Employees Engagement in Hybrid Work Model Within Organisation Using Recommendation System

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Employees Engagement in Hybrid Work Model Within Organisation Using Recommendation System

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Abstract

The COVID19 has force a organisation change the shift pattern towards hybrid work where workers working from home and in office. In hybrid work environments to connecting employees and collaboration is new challenges for organisations. So this study addresses these challenge by introducing platform where employee can connect with each other within organisation based on shared interests. The motivation from recognition that share interest help to make good meaningful connections especially when the physical presence is limited. hybrid work of social networking and recommendation systems we aim to good constraints and cultivate interaction between employees.Our methodology systematically helping with data driven techniques such similarity calculations and correlation analysis to build personalised connections based on share interests to enhancing the collaboration and employees engagement in hybrid work environment. Results are indicating that promising impact with higher acceptance rates for recommended connections, engagement improvements and similarity score. The correlation matrix helps with relevance of connections with cross functional collaboration. The outcomes of research is hold significant of implications for the organizations that to create hybrid work environment. By understanding role of social interactions, technology and organisational values companies can implement a target measures to good employee engagement. This is in turn can lead to enhance the productivity, employee satisfaction and overall organisational success with growth in the evolving mode of hybrid work.

Keywords: Hybrid work, social connections, recommeder system, employee interests, organisation values.

1 Introduction

1.1 Background and Motivation

The epidemic has change everything in way corporates and businesses function to implementation of hybrid work arrangements(Jonas and Eva-Maria; 2022). In this era marked of digital connectivity and involving of work dynamics traditional boundaries of workplace have now expanded to new concept of hybrid work environment. This is shift where about new challenges in connecting employees, collaboration within organisation. So our study explores novel approach to connect the employees in hybrid world through platform. By using shared interests we aim to enhance collaboration among employees in organisation and ultimately contributing to more engaged workforce.

The rise of the hybrid work characterised by both of remote and in office work has some need for the innovative solutions to maintain and help in employee connection (Hellen et al.; 2021) . In absence of physical the traditional offices for casual interactions and collaboration have reduce. The motivation for our study is from recognition that the shared interests serve to meaningful connections with employees. Drawing the inspiration from a social networking and recommendation system we able to use technology to make connections in mutual interests so addressing challenge of making interaction in hybrid work place.

The changing work process requires new technologies mostly in HR department to help manager to navigate semioffice setup. So the COVID 19 (Nicholas et al.; 2021)impact the to a hybrids work approach with remote and inoffice work. The research objective in this research is to design, implement and evaluate platform that can used to connecting employees within hybrid work environment bt their interests. This objective is driven by process that in contemporary landscape of work characterised by both remote and inoffice culture by employee connections and collaboration has new challenges. The primary focus is make a use of technology to bridge gap created by the physical distance and facilitate meaningful connections based on common interest. The aim is to address problem face by hybrid work model where physical presence is basically limited. In such environment casual interactions, collaborations and the sense of community can compromise.

The study is to provide solution to core problem of connecting employees effectively in hybrid work environment. It recognises that traditional methods of making connections like as face to face interactions, have been disrupt and therefore alternative solution is required. The research objective is to create recommendation system that uses employee interests as basis for suggesting connections. By doing this it aims to enhance the employee engagement, collaboration and community building, mitigating the isolation that can be arise in a hybrid work method. The objective also encompasses that examination of systems effectiveness in the enhancing employee engagement, interaction and collaboration. This research aims to uncover potentials of share interests as to building a cohesive and engaged workforce in the hybrid work model. the study seeks to identify user satisfaction and gather feedback to refine and improve the recommendation system iteratively. This is a flexible but still challenging in hybrid model innovative ways for connect engage and motivates employee. Our research aims to explores to how companies can establish and maintain social and organisational connection between hybrid work method. We will identify challenges and solution guiding businesses in using of communication tool and technology for relationships with this environment.

1.2 Problem Statement

The core problem that we address is how to effectively to connect a employees in hybrid work environment where off course physical presence is limited. Traditional means of build connections. Our aim is to design and implement a personalised recommendation system that can use the employee interests and make a use for suggesting connections. By doing so we able to enhance employee engagement, collaboration and community building within organisation to relive potential isolation that may arise in hybrid work setting.

This research is associated with HyWorx company the purpose of HyWorx is Hybrid work is to identify of employee values priorities to help organisations in improved team performance, worker comfort and efficiency in hybrid environment.To address the organisational problem HyWorx is helping to create a multitiered Software as a solution

platform where will help with 4 sets a organisational value employees interest one in a layers. Our implementation uses on a combination of technologies to achieve its objectives: Python: The primary programming language for system implementation and its libraries. Tableau: To develop a dashboard for user interface.

Our methodology involves a structure approach to address the research question: Similarity Calculation : cosine similarity technique use to in calculation similarity within employees based on shared interests. Recommendation Engine: use similarity score and correlation matrix to suggest connection with interests.

User Interface Development: user interface is design to present personalised connection recommend to employees.

The performance is evaluated using the following metrics: Acceptance Rate: The rate from which recommend connections are accepted by employees this set by organisation. Cosine score: use this score to know similarities between users. Engagement Metrics: quantitative measures perform of interactions and collaborations connected employees. Correlation Matrix Insights: A analysing positive and negative correlations within the interest categories to calculate the relevance of recommendations.

Through this comprehensive approach our study has ability of interests in bridging gap between employees and enhancing collaboration in dynamic of hybrid work environment.

1.3   Reserach Question

How can employees connected to each other with similar interests can effectively help in connect employees to hybrid work environment and enhance collaboration and organisation make sure performance and engagement are maintain within community in world of hybrid working?

To answer this questions we look into the liturature, design, implementation and evaluation of impact on employee engagement and interaction.

2   Related Work

The literature review provides summary of current research in connecting employees in a hybrid world, important ideas new concepts and methodologies which can have involved in this area. In todays changing work culture where some employees work from the office while some work remotely the concept of a hybrid world has involved. This new hybrid environment brings new challenges and opportunities for connecting employees and building of community.

