AI BASED

HYBRID OFFICE ALLOCATION

ADHARSH GURUDEV
Department of Information Technology
Sri Sivasubramaniya Nadar College of Engineering
Tamil Nadu
adharsh2110238@ssn.edu.in

ADITI RAJESH
Department of Information Technology
Sri Sivasubramaniya Nadar College of Engineering
Tamil Nadu
aditi2110159@ssn.edu.in

AHAMED JUMAIL M
Department of Information Technology
Sri Sivasubramaniya Nadar College of Engineering
Tamil Nadu
ahamedjumail2110102@ssn.edu.in

Dr. N. Radha
Department of Information Technology
Sri Sivasubramaniya Nadar College of Engineering
Tamil Nadu

Dr. A. Shahina
Department of Information Technology
Sri Sivasubramaniya Nadar College of Engineering
Tamil Nadu

Dr. R. Swathika
Department of Information Technology
Sri Sivasubramaniya Nadar College of Engineering
Tamil Nadu

Abstract— The hybrid workplace is a concept on the lips of every industry trend in the world today. The three main features of this system: First, all the employees of an organization work as teams particularly in IT industries. The office days – employees should go to office for work rather than working from home are allotted. Office days for all the teams of the company are allotted in such a way that all the employees have equal number of working days. It is done using a strategy of Random Selection. Second, is to allot offices to the teams keeping in mind the efficient use of the workspaces of the offices. After random selection of the teams for each working day, the total number of workers allotted with office day on the particular day is calculated. To efficiently use the workspaces of the offices, we ensure that there are no workspaces exploited for the welfare of the office. This is done using the AI strategy called as Genetic Algorithm. Third, all the employees of a particular team should be allotted with same office team is allotted with an office which is nearer to the residence of all the employees of a team. This is done using the strategy of Heuristic Search integrated with Haversines Formula for calculating the distances between the offices and the employees. The system is tested with dynamic inputs to ensure if the algorithm behind that works properly when there is a more than one choice of office to be allotted and also to ensure if all the teams have equal number of office days in a week and also to ensure if with the login of employees and fetching of the distances from the database. The efficiency of the algorithm is higher than the Harvard's efficiency for this problem which is 65%. The highest efficiency that algorithm attained is 98% and the lowest is 65%.

Keywords—Artificial Intelligence, Genetic Algorithm, Hybrid Office Allocation, Heuristic Search

I. INTRODUCTION

The word 'Hybrid' is not a novel one. It has seen diverse use over the years in different representations. In more recent times, hybrid is used to describe a whole new feature of technology's infusion into human beings' lifestyles. Granted, we are familiar with the way of life of where we are from [1]. Culture directly affects us because people make them. When a child is born, the person is introduced to a way of life, and The word 'Hybrid' is not a novel one. It has seen diverse use over the years in different representations [2]. In more recent times, hybrid is used to describe a whole new feature of technology's infusion into human beings' lifestyles [3].

In a survey conducted by Fastighetsvärlden in September 2020, 29 of the Stockholm area's largest office tenants were asked about how they reason regarding their long-term needs for real estate [4]. A common stance regarding telework is that it has worked surprisingly well during the pandemic and that the probability of the organizations to revert to the previous office-centric type of work is low [5]. Instead, the need for more meeting- and collaboration solutions and fewer desks is a probable development [6].

According to new research, almost half of Australian and New Zealand workers are probable to quit their current position if they are not offered adequate flexibility in a post pandemic environment [7].

