

SPL-1 Project Report, 2020

Library Assistant Tool

SE 305: Software Project Lab I

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1. Introduction

There are many types of books in the library, classified by writers, book types, serials, and qualities of books. Usually, readers ask questions frequently to the librarian about which book is very good, which book is so interesting, which book is popular or which book is suitable for them, and many other questions.

On the other hand, a librarian also has many responsibilities like choosing those books that are perfect or more demandable by readers. He also removes those books which are not suitable or not frequently borrowed by readers.

To make the librarian and readers' tasks more easy and comfortable, I planned to make an assistant tool, "Library Assistant Tool" that will recommend and provide decisions automatically through its statistical analysis and previous data manipulation.

1.1 Background Study

To implement this project, some prior study was necessary –

Decision Support System: A decision support system (DSS) is a computerized program used to support determinations, judgments, and courses of action in an organization or a business. A DSS sifts through and analyzes massive amounts of data, compiling comprehensive information that can be used to solve problems and in decision-making.

Multivariable Linear Regression: Multivariable Linear Regression: This is a method used to measure the degree to which more than one independent variable (predictors) and more than one dependent variable (responses), are linearly related

It is a method used to measure the degree to which more than one independent variable (predictors) and more than one dependent variable (responses), are linearly related. A mathematical model, based on multivariate regression analysis will address this and other more complicated questions.

Analytical Hierarchy Process: The analytic hierarchy process (AHP), is a structured technique for organizing and analyzing complex decisions, based on mathematics and psychology. AHP has been extensively studied and refined since then. It represents an accurate approach to quantifying the weights of decision criteria. Individual experts' experiences are

utilized to estimate the relative magnitudes of factors through pairwise comparisons. Each of the respondents compares the relative importance of each pair of items using a specially designed questionnaire.

Page Rank Algorithm: PageRank Algorithm is an algorithm used by Google Search to rank web pages in their search engine results... PageRank is a way of measuring the importance of website pages. According to Google: PageRank works by counting the number and quality of links to a page to determine a rough estimate of how important the website is.

The PageRank algorithm outputs a probability distribution used to represent the likelihood that a person randomly clicking on links will arrive at any particular page, PageRank can be calculated for collections of documents of any size.

Cross-Validation: Cross-validation is a resampling procedure used to evaluate machine learning models on a limited data sample. The procedure has a single parameter called k that refers to the number of groups that a given data sample is to be split into. As such, the procedure is often called k-fold cross-validation. • We use k-fold cross-validation. Where k=5. We train the data set from the training data set and then we use the testing data set to find out the accuracy of data.

1.2 Challenges

I have faced a lot of challenges during this project, specifically design, planning, and implementation of the Library Assistant Tool. This is a new type of idea and I didn't find any similar types of projects so that this will be more challenging for me. Here I describe the difficulties and obstacles of my project.

- Getting data from files and manipulating and organizing them in arrays in software Engineering.
- Designing, modeling, and Planning UI of my project through Java FX
- Understanding decision support system and planning how to implement it to my project
- Understanding Multivariable representation, Analytical Hierarchy Process, and Page rank algorithms and correctly implementing them.
- To compare my result accuracy, understand what is cross-validation and then implement it and see the answer and reach a decision about the best solution.
- Adding readers specific accounts and log in, sign up methods .
- Working with huge numbers of data and maintain the basic fundamentals of Object-Oriented Programming
- Experiment and Analyze huge number of data and bring the best output
- Maintaining huge number of data with multiple attribute using Object-Oriented Concepts

2. Objectives

There are some objective to complete this project I will briefly explain below:

- Try to solve real-world problems (library's readers and librarian problems)
- Make it easy to interact with the Library and get the best outcome from there.
- Suggesting/ Recommended personalized and category wise results that makes easy to select a book from library
- Analyze huge number of library data and implement multiple algorithms/ process
- Try to learn how to maintain a big application with proper documentation and arrangement
- Co-relate and combine different types of functionality in a single application like algorithm implementation, its result, checking the accuracy, recommendation, user management, etc.

3. Scope

In this project, I am trying to solve the problem of both librarian and readers. That means I automated the functionality of readers and librarian specifically in decision making problems. There are user-specific recommendations and category wise recommendations also included. I also try to visualize the whole project data set, algorithms results and statistical analysis.