In a hybrid work environment employees may feel disconnected from each other with organisation and their colleagues due to physical separation. Previous studies have shows strong connections within employees can helps to improve job productivity, increased collaboration and enhanced performance. Finding effective ways to fill gap between physically separation employees is necessary for maintaining good productive work environment.

Table 1: Summary of the Literature Review.

Authors	Methods Used	Results
(Abdullah et al.; 2021)	Popularity based filtering	Good similarity with UserId682
(Lai and Yu; 2021)	Recommender matrix factor	Precision, recall and F1 score
(Ji et al.; 2020)	Collaborative Filtering	Prediction accuracy is 0.95
(Wang et al.; 2022)	Recommender system	Sparsity 99 with VG dataset
(Dokoohaki et al.; 2014)	Correlation techniques	Correlations similarities measured
(Valerie and Terry; 2014)	Behavior Analysis	Hypotheses, correlations calculated
(Hellen et al.; 2021)	Quantitative Analysis	Descriptive methods measured

2.1 Summary of the Related Work

2.2 Difficulties faced by organisation and employees while working in hybrid model

The COVID-19 outbreak changed the model how people used to work and many of started working from home in result which made them feel isolated. This study looked (Jonas and Eva-Maria; 2022) at how can having friends at work affects the mental health during early days of outbreak. It founds talking to coworkers can help people to feel better. But because of outbreak, many cannot talk to coworkers like before. So people who got support from coworkers and management they felt better mentally. We made a tool to help people connect with others. Organisation could do things like online team activities or regular calls to help remote employees to feel connected. This study shows that talking to each other in organisation helps people feel better during tough times like outbreak (Nicholas et al.; 2021). So, organisation can help remote workers to make friends and support employees affected by outbreak. Next, we will learn more about experiments that identify and effectiveness methods of work from home.

The researchers found that hybrid model of working from home and office can make workers better at their jobs and help them with balance work and life (Danijela; 2022). Some workers may did remote work for two days and went to office for three and vice versa. This made them work better, feel happy and not to stressed about traveling. The key was giving workers to choose when and where to work. People who had more controls over this were happier and less stress. This is idea for our research too. The study shows that allowing employees have hybrid of office and remote work can make them to work better and feel better. But we need to careful about how much freedom they can have. We need to know more about how this affects teamwork and if it good for the company in the long run. Next, we will study how employee can engage with organisation brand, their values and connection between them.

2.3 Exploring connection between organisation brand, values and employee engagement

In this research identifies that what you value affect how you act and decide both at personal and professional (Jaya et al.; 2019). This study looks at how your values impact how good you work. People who shared their personal values with the company happier are happier and do better at work. The study found that qualities such as personality and thinking abilities can predict how well you do. People use these qualities to hire,

train, and guide careers:

- See if a person's ways fit the job

- Check if a person's values match those of the job, management, team, or business

Companies that encourage and follows strong values can make employees happier, work better and be more ethical. This study talks about values and how they fit work (Clark and Wyn; 2020), with teams and companies. It says that when your value match your job value, you do well. Next, we learn about the relationship between employees and company.

In this study authors talks about how well person fit with company. This means if their values, personality and goals matches with company. This study looks at how can this fit connects with how happy people are at work (Pei et al.; 2016). In result people feel more happier and work better when they fit good with their company. There are two kinds of fit: one is about skills matching job (Person-Job Fit) and the other is about values matching the company (PO fit). There are two ideas from researchers:

- People who fit well with their company is more likely to do good things at workplace and feel happy. This is like if you help someone they want to help you back when needed (Social Exchange Theory).

- Its important for person to fit good with where they work (Person Environment Fit Hypothesis).

This study checks how remote workers feel close connected with their company. Some things help them to feel close. People (Batia et al.; 2020)who like being with other they try hard to talk and connect with colleague even if they work from home. This make them feel close to company and well connected like their friend. When the company talks to remote worker lot they feel closer. This is because communication helps them feel like they part of group and their company cares about them. if the company helps remote workers connect and talks to them they feel closer and work better. Now we will see how recommendation helps to recommend employees with similar interest.

In this research shows about how important it is to that know what young workers is like when hiring and helping them fit into job (Tatiana; 2018). It looking jobs in entertainment and restaurants. Researchers used surveys and interviews to learn about what job applicants and workers aged 18 to 25 mostly like. In result found that what people like affect how well they do their job when they start new position and learned that people who wants to work with other are good at manager role and money help them settle in. Education and time any company also influence what people like. This study gives advice to organisation to makes the workers happy and stay longer connected. They should treat employees based on what they like. Some need chance to learn and grow in their field while(Sumaia Mohammed and Shahrul; 2019)others like teamwork and company innovation. So research shows that knows what workers like helps managers to choose right employee and keep them happy at workplace. It helps to jobs like a entertainment and restaurants.

2.4 Working process of recommeder system for employee engagement

This study looks at how social recommendation can help to recommend things to people using their friends choices (Rui et al.; 2018). It can work if you are new or dont have

history. For example just like friends suggest things to each other we are using this idea to suggest employees to each other based on what they like and their values. But there are some problems like you might only get suggestions that your friends like not what you really like(Huafeng et al.; 2021). To fix this we will use what you tell us in the survey to suggest things. So, social connections and personal thing can help suggest better things to employees and it can fix some problems with other ways of suggesting that researcher cover in further studies.

