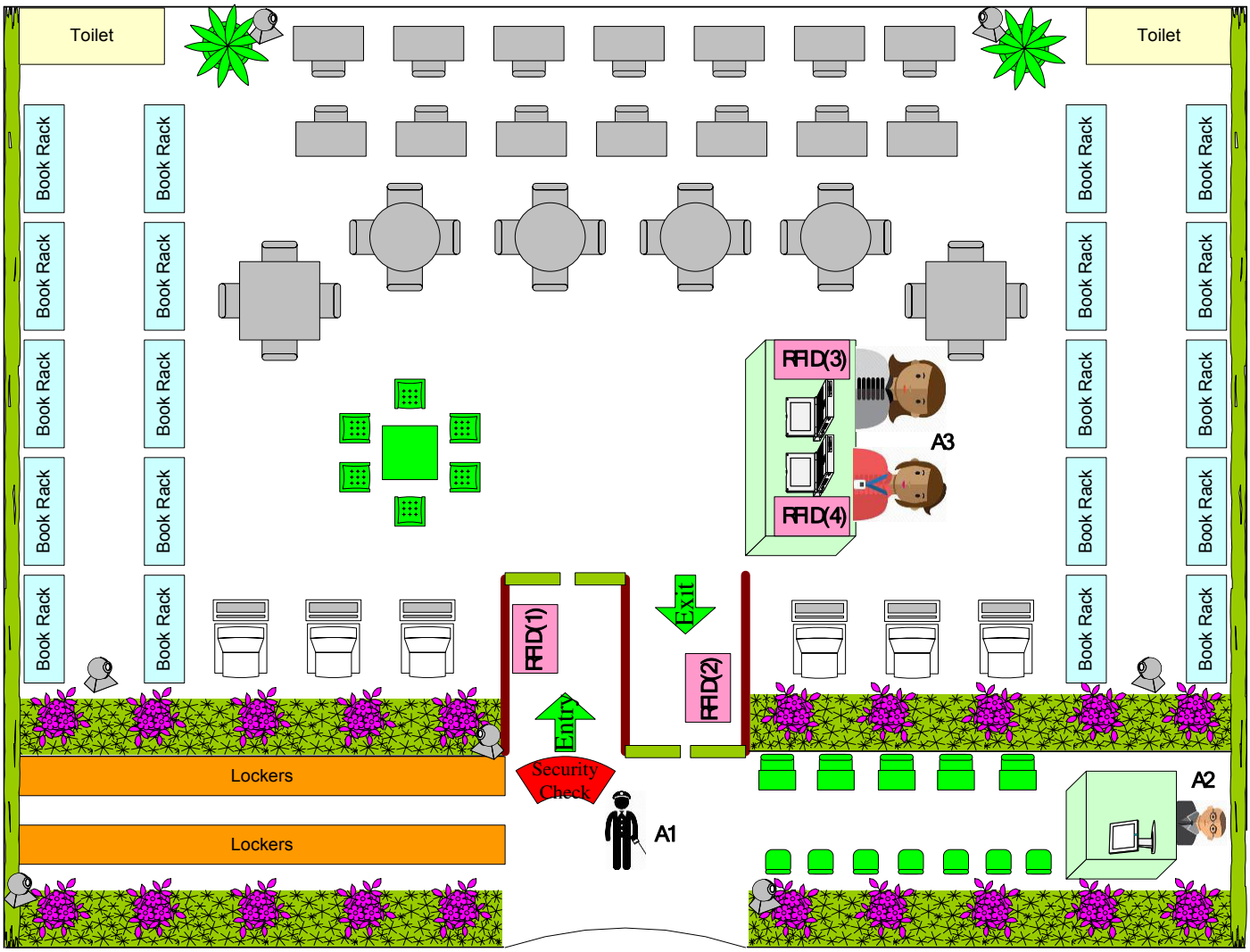

Fig 1. Proposed plan for a small library

4. METHODOLOGY

RFID technology becomes very popular because of its usefulness and CCTV is also in everywhere because of its easiest way to use. In this proposed plan, the high security system is provided by using these two technologies.

