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DOI [https://doi.org/10.15589/znp2023.2-3\(491-492\).16](https://doi.org/10.15589/znp2023.2-3(491-492).16)**SOFTWARE IMPLEMENTATION OF AUTOMATED TEAM FORMATION USING ARTIFICIAL INTELLIGENCE IN AEROSPACE PROJECTS****ПРОГРАМНА РЕАЛІЗАЦІЯ АВТОМАТИЗОВАНОГО ФОРМУВАННЯ КОМАНДИ З ВИКОРИСТАННЯМ ШТУЧНОГО ІНТЕЛЕКТУ В ПРОЄКТАХ АЕРОКОСМІЧНОЇ ГАЛУЗІ**

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Abstract. The specifics of aerospace projects make certain demands on the project team. Depending on the type of project and the conditions of its implementation, the requirements for personnel may differ significantly, so the process of forming a project team must comply with the principles of flexibility and adaptability. In order to form effective teams and reduce the influence of the subjective factor, it is suggested to use specialized software. The article discusses the developed software that automates the process of forming a project team in the aerospace industry with the help of artificial intelligence. Key stages of candidate selection in the developed software include automatic search of potential team members, automated testing, voice recognition interview and real-time conversation using data analysis. Bringing AI into the hiring process offers benefits such as candidate screening, skills assessment, predictive analytics, candidate engagement, talent management, diversity and bias mitigation, onboarding and learning. The proposed method is aimed at solving problems that arise when assembling a team for aerospace projects, using the capabilities of artificial intelligence and advanced technologies. By automating the team building process, organizations can save time and resources while ensuring that appropriate team members are selected based on defined staffing requirements. The software's ability to conduct automated tests, interviews with voice recognition and live conversations simplify the selection process and facilitate management decisions about the formation of the project team. In addition, implementing artificial intelligence in recruiting offers numerous benefits, including increased efficiency, reduced bias, and improved analysis of candidate experience. The purpose of this study is to implement and test software to improve team building in the aerospace industry, particularly in the field of cyber security. The object of research is the developed software, and the subject is its implementation and testing. The material presents the main advantages of artificial intelligence in the recruitment of personnel in the aerospace industry and discusses the unique features of the proposed artificial intelligence method. The results of testing the software demonstrate its effectiveness in automating the team formation process.

Key words: artificial intelligence; team formation; project management; aerospace communications; algorithm, information technology.

Анотація. Специфіка проєктів аерокосмічної галузі висуває певні вимоги до команди проєктів. Залежно від виду проєкту та умов його реалізації вимоги до персоналу можуть суттєво відрізнятися, тому процес формування команди проєкту повинен відповідати принципам гнучкості та адаптивності. З метою формування ефективних команд та зменшення впливу суб'єктивного чиннику пропонується використовувати спеціалізоване програмне забезпечення. У статті розглядається розроблене програмне забезпечення, яке автоматизує процес формування команди проєкту в аерокосмічній галузі за допомогою штучного інтелекту. Основні етапи відбору кандидатів в розробленому програмному забезпеченні передбачають автоматичний пошук потенційних членів команди, автоматизоване тестування, співбесіду з розпізнаванням голосу та розмову в реальному часі за допомогою аналізу даних. Впровадження штучного інтелекту в процес прийому на роботу пропонує такі переваги, як перевірка кандидатів, оцінка навичок, прогнозна аналітика, залучення кандидатів, управлін-

