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## A COMPREHENSIVE METHOD OF BUILDING INTELLIGENT CAREER GUIDANCE SYSTEMS

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**Abstract.** The basic principles of functioning and possibilities of application of systems of professional orientation with use of technologies of artificial intelligence are considered. A complex method of building intelligent systems of professional orientation of students is offered. A general testing module has been developed to determine the professional direction. A sequence of steps for the method of determining the correspondence of professional and personal profiles, which can be implemented as a comprehensive system of vocational guidance and individual testing modules.

**Keywords:** professional orientation, personal profiles, testing modules, vocational guidance.

**Анотація.** Розглянуто основні принципи функціонування та можливості застосування систем професійної орієнтації з використанням технологій штучного інтелекту. Запропоновано комплексний метод побудови інтелектуальних систем професійної орієнтації студентів. Розроблено модуль загального тестування для визначення професійного напрямку. Запропоновано послідовність кроків для методу визначення відповідності професійного та особистого профілів, який може бути реалізований як комплексна система професійної орієнтації та за окремими модулями тестування.

**Ключові слова:** професійна орієнтація, персональний профіль, модулі тестування.

**Аннотация.** Рассмотрены основные принципы функционирования и возможности применения систем профессиональной ориентации с использованием технологий искусственного интеллекта. Предложен комплексный метод построения интеллектуальных систем профессиональной ориентации студентов. Разработан модуль общего тестирования для определения профессионального направления. Предложена последовательность шагов для метода определения соответствия профессионального и личного профилей, который может быть реализован как комплексная система профессиональной ориентации и по отдельным модулям тестирования.

**Ключевые слова:** профессиональная ориентация, персональный профиль, модули тестирования.

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### Introduction

Society actualizes the task of preparing students and high school students for life and professional determination, which will be the basis of their future self-realization in the professional sphere [1]. This process is the most important component of personality development and is a prerequisite for its further professionalization. Modern conditions of functioning of the labor market and educational services require active development and introduction of the newest information and intellectual technologies in processes of professional orientation of youth, a choice of a direction of preparation and educational institution. Today, simply informing the entrant via the Internet about the availability and capabilities of educational institutions is not effective enough due to the large number of such resources, their uniformity and similarity of proposals. The process of professional counseling involves systematic and painstaking work on choosing a future profession. One of the main directions of modernization and improvement of this process is the use of the possibilities of modern information technologies. The best option for such activities in the regions is to create resource centers for intelligent systems of vocational guidance of students.

Currently, there is a problem of effective vocational guidance of young people in a dynamic labor market and educational services. One way to solve this problem is to develop and implement intelligent Internet systems to support decision-making in choosing a profession. It is important to develop methods and models of software that allow to identify and develop human interest and abilities in certain professions or groups of professions, as well as to determine the degree of its suitability to master the chosen specialization before the stage of inclusion in social production.

Among the existing systems of vocational guidance, the most popular are test systems, systems of acquaintance with professional educational programs, special portals for identifying personal abilities and capabilities of the applicant. The most promising way to solve problems related to the reasonable choice of profession and future professional direction is the use of intelligent computer information systems based on the Internet, which comprehensively combines the functions of informing, consulting, evaluating and making recommendations on the optimal choice of professional direction.

The purpose of research is to develop a comprehensive method of determining the profession in accordance with personal abilities and capabilities of labor markets and educational services.

### Artificial intelligence and the possibility of its use in career guidance systems

Artificial intelligence has recently attracted more and more attention. Of all modern innovations, this one has the greatest potential to change our lives, make it more productive and optimized [2]. Consider a few examples of these technologies.

The experience of using artificial intelligence in the medical field will allow to form a special diagnostic module in accordance with the professions. This approach is especially important for professions in which the level of health of the specialist affects his professional ability.

Face recognition technology is used when test results are used to make recommendations to the prospective applicant about his learning opportunities and future profession.

Chatbots can be used to quickly and actively work with a large number of users, determining the main indicators by answering common questions.