Though there is a lot of work to be done. Still, there is some space to develop the project, for example, this tool can recommend only one specific library book. This can be developed and then the tool will recommend for each of the library-specific books. Readers' recommendations can also develop by using more machine learning algorithms to co-relate relations among all attributes of the books and perform more better-personalized recommendations.

4. Project Description

Library assistant tools is a recommended tool that helps readers to select/recommend popular books and assist librarians to add or remove books.

Here I used three methods to find out the results so that the tools can show results and help to give us accurate recommendations. These three methods are multivariable regression, analytical hierarchy process, and page rank algorithm.

I try to automate many tasks of librarians and make this tool a proper assistant for readers and the librarian. For personalized book recommendations, the reader should sign in/ sign up and get his personalized recommendation. During sign up readers provide/her name, education level, list of

favorite writers, list of favorite types of literature, so that tools can easily understand what readers demand and provide them a personalized recommendation.

As this is a decision support system, I am trying to find books' priority/ demand value so that I can organize all books in a different type of category library, that helps us to provide recommendations or guidelines for the library's multiple functionalities.

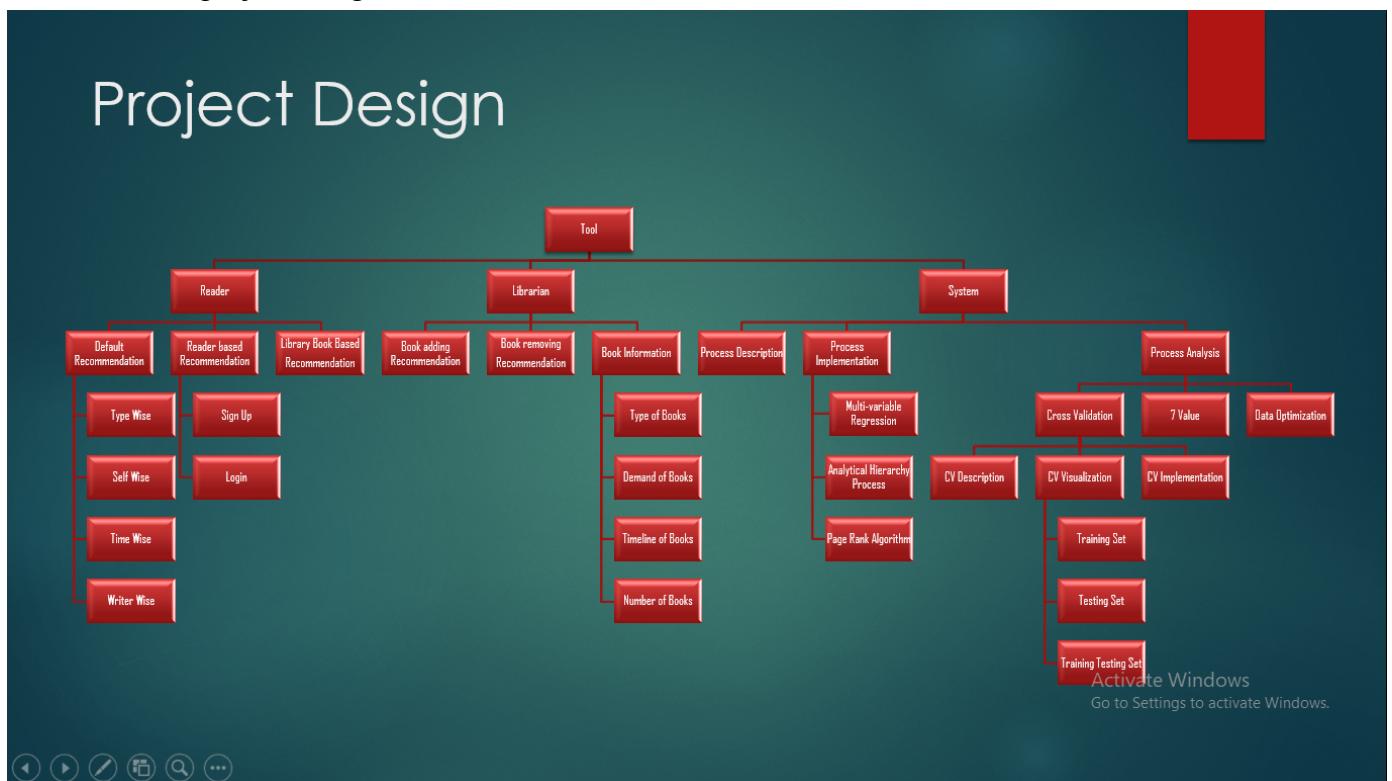
To get better results in the decision support system, I use Multivariable Regression (MLR), Analytical Hierarchy Process (AHP), and Page Rank Algorithm (PRA). After evaluating these three methods we find three different result sheets with unsimilar data distribution.