4.1. Theft Detection System

Theft detection system for this proposed design simply uses CCTV cameras as shown in Fig.1. The staff from registration counter of Fig.1 has responsibility not only for required services of new library membership but also for monitoring the images sending from CCTV cameras. If someone takes a book without permission, the staff can know it from the monitor and then let the other staffs know through communication devices such as mobile phones or walkie talkie. Therefore, it can protect the books taken without permission from this library.

4.2. RFID Based Library Door Security Systems

The block diagram of RFID based door security systems are shown in Fig.2 and Fig.3. There are two RFID based circuits in entry/exit doors: RFID(1) and RFID(2) shown in Fig.1.

In RFID(1) of entry door, PIC16F877A is used as the main control unit. EM-18 RFID reader reads the RFID card and send this unique card number to the microcontroller. The microcontroller decides whether it

is a membership ID number by comparing it with its previously stored data. If it is true, the user must give the password from the keypad. After that, if the password is true, the microcontroller opens the entry door through the motor driver circuit. The user ID numbers are also stored in SD card as a daily record and the number of the people visited to the library can be easily seen on 7-seg display unit.

In RFID(2) of exit door, PIC16F877A with RFID EM-18 is also the main control unit like RFID(1) and its operation is the same as with RFID(1) except keypad function. It does not need to have keypad and user password as the visitor has already been checked at entry gate. It can also reduce a time consuming process.

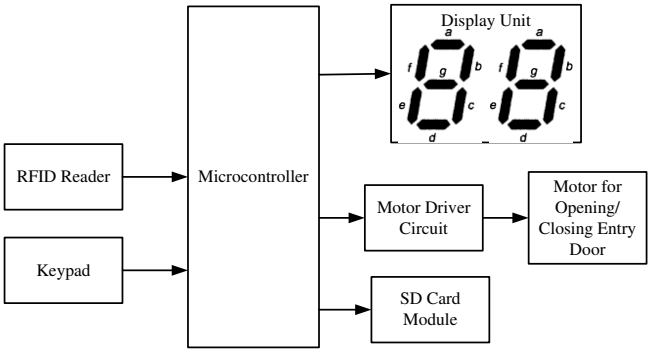

Fig 2. Block diagram of RFID based entry door security system

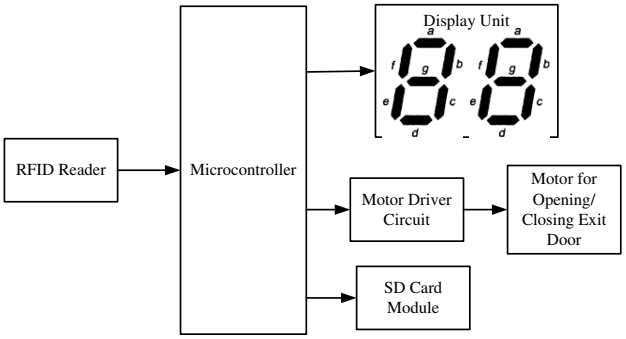

Fig 3. Block diagram of RFID based exit door security system

4.3. RFID Based Book Issue/Return System

The block diagram of RFID based book issue/return management system is shown in Fig.4. It is the same design for both RFID(3) and RFID(4) shown in Fig.1. As soon as the RFID reader has been read the tags from book and user ID card, the PIC16F877A microcontroller sends both unique book tags and user ID card numbers to the PC through PC interface (MAX 232 and RS232). The PC has already provided GUI and database of the user's data and the book details. Therefore, it can easily record the issue and return of books including the last date to be returned and find paid for it through GUI. GSM modem is also used to communicate with the user's mobile phones to send the alert message related to the issue/return book details.

