

**DESIGN AND DEVELOPMENT OF MOBILE APPLICATION ON  
PERSONALIZED SMS BASED RECOMMENDATION**

**BY**

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This Report Presented in Partial Fulfillment of the Requirements for the  
Degree of Master's of Science in Computer Science and Engineering

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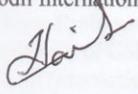
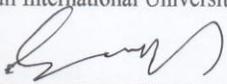
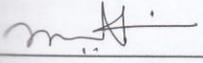
**DHAKA, BANGLADESH**

**AUGUST 2015**

## APPROVAL

This Project titled “**Design and Development of Mobile Application on Personalized SMS Based Recommendation**”, submitted by Tomal Mahdi to the Department of Computer Science and Engineering, Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of M.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on 01 August 2015.

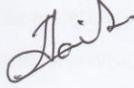
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## DECLARATION

I hereby declare that, this project has been done by me under the supervision of **Dr. Sheak Rashed Haider Noori, Assistant Professor**, Department of CSE Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

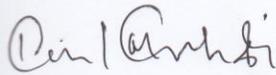
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## **ABSTRACT**

Recommendation systems are software applications or systems that help individual users to find the most relevant products to their needs or tastes. These systems use filtering techniques to generate recommendations. These techniques are categorized majority into collaborative based filtering, content based technique, and hybrid algorithm. In most general terms, Recommendation systems are defined as the techniques used to predict the rating one individual will give to an item or social entity. These items can be books, movies, restaurants and things on which individuals have different preferences. These preferences are being predicted using two approaches first content based approach which involves characteristics of an item and second collaborative filtering approaches which takes into account user's past behavior to make choices. In collaborative filtering, partners are chosen who will make recommendations because they share similar ratings history with the target user. One partner who have similar ratings to the target user may not be a reliable predictor for a particular item. So the past record of the partner of making a reliable recommendation also needs to be take into consideration which is dictated by trustworthiness of a partner. In order to keep track of past records of a recommender reputation systems comes into the picture those who actually assign reputation ratings to the partners.

To develop this project the most essential tool is Android Studio which help to simulate all the parts of the work and test it. And Java,Php,Mysql Technology is used for internal logic development.

After implementation of all functions, the system is tested in different stages and it works successfully as a prototype.

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## CHAPTER 1: INTRODUCTION

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Recommendation systems have changed the way people find products, information, and even other people. They study patterns of behavior to know what someone will prefer from among a collection of things he has never experienced. The technology behind recommender systems has evolved over the past 20 years into a rich collection of tools that enable the practitioner or researcher to develop effective recommenders. We studied the most important of those tools, including how they work, how to use them, how to evaluate them, and their strengths and weaknesses in practice. The algorithms we will study include content-based filtering, user-user collaborative filtering, item-item collaborative filtering, dimensionality reduction, and interactive critique-based recommenders.

The concept of Recommender Systems generally grows out of the idea of information reuse, and persistent preferences. And that's an idea that doesn't begin with computers and technology. It's an idea that you can find in cavemen, ants, and all sorts of other creatures. If you've ever had ants running around your house, you'll notice that they'll often follow in a line from the ants that went before and found food. That's because ants have genetically evolved to leave markers for other ants. Showing, hey, this is the way to food and in the process helping the ants help food survive and breed. It's a simple mechanism, annoying if you happen to spill honey on your floor, but, remarkably effective for the ants. And it's a system that we would know in research as. Social navigation, following in the footsteps of others to find what you want. Of course, social navigation is also something we use as humans. We use social navigation if we're in a place where we don't know our way. If you're in a stadium for a soccer match or a baseball game. And the match ends. You're trying to find the nearest exit. If you don't know your way, you don't need to find a map, you just need to follow the crowd. Because almost everybody is going to the exit. Now it might not work to follow one individual, you might end up at the bathroom. But if you follow the crowd, you will find your way to the exit and eventually find your way where you want to go. That concept of social navigation more generally, gets into the idea of social information reuse. So like the ants, we can learn from each other. And in fact, as people evolved language, this idea of learning from each other formalized. We got concepts like critics. Again, I don't have the

