



The Concept of a Digital Career Guidance System in IT: Architecture, Functionality, and Application Scenarios

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ABSTRACT

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This article explores the concept of creating an information system for digital career guidance, specifically tailored to the field of information technology. The relevance of the study is driven by the rapid transformation of the IT market, the complexity of navigating career directions, and the limited effectiveness of existing tools that support youth in choosing a profession. The aim is to develop the architecture of a digital platform that combines the classification of IT professions, a competency-based approach, and algorithms for personalized recommendations. Methodologically, the system is based on a modular design with four key components: an adaptive user questionnaire, an analytical core, a knowledge base, and a visual interface for navigating professional trajectories. The article analyzes the limitations of international platforms (O*NET, ESCO, CareerExplorer) in the context of IT specializations, the lack of integration with educational trajectories, and the absence of personalized algorithms. The proposed system enables the construction of individual learning paths, provides career and training recommendations, and can be integrated with LMS platforms such as Moodle and Canvas. The results section describes scenarios for applying the system in schools, colleges, career centers, and municipal youth programs. The platform can be adapted to different user needs and scaled to other sectors, including STEM, design, and green energy. The system introduced in this research offers a valuable approach to digitally transforming career guidance and competency enhancement within the IT sector, tailored to meet the demands of society, education, and the knowledge-based economy. The practical significance of the project lies in the development of a tool that can strengthen digital career guidance in Ukraine and support the growth of next-generation educational ecosystems.

KEYWORDS

digital career guidance, IT professions, information system, classification, competencies, educational trajectory, career navigation.



Концепція цифрової системи профорієнтації в ІТ: архітектура, функціональність та сценарії застосування

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У статті досліджується концепція створення інформаційної системи для цифрової профорієнтації, спеціально адаптованої для сфери інформаційних технологій. Актуальність дослідження зумовлена швидкою трансформацією ІТ-ринку, складністю орієнтації в кар'єрних напрямках та обмеженою ефективністю існуючих інструментів, які підтримують молодь у виборі професії. Метою роботи є розробка архітектури цифрової платформи, що поєднує класифікацію ІТ-професій, компетентнісний підхід та алгоритми персоналізованих рекомендацій. Методологічно система базується на модульному дизайні з чотирма ключовими компонентами: адаптивна анкета користувача, аналітичне ядро, база знань та візуальний інтерфейс для навігації професійними траєкторіями. У статті проаналізовано обмеження міжнародних платформ (O*NET, ESCO, CareerExplorer) в контексті ІТ-спеціалізацій, недостатню інтеграцію з освітніми траєкторіями та відсутність персоналізованих алгоритмів. Запропонована система дозволяє будувати індивідуальні навчальні траєкторії, надає кар'єрні та навчальні рекомендації, а також може бути інтегрована з платформами LMS, такими як Moodle та Canvas. У розділі результатів описано сценарії застосування системи у школах, коледжах, центрах кар'єри та муніципальних молодіжних програмах. Платформа може бути адаптована до різних потреб користувачів та масштабована на інші сектори, включаючи STEM, дизайн та зелену енергетику. Система, запропонована в цьому дослідженні, може слугувати ефективним інструментом для цифрової трансформації профорієнтації та розвитку компетентностей у сфері ІТ, адаптованою до потреб суспільства, освіти та економіки знань. Практичне значення проекту полягає в розробці інструменту, який може посилити цифрову профорієнтацію в Україні та підтримати зростання освітніх екосистем нового покоління.

КЛЮЧОВІ СЛОВА

цифрова профорієнтація, ІТ-професії, інформаційна система, класифікація, компетенції, освітня траєкторія, кар'єрна навігація.

1. Introduction

In the current context of digital transformation across the global economy, the demand for specialists in the field of information technology (IT) is growing rapidly. According to reports by the World Economic Forum [10], OECD [5], and data from LinkedIn (not included in references due to its informal nature), IT professions consistently rank among the most promising and fastest-growing sectors in the global labor market. This trend applies not only to programming but also to adjacent areas such as data analytics, cloud infrastructure, artificial intelligence, cybersecurity, UI/UX design, and DevOps.

