DWIT COLLEGE

DEERWALK INSTITUTE OF TECHNOLOGY

Tribhuvan University

Institute of Science and Technology

KIRAFATYANGRA - A TOOL TO RECOMMEND INSECTICIDES

A PROJECT REPORT

Submitted to

Department of Computer Science and Information Technology

DWIT College

In partial fulfillment of the requirements for the Bachelor's Degree in Computer Science and Information Technology

Submitted by

Sarthak Khanal (1814/069)

August, 2016

DWIT College

DEERWALK INSTITUTE OF TECHNOLOGY

Tribhuvan University

SUPERVISOR'S RECOMMENDATION

I hereby recommend that this project prepared under my supervision by SARTHAK KHANAL entitled "**KIRAFATYANGRA - A TOOL TO RECOMMEND INSECTICIDES**" in partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Information Technology be processed for the evaluation.

……

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DEERWALK INSTITUTE OF TECHNOLOGY

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LETTER OF APPROVAL

This is to certify that this project prepared by SARTHAK KHANAL entitled "**KIRAFATYANGRA - A TOOL TO RECOMMEND INSECTICIDES**" in partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Information Technology has been well studied. In our opinion it is satisfactory in the scope and quality as a project for the required degree.

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…….. Jagdish Bhatta [External Examiner] IOST, Tribhuvan University	…….. Sarbin Sayami [Internal Examiner] Assistant Professor IOST, Tribhuvan University

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STUDENT'S DECLARATION

I hereby declare that I am the only author of this work and that no sources other than the listed here have been used in this work.

... ...

Sarthak Khanal

Date: August, 2016

ABSTRACT

Insecticides are used to control diseases that occur in plants. If insecticides are not used properly then it can cause damage to environment and plant.

The project analyzes the data of rating provided by the end users and use the data to recommend insecticides to be used for the plants to the farmer. The recommendation is based on the feedback of different people on the insecticides used. The recommendation is done on the basis of item based collaborative filtering algorithm.

The system is useful for users as they get a recommendation as per their preference. In addition to that, the system also acts as an information system with the description and usages of different insecticides for different plants.

Keywords: Insecticide, item based collaborative filtering, recommendation

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

HTML – Hypertext Markup Language

CSS – Cascading Styles Sheet

GSP – Groovy server Page

CHAPTER 1: INTRODUCTION

1.1 Background

Nepal is an agro-based country. Most of the people in Nepal depend on agriculture which provides daily needs such as crops, vegetables, fruits etc. Most of the cottage industries in Nepal are also based on agriculture because it supplies with raw materials. About 80% of the people's occupation is agriculture. Trade is also mainly of agricultural products. Agriculture provides raw materials for the industries.

The increasing awareness aiming consumers to incorporate vegetables in their diet so as to uplift their nutritional status also indirectly encourage farmers to commercial vegetable production. Commercial vegetable production, as in high external input demanding farming, such as heavy use of artificial chemicals and their indiscriminate and uneconomic use have led to outbreak of certain previously unknown pests which cause heavy losses. As far as the loss caused by insect-pests is concerned, both qualitative and quantitative losses are noticed. A loss of 15-18% in agricultural production annually is estimated in Nepal [4].

Farmers use chemical insecticides as it is easy to use, easily available and fast in action. No matter, it kills harmful or useful insects. Chitwan is one of the Terai districts where there is easy availability of pesticides and there also exists pocket area for commercial vegetable cultivation. Farmers are using excessive pesticides without considering the health of consumers. They sell their product without any consideration of the waiting periods.

Farmers may be unaware of what insecticides should be used for plants. KiraFatyangra helps farmers to get recommendation of insecticides that other user had previously used for the same plant. It uses item based collaborative filtering to provide recommendation to the users.

1.2 Problem Statement

Currently, farmers visit veterinary doctors to ask for recommendation regarding insecticides to use on different plants. They get the information about insecticide informally by attending awareness programs or they hear what insecticides to use on plants from other people. The suggestions that they get may not be right, so the improper use of insecticides might result in various consequences. Thus, this system helps to provide the recommendation of insecticide to be used in different plants.

1.2 Objectives

a) To help farmers get accurate information about insecticides for their plantation.
b) To implement item based collaborative filtering to recommend insecticides to the farmers.

1.4 Scope

This is a web based application so farmers can access it from anywhere with internet connection. Farmers who don't have proper knowledge about insecticides will be benefitted and they also get recommendations on which insecticides to use based on user rated insecticide.

1.5 Limitation

a) Only five types of plantation are available for pesticide recommendation.
b) Since recommendation for insecticide is based on other user's choices, recommendation may not be fully reliable.