documentation to prove this but it's hard to imagine that there wasn't somebody wandering around Athens at the time that the Harolds were crying out. Come and see this wonderful performance by Homer, the greatest living poet of our time as he tells the stories of the Trojan war. And then as you're walking around, you can hear people say, Homer oh, what a wonderful opportunity. Homer is such a wonderful poet. Someday, they should write down the stuff that he's saying and, heck, we're going to have everybody read it. Somebody else is probably saying something different. Saying, oh, homer, I saw homer in Sparta. First of all, he says it's poetry, but it doesn't ever rhyme. It's long, it's boring. And he made most of it up. This isn't what really happened in the war. If people read this in the future, it's going to be because they were forced to. Well, what you've just experienced were two different critics. Two people With different opinions that impact part of the heart of recommender systems, is trying to understand, what do you do when people have different tastes. How do you know whether you're 1 of the people who's going to love listening to Homer or hope you're not forced to listen to Homer. And that's what we're going to be talking about. Now as we go forward, we can introduce technology. Two particular technologies that emerged. Starting in the sixties and moving forward in the seventies, eighties. Are information retrieval and information filtering. Information retrieval is the idea that if you have a large database of content and you want to be able to run a query against that content. You can make that possible by investing a lot of effort into indexing that content. So if you imagine that you have a whole lot of books You might index topics and authors and titles, and maybe even summaries of the books. So that somebody can come in and say oh, I'm looking for books on the Trojan War or I'm looking for books by Homer. And you could quickly pull out of that index the things that you need. The idea here is that your content base is relatively static. You may add new pages from time to time or new documents or new books but they don't change all that quickly. But your information need changes from time to time rather quickly. You could come in and look for something on the Trojan War today and something on the infield fly rule in baseball tomorrow. If this sounds like a search engine well, that's what search engines do. They spend a long time indexing the web, capturing information about keywords and titles, and sometimes even authors and sites. So that different people can come in 1,000 of times a second and ask a query that says, I want to find out about this stuff and have that stuff delivered to them quickly. That says that the likelihood that you want a particular document has to do with how often that document,

that term that you put in appears in your document. Versus how often it appears in the rest of the documents that happen in your corpus. Corpus being a fancy term for the full collection of your documents. So, if you have a term like recommender systems, that doesn't appear in very many web pages or books or, or articles. So, if it appears a couple of times in a document that you're looking at, it's probably relevant to you.

### **1.1 Motivation**

A huge number of people's have similar interest in different items. And people's most often tends to take similar items with his profile. So taking those benefits to guide them about what they actually need by understanding their interest. Tradition System has less accuracy for understanding them & most often provide wrong guideline. We are motivated in the topic Recommended System so that we can use people's interest & items similarities to provide full support for a user. Many works are done in this area and achieved great accuracy, we are work in this field because we are trying to propose a system with great accuracy and proficiency in different way.

### **1.2 Objective**

The main objective of this project is to develop a system that will be able to recommend users by analyzing user profile and items. For developing such system we followed some steps including user profile analysis that is similar item interested users segmentation and then similar item preferences.

### **1.3 Scope of Research**

Our system recommend users on the basis of their need. This system includes many procedures like, categorized different users into different segment and then categorized different items. This work also includes pattern matching techniques. In the field of Computer Science it has many scope of work and the topic of recommendation system is also an evolving and promising section for future work.

## CHAPTER 2: BACKGROUND STUDY

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### 2.1 Recommendation Approaches

In most general terms, Recommendation systems are defined as the techniques used to predict the rating one individual will give to an item or social entity. These items can be books, movies, restaurants and things on which individuals have different preferences. These preferences are being predicted using two approaches first **content-based approach** which involves characteristics of an item and second **collaborative filtering approaches** which takes into account user's past behavior to make choices. In collaborative filtering, partners are chosen who will make recommendations because they share similar ratings history with the target user.

#### 2.1.1 Collaborative filtering (CF)

It is a technique used by some recommender system Collaborative filtering has two senses, a narrow one and a more general one. In general, collaborative filtering is the process of filtering for information or patterns using techniques involving collaboration among multiple agents, viewpoints, data sources, etc. Applications of collaborative filtering typically involve very large data sets. Collaborative filtering methods have been applied to many different kinds of data including: sensing and monitoring data, such as in mineral exploration, environmental sensing over large areas or multiple sensors; financial data, such as financial service institutions that integrate many financial sources; or in electronic commerce and web applications where the focus is on user data, etc. The remainder of this discussion focuses on collaborative filtering for user data, although some of the methods and approaches may apply to the other major applications as well. In the newer, narrower sense, collaborative filtering is a method of making automatic predictions (filtering) about the interests of a user by collecting preferences or taste information from many users (collaborating). The underlying assumption of the collaborative filtering approach is that if a person *A* has the same opinion as a person *B* on an issue, *A* is more likely to have *B*'s opinion on a different issue *x* than to have the opinion on *x* of a person chosen randomly.

