

# Developing Combo Recharge Plans for Customers using Apriori Algorithm

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## Abstract

Machine Learning has become an integral part of human research now a day. People are tending to select more automatic system rather than going with the manual handling. Data mining has the huge effect on business analysis as all business rely on their behaviour of customers. Mining the behaviour of customers can help the very existence of the company. For mining such kind of data, association rules are used. This algorithm helps in finding the itemsets that are used frequently. This paper has proposed the way to satisfy customers in telecommunication market. Knowing the customer's recharge pattern can enhance their will to use the same service provider. By mining the recharge pattern of individual customer, this system should be able to provide a new combo of recharges which will indeed be less than the individual recharges. For mining such frequent itemsets, this paper has used Apriori algorithm.

**Keywords:** *customer retention; prepaid churn; Apriori algorithm; association rule mining; frequent item set.*

## Introduction

### Problem Definition:

Customer retention in Telecom market is a big research challenge in developed as well as developing economies as the market is almost saturated as well as competitive with large number of local and global service providers.

In this work instead of predicting who are going to churn and offering them some promotional offer, this study will focus to minimize the customer dissatisfaction which is one of the most important attribute that contributes to churn. Goal of This study is to identify such recharge combo offers that will bundle all important services

(like talk value, data, SMS, Value Added Services (VAS) etc.) in such a way to make most of the customers happy (with the offer) as well as maximize revenue per user from all services.

### **Justification of the Problem**

Customer retention in Telecom market is a big research challenge in developed as well as developing economies as the market is almost saturated as well as competitive with large number of local and global service providers.

Mobile number Portability (MNP) is a scheme that is introduced in India by Telecom Authority of India (TRAI). A customer can use MNP to change service provider without changing his/her mobile number. So looking at current MNP statistics in India will give some insight about the grave necessity to reduce customer attrition. As per the latest press release of TRAI (Press Release No. 90/2016) around 5.16 million customers have used MNP in June 2016. Total number of MNP requests since inception stood around 224.43 million in the same period. We see that churn reduction has become a survival strategy for the telecom service providers.

In this work instead of predicting who are going to churn and offering them some promotional offer, this study will focus to minimize the customer dissatisfaction which is one of the most important attribute that contributes to churn. Goal of this study is to identify such recharge combo offers that will bundle all important services (like talk value, data, SMS, Value Added Services (VAS) etc.) in such a way to make most of the customers happy (with the offer) as well as maximize revenue per user from all services.

### **Need For The New System**

Nowadays Service providers are offering different kinds of schemes to attract the customers, there is big competition between large number of local and global service providers. Mobile number Portability (MNP) is a scheme that is introduced in India by Telecom Authority of India (TRAI). A customer can use MNP to change service provider without changing his/her mobile number, it increases customer attrition. So it is challenging for service providers to maintain customer retention and reduce customer attrition. Customer retention is the ability of a business to retain customers. It is both a measure of customer loyalty and the capacity of the business to keep customers satisfied by quality service. Customer should be happy with the offered services.

As per the latest press release of TRAI (Press Release No. 90/2016) around 5.16 million customers have used MNP in June 2016. Total number of MNP requests since inception stood around 224.43 million in the same period. Service providers are trying to reduce customer churn by offering different kinds of delightful services.

The purpose of this system to reduce customer dissatisfaction by offering them delightful services. This study is to identify such recharge combo offers that will bundle all important services (like talk value, data,

SMS, etc.) in such a way to make most of the customers happy (with the offer) as well as maximize revenue per user from all services.

### **Advances/Additions/Updating the System**

There is huge competition between local and global service providers nowadays, that's why it becomes very difficult for service provider to reduce customer attrition. Telecom Authority of India (TRAI) has introduced Mobile number Portability (MNP) scheme, due to that it becomes very easy for customers to change their service providers without changing his/her mobile number. Loss of customer from their service provider is known as customer churn or customer attrition. Because of the competitive environment, churn rate is becoming high. Customers are tending to switch to other operator whose schemes match their requirements. Customers often switch service provider due to good promotional offers and lower monthly cost from other providers. As prepaid customers are not bind by any contract to the service providers so prepaid customers are inherently more prone to discontinue the service. Indian customers are mostly prepaid customers, so there is always a very high chance of attrition. As per current data churn rate in India has gone up to 14 per cent per month with incremental net additions are at 8-10 million.

In this work, instead of predicting who are going to churn and offering them some promotional offer, this study will focus to minimize the customer dissatisfaction which is one of the most important attribute that contributes to churn. Goal of this study is to identify such recharge combo offers that will bundle all important services (like talk value, data, SMS, Value Added Services (VAS) etc.) in such a way to make most of the customers happy (with the offer) as well as maximize revenue per user from all services.

Every recharge pack has time limit and particular size of data. Some time it happens that we do not use the data, talk time and after particular period i.e. service providers do not provide that talk time or data which they have offered in the pack. To overcome from that problem we propose a system it will offer you combo pack based on pervious history of the user. It will help to utilize all data, talk time and SMS offered in the Combopack.

### **Presently available system for the same**

. Previously, P.S. Rajeswari *et al* proposed a theory to predict the customers who are likely to switch the service provider. this study was mainly to gauge the level of customer satisfaction and to analyze the factors driving the customer churn on Indian prepaid segment. Based on the churn factors, the operational retention strategies were designed to enhance the customer loyalty by arresting the churn rate. The research study was descriptive and survey method was employed using structured questionnaires as sampling instrument. Sample size was 1102 and Tamil Nadu, one of the states of India was selected as the sampling framework. Exploratory factor analysis and multiple regression were taken as statistical tools for data analysis. The factors related to the technology

based services, network coverage, net speed, complaint resolution system was acting as driving source for the customer churn. Based on this operational strategy were devised to improve customer loyalty.

### Purpose of the System

The main objective is to provide a combo pack which will contain talk-time, data and SMS value pack with minimum cost based on the individual interest.

A single customer normally makes more than one recharge for different recharge-types mentioned above. Our aim is to identify those set of recharge types that are done very frequently and by a great percentage of customers within a fixed time period (may be for a month).