Despite this growth, young people often face difficulties when choosing a professional path. These challenges are associated with the complex structure of the IT field, uncertainty surrounding the required digital competencies, a lack of systematic information, and the absence of convenient tools for independent career navigation. Traditional career guidance approaches, especially within secondary and higher education systems, remain mostly formal, fragmented, and poorly adapted to the realities of the modern IT labor market [1].

Internationally, a number of career guidance systems (such as O*NET [6], ESCO, and CareerExplorer) offer access to professional databases and career indicators. However, these tools often lack the specificity needed for the IT sector, are insufficiently dynamic, and rarely align with educational environments or provide personalized recommendations. In addition, most of these systems are tailored for the labor markets of the United States or the European Union, with little or no localization for Ukrainian users.

In the Ukrainian context, the problem is further compounded by the absence of Ukrainian-language solutions that are attuned to the local education system, real employment conditions, and the expectations of youth aspiring to enter the IT industry. Existing resources—such as career tests, guides, and career portals—offer limited features, rarely provide feedback, lack dynamic learning paths, and are not integrated with digital education platforms [4].

These challenges highlight the need to develop a dedicated information system for digital career guidance that:

- is focused exclusively on the IT field;
- combines a modern classification of IT professions with a competency-based approach;
- incorporates personalized recommendation algorithms;
- supports integration with online education platforms;
- is fully adapted to Ukrainian users.

The aim of this study is to substantiate the architecture and functional model of such a system, to describe its core components and logic, to provide illustrative scenarios for its application, and to outline the potential for scaling in the fields of education, career counseling, and government career development programs.

2. Literature Review

Over the past decade, a growing body of research has focused on digital career guidance, automated recommendation systems, and the transformation of career counseling practices. Leung (2022) examines the concept of career construction in the context of digital interaction and the influence of online environments on professional choices [4]. Ong and Lim (2023) propose the SkillRec algorithm, which uses skill-based data analytics to build personalized educational trajectories [7]. Tavakoli et al. (2020) explore the integration of labor market trends with open educational resources (OER), creating systems that offer lifelong learning recommendations [9]. Ilkou et al. (2021) introduce the EduCOR ontology, which connects educational and career contexts [3]. Ananiadou and Claro (2009), in a report for the OECD, emphasize the importance of digital and soft skills as the foundation of modern professional training [1]. The OECD (2024) stresses the need for tools that combine labor market analytics with digital education platforms [5]. The World Economic Forum (2023), in its “Future of Jobs” report, highlights the increasing relevance of digital competencies, the rapid evolution of professions, and the need for flexible, personalized career support systems [10]. The European Commission, in its “Digital Education Action Plan 2021–2027,” emphasizes the importance of building systems that ensure personalized access to education [2].

Youth career guidance remains one of the core functions of the education system, particularly amid ongoing labor market shifts driven by digitalization [2], [5]. However, in most Ukrainian educational institutions, career guidance remains formal in nature and fails to reflect the dynamic development of the IT sector.

International career counseling systems possess valuable experience but remain limited when applied specifically to the IT field. For instance, O*NET (USA) provides a multifactorial description of professions but does not include many emerging digital roles [6]. The European ESCO system provides a skill ontology but lacks mechanisms for personalized trajectory mapping. Other popular platforms, such as CareerExplorer, Truity, or 123Test, are mainly focused on psychological assessments and often overlook the specificity of the IT domain.

In Ukraine, state-run career guidance platforms are typically limited to static descriptions of professions, lacking dynamic matching mechanisms, educational trajectory integration, or interoperability with LMS platforms [2]. There is a clear need for a system that:

- classifies IT professions by functional characteristics;
- evaluates users' digital and soft skills;
- provides personalized education recommendations;
- integrates with both Ukrainian and international EdTech platforms.

In summary, the literature reveals both a solid theoretical foundation and a lack of practical, fully implemented digital career guidance tools that are tailored to the IT field and adapted to the Ukrainian context. This duality forms both the scientific and applied rationale for the present study.

