



SIMULATION OF RADIO FREQUENCY IDENTIFICATION BASED LIBRARY MANAGEMENT SYSTEM

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Abstract: (RFID) is a technology used for identification or tracking of any objects. RFID system contains "tag and RFID reader" that performs the main operation of identifying things. a library system has been built using RFID components and using special programs. Microsoft access database was used to build the tables that needs to store the information of the books. The implementation of the system has been done in two main stages, the first one is a Hardware Device "RFID-RC522" and "Arduino card", and the second is the implementation of a specific read software program, a graphical User Interface (GUI) for the system has been built by using Visual Basic (VB).

Keywords: RFID, Arduino, Library Management System, VB, Database.

محاكاة نظام التعرف بالترددات الراديوية الخاص بإدارة نظام مكتبة

الخلاصة: أن تقنية التعرف بالموجات الراديوية هي إحدى التقنيات المهمة التي تستخدم للتعرف ولتعقب أي كائن. في تطبيق (RFID) يتكون النظام من بطاقة و جهاز قارئ والذي يقوم بالعملية الأساسية للتعرف على الكائنات. في هذا البحث تم بناء نظام إدارة مكتبة باستعمال أجهزة وبرامج خاصة. تم بناء قاعدة بيانات لحزن معلومات الكتب باستعمال (Microsoft access). تم بناء النظام المقترح بمرحلتين أساسيتين، الأولى هي بناء المكونات المادية (جهاز القارئ وجهاز مايكروكونترولر) ، والمرحلة الثانية هي بناء البرمجيات الخاصة بعملية القراءة ، وتم بناء واجهة مستخدم رسومية باستعمال برنامج (visual basic 6).

1. Introduction

RFID is a technology uses radio signals to identify any tagged items. The advantage of (RFID) system is the data that must be processed can be carried on a small device which is known as (RFID tag). Since the library contains a huge amount of data such as books, theses, and DVDs, therefore a management system is necessary for any library system [1]. RFID works by a radio wave signal. A signal is sent to a tag, which wakes up and send its data [2].

Electronic Product Code (EPC) give a great ability of identifying each object, therefore RFID technology enables reading large amount of data at high speed and can be used for locating, identifying, monitoring and tracking physical objects without line of sight [3].

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The aim of this paper is to Design a hardware circuit for the library system using the RFID technology .

2. Components of an RFID System

The different parts of RFID system are integrated with each other to allow the system to read the tag and apply different processing on it.

The RFID system as in Fig. (1) contains the following:

- Reader.
- Tag.
- Antenna.
- Communication infrastructure.
- Application software [4].

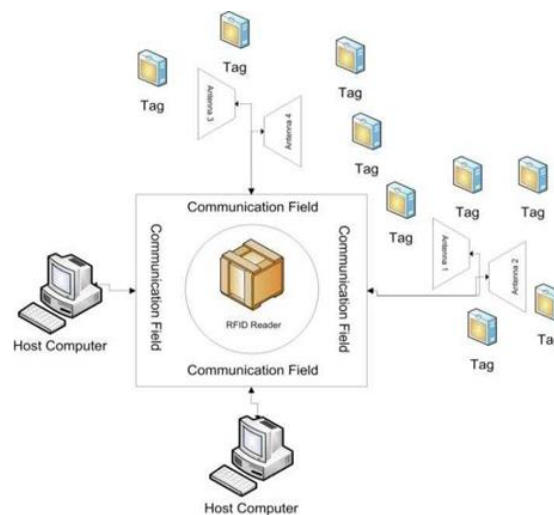


Figure 1. Components of RFID

2.1. Rfid Reader

The (RFID reader) reads tags data by using the antennas, used to generate and receive the radio signals. It consist of a built - in anti - collision algorithms and can operate on more than one frequency. Therefore, the readers are used to deliver the data to computer systems [4,5].

