



RESEARCH ARTICLE

RFID Library Implementation

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Abstract— *this research paper shows how one can actually implement RFID into libraries. Paper shows the library scenario to give a clear understanding where the readers, tags and antennas will be placed in an example library. Also gives detail requirements for the project. Paper provides easy to access check list for the developer with the aim of developing such kind of system. Explains how reader is actually connected with the custom library application. Also explains best place to tag books as per the research. Then gives the idea how the complete system can be implemented and tested.*

Keywords— *RFID (radio frequency identification); library; implementation; RFID reader; RFID tags; RFID; anti-theft; UHF (ultra high frequency)*

I. INTRODUCTION

RFID is a technology that allows automatic identification of tagged items such as books in libraries with the help of radio waves produced by the antenna which are either externally connected with reader or is present inside the reader.

II. LIBRARY SCENARIO

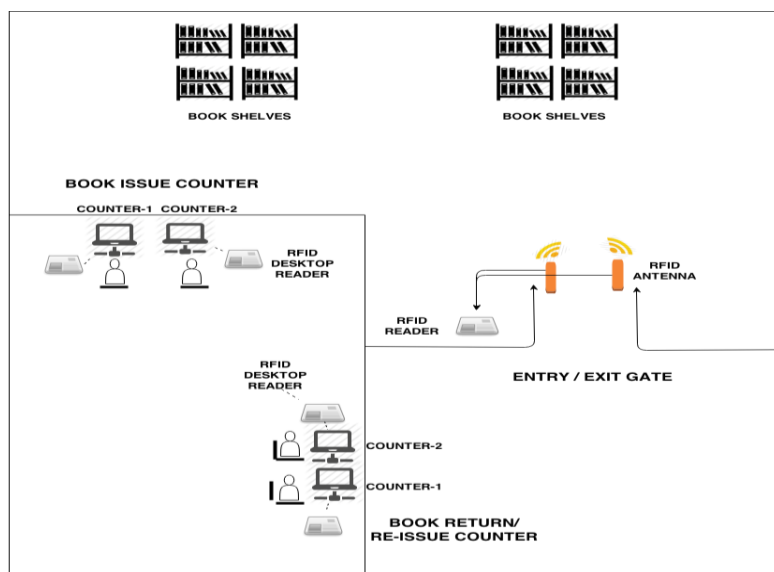


Fig: A (Library scenario)

Figure shows the scenario of a library and shows where RFID readers, antennas and tags will be assembled in an example library (Fig: A). Library focuses on 3 modules i.e. book issuing, re-issuing, returning and monitoring of books through RFID. Book issue counter is having two counters that are counter 1 and counter 2, with two desktop computers attached with their separate desktop RFID readers, similar is the case with book return/re-issue counter. At entry/exit gates one RFID fixed reader is connected with the two antennas assembled on the top of library entrance/exit gate, To make sure that no unauthorized book goes outside the library, as soon as the antenna's comes in contact with the tagged book, it sends the signal to the RFID fixed reader which wirelessly checks the issue date of the book with the database and matches it with the information stored in the tag, and beeps if book issue date of tag does not matches with the current date. Also books at the shelves will be tagged with inlay tags. Readers, tags and antennas all are UHF based [1][2][3][4].

III. CHECKLIST FOR DEVELOPMENT OF RFID LIBRARY SYSTEM PROJECT

1. Site survey: Site survey is an important task to understand the requirements of the library or any other domain you are working for to implement RFID.
2. Design the top view architecture of the library as shown in the Fig: A to help understand requirements of the system (see section III for requirements).
3. Now decide on the modules on which, library needs to have RFID implemented as in this project focus was on book issuing, re-issuing, returning, and monitoring. One can also use book searching, inventory etc. that totally depends upon library requirements.
4. Once the architecture has been designed one needs to create flowcharts for the modules selected.
5. Now it's time for application development, for that, create database and tables according to the flowcharts, for this project library database was created in SQL and tables was divided into two parts master tables and transaction tables:
Master tables: book master table, member master table.
Transaction tables: issue, re-issue, reservation, anti-theft detection.
6. Develop the application and connect that application with the database: For the project application was developed in .net c#, according to the database tables created.
7. As application has been developed one need to learn how readers can be connected to the system's application and to read / write tags.
8. Now place those written tags inside the book at a place, such that no one can remove or tamper tags.
9. Next step is to assemble the complete system according to the architecture shown at the section I.
10. Testing needs to be done.[8]

