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REVIEW OF PERSONNEL SCHEDULE IN TERM OF WORK-LIFE BALANCE

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Keywords

Work-life balance, Shift planning, Personnel scheduling, Algorithm.

Abstract

Work-life balance (WLB) can be defined as the ability of employees to fulfill their family and work responsibilities smoothly. Accordingly, WLB can be achieved by creating an environment that the individual can determine to keep the conflict between the tasks undertaken by individuals in their work and non-work lives to a minimum. In a study, it was found that 30% of the employees were not satisfied with their job due to long working hours, 21% due to high workload and 16% due to work-related stress. It was observed that 11% of the employees could not devote enough time to their social life (family) and therefore had difficulty in establishing the work-life balance. It is necessary to develop the most appropriate solutions with shift planning for the work success and social life of the employees. For this reason, the software developed was developed in accordance with the WLB of the employees, and programming algorithms were applied in the software with different methods.

In this study, the ACO and the PSO literature research were conducted for scheduling problems suitable for the WLB of hospital staff. Scheduling flows were created with the software developed by considering the parameters required for the algorithms.

İŞ-YAŞAM DENGESI AÇISINDAN PERSONEL ÇIZELGELEMENIN İNCELENMESI

Anahtar Kelimeler

İş Yaşam Dengesi, Vardiya Planlama, Personel Çizelgeleme, Algoritma,

Öz

İş-yaşam dengesi (Work Life Balance), çalışanların aile ve iş sorumluluklarını sorunsuz bir şekilde yerine getirme becerisi olarak tanımlanabilir. Buna göre, bireylerin iş ve iş dışı yaşamlarında üstlendikleri görevler arasındaki çatışmayı minimumda tutabilmek için bireyin belirleyebileceği bir ortam oluşturularak iş-yaşam dengesi (WLB) sağlanabilir. Yapılan bir araştırmada, çalışanların% 30'unun uzun çalışma saatleri,% 21'inin yüksek iş yükü ve% 16'sının işle ilgili stres nedeniyle işlerinden memnun olmadığı tespit edilmiştir. Çalışanların % 11'inin sosyal yaşantısına (ailesine) yeterince zaman ayıramadığı ve bu nedenle iş-yaşam dengesini kurmakta zorlandığı görülmüştür. Çalışanların iş başarısı ve sosyal yaşamlarındaki denge için vardiya planlaması ile en uygun çözümlerin geliştirilmesi gereklidir. Bu nedenle geliştirilen yazılım çalışanların iş-yaşam dengesine uygun olarak geliştirilmiş ve yazılımda farklı yöntemlerle programlama algoritmaları uygulanmıştır.

Bu çalışmada, karınca kolonisi algoritması (ACO) ve parçacık sürüsü algoritması (PSO) literatür araştırması, hastane çalışanlarının iş-yaşam dengesine (WLB) uygun çizelgeleme problemleri için yapılmıştır. Algoritmalar için gerekli parametreler dikkate alınarak geliştirilen yazılım ile çizelgeleme akışları çıkarılmıştır.

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1. Introduction

Since the health sector is working on human health and its results have great effects on human life in a very short time, health sector employees are expected to work with a lot of self-sacrifice, constancy, and responsibility comparative to all other. In this case, employees must continue their lives business- oriented. Their success in their work depends on their social life, sleep patterns, family relationships, etc. It is directly proportional to personal situations such as non-business life. Employees' work-life balance positively affects their success at work (patient satisfaction, shift efforts, etc.).

Work-life balance, in its shortest definition, is a situation where a person's demands regarding his job and his personal life demands are in balance. (Lockwood, 2003) Considering that employees work in hospitals that need to serve 24/7 by their sectors, the working conditions of the employees, designed break areas in hospitals, equipment used, etc. Besides the subjects, it is seen that their basic demands on work are working hours.

The most important issue for hospital management is that the number and quality of personnel are on duty to meet the needs of the hospital. It is seen that this situation requires employees to live a life according to the working hours deemed appropriate by the management and accept the results in order to balance their work and non-work lives.

The question that the study tries to find a solution and a model is developed as a result is how it will be possible for the hospital staff, whose working hours are determined according to the requests of the management, to establish a work-life balance. In the process of seeking a solution to this question, previous studies were examined, the surveys were evaluated, and hospital staff who continue their working life with this problem were interviewed.

As a result of the studies, it was found that adhering to the hospital management in determining the working hours of the hospital staff created a dissatisfaction among the employees, and psychological negative effects were experienced in long shifts due to the ongoing shift planning according to standard patterns.

