

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 good, which book is 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 decisions automatically through its statistical analysis and previous data manipulation.

## **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 systems and planning how to implement them 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 the huge number of data and bring the best output
- Maintaining a huge number of data with multiple attributes using Object-Oriented Concepts

### **3. Objectives**

The objectives of this project are given below:

- Solve real-world problems ( library's readers and librarian problems)
- Make it easy to recommend books for readers selecting by writer type or shelf wise
- Make it easy to get recommendations for adding new books or removing old books from the library
- Suggesting/ Recommended personalized and category wise results that make it easy to select a book from library
- Analyze 700+ books data and implement/ process for find outcome for recommendation.
- 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.

### **4. Background Study**

To implement this project, some prior study was necessary –

**Decision Support System:** A decision support system (DSS) is a process used to support determinations, judgments, and courses of action in a system. A DSS sifts through and analyzes massive amounts of data, compiling comprehensive information that can be used to solve problems and in decision-making. DSS uses the summary information, exceptions, patterns, and trends using the analytical models. A decision support system helps in decision-making but does not necessarily give a decision itself.

**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 to rank objects by calculating the relationships among all others objects. Page Rank is a way of measuring the importance of an object by finding out links and relations among these objects. PageRank works by counting the number and quality of links to an object to determine a rough estimate of how important the object is.

The PageRank algorithm outputs a probability distribution used to represent the likelihood that a person randomly choosing objects will arrive at any particular object, PageRank can be calculated for collections of documents of any size of data.

**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.

## 5. Project Description

Library assistant tool 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 automate many tasks of librarians and make this tool a proper assistant for readers and the librarian. For personalized book recommendations, the reader needs to 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 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, which helps us to provide recommendations or guidelines for the library's multiple functionalities.

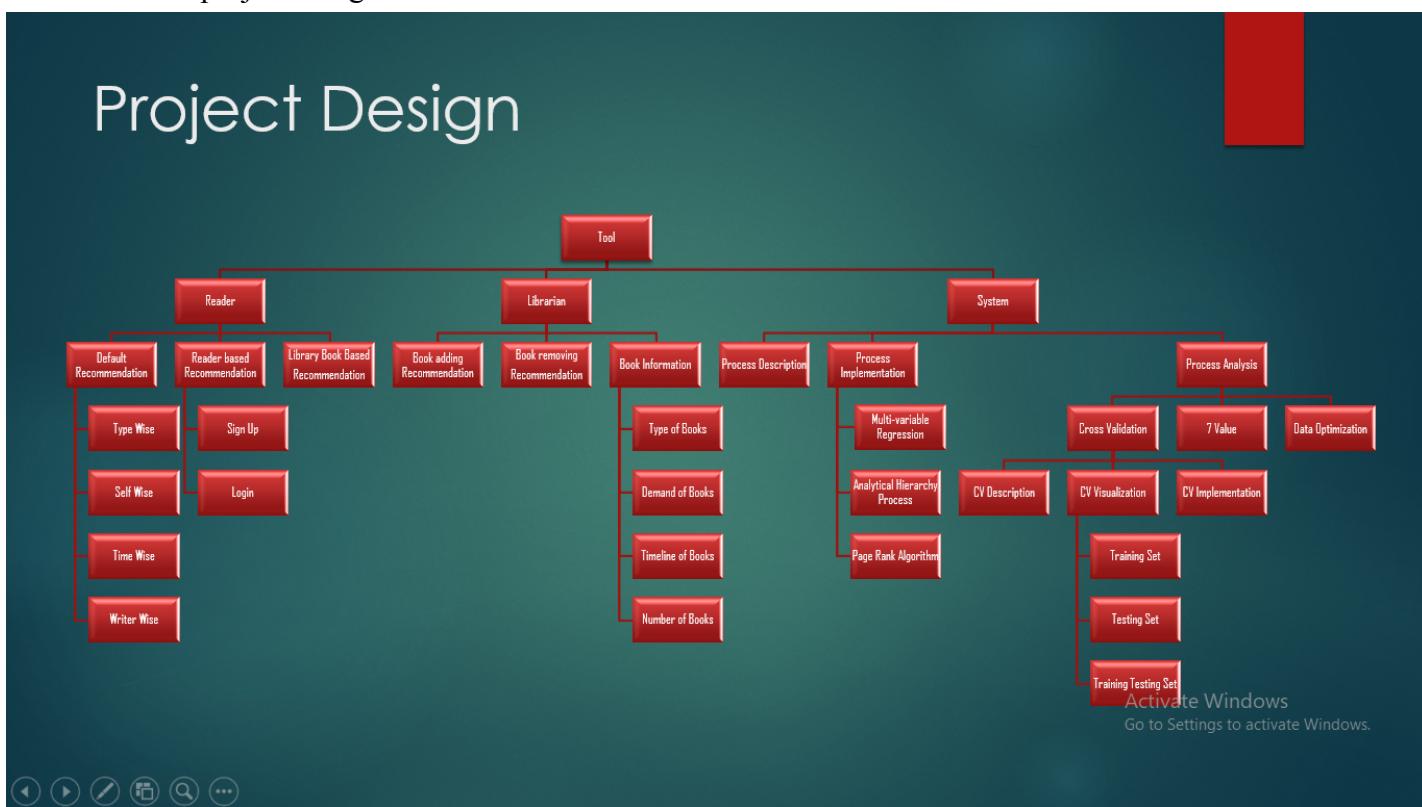
To get better results in the decision support system, I use Multivariable Regression (MLR), Analytical Hierarchy Process (AHP), and Page Rank Algorithm (PRA). After evaluating these three methods we find three different result sheets with unsimilar data distribution.