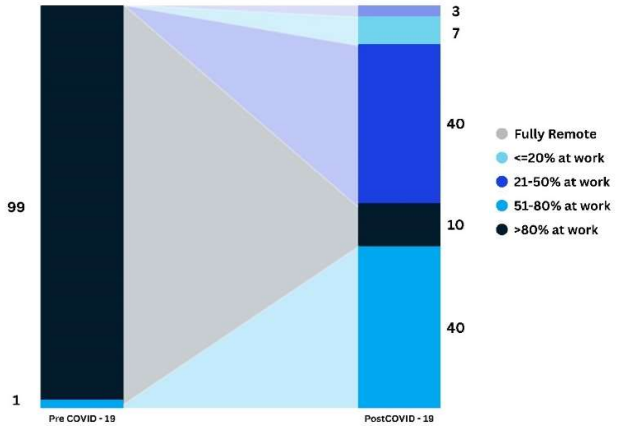

Figure 1 - Hybrid Working before and after COVID - 19

In Figure – 1, some 47% of employees surveyed stated they would probably resign rather than return to a rigid schedule [8]. Provided a choice between flexibility of hours and location, 52 percent favoured flexibility with when they work, compared with 40 percent who preferred it for where they work [9]. In a survey conducted by PWC (2021) exhibit that employees with the least amount of professional experience (0-5 years) are more probable to want to spend more time at the office [10].

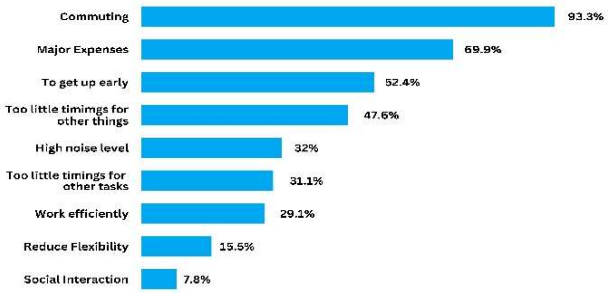

Figure 2 – Reason for the difficulty to go to Office for work.

The Figure – 2, shows the difficulties in going to offices for work. The most common difficulty is commuting – travelling more distances which is 65%. The major three difficulties can be overcome by smart office allocation using the AI strategy – Genetic Algorithm.

The optimization of hybrid office allocation using artificial intelligence (AI) presents a multifaceted challenge influenced by factors such as varied work preferences, spatial constraints, and the need for efficient collaboration [11]. In addressing this complexity, hybrid office allocation leverages advanced technologies, with a focus on integrating AI, to create adaptive and optimal work environments [12]. AI techniques emerge as promising tools for this task, allowing for the seamless integration of individual work habits, team dynamics, and spatial considerations [13]. By incorporating domain-specific knowledge such as work patterns, collaboration requirements, and employee preferences, the hybrid office allocation system goes beyond conventional approaches [14]. This integration aims to enhance the overall effectiveness of office space utilization, acknowledging that the dynamics of a modern workplace extend beyond physical layouts. may play a crucial role in shaping the future of office spaces [15].

II. PROPOSED WORK

With digitalization becoming more normalized across every sphere in the global village. Every workplace needs to maximize and transcend obstacles and innovations to ease into the hybrid workplace. Beyond that, there is also the lesson of flexibility and adaptability in the workplace. So, to ensure it there is the need to embrace the hybrid workplace model. Artificial Intelligence can give a make a way to automize this practice for example, genetic algorithm. To prioritize it: First, all teams are allotted with three working days to be present in the office. Second, office workspace efficiency is considered on the basis of number of employees who are allotted office on a particular day. Third, out of all the available offices which is nearer to all the employees who are there to come to office on a particular day will be allotted. Thus, the most efficient office can be allotted all the day.

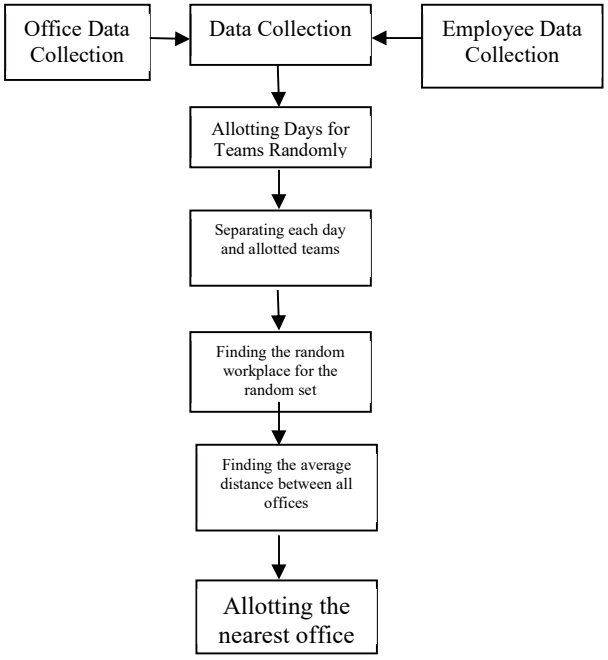

Figure 3 – Workflow of the Office Allotment.