1.6 Report Organization

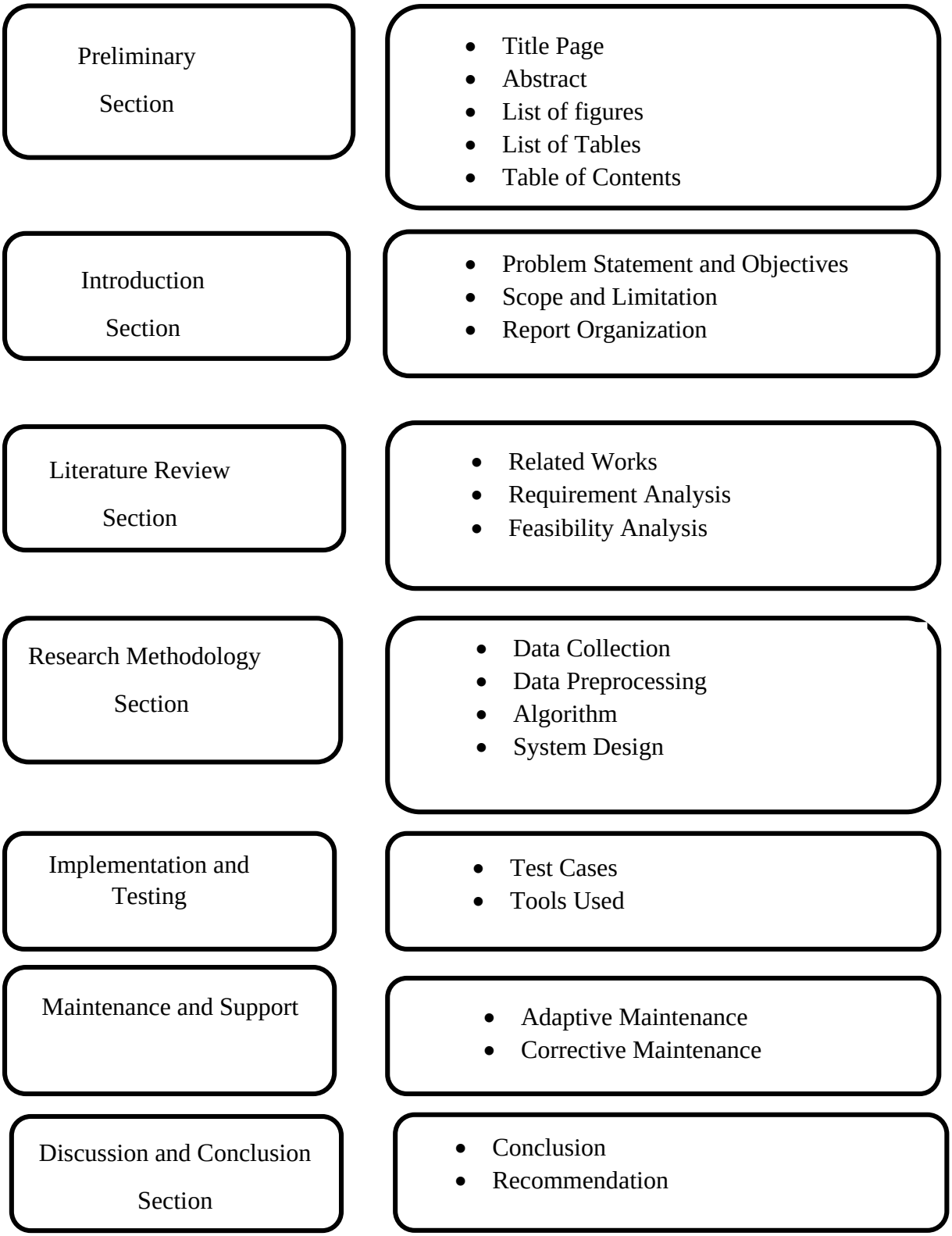


Figure 1 Outline of document

CHAPTER 2: REQUIREMENT ANALYSIS AND FEASIBILITY

2.1 Literature Review

2.1.1 Technical overview

As explained by Melville and Sindhwani in their paper, 'Recommender Systems', the goal of a Recommender System is to generate meaningful recommendations to a collection of users for items or products that might interest them. Suggestions for books on Amazon, or movies on Netflix, are real world examples of the operation of industry-strength recommender systems. The design of such recommendation engines depends on the domain and the particular characteristics of the data available.

For example, movie watchers on Netflix frequently provide ratings on a scale of 1 (disliked) to 5 (liked).

Such a data source records the quality of interactions between users and items. Additionally, the system may have access to user-specific and item-specific profile attributes such as demographics and product descriptions respectively. Recommender systems could be different in the way they analyze these data sources to develop how the actions of users and items can be used to identify well-matched pairs. Collaborative Filtering systems analyze historical interactions alone, while Content-based Filtering systems are based on profile attributes; and Hybrid techniques attempt to combine both of these designs. The architecture of recommender systems and their evaluation on real-world problems is an active area of research [6].

2.1.2 Item based collaborative filtering

In item based collaborative filtering recommendation algorithm paper, different techniques for computing item-item similarities (e.g. item-item correlation vs. cosine similarities between item vectors) and different techniques for obtaining recommendation from them

(e.g. weighted sum vs. regression model). Finally, results were compared with k –nearest neighbor approach. This experiments suggest that item-based algorithms provides dramatically better performance than user-based algorithms, while at the same time providing better quality than the best available user based algorithms[1].