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 results of 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:



**Figure 1: Full Project Design**

## 6.User manual

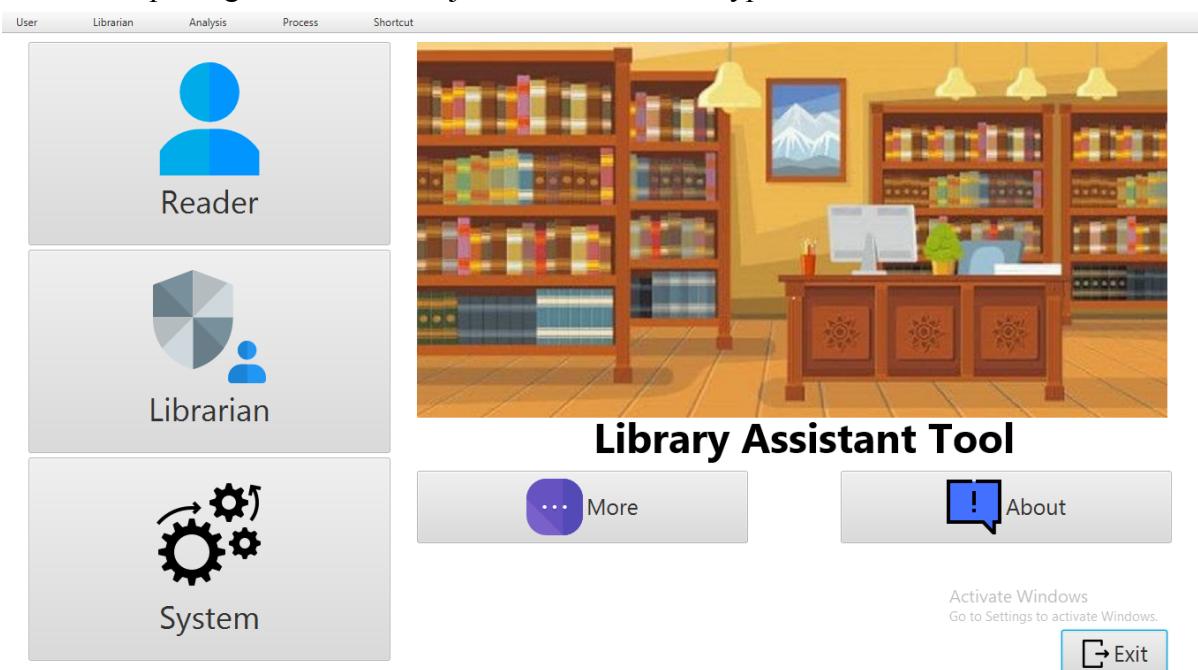
**Cloning/Downloading the project:** First clone the repository by this:

```
git clone https://github.com/rakib3004/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$
```