This literature study (Abdullah et al.; 2021)suggests a better things to connect people using two ways - what many people do like and what similar people do like. They may look at many of the actions on researches to do this. Find Popular Words: They have made list of words(Kanwal et al.; 2021) that people use lot. They ignored the common words like "and" or "the" These words like labels for chart. Know What People Like: They see the what articles of people look at and make table. pattern followed by each row is person and each column is popular word. They fill the table to show what a each person likes. Find Similar People: They see who is similar person based on what they like. If you like something else they find others who liking the same ting. Then they see what the people likes. In findings (Adam and Susan; 2018)words that many like "google" or "blockchain" researchers look at active people to keep it with simple. They make a table showing what people like mostly. They see whos like you to suggest things and suggested words based on what similar people liked. Authors system that uses popular things with what similar people like. This gives good suggestions making people happy and know the person who likes the similar things.

This research paper discussed about making best suggestions on websites and apps using similar properties (Ji et al.; 2020). it's hard when there not much data or sometimes new things are added. But authors found way to improve this. They look at how user can act and made special formula to find similar users. This helps them to give better suggestions even if there no lot of data available. They also use the user preferences and trust to make suggestions as even more accurately and tested their idea and found better than other usual ways. It solve the problem of not enough data and new innovative things. This method makes websites and apps suggest things that you like even when its tricky.

This research focuses to making recommendation systems (Lai and Yu; 2021) advance with predictions by solving two problems that is not having much data about users and starting with new users. The authors came up with good method that combine the two things special graph that shows how the item are related and math technique that help to guess what users may like. The method is examine to what users have liked in past. based o this follows connections in graph to find similar things that user might also like and suggest it. The method uses user like to create better picture of what they interested in. This helps to understand the user interests more accurately. Using this better picture of user taste and data about new things method makes good guess about whether person may like something or not. The method uses a math trick to guess how much user might like something even if they havent seen that before. based on all this work method recommends a few things that user is likely to a enjoy lot. When tested with dataset of movie preferences this new method given good results suggestions.

3 Methodology

The methodology for connecting employees in hybrid world by using employees a similar interest with recommendation system successfully enhanced employee connections by recommending similar employees interests and collaborate with each other. By collecting and analysing employees data the study is able to achieved the goal of shared interests to personalise connections request as shown in Figure 1. The recommendation system here uses cosine similarity score and correlation matrix to calculate results and enable employee to make meaningful connections and promote collaboration that excel physical boundaries. The project method steps explain below and project continues to evolve ongoing iteration enhancement to recommendation system to ensure that organisation can build employees engagement in hybrid work environment to develop connections and maximising employee engagement and productivity in workplace.
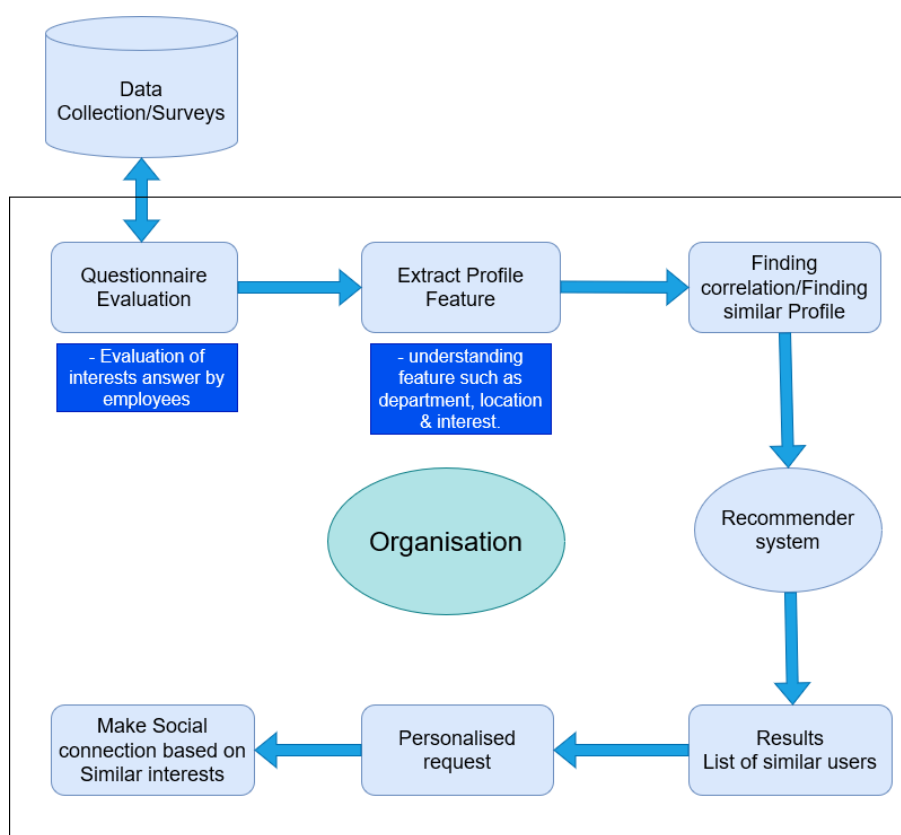

Figure 1: Workflow of recommender system to connect employees

Data Gathering: Collected data from Survey monkey open source public dataset which contains employee surveys data and further questionnaire evaluation perform to create detail questionnaire to understand employees characteristics, hobbies and interests.

Data Analysis and Profile Extraction: Organise the surveys and questionnaire responses in format that needed for analysis and cleaning inconsistencies data and preparing data for further analysis name of employee not there in data so added employee name like HW01, HW02 so on. Format followed for this research is looked at data points to create a good employee profiles, demographic information, communication preferences and personal interests.

Correlation and Similarity Analysis: Analyse carefully extracted profile to identify

correlations between employees based on shared interests by them. then calculated the similarity score by cosine similarity to quantify of similarities between employee profiles.

Recommender System : Develop advanced algorithms that helps the calculated similarity score to recommend connection to employees with similar profile interests. Used cosine similarity approach to calculate similarity between employee profiles.

Connection Suggestion and Initiation: So profiles suggested of employees who share significant similarities or interests by recommender system to extracted to sheets then added to tableau for proper visualisations for intuitive interface that presents the connection suggestions to employees and allowing them to view connections easily so employees can have a better view to see and make a personalised connection request.

