ON THE DEVELOPMENT AND VALIDATION OF A MATCHMAKING MENTORING PLATFORM

Gabriela RUS, Calin VAIDA, Bogdan GHERMAN, Adrian PISLA, Laurentiu NAE, Paul TUCAN, Mihai CIUPE, Doina PISLA

Abstract: *Recent events in our society, such as the Covid-19 pandemic, revealed a series of complex problems in many sectors, where human factors represent the central point. One of the most affected sectors is industry, where the lack of experts often caused disruption of the supply chains. This paper aims to respond to the scarcity of experts in this area, providing possible viable solution in the form of a mentoring platform which gathers together senior experts and mentees, based on the requirements of the industry companies. The proposed mentoring platform focuses on providing capable experts to companies, able to respond to a specific problem in an efficient way, considering that experts are seniors with extensive experience in industry. This becomes achievable through a matchmaking system that can link a senior profile with the stated problem submitted by the companies' representatives powered by artificial intelligence agents. Some initial results are presented, validating the concept before the market launch.*
Key words: *Industry experts, Mentoring platform, Artificial intelligence, Intelligent recruitment.*

1. INTRODUCTION

Even though the lack of expertise has long been recognized as a concern in many industries, the Covid-19 pandemic exposed several intricate issues with human resources and the potential effects these issues could have on every element the global economy [1] [2]. The main challenge these sectors must face is the scarcity of qualified human resources, resulting from the fast-aging population, inability to recruit competent resources, or incapability to keep a person for a long period of time. The industrial sector holds a distinctive place, where the development of technology introduces new methodologies that require updated skill sets [3]. As a result, future engineers are no longer adequately prepared to work with the so-called "classic" technologies, even if they are still prevalent in the industry. Another factor that amplified this scarcity is the ageing populations which cause a massive retirement of the experts [4]. The major problems with this shortage of industry experts are related to the supply chains [5], considering that a lack of engineers can cause delays in design and development, poor manufacturing practices, equipment failures, weakened quality control, and a lack of problem-solving skills [6].

In this context, finding solutions to connect companies from the industry sector with senior engineers has become a major concern. Even though the usage of sites specialized in providing human resources (Linkedin, Indeed, Monster) will always be an option, the weakness of these sites consists in their customer targets, because their focus is on young or middle - age persons, but they omit the elderly who usually have the experience and the knowledge to be considered experts in a certain field.

Digital platforms have been developed to create a welcoming environment and attract older adults, offering them a tailored experience.

The authors from [7] proposed a knowledge transfer platform, named Elders-Up!, with the help of which the experience and knowledge of seniors can be transferred to small companies and start-ups, in this way supporting both companies that cannot afford qualified staff and seniors in their reintegration into a pleasant work environment, in case they want to work after retirement. Another knowledge platform

dedicated to reintegrating the seniors in the work field is ProMe, presented in [8]. Besides the friendly interface, the platform has the advantage of using an innovative method to match an expert with a certain task, using artificial intelligence (A.I) algorithms. However, none of these initiatives were ever completed, primarily due to the fact that they didn't live up to the expectations of their customers (bad interface design and general rather than niche content).

The Wisdom of Age (WoA) platform was created in response to the demand for a specialized environment where companies could hire a specialist for a particular assignment [9]. The platform provides a precise A.I based matching system targeting firms (mentees) and seniors (mentors) based on the tasks submitted by the companies and the mentors' profiles. The platform has the advantage of being niche, offering candidates to companies with a high degree of accuracy in a very short time.

This paper aims to conduct an analysis of the platform, examining its ground-breaking approaches in addressing one of the most pressing issues regarding human resources in the industry sector.

After the introduction, the following section treats the expectations of the companies regarding a mentoring platform, followed by section 3, where the matchmaking system of the platform is presented. Section 4 presents the preliminary testing, and the validation of the system and section 5 contains a short summary of the work along with the conclusions.