**Figure 2: Downloading the Project from Github**

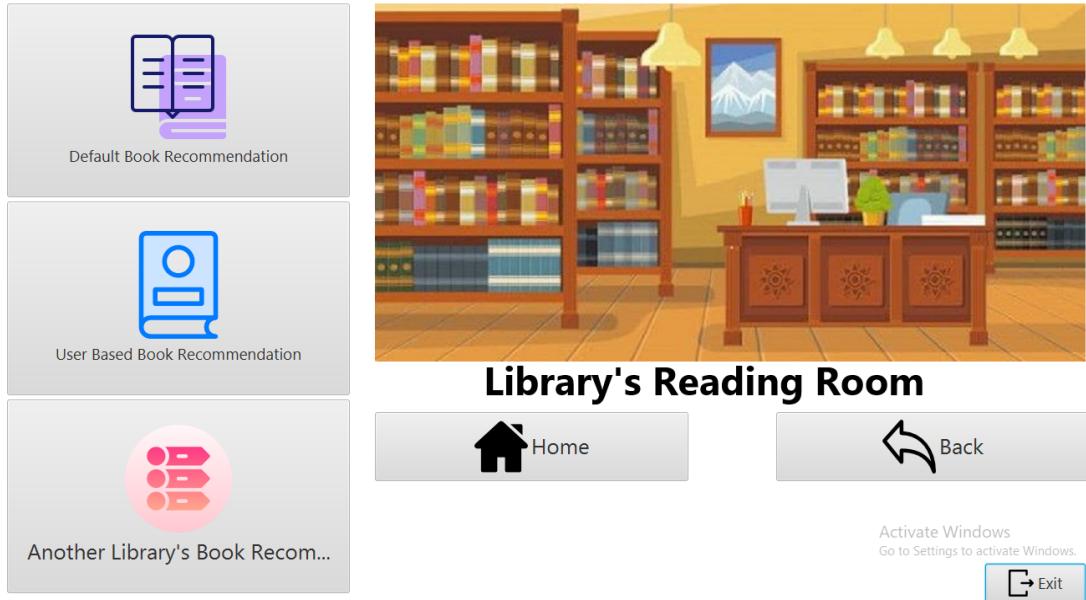
**Run/ Execute the project:** After completing the download, open the folder and go to src/JavaFX package then run Main.java file and see this type of UI:



**Figure 3: Run the project**

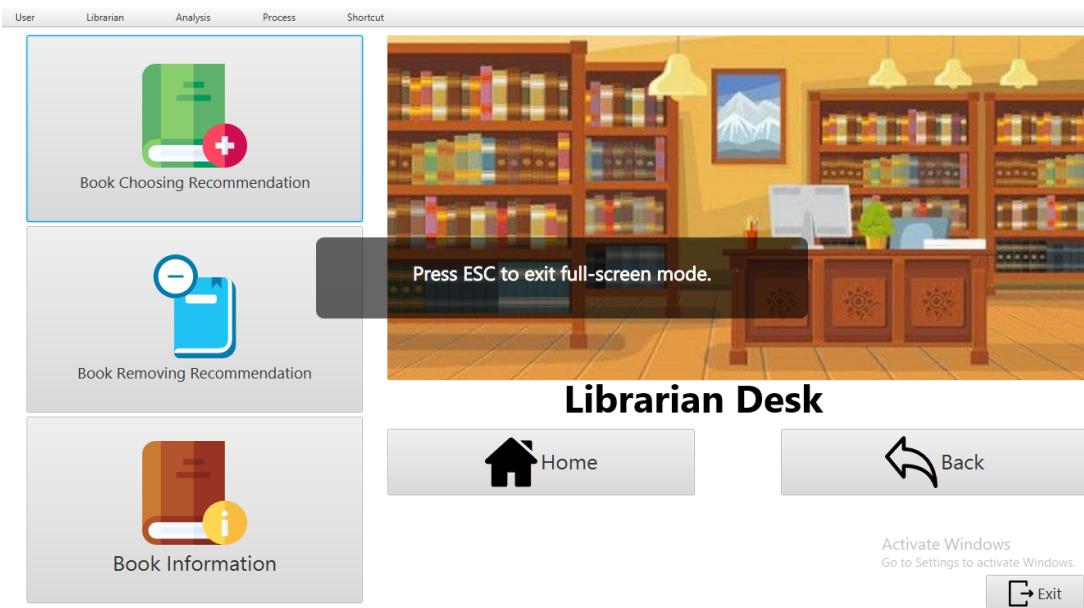
There are 3 options: Reader, Librarian, and System. By clicking each of the options, you can find this type of view:

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



**Figure 4: Library's Reading Room**

**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.

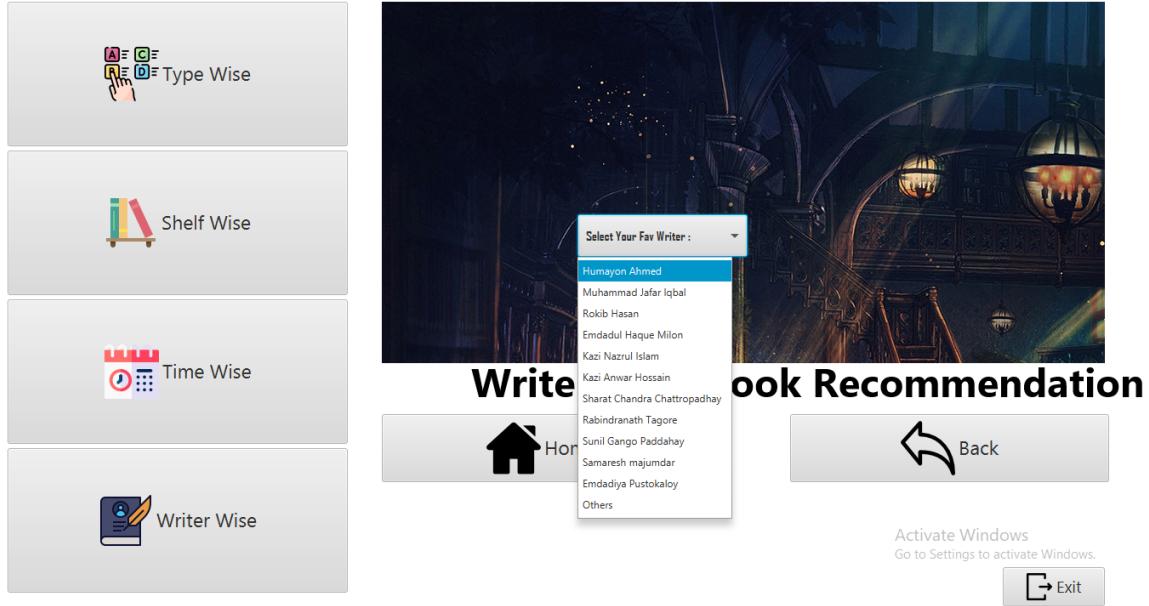


**Figure 4: Librarian Desk**

**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:



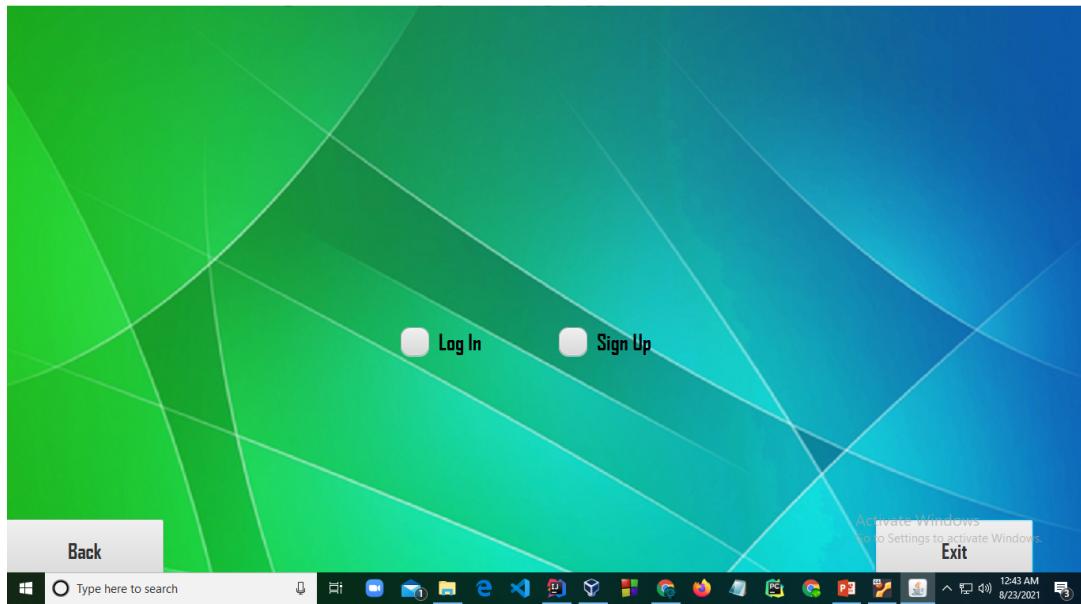
**Figure 5: Default Book Recommendation**