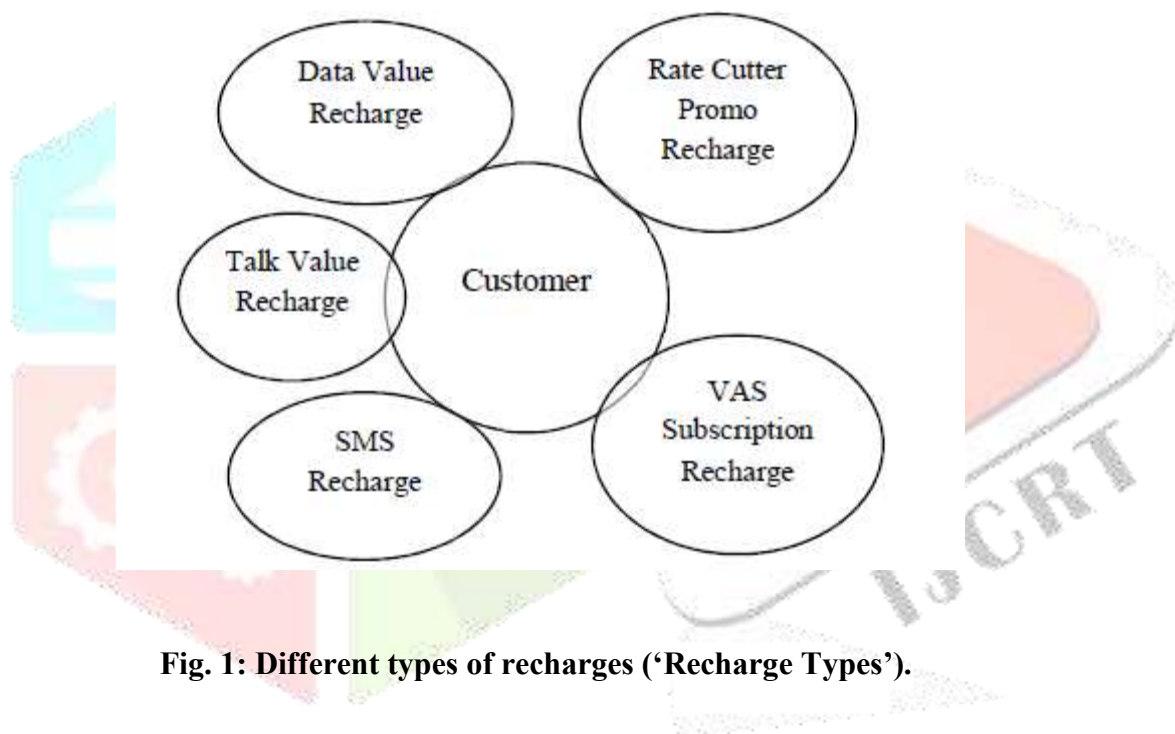


Fig. 1: Different types of recharges ('Recharge Types').

Any association rule mining process consists of below two sub-processes:

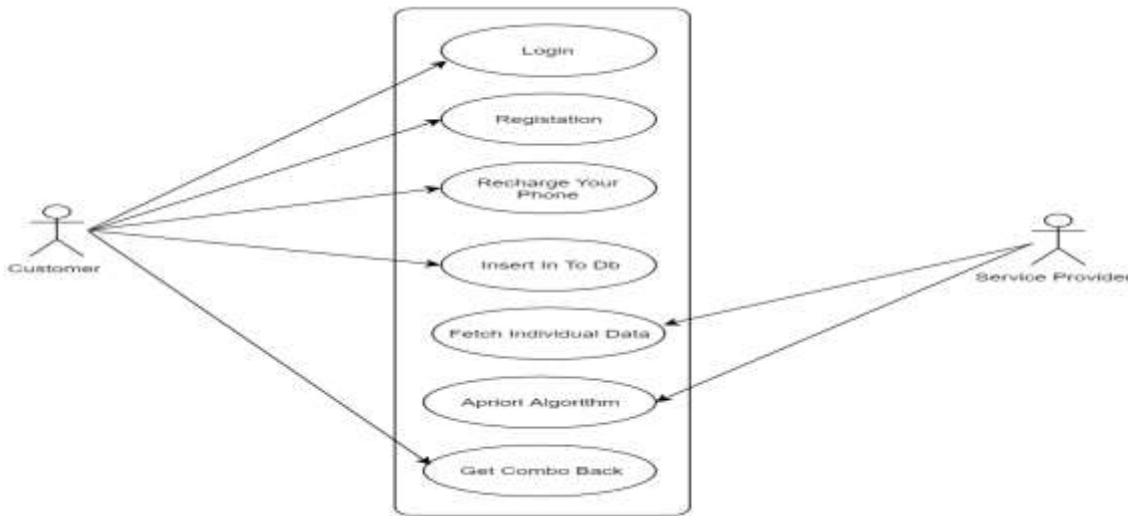
1. Find all itemsets with adequate support value.
2. Derive association rules from the above itemsets.

### System design:

#### Usecase Diagram:

A use case diagram is a representation of a user's **interaction** with the system and depicting the specifications of a use case. A use case diagram can portray the different types of users of a system and the various ways that they interact with the system.

Fig 4.9 shows the use case of our system. User has to register to login into the system. After verification, his details are stored into database. Then user login into the system to get combopack, which fulfill the requirements of the user.



**Fig: Usecase Diagram**

**Data Flow Diagram 0:**

A data flow diagram (DFD) is a graphical representation of the flow of data through an information system, modeling its process aspects.