Organisation can do online forums or groups where employees interact with similar interests can discuss topics, share experiences and collaborate with each other. Organize virtual events, workshops and activities that align with the employees interests to increase productivity providing the opportunities for interaction.

Organisation can regularly take feedbacks from employees regarding their experiences with connection process and the effectiveness of the suggestions to improve system more. Withing the dashboard organisation can track engagement levels, communication frequency and active participation of employees in shared interest groups indicators for successful employee connections. Also to monitor overall productivity, collaboration and employee satisfaction to impact of improved connectivity on organisation. Further in future more advancements can be implement like notification system to inform users about the incoming connection requests and all the updates in their network or by organisation.
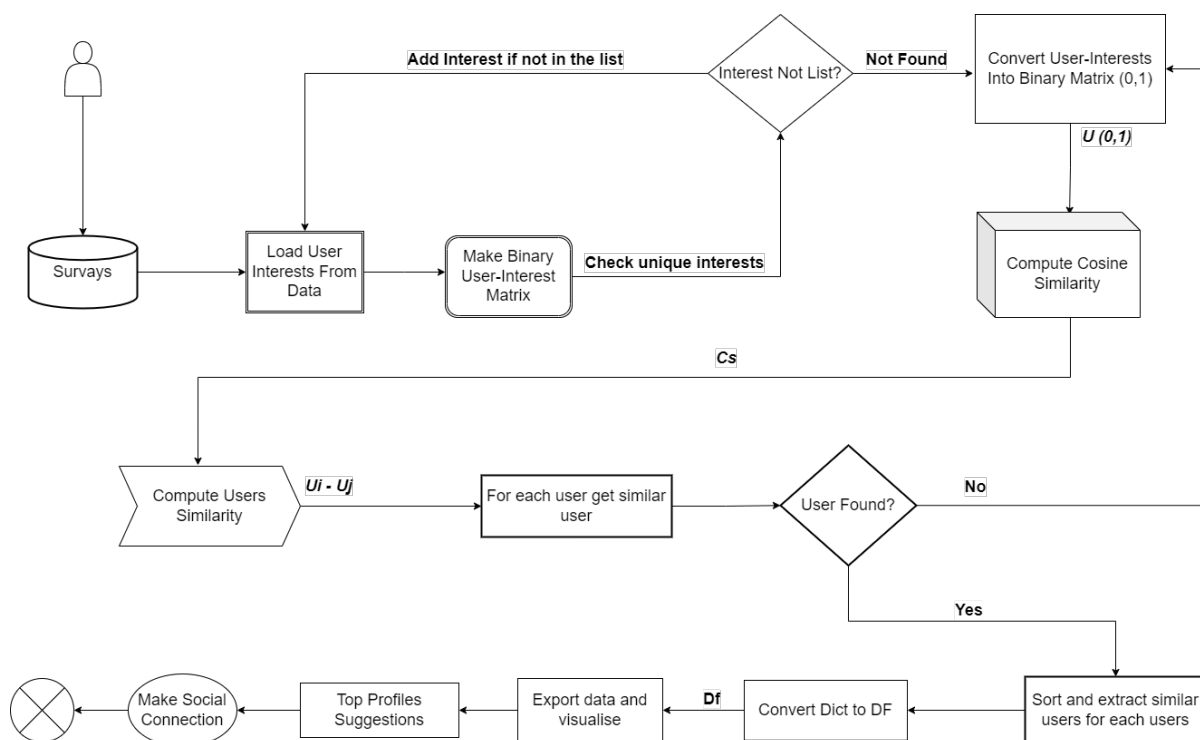
4   Design Specification

Figure 2: Framework method to connect employees based on shared interests

In this section, we explain framework that use to implementation for connecting employees in hybrid world and recommendation system based on shared interests by employees. We detail essential components and technologies used to create effective solution. The recommender system main component in enhancing employee connectivity within hybrid work environment. It uses advance algorithm to analyse employee profiles and identify similarities to suggest connections. The design of recommender system involves multiple component to make accurate, relevant and meaningful connection suggestion.

Once we cleaned dataset in appropriate format that structured into employee interest matrix where each row represents employee and each column represents unique interest as we can see in framework Figure 2. with binary values (1 or 0) indicates the presence or absence of interest. Identify key feature from employees profiles contribute to the meaningful connection shared interests. then preform normalisation on feature vectors to make sure that difference in the scale do not make problem to similarity calculations. Then apply cosine similarity Cs algorithm for measuring the similarity between employee
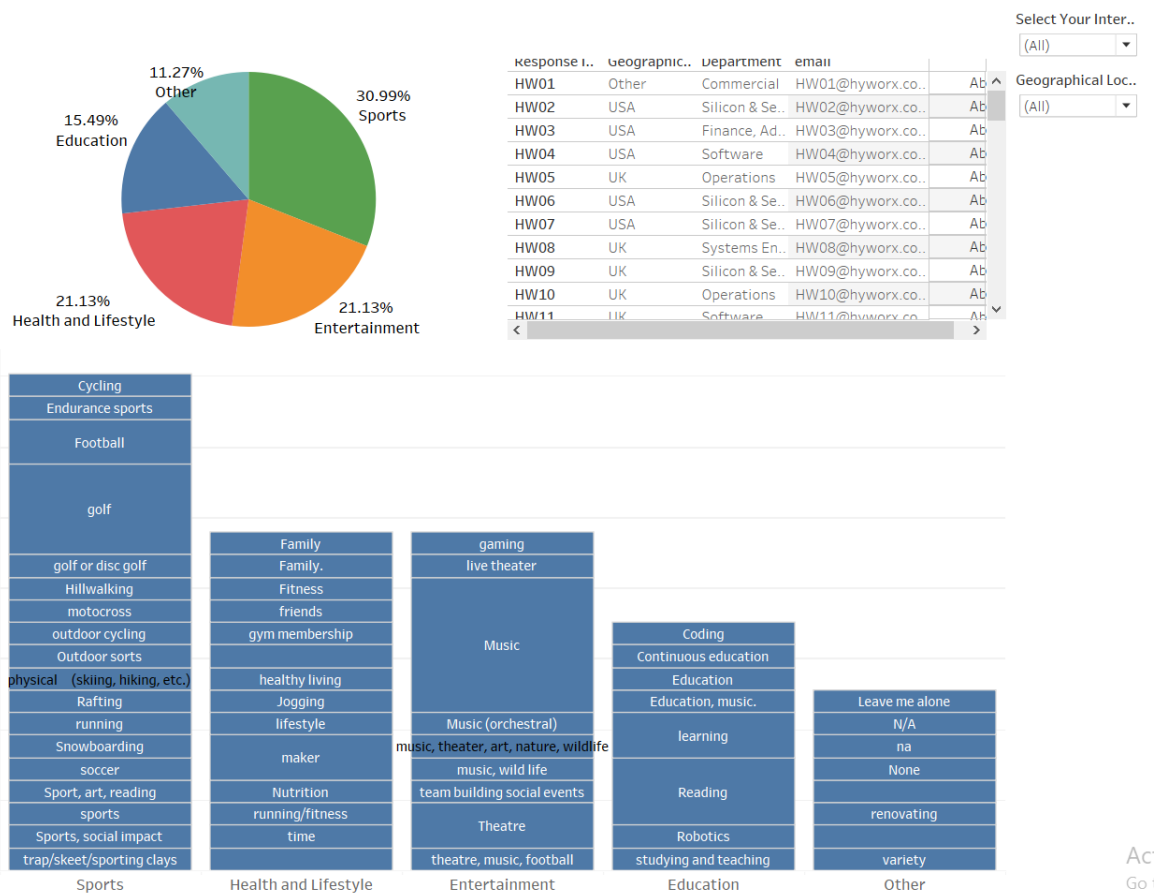