A reader may be fixed or portable, and it can converts the radio waves captured from a tag into a digital signal that can be transferred to any computer; readers and tags have to work on the same radio frequency to be able to communicate [6].

2.2. RFID Tags

A unique identifier information of any application is stored in the tag. Tags are always combined to objects, people and papers, its power is captured from a reader.

Tags activated when the reader receives radio waves from tags. Electronic circuit and an antenna are integrated into one package as a basic parts of tag, as in Fig. (2). RFID tags used in many applications, therefore different expectations for tag price, and read range are available [5,7].

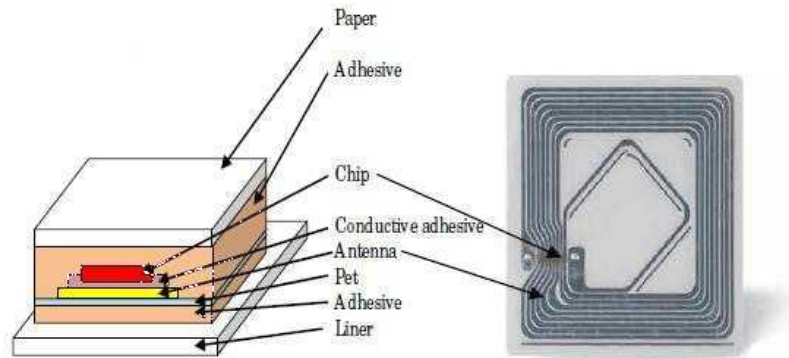


Figure 2. Components of RFID Tag

2.3. Antenna

An antenna works on small band of frequency, and this frequency band must be same for reader and tag.

Antennas are the interface between the tag and the transceiver, which controls the system's data and communication [7].

3. Advantages Of RFID In Libraries

use of RFID reduces the cost and effort and has many advantages likes:

- More economic.
- Reliability.
- Automated sorting of books.
- Easy search of books.
- Multi books identifying at the same time.
- Easy locating of books [1].

4. Implementation of the proposed system

The proposed system design has two important steps: The hardware and software tools and as follows:

4.1. The hardware

The following three hardware devices were used to implement the system:

- Arduino card (UNO).
- RFID-RC522 Device.
- RFID Tag chips.

4.1.1 Arduino card

Powerful single board computer, easy to use, with the Arduino board, Fig. (3), you can create any electronic circuits and write programs with very little effort.[8]



Figure 3.Arduino Device

4.1.2. RFID-RC522 Device

MF RC522 is contactless communication card chip used to read and write, Fig. (4). the application used a small size, low voltage, low cost and contactless card chip to perform read and write.

The MF RC522 also use advanced transmission and receiving concept that works in all kinds of the (13.56MHz) passive communication protocols. The read range of this RFID card may be less than one meter to work efficiently. [9]

The overall hardware system is shown in figure (5).

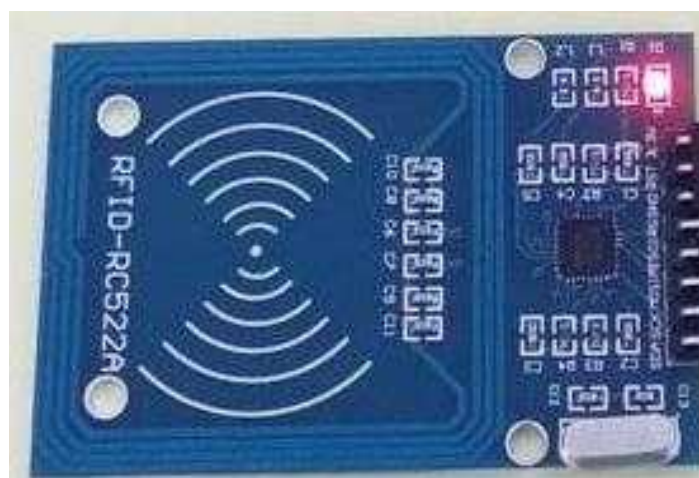


Figure (4): RFID-RC522.

