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Design of Targeted Advertising for Location Based Services and User Profile Based Recommendation

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ABSTRACT: This paper presents the study of algorithm used for navigation of Location based services (LBS) and data mining. Location Based services (LBS) is one of the new approaches of technology that gain a position in the geographic presence of mobile devices. The presence of LBS technology can be used for information mapping of an area such as the existence of the event**.** Data Mining Technology provides the solution to meet the market trends. A Graph-Based method of Data mining is an improved approach to mine strong association rules from an association graph, called graph based association rule mining method, where the association for each frequent item set is represented by a sub-graph, then all sub-graphs are merged to determine association rules with high confidence and eliminate weak rules, the proposed graph based technique is self-motivated since it builds the association graph in a successive manner. In this paper the Haversine algorithm and the FP-growth Graph algorithm is used to determine the presence of visitors is done by calculating the results of haversine formula with a radius area of each of these events. From the calculations, if the users are in the radius area, the number of visitors the event will be calculated and updated.

KEYWORDS: Haversine Formula, FP-Growth Algorithm, LBSs

I. INTRODUCTION

Now, current technology has allowed getting information from an area of the Earth surface. Geographical is one of scientific field that describe and represent the Earth. The Earth can be represented as two dimensional space, without ignoring the original shape of the Earth. This representation of earth also knows as map. Digital map can be displayed in two dimensional with the use of latitude and longitude, this is an invaluable tool to show the position of a region based on its original position. Technology has been developed fastly, it is indicated with the popular technology that known as Location Based Services (LBS) which is technology to obtain a position geographically existence of mobile devices such as Smartphone The Location Based Service technology can be used for information mapping from a region such as the existence of the event [1]. Event is defined as activities that are held an individually or a group that aim to celebrate or commemorate important things in human life [KBBI].This events can be a cultural events, culture, arts, sport and etc. The successful event can be seen from the number visitor which comes to the event area, thus the total of visitor which come to the event are made to be exposed. The use of LBS technology to collect total visitor who enters an event area can be done by looking at the closest point from centre point that has been determined. The central point will store the coordinates and the radius of the event area. On the other hand, mobile devices send the coordinates of the user by using LBS technology that has been provided by Android. There are several methods that can be used. There are several methods that can be used to calculate the shortest distance between the coordinate to each other. Haversine formula is one of the example methods that use for resolve distance calculation problem and this method is also used for many researches.

Data mining techniques is used to extracting information from that data. Many researchers developed a lot of algorithm and techniques for finding useful information in the database. Frequent item-set mining is a core data mining operation and has been extensively studied over last decade. It plays an essential role in many important data mining

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tasks. Algorithms for frequent item-set mining form the basis for algorithms for a number of other mining problems, including association rule mining, correlations mining, and mining sequential and emerging patterns. Association rule mining is very effective technique of data mining that finds the useful hidden information in the data, its aim to extract correlation [3], frequent pattern, association by transaction database or other data repository. This rules generated by datasets and it derives by measurement of support and confidence of every role, which define the frequency of that role. Association rule is a rule which is depends on the association relationship of objects and items. For example data item interrelation ship which is occurs simultaneous with other data items. This rule is calculated by data and association calculated with the help of probability. Share market and recommended system etc. are its practical applications. To concept of document based clustering, association rule mining is very effective algorithm and useful approach. It utilize the FP-Growth approach that discover frequent patterns and modified it to frequent sub graph discovery. Originally the algorithm is design to frequent item-set mine in market basket analysis. In this paper, analyze FP-Growth approach to document clustering. The FP-Growth algorithm which discover frequent connected graph and perform better for thick connected graph. This paper includes haversine algorithm and FP-growth graph algorithm into the next section where as the complete study of both algorithms can be explained.

II. RELATED WORK

A. Location Based Services (LBS)

LBS (Location Based Service) is a service that take input as a current location of a user (generally acquired through a mobile device carried by this user) and tailors its output depending on the acquired location data. For instance, a user visiting a shopping mall may call LBS to locate the closest shop that matches his budget and its clothing preferences.LBS applied to technologies that we know today as GPS or Global Positioning System. GPS is a global coordinate system that can determine the position coordinate of object anywhere on the earth either it is longitude, latitude or altitude [2]. GPS can be used as an efficient alternative to obtain spatial data automatically and in real time [2].In the proposed work the Location Based Services (LBS) that means the location of user can be identify using the GPS (Geographic Positioning System) where the haversine algorithm is the used to measure the latitude and longitude of user corresponding distance and specify the nearest location of user.