Figure 3: Dashboard for organisation to filter employees within organsiation

profiles. This algorithm help to calculate cosine of angle between two vectors V shows the profiles and provides a similarity score indicating their similarity. So similarity score was computed Cs for the each pair of employee profiles using a employee interest matrix. This metrics quantifies degree of the similarity between profile based shared interest. To check relationships between the different interest categories correlation matrix was derive from employee interest matrix U[i]. Positive and negative associations are identified among various interest.

To calculate cosine similarity we build user interest matrix (U) where rows represents users and columns represents unique interest. Each element of U[i, j] is 1 if user i has interest j else 0. cosine similarity is users i, j is then given with formula:

$$\mathrm{cossin}(U[i], U[j]) = \frac{U[i] * U[j]}{\|U[i]\| * \|U[j]\|}$$

where:
- $U[i]$ and $U[j]$ are binary vectors representing interest of user i and j.
- * shows relation of two vectors.
- $\|U[i]\|$ and $\|U[j]\|$ represents Euclidean norm of the vectors $U[i]$ and $U[j]$. [1] [2]

Represent employees profile high dimensional vectors with each dimensions corresponding to selected feature. Define threshold similarity score above where employees can consider connection. This threshold can be adjust base on the organisational setting and expected level of similarities and select employees with highest similarity scores connection suggestion for each user.

Employee can see personalise connection recommendation that presented to employees through user interface. Recommended connections are highlighted to make visually appear on shared interests. Visual representation Figure ?? of correlation matrix were generates showcase interplay between different interests category and help in identifying cluster of related interest. With the help of dashboard organisation can track the per-

Figure 4: Metrics for organisation to asses performance of engagement

formance metrics and user engagements as shown in Figure 4. How employees are actively participating in the engagement process with each other. organisation can introduce element of a suggesting connections with slightly lower similarities score to encourage the employee to connect with the individuals from a different departments. Next combine collaborative filtering with based on employee interactions with content based filtering based on the profile attribute to provide balanced mix of connection suggestion.

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[1] https://en.wikipedia.org/wiki/Cosine_similarity

[2] https://www.sciencedirect.com/topics/computer-science/cosine-similarity

Employees are able to provide a feedback on the connection suggestion indicates whether suggestion are relevant and valuable or not this incorporate user feedback into recommendation algorithm to improve accuracy and relevance of future suggestions.

In this research ensure that employee profile information is anonymised and secure with access limited to authorised personnel and authorisation handle by organisation. Provide clear explanation to user informed consent about how recommender system works and how their data is being used to generate suggestions. So by carefully designing and implementing recommender system employee connectivity enhancement platform could provide employees with valuable and good connection suggestions, collaboration, engagement in hybrid work environment.

5   Implementation

The process start by collecting users data from an Excel file which is collected by surveys for this research we are using open source dataset from survey monkey. The dataset has all information of users and survey answers such to know employees interests. Before we proceeding with analysis part data preprocessing is perform on data to ensure data quality and consistency. so we perform removing unnecessary columns from the sheet removing duplicates null values taking into format that recommeder algorithm can apply. so we need only user and their interests for analysis and further import this file for analysis.

A key step in methodology is construction of user interest matrix U. The user interest matrix is fundamental representation of relationships between employees and their interests. It is binary matrix containing values [0,1] here every row shows to employees and every column shows unique interest. matrix element are allocated binary values of 1 or 0 indicating to check the user has particular interest or not respectively if has interest = 1 else then = 0. This compact of the representation allows a efficient computation of user to user similarity and recommendations.

To calculate a similarity from users with their interests which provided by employees this uses cosine similarity algorithm. Cosine similarity Cs is a used metric in recommendation systems to calculate co sine of angle from two vectors V1, V2. the user vector V is represent their interest in user interest matrix and cosine similarity vU(i) from -1 to 1 with higher value indicates higher similarity Ui - Uj between users. The diagonal elements of similarity matrix are set to 0 to avoid self similarity so each user is identical to them.