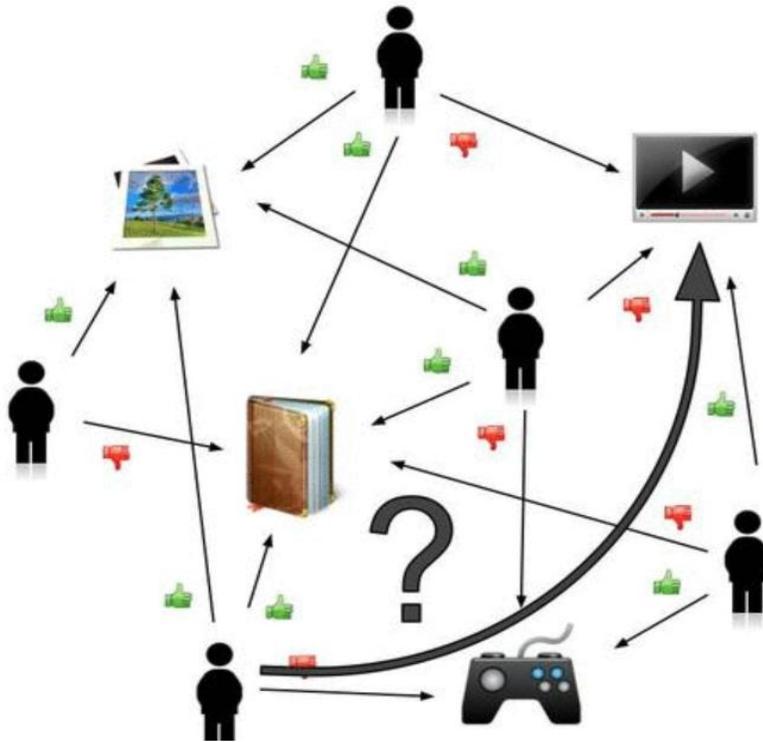


Figure -1 : recommendation based on collaborative filtering.

### 2.1.2 Item-based filtering

Content-based filtering makes suggestions according to customers past interests. Therefore, the items will be suggested to the customers that are very similar in content and character to his or her favorite items. It is a form of collaboration filtering based on the similarity between items calculated using people's ratings of those items. Item-item collaborative filtering was first published in 2001, and in 2003 the e-commerce website Amazon stated this algorithm powered its recommender system.

Earlier collaborative filtering systems based on rating similarity between users had several problems:

- systems performed poorly when they had many items but comparatively few ratings
- computing similarities between all pairs of users was expensive
- user profiles changed quickly and the entire system model had to be recomputed

Item-item models resolve these problems in systems that have more users than items. Item-item models use rating distributions *per item*, not *per user*. With more users than

items, each item tends to have more ratings than each user, so an item's average rating usually doesn't change quickly. This leads to more stable rating distributions in the model, so the model doesn't have to be rebuilt as often. When users consume and then rate an item, that item's similar items are picked from the existing system model and added to the user's recommendations.