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

**Figure 6: Writer Specific Recommendation showing**

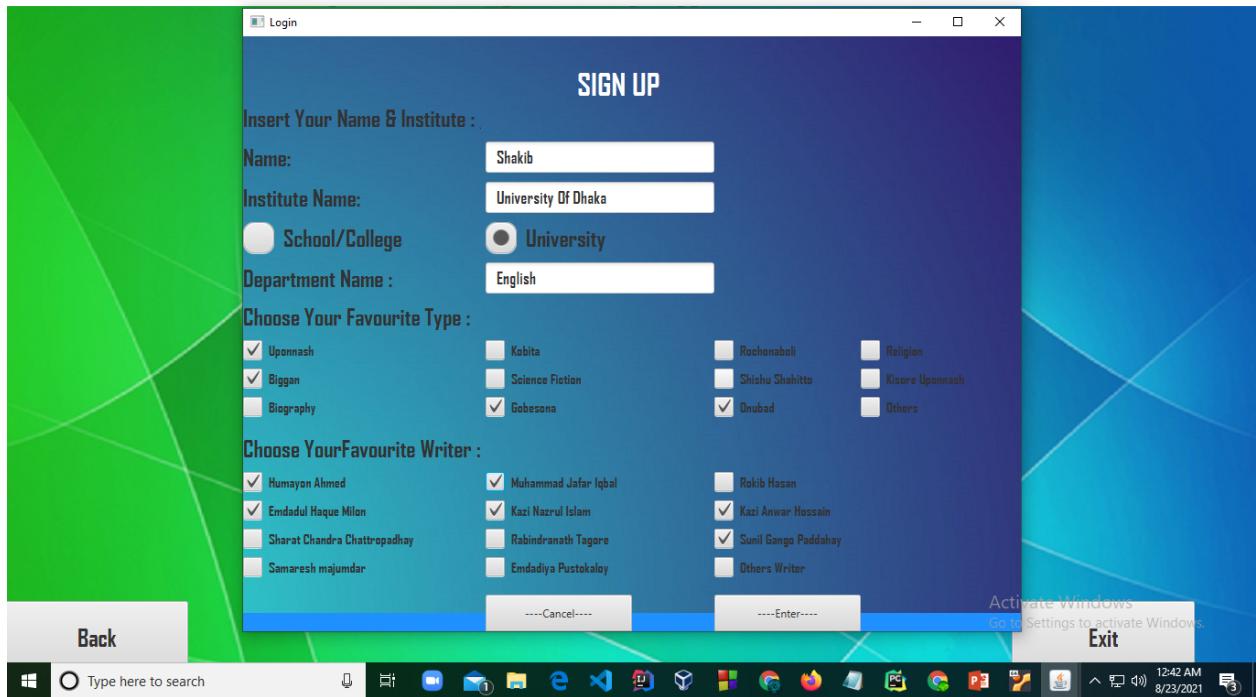
**User-Based Book Recommendation:** For user-based recommendation, readers must Sign Up first with their favorite writers, and favorite types of literature lists which help to recommend their choice list book. After creating an account successfully he must log in and find his recommended books.