**Fig: Data Flow Diagram 0**

### Data Flow Diagram 1

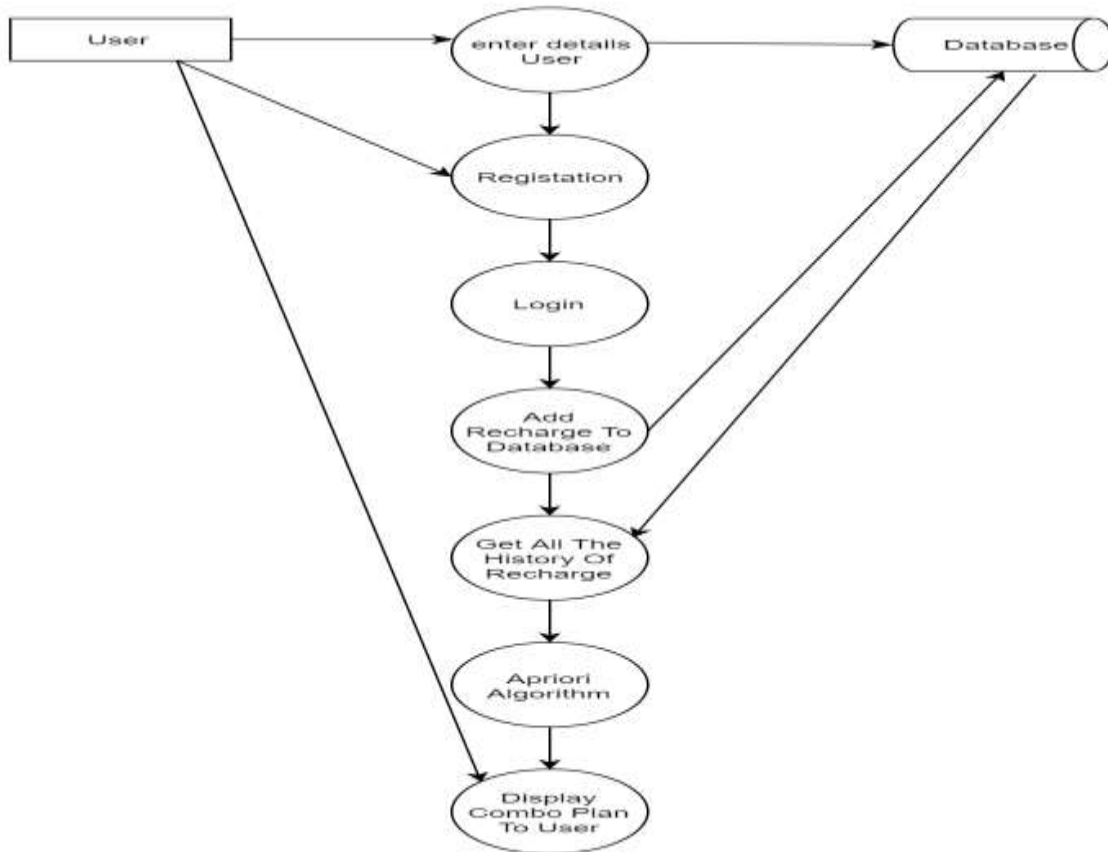


Fig: Data Flow Diagram 1

### Deployment Diagram:

Fig shows the deployment diagram of our system. Deployment diagram is a structure diagram which shows architecture of the system as deployment(distribution) of software artifacts to deployment targets. Artifacts represent concrete elements in the physical world that are the result of a development process.

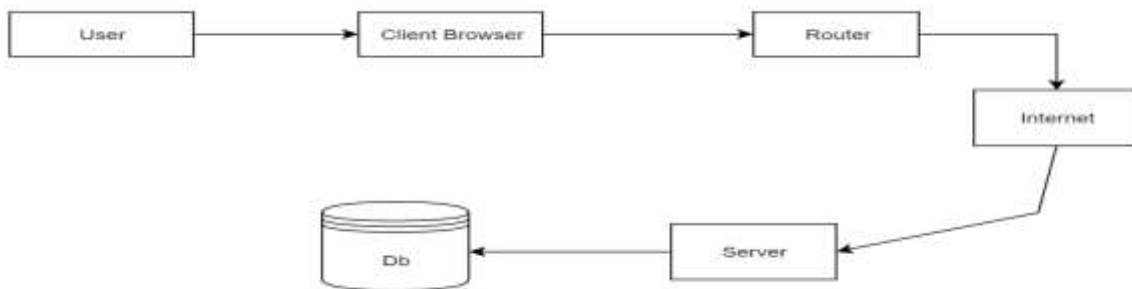
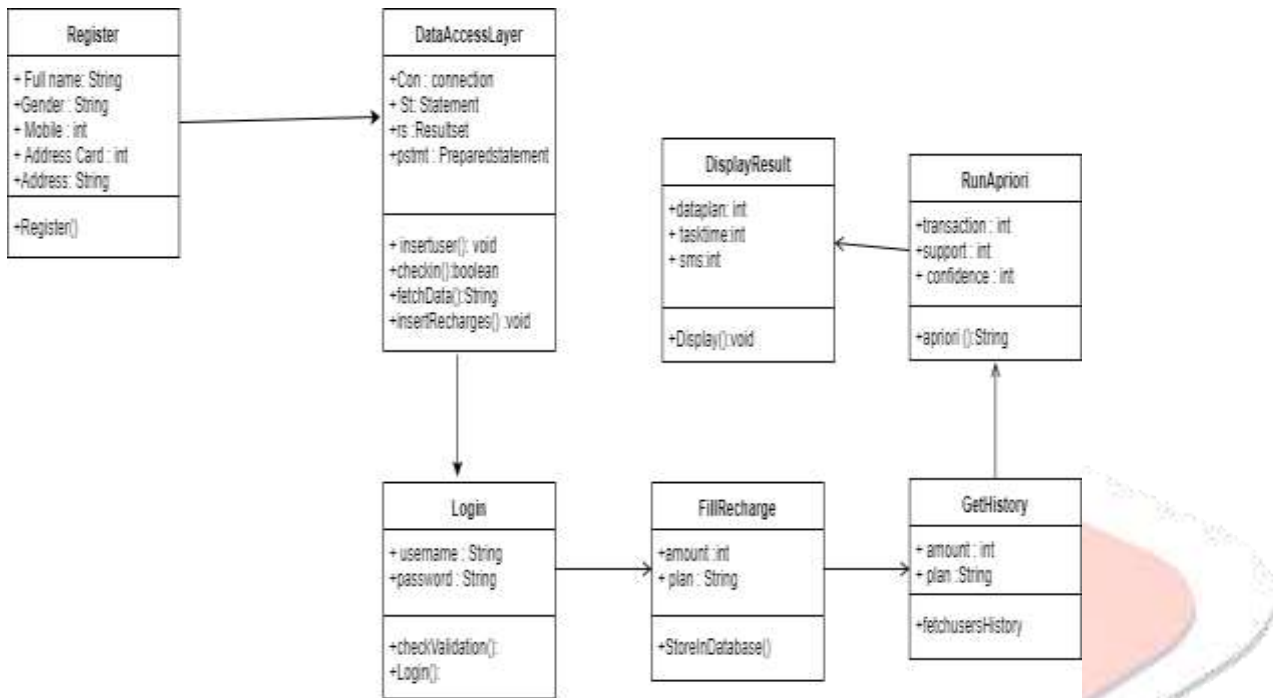


Fig: Deployment Diagram

**Class Diagram:**

Fig 4.2 shows class diagram of our system. A **class diagram** is a type of static structure **diagram** that describes the structure of a system by showing the system's **classes**, their attributes, operations (or methods), and the relationships among objects.