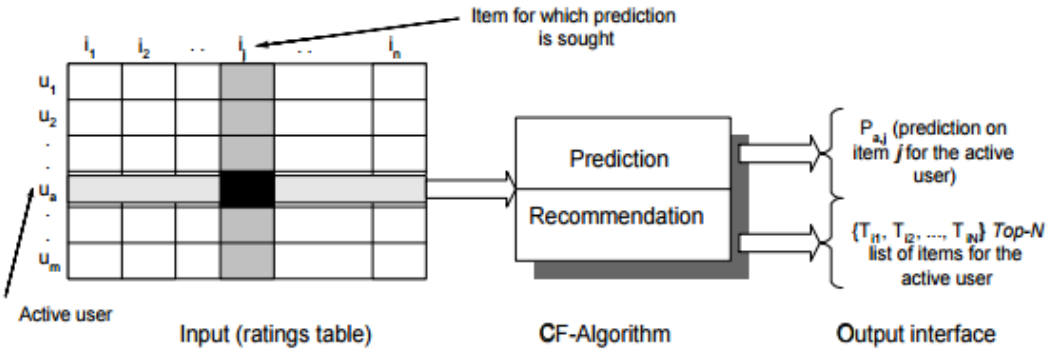


Figure 2 Collaborative filtering algorithm

2.1.3 Related works

a) Outbrain- Outbrain is very popular content discovery service which is being used by big brands for both advertising their content and publishing recommendations from other websites. These websites includes TIME, CNN, Fast Company, etc. It serves most relevant recommendations to your blog. Outbrain serves over 50 billion recommendations every month and over 90,000 blogs are using it.[2]

b) Amazon.com- Amazon.com is the largest internet- based retailer of US. It uses recommendations as a targeted marketing tool in many email campaigns and on most of its websites' pages. Clicking on "Your Recommendations" link clients are directed to a page where they can filter their recommendations by product line and subject area, rate recommended products and rate their previous purchase. Our shopping cart recommendations offer product suggestions to the clients based on the items in their shopping cart [3].

This project aims to incorporate item based collaborative filtering algorithm to recommend insecticides to the user based on user rating.

2.2 Requirement Analysis

2.2.1 Functional requirement

a) User must enter the URL of the application in the web browser

b) User must be registered to the application

c) User can choose new plantation.

- Choose only one vegetation at one time.
- Item based collaborative filtering for recommendation is used.
- Insecticide related to particular vegetation are only choose.

d) Users are recommended with insecticide.

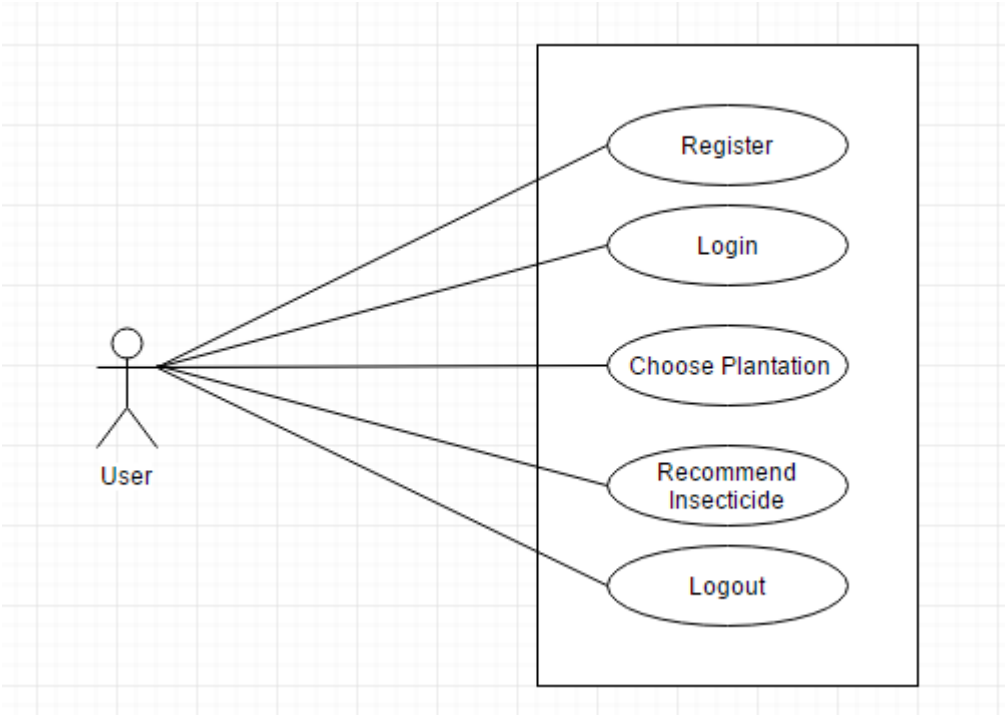


Figure 3 Use case diagram for user.

As shown in the Figure 2, the user is allowed to create a new account by registering to the application. The email address should be unique for each user.

The registered user can log in to the application by entering their valid username and

password.

Once the user logins to the application they can choose plantation. For another plantation user must add other plantation separately.

The user can receive recommendation either on the basis of item-based collaborative filtering based on the choice of the user. The insecticide needs to have at least 5 ratings for getting the recommendation based on item-based collaborative filtering. Non-Functional Requirement

The non-functional requirements of the project are given below:

a) To access the web services user should be connected with internet.
b) The information in the platform can be viewed only after registering.

2.3 Feasibility Analysis

The following result was obtained while performing the feasibility analysis:

2.3.1 Operational feasibility

This application uses 2-tier client server architecture. Clients of the applications are end users who choose plant, rate insecticide and gets recommendation for insecticide. The server in this application responses to the user request. The application can be accessed from anywhere with an internet connection. It is easy to use. Thus, it was determined to be operationally feasible.