**Login/ Sign Up Option:**



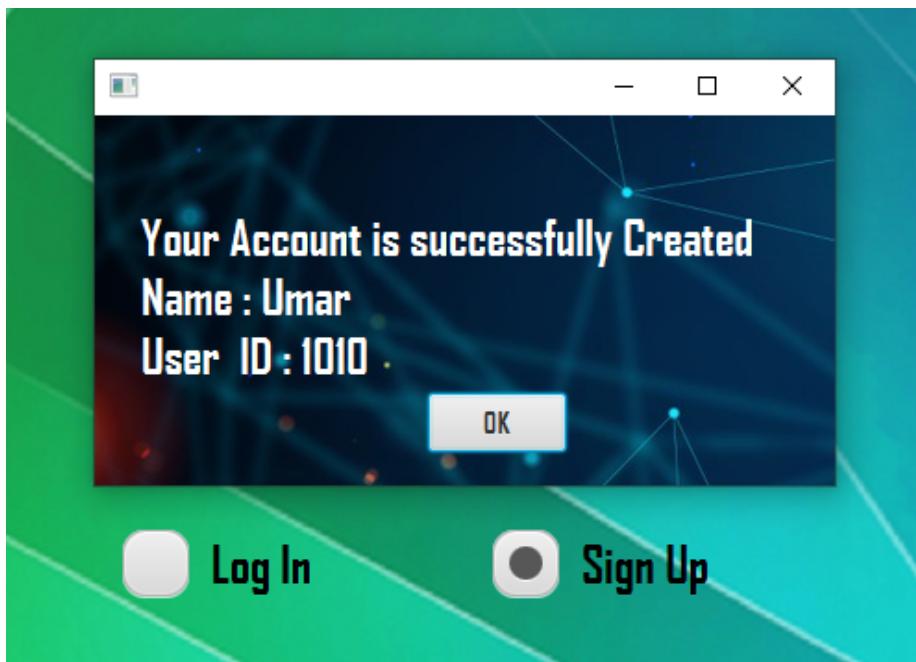
**Figure 7: Login/ Sign Up Option**

#### **Sign Up Window (Fill Up with reader information):**



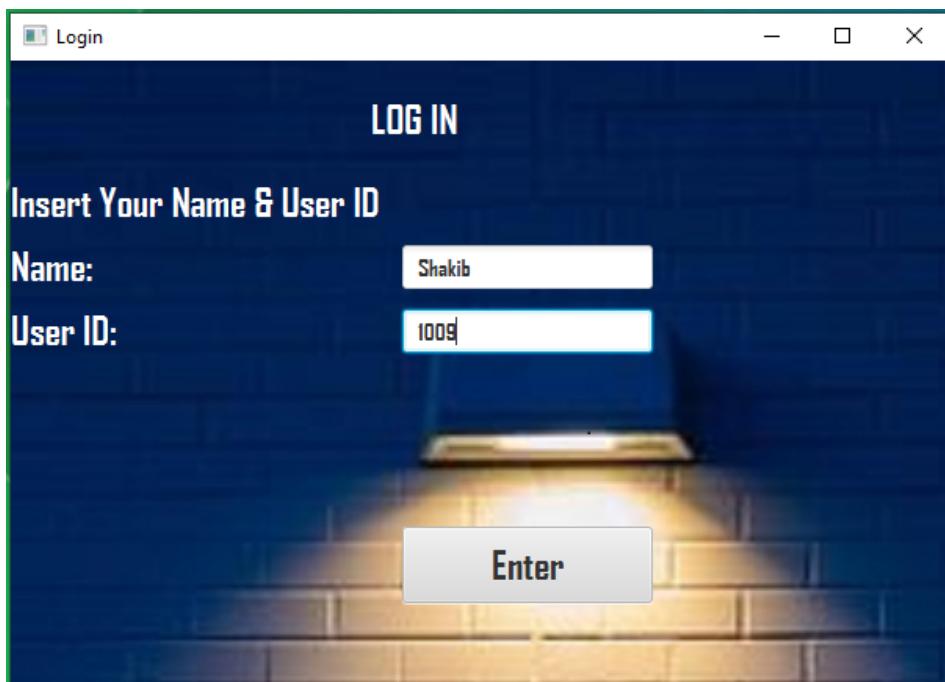
**Figure 8: Sign Up Window**

#### **Create Account Successfully:**



**Figure 9: Account Confirmation**

**Login Window:**



**Figure 10: Login Window:**

**Showing Personalized Book Recommendation:**

| 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 Tusar                 | 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 Bosnter 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 Khabini 1           | Muhammad Jafar Iqbal         | Kisore Uponnash | 10-0810-100193 |
| Holud Himu Kalo Rab 2    | Humayon Ahmed                | Uponnash        | 01-0608-100039 |