So I want to clarify which method's calculation is more accurate than others. We have done cross-validation for each of the three methods. We find the R.M.S value for every three methods and find the lowest R.M.S value for multivariable regression.

Low R.M.S. value means better accuracy, so I use a multivariable regression method's result for all my recommendations like adding books suggestions, removing book suggestions, most popular books, etc.

I also visualize all types of data distribution and result like Multivariable Regression (MLR), Analytical Hierarchy Process (AHP), and Page Rank Algorithm (PRA)'s result, cross validation's training set, testing set, implementation of seven value statistics, methods comparison and other through scatter chart, line chart and stacked area chart.

Here is the full project design:



5. User manual

Cloning/Downloading the project: First clone the repository by this:

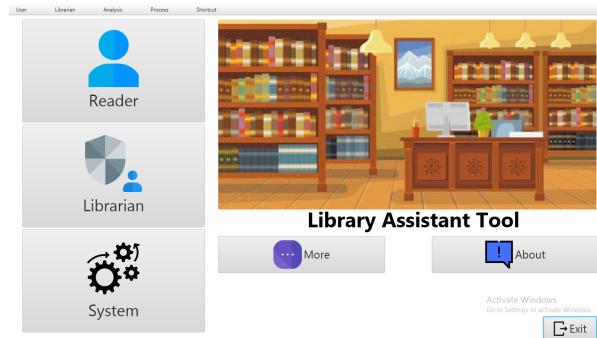
```
git clone https://github.com/rakib 3004/SPL1
```

Git command using ubuntu terminal or git bash.

or download the full repository from the Github website.

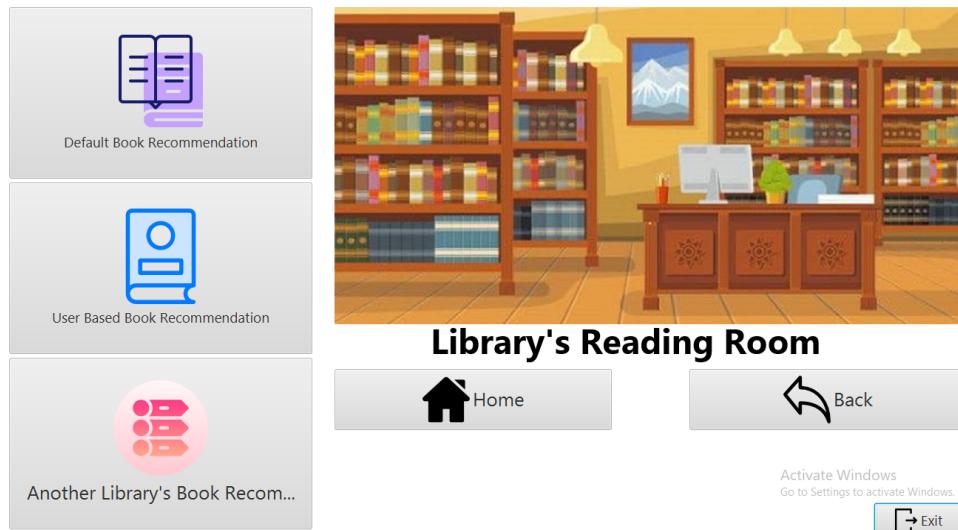
```
rakib@rakib-VirtualBox:~/Documents$ git clone https://github.com/rakib3004/SPL1
Cloning into 'SPL1'...
remote: Enumerating objects: 14522, done.
remote: Counting objects: 100% (143/143), done.
remote: Compressing objects: 100% (95/95), done.
remote: Total 14522 (delta 59), reused 106 (delta 34), pack-reused 14379
Receiving objects: 100% (14522/14522), 32.91 MiB | 442.00 KiB/s, done.
Resolving deltas: 100% (11194/11194), done.
rakib@rakib-VirtualBox:~/Documents$
```

Run/ Execute the project: After completing download, open the folder and go to src/JavaFX package then run Main.java file and see this types of UI:

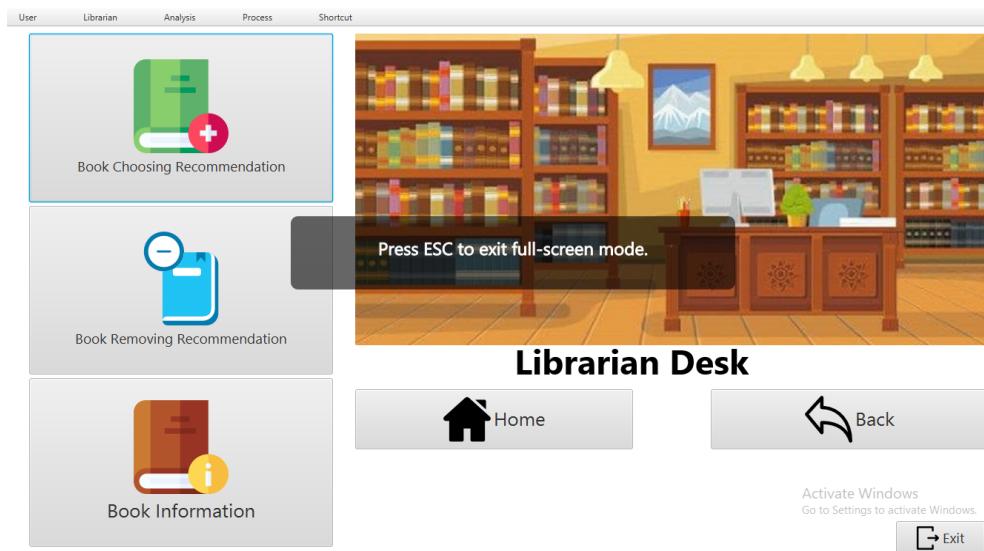


There are 3 options: Reader, Librarian and System. By clicking each of the option, you can find this type of view:

Library's Reading Room: Where users can find out library's book with the help of a tool's recommendation. There are three options: Default, User Based and Another Library's book recommendation.



Librarian Desk: Where librarian can choose to add more relatable/ suitable books for library or remove unused/ unpopular books from library using the tool's recommendation.



Default Book Recommendation: By selecting, Default Book Recommendation, there are 4 categories to choose specific books' recommendations. They are Type, Writer, Time and Shelf wise.

For example, selecting “Humayon Ahmed” in the Writer wise menu item. We can view all Humayon Ahmed's most popular books from this library.

The following picture shows the functionality:

Book Name	Writer Name	Type Name	Book ID
Himu Rimande 1	Humayon Ahmed	Uponnash	01-0608-100034
Misir Alir Omnidash	Humayon Ahmed	Religion	04-0914-100565
Holud Himu Kalo Rab 1	Humayon Ahmed	Uponnash	01-0608-100038
Magic Mursi	Humayon Ahmed	Uponnash	01-1016-100829
Tondra Bilash	Humayon Ahmed	Uponnash	01-0815-100679
Aj) Himir biye	Humayon Ahmed	Uponnash	01-1016-100826
Misir Alir Chosma	Humayon Ahmed	Uponnash	01-0608-100036
Chole Jay Bosonter Din	Humayon Ahmed	Uponnash	01-0815-100677
Dhigir Jole e Kar Sayago	Humayon Ahmed	Uponnash	01-1016-100830
Rupar Palonko	Humayon Ahmed	Uponnash	01-0815-100678
Holud Himu Kalo Rab 2	Humayon Ahmed	Uponnash	01-0608-100039
Rupa 1	Humayon Ahmed	Uponnash	01-0608-100044
Rupar Palonko	Humayon Ahmed	Uponnash	01-0608-100040
Ei Bosonte	Humayon Ahmed	Uponnash	01-0608-100032
Badol Diner Ditiyo kodom ful	Humayon Ahmed	Uponnash	01-0608-100033
Ekjon Hiimu o koyekti jiji poka	Humayon Ahmed	Uponnash	01-1208-100045
Dure Kotau	Humayon Ahmed	Uponnash	01-0409-100087
Mojar Voot	Humayon Ahmed	Shishu Shahitto	11-1210-100211
Himur Ditiyo Prohor	Humayon Ahmed	Uponnash	01-0409-100084
Himu Rimande 2	Humayon Ahmed	Uponnash	01-0410-100145
Ema 2	Humayon Ahmed	Uponnash	01-0815-100680
Himu Mama	Humayon Ahmed	Uponnash	01-0409-100085

