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Personalized Promotion Tracking: A Location Based Approach for Merchandizing Industry using Haversine Formula

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Abstract: **-- In this proposed application, personalized promotion is realized by an individual where the mobile client enables the application to get offers, discounts from nearby merchants on mobile devices. This application continuously keeps track of the constantly moving mobile clients coming under the periphery of the static data objects which represents the merchant office. A distance based circular area is defined for every store and if any customer enters in this geographical area with proper connected network through GPS or mobile they will get promotional offer with respect to his or her previous offer avail. Author use goggle maps for describing geographical area.**

This application is an approach which allows a retailer to promote products or services by using geographical position of a mobile device to targeted customer consistently and efficiently.

Keywords: **— GPS, Haversine formula, K-means, Promotion, Resourceful applications, Web Client**

I. INTRODUCTION

Mobile internet technology now a days has a rapid development, Smart phone makes key role in this domain of promotion. Open source operating system, Android dominant this domain and location based application on android platform attracts more. In modern days, the numbers of mobile users are increasing rapidly. Many statistical sites forecast that within 2018 smart phone user reaches 2.56 billion.

This is because of numerous reasons. One of them is the excellent features that new advanced mobile phone offers, particularly Android based phones [1][2]. Based on advanced features ingenious applications are developed on smart phones. Tracing of human being is important for several reasons. Global Positioning System (which is one of the essential features of smart phone) returns accurate geographical location of user. Based on Geographical location, customers will be privileged through advanced application which helps them getting personalized offers, discounts and gives servers an unprecedented way to connect with customers and deliver highly relevant messages at time and place when a client is most likely to act on them [3]. GPS is a navigation system that uses coordinate system based on latitude, longitude and altitude. Latitude is defined based on equator, longitude on prime meridian and Altitude is represented in meters above sea level [1].

The proposed application is client-server application where the mobile clients get its geographical location through gps and sent it to main server along with queries. When a query arrives main server executes the query in main memory and check if the mobile is in any store's defined geographical area and according to that offers will be provided to the mobile. If the customer availed the desired offer, then it will update main database. The location of mobile client is continuously changing and because of that tracing the location of a mobile client involves high cost as continuous re-computations is required. So the technique of store's geographical area calculation is used. When the customers remain inside a geographical area, the results of those queries will remain unchanged, so reevaluation is not needed unless it leaves a particular defined geographical area.

II. PROPOSED MODEL

Personalized promotional tracking apps target to reach specific customers based on previous offer availed by client and geographical location of customers.

The most fundamental analysis for vendors is significantly focused on the needs of the customers. It is the basic rule of a successful business to engage existing customers because returning customers helps to increase or maintain the volume of business. A valuable customer should be taken special attention for making him "returning customer".

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Vendor need to raise new potential customer for the expansion of his business. He has to arrange profit for convincing customers. Area of interest of the customer should be taken care of to get an absolute benefit from it. Careful observation of market and regular researches are essential to make strategies for improvement. Relationship of vendor and customer should be bonded with the feelings of security, trust, need, dependence, profitability, comfortness, assistance, strong understanding and satisfaction. These key points play crucial role for the success of vendor. To keep up a business it's necessary continuous advertisement and build promotion depend on customer's needs. But generally it's a very costly process. In this application we provide following facilities along with analysis and report generation for every promotional activity:

1) Generate the New customers.
2) Lifetime value of customers.
3) Generate Offers depending on customer past activity.

Guaranteeing the perfect individual gets the right message at the ideal time, this application focused on ads to build the adequacy of promoting. It's a platform that helps vendor to promote their product directly to customer and in less expensive way. Also, customer want to get some applicable and helpful offer depends on their exact need.

Mobile devices are key influencers of purchase decisions. Research indicates that 81% of purchase decisions made using smart phones are instantaneous rather than planned. Consequently, this app offers a critical window of promotion for offers/discounts by providing access to consumers at any location when they are mostly able to make a purchase. Thus the application provides consumers the ability to easily get local advertising, offer, and discount on their mobile phones and provides respective businesses with cost-effective mobile advertising.

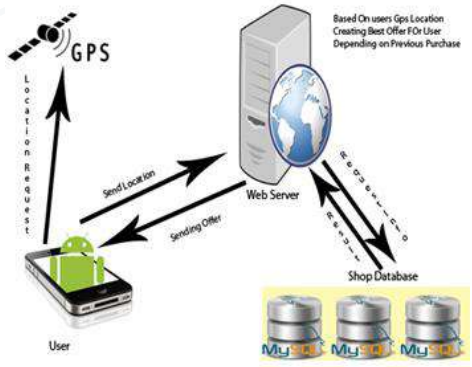

Fig1: Proposed System Architecture

This architecture shows how the web server receives the current position of the customers and provides best offers based on previous purchase from the nearby shops. Fig. 2 shows the communication between the customers and the shops via internetwork. It shows how the customer receives offer when he enters the predefined zone of a shop.