**Fig: Class Diagram**

**Sequence Diagram:**

A sequence diagram is an interaction diagram that shows how processes operate with one another and in what order. It is a construct of a Message Sequence Chart. A sequence diagram shows object interactions arranged in time sequence. It depicts the objects and classes involved in the scenario and the sequence of messages exchanged between the objects needed to carry out the functionality of the scenario. Sequence diagrams are typically associated with use case realizations in the Logical View of the system under development. Sequence diagrams are sometimes called event diagrams, event scenarios

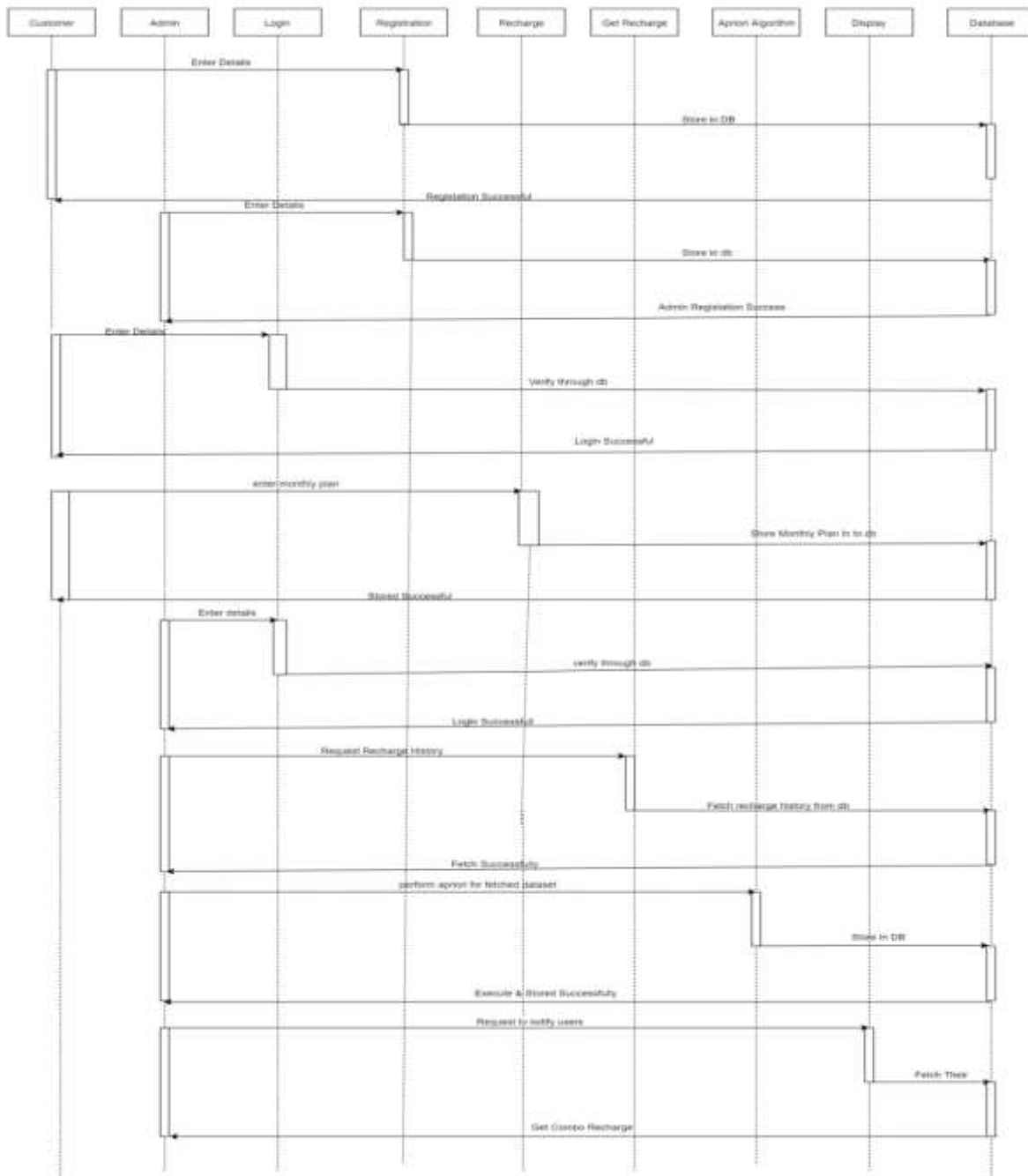


Fig: Sequence Diagram



Package diagram:

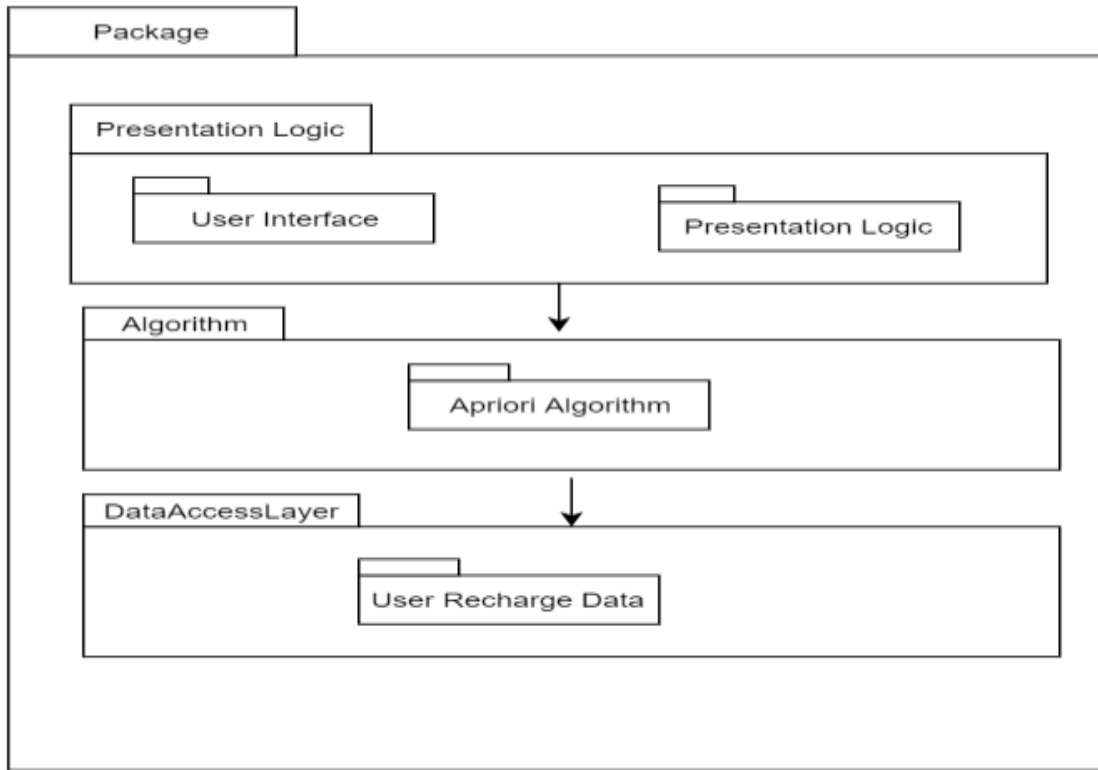
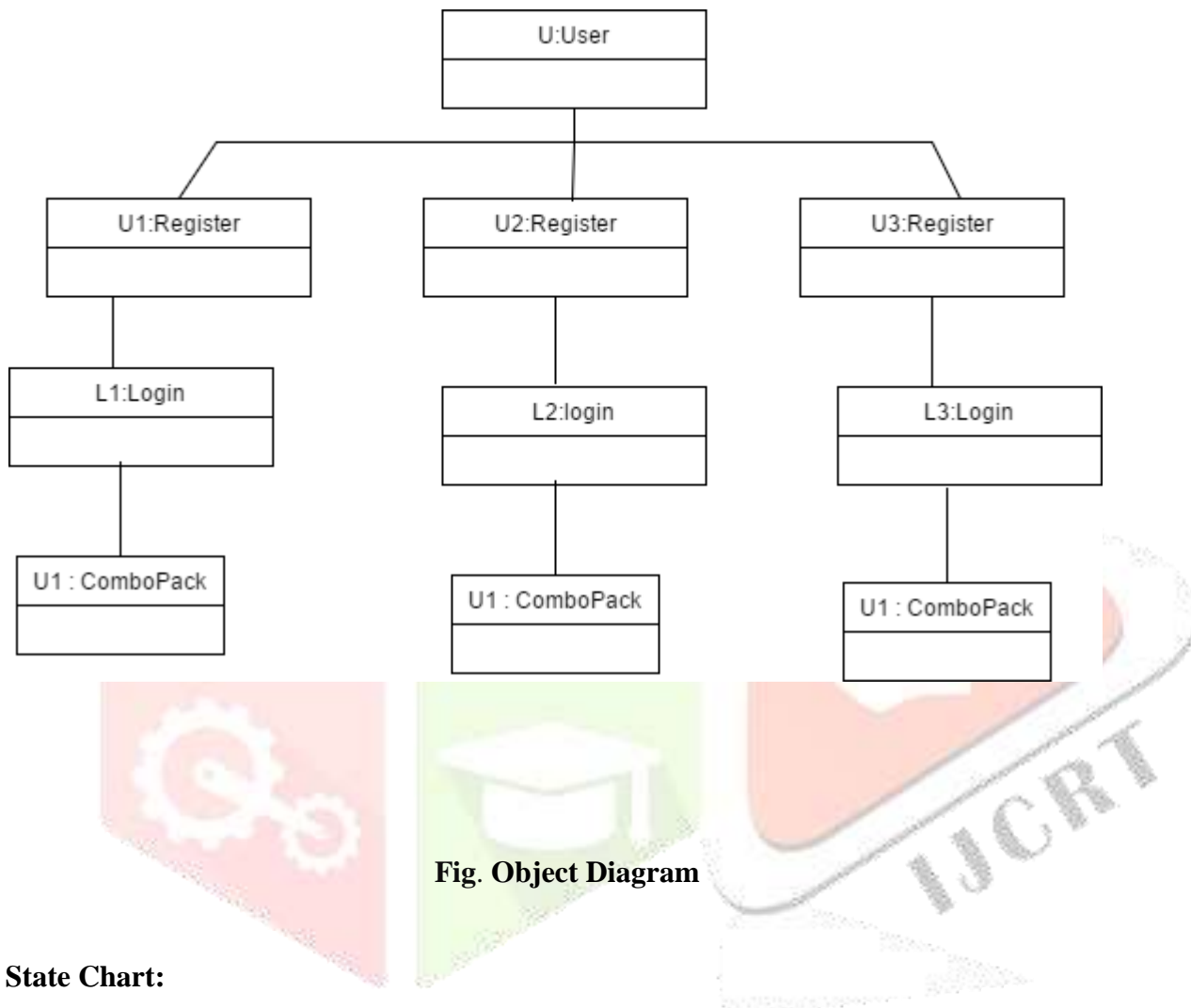


Fig: Package diagram



## Object Diagram

Fig. shows object diagram of our system. It is a diagram that shows a complete or partial view of the structure of a modeled system at a specific time.



**Fig. Object Diagram**

## State Chart:

State chart diagram is used to model the dynamic nature of a system. They define different states of an object during its lifetime and these states are changed by events. Statechart diagrams are useful to model the reactive systems