2.3.2 Technical feasibility

The application uses HTML to display content in the browser, CSS to design the HTML content, and JavaScript is used for making the web page interactive. At the server side, it uses grails to implement the logic and to display the predicted result in the browser as well as to handle page requests It requires a server, client, and internet connection to function properly. It supports both Windows and Linux platform for its operation. All of the technology required by the application are available and can be accessed freely, hence it

was determined technically feasible.

2.3.3 Schedule feasibility

The schedule feasibility analysis is carried out using the CPM method. CPM was used to identify critical tasks and calculate the interrelationship between tasks. The plan was carried out which defined critical and non-critical tasks with the goal of preventing time-frame problems and process bottlenecks. The CPM analysis was carried out as follows:

Step 1: The activity specification table is constructed with Work Breakdown Structure.

Table 1 Activities

Activity	**Time (weeks)**	**Predecessor**
Data Collection (A)	1	-
Database Design (B)	1	-
Data Preprocessing (C)	1	A, B
Implement Item Based Filtering (D)	4	C
Front End Design (E)	4	D
Testing (F)	5	E
Documentation (G)	9	C

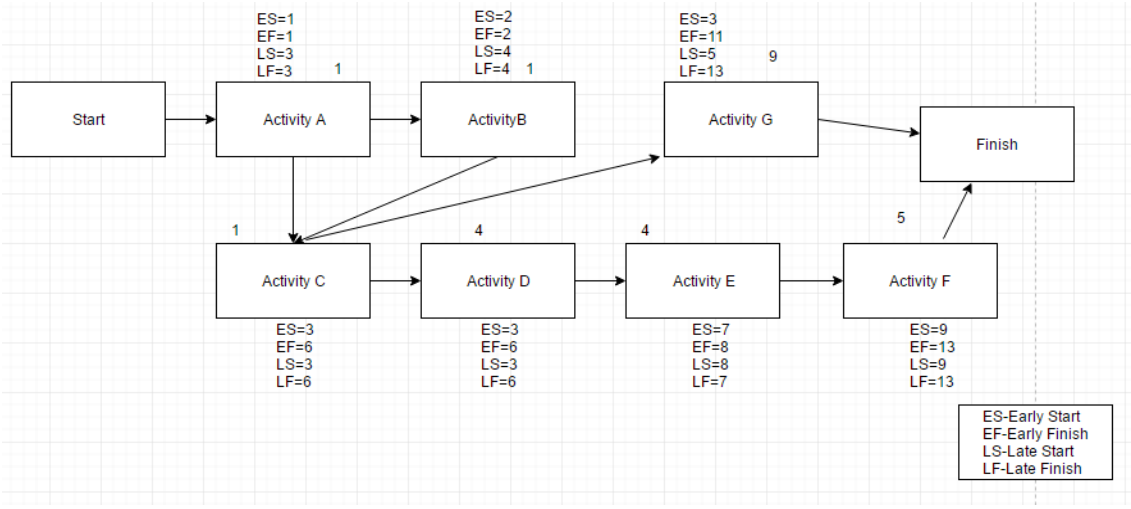


Figure 4 Activity network diagram

From the figure 3, we can see that the application was completed in 13 weeks which is within 15 weeks of a semester. Hence, the project was determined to be feasible in terms of schedule.

CHAPTER 3: SYSTEM DESIGN

3.1 Methodology

The system uses item based collaborative filtering for recommending insecticide to users based on the users rating to the insecticide. The methodology can be divided into two parts data collection and item based collaborative filtering algorithm.

3.1.1 Data collection

Data used by this system for insecticide were collected from www.lyzhongdachem.com www.sentinelplant.com website.

For five major plantation and the insecticide used in those plant for recorded. These information were recorded in database for processing.

3.1.2 Data preprocessing

The available data was divided into training set and test data. 80% of the data was used for the training set. Since the maximum number of responses were from user, 60 responses were taken into consideration. 100 users were taken for the purpose of training. User ratings of 100 users for different insecticides items were created such that each user has at least 10 ratings.

3.1.3 Algorithms

Item based collaborative filtering:

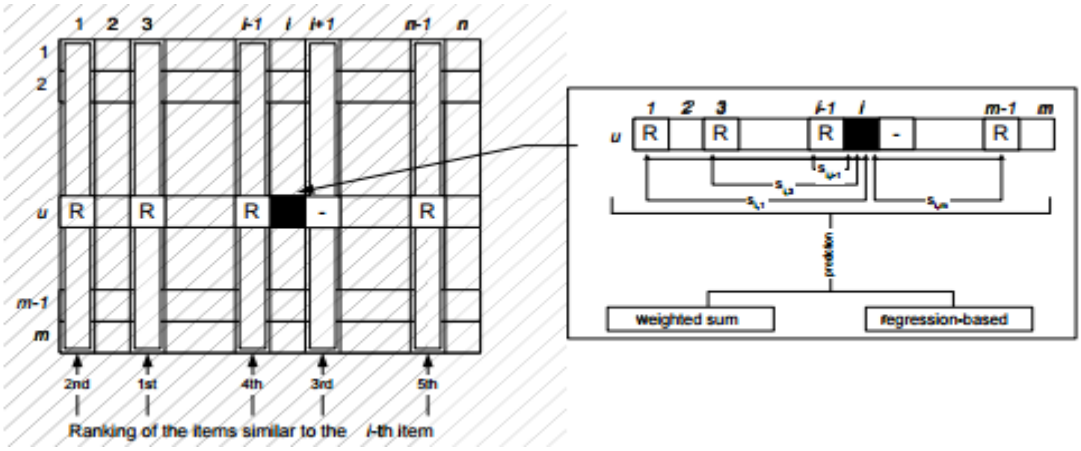


Figure 5 Item-based collaborative filtering

The difference between the similarity computations in user based collaborative filtering and item based collaborative filtering is that in case of user-based collaborative filtering the similarity is computed along the rows of the matrix but in case of the item-based collaborative filtering the similarity is computed along the columns i.e., each pair in the co-rated set corresponds to a different user. Computing similarity using basic cosine measure in item-based case has one important drawback–the difference in rating scale between different users are not taken into account. The adjusted cosine similarity offsets this drawback by subtracting