B. Haversine Formula

In the proposed work the haversine algorithm is used to specify the user location by GPS technique. The haversine formula is an important equation for navigation, giving great-circle distances between two points on a sphere from their longitudes and latitudes. It is a special case of a more general formula in spherical trigonometry [3]. Haversine formula is one of the method are used to calculate distance between two coordinate on two dimensional map with ignoring the mountain heights and valley depths. The distance is the actual distance by which the earth's spherical trigonometry. Haversine formula is also known as great circle distance, this formula perform calculation from main point to destination point with trigonometric function by using latitude and longitude. Finally, haversine formula produces distance data between two points in meters. Some research has been done with the use of Haversine methods. This research was done by Chopde and Nichat. The research used haversine formula to calculate distance from origin until the destination and A* algorithm also implemented to analyze and determine shortest route. This method is known as path finding algorithm [4].

Another research conducted by Prasetyo and Hastuti presented the use of haversine formula to search location and get information from church in Semarang city. In this research, mobile application was developed to help people to search nearby church based on position of user and accompanied by information of church. Therefore, user can choose [13].

Again the research done by Cecep Nurul Alam, Khaerul Manaf, and Aldy Rialdy Atmadja in an Implementation of Haversine Formula for Counting Event Visitor in The Radius Based on Android Application used haversine formula to calculate distance from user location to the event. The event have radius area, radius are used to show an event area. If the radius of the area of event is smaller than distance from user to destination, so the system can

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detect the location of the user and then user can be register as event visitor. Then, the system can calculate the total of visitor that can show the potential and interest to the public [2].

Haversine formula is used to determine the distance between one point to another point. This method is used for applications in geographic information systems. On the use of maps that are already have two dimension will have points depicted in integers. In the calculation steps haversine are first will change the value of the latitude and longitude integer number into radians, and then these numbers are calculated in the algorithm haversine. Here is the formula of haversine:

Where:

- d is the distance between the two points (along a great circle of the sphere; see spherical distance),
- r is the radius of the sphere,
- φ_1, φ_2: latitude of point 1 and latitude of point 2, in radians
- λ_1, λ_2: longitude of point 1 and longitude of point 2, in radians

On the left side of the equals sign d/r is the central angle, assuming angles are measured in radians (note that φ and λ; can be converted from radians to degrees by multiplying by $180/\pi$ as usual).Solve for d by applying the inverse haversine (if available) or by using the arcsine (inverse sine) function:

$$d = 2r \arcsin\left(\sqrt{\operatorname{hav}(\varphi_2 - \varphi_1) + \cos(\varphi_1)\cos(\varphi_2)\operatorname{hav}(\lambda_2 - \lambda_1)}\right)$$

$$= 2r \arcsin\left(\sqrt{\sin^2\left(\frac{\varphi_2 - \varphi_1}{2}\right) + \cos(\varphi_1)\cos(\varphi_2)\sin^2\left(\frac{\lambda_2 - \lambda_1}{2}\right)}\right)$$

r: radius of the earth (r = 6.731 km),
d: Distance

To perform distance calculations using haversine formula, we need the location of each data event. The latitude, longitude, and the radius area of the event are need for calculating distance. This information will be entered into database, so it can make easy to retrieve data when finish to calculate using haversine formula. Below shows the haversine algorithm to calculate the longitude and latitude of an area.

HAVERSINE ALGORITHM

```
Function
 getDistanceFromLatLonInKm(lat1,lon1,lat2,lon2)
 {
  var R = 6371; // Radius of the earth in km
  var dLat = deg2rad(lat2-lat1);  // deg2rad below
  var dLon = deg2rad(lon2-lon1);
  var a =
  Math.sin(dLat/2) * Math.sin(dLat/2) +
  Math.cos(deg2rad(lat1)) * Math.cos(deg2rad(lat2)) *
  Math.sin(dLon/2) * Math.sin(dLon/2) ;
  var c = 2 * Math.atan2(Math.sqrt(a), Math.sqrt(1-a));
  var d = R * c; // Distance in km
  return d;
}
function deg2rad(deg) {
```