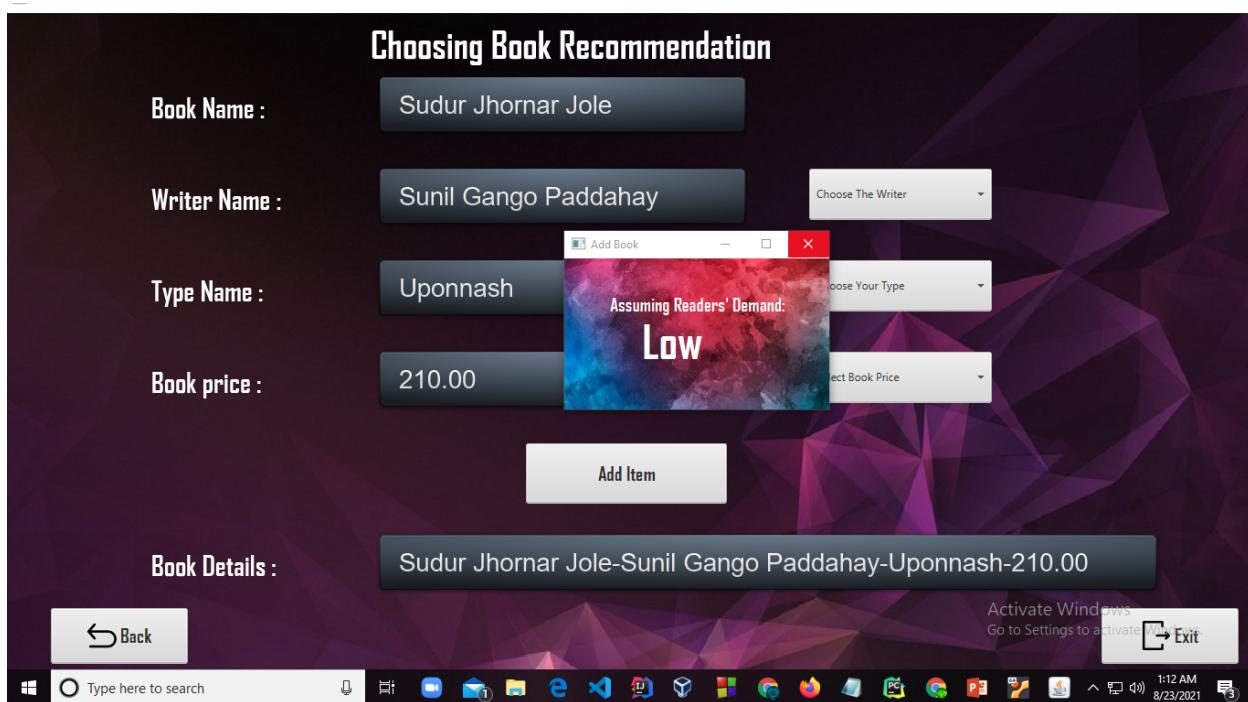
Back

Activate Windows  
Go to Settings to activate Window  
Exit

Figure 11: Personalized Book Recommendation

### Librarian Functionality:

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



**Figure 12: Choosing Book Recommendation**

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

| 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 Chottopaddhday  | Kisore Uponnash | 10-1210-100221 |
| Prothom Valobasa Vula Jay Na    | Nurjahan Sila                 | Uponnash        | 01-0815-100689 |
| Nam tar Fakhruh                 | 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 Sray Maton                | Anjuman ara begum             | Uponnash        | 01-1009-100103 |
| Talash                          | Kuyasha                       | Uponnash        | 01-0410-100149 |

Back

Total Books :

20

Activate Windows  
Go to Settings to activate Windows.

Exit

**Figure 13: Remove Book Recommendation**

**Remove Book Recommendation:** This tool can recommend any number of books, that are unused or unpopular for this library. For example, here recommend the top 20 books that need to 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.



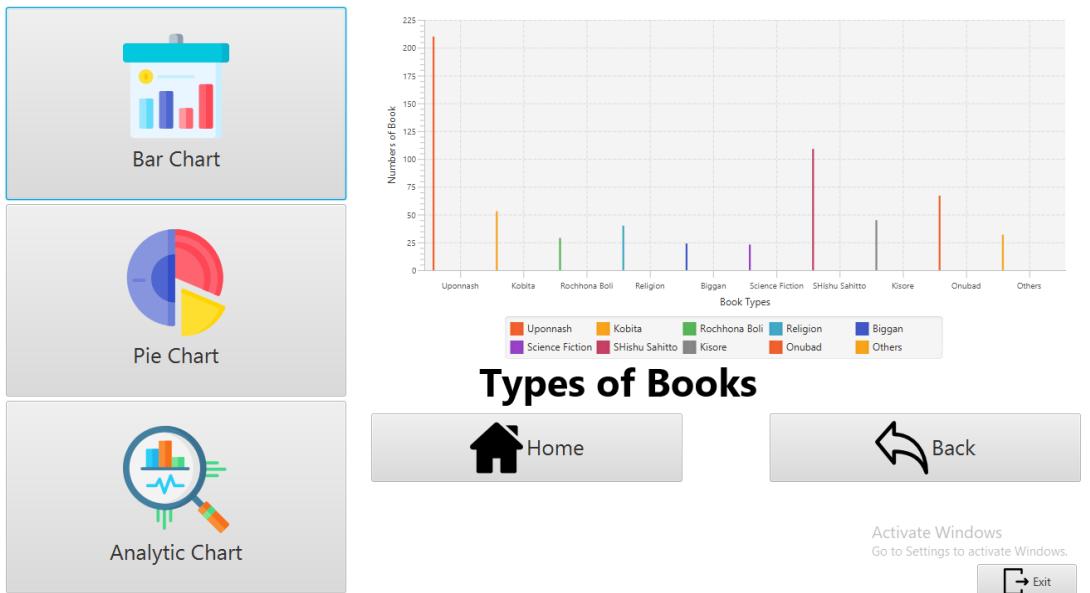
**Figure 14: Testing Set Stacked Area Chart**