Algorithm:

a) List all the items with the given rating to them by different users.

b) Calculate similarity between the items using Pearson Correlation Coefficient.

$$r = \frac{n(\sum xy) - (\sum x).(\sum y)}{\sqrt{(n\sum x^2 - (\sum x)^2)(n\sum\ y^2 - (\sum y)^2)}}$$

Where,

n = number of pairs of scores

∑xy = sum of products of paired scores

∑x = sum of x scores

∑y = sum of y scores

∑x2 = sum of squared of x scores

∑y2 = sum of squared of y scores

c) Sort the similarity between the items such that the items are in descending order.

d) Produce weighted scores that rank the items by multiplying the ratings by different users similarity score.

3.1.4 Validating model

The validation of the model was done using Precision and Recall model.

Precision= tp/(tp+fn)

Recall = tp/(tp+fp)

Where,

tp = true positive

fn = false positive

fp = false positive

3.2 System Design

For the system design of this application, following three methods have been used:

3.2.1 Class diagram

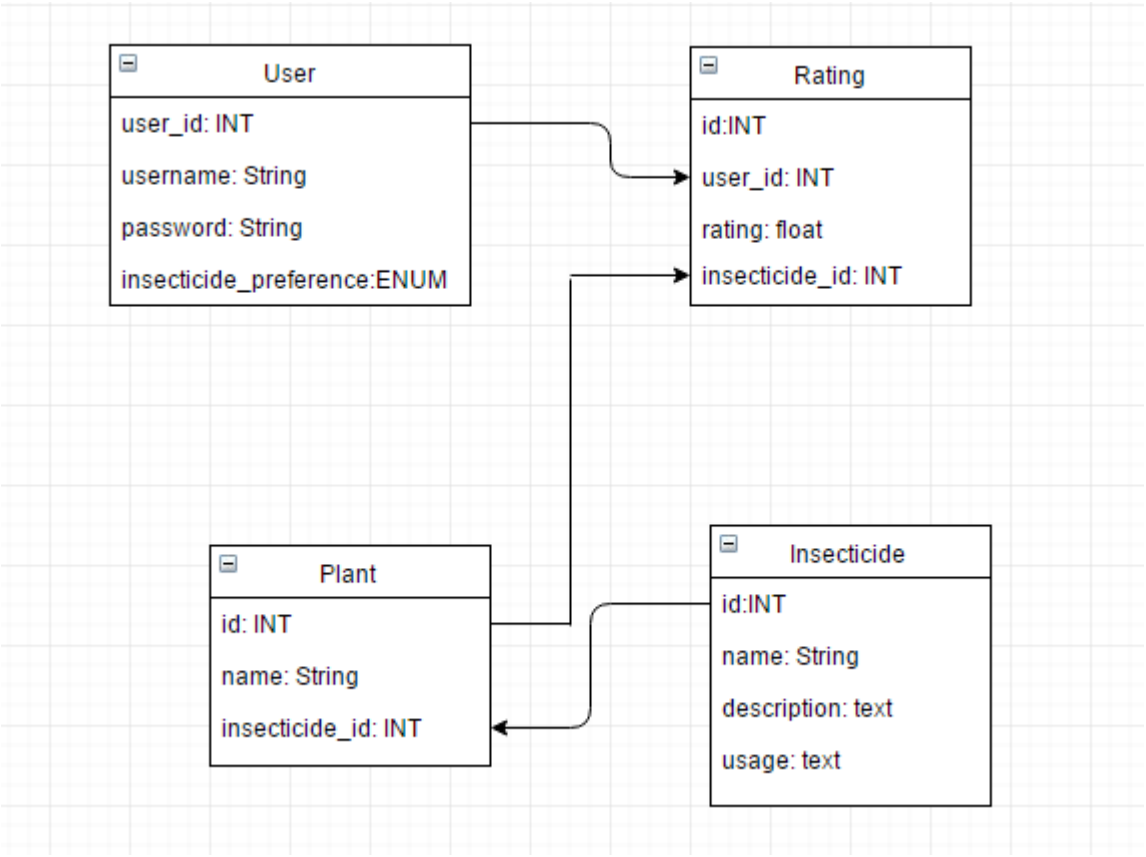


Figure 6 Class diagram of application

There are four main classes used in this application. The user class consists of all the users that are registered in the application.

It contains a list of user_id, name, username, email address, and insecticide preference of each user. The user needs to enter their details while registering to the application. When a user tries to log into the application, it is checked if the username and password match the value in the database and if the password matches then the user is allowed to log into the system.

The class insecticide consists a list of unique insecticide items along with its details, such as name, description and usage.

The class Plant provides the list of plant in the database. The class references to the Insecticide class using insecticide_id.