ня талантами, різноманітність і пом'якшення упередженості, адаптація та навчання. Запропонований метод спрямований на вирішення проблем, які виникають під час збирання команди проєктів аерокосмічної галузі, використовуючи можливості штучного інтелекту та передових технологій. Автоматизуючи процес формування команди, організації можуть заощадити час і ресурси, забезпечивши при цьому відбір відповідних членів команди з урахування визначених вимог до персоналу. Здатність програмного забезпечення проводити автоматизовані тести, співбесіди з розпізнаванням голосу та живі розмови спрощують процес відбору та полегшують прийняття управлінських рішень щодо формування проєктної команди. Крім того, впровадження штучного інтелекту при підборі кадрів дає численні переваги, зокрема підвищення ефективності, зменшення упередженості та покращення аналізу досвіду кандидатів. Метою цього дослідження є впровадження та тестування програмного забезпечення для покращення формування команди в аерокосмічній галузі, зокрема у сфері кібербезпеки. Об'єктом дослідження є розроблене програмне забезпечення, а предметом – його впровадження та тестування. У матеріалі представлені основні переваги штучного інтелекту при підборі персоналу в аерокосмічній галузі та обговорюються унікальні особливості запропонованого методу штучного інтелекту. Результати тестування програмного забезпечення демонструють його ефективність в автоматизації процесу формування команди.

Ключові слова: штучний інтелект; формування команди проєкту; управління проєктом; аерокосмічні комунікації; алгоритм; інформаційні технології.

FORMULATION OF THE PROBLEM

Assembling an aerospace communication team involves selecting individuals with diverse skills and expertise to ensure effective communication in a complex environment. The team may include individuals with backgrounds in engineering, physics, computer science, and other relevant fields.

To improve the current method of assembling such teams, one approach would be to consider the specific needs of the project and to recruit individuals with skills that align with those needs. This could involve developing a skills matrix to help identify key skills required for the project and using this to guide the selection process. Additionally, efforts could be made to foster a collaborative and inclusive team culture, which may include providing training and resources to support effective communication. Another potential improvement could be to leverage emerging technologies and tools to enhance communication within the team. For example, virtual reality environments could be used to facilitate remote collaboration and communication, and data analytics tools could be used to identify patterns and trends in communication data to inform team decision-making.

The software implemented and tested in this article will discuss in detail a newly proposed method of forming an aerospace communication team almost entirely automatically with the assistance of artificial intelligence. The steps of the method suggested are thoroughly discussed in the [1, p. 1] article.

The steps include:

- Step 1. Automated potential team members' search.
- Step 2. Automated test.
- Step 3. Voice recognition interview.
- Step 4. Live conversation.

The application of software used in the method above is implemented and tested in this paper.

ANALYSIS OF RECENT RESEARCH AND PUBLICATIONS

A recent study on the subject [2, p. 11] has found that it is possible to enhance the skill level of human resources through hands-on learning over a specific period of time. To address this phenomenon, the paper proposed a scheduling problem for a multi-project portfolio that takes into account the evolving skills of flexible resources, assuming a known expected human resource structure. To minimize the number of projects and the total input cost required to achieve the desired human resource structure, a mixed integer programming model was developed in the paper. To solve this model, the paper designed a hybrid multi-objective teaching optimization algorithm [3, p. 86] that utilizes a multi-layer linked list structure encoding. This research is worth taking into account when testing the software proposed in this paper and potentially even incorporate neighborhood search to enhance the algorithm's ability for local exploration since the experimental data in [2, p. 12] confirmed the effectiveness of both the model and the algorithm.

Another paper [4, p. 1761] addresses a novel problem called the resource-constrained multi-project scheduling problem based on detection and rework (RCMPSP-DR), which aims to establish an efficient schedule for the assembly process that includes detection and rework activities. The methodology involves two main steps. Firstly, a mixed integer programming model is developed to handle both online and offline scheduling, with a focus on minimizing the expected total time required to complete a set of tasks or operations in a scheduling problem, as well as ensuring solution robustness through a weighted bi-objective approach. Secondly, an algorithm is devised by combining a tabu search framework with a critical chain-based baseline generation scheme. The tabu search framework aims to find a reasonable resource flow that represents the execution sequence of activities [5, p. 1], while the critical chain-based baseline generation scheme establishes a buffered baseline schedule by considering

the tradeoff between the two objectives. The findings indicate that the proposed algorithm achieves solutions with gaps ranging from -4.45% to 2.33% when compared to those obtained by the commercial MIP solver CPLEX. Furthermore, the algorithm demonstrates superior performance and stability compared to four other algorithms across instances with different weighting parameters, demonstrating its effectiveness [6, p. 47]. This research introduces the RCMPSP-DR, which extends the scheduling problem for large-scale equipment by considering overall detection and rework activities. The proposed algorithm is significant for practical engineering applications as it establishes a baseline schedule and determines the execution sequence of activities for the assembly process which may be useful when using software implemented and tested in this paper.

