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Likeminded – A Recommender System Based Knowledge Sharing Application for Students

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Abstract*—Students in college/university face many issues in doing a project, organizing an event, finding a mentor to guide them. The main reason for this problem is lack of proper networking among students and professors. In order to solve this problem, within the college/university, there must be a proper networking channel among students and professors so that they come to know about each other. Consider a scenario in which a mechanical student wants to do an "Object Following Rover" project. In order to do the project, he/she needs skills like mechanical design, image processing, electronic controller, programming and many more. It is not possible for a single student to be expert in all these fields. He/she may be an expert in mechanical design, for the rest he/she needs to find students from other departments or from their seniors, and for mentoring he/she needs to find a professor who has worked in that area. This team formation is possible only if the student knows about what others are doing in the college/university, what other students skill-set are, and in what field they are expert in. This information cannot be obtained easily because a college/university contains 5000+ students and professors. So, it is very difficult for a single student to know about most of his/her fellow students in their college/university. This application provides solution to this problem, by providing a platform for a student to share his/her works, skills and reaching them out to target audience by using suitable recommendation algorithms and helping out students to know what their peers are doing and what are their skill-sets. This paper focuses on the various recommendation approaches that are used for this application in delivering the contents to the target audience.

***Index Terms*— Machine learning, Graph theory, Recommender system, Clustering, Social networking**

I.INTRODUCTION

A comprehensive list of social networking websites is found at [1]. Each website serves its own purpose and none of these websites help connecting people based on their skill sets. These web sites mainly share user created contents such as text, photos, videos, service specific profiles and they lack connecting people having similar skill sets. One of the main problem a student faces in a college while doing a project is finding the right set of skilled students and mentors to provide guidance for him.

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About 4000 to 5000 students at an average in a college makes one very difficult to come to know about the right set of skilled students who can guide him and be a part of his/her project work. This application is a social media platform which connects with each and every student in the college like a centralized system.

Fig. 1: Social Networking sites

A unique machine learning algorithm will help the students to get notified about the project request posted by other students in the college, if the skill set of the student(s) matches the project requirement skill set. If the student is interested in that project he/she can comment on that project and can also send a direct message (DM) to the project head.

The project head will receive so many DMs like that. Then the project head can select the student(s) who ever he/she wants to. This applies for every student in that social networking group. It's just like Facebook for technical student. The user can also see the feeds of the project that have been done by all other students. Then he/she can like/dislike/comment the project. Based on the user likes/dislikes/comments, our proposed algorithm will form a cluster which will connect the user with the topics that he/she liked. This social media application is a lightweight application where the user can install in their phone instantly without involving any complicated procedure. To make the platform to work seamlessly one only has mobile apps but no websites like Instagram or Snapchat. Many companies like Pied piper, Hooli, Sliceline, Aviato, Optimojiuse use this business model. Further app features like tagging, chatting and sharing the project will be done in order to go with the trend. The topics in the projects are dynamic that there is no need to update in the content management system from time to time. It works according to the user topics.

II. LITERATURE SURVEY

Considering the volume of research performed in the usage of social networking sites for the education system, it is necessary to determine whether these sites helped to have any impact on student achievement and engagement [5].Through virtual communities and networks, social media aid in sharing of information, thoughts and career interests.

Social Networking sites help individuals to construct their personal profile, identify a group of users with whom they can connect for a public forum for chatting, making video calls and sharing of videos and photos [3]. People spend much of their time on social networking sites for browsing, downloading information, chatting with their friends for keeping themselves connected with others and for updating entertainment information.

People are addicted to such sites in that they prefer browsing and jumping from one site to another and ignore their official work. Some have benefited from accessing these sites; some have set their own time limits for accessing such websites, while very few only do not access such websites [2].

This paper provides a platform for connecting students those who want to perform an interdisciplinary project and also build a strong community among likeminded people. Two approaches have been considered for clustering students having similar skill-sets and similar area of interest. The first method is clustering based approach in which K-means algorithm is used for clustering and the second method involves constructing a graph using graph theory.

III.PROPOSED SYSTEM

A. Clustering based approach

In this approach, clustering is done based on the user similarities and not based on the knowledge of the post or its category [6][7].

The user interactions with the post are collected basically with their likes, unlikes and comments that are made on the post by the user. This is converted to a rating on the scale of 1-5.

If a user

- Likes and comment the post with positive sentiment then his/her rating to that post is 5.
- Likes the post but doesn't comments or make some neutral comments then his/her rating to that post is 4 [Negative comments in this case are very unlikely].
- Just views the post, no other actions then his/her rating to the post is considered to be 3.
- Dislikes the post with no comment or with positive or neutral comment then his/her rating to the post is 2.
- Dislikes with a negative comment then his/her rating to the post is 1.

Example data

id, user_id, post_id, rating

0,1,1,5

1,4,2,3

….

This data is used to cluster the users based on their similarities.

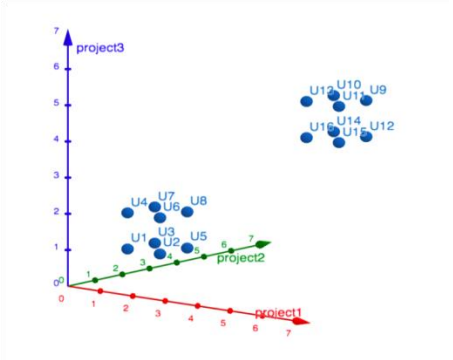

Fig.2:Graph for clustering users interested in similar projects

The above graph is plotted for 16 users and 3 projects, the project 1 is in x axis, project 2 is in y axis and project 3 is in z axis. The scale is from 1-5 and the points denote the users rating.