The Rating class consists of all the ratings provided by the users to different insecticide items for different plants.

3.2.2 State diagram

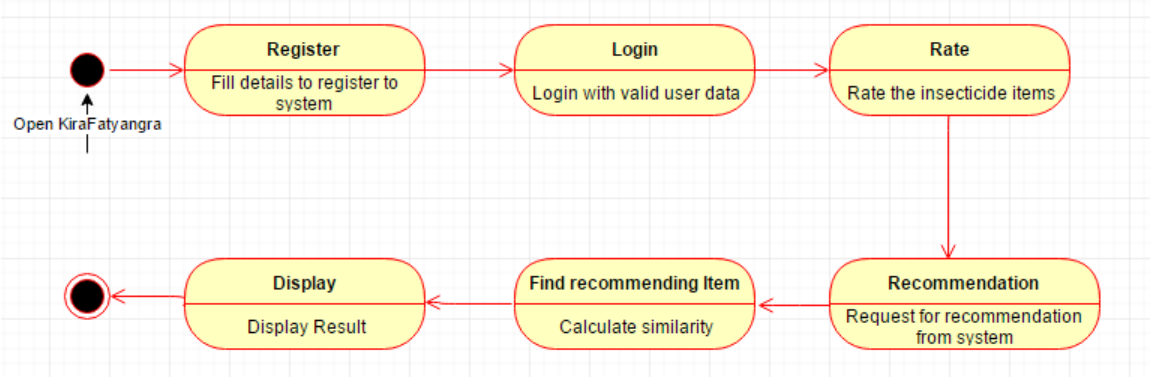


Figure 7 State diagram of the application

The Figure 6 explains states of the application. At first, when the user opens the application for the first time, they need to register to the application. Then they are required to log into the application with their valid user credentials. The user can now rate insecticide items of different plants. For that, user can only rate the insecticide items that users choose for their plant. For example: if a user choose insecticide items for apple, they can only rate the insecticides that are applicable for apple, but not other plants. The ratings of the users are stored into the database.

The user can also choose to get recommendations. When the user searches for the recommendation, the similarity is calculated and the results are displayed on the screen.

3.2.3 Sequence diagram

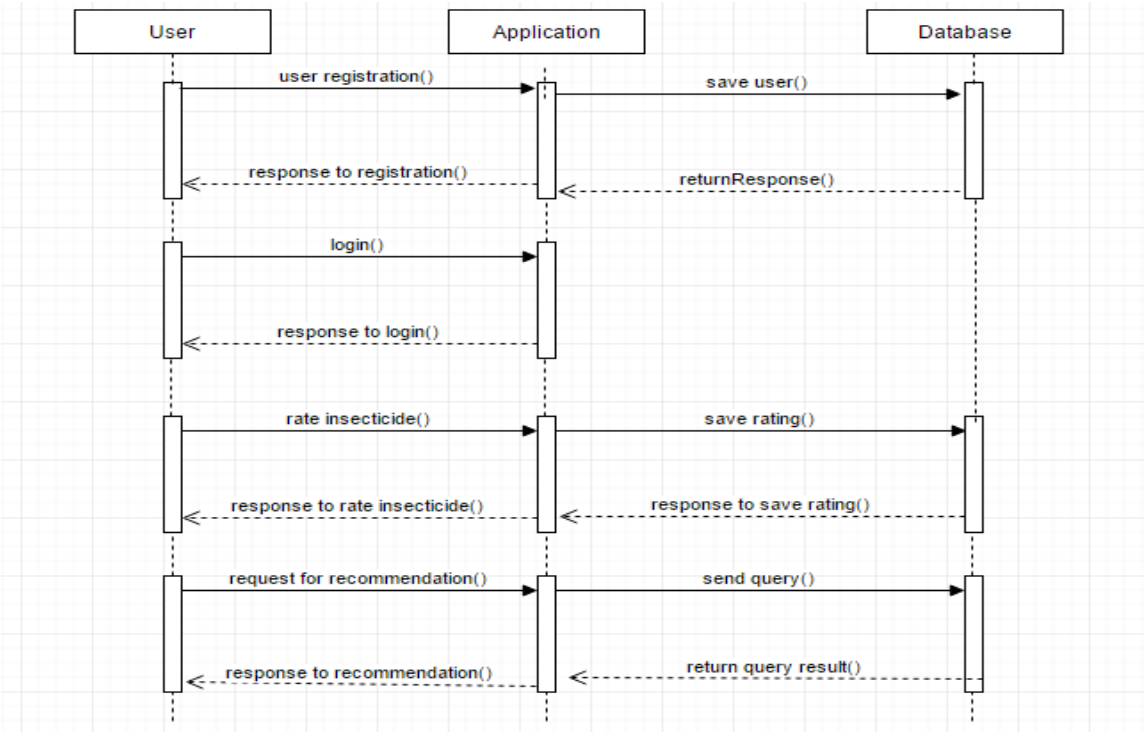


Figure 8 Sequence diagram of the application

The user first needs to register to the application. When the user fills in the registration form, the details are validated by the application and stored into the database. Then, the user successfully registers to the application.

While the user tries to log in to the application with its user credentials, the application checks if the credentials are valid or not. If the credentials are valid, the user can log into the system, whereas if the credentials are incorrect, the user is redirected to the same login page. When the user rates an item, the application first checks if the user has already rated the specific item. If yes, the user is not allowed to rate the item, else the value is stored into the database. When the user asks for a recommendation, the application checks if the

number of ratings by the user is greater than 5, if yes, the recommendation is made and the result is displayed, else the application sends an error message.