Simulators of professional activity with use of technologies of virtual reality; situational cases, etc. [4].

Systems of interaction with the user allow to adapt design and content under group of users, to form convenient electronic information space for the further work [5].

Analytical modules of the career guidance system should contain intellectual knowledge bases that allow to form recommendations for choosing a profession based on systems analysis.

According to the architecture and specifics, the intelligent Internet system for professional orientation belongs to the class of open information systems. The information aspect of an open system can be characterized as its ability to exchange and interact with the entities of the environment and other systems based on unified methods, tools and protocols [8].

The general properties of open information systems are formulated as:

- scalability / scalability
- mobility
- interoperability (ability to interact with other systems)
- friendly interaction with the user, in particular - ease of management

As part of the information resource of the intelligent Internet system of professional orientation, we can identify the main functional components:

- data on types of professional activity, their content and features;
- data on educational institutions and their characteristics;
- statistical and analytical data on the labor market and employment opportunities;
- results of opinion polls, reviews, comments, recommendations, etc.;
- test questions for the assessment of professional suitability and assessment of personal qualities;
- knowledge base and rules for processing the results of testing, formation and justification of decisions on the choice of profession;
- statistical, final and reporting data on the results of the system;
- the results of the user's work in an online environment that offers professional tasks.

In fig. 1 presents a general scheme of the intellectual system of vocational guidance.

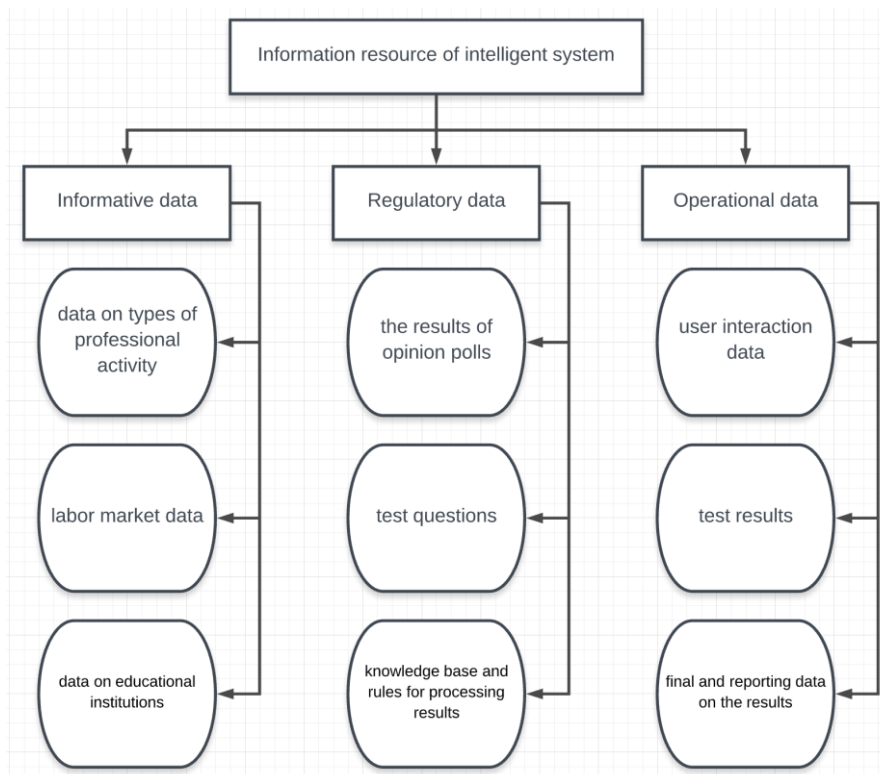


Figure 1 – General structure of the resource

The information resource of the intelligent Internet system of professional orientation can be described as multifunctional, heterogeneous and dynamic. This largely determines the peculiarities of its formation and further application in the functioning of the system.

### The main tasks and features of the functioning of the intellectual system of professional orientation

In fig. 2. the general scheme of decision-making on a choice of a profession is presented.