Figure – 3 depicts the step-by-step flow to develop a system which will preform an efficient office allocation with an efficiency more than the Harvard's efficiency – 65%.

A. Data

The data is collected and stored in the databases. The basic fields that are required for the algorithm are specified in the schemas below.

OFFICE:

```
COMPANY_ID
COMPANY_NAME
BRANCHES {
        OFFICE_ID
        OFFICE_NAME
        LATITUDE
        LONGITUDE
        ADDRESS
}
```

EMPLOYEE:

```
COMPANY_ID
EMPLOYEE_ID
EMPLOYEE_NAME
EMAIL_ID
PASSWORD
LATITUDE
LONGITUDE
TEAM {
        TEAM_ID
        TEAM_NAME
}
```

Figure 4 – Structure of the Office and Employee databases.

Figure – 4 shows that, the credentials of each employee is stored in the employee database and the latitude and longitude of the location of the offices and the residence of the employees which are stored is used in haversine's formula to calculate the distance between the employees and all the offices and these distances are again stored and used in allotting offices.

B. Office day Allottment

To infuse flexibility into the hybrid work model by randomly assigning three office days for each team, acknowledging diverse preferences and schedules. Implement a fair randomization process to ensure equitable distribution of office days among team members.

C. *Separation of teams*

After all the teams are allotted with office days, the teams are split into a set of teams on the basis of the allotted office days. This is done find the total number of employees who are allotted with office day on a particular day in a week.

D. *Selection of workplace*

A workplace is selected among the all-available workspaces in such a way that the selected workspace is able to accommodate all the employees with office day. Calculate the average distance between team members' residences and each office, aiming to identify the most convenient workplace for a specific day. Utilize dynamic allocation by assigning teams to the office with the lowest average distance, optimizing daily operations for proximity and efficiency.

E. *Allot the Office*

Employ a genetic algorithm to optimize the assignment of employees to offices for a given day, accounting for team collaboration dynamics and individual work preferences. Iteratively refine the assignment strategy through multiple generations, aiming for solutions that maximize overall workplace efficiency.

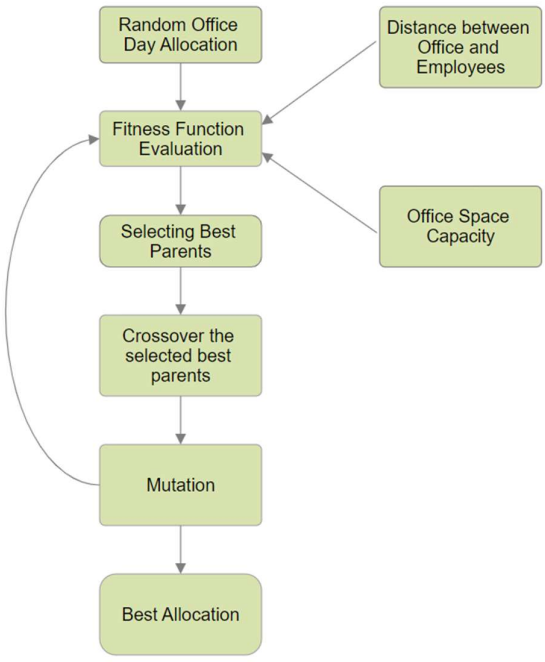

Figure 5 – Working of Genetic Algorithm

The Figure 5 shows the flow diagram of the working of the Genetic Algorithm by which the most efficient office allocation is been made.