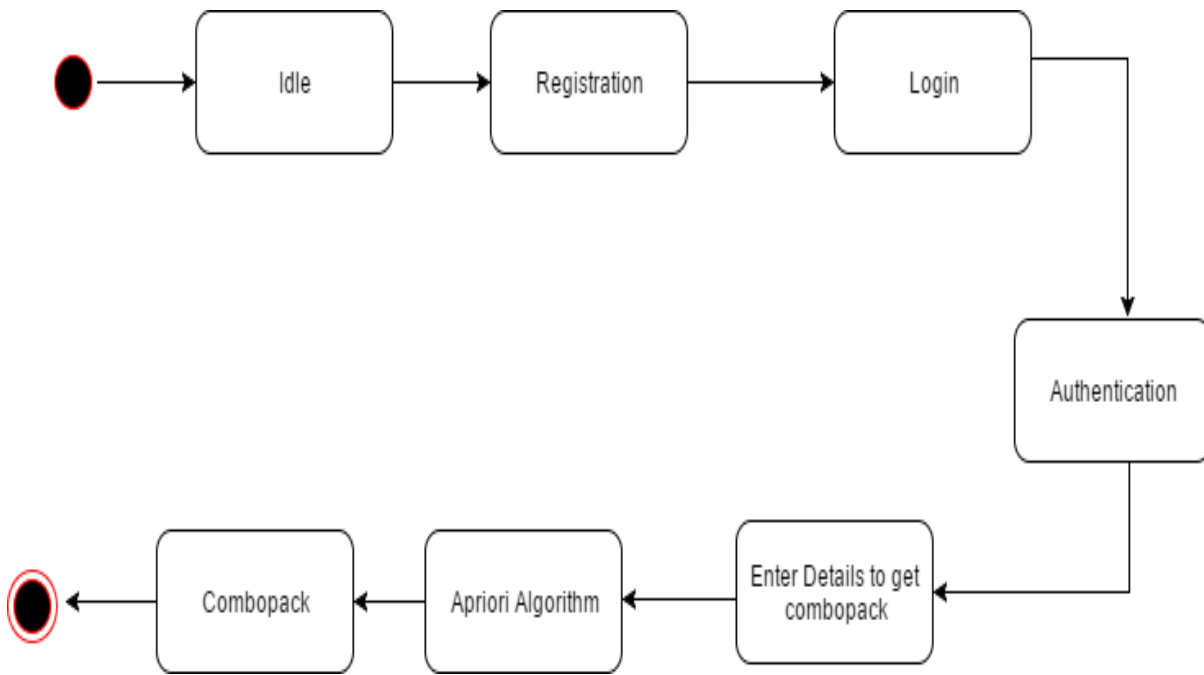
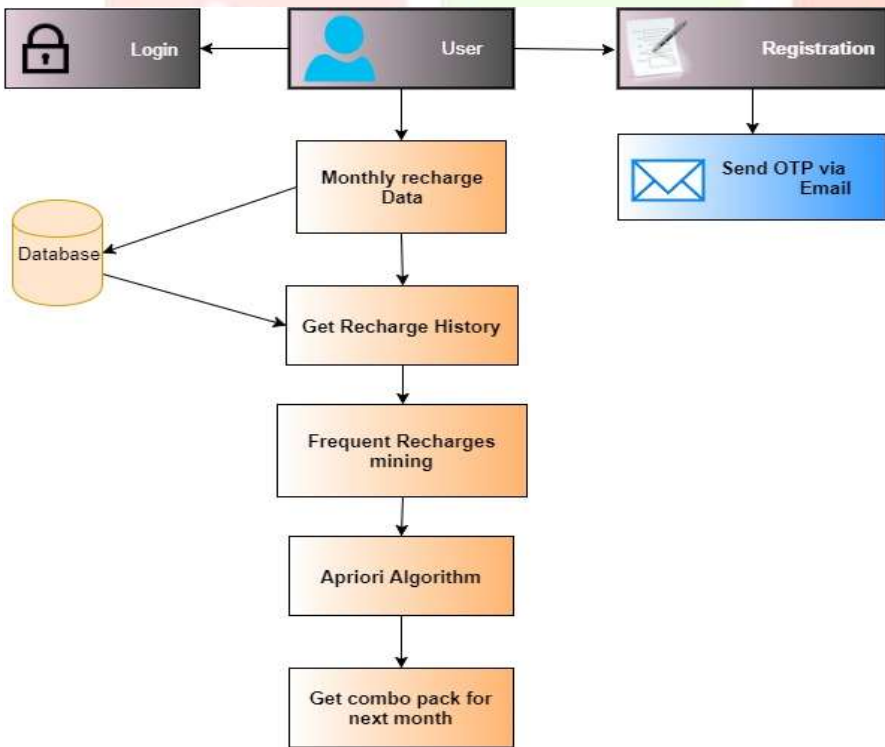


Fig: State Chart

SYSTEM ARCHITECTURE



As shown in the above Architecture,

First user will register with the system by providing details like First name, last name, mobile number, service provider, mail id, and password. after that user will receive the Opt on his mail id .

If user enters correct OPT then user will get registered with the system. and user details will be get stored into the database

After registration user can login into the system with valid mail id and password.

After login user can view his or her profile, recharge history and Combo plan offered by the system.

Then user can logout from the System.

Admin user will add recharge history of the users those are registered with the system .

### **Related Works**

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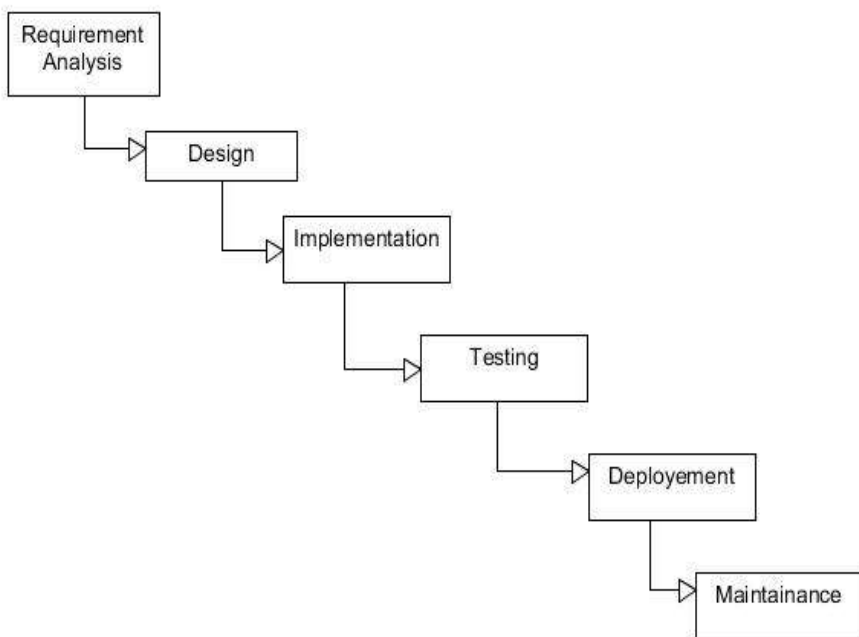
### **HYPOTHESES**

- 1- We have developed the system that mines the frequent recharge done by the user. And on the basis of that it generate the combo plan and offers to the users
- 2- Admin user has permission to add recharge history of the users
- 3- Apriori algorithm is used to mine the frequent recharge types of the users .

- 4- Proposed framework helps to predict the combo plan of different types such as Talktime-SMS, Talktime-Data, Data-SMS and Talktime-Data-SMS.

## DESIGN OF THE STUDY

Implementation phase focus over system design objectives. Software implementation is the process of designing, writing, testing, debugging / troubleshooting, and maintaining the source code of computer programs.



**Fig : Software Development Process**

Implementation of system is divided into 5 main modules. With the help of Register and Login module user will register and login into the system. After login user can view his or her profile by using Profile module, recharge history using RechargeHistory module and Combo-Plan using plan module .

## SAMPLE OF THE STUDY

A single customer normally makes more than one recharge for different recharge-types mentioned above. Our aim is to identify those set of recharge types that are done very frequently and by a great percentage of customers within a fixed time period (may be for a month).

## TOOLS UDED

### Software Requirement:

- Framework: *Eclipse Oxygen*.
- Development Tool Kit: *JDK 1.8* or more.
- Hadoop
- *mail –Gmail API*.

**Hardware Requirement:** The hardware design of the system includes designing the hardware units and the interface between those units.