Another topic to review before starting to discuss software implementation is virtual organizations; they are structured to enable three key capabilities: rapid creation or assembly of productive resources; frequent and simultaneous creation or assembly of productive resources; creation or assembly of a diverse range of productive resources, including research, manufacturing, and design [7, p. 52]. IBM is seeking to develop a system that can address the most urgent and essential questions of new employees, aiding them in quickly acclimating to their roles [8, p. 73]. For instance, an AI could offer training recommendations or furnish details like names, locations, and contact information of individuals the employee should reach out to during their initial days. Additionally, AI engines could guide the employee to valuable information contained on a webpage specifically designed for new hires [9, p. 971]. In the IBM version of the artificial intelligence software, it solves a lot of questions but for people who are already employed at the company. It would solve questions similar to: personalized employee experiences, cognitive-supporting decision-making, vacation requests, team training. It only touches briefly about the hiring process, but this is what we will go into detail in this paper.

SEPARATION OF PREVIOUSLY UNRESOLVED PARTS OF THE OVERALL PROBLEM

One of the urgent tasks, the solution of which will ensure the best possible team formation process in aerospace industry, is to add artificial intelligence to the process. AI can greatly benefit recruitment in aerospace by automating resume screening and candidate evaluation processes, saving time and effort for recruiters. It can objectively assess candidates' technical skills and knowledge through automated testing or simulations, ensuring the selection of highly qualified individuals. AI algorithms can analyze historical recruitment data to predict successful candidates based on factors such as qualifications and experience, assisting recruiters in making

data-driven decisions. Additionally, AI-powered chatbots and virtual assistants can engage with candidates, providing information, answering questions, and facilitating a seamless application process.

THE AIM OF THE STUDY

The purpose of the research is to implement and test the newly developed software which uses artificial intelligence to greatly enhance team formation in the field of aerospace communications, particularly in the cybersecurity sector. This research is developed on the basis of a systematic approach to the analysis of achievements AI can help with during the hiring process and forecasting the best future candidate prospects as well as their potential future positions within and outside the company.

METHODS, OBJECT AND SUBJECT OF RESEARCH

The work uses methods of statistical data analysis, decision-making theory, and information modeling of production.

The object of the study is the software implementation of a novel application to use artificial intelligence during recruitment and further – to aim with team formation, taking into account the conditions of the current team building method in the aerospace industry.

The subject of the study is the software implemented and tested in this paper.

MAIN MATERIAL

Artificial Intelligence (AI) can bring several benefits to the aerospace recruitment process. Here are some of the main areas where AI can make a positive impact:

1. Candidate Screening: AI-powered systems can automate the initial screening of resumes and applications, saving time and effort for recruiters. These systems can analyze and match candidate qualifications, skills, and experience with job requirements, making the selection process more efficient.

2. Skill Assessment: AI can be used to assess candidates' technical skills and knowledge through automated testing or simulations. This helps recruiters evaluate candidates objectively and identify the most suitable candidates for technical roles in aerospace.

3. Predictive Analytics: By leveraging AI algorithms, recruiters can utilize historical recruitment data to detect trends, patterns, and correlations, enabling them to forecast the likelihood of candidate success. These algorithms take into account factors like prior achievements, qualifications, and experience, empowering recruiters to make informed and data-driven decisions during the candidate selection process. Consequently, this application of AI enhances the overall effectiveness of recruitment and contributes to refining the selection process.

4. Candidate Engagement: Candidates can benefit from AI-powered chatbots and virtual assistants, which offer valuable support throughout the recruitment

process. These intelligent systems engage with candidates by delivering relevant information regarding job opportunities, addressing commonly asked questions, and offering guidance during the application process. This interactive assistance enhances the candidate experience by providing timely and accurate information, streamlining the application journey, and ensuring candidates receive the necessary support and guidance at each step. This improves the overall candidate experience and ensures prompt communication.