The fitness function of the genetic algorithm is given as:

$F(s) = F[\text{workload}(s)] + F[\text{capacity}(s)] + F[\text{distance}(s)]$

$F(s) = \sum_{i=1to5} (W_{i\_}\text{week\_total})^2 + \sum_{i=1to5} \max(0, \sum_{\text{team k in allocation}[i]} T_k)^2 + (0.1 \times \text{Total Distance})$

W_i – Workload on day i

T_k – Capacity of Team k

This includes the fitness of the workload and the fitness of the capacity and the fitness of the distance travelled by the employees on a day i.

The crossover is done by selecting best parents on the basis of the fitness function as chromosomes and fixing the crossover point continued by reproduction which produces the offspring which is the efficient allocation. Many generations are been generated to get the more efficient allocation.

$$C_1[i] = \begin{cases} P[i], & i < \text{crossover\_point} \\ Q[i], & \text{otherwise} \end{cases}$$

The crossover is continued by mutation at a probability of 0.1. The random permutation of the P[i] is the mutation.

III. RESULTS AND EXPERIMENTS

OUTPUT:

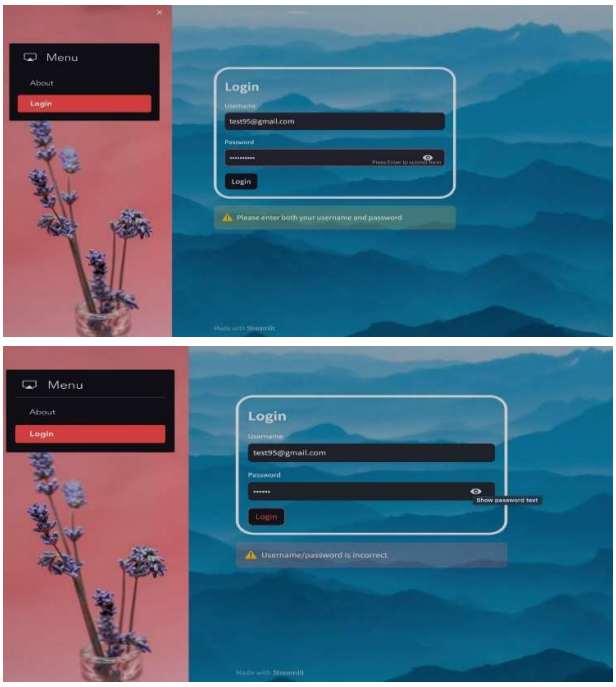

Figure 6 – Login page and Authentication result.

The Figure 6 shows the login page and the authentication result as incorrect username or password.

The Figure 7 is the home page of the application that contains some motivation and survey that shows the need of efficient office allocation.

Figure 7 – Home Page.

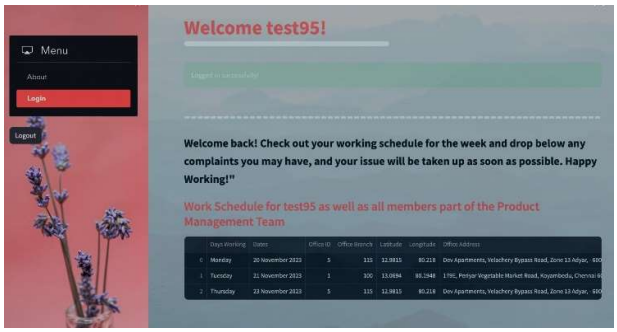

Figure 8 – Office Allocation

The Figure 8 shows the efficient office allocation which is the result of the Genetic Algorithm. It shows the office days, and date and the office location an employee.