The Proposed System architecture consists of the following modules:

1) Mobile client.
2) Main Server
3) Web client
4) GPS service
5) Generate Promotion
6) Alert Update

1) Mobile client:

Android operating system based mobile phone with Global positioning system.

2) Main Server:

A customer details, store details, customers previous purchase records and stored geographical area is defined here.

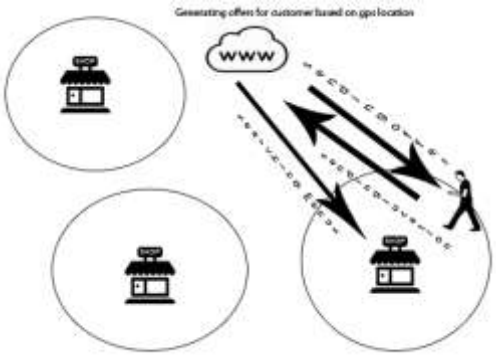

Fig 2: Offers Based On Location

Some of the tables used are:

A. Offer Details

Mid	status	Offer
M100	A	30%

Where, Mid->Menu ID, Status->Customer status based on previous record, Offer->Available offer

B. Customer Details

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Cid	Cname	MDevice	plocation	Pmenu	status
Ba05	Rajesh	Moto-G	Kolkata	Mobile	A

Where, Cid->Customer ID, Cname->Customer Name, MDevice->Mobile Device, Plocation->Preferred location, Pmenu-> Preferred Menu.

C. Purchase Details

Cid	Mid	Dated	Location	Price
Ba05	M100	20-5-16	Kolkata	13000

Where, Cid -> Customer ID, MDevice -> Mobile Device, Dated -> Date of Purchase, Location->Location of Purchase, Price -> Item rice,

3) Web client:
The information in the repository is managed by MySQL Database which is manipulated using PHP.

4) GPS service:
To track the position of the mobile clients, map service is used which provides both the mobile and the web client with map data. Global Positioning System is used by map service to track the geographical position. Haversine formula and k-means algorithm is used to calculate distance between a customer and a store as well as compare distance with nearest store's geographical area.

A. Haversine Formula:

Haversine Formula helps to find distance between two different latitude longitudes of values on earth.

$a = \sin^2(\Delta\varphi/2) + \cos\varphi1 \cdot \cos\varphi2 \cdot \sin^2(\Delta\lambda/2)$ … (1)

$c = 2 \cdot \text{atan2}(\sqrt{a}, \sqrt{(1-a)})$ … (2)

$d = R \cdot c$ … (3)

where φ is latitude, λ is longitude, R is earth's radius (mean radius = 6,371km). Here all angles are calculated in radian.

B. K-Means Algorithm: It is a well-known unsupervised learning algorithm to solve the clustering problem. K-Means Algorithm is formally represented by

( ) ΣΣ(‖ ‖) … (4)

where, ‖xi - vj‖ is the Euclidean distance between xi and vj. ci is the number of data points in ith cluster. c is the number of cluster centers.

5) Generate Promotion:
Based on previous offer availed and consumer's status web client give offers to consumers.

6) Alert:
According to consumer's action on offers information is updated every time by the web-client.

III. EXPERIMENTAL RESULT

At first customer register in the application by providing customer details (Fig. 3). After registration customer login uses username and password. (Fig. 4) and the user receives a localized store's offer notification based on previous offer availed (Fig. 5).

Fig. 3 Registration Form

IV. CONCLUSION AND FUTURE SCOPE:

This android application finds customers geographical location by using GPS and generates offers based on his previous purchase and guide customer to nearest vendor's physical store. Using Google map customers mark his location and using GPS nearest retailers get the position and give the user offer best suited based on previous purchase records. Thus the offer from the nearby locations are displayed on mobile device using store's geographical area and smart update

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Fig. 4 Login page

Fig. 5 Personalized Offer List

Personalized Offer generation is a very tough process because customer's choice can change depending on taste, mood, weather etc. which can't be tracked using regular algorithm or process. The various unexplored areas are

1) To introduce neural network to generate offers.
2) Introduction to wish list.
3) Extension of ecommerce portal for windows and mac environment.

Author also ignored the product search result when developing apps which helps to find customers proper choice. Also chain of stores is yet to be considered.

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