Work-life balance (WLB) is defined as the balance between business contacts and activities outside of work. Work-life balance is a complex system of different factors and the optimization of WLB cannot simply be regulated. The sectors are affected by the presence or absence of WLB initiatives. Various factors within organizations increased imbalances, and sociological factors and technology were effective in this case. However, as technology is a factor in increasing imbalance, it also offers a new solution to this organizational performance management problem. A general solution can be developed that improves the work-life balance of employees and meets the business requirements. A Business Life Optimization model (WLO) that integrates information systems, analytics and decision-making into a System is proposed. For this model, a general framework is described detailing assessment, sociological issues, and data collection. Results include improved WLB, higher quality of life, and increased organizational performance.

It has been observed that employees' need for flexibility in shifts and meeting the demands of the management with different configurations will satisfy the management in terms of both patient satisfaction and personnel satisfaction. In the previous study by Emek (Emek, 2016), it confirms the findings obtained from the software prepared using genetic algorithm, in this study, it is a software for collecting shift demands of employees in configurations developed according to the demands of the management and shift planning with the ant colony algorithm and particle swarm algorithm. The process that was achieved with was transferred to automation.

2. Literature Review

In this study, shift planning was automated to establish work life balance. Thanks to the different algorithms used, benefit-cost analysis was made with the solutions offered, and reports were created for management by evaluating them from different perspectives in the researches of Hoeven and Zoonen (2015), with the developing world conditions, the changing working conditions and the adaptability of the flexible working system to workplaces and

processes have increased. It is observed that as the shift hours increase, the employees cannot show 100% the performance expected from them. In addition, their inability to spend enough quality time with their families and friends due to unsuitable working conditions negatively affects their commitment to work. In all these respects, it has been concluded that flexible working hours design for employees is very important in terms of work-life balance.
Greenhaus and Beutell (1985) and Greenhaus et al. (1989) examined the causes of conflict between family and work,Goodstein (1994) and Ingram and Simons (1995) presented an institutional perspective on organizations 'responses to work-family issues. In addition, Campbell, Campbell and Kennard (1994) have examined the effects of family responsibilities on work commitment and job performance of women. The work-family issue is even further expanded to address the relationship of business partners (Foley, and Powell, 1997).

Brucker et al. (2010) obtained solutions from different angles by addressing the problem of workforce and shift scheduling for nurses in terms of scheduling, sequencing, and task distribution.

Attended three hundred ninety-four anesthesiologists (280 specialists, 114 anesthesiology trainees). Anaesthesiologists reported that they worked frequently under time pressure (95% Cl: 65.6 74.6), high working rate (95% CI: 57.6-67.1), delayed or canceled intervals (95% CI: 54.5-64.1) and frequent overtime. . 95% CI: 42.6-52.4). (Wolfgang Lederer, Peter Paal, Daniel von Langen, Alice Sanwald, Christian Traweger, Johann F. Kinzl, 2018)

In this study, using the ant colony algorithm and particle swarm algorithm in the software developed in C# programming language that aims to determine shift demands and planning from the management, for the time periods, they want to work, and to make shift planning with the developed software. In this way, employees' expectations for flexible working hours will be learned and employees will be able to work overtime whenever they demand in line with management demands. From the algorithms used in this software.

Ant Colony Optimization (ACO) is used to develop meta-heuristic algorithms for complex and multivariate systems.

The first algorithm capable of performing such a classification was presented in 1991 and since then many varieties of the basic principle have been reported in the literature.

Particle swarm optimization was first introduced in 1995 by Dr Kennedy and Eberhart. It is an intuitive optimization method introduced by Kennedy and Eberhart. Particle Swarm Optimization (PSO) includes swarm behavior and even human social behavior seen in flocks, flocks or bee swarms.

3. Method

3.1 Ant Colony Optimization Algorithm

The meta-heuristic algorithm is the starting point of nature. ACO, which is one of the methods by examining systems that have developed solutions in nature, differs significantly from other meta-heuristic methods. ACO also shows according to the situations encountered, and although it starts with the basic salmon liquid monitoring, a special solution is produced for the situations encountered.

Natural scientists, during the examination of the life cycle of ants while carrying food to the nest in all different situations every time they determined that they find the shortest route and transfer it to the entire colony. When the reason for this situation was investigated, it was seen that the ants found the shortest path and the reason the whole colony used this path was the pheromone fluid. During their movements, ants leave pheromone fluid on the path they pass. The ants reaching the food through different ways with the pheromone fluid whose effect decreases over time, detect the shortest path and enable the entire colony to use this short path, due to the more intense pheromone found on that path.