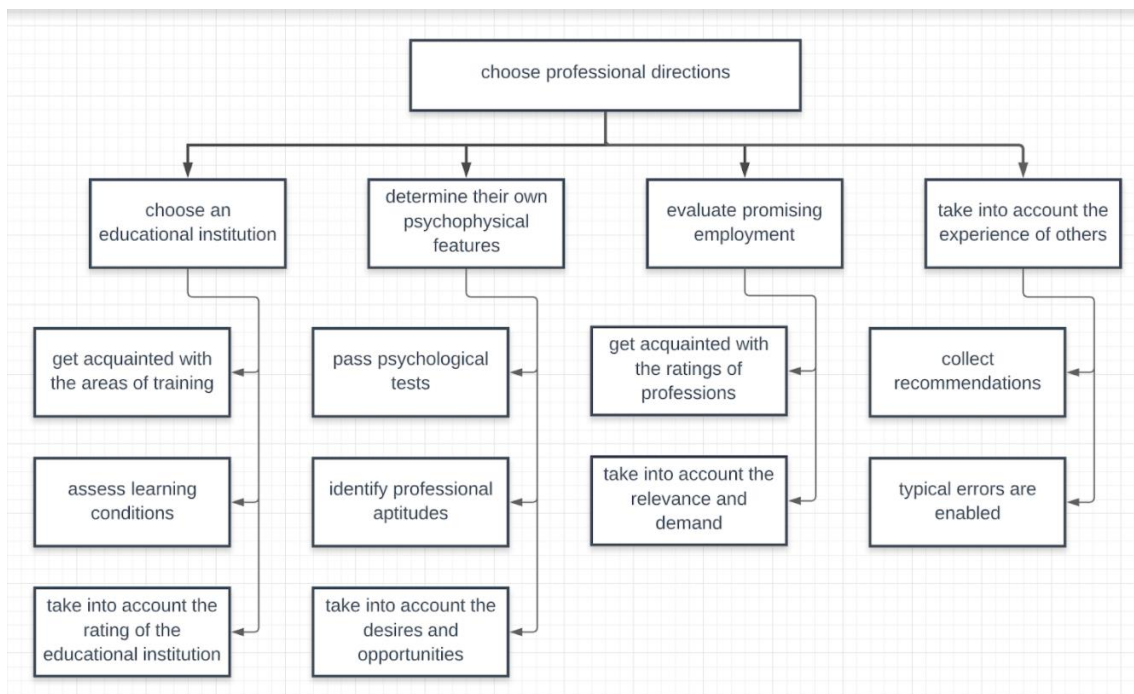


Figure 2 – General scheme of the decision-making process for the choice of professional direction

The main tasks that are solved in the process of functioning of the intellectual system of professional orientation are the following:

- analysis of the labor market and educational services of professions;
- determination of priorities regarding the type, industry, direction and features of future professional activity;
- updating of knowledge on the basis of evaluation and comparison of information about the possibilities of professional choice;
- testing for compliance with the level of training, skills, experience and individual characteristics of the chosen specialty;
- evaluation of test results, determination of the degree of compliance with the requirements of the chosen specialty and development of recommendations on a possible decision on the choice of specialty;
- determination of prospects and further actions of the applicant in case of decision-making on the choice of future professional direction.

Such a comprehensive system involves the user's work with information, tests and in a special environment, which is formed in accordance with simple professional tasks that the applicant can already perform without special knowledge. It is also necessary to determine the level of complexity of the user, the amount of tasks, the time to complete them. If the time to complete the tasks exceeds 30 minutes, it is advisable to divide the user's work into parts.

The basis for decision-making on the choice of professional direction is the operational comprehensive testing of the user. As a result of testing, he receives a generalized assessment of his qualities and abilities, as well as the percentage of suitability for a particular type of professional activity. According to the specified base of rules and test results, you can determine the necessary recommendations for each search engine.