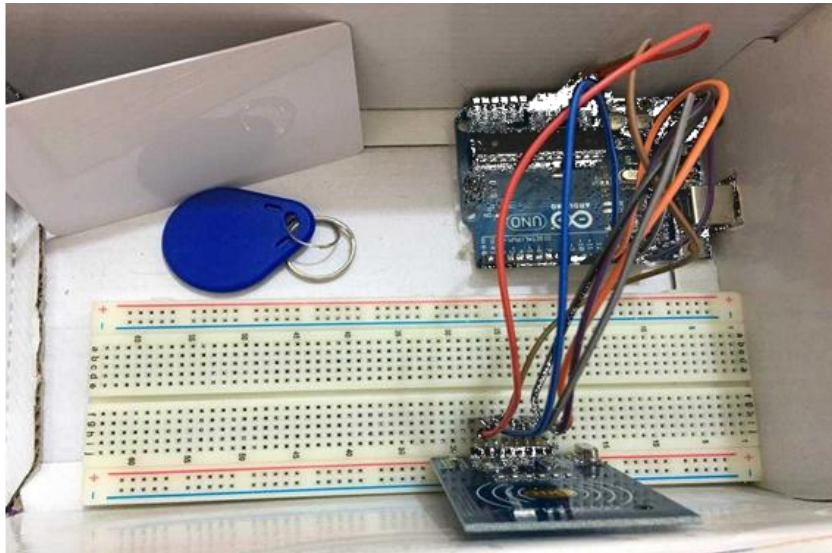


Figure 5. RFID - RC522 Connected to Arduino

4.2. Software tools

The GUI for the system is built using visual basic, while the tag's ids is stored in the database; visual basic is used as a interface between the Arduino and database. The software tools used in the system are as follows:

- Microsoft Access.
- Arduino program.
- Microsoft Visual Basic 6.0.

4.2.1 The Database

The database is built using Microsoft Access, A table in the database contains the following fields: ID, Book ID, Title, Code, and Author, as shown in Fig. (6).

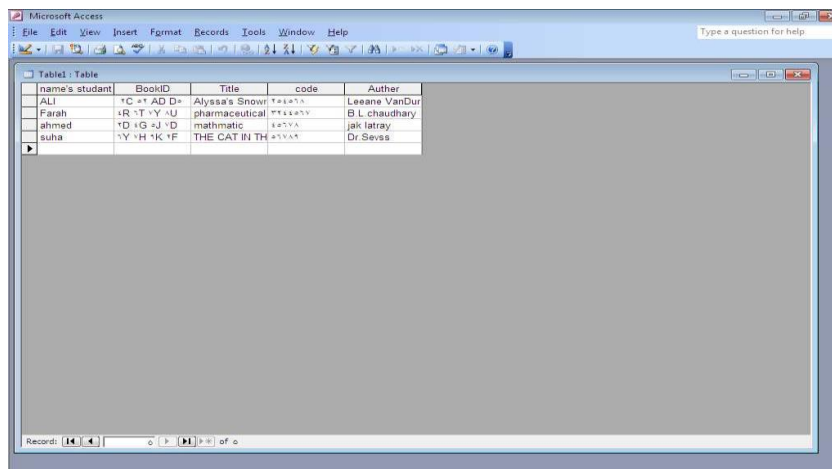
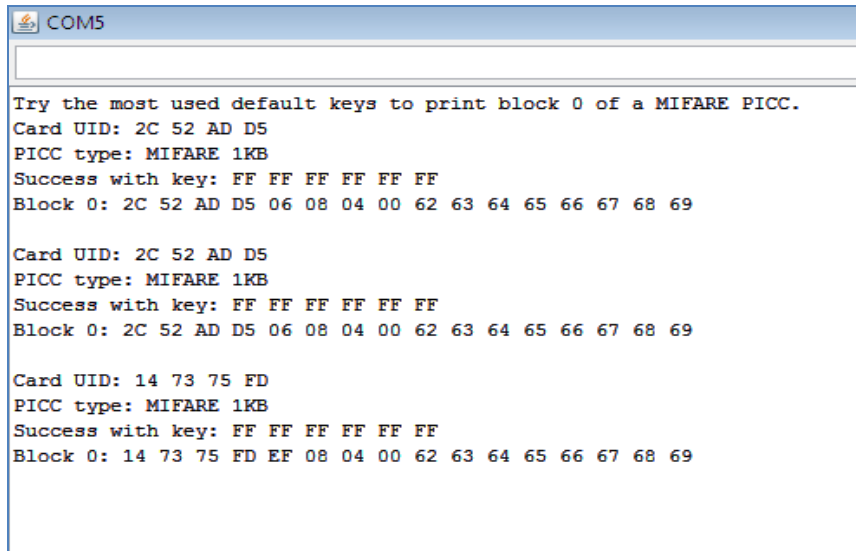