5. Talent Pipeline Management: AI can help in managing and maintaining a talent pool of potential candidates for future positions. By analyzing candidate data and profiles, AI systems can proactively identify suitable candidates for upcoming roles and reduce the time and effort required for sourcing candidates [10, p. 1].

6. Diversity and Bias Mitigation: AI systems can help mitigate bias in the recruitment process by focusing on objective criteria and reducing human bias in candidate selection. This promotes diversity and inclusion within the aerospace industry.

7. Onboarding and Training: AI-powered systems can assist in onboarding new hires by providing personalized training recommendations, answering common questions, and facilitating connections with relevant colleagues. This helps new employees adapt quickly and become productive in their roles.

Overall, AI can enhance the efficiency, objectivity, and effectiveness of the aerospace recruitment process, leading to better candidate matches, improved decision-making, and a more streamlined hiring experience.

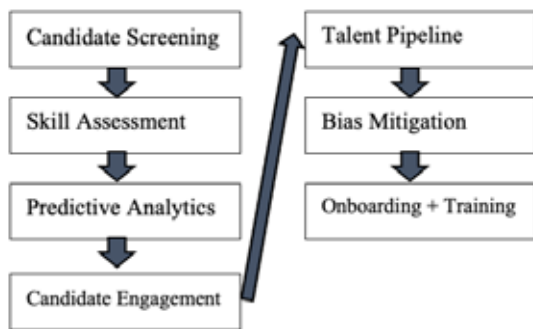


Figure 1. Artificial Intelligence Benefits

Based on the above discussed, AI would benefit the team building work in the aerospace industry. Below this paper discussed the implementation and testing of a novel method which utilizes artificial intelligence during the hiring process, and which does not require a human person all the way up to step 4.

Step 1 tested. Automated potential team members' search. The application goes through various online websites such as LinkedIn, Indeed, Glassdoor, ZipRecruiter, and others, and finds the potential candidates – people

who are the most suitable for an available job, in this testing case, a software engineer job. The job title and description can also be more specific, and although that may lead to a smaller pool of candidates, that candidates' list may be more suitable for a specific position the company or organization is looking for [11, p. 173].

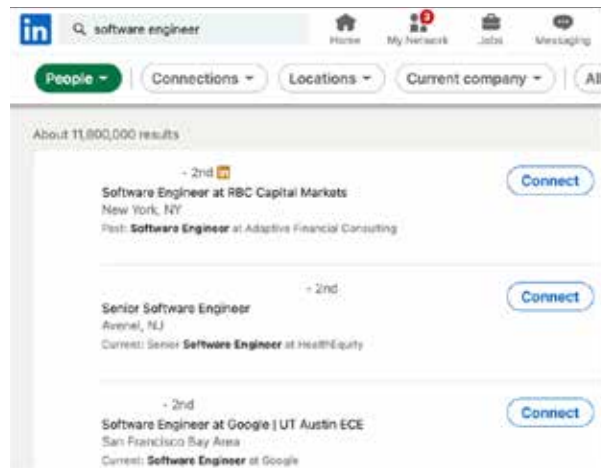


Figure 2. The AI application goes through LinkedIn candidates

The proposed application aims to go beyond traditional qualifications assessment. It not only analyzes job-related skills but also evaluates potential team member interactions on social media platforms like LinkedIn and other websites. This analysis helps determine whether the candidate's communication style aligns with the team's dynamics [12, p. 1178]. It acknowledges that work qualifications alone are not the sole consideration for a successful team fit. The proposed artificial intelligence method seeks to enhance this approach and identify the most suitable candidates holistically.



Figure 3. Potential team member interactions on social media platforms

This step has not been implemented anywhere else worldwide. The latest Artificial Intelligence development application can only recommend the criteria and websites for finding candidates [13, p. 1], but the software developed in this paper actually finds real people who are interested in the job and suggests that they apply to continue to the next step. Another unique aspect of the new

AI method tested in this paper is the ability to predict future team member interest, meaning that only the candidates who are most likely to want the job will be invited to apply for the position.