2. NEEDS AND REQUIRMENT OF THE COMPANIES

To validate the necessity of the platform for the industrial sector and to have a clear idea about the requirements of the companies, a business survey was conducted in the early stage of the project.

The objective of this survey was to assess the effectiveness of this platform across various European countries and determine the necessary enhancements to meet companies' requirements. The survey focused on identifying areas with high demand for experts, exploring and understanding mentors' and companies' collaboration preferences (hourly payment, project-based payment, or task-based payment).

Based on these goals, the survey was distributed to small, medium, and large companies from three countries of Europe: Romania, Belgium, and Switzerland, the total number of participants being 119 (92 persons from Romania, 18 from Switzerland and 8 from Belgium).

An examination of the industry sectors represented by the surveyed companies indicated that the automotive and transportation sector has the highest demand for experts 20%, followed by industrial machinery (15%), consumer and products & retail (14%) and aerospace & defence (10%). The last 10 % includes other sectors (Fig. 1.).

Another important aspect of the survey was related to the skills required by companies. It can be observed that even if the "others" category occupies a significant percentage of the total, the next category was "engineering skills".

An analysis of the industry sectors from which the surveyed companies originated, revealed that the industry where there is the greatest need for experts is automotive and transport 20% followed by industrial machinery (15%), consumer and products & retail (14%) and aerospace & defence (10%). The last 10 % includes other sectors. Another important aspect of the survey was related to the skills required by companies. It can be observed that even if the "others" category occupies a significant percentage of the total, the next category was "engineering skills".

3. THE MATCHMAKING SYSTEM

As has been mentioned before, the novelty of the platform is the matchmaking system which has the role to provide the most suitable mentor for a certain task. Through comprehensive research, it was established that the most effective approach to matching a mentor with a company is by calculating the degree of similarity between them using keywords.
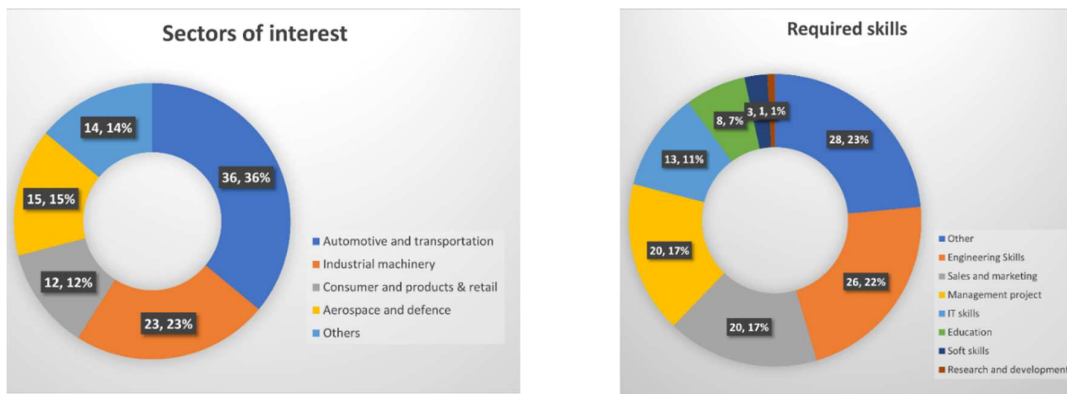
Fig.1. Schematic representation of Industries where is a demand for experts and the required skills

