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# Purpose

## Intended Audience

This SRS document describes the System Requirements and Software Design for a Library Book Reservation and Collection System, and the target audience are System and Software Engineers working on the development of this project.

## Intended Use

The SRS defines the overall System Architecture and Requirements as well as the Software Architecture and Design. This document also contains the definition of the System Requirements which shall be used as the input for System Test cases and Software Unit Test cases.

## Scope

The Library Book Reservation and Collection System aims to serve the community, to encourage and increase the number of people reading and loaning books from the public libraries.

## Definitions and Acronyms

|  |  |
| --- | --- |
| **Acronym** | **Description** |
| IR | Infra-Red |
| LED | Light Emitting Diode |
| NFC | Near Field Communication |
| SW | Software |
| HW | Hardware |

# Overall System Description

## Use Case Diagrams



Library Patrons



Library

## System Architecture



DC Motor

Servo Motor

RFID Card Reader

LCD

I2C

**Raspberry Pi Development Board**

Camera

PWM

PWM



GPIO

SPI

Keypad

Switch

GPIO

CSI

## Functional Requirements

### Library Location Selection

There should be a main home screen providing any user options of whether where the user wants to access.

|  |  |
| --- | --- |
| **REQ\_ID** | **Requirement** |
| REQ-01 | Users shall be able to select the library branch from which they wish to borrow books while reserving on the webpage |
| REQ-02 | Depending on the user input in REQ-01, the location is decided by the state of the switch:  Left: Location 1  Right: Location 2 |

Is the switch on the left?

START

Location 1

Location 2

END

Yes

No

REQ-01

### User Account management

In the event if the user would like to borrow books or return book, this function is to get the user information and verify the user (Strictly only using NRIC or SP student card)

|  |  |
| --- | --- |
| **REQ\_ID** | **Requirement** |
| REQ-03 | In the webpage, the users will be brought to a page to provide their name and admin number to sign in |
| REQ-04 | In the RPI interface, the RPI is prompted to scan the users IC, the following text is displayed is displayed, the camera shall turn on, allowing the users to put their cards under to scan.  Line 1= “Scan your IC”  Line 2= “” |
| REQ-05 | If the barcode corresponds to an account, display on the LCD for 1s  Line 1= “(User’s name)”  Line 2= “(User’s admin number)” |
| REQ-06 | If the barcode does not correspond to an account, display on the LCD  Line 1= “Please press ‘#’”  Line 2= “to try again” |

START

END

Prompt user to sign in with the name and admin number

LCD displays “Scan your IC”

Camera will be switched on

Does barcode correspond to an account

LCD displays “Please press ‘#’ to try again”

No

LCD displays:

(Username)

(User’s admin no.)

Yes

REQ-04

REQ-05

REQ-06

### Book Selection and Reservation

This function will be able to help the users identify the books through the book barcode or number for tracking purposes.

|  |  |
| --- | --- |
| **REQ\_ID** | **Requirement** |
| REQ-07 | The user interface of the library with the text below shall be displayed on the LCD screen, the camera turns on when ‘\*’ is pressed, going to REQ-04:  Line 1 = “Location [1 or 2 (REQ-02)]”  Line 2 = “Press ‘\*’” |
| REQ-08 | The user interface of the library with the text below shall be displayed on the LCD screen and sign in successful as defined in REQ-07:  Line 1 = “Collect press 1”  Line 2 = “Return press 2”  The LCD will rotate screens to display the following text as well:  Line 1 = “Extend press 3”  Line 2 = “Pay fine press 4” |
| REQ-09 | If the option “Collect” is selected above, the location will be checked as defined in REQ-02. If the user is at the correct location, dispense book |
| REQ-10 | If the option “Collect” is selected above, the location will be checked as defined in REQ-02. If the user is at the wrong location, display:  Line 1= “Wrong location”  Line 2= “Go to location [1/2 (other location)]” |
| REQ-11 | If more than 10 books have been collected already, stop dispensing books and display  Line 1= “Maximum books”  Line 2= “reached (10)” |
| REQ-12 | If the option “Return” is selected in REQ-09, the respective names for the books being lent out would display on the LCD screen and sign in successful as defined in REQ-07. If there are more than 2 books, the screen will cycle until all the books have been displayed.  Line 1= “BOOK1 press 1”  Line 2= “BOOK2 press 2” |
| REQ-13 | If it has been 5 days since the time of reservation, the reserved book will be automatically removed from the reservations |

### Loan Period and Fine Payment

|  |  |
| --- | --- |
| **REQ\_ID** | **Requirement** |
| REQ-14 | If it has been 18 days since the loan date, there will be a $0.15 fine for every additional day |
| REQ-15 | In REQ-08, if option 3 is pressed, the following text is displayed:  Line 1= “Which book”  Line 2= “to extend loan” |
| REQ-16 | The respective names for the books being lent out would display on the LCD screen. If there is more than 1 book, the screen will cycle until all the books have been displayed.  Line 1= “BOOK1 press 1”  Line 2= “Return by [date]” |
| REQ-17 | If the book selected has not been extended before, the following text will be displayed:  Line 1= “Successfully”  Line2= “extended loan” |
| REQ-18 | If the book selected has been extended before, the following text will be displayed:  Line 1= “Previously”  Line 2= “extended” |
| REQ-19 | In REQ-08, if option 4 is pressed, the following text is displayed and the RFID is turned on  Line 1= “Scan your card”  Line 2= “To pay fine” |
| REQ-20 | If there is a fine, users are not allowed to borrow any books before paying |
| REQ-21 | If no fines are present, the following text will be displayed, before ending the sessions and going back to the main page  Line 1= “No fines” |

## Non-Functional Requirements

START

Library Location Selection

User Account Management

Prompt User to choose (Collect/Return/Extend/Pay Fine)

Is “Collect” chosen?

Is “Return” chosen?

Check the location

Is location correct?

LCD displays the books

Dispense books at location

LCD displays “Wrong location, go to location(1/2)”

Chosen books are returned

No

Yes

Yes

No

No

Yes

Is “Extend” chosen?

LCD displays “Which book to extend loan”

LCD displays “Book 1 press 1 return by (+7d) Book 2 press 2…”

Is it 1st time extending?

LCD displays “Previously extended”

LCD displays “Successfully extended”

Yes

No

Yes

Is “Pay Fine” chosen?

Is the user owing fine?

LCD displays “No Fine”

LCD displays “Scan your card to pay fine”

RFID is turned on

No

Yes

No

Yes

No

REQ-07

REQ-08

REQ-09

REQ-12

REQ-15

REQ-19

REQ-10

REQ-16

REQ-18

REQ-17

REQ-21

Borrowed books <10?

Yes

No

### 2.4. Non-Functional Requirement

|  |  |
| --- | --- |
| **REQ\_ID** | **Requirement** |
| REQ-22 | Users can only reserve up to 10 books |
| REQ-23 | The system shall respond to any user action within 500 ms under normal conditions. |
| REQ-24 | Only students and stuff with a Singapore Polytechnic student/stuff barcode can use this. |

# 3. Software Architecture

## 3.1. Static Software Architecture

The Software Architecture defines the various Software Components that are developed to realize the implementation of the system requirements.

**libInterface.py**

**webpage.py**

**Application Layer**

**Hardware Abstraction Layer (HAL)**

**hal\_dc\_motor.py**

**LCD**

**NFC**

**hal\_servo.py**