IV. REQUIREMENTS FOR THE PROJECT

Platform: windows 7

Host software:

- Front end tool: Microsoft Visual Studio 2008
- Back end tool: SQL server 2005 enterprise edition

RFID Reader:

- Intermec IF2 Fixed reader
- ThingMagic USB Desktop RFID Reader

Tags: RFID Tags (AIDC Class II compliant) Inlays UHF

Antenna: Intermec Antenna UHF

Port: RS-232 serial port, network port

Frequency: UHF

Connecting Cables: LAN cables, serial cables

SDK: Download SDK for IF2 network Reader and ThinkMagic desktop reader for windows.[8] [5] [6] [2]

V. READER CONNECTIVITY WITH THE SYSTEM

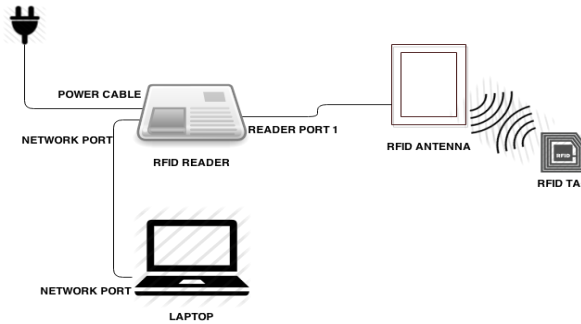


Fig: B (Shows network connection with IF2 Reader)

Before connecting your application with the IF2 network reader that will be used at the entry/ exit gates of the library, the very first connection with the reader if developer doesn't know the IP address of the reader than developer needs to establish serial connection with the reader, for that one needs to connect reader rs-232 port with rs-232 of the laptop with the help of null-modem cable, Developers needs to go through the reader's manual for the particular reader that they are using to see how to configure IP of the reader, once developer is aware of reader's IP address, from the next time onwards we can directly connect to the reader with network connection as shown in the figure B. For testing the connectivity with reader, developer can do so with the help of demo applications that can be downloaded from reader's r respective websites .Demo applications gives you different options for readers and antennas settings, reading/ writing tags, etc. [2][6][8]

Similarly ThinkMagic desktop reader can be connected to the system through USB connection, and rest of the things to configure desktop reader is same as introduced for IF2 reader above.

Once the developer is sure of reader's connectivity with laptop than he/she can continue to connect developed application for the library to the reader, for doing so one needs to have RFID SDK for reader that can be downloaded and installed. Once these SDK are installed correctly, developer can add reader's references into the .net application by right clicking the references in the solution explorer and then choose .net tab and search for reader's references to be added. Then some coding needs to done in order make reader properly working with the application.

VI. TAGGING OF BOOKS IN THE LIBRARY

Book can be tagged at different places like on the spine of the book, top of the book etc but the best place to put tag on the book according to research done is to place it any page inside book near the binding of the book, the reason for that is, it won't be visible as it would be placed really close to the binding, also it's very difficult to search tag in the book for the person who wants to tamper it, as it could on any random page. Also the tags that comes for library purpose are ¼ the width of normal inlay tags, so those could be easily be placed near to the book's binding.[8].



Fig: C (Book tag)[7]

VII. IMPLEMENTATION

Now implement the complete system according to the architecture shown in the Fig: A. Every reader needs to be integrated with the application, every book in the library needs to be tagged, antenna's frequencies needs to be set, library requires antennas frequency range to be only inside library not outside the library as we are only monitoring books going outside the library, so antenna's frequency needs to configured like the range, direction etc [8][5][6].

VIII. TESTING

Test the system with actually issuing, re-issuing, returning and entering and exiting out of the library with books. Antenna's frequency needs to be tested by focusing on the books that are going outside the library and to make sure that antenna's are sending signal back to the reader or not. Also desktop reader needs to be tested so as to make sure they are reading the books tags correctly and is accurate, and to make sure that there is no collision between readers.[8].

IX. CONCLUSION

With the help of this developer can actually understand the how to implement RFID technology into libraries. But for more clear understanding of how to actually integrate the application with reader developers needs to go through the reader's manual, developer's guide and sample code and try to run sample codes and demo applications, then go for your own developed library application or an existing library application in which you are willing to integrate RFID.

X. FUTURE WORK

My future work is to cover other module of library which are not explained in this paper i.e. searching module for the library, which helps in inventory management, book searching. Searching is done with the help of hand held reader, but to actually integrate application with the handheld reader could be challenging, so that would be my future prospect.

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