After computing user user similarities matrix this identifies top similar users Ui for each user. The number of the similar users to recommend can be adjust base on application requirement. To obtain this top similar user that sorts the row of user user similarity matrix in the descending order. It then select top similar user indice and retrieve the corresponding user id.

The results is stored in dictionary recommended users = dictionary where each user is associated with list of similar users basis for personalised recommendations. To make recommendations easily and accessible to users present to tabular format using a Data-Frame. The DF contains user Ids is rows and columns for recommended similar user. This tabular representation can allow users to quickly view their suggest connection and explore the collaborations. this exports recommendations to Excel file enabling further analysis integration with other systems.

The methodology uses binary user interest matrix with cosine similarity to identify the

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Algorithm 1 User Similarity and Recommendations
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1. $I/p \leftarrow$ Uid Input: List of user IDs and Interests

2. $df \leftarrow$ users.xlsx User data from excel to dataframe

3. users $\leftarrow$ [] Create list to save user IDs

4. unique_interests $\leftarrow$ [] Create list to save unique interests

5. Set user_interest_matrix [U] = 0 Initialise matrix user interests with zeros

6. **for each** user_id and user_interests in df: taking user id and their corresponding list of interests in df

7. Append *user_id* to users

   end for

   each *interest* in *user_interests*

   If *interest* is not in unique_interests

8. Add *interest* to unique_interests

   end if

9. Set element in user_interest_matrix = 1

   end for

10. Set diagonal elements of the similarity matrix = 0 to avoid self-similarity

11. user_similarity = cosine_similarity Calculate user similarity using cosine similarity and Store results of similarity matrix to user similarity.

12. recommended_users $\leftarrow$ {} Initialize recommended users dictionary

13. num_similar_users $\leftarrow$ 5 Number of similar users to recommend

    for each $(user\_id, user\_index)$ in users

14. Sort user_similarity in descending order to find indices of most similar users

15. Extract top num_similar_users indices as similar_users_indices

16. Convert similar_users_indices to a list of user IDs

17. Store the list as the value for key *user_id* in recommended_users **end for**

18. Convert recommended_users to recommendations_df

19. O/p recommendations_df

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users with similar interests promoting interactions to collaborations within a organisation. The simplicity and the flexibility of make suitable for various applications from social networks to ecommerce multilevel platforms. Future extensions and optimizations such as incorporating user activities and using advanced recommendation algorithms can further be enhance recommendation better accuracy and personalisation. So the methodology offers a valuable insights into a user engagement and satisfaction through personalised recommendations.

6   Evaluation

In this section, we will discuss evaluation results correlation matrix, cosine similarity scores and their significance in user recommendations.

So here is results of dataset of users and their respective interests as we needed for analysis. User name not given in dataset so it will consider as HW01, HW02 in Figure 5 and so on and interests are combine together to understand the similarity and apply algorithm.

	User	Interests
0	HW01	Purpose, Authenticity, Curiosity, Results-orie...
1	HW02	Credibility, Empathy, Dedication, Dependabilit...
2	HW03	Integrity, Accountability, Respect, Results-or...
3	HW04	Communication, Honesty, Teamwork, Communicatio...
4	HW05	Kindness, Respect, Integrity, Conscientiousnes...

Figure 5: Overview of dataset

1. Correlation Matrix: The correlation matrix represent relationships between pairs of interests in userinterests dataset. For binary data like interests (0 or 1) we use point biserial correlation coefficient to measure the association between two binary variables.

The point biserial correlation is from between -1 and 1 where positive coefficient is indicates positive association and negative correlation showing negative manner and co relation is close to 0 suggests weak association.

	Accomplishment	Accountability	Adaptability	Ambition	Appreciativeness	Assertiveness
HW01	0	1	0	0	0	0
HW02	1	0	0	0	0	0
HW03	1	1	0	0	0	0
HW04	0	0	0	0	0	0
HW05	0	0	1	0	0	0

5 rows × 102 columns

Figure 6: Employee interest matrix

In correlation matrix each element of U(i, j) represents point of correlation coefficient between the interest i and interest j. The diagonal elements of (i, i) are always 1 and correlation between interest and itself is the perfect which shown in Figure 7. The off diagonal elements are U(i, j)andU(j, i) showing correlation between interest i and interest j. Further in the user interest matrix as we can see in Figure 6 the matrix represents with 0,1 where if correlation is there then 1 else the value would be 0.
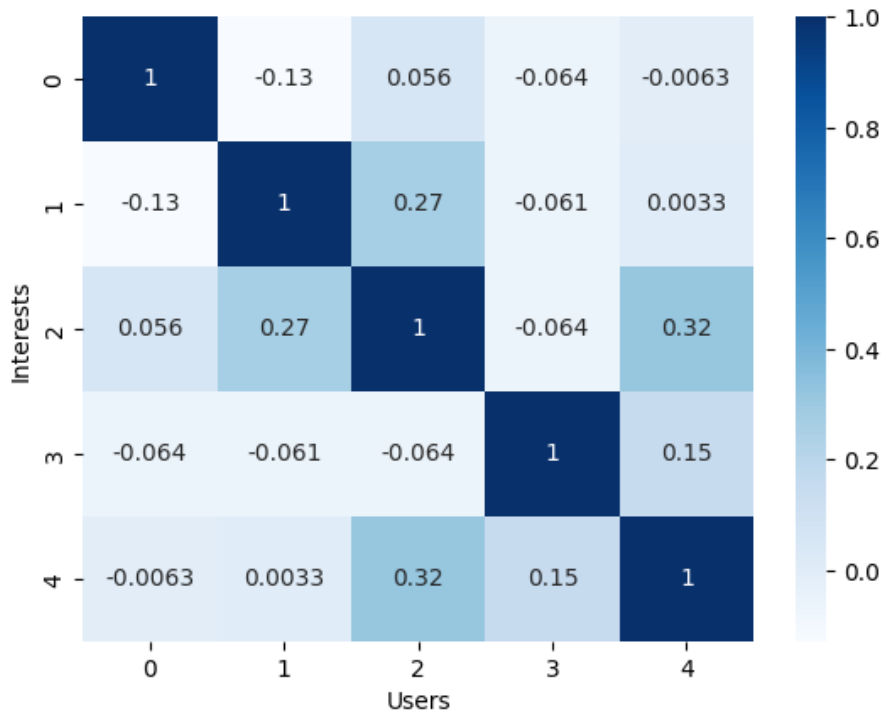