Figure 6.The Database.

4.2.2 Arduino program and reading tags

After connecting Arduino to computer and upload the code to Arduino card, open the serial monitor by clicking the Serial Monitor icon set the serial baud rate to 9600 baud by clicking on the drop down selection in the lower right corner of the Serial Monitor window. Now take one of the RFID tags and hold it near the white graphic printed on RFID-RC522 module, the Arduino IDE will read the ID of books as shown in Fig. (7):



```
COM5
Try the most used default keys to print block 0 of a MIFARE PICC.
Card UID: 2C 52 AD D5
PICC type: MIFARE 1KB
Success with key: FF FF FF FF FF FF
Block 0: 2C 52 AD D5 06 08 04 00 62 63 64 65 66 67 68 69

Card UID: 2C 52 AD D5
PICC type: MIFARE 1KB
Success with key: FF FF FF FF FF FF
Block 0: 2C 52 AD D5 06 08 04 00 62 63 64 65 66 67 68 69

Card UID: 14 73 75 FD
PICC type: MIFARE 1KB
Success with key: FF FF FF FF FF FF
Block 0: 14 73 75 FD EF 08 04 00 62 63 64 65 66 67 68 69
```

Figure 7. Arduino Read the Tag

4.2.3 Visual Basic for RFID Library management

The main form of the proposed system was built by visual basic. This form contains three command buttons (staff login, entering students, and exit). The main form is shown in Fig. (8).

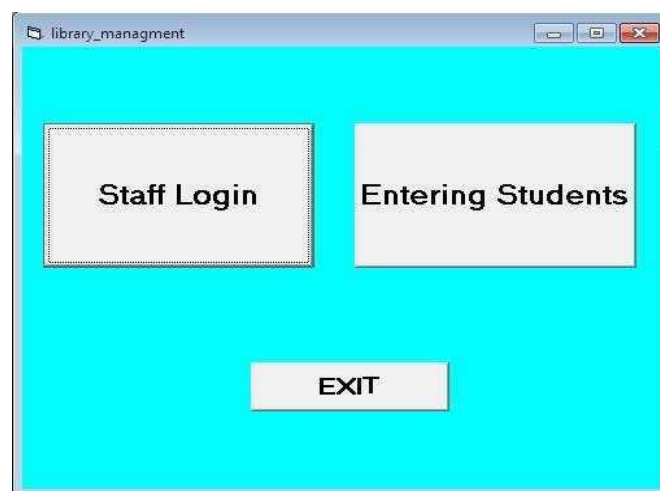


Figure 8. Main Form of Library System

When the staff button is pressed the login form is appeared as shown in Fig. (9).