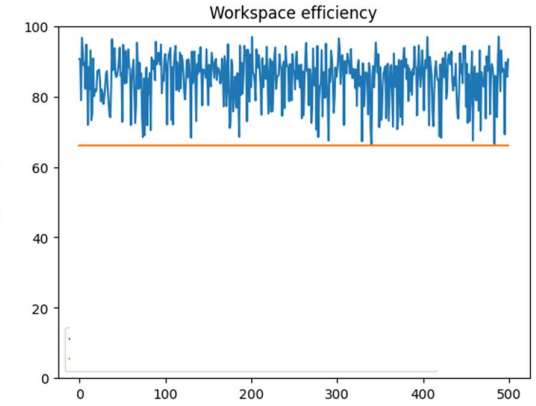

Figure 9 – Efficiency of genetic algorithm for 500 test cases

The Figure 9 shows the workspace efficiency of 500 test cases when genetic algorithm is used to allot offices in which all the allocation has the efficiency above 65% where 65% is the benchmark efficiency (yellow line).

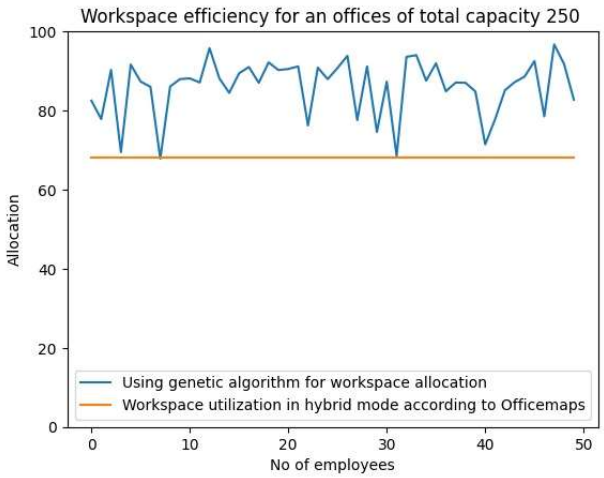

Figure 10 – Efficiency of genetic algorithm for 250 test cases

The Figure 9 shows the workspace efficiency of 500 test cases when genetic algorithm is used to allot offices in which all the allocation has the efficiency above 65% where 65% is the benchmark efficiency (yellow line).

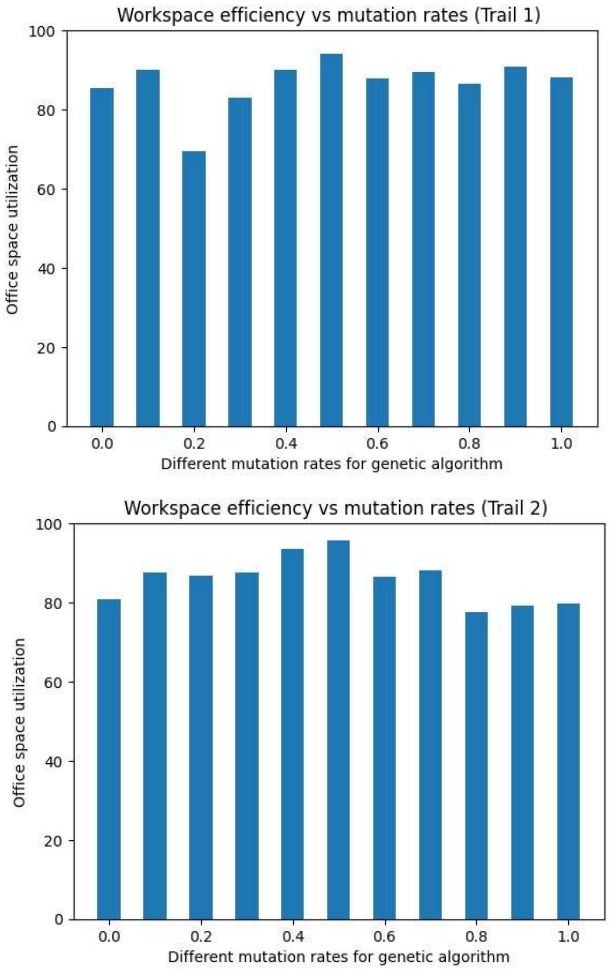

Figure 11 –Office space utilization for different mutation rates

The Figure 11 gives conclusive evidence that for a initial population of 100 and number of generations of 50, the mutation rate does not affect the efficiency.