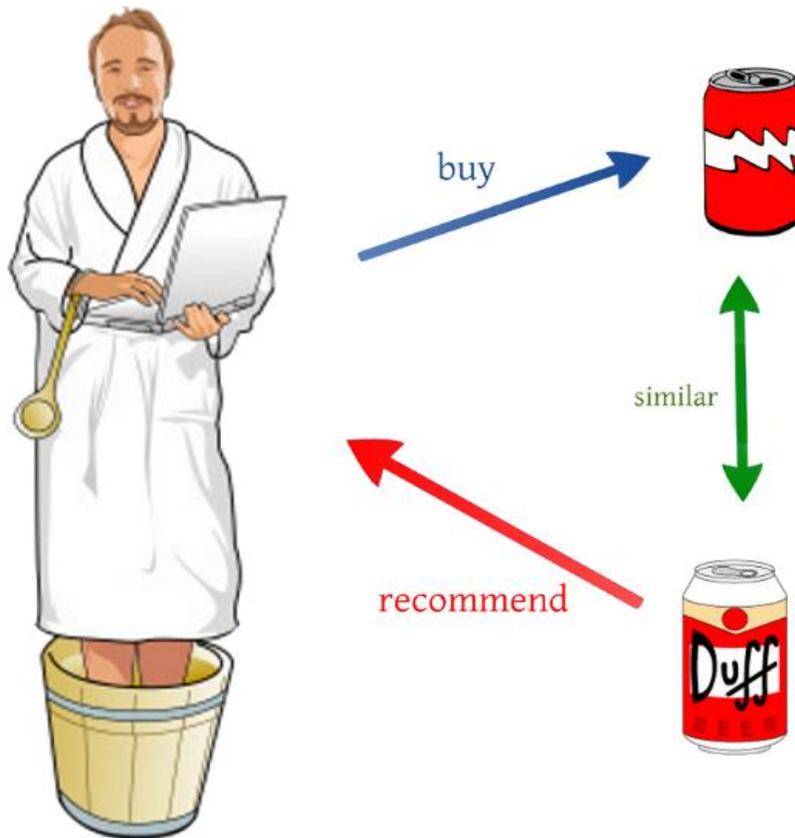


Figure-2: recommendation based on item/content based filtering

### 2.1.3 Hybrid Filtering

Hybrid approach is, combining collaborative and content-based filtering could be more effective in some cases. Hybrid approaches can be implemented in several ways: by making content-based and collaborative-based predictions separately and then combining them; by adding content-based capabilities to a collaborative-based approach (and vice versa) or by unifying the approaches into one model. Several studies empirically compare the performance of the hybrid with the pure collaborative and content-based methods and demonstrate that the hybrid methods can provide more accurate recommendations than

pure approaches. These methods can also be used to overcome some of the common problems in recommender systems.

## **2.2 Data Mining Techniques for Recommender Systems**

Almost all recommender systems use data mining techniques to generate suggestions. The types of data mining techniques which are used in this paper are clustering and association rules mining.

### **2.2.1 Clustering**

It is data division into several groups so that the data in a group should have the most similarity together and the most differences with the other groups. Among the clustering methods, self-organizing map and k-Means have been used for many decades.

### **2.2.2 Association Rules Mining**

Association rules can discover relationships between products in a particular domain. So, they can find relations between the products in one event, this event is called transaction as a purchase transaction. We define an item set as a collection of one or more items. An association rule is an expression in the form of  $X \rightarrow Y$ , where X and Y are item sets. In this case the support of the association rule is the fraction of transactions that have both X and Y. On the other hand, the confidence of the rule is how often items in Y appear in transactions that contain X. Given a set of transactions T, the goal of association rule mining is to find all rules having support  $\geq$  minsup threshold and confidence  $\geq$  minconf threshold.

## **2.3 Recommender Systems Challenges**

Despite their popularity and advantages, recommender systems have several shortcomings:

### **2.3.1 Cold start**

It refers to the situation in which an item cannot be recommended unless it has been rated by a substantial number of users. This problem applies to new and obscure items and is particularly detrimental to users with eclectic taste. Likewise, a new user has to rate a sufficient number of items before the recommendation algorithm be able to provide reliable and accurate recommendations.

### **2.3.2 Sparsity**

In many commercial recommender systems, both the number of items and the number of consumers are large. In such cases, even very active users may have purchased less than

1% of the items. So, the consumer-product interaction matrix can be extremely sparse. This problem is commonly named as the sparsity.

## CHAPTER 3: RELATED WORKS

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This chapter is about the existing work done by different peoples and their problems. This chapter will also show about their working strategy, findings.

Based upon the two major methods that is content based filtering and collaborative filtering a lot of work has been carried out in this field to develop the commercial recommender websites like amazon.com and many more but there are very few in research paper domain. CiteSeerx is an example of research paper recommender system but it has a limited domain research papers related to computer science field only. CiteSeerx uses content based filtering along with citations whereas Scienstein which is also a research paper recommendation system uses the hybrid technique. PRES (Personalized Recommender System) is one of the systems developed by using the content based filtering technique.