Figure 4. Current candidates search limitations

Step 2 tested. Automated test. All potential candidates would be required to take a test through the application. Once the applicants complete the test, the application would review their answers to determine which candidates passed and which did not. The test results would be evaluated on a percentage scale, as explained in greater detail in Figure 5 [1]. Priority would be given

to candidates who scored in the top 10th percentile. For candidates who scored in the 85-90th percentile, a shorter second test would be administered. Those who achieve a score in the top 5th percentile on the second test would be assigned the second priority level and advance to the next round of team building.

As shown in Figure 6 and Figure 7, the automated test questions would be presented to applicants. Those who choose to take the test will then have the answers checked by the application and then the application would grade the tests according to Figure 5 and determine if the candidate passes the test. Such a method brings a lot of benefits to the team building process. Some examples are but not limited to: efficiency and time savings, consistency and standardization, immediate feedback, data-driven insights, test security and integrity [14, p. 5].

Step 3 tested. Voice recognition interview. The proposed approach suggests leveraging artificial intelligence to gather and analyze data, aiming to expedite team building, reduce reliance on human and financial resources, and mitigate discrimination. However, it is important to note that question answering (QA) poses significant challenges within the field of natural language processing,

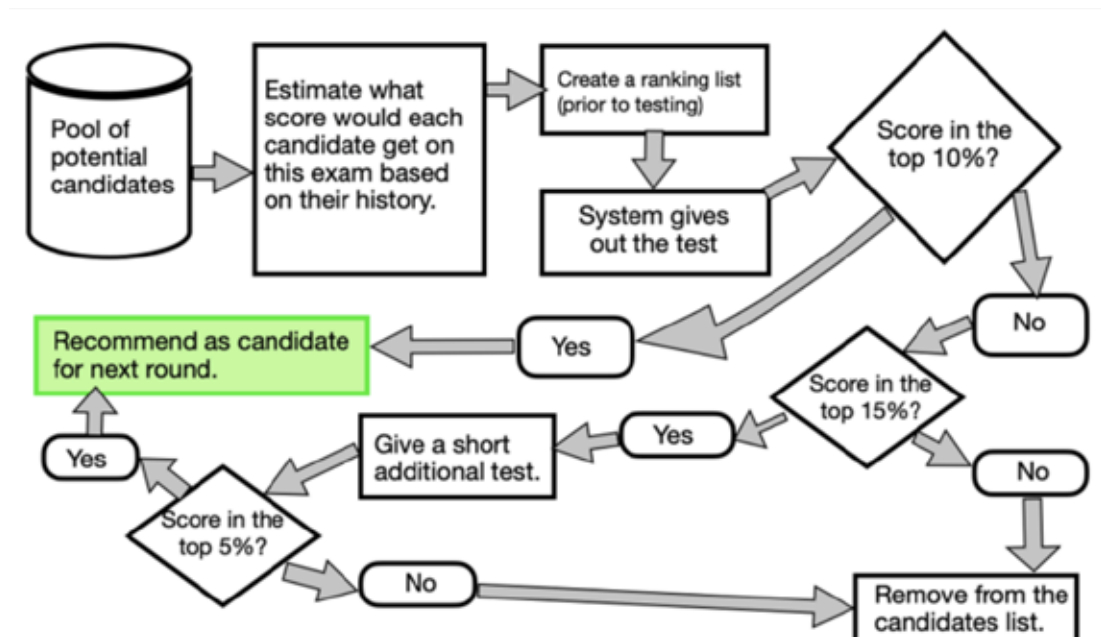


Figure 5. The passing of the automated test algorithm

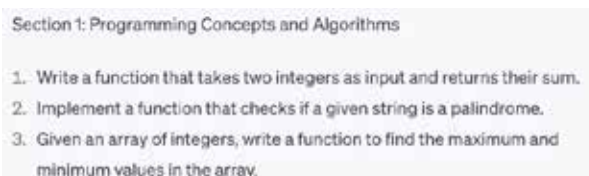


Figure 6. Automated test Part A – Questions

```
python
def calculate_sum(a, b):
    return a + b
```