Point U1 denotes user 1 gave rating 1 for project 1, rating 1 for project 2 and rating 1 for project 3 and similarly for other users. 3 projects are chosen to make the plot 3 dimensions because more than that cannot be visually represented. This is applicable for any number of users and any number of projects.

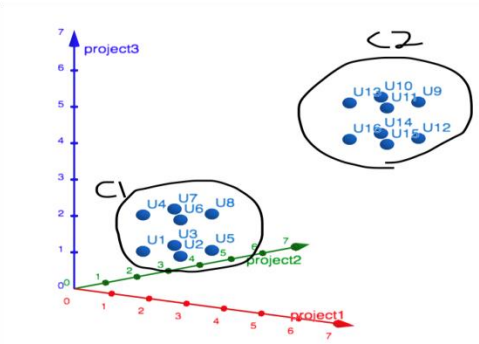

Fig. 3: Graph showing users clustered based on similar interest

From the graph it is clear that Users U1 to U8 belongs to cluster 1 and users U9 to U16 belongs to cluster 2 based on the similarity in their response to the posts which is depicted in the above post. Once the users are clustered the recommendations can be made among users within the cluster. This cluster formation can be automated by using the machine learning technique using K-means algorithm.

Pseudo code for K-means clustering

1. Initialize **cluster centroids** $\mu_1, \mu_2, \ldots, \mu_k \in \mathbb{R}^n$ randomly.
2. Repeat until convergence: {

   For every i, set
   $$c^{(i)} := \arg\min_j ||x^{(i)} - \mu_j||^2.$$

   For each j, set
   $$\mu_j := \frac{\sum_{i=1}^{m} 1\{c^{(i)} = j\} x^{(i)}}{\sum_{i=1}^{m} 1\{c^{(i)} = j\}}.$$

   }

Once the cluster is formed, the recommendations to a user is made based on the peer users in his/her cluster based on what post the peers liked and posts created by peers will be shared to the user.

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B. Graph theory based approach

Clustering based approach requires more number of users and lot of data from the users in order to make the cluster more effective in grouping users of similar interest. The second approach which uses graph theory, clusters users of similar interest with less effort and data compared to the first approach.

In this a graph is constructed, in which the users and the post becomes the nodes and the link between user and post like 'created', 'liked', becomes the edges.
Sample graph is shown below

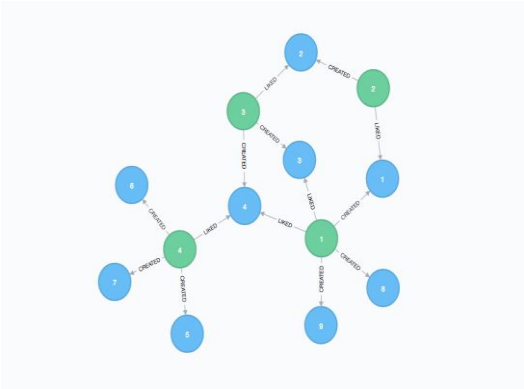

Fig. 4: Graph showing users clustered based on similar interest

In the above graph blue color are post and green color are users.When a user creates post then in the above graph a new post node with corresponding edge from the user is created. When a user likes a post then similarly a like edge between the user and the post is created.
This graph is modeled using Neo4j graph database.

Here recommendations are made using the breadth first approach with one node distance. For example in the above graph, user1 liked the post3 and post 4 which was created by user3 and user4, then for user1 all the posts that are created by user3 and user4 liked by him is shown as recommendation. Similarly user3 liked the post created by user2 and hence all the posts created by user2 are liked by user3.

Neo4j database is used for constructing graph and the process involved in constructing the graph is shown below

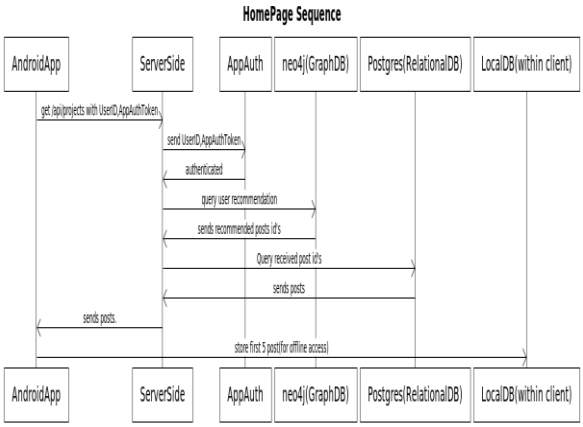

Fig. 5: Working of News feed

In homepage, under news feeds from the android app the get /api/projects go to the server side and the server checks whether the user is authenticated or not. If authenticated then the user queries the Neo4j graph dB to find the recommended post id's for the user using the breadth first approach. The server then queries the Postgres to find the project details and sends the list of projects to the client, then the client stores the post in the local Sqlite3 db for offline experience.

This approach is found to be more effective than clustering based approach. Initially the graph is found to be sparse as the user interaction increases, the graph becomes denser and denser and this approach became more effective.

PostgreSQL database is used which is highly scalable both in the sheer quantity of data it can handle and in the number of concurrent users it can accommodate [4].

IV.IV. CONCLUSIONS AND FUTURE WORK

The proposed project provides a platform for connecting students who want to carry out interdisciplinary projects and also to build a strong community among likeminded people.
The following features are to be developed for the future enhancement product:

- Adding more component support like videos, photos
- Enhancing the offline experience of the user
- Scaling the system to support a wide population of customers
- Tuning the machine learning system to provide more accurate recommendations to the user

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