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Development of Expert System for Professional Orientation in IT Industry

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Abstract: The right professional orientation is the crucial choice for each developing personality in the period of his whole life. The finding of trade-off between the personal abilities and personal practical skills and their applicability to the existing professions and current trends is very important issue in the life of any person. According to new trends of the industry and technology development in the nearest future we have to deal with the demand of increase number of IT-specialists and the right choice in this particular area of human activity may form the special interest in IT technologies and growth of the number of IT-professionals for current generation of people. In this paper we describe the technique, process and implementation of the expert system development for professional orientation in IT industry.

Keywords: expert system, professional orientation, IT-specialist, self-diagnostic questionnaire, self-determination

1 Introduction

The right professional orientation is the crucial choice for each developing personality in the period of his whole life. The finding of trade-off between the personal abilities and personal practical skills and their applicability to the existing professions and current trends is very important issue in the life of any person. According to some researches [1] the only 50% (in average) of the modern graduates select the future profession based on their own decisions, while the other part of graduates use the recommendations of parents, friends and other surrounding them people. Some of the professions put the high requirements for the personal psychological features of the graduates. Therefore, sometimes unsatisfied person's life bases on the wrong choice of profession that is accompanied by low performance, stress and personal discomfort. At the foundation of the development of human capabilities we can consider sustainable special interests. Special interest relates to certain area of human activity which develops the tendency to be engaged professionally to this kind of activity.

According to new trends of the industry and technology development in the nearest future we have to deal with the demand of increase number of IT-specialists and the right choice in this particular area of human activity may form the special interest in IT technologies and growth of the number of IT-professionals for current generation of people.

In this paper we describe the technique, process and implementation of the expert system development for professional orientation in IT industry.

2 Overview of psychological techniques in professional orientation area

The psychology of professional self-realization was the main idea in the research (2005) of the famous scientist-psychologist Klimov E.A. [2], [3]. He has proposed the self-diagnostic tests for defining the person's professional inclinations based on the analysis of the psychological preferences. In the term of the "psychology of Professionals" Eugeny Klimov opens the complicate system that includes not only external but also the internal psychic functions such as "image of future professional activities results", "the methods and ways to reach them", "variants of achieving results", "emotional

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adjustment", "perceive of self-protection", "confidence in the future life activity" and many others.

Some other authors, Rezapkina G. and Samukina N.[3] studied the psychology and career choice: pre-specialization programs and psychology of professional activity. The authors Gudkova E.V., Zeer E.F.[4], and Chistyakov N[5] described the foundations of vocational guidance and professional counseling in the area of Professional Orientation in Theory and Practice. The researcher of pedagogy Mizherikov V.A. [6] in his work introduces the methodology of the Jovaisi questionnaire of person's professional inclinations.

The research area in career orientation is represented by various psychological and diagnostic tests. For example, "career anchor" questionnaire of E. Shane, "career goals" questionnaire for the city of Mall, the techniques of the so-called Maralov "essay about my life in 10 years", or Senin's "terminal values questionnaire" , the methodology of F. Noe, P. Noe, D. Bahuber regarding the "motivation for a career" (quoted by A. Mogilevkina), "Diagnosis of motivation", test - technique created by S. Richie and P. Martin, "research of the motivational profile of a person" (adapted by E. A. Klimov [2]), the technique of A. Mogilevkin "career development factors," the technique of Pankratov I.E., "career photography" by Zhuina[7] and some others.

All these tests are aimed at psycho-diagnostic, acmeological structural components of professional orientation of the person: career potential, career orientations, career image and career motivation, which determine the level of career development of respondent's personality.

Each test should be constructed by using the special tools but the crucial role in the analysis of results is played by the person-researcher. To make such type of systems reliable for the self-diagnosis it is critical to develop the special expert systems that can help to identify the right characteristics for each respondent regarding the professional orientation.

3 Self-diagnostic expert systems concepts

3.1 Defining the System Concepts

To create the self-diagnostic expert systems in the area of IT-industry we have to consider the different specialties in IT-area that may differ by sounding but can include a lot of common responsibilities and activities and, in opposite, they can have the similar sounding but differ by special skills and abilities. For example, two IT-specialties "Web-developer" and "Web-designer" sound similar but they have the special interests which can differ by the skills and abilities of the respondents. The identifying of this respondent's special interest may form his right professional orientation and give him right direction in the future selection of the profession.