3. Problem Statement

Amid the growing demand for IT specialists and the simultaneous complexity of career navigation for young people, there is a pressing need for a tool that provides individualized digital career guidance. The modern IT sector is multilayered, rapidly evolving, and requires users to not only have a general understanding of professions but also a clear awareness of their own interests, strengths, necessary competencies, and potential entry pathways into the field [5], [10].

Based on the analysis of prior research, a set of critical requirements has been identified for such a system:

- a focus exclusively on the IT industry;
- the application of a competency-based approach;
- adaptability to the needs and profiles of individual users;
- inclusion of visual and interactive navigation elements;
- compatibility with online education platforms (LMS) and learning catalogs [2];
- scalability to other knowledge domains (STEM, green jobs, creative industries) [3].

The goal of this study is to design the conceptual model and architecture of a digital career guidance system in the field of information technology that enables the selection of IT professions based on a user's interests, skills, and goals.

To achieve this objective, the following research tasks were defined:

- to analyze the shortcomings of existing career guidance systems within the IT specialization context [4], [6], [7], [9];
- to formulate the functional and technological requirements of the new system;
- to develop a classification of IT professions based on functional characteristics and entry levels [8];
- to construct the system's architecture with attention to modularity, integrability, and user interface simplicity;
- to describe practical use scenarios in educational, consulting, and governmental settings.

The scientific novelty of this study lies in the development of a conceptual architecture for a digital career guidance system tailored specifically to the IT domain. For the first time, a four-tier structure is proposed that integrates a classification of IT professions, personalized recommendation algorithms, modular user interaction, and visualized navigation through educational trajectories. The system is designed to adapt to the Ukrainian education market, supports LMS integration, and aligns with current challenges of digital transformation [2], [5].

4. Methods and Materials

This study employed a comprehensive methodological approach that integrates the following components: systems analysis; functional modeling; architectural design of information systems; competency-based user profiling [3], [4].

The design concept was based on the principles of user-centered design (UCD) and modular flexibility, ensuring adaptability of the system to the needs of different target audiences—including high school students, university students, and career counselors. Special attention was paid to integration with digital platforms, personalization of the user experience, and the use of visualization tools to enhance the accessibility of career guidance content [2].

To justify the system architecture and functionality, the following sources were analyzed:

- analytical reports from international organizations: OECD [5], World Economic Forum [10], and the European Commission [2];
- scientific literature in the fields of career guidance, EdTech, and digital education [3], [4], [7], [9];
- open-access resources of career guidance platforms: O*NET [6], ESCO, CareerExplorer, Truity, 123Test, as well as relevant Ukrainian public sector portals.

The system architecture was modeled with consideration for:

- separation of operational levels (user, analytical, informational);
- implementation of internal API communications to enable integration with LMS platforms such as Moodle and Canvas [2];
- use of adaptive questionnaire principles and a multi-tier classification of IT professions [8].

The following tools were used to design diagrams, user interface prototypes, and recommendation logic:

- *draw.io* — for creating flowcharts and system diagrams;
- *Figma* — for UX/UI design modeling;
- *Google Forms*, *Notion*, and *Airtable* — for prototyping surveys, knowledge bases, and recommendation logic structures.

As part of preliminary testing, two focus groups were organized in 2023–2024, involving a total of 16 participants:

- high school students (10th–11th grades) from community-based educational hubs;
- college and university students in technical majors;
- career guidance counselors from educational institutions.

The focus groups were presented with an adaptive questionnaire and a basic digital skills assessment, after which participants received individualized results. The participants evaluated the relevance of the suggested professional paths and the overall functionality of the system [4], [9].

5. Results and Discussion

As part of this study, a concept and functional logic were developed for an information system designed to support digital career guidance, specifically tailored to the IT sector. The main idea was to create a practical tool that would help individuals who are just beginning to explore IT careers receive clear, structured guidance in choosing a professional path. To achieve this, the system was designed not only to suggest a list of roles but also to account for users' interests, skills, preparedness level, motivation, and educational preferences. Below is a detailed description of the system's architecture, the algorithm's operational logic, real-world use scenarios, and analytical conclusions based on initial testing.