These keywords are entered when the mentor creates the profile, representing the skills he has, respectively when the company creates a new task, the task for which a suitable mentor is being sought. They are analysed using the NLP (Natural Language Processing) technique, which helps to calculate the percentage of semantic similarity between words. A very popular technique used for this purpose is, Word2Vec [10]. Using the Skip Gran architecture, which is especially used to find out the contextual meaning of words and implicitly the similarity between certain words, the semantic similarity between keywords was calculated. Since the recommendation system suggests multiple mentors to a company, the similarity is calculated between each word in the company's keyword list and each word in the mentor's keyword list, for all mentors registered on the platform, as can be seen in Fig.2.
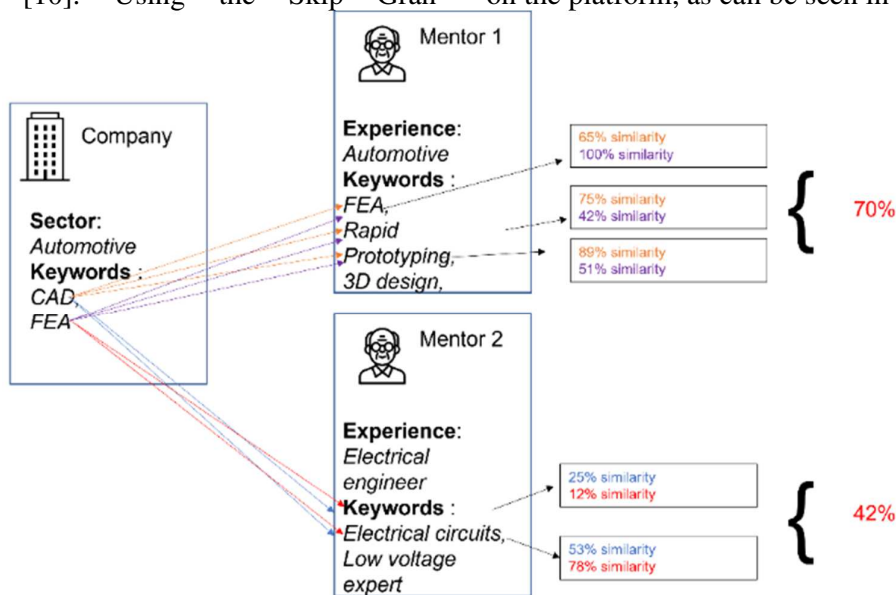

Fig. 2. Schematic representation of the matchmaking system

4. PRELIMINARY TESTING AND VALIDATION

The process of validating the AI agents was carried out by subjecting them to various tests based on scenarios designed to highlight their possible vulnerabilities such as the bias of a mentor in the selection process.

One of these tests is presented in the figures below. First candidate has just one component in the keywords (even if there are two words, the system perceives this structure

as one component, because there is no comma separating them) and candidate 2 has two keywords, but the first candidate has the same keyword structure as the requirement of the company (Electrical Code). The aim of this test was to observe if the number of keywords could influence the decision of the algorithm even if these keywords don't have a high degree of similarity with the keyword of the company.

In Fig. 5 and 6 it can be seen that the system sent invitations only to those mentors who correspond to the description of the objective, mentors considered unsuitable being excluded from the list of invitations.

Inputs: **Keywords of company** "Electrical Code"
        Discipline: "Electrical Engineer"
        Keywords of candidate 1:" Electrical Code"
        Keywords of candidate 2 :" Autocad, PCB"
Outputs: **Candidate 1** : 0.93; **Candidate 2** : 0.57

Fig.3. Testing scenario example

Fig.4. Requirements of the company

Fig.5. Profiles of mentors

Fig.6. Invitations section for both mentors

Additionally, two people specialized in employee hiring for IT and Tech companies, were asked to inspect profiles of 10 mentors, to find the most suitable mentors for a given task, ranking the profiles from the most suitable to the least suitable candidate. The same profiles were introduced into the artificial intelligence matchmaking system. This test aimed at comparing the choices made by the HR (Human

Resources) staff and the choices made by the AI agent.

The results, as can be seen in Fig. 7, revealed that both the human factors and the AI agent considered that the most suitable persons for the respective task would be mentors 4, 2, 3, and the least suitable person would be the mentor. 9.

While the order of mentors varies between the two extremes, the differences observed are not significant. In fact, the human factor (on the left side) placed six individuals at the same position as those from the AI-based system.