Figure 7: Confusion matrix of correlations

2. Cosine Similarity Scores: Cosine similarity is here used to measured similarities between the user vectors and representing their interests. The cosine similarity is between -1 and 1 is 1 indicate that identical vectors and 0 is indicate the orthogonal vector 0 and -1 indicates the completely opposite vectors in Figure 8. This context of user interests the higher cosine similarity scores between the two users indicates that they have share more common interest. Cosine similarity scores calculates the similarity between users

	HW01	HW02	HW03	HW04	HW05	HW06	HW07	HW08
HW01	0.000000	0.000000	0.166667	0.00000	0.096225	0.000000	0.365148	0.000000
HW02	0.000000	0.000000	0.348155	0.00000	0.100504	0.090909	0.190693	0.000000
HW03	0.166667	0.348155	0.000000	0.00000	0.384900	0.261116	0.273861	0.174078
HW04	0.000000	0.000000	0.000000	0.00000	0.192450	0.174078	0.365148	0.000000
HW05	0.096225	0.100504	0.384900	0.19245	0.000000	0.301511	0.210819	0.201008

Figure 8: Cosine similarity scores

interest vector. Higher score suggests users to share the more common interest potentially forming the user groups.

Users with the high cosine similarity score can be a recommended to the each other interactions that amongst like minded user and encouraging collaboration on the shared interests.

employees with low cosine similarity score represent as connections for users seeking new collaborations or a just profile with no interests. This connections may be lead to increased the engagement and broader network of the employees.
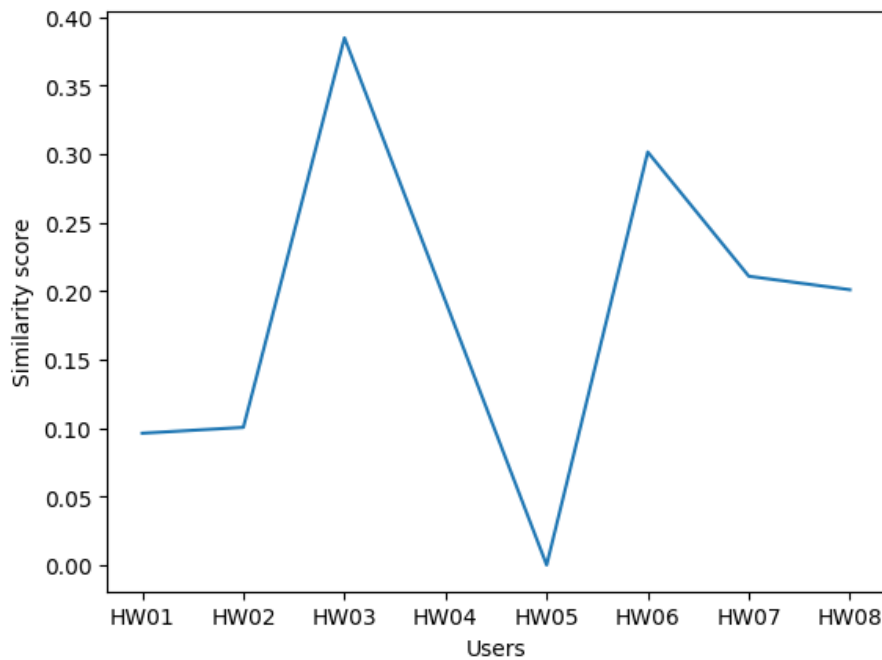

Figure 9: Graphical representation of user similarity score

The graphical representation in the line chart shows that one particular employee from organisation similarity pattern with other employees with similarity score Figure 9. This representation gives clear understanding of the employee similarities with other.

Measuring the Word frequency: Here we are observe frequency popular keyword from interest. so extracted frequency created to individual tags as per the frequencies and

	Word	Frequency
26	Collaboration	57
29	Communication	51
17	Accomplishment	35
7	Accountability	34
31	Teamwork	33

Figure 10: Interests frequencies

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save title into the proper frequencies of locations. Their is total of the frequency files in our Recommended folder. by looking at this we can see the employees that who has with highest interest in Figure 10. This will help to organisation to find the top rated interests by employees then categories and analysis to enhance the engagement of employees within the organisation with this organisation has idea what employees interests in so they can arrange sessions and activities create further collaborations for employees.