One of the options for applying a quantitative scale for evaluating professional results suitability may be a system of measures of the following kind:

- from 0 to 10% - not suitable;
- from 11 to 25% - no more suitable than suitable;
- from 26 to 50% - more suitable than not suitable;
- from 51 to 100% - suitable.

The proposed numerical measures of the scale, in general, are evaluative in nature and do not describe the absolute value associated with suitability for a particular activity, but the general advantage of some factors of professional choice over others [3]. An example of a graphical representation of test results by areas is presented in Fig. 3.

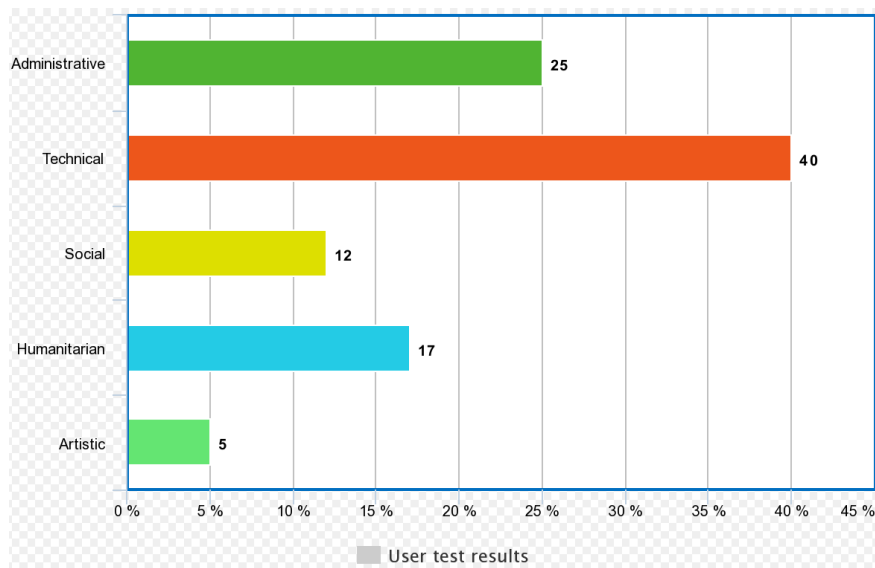


Figure 3 – Example of presenting user test results

Thanks to such a system a person can make the right choice of profession, reduce the time of its development, increase the productivity of professional results. The purpose of the system is to assist a person in choosing or changing a profession, taking into account his wishes, inclinations and opportunities, existing vacancies and employment prospects. The implementation of such a system can be carried out in the form of a mobile application.

Students install the application, register and fill out a minimum questionnaire: indicate the name, age, brief information about their studies, hobbies and hobbies.

Then proceed to view the cards, which will indicate information about different industries and professions. They are asked to choose a number of cards that they like [7].

Cards are dropped after the analysis of the specified data at registration. Artificial intelligence based on the user's favorite cards will ask them more and more similar questions in order to minimize their choice. So the user comes to the most appropriate areas that meet their criteria. The scheme of card submission is presented in fig. 4.

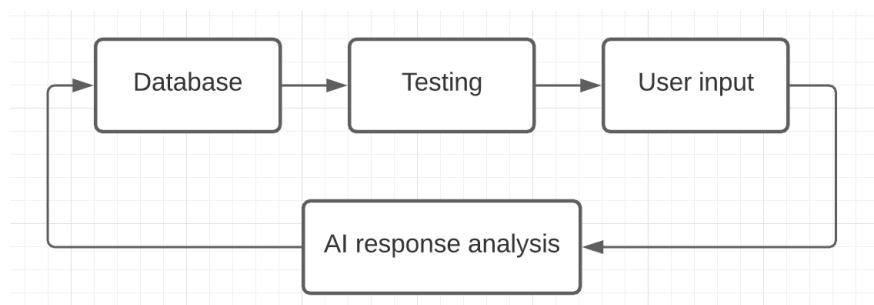


Figure 4 – Scheme of information supply

Artificial intelligence directly interacts with the user through card testing. Analyzing the user's answers, he gradually paints a portrait of the profession, which is ideal for this user, taking into account all the details. The first general testing allows to determine the direction in which the applicant can choose professions, educational institutions, try to perform simple professional tasks.