Figure 7. Automated test Part B – Answer to Question 1 in Figure 6

making it a particularly complex task. One example question that can be asked during such an interview is «Can you describe your experience working with aerospace software development standards and regulations?». This question aims to assess the candidate's familiarity with the specific standards and regulations that govern software development in the aerospace industry. The application may ask the person to discuss any relevant experience they have in complying with standards such as DO-178C (Software Considerations in Airborne Systems and Equipment Certification) or other relevant industry-specific guidelines.

Another question which can be asked is «How would you approach designing and implementing software for safety-critical aerospace systems?». This question evaluates the potential employee's understanding of safety-critical software development practices and methodologies. The person would need to demonstrate their knowledge of techniques like fault tolerance, redundancy, error handling, and risk analysis. This step 3 of the new software proposed and tested in this paper can be used even internally, to move certain employees to higher positions. An example part of such an interview may include the following questions: «Can you explain the challenges you have faced when working on aerospace software projects and how you resolved them?». This question assesses the employee's problem-solving skills and ability to overcome challenges in aerospace software engineering projects. The employee should share specific examples where they encountered difficulties such as tight deadlines, technical complexities, or integration issues, and describe the strategies they utilized to overcome those challenges [15, p. 445]. Bonus points would be provided if those examples come from working both internally within the same company and in other organizations.

Step 4 tested. Live conversation. During the last stage of the method, referred to as a live conversation, human interviewers would interact with the candidates while utilizing the application's assistance. While a real person conducts the interview, the application records and analyzes the audio and video for future learning purposes. This enables the application to understand and improve its interview conducting capabilities, potentially leading to a future where the application itself can fully handle the fourth step of the process.

DISCUSSION OF THE OBTAINED RESULTS

The successfully ran test of the newly developed software proposed in this paper demonstrates that using artificial intelligence during the team formation process in the aerospace industry has huge benefits. Using AI in the

recruitment process provides several benefits. It enhances efficiency by automating repetitive tasks, such as resume screening and candidate sourcing. AI algorithms analyze job requirements and candidate profiles, resulting in more accurate and efficient candidate matching. It also helps mitigate bias by objectively evaluating candidates based on predetermined criteria. AI reduces costs by streamlining manual processes and saving time and resources. It enhances the candidate experience through personalized communication and support provided by chatbots and virtual assistants. AI generates valuable recruitment data and analytics, enabling data-driven decision making and optimizing recruitment strategies. It improves scalability by handling large volumes of candidates and managing multiple positions simultaneously. AI reduces the time-to-hire by automating time-consuming tasks and expediting the identification of suitable candidates. It contributes to higher-quality hires by accurately matching candidates to job requirements. AI systems continuously learn from past data, improving their performance over time. They provide consistent and objective evaluations, ensuring fairness in the recruitment process. AI enables comprehensive candidate sourcing by searching across various platforms and databases. It helps organizations maintain compliance with employment laws and regulations. Real-time insights provided by AI enable recruiters to monitor and adjust their strategies for better outcomes. In summary, AI in recruitment brings efficiency, accuracy, fairness, cost savings, and improved candidate experiences to the hiring process.

CONCLUSIONS

In conclusion, the process of assembling an aerospace communication team involves carefully selecting individuals with diverse skills and expertise to ensure effective communication within a complex environment. By considering the specific needs of the project and recruiting individuals with aligned skills, the team's effectiveness can be enhanced. Fostering a collaborative and inclusive team culture, along with leveraging emerging technologies, can further improve communication within the team. The proposed method discussed in this article suggests using artificial intelligence to automate the formation of an aerospace communication team. The steps of the method, including automated search, testing, voice recognition interviews, and live conversations, have been thoroughly explained. The implementation and testing of the software used in this method have been addressed in this paper. By adopting these approaches, the process of assembling an aerospace communication team can be made more efficient, accurate, and well-suited to the project's requirements.

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