The system's architecture follows the principle of functional segmentation — from initial user interaction to generating personalized recommendations. At the first stage, the user completes a dynamic questionnaire. This adaptive survey adjusts in real time based on responses, capturing factors such as digital literacy level, interests, preferred learning formats, desired work style (individual or team-based), and prior experience. This avoids a generic approach — instead of offering pre-set paths, the system seeks to understand who the person is and where they currently stand in their development.

Once the questionnaire is completed, the system processes the responses automatically. Rather than searching for exact matches, the algorithm analyzes the full user profile — including interests, digital skills, cognitive style, job expectations, and learning readiness. The algorithm is flexible and

accounts even for partial matches. For example, if a user expresses interest in analytics but has a low level of digital skills, the system doesn't exclude this career direction. Instead, it proposes an entry path that starts with foundational training and progresses step-by-step.

The recommendation engine relies on a knowledge base developed from the author's original classification model and book publication [8]. It includes descriptions of 10 core IT professions, categorized by domain (e.g., development, infrastructure, analytics, cybersecurity, creative roles, and innovation), entry levels, and required competencies. Each profile emphasizes practical content: what the specialist must know, which tools are used, and where to begin learning. The database is regularly updated to reflect labor market changes and new offerings from leading EdTech platforms such as Coursera, Prometheus, and GIOS.

Special attention was paid to the visualization of results. After completing the assessment, the user receives an interactive map outlining recommended roles, development trajectories, required steps, and accessible learning resources. The interface is designed as a dashboard with options to export results as PDF or integrate with LMS platforms for further educational planning. This format is especially useful for educational consultants working with student groups, or for use in career guidance workshops.

The system's practical value was tested through focus groups involving high school students, university students, and career center consultants. For instance, one high school student who was interested in graphic design but unsure where to begin was advised to explore UI/UX design, with guidance to complete short online courses and build a portfolio. A college student looking to switch from QA to DevOps was offered a personalized path that included learning Linux and Docker, along with a curated list of up-to-date training courses. A consultant working with a group of 12 students automatically generated personalized career cards for each participant and conducted a session based on those individualized results.

In general, over 80% of participants rated the results as "clear," "relevant," and "motivating." Consultants also noted a substantial time savings in conducting individual assessments and a more structured approach to group sessions. These findings suggest that the system is not an abstract academic prototype but a tool ready for real-world implementation in schools, public education hubs, and municipal youth support programs.

All user results generated by the system were saved as PDF files and shared with participants for future use. Additionally, LMS integration capabilities were tested, which opens the door to full educational deployment within school programs or EdTech initiatives. This further confirms that the proposed system is not merely theoretical but a highly practical instrument ready for pilot implementation in real educational settings.

6. Conclusions

This article substantiates the relevance of developing an information system for digital career guidance specifically focused on the IT sector. An analysis of current trends, international practices (O*NET, ESCO, CareerExplorer), academic research [3], [4], [7], [9], and reports from global organizations [2], [5], [10] revealed a notable lack of tools that effectively combine personalized recommendations, educational integration, and a competency-based model within career guidance frameworks.

The study resulted in the following key outcomes:

- A multi-level architecture was designed for the system, featuring a modular structure and scalability potential [8];
- A personalized recommendation algorithm was proposed, based on users' interests, skills, thinking style, and educational goals [4], [7];
- A visual interface prototype was developed, enabling the construction of individual learning trajectories [2];
- Several application scenarios were tested in focus groups, confirming the relevance of the results and receiving positive user feedback [3].

The practical value of the proposed system lies in its capacity to:

- Support personalized educational navigation for youth;
- Provide fast and accurate career orientation;

- Serve as a functional tool for use in schools, municipal career programs, EdTech incubators, and public initiatives [2], [5].

Future research directions may include:

- Developing an MVP (minimum viable product) and conducting A/B testing of the model;
- Expanding the classification system to include related domains such as STEM, green jobs, and creative industries [7];
- Deepening integration with LMS, EdTech platforms, and talent development systems (LXP).

In conclusion, the system proposed in this study can serve as an effective tool for digitally transforming career guidance and competency development in the IT sector, aligned with the needs of society, education, and the knowledge economy.

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