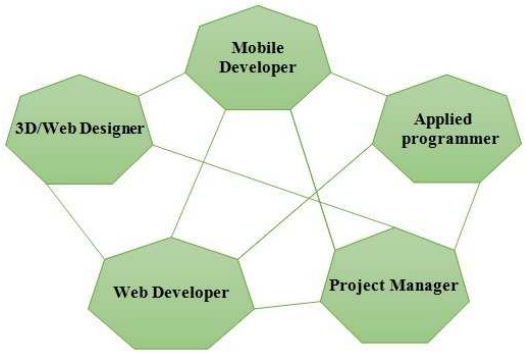

Fig. 1: Links between IT-area specialties

For these purposes any expert system should contain the special questions that relate to the psychological aspects of each respondent but also may give the hints about the future professional orientation.

By using the technique of Eugeny Klimov [2] we create the questionnaire with the blocks of couple questions that can define the preferences of the respondents by his choice. In one block we identify 15 questions which can lead to the self-diagnostic results of each respondents regarding the IT-area specialty selection based on the self-estimated abilities and skills.

Each question is represented by suggestions like, for instance, suggestion A - " I am interesting in developing web-sites, internet services" in compare with suggestion B - "I like to create desktop applications for Windows, MacOS, Linux". This technique is directed to criteria of "labor object" focused on person's professional activity.

We distinguish five current the most popular IT-area specialties:

–Mobile Developer
–Web Developer
–3D/or Web Designer
–Applied programmer
–Project manager

Each of these IT-specialties relates some others and can organize the links between the areas which help to find the common features, functions, activities as well as skills and abilities of respondent's professional orientation (Figure 1).

3.2 Description of Testing Concepts

The choice of these five IT-area specialties can be explained by the description of the following conceptions.

"Mobile Developer" concept has been chosen since it describes the specialist which develop the applications for the different mobile devices such as tablets and smart phones. According to statistics this profession is the most

fashionable among IT-specialists, promising and in high demand on the market.

The current trends in voice & gesture interfaces and recognition have been appeared due to the mobile devices industry development. Nowadays the market of proposed vacancies for Mobile Developers is in high demand. It has a great deficit of such specialists. The growth of the mobile devices users creates this demand of mobile developers. The professional skills of Mobile Developers generally include the following requirements:

–skills for Apple iOS applications development
–skills for Google Android applications development
–skills for Windows Mobile applications development
–programming languages skills for iPhone and iPad
–new library tools for application developement
–using of databases and its development for mobile applications and etc.

”Web Developer” concept bases on developing of the web programmer professional area for implementation the ideas of Web Designers and improvement the existing web-sites. The main skills of Web Developer include HTML, JAVA, JAVA Script, PHP, CGI, Perl and other web programmer tools that can improve the performance of the web-sites by adding the animation, sounding, dialogue interpretation, e-commerce and other opportunities. Regarding the psychological aspects for the Web Developers it is enough to work in silent environment and using only online format for communication.

”Applied Programmer” concept contains the idea of developer, applied programmer who is involved to the process of applied software development (coding, debugging, maintaining, and etc.). As a rule, applied programmer concept envisages that there is no any issues with the system tools (environment tools) and applied programmer only develops the application by using the existing tools and libraries. The psychological aspects include the abstract and strong logical mind, patience, abilities to the routine and monotone work and presence of strong will power. Among the skills of the applied programmer the different programming languages skills (Java, Python, C/C++/C#, 1C, Android, JavaScript and etc.) usually define the special interest and direction of the developer.

”Project Manager” concept defines the specialist who is responsible for the successful execution (implementation) of the project in the terms of the customer conditions with enough quality, fixed budget and resources and under the demand of the customer side. The psychological features of the specialist ”Project Manager” include the responsibility, confidence , leadership, communication skills, analytical abilities, management skills, domain area knowledge , communication language skills and etc.

”3D/or Web Designer” concept characterizes the specialist in the area of 3D graphics (or web-design) which can adjust or create 3D-objects (Web-site objects), their movement and drawing, usable information (graphics, text, animation). The professional skills usually include

–Skills of high-level forecasting;
–Understanding the motion of photorealistic mapping;
–Knowledge of figurative manners;
–Post-processing skills in graphics editors (3dMax, Maya; Cinema 4D;LightWave; Softimage XSI; Blender; Modo, etc.);

The psychological aspects may include the good imagination, spatial thinking, art abilities and etc.