CHAPTER 4: IMPLEMENTATION AND TESTING

4.1 Implementation

This application is a web application and it was built in Grails framework.

4.2 Tools Used

Intellij: was used as an IDE to develop this application.

4.2.1 Front end:

Groovy Server Page (GSP)

JavaScript

JQuery

4.2.2Back end:

MySql

Java

Groovy

4.3 Testing

4.3.1 Unit testing

Unit testing was performed to test correctness of different modules.

Test Case 1:

Title: Login

Precondition: The landing page of the application is opened in the browser

Test Steps:

- Input username and password.

Expected Output:

- If the user credentials are correct, user will be directed to the home page of the application.
- If the user credential is incorrect, an error message is displayed and the user will be redirected to the same page.

Test Case 2:

Title: Rate Insecticide

Preconditions:

- User has successfully logged in to the system
- User has choose the plantation of which insecticide is to be rated.

Test Steps:

- User clicks on the insecticide item to be rated.
- User rates the insecticide item on the scale of 1 to 5

Expected Results:

- The rated value is stored into the database.

CHAPTER 5: MAINTENANCE AND SUPPORT

The application will be maintained and updated overtime, to upgrade the system future needs. Some of the strategies are:

5.1 Adaptive Maintenance

The data for plant in the application are limited. Thus, the data for other plants needs to be updated along with their insecticides.

5.2 Corrective Maintenance

As application could be sold or deployed for public use. May be there could be unresolved issues and if user complains about it, the maintenance have to done.

CHAPTER 6: CONCLUSION AND RECOMMENDATION

6.1 Conclusion

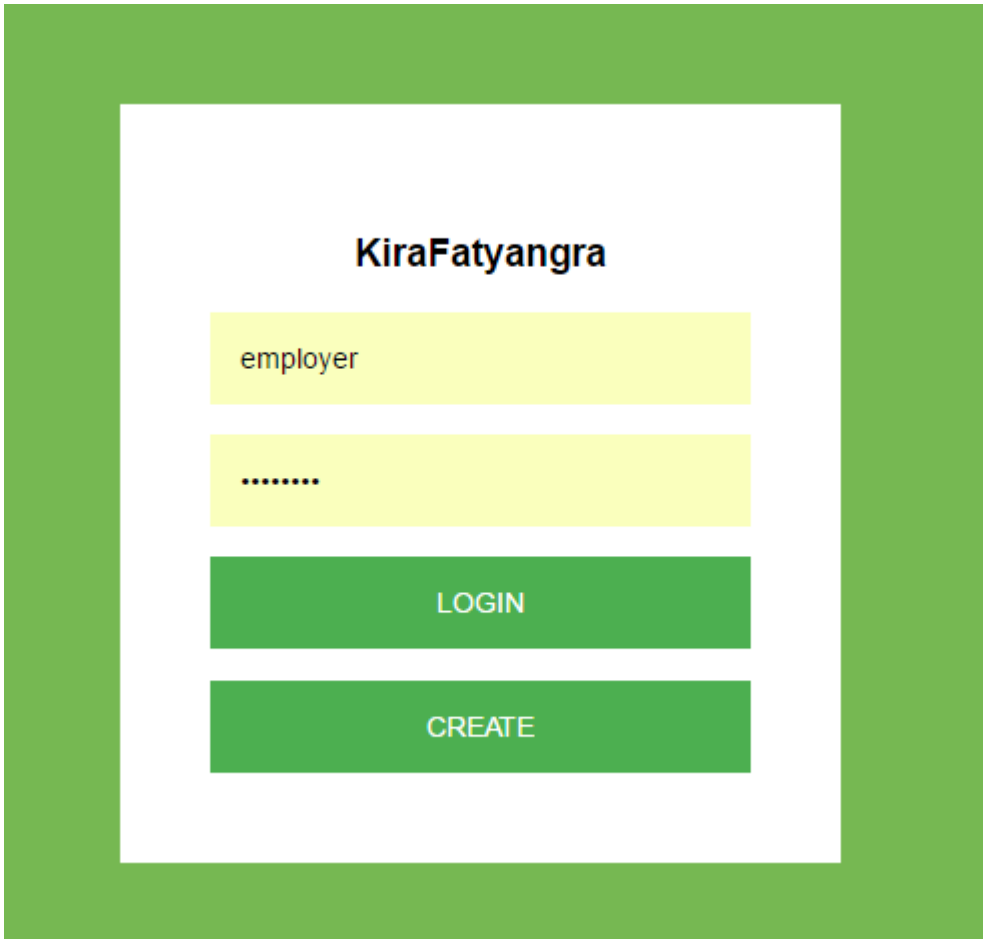
The project KiraFatyangra was successfully completed by using Item-based collaborative filtering. The data set were collected from internet which was preprocessed on the basis attributes. The data were then used to model the system.