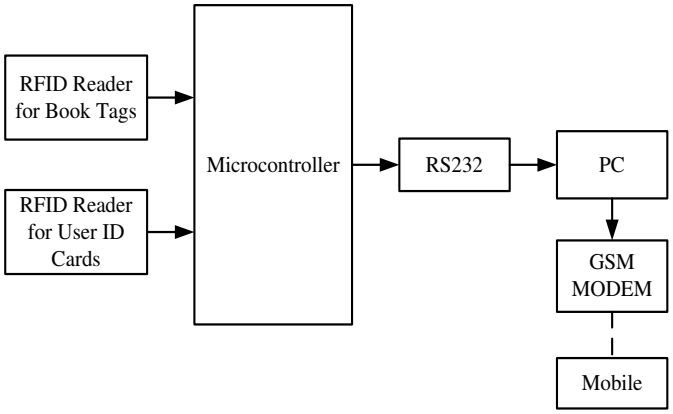

Fig 4. Block diagram of RFID based book issue/return management system

5. IMPLEMENTATION

In this section, the proposed RFID based circuits can be divided into two portions: hardware and software implementation.

5.1. Hardware

The component lists used in the proposed circuit designs are as follows: PIC16F877A, EM-18 RFID reader module, GSM module (SIM900A), Catalex micro SD card module, MAX232, RS232, 7-seg display. Among these devices, the first four ICs are shown in Fig.5.

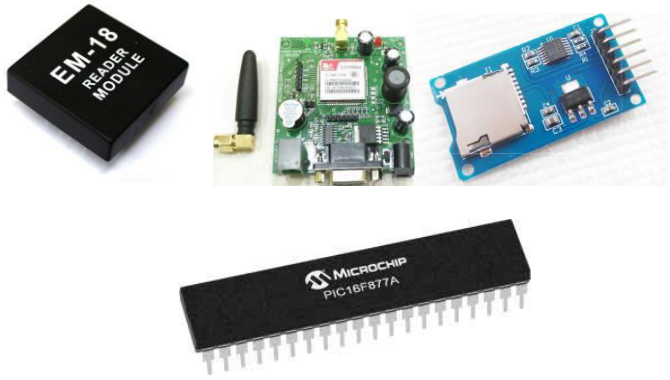

Fig 5. Components for proposed design

5.2. Software

Before the proposed circuits are constructed in real world, the simulation of these design circuits can be tested in Proteus software.

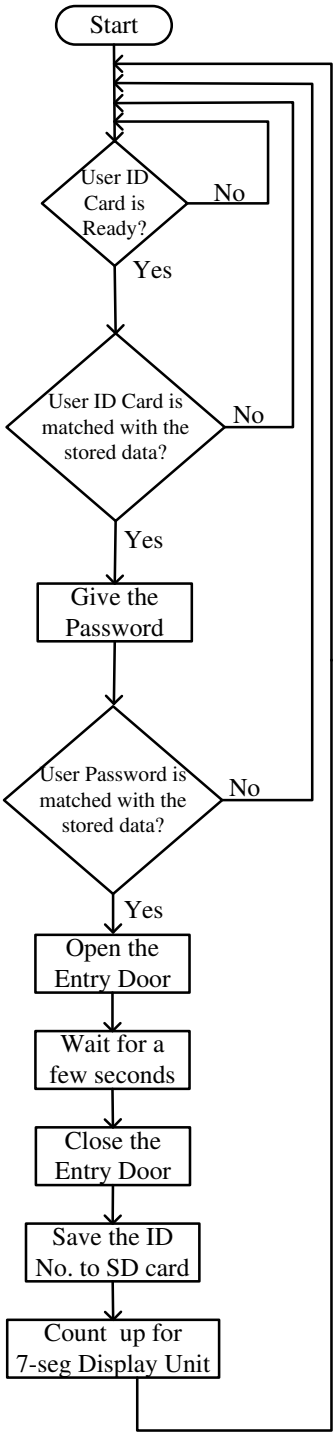

Fig 6. Flow chart for entry door security system

Mikro C pro language is used for PIC16F877A with its compiler software. The flowcharts for PIC16F877A of RFID(1), RFID(2), RFID(3) and RFID(4) are shown in Fig.6, Fig.7and Fig.8. PIC kit2 programmer board with its software package is used to download the hex files of dedicated programs to PIC16F877A. The graphical user interface(GUI) for PC is created by using VB software.