- 4GB or higher.
- Hard Disk: 20GB or higher.
- Processor: *Intel(R) Core(TM) i3* or advanced

## STATISTICAL TECHNIQUE USED

### ALGORITHM

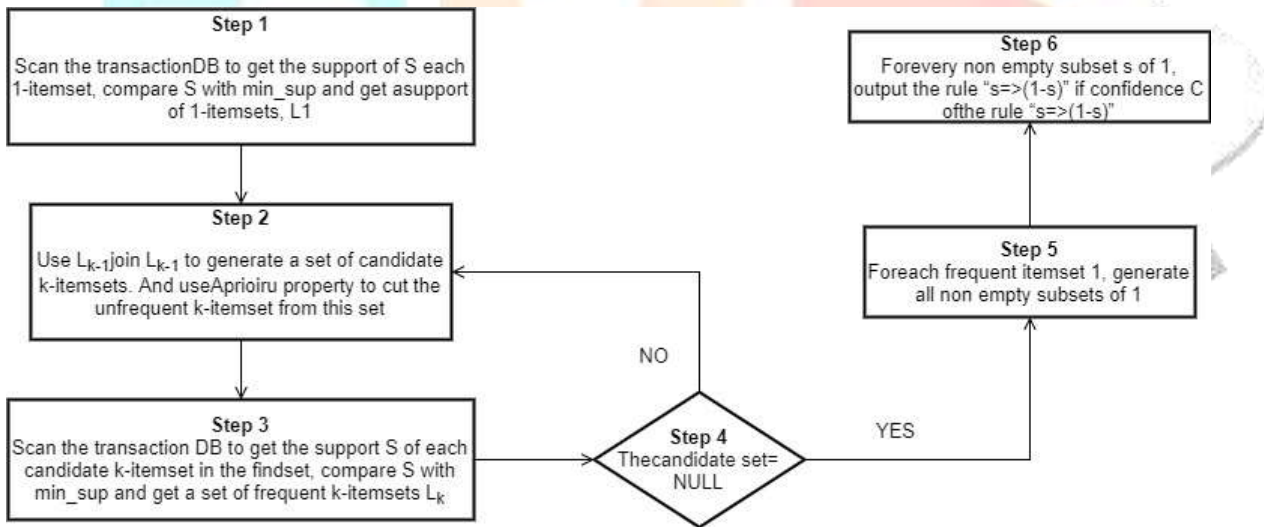
#### 5.1.1 Apriori

**Apriori** is an algorithm for frequent item set mining and association rule learning over transactional databases. It proceeds by identifying the frequent individual items in the database and extending them to larger and larger item sets as long as those item sets appear sufficiently often in the database. The frequent item sets determined by Apriori can be used to determine association rules which highlight general trends in the database; this has applications in domains such as market basket analysis. The mechanism of Apriori algorithm is as given below:

- Find the frequent itemsets: the sets of items that have minimum support – A subset of a frequent itemset must also be a frequent itemset
- i.e., if  $\{AB\}$  is a frequent itemset, both  $\{A\}$  and  $\{B\}$  should be a frequent itemset – Iteratively find frequent itemsets with cardinality from 1 to k (k-itemset)
- Use the frequent itemsets to generate association rules.
- Join Step:  $C_k$  is generated by joining  $L_{k-1}$  with itself
- Prune Step: Any (k-1)-itemset that is not frequent cannot be a subset of a frequent k-itemset
- Pseudo-code:  $C_k$  : Candidate itemset of size k
  - $L_k$  : frequent itemset of size k

- o  $L_1 = \{\text{frequent items}\};$
- for ( $k = 1; L_k \neq \emptyset; k++$ ) do begin
- $C_{k+1} =$  candidates generated from  $L_k$  ;
- for each transaction  $t$  in database do increment the count of all candidates in  $C_{k+1}$  that are contained in  $t$
- $L_{k+1} =$  candidates in  $C_{k+1}$  with  $\text{min\_support}$  end
- return  $\cup_k L_k$

1. Input: Recharging history
2. Output: Combo plan offer
3. Collect all the information of recharge history of a customer.
4. Run Apriori algorithm to find the support and confidence of the recharge data.
5. This algorithm will give us frequent itemset of a particular user. This would result in giving us the combination of recharges with the best plans to satisfy the users.



**Fig: Apriori Algorithm Steps**

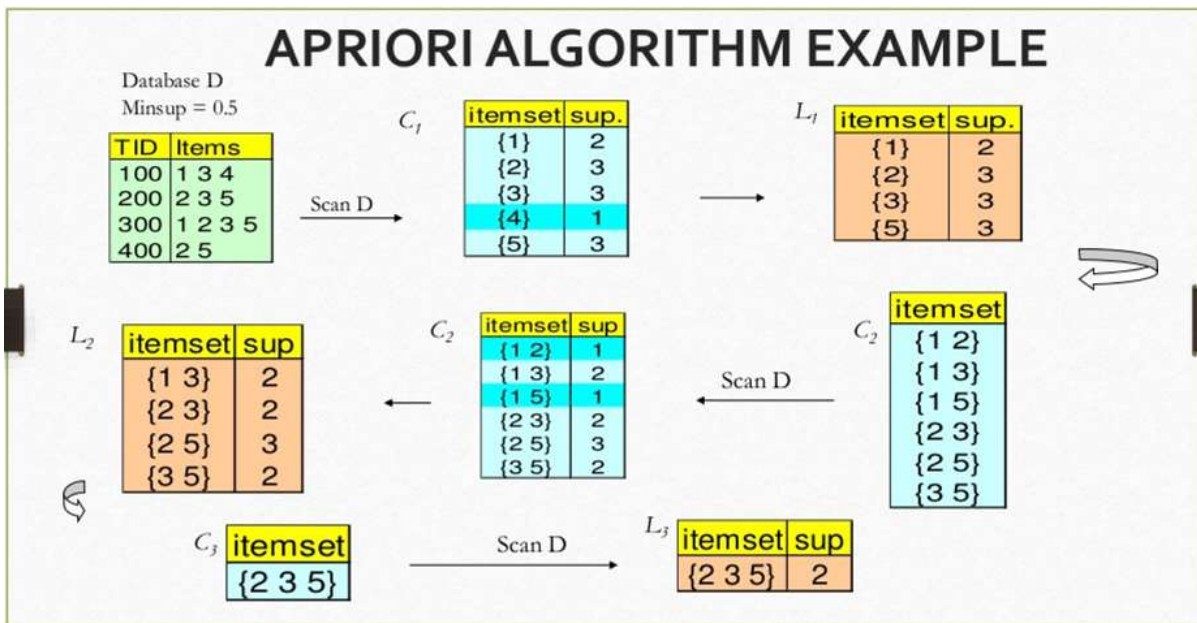


Fig: Apriori Algorithm Example

### Software Used

#### JSP

#### JavaServer Pages

(JSP) is a technology that helps software developers create dynamically generated web pages based on HTML, XML, or other document types. Create view of the project we have used JSP with CSS.