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return deg * (Math.PI/180)
}

Here is the result obtain by using the Haversine formula to measure the latitude and longitude of the given distance.

gid	lat	lon	acc
793	20.74283	78.60108333333332	1.0
794	20.74283	78.60108333333332	1.0
795	20.74283	78.60108333333332	1.0
796	20.74283	78.60108333333332	1.0
797	20.74283	78.60108333333332	1.0
798	20.74283	78.60108333333332	1.0
799	20.74283	78.60108333333332	1.0
800	20.74283	78.60108333333332	1.0
801	20.74283	78.60108333333332	1.0
802	20.74283	78.60108333333332	1.0
803	20.74283	78.60108333333332	1.0
804	20.74283	78.60108333333332	1.0
805	20.74283	78.60108333333332	1.0
806	20.742798333333333	78.6011	1.0
807	20.742798333333333	78.6011	1.0
808	20.742798333333333	78.6011	1.0
809	20.742798333333333	78.6011	1.0
810	20.742798333333333	78.6011	1.0
811	20.742798333333333	78.6011	1.0
812	20.742798333333333	78.6011	1.0

Figure 1 : Shows latitude and longitude of distance

C. FP-Path Growth Algorithm

The Frequent Pattern (FP)-Growth method is used with databases and not with streams. The idea of the algorithm is to use a divide and conquer strategy: Compress the database which provides the frequent sets; then divide this compressed database into a set of conditional databases, each associated with a frequent set and apply data mining on each database. The FP-Tree is generated in a simple way. First a transaction t is read from the database. The algorithm checks whether the prefix maps to a path in the FP-Tree. If this is the case the support count of the corresponding nodes in the tree are incremented. If there is no overlapped path, new nodes are created with a support count of 1.

FP- GROWTH ALGORITHM:

Input: A database DB, represented by FP-tree constructed according to Algorithm 1, and a minimum support threshold ?.
Output: The complete set of frequent patterns.
Method: call FP-growth (FP-tree, null).
Procedure: FP Growth (DB, ξ)
Define and clear F-List: *F []*
for *each transaction* Ti *in* DB **do**
for *each Item aj in Ti* **do**
F[ai] ++;
end
end
Sort F [];
Define and clear the root of FP-tree: r;

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for *each Transaction Ti in DB* **do**
Make Ti ordered according to F;
Call *Construct Tree (Ti,r);*
end
for *each item ai in I* **do**
Call *Growth(r, a, ξ);*
end

The above FP-Growth Algorithm is used in the proposed work for identifying the profile based recommendation where the information about the user preference or interest according to the user profile can be manually inserted by user by considering the location of user as dynamic. Here profile based recommendation and nearest recommendation of user can be done by using the FP-Growth Algorithm by sorting the user preference according to location. The FP-Path Growth algorithm is work as follows shown in figure 1[3].

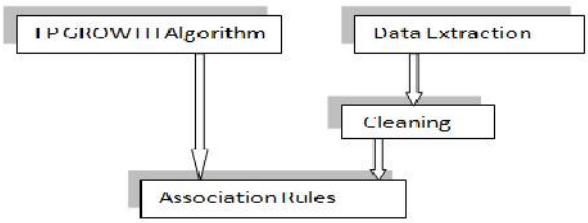

Figure 2: Flowchart stage during implementation of FP- Growth Algorithm [3]

Figure 2 shows the implementation process. The implementation starts with the user recommended dataset obtained from user and comprised of a range of attributes. Then available FP Growth algorithm is applied on the clean dataset which results in formation of association rules required for analysis.

Why FP-Growth algorithm is more efficient?
The reason of the FP Growth algorithm is being more efficient than other algorithms are:

1. Divide and Conquer: The mining data is decomposed into sub-datasets according to the frequent patterns identified. It leads to more focused search of smaller databases.
2. There is no candidate generation. As a result no candidate test is required.
3. No repeated scans of the whole database[3].