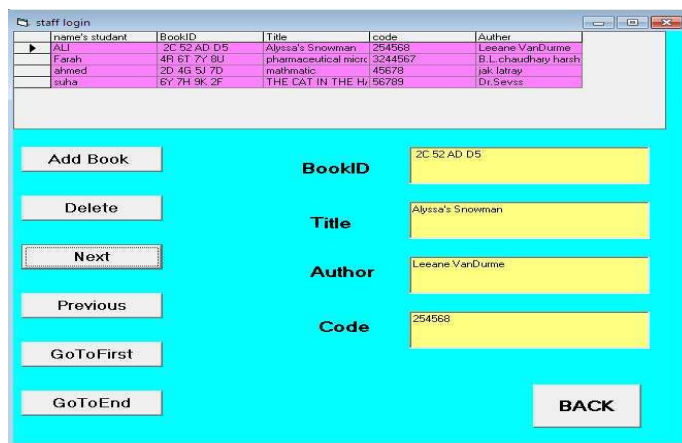


Figure 9. Staff Login Form

ADD Book form contain read, add, and save button. When the Read button is pressed , the Arduino device will read the (book ID) and store it. The library staff then record the book title, the author and student code. When the add button is pressed, all these information of the book will add to the data base. As in Fig. (10).



Figure 10. Add Book Form

When the Entering Students Button is pressed this form is appeared as shown in Fig. (11). The student

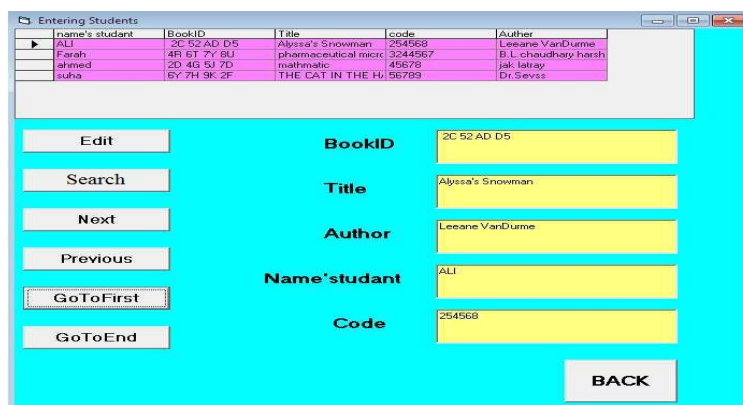


Figure 11. Entering Students Form

5. RFID library system flowcharts

The operation of reading the Tags are shown in figure (12), while the main RFID library system flowchart is shown in figure (13).