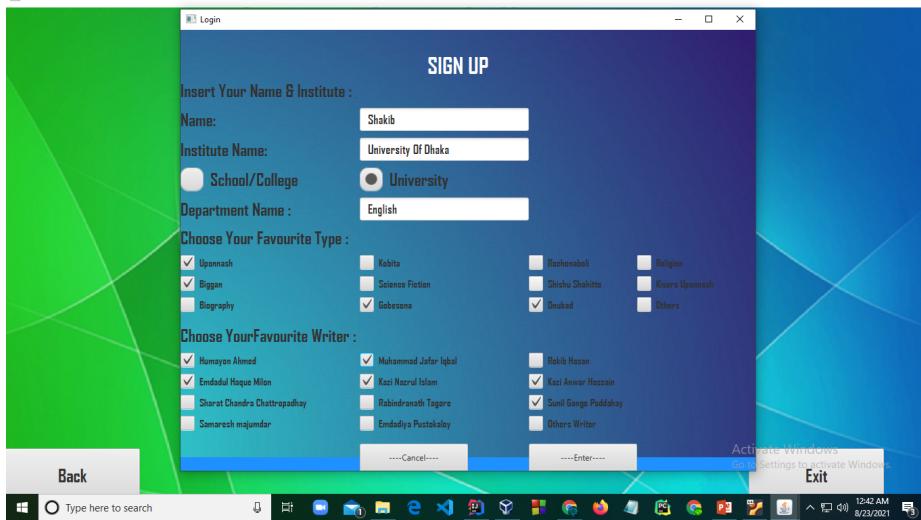
User Based Book Recommendation: For user-based recommendation, readers must Sign Up first with their favorite writers, and favorite types of literature list which help to recommend their choice list book. After creating an account successfully he must login and find his recommended books.

Login/

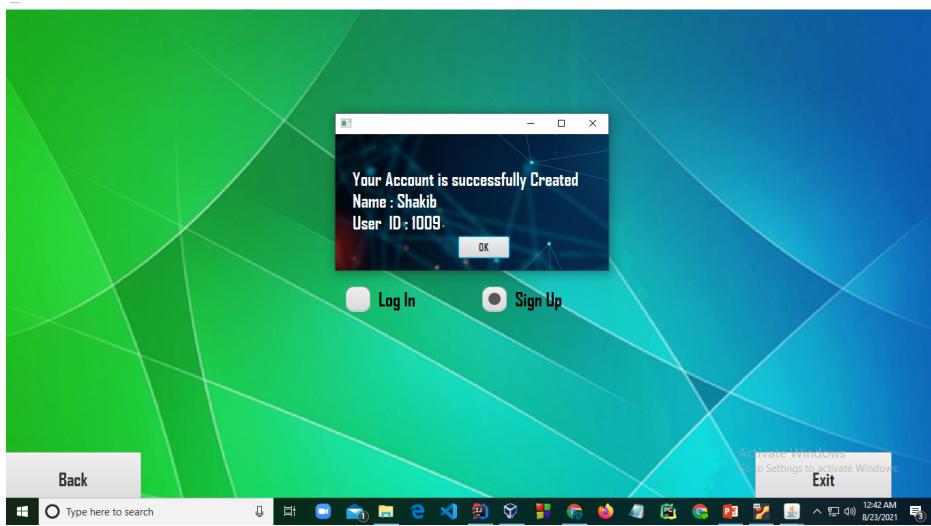
Sign Up Option:



Sign Up Window (Fill Up with reader information):



Create Account Successfully:



Login WIndow:



Showing Personalized Book Recommendation:

Shakib's Choice List

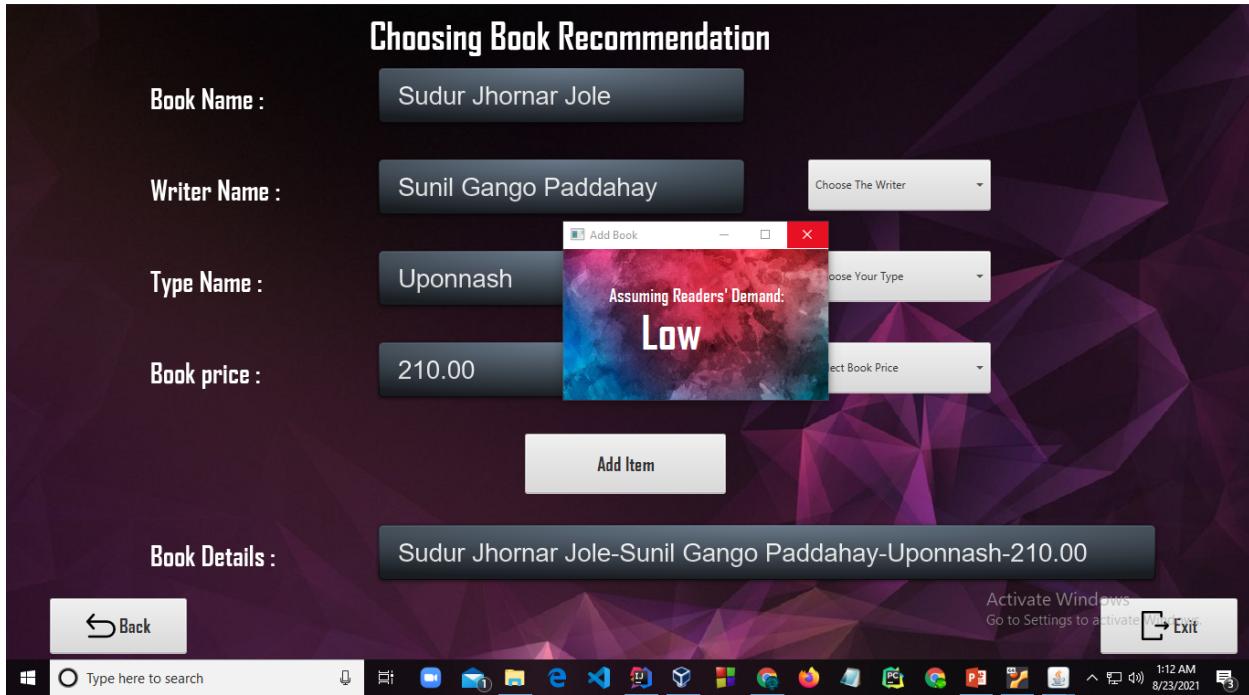
Book Name	Writer Name	Type Name	Book ID
Science Friction Somogro	Muhammad Jafar Iqbal	Sci Fi	06-0810-100180
Himu Rimande 1	Humayon Ahmed	Uponnash	01-0608-100034
Tom and Jerry	Sahara Tusr	Uponnash	01-0516-100516
Holud Himu Kalo Rab 1	Humayon Ahmed	Uponnash	01-0608-100038
Nisongo Grohochari	Muhammad Jafar Iqbal	Sci Fi	06-0815-100672
Suhancer Sopno	Muhammad Jafar Iqbal	Sci Fi	06-0810-100181
Magic Munsi	Humayon Ahmed	Uponnash	01-1016-100829
Tondra Bilash	Humayon Ahmed	Uponnash	01-0815-100679
Gopal Var 100 Golpo	Gopal Var	Uponnash	01-0516-100812
Finix 1	Muhammad Jafar Iqbal	Sci Fi	06-0815-100670
Debdash	Sharatchandra Chottopaddhday	Uponnash	01-0815-100682
Aj Himur biye	Humayon Ahmed	Uponnash	01-1016-100826
Kajol er Diba Rattri	Muhammad Jafar Iqbal	Uponnash	01-0410-100153
Cromium Oronno	Muhammad Jafar Iqbal	Sci Fi	06-0810-100184
Misir Alir Chosma	Humayon Ahmed	Uponnash	01-0608-100036
Chole Jay Bosconter Din	Humayon Ahmed	Uponnash	01-0815-100677
Dhigir Jol e Kar Sayago	Humayon Ahmed	Uponnash	01-1016-100830
Rongin Eshoper Golpo	Suvro Sham	Uponnash	01-0516-100809
Rupar Palonko	Humayon Ahmed	Uponnash	01-0815-100678
Finix 1	Muhammad Jafar Iqbal	Sci Fi	06-0810-100188
Meku Khahini 1	Muhammad Jafar Iqbal	Kisore Uponnash	10-0810-100193
Holud Himu Kalo Rab 2	Humayon Ahmed	Uponnash	01-0608-100039

Back

[Activate Windows](#)
[Go to Settings](#) [Create Window](#) **Exit**

Librarian Functionality:

Librarian has mainly two functionality through this tool they are: choose new books and remove unused/ unpopular books.