As a result of this situation, the pheromone decreases and disappears over time on the long and dysfunctional road, while the pheromone is more intense in the effective way in terms of transportation and energy use.

3.1.1 Ant Colony Optimization Algorithm Historical Development

Inspired by the behavior of ants, Marco Dorigo introduced the ant colony algorithm optimization approach in his PhD.

The work of Dorigo, which is the first study in this country, is between 1991-1992. Later, with this method used in studies, the ants' ability to find food and act as a colony was examined and transformed into an algorithm for use in complexes.

This algorithm, which is used from other meta-heuristic algorithms, has a flexible structure in producing optimal solutions according to situations, unlike other meta-heuristic algorithms, unlike problems similar to ant movements.

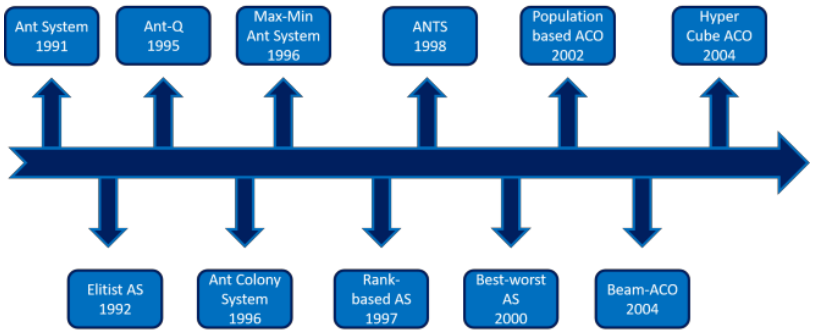

Figure 1. Ant Colony Optimization Algorithm Historical Development

Many studies are carried out to develop solutions for different sectors regarding this algorithm, which offers original results. First application for rule classification with ant colony (Parpinelli et al., 2002a) Parpinelli et al. Continues. (Parpinelli et al., 2002b). The ant colony algorithm is based on the logic of parsing the problem and generating solutions for the problem. After his assignment in a shift planning, the completed assignments and the active pheromone fluid in the system are updated. The pheromone in the assigned section will disappear over time and the ant whose assignment has been completed is now accepted in the system and its rules are updated. These roll assignment probabilities and the final result are changed after each assignment.

3.1.2 Ant Colony Optimization Algorithm Working Principle

Ant Colony Algorithm Optimization:

- Developing a solution to the problem of pheromone traces according to their intensity,
- Developing a solution by evaluating the buffers according to those found in the denser or lesser part of the pheromone,
- Intended to be optimized for its purposes.

ACO methods have been applied to various optimization problems such as traveling salesman problems, shift planning, supply chain planning, routing in production networks, constraint-specific solutions and scheduling.

Ant Colony Algorithm Parameters:

Number of ants: It is the parameter that determines how many ants will be used in the colony.
Number of repetitions: The parameter determining how many iterations (steps) the search will be made.
Pheromone enhancement ratio (α): It is a parameter that determines the importance of pheromone amounts between nodes. (One of the important parameters as the preference will increase in the scenario with a lot of pheromones.)
Heuristic boost rate (β): It is a parameter according to the distance between nodes after each assignment. The algorithm's ship:
Initialisation: This is the first step where all its parameters are set and the assignment of pheromone variables is made.
Build Ant Solutions: After the start, it creates a solution to the problem using a set of ant pheromone fluid values and other constraints in the process according to the constraints.
Local Search: This stage includes feeding the optional and implemented solution. (Includes assignment control based on pheromone fluid.)

Pheromone Update: This is the final stage and includes updates in pheromone variables with the search experiment reflected by the ants.

A small example
procedure Start of ACO Algorithm initiation;
while (Repeat until the final criteria are reached)
BuildAntSolutions;
LocalSearchMethod% optional;
PheromonesGlobalUpdate;
when finished
end End of ACO algorithm

3.2 Particle Swarm Optimization Algorithm

Particle Swarm Optimization (PSO) is a meta-heuristic optimization that has been applied in the last twenty-five years on multidimensional problems that cannot be solved by deterministic algorithms. There is an algorithm problem for this algorithm problem, which is the living creatures at the point of origin. Fish, birds, sheep, etc. To examine the movement of living creatures and their communication in clusters, naturalists formulated the herd algorithm when problems arise in uncontrolled, variable constraints and emerging in different sciences according to the situations.