The obtained result allows one to form a profile of the applicant and to perform his analysis of its compliance with the profile of professions.

The development of tests should involve the use of methods to optimize their creation and testing [9].

The method of forming a complex information environment for a professional environment is based on the use of a multi-circuit general model. It consists of functional, emotional, motivating contours and provides

support for the user's decision-making on their own professional orientation. Such a system can be represented as an ontology of levels and contours. Similar to the known approaches to the formalization of a modular multilevel system of vocational guidance *ESP* [10] contains such modules as the initial information (catalog of professions and a brief description) *I1*; test initial block *T1*; block of presentation of separate educational programs (on establishments and / or faculties of one establishment) *Ed*; developed information block *I2* (with references to the cases of the enterprise; recruitment companies); developed test unit *T2*; unit for supporting the individual decision-making process *Sid*; support unit *Scd* collective decision (in case of decision making together with parents, friends, friends, experts, etc.).

$$ESP = \langle I1; T1; Ed; I2; T2; Sid; Scd \rangle \quad (1)$$

Each of the components must have emotional (*E*), motivating (*M*), functional contours (*F*)

$$KESP = \langle E; M; F \rangle \quad (2)$$

The proposed method involves the use of special content and mechanisms of user interaction with the system of career guidance and shaping the behavior of site visitors in accordance with the level of development of the contours. Scenario models allow you to assess the level of development of each circuit by modules. To do this, a matrix of correspondence  $m * n$  is formed, where  $m$  is the number of modules that can vary from 1 to  $l$ , and  $n$  is the number of circuits that can vary from 1 to  $k$ . After receiving the data of behavioral models, user surveys, you can assess the level of development of contours and the level of decision support according to *Amn* estimates.

<i>K/M</i>	<i>I1</i>	<i>T1</i>	<i>I2</i>	<i>T2</i>	<i>I3</i>	<i>Ed</i>	<i>Sid</i>	<i>Scs</i>	<i>ESP</i>
<i>E</i>	A11	A12	A13	A14	A15	A16	A17	A18	A19
<i>M</i>	A21	A22	A23	A24	A25	A26	A27	A28	A29
<i>F</i>	A31	A32	A33	A34	A35	A36	A37	A38	A39

The obtained estimates are the basis for the analysis of the efficiency of the system by individual modules and for decision-making on the choice of profession (*ESP*).

Thus, a comprehensive method of determining the compliance of personal abilities of the profession profile involves the use of the applicant of the following steps:

1. Definition of professions and formation of their professional profiles.
2. Testing for compliance with the professional direction.
3. Testing for compliance with the profession.
4. Testing for simple professional tasks.
5. Choice of educational institution.
6. Formation of a specialty profile in accordance with the educational institution and labor market data.
7. Obtaining recommendations for choosing a profession.

Depending on the scale of use of the information intelligence system of vocational guidance there is a need to form databases on the availability of specialties in educational institutions, identify features of professional programs, use databases of regional and state labor markets, the formation of individual modules of the system and the general complex [10].

### Conclusions

Research on the possibility of application and design of intelligent information systems of vocational guidance, as well as a general method of determining the professional direction for the applicant and the specialty in which he will study.

It is advisable to use the proposed systems in institutions such as schools, universities, courses, vocational training, employment and retraining centers; on the sites of educational institutions, psychological support for applicants. The proposed general architecture and method of determining the correspondence between the personal profile of the user and the profile of the profession is the basis for further research on the formation of knowledge bases of analysis of the profession, proposals of educational institutions and the labor market, the formation of brief recommendations for entrants.

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## КОМПЛЕКСНИЙ МЕТОД СТВОРЕННЯ ІНТЕЛЕКТУАЛЬНИХ СИСТЕМ ПРОФОРІЄНТУВАННЯ

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