Fig.7. Vann diagram for mentor rankings - HR persons on the left, AI based system on the right

5. CONCLUSION

The Covid-19 pandemic reveals a series of complex problems related to the human resource factor. Due to the inherent nature of this component in all aspects of our society, the people became conscious of the need for experts in a variety of fields, with an emphasis on industry, where a shortage of skilled workers could result in a disruption of supply chains.

To help companies to find people with experience and a high level of knowledge, the WoA platform was created. Furthermore, the platform offers seniors the opportunity to be reintegrated in the work field, remaining in touch with the domain in which they worked.

The novelty of the platform consists in the matchmaking system which provides the companies with the most suitable mentor for a certain task, reducing the time assigned for recruiting and increasing the accuracy of the process. The platform was tested for multiple scenarios and validated with specialized personnel.
Following the successful initial validation, the next steps consist in the validation of the WoA platform using real companies and mentors before the official market launch.

6. ACKNOWLEDGMENTS

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Dezvoltarea și validarea unei platforme de mentorat bazată pe matchmaking

Abstract: Evenimentele recente din societatea noastră, precum pandemia de Covid-19, au scos la iveală o serie de probleme complexe în multe sectoare, unde factorii umani reprezintă punctul central. Unul dintre sectoarele cele mai afectate este industria, unde lipsa experților a cauzat adesea perturbări ale lanțurilor de aprovizionare. Această lucrare își propune să răspundă deficitului de experți în acest domeniu, oferind o posibilă soluție viabilă sub forma unei platforme de mentorat care reunește experți seniori și oameni care au nevoie de persoane cu expertiză pentru anumite sarcini, pe baza cerințelor companiilor din industrie. Platforma de mentorat propusă, se concentrează pe furnizarea de experți companiilor, aceștia fiind capabili să răspundă la o problemă specifică într-un mod eficient, luând in considerare faptul că experții, sunt seniori cu o vastă experiență în industrie. Acest lucru devine realizabil printr-un sistem de matchmaking (potrivire) care poate potrivi un profil de senior cu o problema transmisă de reprezentanții companiilor, cu ajutorul agenților de inteligență artificială. Sunt prezentate câteva rezultate inițiale, validând conceptul înainte de lansarea pe piață.

Gabriela RUS, Research Assistant, Technical University of Cluj-Napoca, CESTER research center, Gabriela.Rus@mep.utcluj., 103 Muncii Blv. Cluj-Napoca, Romania

Calin VAIDA, Professor, Technical University of Cluj-Napoca, CESTER research center, Calin.Vaida@mep.utcluj.ro, 103 Muncii Blv. Cluj-Napoca, Romania

Bogdan GHERMAN, Assoc. Prof., Technical University of Cluj-Napoca, CESTER research center, Bogdan.Gherman@mep.utcluj.ro, 103 Muncii Blv. Cluj-Napoca, Romania- **Corresponding author**

Adrian PISLA, Professor, Technical University of Cluj-Napoca, CESTER research center, Adrian.Pisla@muri.utcluj.ro, 103 Muncii Blv. Cluj-Napoca, Romania

Laurențiu NAE, Founder, Digital Twin, laurentiu.nae@digitaltwin.ro, Bd. Mircea Voda 24, Bucharest, Romania

Paul TUCAN, Lect., Technical University of Cluj-Napoca, CESTER research center, Paul.Tucan@mep.utcluj.ro, 103 Muncii Blv. Cluj-Napoca, Romania

Mihai CIUPE, economist, Technical University of Cluj-Napoca, Ciupe.Mihai@staff.utcluj.ro, Strada Memorandumului 28, Cluj-Napoca 400114

Doina PISLA, Professor, Technical University of Cluj-Napoca, CESTER research center, Doina.Pisla@mep.utcluj.ro, 103 Muncii Blv. Cluj-Napoca, Romania