III. EXPERIMENTAL ANALYSIS AND RESULT

Here is the comparison between the algorithm which is used in existing system and the proposed system. The existing System uses Apriori algorithm to scan the large dataset for frequent item set discovery. The comparison between the Apriori algorithm and FP-Growth algorithm with respect to the time required for the execution of frequent item set.Suppose 1 item set take 324ms for execution with using Apriori algorithm and in advance the FP-growth is 0.5 times faster than Apriori then 1 item set can execute in 162ms to find frequent item set discovery as studied in previous paper and current result evaluation of execution. Similary, Table 1 shows the time required for execution of different item set with representation of graph .

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Table 1: Comparison of Execution time required for Apriori algorithm and FP-growth algorithm

Itemset (No.of data item)	Time (ms)	
	Apriori Algorithm	FP-Growth Algorithm
5	1620ms	810ms
10	3240ms	1620ms
14	4536ms	2268ms
25	8100ms	4050ms

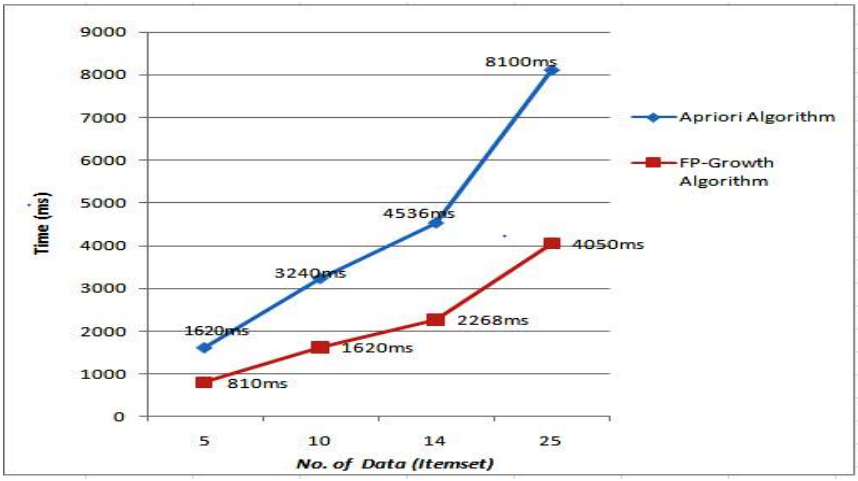

Figure 3: Comparison of performance of execution time for Apriori algorithm and FP-Growth algorithm

As compared to the Apriori Algortithm the FP-Path Growth Algorithm is work well to find the frequent item within the minimum time period. Following is the output/result that can be obtained by using the Frequent pattern tree and FP-growth algorithm as shown in figure 3 and 4.

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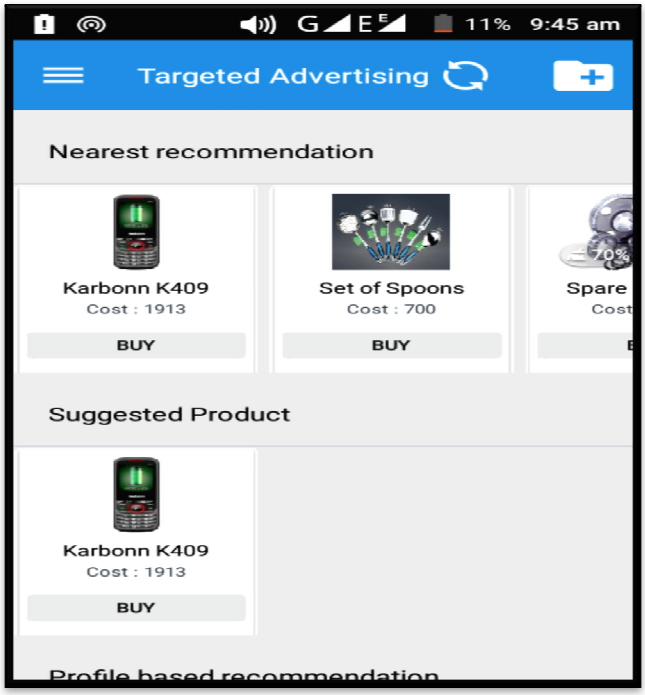

Figure 3 : Output result of proposed work

Figure 4: Output result of proposed work

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IV. CONCLUSION

This paper presents the importance of Haversine algorithm and Frequency Pattern (FP) Growth Algorithm to obtain Location of user and association rules between related data, which would help in targeting favorable recommendation according to the requirements. This technique can find information and relationships from the data, and take further decisions based on the acquired knowledge.

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