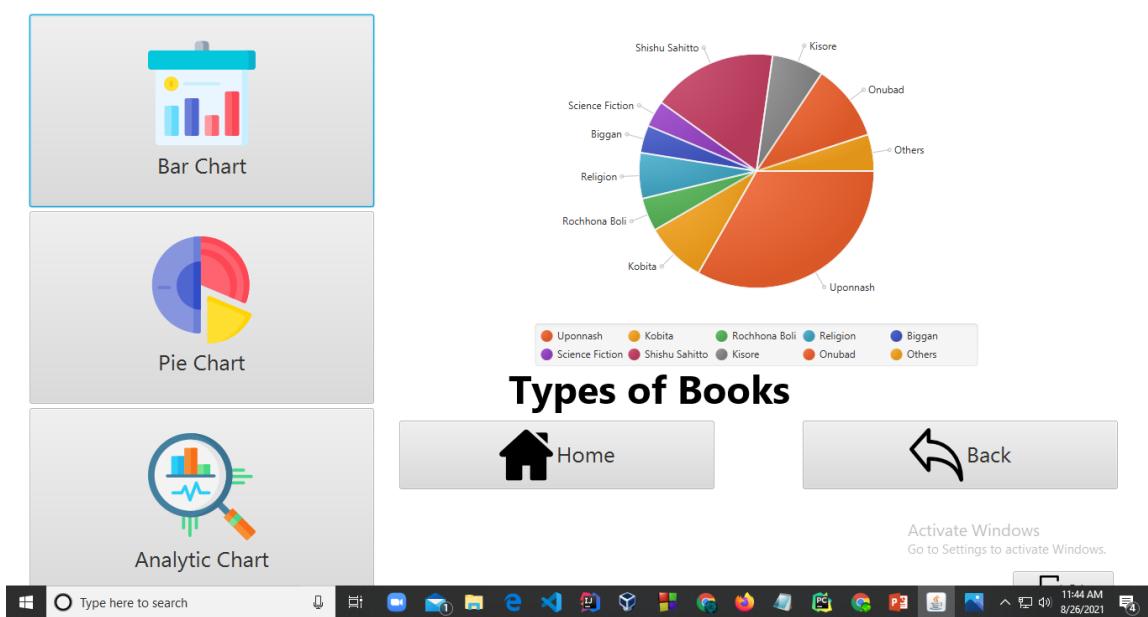
**Figure 15: Training Testing Set Line Chart**

Fig 14 showing all 4 training set data visualization through stacked area chart in cross-validation of multivariable regression.

Fig 15 showing the comparison between training and testing data set visualization through stacked area chart in cross-validation of multivariable regression.



**Figure 16: Type of Library Books in Bar Chart**



**Figure 17: Type of Library Books in Pie Chart**

Fig 16 & Fig 17 showing the number of books in this library with different types of books classification through bar chart and pie chart.

So, there are many types of many data visualization of process implementation. Like these to more clarify about process, data manipulation, and results.

## **7. Implementations and Tools**

- Language: Java
- Framework: Java FX
- Lines of Code: 37,000+
- Number of Packages: 30
- Number of Classes: 140
- Percentage of Source lines: 88%
- Percentage of Blank lines: 10%
- Number of Github Commits: 1300+
- Project Duration: January 2020 to August 2021

## **8. Scope**

In this project, I am trying to solve the problem of both librarians 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.

The functions of This tool solve the most common problems of both librarian and user. Recommendation of multiple sections is the main scope of this project. Still, there is enough scope to improve like working with multiple library data, add feedback value of readers in the recommendation process, user-specific recommendations through previous readers data analysis.

## **9. 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, checking accuracy. 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.

Though there is a lot of work to be done. Still, there is some scope 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.

# References

- “Cross-Validation Methodology.” 2013. cross-validation-explained.  
<https://towardsdatascience.com/cross-validation-explained-evaluating-estimator-performance-e51e5430ff85>.
- Khilkhet Pathagar. 2010. “Facebook Page of Khilkhet Pathagar.” Khilkhet Pathagar.  
<https://www.facebook.com/khilkhetpathagar/>.
- “Multivariable Regression Methodology.” n.d. multivariate-regression.  
<https://brilliant.org/wiki/multivariate-regression/>.
- “Page Rank Algorithm Methodology.” 2007. Page Rank Algorithm.  
<https://en.wikipedia.org/wiki/PageRank>.
- Trofder, Md. Rakib. 2020. “Library Recommendation Tool 1st Repository.” Software-Project-Lab-1.  
<https://github.com/rakib3004/Software-Project-Lab-1>.
- Trofder, Md. Rakib. 2020. “Library Recommendation Tool 2nd Repository.” SPL1.  
<https://github.com/rakib3004/SPL1>.
- Wikipedia. 2014. “Analytical Hierarchy Process Methodology.” Analytic\_hierarchy\_process.  
[https://en.wikipedia.org/wiki/Analytic\\_hierarchy\\_process\\_%E2%80%93\\_car\\_example](https://en.wikipedia.org/wiki/Analytic_hierarchy_process_%E2%80%93_car_example).
- Jenkov, “JavaFX Tutorial.” jenkov's tutorials.  
<https://tutorials.jenkov.com/javafx/index.html>.