### **3.1 Operational Customer Relationship Management (CRM) using Short Message Service (SMS)**

Their working mechanism is, first of all customer should fill in their phone number in application form. This phone number will be used to inform and notify the customer to maintain their vehicle when the time has come (the time will be estimate by system automatically). To forecast the time (customers will come to garage to maintain their vehicle for the next period); the service provider company should have two previous record of each car. System will use all previous kilometer records to forecast when customer will be come to garage and maintain their vehicles. After forecasting is complete, system will send text message to remind customer to maintain their vehicle for the next few day. The notification will be send to customer within two weeks before estimation day (if estimation day is 14th, then notification would be send on 1st). This mechanism chosen, we realize that customer will need time to decide when they will come to garage to maintain their vehicle. Figure 1 illustrates the whole proses of system development. Customer's historical data in database forecaster by system to gain the estimation date or day, and send reminder message accordance to estimation result. Database consist customer's historical service can be connected to SMS Server to supply data or can be uploading as external data (e.g.,

excel file or text file). Whereas figure 2 illustrates the text message would receive by customer.

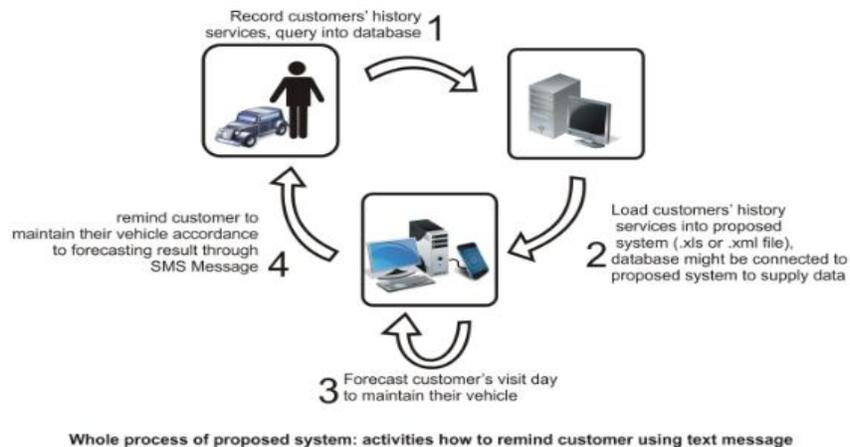


Figure 3: Whole process in the system

Remind customers to maintain their vehicles using Sort Message Service



Figure 4: Message sent by System.

### Algorithm Scenario One:

This scenario forecast shows how system forecast the time when customer due visit garage to maintain vehicle. Accordance the result of this scenario system will send short message to inform or remind customer to maintain the car. This scenario will forecast

how long the car reaches next 10000 kilometers (generally, the car will be maintain when reach 10000 kilometers of usage).

### **Algorithm scenario one**

**Input:** customers' service records

**Output:** estimation day

Begin

**Step 1:** Upload customers' service records contain (police number, address, kilometer stated , and execution date of maintenance) into system.

**Step 2:** calculate average kilometer per day. Forecast how long the car will reach next 10000 kilometers (first of all system will count the average kilometer usage per day).

**Step 3:** show estimation day of all customers.

End;

### **Algorithm Scenario Two**

Accordance to the result of scenario one, system will remind customers to maintain their vehicle using text message. System will send message to the nearest estimation result from day while estimating performed. Algorithm scenario two:

**Input:** police number, estimation day, phone number

**Output:** SMS Message, notification message that remind customer to maintain their vehicle.

Begin

**Step1:** Make sure phone number was a valid input, and insert message to SMS\_RECEIVER table (this table contains outgoing message).

**Step2:** The SMS server will be always active. Translate the message into Protocol Data Unit (PDU) before ready to send.

**Step3:** Check if the message has been Inserted into the SMS\_RECEIVER table in the Local database as an outgoing Alerting message, mark as sent. At the end, this message should be received by the DBA in his mobile phone.

End;

As the result of our scenario, the outgoing message in the SMS\_RECEIVER table should be same as the message that shall get to a customers' mobile phone.

### **Algorithm Scenario Three**

As mention earlier, our proposed system supporting two-way communication. Customer can interact with system by reply the message. The third scenario will show how system

read and process the message sent by customer and send alert message when customer sent invalid message format Algorithm scenario three;

Input: Text message (keyword)

Output: Alerting text message due to invalid message format.

Begin

**Step 1:** Retrieve message from phone and translate message from Protocol Data Unit (PDU) format into text. Insert into INBOX table. Make sure the message in modem or phone deleted.

**Step 2:** Read new record in INBOX table and divide as parts and compare to format identified by system.

**Step 3:** if message format doesn't matched, then system will sent message alert due to invalid message received. Before send alert message, system will translate message into Protocol Data Unit format.

