NFC Based Library Automation using Smart Phone

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Abstract-**The prevailing practices in library, the borrower picks up a book and goes to the librarian. The librarian enters the borrower's & book's details into the database and issues the book. While the librarian is busy with this work then borrower have to wait for issuing the book. The goal of this project, library automation is to automatically issue books and return it. In simple words Library Automation can be defined as the use of smart phone to perform basic jobs of library like issue of books, entry of borrowers & books details into the library database. Here we have opted to use NDEF for communication, NFC tags and NFC enabled smart phone. With implementation of such a cutting edge technology, an organization will not only be using the library efficiently but will also be effective in time.**

Index Terms- NFC, Smart Phone.

I. INTRODUCTION

A Library is an institution of knowledge acquisition and learning; it provides invaluable service to its members, to a wider local community. The main objective of our project is focus on an implementation of NFC based system in library. It will provide a comprehensive route for enhancing all library services and upgrade operations for everyone concerned with the library. The NFC technology is product for performing transaction quickly, easily and without manual error. With NFC applications in libraries, all the library assets, namely books, journals, CDS, DVDs, videos, audio cassettes, etc. have to be embedded with NFC tags and they are scanned by using NFC enabled smart phone. The library activities which we mainly focusing in our project are check in and checkout process which are important jobs in library.

Problem Definition: The problem revolves around automation of library using NFC technology through use of smart phone. Basic task of library such as check-out is performed through smart phone and check in process is performed through smart phone or NFC reader to facilitate smooth, effective and time saving library process.

II. NEAR FIELD COMMUNICATION

Near Field Communication (NFC) is wireless technology which operates on 13.56 MHz frequency at less than about 4 cm. It is based on the Radio Frequency Identification (RFID) technology. NFC link between tag and NFC reader is established by just a tapping once or bringing NFC reader in close proximity less than four cm which makes it convenient for user. It transmits the data with transfer rate up to 424 kilobytes per second. The functionality of NFC is based on three modes as specified by NFC forum.

Reader/Writer mode enables device to read or write data on NFC tag. Peer to Peer (P2P) mode allows two devices to exchange data in between them and Card Emulation mode enables device to act as a smart card.

NFC tags are integrated circuits storing data that can be read by using any NFC enabled device. For maintaining operability of NFC device and tags, the NFC Forum has specified the four types of tags (Type 1/2/3/4) which differs from each other in storage capacity and their uses.[1][2]

III. REQUIREMENTS AND CHALLENGES

Our main objective is to perform various operations of library using smart phone with less intervention of librarian and with minimum amount of time invested by user. The important requirements for project are as follows,

1. NFC enabled smart phone
2. NFC tags

NFC enabled smart phone is used for reading NFC tags. Smart phone must have internet connection for performing library operations. NFC tags, type 1 or type 2 read only tags with unique tag id is attached to every book for recognizing the unique book. This unique id is read by the smart phone and processes further to perform check in or checkout process.

IV. SYSTEM DESIGN

The system is built by using basic four blocks which performs three important jobs in library named as- checkout (book issue), check in (book return) and book search operation. This section also describes the operational functioning of the system.

A. NFC TAG READING

The process is used for communication between tag and NFC enabled smart phone. The NFC tag reading system contains NFC tag which is read by using smart phone.

Unique tag id and book name are stored in the tag. In this project, type 1 and type 2 tags are used.

Type 1 & 2: Tags with read and write capabilities with memory 48 or 96 bytes expandable up to 2 KB.

Type 3: Tag is based on Japanese Industrial Standard with memory 1 MB.

Type 4: Tags are read, rewritable or read only type with 32 KB memory. [2]

Fig.1. NFC tags

Information stored in tag is transferred to the phone by using NFC Data Exchange Format (NDEF). It specifies common format and rules for exchanging information under NFC environment. NDEF message can contain more than one NDEF record. Figure shows the NDEF record structure. [2]
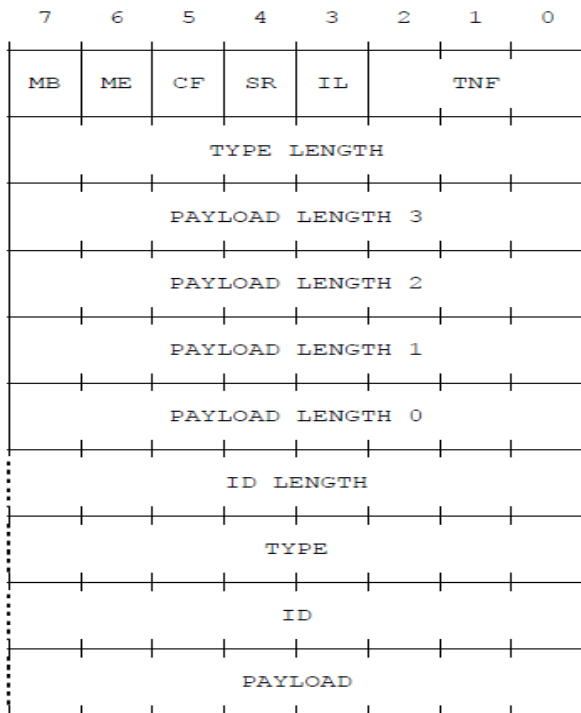

Fig.2. NDEF record structure

1. Message Begin (MB): shows first record of message.
2. Message End (ME): shows last record of message.
3. Chunk Flag (CF): shows payload of record is continued in next record.
4. Shortest Record (SR): defines size of payload field.
5. ID Length Present (IL): shows presence of optional ID field.
6. Type Name Format (TNF): determines type information format.
7. Type and ID field is optional. [2][3]

B. CHECKOUT

In conventional library system, checkout process is done manually. User selects the book and submits it to the librarian for issuing purpose. Librarian checks all the minimum required constraints for issuing the book. If he finds everything ok then issues the book by entering record in database manually.