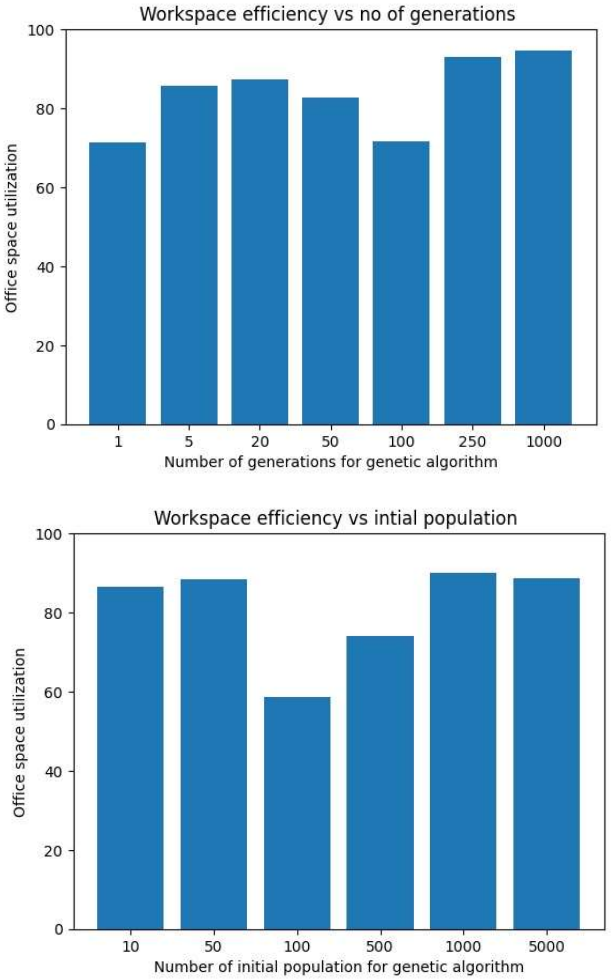

Figure 12 –Office space utilization for different initial population.

The Figure 12 shows that as number of generations increases up to 100 there is no noticeable change, but after that as num of generations increases the office space utilization ratio increases.

IV. CONCLUSION

For any work environment whose stakeholders intend to transcend the expectation of the constantly evolving workplace, the future of work should be a priority. Although some countries have relaxed the lockdown in their states, businesses are taking their time to set up a more formidable work arrangement. Many are already operating the hybrid system while others are running fully remote. The pandemic has taught the workplace a lesson of preparation and planning and given the reality check to keep up with the technological and management related advancements to ensure productivity and growth. Beyond that is also the lesson of flexibility and adaptability in the workplace. In prioritizing the future of work, there is the need to embrace the hybrid workplace model. Indeed, the future of work would likely be the hybrid workplace model.

The research endeavours to redefine the landscape of workplace management by embracing the hybrid model and leveraging Artificial Intelligence strategies. In essence, research represents a significant step toward an efficient, fair, and employee-centric hybrid workplace allotment technique. The successful development and implementation of the system underscore its potential to revolutionize how organizations manage their workforce in the evolving landscape of work which provides an efficiency more than 65% in all cases.

VII. FUTURE SCOPE

Explore the integration of predictive analytics to anticipate future workforce trends, enabling proactive adjustments to office allocations based on evolving needs. Implement machine learning algorithms to dynamically adjust office allocations based on historical data, employee preferences, and emerging work patterns. Integrate Internet of Things (IoT) devices within office spaces to capture real-time data on workspace utilization, enhancing decision-making for future allocations. Develop feedback mechanisms to gather employee insights on the hybrid work model, allowing for continuous improvements and adaptability to changing preferences. Explore advanced spatial optimization algorithms to enhance the overall layout of office spaces, considering factors such as team dynamics, collaboration zones, and individual workstations. Extend the project's scope to incorporate sustainability considerations, optimizing office allocations to reduce carbon footprints and improve energy efficiency. Collaborate with smart building technologies to create intelligent offices that automatically adapt to changing workforce dynamics, creating a seamless and responsive environment.

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