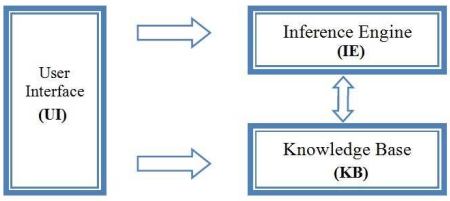

Fig. 2: Expert System Structure specialties

Table 1: Key numbers for categories of IT specialists

Key Numbers					
Mobile Developer	3D/ Web Designer	Web Developer	Applied Programmer	Project Manager	Not applicable for IT specialists
1-9	1000-9999	10-99	100-999	10000-99999	0-1

4 Building an expert system for IT-industry professional orientation

In order to create the expert system we have to use the main essential concepts of the expert systems development that include three main components [8], [9]: KB as a Knowledge-base; IE as an inference engine; and UI as user interface (Figure 2).

To create the knowledge-base (KB) we need to find the main categories of professional orientation for IT industry specialists that are based on Klimov’s technique [3]. We can mark the five professional fields of IT specialists as key numbers (or the range of numbers) the explanation of which you can find in Table 1(Here we have added one additional category for the users which category is not applicable for IT specialists).

During the construction of an appropriate independent questions (see Figure 3) we can identify the special weights (or key numbers) for each category.

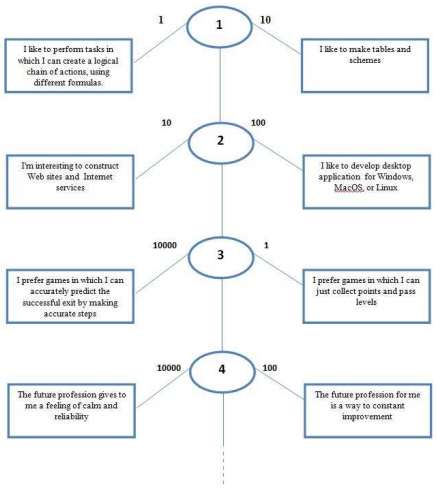

Fig. 3: Questions binary tree

After the selection of answers by users these special weights will be stored and calculated in database at the special fields.

Thus, by using the sorted set of different m-elements chosen from the bunch of n-elements we can get the set of different questions for identification of the professional fields of IT specialists (labor objects). For each question we can consider only 2 answers and by using the combinatory analysis we get the appropriate number of questions:

$$A_m^n = m!/(m-n)!$$

The inference engine of the expert system contains the programming in SWI Prolog language and user interface has been represented by web site interface. Following by the essential rules of the expert system building [10], [11] we can consider IF-THEN rules for inference engine implementation. The algorithm of the main key numbers calculations is represented in the Figure 4.

5 Discussion of testing results

In our research we provided tests among the respondents (N=61) that are the people (students) who are involved to IT area activities. The 78% of respondents have been males and the other 22% - the women. About 13% (N=8) of respondents have been in the range of 16 till 20 years. 67% (N=41) of respondents had the range of age from 21 till 25 years, 13% (N=8) were selected from the age of 26 till 35, and 7% (N=4) were in the range of 36 to 42 years. According to specialty we distinguished technical sciences and IT (N=53) and schoolchildren (N=8).. The list of questions (see table 2) for this case we prepared by using the special principles to avoid the mistakes.

We specified couple of questions and duplicated some of them to clarify the whole situation of the inclinations