End;

As a result the outgoing message should be same as the alert message that shall get to a customers' mobile phone

#### **Algorithm Scenario Four**

This is the last scenario to test and measure our proposed model. This scenario will show how system responds the message sent by customers. Previous scenario show how system alert customer regards invalid format, this scenario system responds valid format.

Algorithm scenario four:

Input: Text message (keyword)

Output: Appointment or booking.

Begin

**Step 1:** Retrieve message from phone and translate message from Protocol Data Unit (PDU) format into text. Insert into INBOX table. Make sure the message in modem or phone deleted

**Step 2:** Read new record in INBOX table and divide as parts and compare to format identified by system.

**Step 3:** If message format matched compare to format message identified by system, system will submit a query corresponding keyword. In case keyword was an appointment system will query database as new appointment. Else, if keyword was a booking home service, system query database as booking service.

End;

At the end of this scenario, system will creates new appointment or booking and save it in database corresponding the keywords. The keyword would be BOOKING for appointment or THS to request home services. The all of scenarios will always executes when send remind or alert message toward customers and read message sent by customers.

- b. Compute the similarity of paper K to paper P<sub>j</sub> by using
 
$$\text{Sim}(P_k, P_j) = \frac{\sum_{i=1}^n w_{i,j} \cdot w_{i,k}}{\sqrt{\sum_{i=1}^n w_{i,j}^2} \sqrt{\sum_{i=1}^n w_{i,k}^2}}$$
- c. Sim\_Values[p<sub>k</sub>] ← Sim(P, P<sub>j</sub>)
 

Note: *Sim\_Values* is an associative array containing the similarity values of all relevant papers to P<sub>j</sub>.
- viii. Sort the associative array *Sim\_Values* in descending order with respect to similarity value
 

```
FOR p=1 TO N
  IF Similarity Value of "p" >=0.3 THEN
    Store and retrieve the details of paper 'p',
    and display it
  END
NEXT
```
- ix. END
 

**Note:** P<sub>j</sub> = the current documents or research paper liked by an active user.  
 N = number of documents or research papers that are similar to P<sub>j</sub>.  
 W<sub>ij</sub> = Weight of term i in paper J  
 W<sub>ik</sub> = Weight of term i in paper K  
 Sim\_Values = An associative array containing the similar papers in order of their similarity to P<sub>j</sub>.

## 3.2 A Paper Recommender System Based on the Past Ratings of a User

### 3.3 Limitations

The paper on [3.1] presents only calculative approach based on previous history. The paper on [3.2] presents a paper recommender system that suggests or provides recommendations to the intended users based on the papers the users have liked in the past. This paper adopted content based filtering technique to generate recommendations to the intended users. The system does not provide recommendations to an active user based on the past ratings of other similar users to the active user.

## CHAPTER 4: PROPOSED SYSTEM

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In this chapter we introduce a model for recommendation systems, based on a utility matrix of preferences actually that is collaborative filtering & also based on content based filtering. Our proposed algorithm is simple enough through combing those two types of filtering. In this chapter we will briefly describe different steps of our algorithm.

### 4.1 The Utility Matrix

In a recommendation-system application there are two classes of entities, which we shall refer to as users and items. Users have preferences for certain items, and these preferences must be teased out of the data. The data itself is represented as a utility matrix , giving for each user-item pair, a value that represents what is known about the degree of preference of that user for that item. Values come from an ordered set, e.g, integer 1 representing the item purchased by that user gave as a rating for that item. We assume that the matrix is sparse, meaning that most entries are “unknown.” An unknown rating implies that we have no explicit information about the user’s preference for the item.

	Item1	Item2	Item3	Item4
A	1		1	1
B		1	1	
C		1		1
D	1		1	

Table -1: utility matrix.

Notice that most user-item pairs have blanks, meaning the user has not purchased the item. In practice, the matrix would be even sparser, with the typical user rating only a tiny fraction of all available items.

The goal of the recommendation system is to predict the blanks in the utility matrix. For example, user A & C have purchased most similar item and A also purchased item4

which D has not purchase yet. So, D may purchase item4. So fill the blank for D. This is an approach using collaboration filtering for recommendation in our system.