6.2 Recommendation

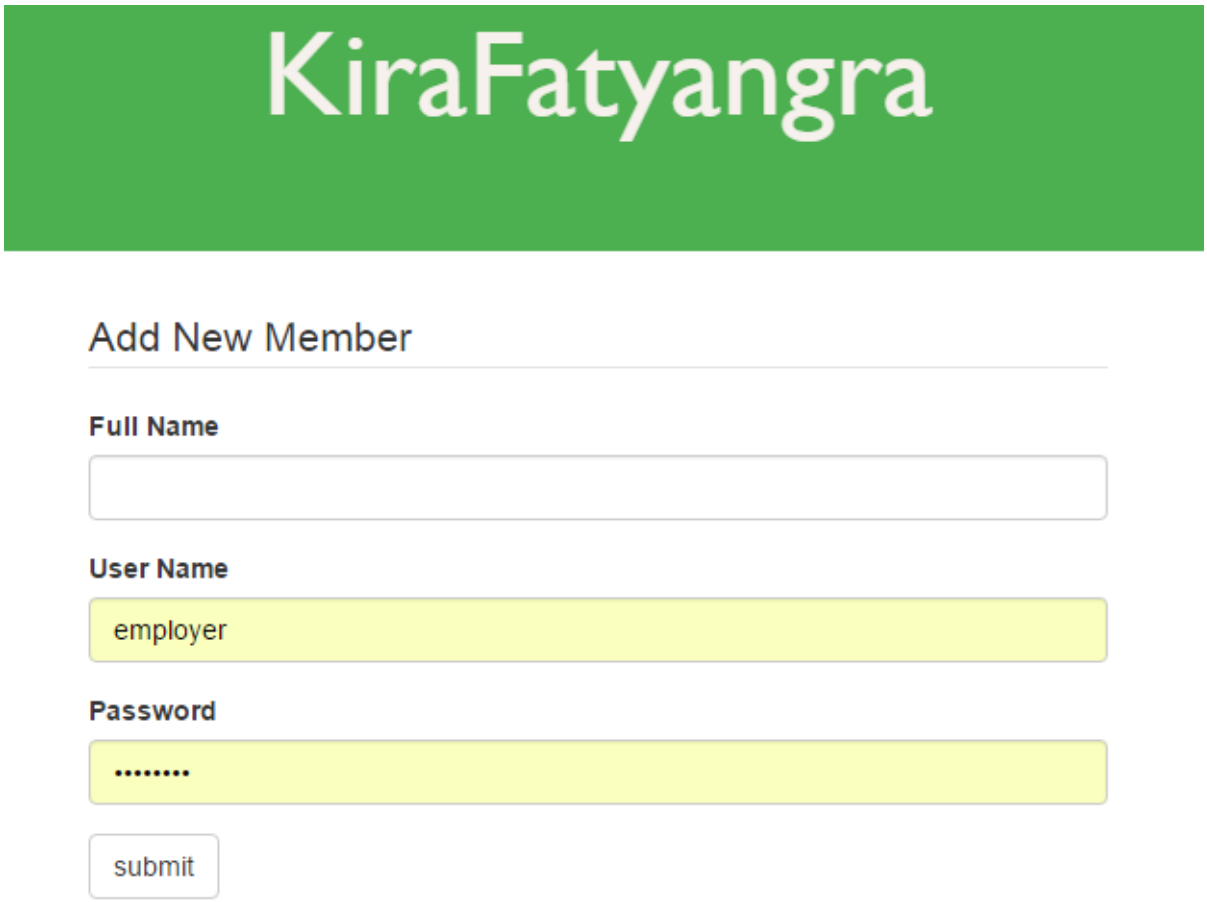
The data used on the application is solely based on the internet. In order to commercially use the product, it is important to collect data of all the insecticides used for different plant from Ministry of Agriculture Development. Furthermore, since the use of mobile phones is huge, the application will be more effective if built in mobile platform.

APPENDIX

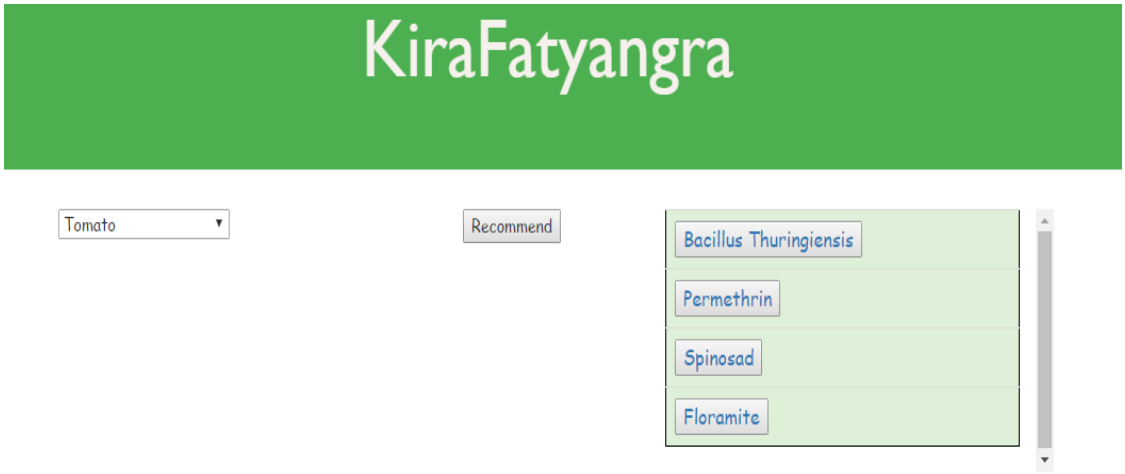
Login Page



Register Page



Recommendation Page



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