Table 2: Case questions for the test

1 I like to perform tasks in which I can create a logical chain of actions, using different formulas.	1 I like to make tables and schemes
2 I'm interesting to construct Web sites and Internet services	2 I like to develop desktop application for Windows, MacOS, or Linux
3 I prefer games in which I can accurately predict the successful exit by making accurate steps	3 I prefer games in which I can just collect points and pass levels
4 The future profession gives to me a feeling of calm and reliability	4 The future profession for me is a way to constant improvement
5 I immediately implement the given tasks	5 I finish the work at the last minute
6 I'd like to develop the drivers for a variety of devices, web-sites and Internet Projects	6 I'd like to develop applications and games for mobile phones
7 Before the responsible affairs, I always make a plan and consequently implement it	7 I always do everything not according to the plan
8 I want to work in a bank or a large organization	8 I want to work in an Internet studio or in a startup
9 If something doesn't work by plan, I try to find a solution patiently	9 If something doesn't work by plan, I am starting to become nervous and angry
10 I hardly manage the works where it is necessary to act according to the predetermined algorithm	10 I like to work with laptop or PC: just type or format texts
11 I like to develop the games and not only the games	11 I'm not interested in games development
12 I can reinstall Windows by myself, and install complicated software on my computer	12 I dream to create mock-ups of future houses, business centers
13 I distinguish colors very good	13 I like to generate new ideas and initiate new projects. The generating of ideas is my inherent dignity.
14 I try to distribute my workload by separating them to the tasks of moderate complexity	14 I'm interesting in the development of mobile app for phones and tablets
15 I know the usability of websites very well	15 I hardly understand algorithms and complex logic circuits

of the respondents. The combination of key results by categories of IT-specialists are represented in Table 3.

According to results received during the testing we have found out the following situation. From all respondents 100% (N=61) about 20% (N=12) have an inclination to the profession "Mobile Developer" or "Applied Programmer", 25% (N=15) of respondents have the results as "Web Developers" or "3D/Web Designer" whereas 10% (N=6) have the priority to "3D/Web Designer" and only then - "Web Developer". About 18% (N=10) of respondents have the inclinations to the profession of Project Manager. 22% (N=13) had as a

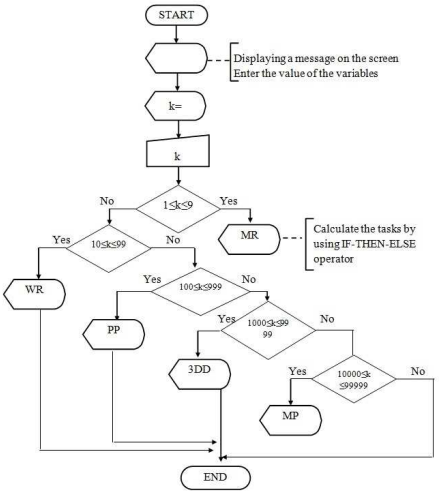

Fig. 4: Algorithm for inference engine

Table 3: Combination of key results for the present case

Mobile Developer	3D/ Web Designer	Web Developer	Applied Programmer	Project Manager	Not applicable for IT specialists
1	8	1	2	4	5
3	9	2	4	5	7
6	11	3	6	7	9
11	12	10	8	13	10
14	13	15	12	14	15

results the selection of pure ”Applied Programmer”. There were other type of respondents about 5% (N=5) who do not ready to be IT specialist and it was a wrong selection of their profession.

All participants have been informed about the results of tests and they were asked to answer the question ”Do you enjoy the results? If yes, please can you explain why?”

The most of the respondents have been confident in their results and their selection of future profession whereas the respondents who have made a wrong selection of profession could explain the influence factors of this choice. They have mostly included personal reasons (influence of parents’ recommendations, wrong understanding of future work, not enough educational background, and other).

6 Conclusion

The career choice is a delicate decision making problem since it has an effect on efficiency and competency. The person who has chosen a profession that does not meet his nature often feels frustration in his choice. In this way early correct professional orientation may help to build a suitable career. The building of an expert system in this area may serve as an excellent tool for these purposes.

Especially nowadays, IT sphere is a sphere of professions of the future, where modern jobs appear more and more as the replacement of manual processes to computer-automated procedures. We can also confirm that nowadays, there is a high level of demands for professionals in IT industry according to the analysis of labor market and based on the information of recruitment agencies. Therefore, IT professionals need to have not only appropriate technical skills and experience, but also a broad understanding of the context in which they operate. For this purpose we have developed an Online Expert System which guides students for the selection of their suitable future professions in IT sphere by special type of survey which contains the special psychological aspects.

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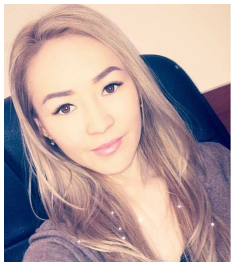

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