### 4.2.1 Item Profile

Content-Based systems focus on pro<sup>13</sup> of items. Similarity of items is determined by measuring the similarity in their properties. In a content-based system, we must construct for each item a profile, which is a record or collection of records representing important characteristics of that item. In simple cases, the profile consists of some characteristics of the item that are easily discovered. For example, consider the features of a item that

might be relevant to another item. For example,

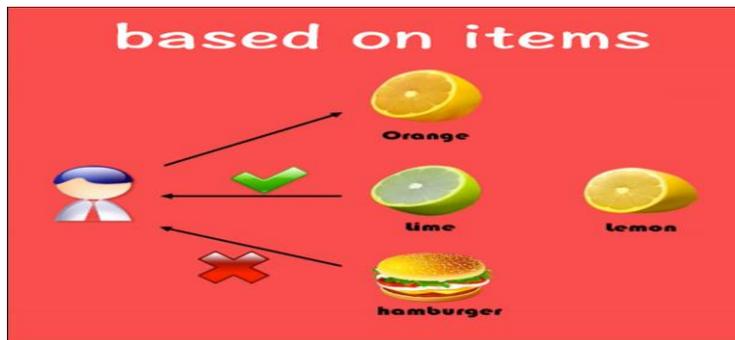


Figure-5: content based example

A user has purchased lemon and burger. We will recommend his orange based on similarities with lemon not burger.

### 4.2.2 Package

Content-Based systems focus on properties of items and also packages. For example,

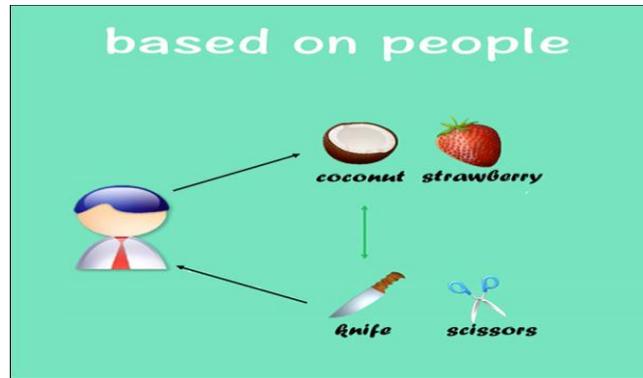


Figure-6: package

when a customer buy a burger he/she may need ketchup and also for when somebody will buy a coconut he/she may need knife This is the another approach in our recommended system.

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### 4.3 Proposed Algorithm

The proposed algorithm for generating recommendations, discussed below,

- Start
- Get The Product(Pi) purchase By Active customer.
- Get The Product Category(PCj) purchase By Active User.
- FOR k=1 to N
  - 1 Map the product with new products.
    - a) Pick the products for recommendation

$$sim(i, j) = \frac{\sum_{u \in U} (R_{u,i} - \bar{R}_i)(R_{u,j} - \bar{R}_j)}{\sqrt{\sum_{u \in U} (R_{u,i} - \bar{R}_i)^2} \sqrt{\sum_{u \in U} (R_{u,j} - \bar{R}_j)^2}}$$

- 
- Pick the product.
- For L=1 to N
  - 1 Map the product that belongs to same package.
- Finally merge products for recommendation.

Here,  $\text{sim}(i,j)$  associative array containing the similarity values of all relevant items using Pearson correlation theory.

## CHAPTER 5: APPLICATION AND EVALUATION

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Recommender system research is being conducted with a strong emphasis on practice and commercial applications, since, aside from its theoretical contribution, is generally aimed at practically improving commercial Recommended Systems. Thus, RS research involves practical aspects that apply to the implementation of these systems. These aspects are relevant to different stages in the life cycle of a RS, namely, the design of the system, its implementation and its maintenance and enhancement during system operation.

Software testing, a pragmatic investigation conducted to provide stakeholders with information about the quality of the product or service under test, with respect to the context in which it is intended to operate. Software Testing also provides an objective, independent view of the software to allow the business to appreciate and understand the risks at implementation of the software.

Test techniques include, but are not limited to, the process of executing a program or application with the intent of finding software bugs. It can also be stated as the process of validating and verifying that a software program/application/product meets the business and technical requirements that guided its design and development, so that it works as expected and can be implemented with the same characteristics. Software Testing, depending on the testing method employed, can be implemented at any time in the development process, however the most test effort is employed after the requirements have been defined and coding process has been completed.

This system is done with the requirement of a on line shop harkar.com. Testing phase is done by them live.

This stage is very important to check whether the system does all the functionality properly or not. Also, to check whether the objectives of the system have all been carried out or not? This project is developed in the local machine so it is implemented in the local machine.