#### Servlet

To deploy and run JavaServer Pages, a compatible web server with a servlet container, such as Apache Tomcat or Jetty, is required.

### 5.2.2 Hadoop:

The Apache Hadoop software library is a framework that allows for the distributed processing of large data sets across clusters of computers using simple programming models. It is designed to scale up from single servers to thousands of machines, each offering local computation and storage. Rather than rely on hardware to deliver high-availability, the library itself is designed to detect and handle failures at the application layer, so delivering a highly-available service on top of a cluster of computers, each of which may be prone to failures.



### 5.3 Hardware Specification

Processor	- Pentium –4
RAM	- 1 GB (min)
Hard Disk	- 20 GB
Key Board	- Standard Windows Keyboard
Mouse	- Two or Three Button Mouse
Monitor	- SVGA

### 5.4 Programming Language : Java

**Java** is a general-purpose computer programming language that is concurrent, class-based, object-oriented and specifically designed to have as few implementation dependencies as possible. It is intended to let application developers "write once, run anywhere" (WORA), meaning that compiled Java code can run on all platforms that support Java without the need for recompilation. Java applications are typically compiled to bytecode that can run on any Java virtual machine (JVM) regardless of computer architecture. As of 2016, Java is one of the most popular programming languages in use, particularly for client-server web applications, with a reported 9 million developers. Java was originally developed by James Gosling at Sun Microsystems (which has since been acquired by Oracle Corporation) and released in 1995 as a core component of Sun Microsystems' Java platform.

### 5.5 Platform

Windows 10 Operating System is used as platform to develop the application .

### 5.6 Tool

#### Eclipse IDE

Eclipse is an integrated development environment (IDE) used in computer programming, and is the most widely used Java IDE. It contains a base workspace and an extensible plug-in system for customizing the environment. Eclipse is written mostly in Java and its primary use is for developing Java applications, but it may also be used to develop applications in other programming languages.

### 5.7 Coding Style Format

Bottom-up coding format is used in our project.

## OUR APPROACH

### Mathematical Model

Let, S be the System Such that,

$A = \{I, O, F, \text{success, failure}\}$

Where,

I= Set of Input (recharge history of the users)

O= Set of Output (Combo Plan)

F =Set of Function

### Input:

I= recharge history of the user

### Function:

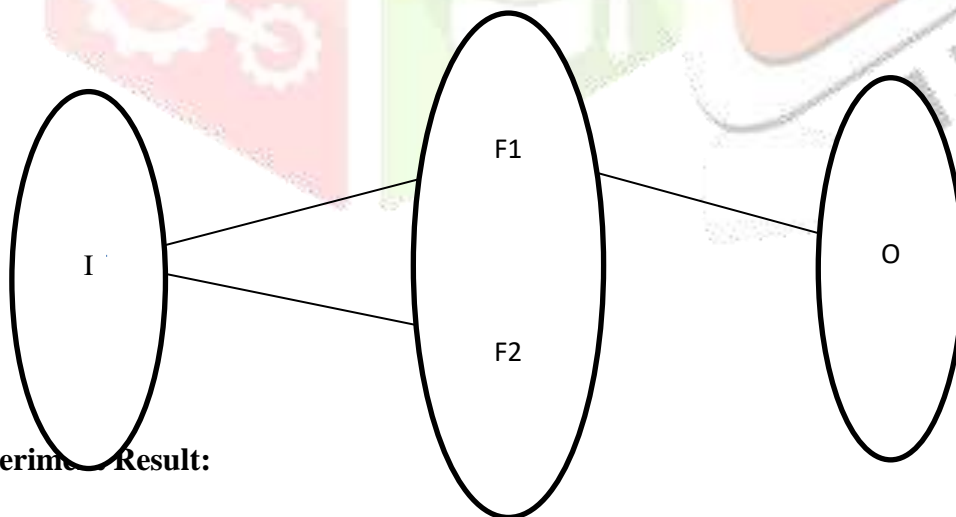
F1= Apriori algorithm (This function is used for itemset mining)

F2= Mining Frequent Item set (This function is used for repeated item mining)

### Output:

O1=Success Case (It is the case when all the inputs are given to the system are entered correctly).

O2=Failure Case (It is the case when the input does not match the validation Criteria).



### Experiment Result:

This System proposes a framework to provide a combo pack which will contain talk-time, data and SMS value pack with minimum cost based on the individual interest.

A single customer normally makes more than one recharge for different recharge-types mentioned above. Our aim is to identify those set of recharge types that are done very frequently and by a great percentage of customers within a fixed time period (may be for a month).

System is able to predict the different type of combo plans these are Talktime-SMS, Talktime-Data, Data-SMS TAlktime-Data-SMS. The proposed algorithm has an accuracy of 90%.

Results demonstrate that a proposed technique is able to predict the combo plan accurately, proposed algorithm outperforms in terms of effectiveness and efficiency. Due to the real-time requirements, we aim to give proper service to the user.

### **Future scope:**

Future work will include analysis on the monthly amount spend by any single customer for different type of recharges and based of them new combo plans of different recharge denominations will be calculated. A customer may recharge same type of recharge multiple times in a month so aggregating them for the whole month needs to be done. Some of the existing recharge plans may have varying validity period so proper modeling needs to be done to accommodate it before considering them for monthly analysis.

### **Acknowledgment**

It gives us great pleasure in presenting the preliminary project report on 'Developing Combo Recharge Plans for Customers using Apriori Algorithm'.

I would like to take this opportunity to thank my internal guide Prof. Pooja. N. Vengurlekar for giving us all the help and guidance we needed. We are really grateful to them for their kind support. Their valuable suggestions were very helpful.

In the end our special thanks to Prof. Geeta Navale for providing various resources such as laboratory with all needed software platforms.

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### **Conclusion**

This paper has proposed a model to analyse the recharge plans of a customer by using Apriori algorithm and suggest a combo recharge plans. This paper has discussed data pre-processing steps to generate the item set

from raw recharge transactions dataset. Proposed model allows to generate combo data plans after analysis. Expectation is that these combo plans with cost price slightly less than the individual price combined will make most of the customers happy as well as telecom service provider can be sure to get full potential revenue from those customers.

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