3.2.1 Particle Swarm Optimization Algorithm Historical Development

The particle swarm optimization (PSO) algorithm is a new addition to the global list of search methods. This non-derivative method is particularly suited to problems with continuous variables and has received increasing attention in the optimization community. It has been successfully applied to many problems of different scales in various engineering disciplines and can easily be developed for different scenarios as a population-based approach. It has several algorithm parameters and the general settings for those parameters work well on most problems.

3.2.2 Particle Swarm Optimization Algorithm Working Principle

In this algorithm, where the number of variables and the problems subject to the problem are variable, the information is combined to adjust the new location of the particle and the dispersion velocity. Messages (optimal solutions) change in the problem space until these messages reach equilibrium or optimal. When this cycle occurs, it becomes an optimal result.

A small example

procedure Start of PSA
Algorithm initialization;
while (Iterate until end criteria are reached)
Particle fitness evaluating
Calculating the individual historical optimal position
Calculating the swarm historical optimal position
Updating particle velocity and position according to the velocity and position updating equation end
while end
End of PSA algorithm

3.3 Ant Colony Optimization and Particle Swarm Optimization Assessment

Since Ant Colony Optimization and Particle Swarm Optimization are meta-heuristic algorithms, they are used in solving problems with many constraints and variables. Among these methods, ant colony optimization is more suitable for use in large clusters where the selections are similar depending on the conditions. The particle swarm algorithm is designed to be used in clusters with different demands but with common goals.

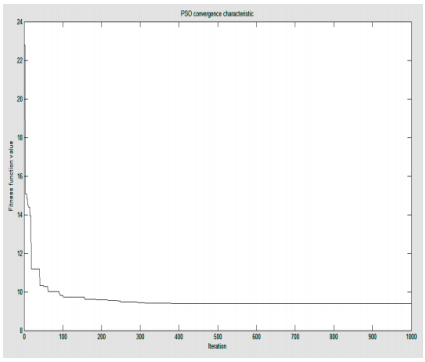

Figure 2. The plot of error square Vs iterations with PSO (Arushi Gupta et al.; 2020)

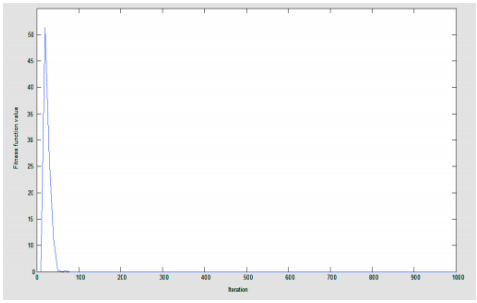

Figure 3. The plot of error square Vs iterations with ACO (Arushi Gupta et al.; 2020)

According to the results obtained from a study conducted in 2020 to find the shortest distance between the determined points, it is seen that while the optimal result was achieved in 80 iterations with ant colony optimization, 400 iterations were obtained with the particle swarm algorithm.

4. Result and Discussion

The following graphic was obtained as a result of the hospital staff interviews and surveys. It is observed that the employees are on average 70% not satisfied with the adjustment of their working hours by the management. In addition, the employees stated that they were uncomfortable with the lack of their opinions regarding their shifts. Among the most important purposes of the developed software is to meet the personnel employment requests of the management and to ensure that the personnel work in line with their own wishes as much as possible.

Figure 4. Employees' working hours and managemnet's working hours questions about editing (Koruca, and Boşgelmez; 2018)

Working hours are of great importance in establishing work-life balance. With flexible working hours, employees are ensured to balance their social lives with their jobs, and increasing the level of satisfaction of the employees has increased their performance and success in successful jobs, and it has become a priority for the management by surveys and interviews. Shift determinations are an important problem that employees experience in their

shift planning. It has been observed that the shifts are shared by individuals and are not standardized, reducing employee customer satisfaction and respect for management.

The experiment, which is presented as a solution to the aforementioned issues, is aimed at life, life experiences and methods to standardize employee-management relations and camera software. With the developed software, while management demands were met 100%, employees were able to have a say in the selection of shifts, and the sense of trust and cooperation in management was increased with standardized shift assignments.

Determining the shift times and periods of the employees has also enabled them to be more successful and willing while doing their own work. This situation increased satisfaction both in the hospital-patient relationship and in the employee-management relations.

Conflict of Interest

No conflict of interest was declared by the authors.

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