Interface for the system is,

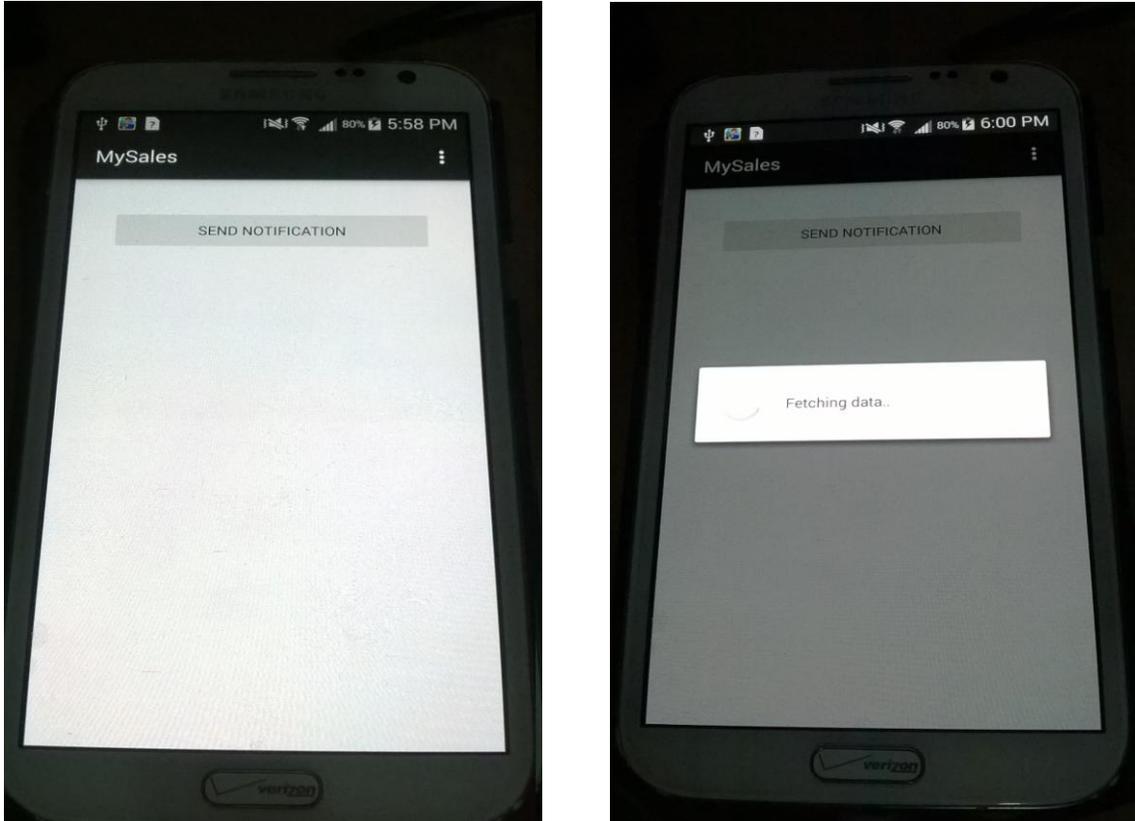


Figure 7: Interfaces

## CONCLUSION

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Recommendation systems have definitely opened new options of searching and filtering information. Internet stores have accelerated profits, item lovers have discovered new types unknown to them before, and tourists might take a look to new interesting places. Having all these options available, the customers save their time in multiple numbers. And this is the minor part of the beneficial influence of recommendation system on the clients. At the same time, there are some shortcomings, limits, and defects. Some of them were discussed above. Numerous improvements are required in the sphere of development of user's model, of dapper semantic analysis of information, and of acceleration and polishing of recommendations. Recommendation systems are not limited by only computers and mobile devices, but they can also open new security capabilities while embedded into automobile industry, and overall, into devices of everyday use. This, in turn, would require development of more specified recommendation systems. All these facts make us sure that these systems will be promising and topical for long time. And we are just in the initial stage of their development.

This is to conclude that the project that I undertook was worked upon with a sincere effort. Most of the requirements have been fulfilled up to the mark and the requirements which have been remaining, can be completed with a short extension. It is a great pleasure to come at this point of the project.

During the project the author has achieved great skills and knowledge. These skills and knowledge will help the author to develop other project greatly. During the development the author had to deal with many challenges critical to the system, but the author had overcome to these challenges and provided solutions which will encourage the author in the future to deal with challenges confidently. Finally, communication between the author, client and the supervisor guideline helped to stay on the tack to complete the system throughout the project.

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