The free software from Elementz Engineers Guild Pvt Ltd. is used in PC for GSM modem sending required SMS to the library members.

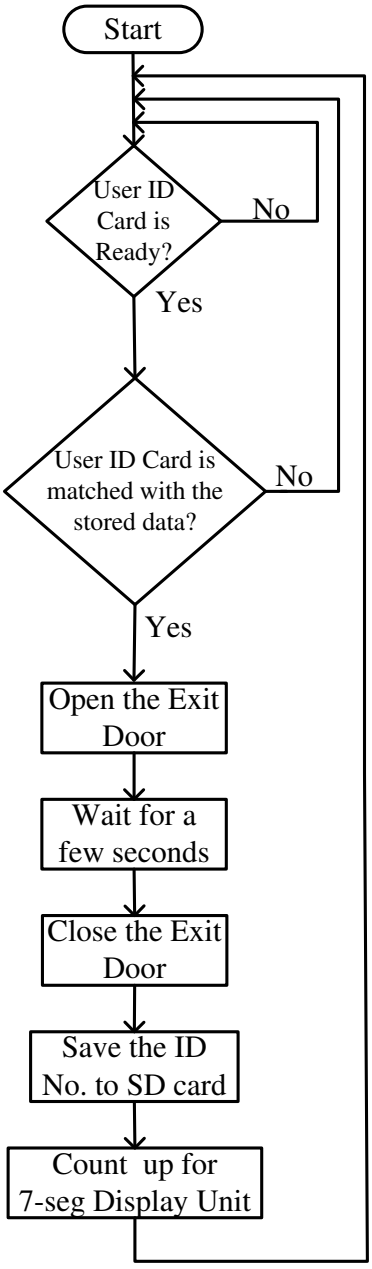

Fig 7. Flow chart for exit door security system

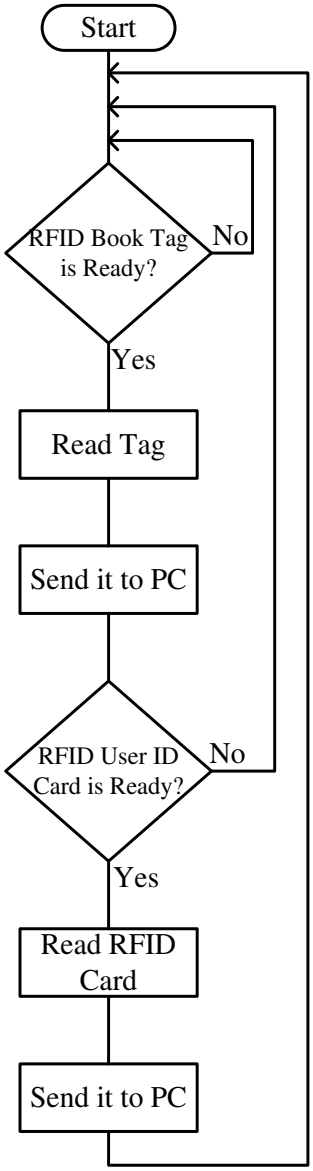

Fig 8. Flow chart for book issue/return management system

6. CONCLUSION

The proposed plan has been successfully designed. It is very useful for one storey small land such as 50'x80' area. As a limitation, the display units from entry/exit doors can show only up to 99 maximum library members because of two digit display unit. As Fig.1 is not an architectural layout, sunlight, emergency exit and wind direction are not included in design consideration. Theft detection system can also be designed with RFID technology besides CCTV cameras as the future work.

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