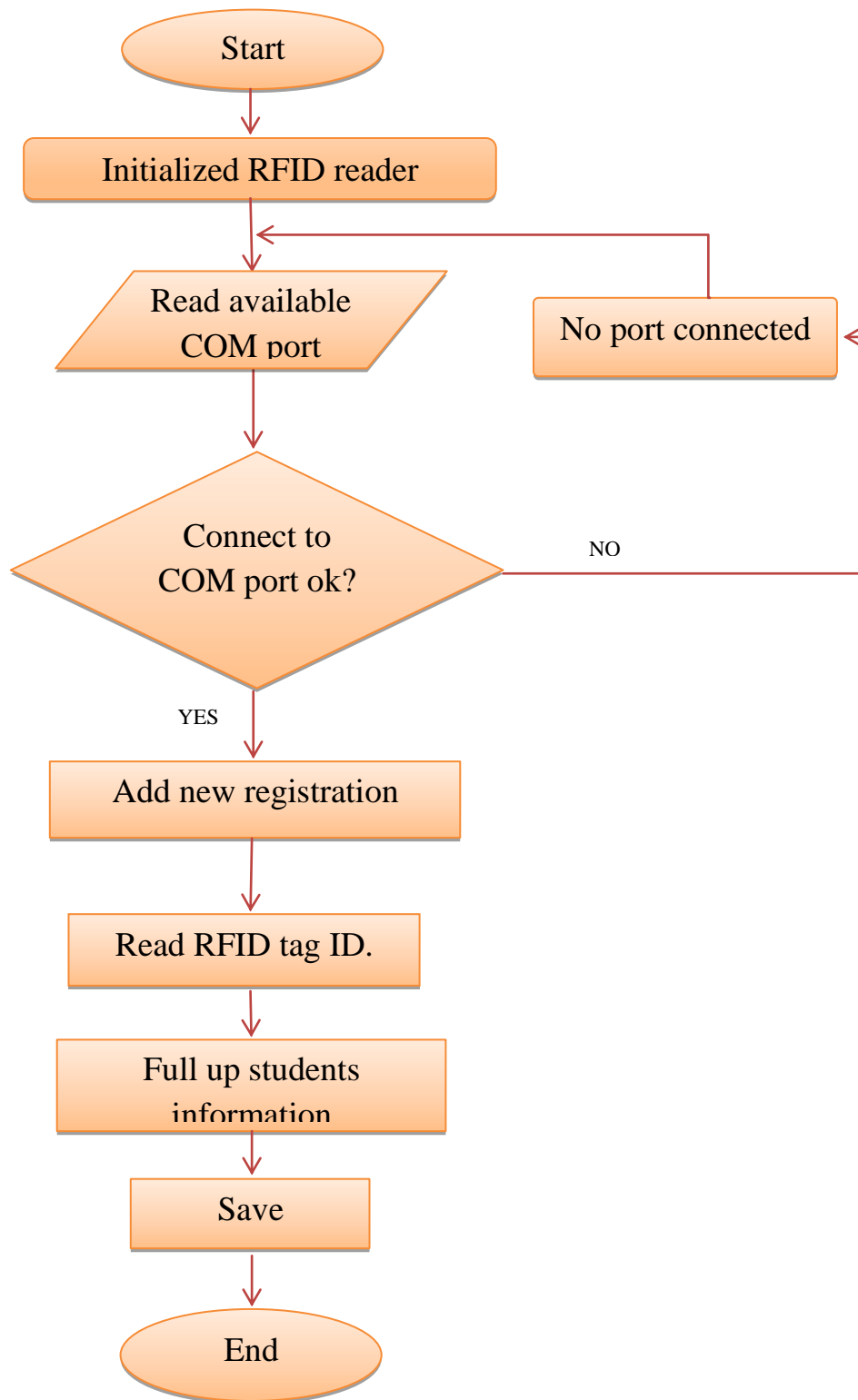


Figure 12. Flow Chart Of Reading Operation of Tags in Library Management System

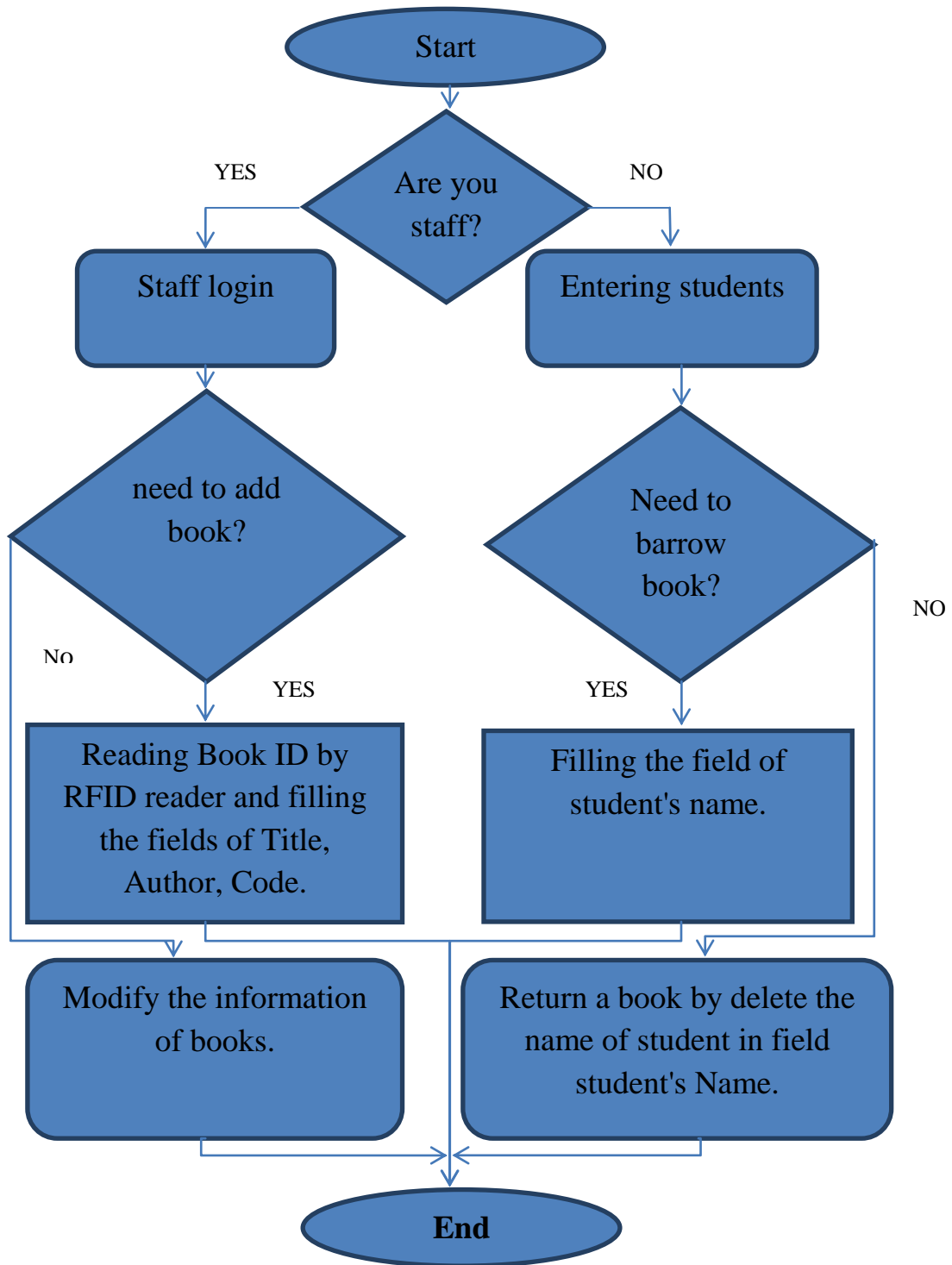


Figure 13. Main Operation Of RFID Library System Flow Chart

6. Conclusions

After finishing the work of this project, it can be found that using Arduino give a large facilities that help us to build RFID library management system.

7. References

1. P. Pandey and K.D. Mahajan ,(2010) " Application of RFID Technology in Libraries and Role of Librarian", In 12th MANLIBNET Convention 2010, Jaipur (India), 22-24.
2. M. Roberti,(2005), "The History of RFID Technology", RFID journal.
3. K.Bai, S. Li and J.Tian,(2011), "A data model for RFID data", IEEE, 978-1-61284-486-2/111.
4. K. AHSAN, H. SHAH and P. KINGSTON,(2010) "RFID Applications: An Introductory and Exploratory Study", IJCSI International Journal of Computer Science Issues, Vol. 7, Issue 1, No. 3.
5. A. Repanovici and L. Cristea,(2011) "RFID- Application in Info-Documentary Systems ", chapter from book "Designing and Deploying RFID Applications", ISBN 978-953-307-265-4, , Published online in www.intechopen.com.
6. C. E. Palazzi, A. Ceriali, M. D. Monte,(2009)" RFID Emulation in Rifidi Environment", article at www.researchgate.net .
7. S. S. Srikant and R. P.Mahapatra,(2010) " Read Range of UHF Passive RFID", International Journal of Computer Theory and Engineering, Vol. 2, No. 3,pp 1793-8201
8. A. Spieser, " Microprocessor & Embedded controllers EE5563 Laboratory Series1.
9. www.ek2.com/pdf/412-arduino-module-RFID-TAG.pdf