Providing all information of a new book, it recommended the readers demand **High, Medium or Low**.

Remove Book Recommendation

Book Name	Writer Name	Type Name	Book ID
Dr. Lutfar Rahman Rocona Boli	Dr. Lutfar Rahman	Rochonaboli	05-0608-100028
Sresto Kobita	Sunil Gangopadhyay	Kobita	02-1211-100282
Griho Dah	Sharat Chandra Chattropadhyay	Uponnash	01-1009-100095
Meghe Matite Makha Makhi	Somresh Mojumder	Uponnash	01-0410-100137
Josna Raat e Tin ta meye	Emdadul Haque Milon	Uponnash	01-1208-100054
Jugol Bandi	Shirshendu Mukhopadhyay	Uponnash	01-0409-100091
Sufia Kamal Rocona Boli	Sufia Kamal	Rochonaboli	05-0608-100016
Monsur Ahmed Rocona Boli	Monsur Ahmed	Rochonaboli	05-0608-100026
Sopno Iojahin	Sunil Gangopadhyay	Uponnash	01-0409-100076
Paksar Jamin Saad Baad	Humayun Azad	Uponnash	01-0810-100155
Sharat Kisore Shahitto	Sharatchandra Chottopadddhay	Kisore Uponnash	10-1210-100221
Prothom Valobasa Vula Jay Na	Nurjahan Sila	Uponnash	01-0815-100689
Nam tar Fakhrul	Asad Bin Hafeez	Shishu Shahitto	11-1210-100223
Hok o Batiler Cironton Dondo	Shah Ahmed Shafi Shaheb	Religion	04-1215-100710
Selected Poem of Asad Chowdhury	Asad Chowdhury	Kobita	02-1211-100298
Prothom Alo 2	Sunil gangopadhyay	Uponnash	01-0409-100078
Antor Ambare	Antor Ambare	Uponnash	01-0409-100082
Prane Dhoresi Tomake	Shahera Khatun	Kobita	02-0212-100307
Surer Shay Maton	Anjuman ara begum	Uponnash	01-1009-100103
Talash	Kuyasha	Uponnash	01-0410-100149

Total Books : 20

Activate Windows
Go to Settings to activate Windows.
Exit

Remove Book Recommendation: This tool can recommend any number of books, those are unused or unpopular for this library. For example, here recommend top 20 books those should remove from this library.

There are also other usage of this tool like showing the result of Multivariable Regression (MLR), Analytical Hierarchy Process (AHP), and Page Rank Algorithm (PRA), Cross Validation of those three methods and these data set visualization, book information bar and pie chart, seven value statistics, methods' result comparison using scatter, line and stacked area chart.

6. Conclusion

From the beginning of this SPL project, I am confident that I have done all the documentation, design, planning, implementation, coding, and testing properly. I have fulfilled all functionality that I was committed to from the beginning of this SPL project. I had very little experience in developing and handling large codes. This SPL project has challenged my limits. I am happy that I could complete this challenge successfully and have taken the project to a state of progress that I had hoped at the beginning. I have learned a lot about the field of Statistics, Charts, methods comparison, user interface, user account management, accuracy checking b. I feel that my critical thinking has also improved a lot. This project makes me mentally stronger, more confident, and more determined for my future projects.

References

My First Repository: <https://github.com/rakib3004/Software-Project-Lab-1>

My Second Repository: <https://github.com/rakib3004/SPL1>

Library's Book Information from: <https://www.facebook.com/khilkhetpathagar/>

Multivariable Regression: <https://brilliant.org/wiki/multivariate-regression/>

Analytical Hierarchy Process:

https://en.wikipedia.org/wiki/Analytic_hierarchy_process_%E2%80%93_car_example

Page Rank Algorithm: <https://en.wikipedia.org/wiki/PageRank>

Cross-Validation:

<https://towardsdatascience.com/cross-validation-explained-evaluating-estimator-performance-e51e5430ff85>

<https://www.analyticsvidhya.com/blog/2018/05/improve-model-performance-cross-validation-in-python-r/>

JavaFX Tutorial: <https://tutorials.jenkov.com/javafx/index.html>