6.1 Experiment / Testing similarities between employees

We for effectiveness of platform tested similarity score between two users using cosine similarity to proven method in data analysis.This mathematical method measuring the cosine of angle between their interest vectors. A higher score indicates greater similarity suggesting to shared interests. likewise by comparing their interest we able to quantified their similarity with scores closer to 1 indicating higher similarity. This approach ensured that accurate identification of the shared interests for a effective connection in recommendations. The testing process was validated by the known profile with the dis-
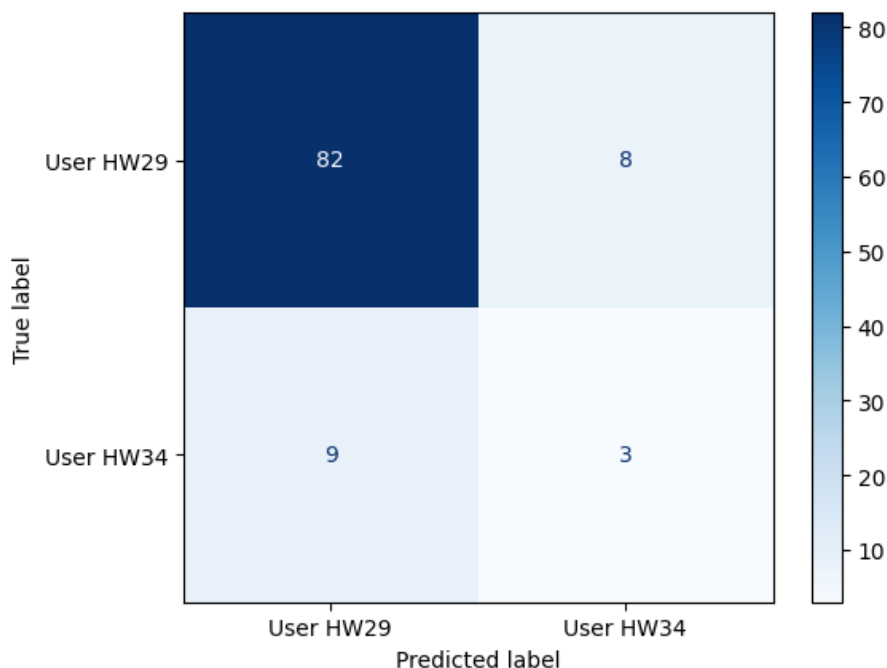

Figure 11: Confusion matrix of testing similarity for 2 users

tinct level of a similarity to making sure accurate results. test cases were perform on two employees we taken HW34 and HW29 for testing so conducted with various interest combinations cross referencing computed scores with expected better outcomes. with the help this we confirmed that reliability and effectiveness of similarity score as we see

```
array([[1.        , 0.26111648],
       [0.26111648, 1.        ]])
```

Figure 12: Testing scores

in Figure 12 for calculation in accurately calculating interests between employee profiles based share interests.

   3. Significance of Results: The correlation matrix and cosine similarity score is in the understanding of user interests and connections with organisation. Now discuss the significance of the each: The correlation matrix in which interest is positively or the negatively associate with each other. Positive correlation are users to who have one interest is likely to have another while a negative is correlations suggest opposite. Positive correlation can be indicates the collaborations content recommendations. For example a employee interested in "Machine Learning subject" means he may also interested in the "Data Science" making it the beneficial to a recommend related users. Negative correlations can be help to identify the interests. For e.g, users interested in the "Investments" that means may be or less likely to interest in "Cryptocurrency" This data can be valuable for the engagement among users with diverse interests.

   4. Recommendations and Personalisation: Based on correlation matrix and cosine similarity scores the algorithm generates personalised recommendation for each user. The recommendation has list of similar users with whom can they share the common interests. These is recommendation is aim to promote the interactions to enhance user engagement and build community within the platform. the results offers insights and profiles to

	Similar User 1	Similar User 2	Similar User 3	Similar User 4	Similar User 5
HW01	HW43	HW63	HW47	HW54	HW64
HW02	HW37	HW82	HW22	HW31	HW55
HW03	HW24	HW39	HW05	HW11	HW36
HW04	HW51	HW32	HW38	HW45	HW53
HW05	HW52	HW21	HW76	HW74	HW03

Figure 13: Overview of recommeded employees

connected with each other into user connections and interests as shown Figure 13. The correlation matrix and cosine similarity score are provided good information on positive and negative associations between interests and the user similarity. Here the HW01,Hw02 are the users and in further rows their recommeded employees. This result are important for generating the personalised recommendations interactions and promoting engagement within organisation and this imported to tableau for visualise results so employees have better view to connect. As continues to advancements that incorporating additional factors, features and advance techniques will enhance its recommendation accuracy and can give a more personalised user experience this in details discuss in the future work section.

6.2   Discussion

The connecting in hybrid work recommendation system fro employees shows the potential to connect the employees in hybrid world through a shared interests. The acceptance rates, engagement metrics, user satisfaction and insights from a correlation matrix is the collectively validate system ability to enhance the employee connections, collaboration and engagement. While the challenges and limitation exist in positive results and the user feedback is underscore significance of a leveraging shared a interests the facilitate meaningful to connections in modern workplace. This system is serves as the stepping

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stone towards the creating cohesive and engaged the workforce in good landscape of hybrid work.

7   Conclusion and Future Work

In this study successfully develop and implement a platform for employees in working in hybrid mode with recommendation system designed to connect the employees in hybrid workplace environment base on shared interests. Through proper data collection, preprocessing, modeling and evaluation we have examined potential of common interests to make meaningful connection and enhance collaboration among employees within the organisation. Throughout this methodology we have highlighted significance of profile analysis and implementation of recommender system. By combining these elements organisations can suggest a connections based on shared interests. The resulting connections overall employee experience is improve collaboration and contribute towards good organisational culture.

The results of our implementation is indicates that is recommendation system has a huge impact on employee engagement and interaction within hybrid mode of work. The increased acceptance rates of connection request to quantify improvement in the engagement metrics and positive user feedback is collectively of our approach. By using connection grounded in the shared interests of our system addresses that challenges may be posed by hybrid work model where the physical boundaries are often limit to traditional opportunities for the interaction. Employees is empowered to make connections that enriching their work experience and stay connected within the organisation.

While our study has good promising outcomes still there few suggestions that can be implemented is integrating recommendation system with learning and development platforms so not only social connections but also knowledge sharing, mentoring and skill building opportunities will gets among employees. Future work can be investigate for cross functional collaboration that recommendation system, inter disciplinary interactions and innovative problem solving solution. Integrate behavioral data to dataset to better understand how the employees can interact within recommended connections and enabling system to refine the suggestion that based on the actual interactions.

Enhance the recommender system by using NLP techniques to analyse the written communication and extract the additional insights about employee interests and expertise. Develop AI powered insight that can be help employees to understand potential benefits of the connecting with specific individuals and value they can bring to each other professional growth. So as we look to future works evolution and refinement of our system hold promise of further employee experiences and contributing to thriving, engaged and inter connected workforce.

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