In our automated system, the checkout process will be carried out with the help of the NFC enabled smart phone. User login the system using unique id and password assigned by the library. For this, user must be registered with the library.
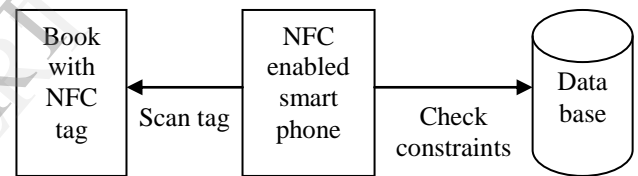

Fig.3. Checkout process

The figure shows checkout process, in which NFC enabled smart phone is used for reading unique tag id stored in NFC tag which is attached to the book. Before issuing book system will check two types of constraints as follows,
1. If user has four books already issued on his name then system will not permit user to issue new book.
2. If user has already issued copy of the same book then system will not allow user to issue book.

If both of these constraints are satisfied then system updates library database. Once the checkout process is completed system gives acknowledgement message as well as returning date of the book.

C. CHECK IN

Check in process is related with the returning of the book. In conventional library, check in process is also done manually. In proposed automated system, check in process is divided into two parts- book return before due date and book return after due date.

In case of book returning before due date, user will scan NFC tag using smart phone. Book's unique id is fetched by the smart phone. System will check if returning date of

book is not passed then it will update library database and acknowledge user. For book security or for checking whether book is submitted in library one return bit is maintained which turns on after completion of check in process.

In case of book returning after due date, if system finds that returning date of book is passed then it will calculate fine. Fine is calculated for each day after returning date. It will show the fine to user with proper message for returning the book to librarian.

D. SEARCH BOOK

Search book is the process which is used for finding whether required book is available in library or not. In this process user can search book by using the book name or by using an author's name. After entering the book name or author name system will give details about book as well as status of book whether the book is available or not in library. In case, if all copies of respective book is issued by the different users then system will inform user.

V. FUNCTIONING OF THE SYSTEM

The block diagram for the whole automated library system is shown in Fig.4. The NFC based library automation system is developed for the android hence it requires NFC enabled smart phone having android. As it is real time system internet connection is required for the smart phone. Mifare type 1 and type 2 read only tags are used in proposed system. NFC tags contains unique tag id and book name stored in it. Unique tag id is used as a unique book id for the system. Single tag is attached to each book in the library.

Before using application on smart phone every book available in library and every user using library must be registered with the system. Each time new user or book arrives librarian registers it with system. At the time of registration, user is assigned with the unique username and password which will be used by him forever for using system. Book names and their tag id are registered by the librarian for ease in operations. Book database is also used for inventory management and inventory check purpose.
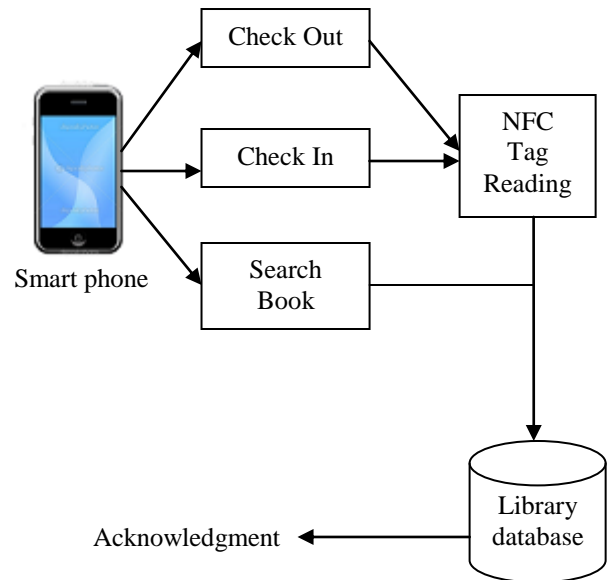

Fig.4. System Block Diagram

Above figure shows the functionality of system. Library application is installed on the smart phone. User must login using username and password assigned to him at registration for using an application. After successful login, menu comes to screen which shows three operation- checkout, check in and search book. If user chooses one of the option from checkout or check in then using smart phone NFC tag is read and further processing is done of respective job as mentioned earlier in paper. If user selects search book operation then NFC tag reading is not required. In each case library database is updated and user's account is maintained as well as shown to user after completion of single operation. Once the all processes are done user must logout from the system.

A. ALGORITHM:

Step 1: Start.

Step 2: Login the system using username and password which is already registered with the system.

Step 3: Select choice from menu.
   a. Checkout
   b. Check in
   c. Search

Step 4: If checkout then,
   a. Read NFC tag using smart phone.
   b. If user has already issued 4 books then system will not issue the book else issue book.
   c. Give acknowledgement message.

Step 5: If check in then,

   a. Read NFC tag using smart phone.
   b. If return date is passed then calculate fine and give message to user.
   c. Else return book successfully and give acknowledgement message.

Step 6: If search then enter book name, system will give message whether book is available or not in library.

Step 7: Logout.

Step 8: Stop.

VI. CONCLUSION

In this paper, automated library system is presented which uses NFC enabled smart phone automating and performing various jobs of library. The presented system reduces manual errors in library processes as well as it helps to schedule the routine of library staff as so much time is saved by using this system. System uses smart phone and NFC technology which are very reliable.

VII. ACKNOWLEDGMENT

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