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AN INTELLECTUAL INFORMATION SYSTEM FOR RANK-BASED SELECTION OF WEB PROGRAMMERS

The rapid growth of the digital economy and the increasing demand for high-quality web applications have intensified the need for skilled web programmers. The selection and evaluation of these professionals pose significant challenges, particularly for organizations seeking to balance technical proficiency, team collaboration, and alignment with project objectives. Traditional hiring methods often fail to address the complexities of evaluating candidates' multifaceted skills, leading to inefficiencies in recruitment processes and suboptimal project outcomes. As a result, the development of intellectual information systems for automated and objective evaluation of web programmers has emerged as a crucial area of study.

This article presents the conceptual framework of an intellectual information system for rank-based selection of web programmers. The proposed system integrates principles of artificial intelligence, machine learning, and multi-criteria decision analysis to ensure objective, transparent, and efficient evaluations. The core of the system is a multi-dimensional model that assesses candidates based on technical expertise, problem-solving skills, programming efficiency, adherence to coding standards, and soft skills such as communication and adaptability. A critical component of the system is its ability to dynamically weigh these criteria based on the specific requirements of a given role or project.

The primary goal of this research is to design a system that facilitates rank-based selection through objective scoring mechanisms, enabling organizations to identify candidates best suited to their specific requirements. By employing advanced data analytics, the system is capable of generating detailed profiles for each candidate, offering insights into their technical and behavioral competencies. Additionally, the system supports integration with corporate learning management systems (LMS) to provide targeted training recommendations for skill enhancement.

The intellectual information system proposed in this article represents a significant advancement in corporate IT education and human resource management. By automating and standardizing the evaluation process, the system not only reduces the time and cost associated with recruitment but also ensures a higher degree of precision in candidate selection. This innovation has the potential to transform the hiring landscape, fostering a more data-driven, equitable, and efficient approach to workforce development in the web programming industry.

Keywords: Intellectual information systems, Artificial Intelligence, IT education, IT assessment, Machine Learning

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ІНТЕЛЕКТУАЛЬНА ІНФОРМАЦІЙНА СИСТЕМА ДЛЯ ПОРАНГОВОГО ВІДБОРУ WEB-ПРОГРАМІСТІВ

Сьогодні автоматизовані системи управління персоналом являють собою потужні засоби для досягнення конкурентоспроможності будь-якого підприємства, зокрема ІТ-компаній. У сучасних умовах стрімкого розвитку інформаційних технологій та високої конкуренції на ринку праці, ІТ-компанії потребують інноваційних підходів до оптимізації роботи з прийняття управлінських рішень, зокрема відділу роботи з персоналом для підвищенні ефективності компанії в галузі ІТ. Запропоновано модель автоматизованої системи управління персоналом в ІТ-компанії, яка оптимізує процеси підбору, адаптації, розвитку та утримання ІТ-фахівців, використовуючи штучний інтелект та машинне навчання.

Ключові слова: інтелектуальні інформаційні системи, штучний інтелект, ІТ-освіта, ІТ-оцінювання, машинне навчання

Formulation of the problem

Intelligent information systems comprise a complex of unified methodological, psycho-pedagogical, logical-mathematical, and software-technical resources designed to support user activity through an extended dialogue in natural language. The modern global digital economy is based on the knowledge and values of the information society. The rapid development of information technologies necessitates IT professionals across all sectors of economic activity.

Additionally, software development and maintenance, along with IT services provision, depend on the quality of the programming team. Modern enterprises with their IT infrastructures require specialists who possess specialized knowledge and skills in information technology. The creation and maintenance of websites and web applications demand effective development and debugging, quality control, and testing, all of which fall within the professional competencies of web programmers.

Research indicates that qualified web programmers prefer to work in a collective of IT professionals, that is, in IT companies where there is an opportunity to engage in forward-looking IT projects, with new technologies and a transparent system for organizing professional activities.

Analysis of recent sources

IT companies are involved in creating and implementing IT products and services, where the work of programmers plays a pivotal role. According to studies [1, 2], the main portion of Ukrainian IT exports is comprised of IT service outsourcing.

Despite the substantial number of IT specialists annually trained by higher education institutions in Ukraine, the search for qualified web programmers remains a non-trivial task for IT companies. According to statistics provided by the DOU service, programmers account for 45% of the new professionals who entered the IT market during 2023, representing the majority compared to other technical and non-technical IT professions [3]. Additionally, DOU statistics indicate that 66% of new programmers entering the IT market in 2023 possess higher education. For the overall population of programmers on the Ukrainian IT market, this figure is 86%.

This underscores the necessity for active collaboration between IT companies and higher education institutions, particularly in facilitating the initial selection of potential candidates through internships, professional corporate training, and organized contractual cooperation with senior students who successfully complete internships and show promising results. In this way, IT companies prepare future contractors, ensuring a high level of professional compatibility with the company's processes and technical specifications.

Thus, the selection of qualified programmers, particularly web programmers, is one of the most complex and critical tasks for an HR manager in an IT company. The main challenge in selecting programmers is the objective assessment of hard and soft skills.

The requirements for candidates vary depending on the rank, team composition, type, and specifics of the IT project. The development of a methodology for the automated assessment of candidates for the position of web programmer supplements traditional interviews and provides an effective alternative for recruiting web programmers for various IT positions.

A new approach to training and selecting web programmers in IT companies has been proposed, which is based on artificial intelligence technologies and neural networks.

Managing the training and selection of programmers is a crucial aspect for the IT business, as effective personnel management strategies are a decisive factor in achieving success in the dynamic and demanding IT sector [4, 5].

Managing IT projects in IT companies requires consideration of the specifics of the information technology sector [6]. This is achieved through the following continuous cycle:

- Targeted management [7];
- Conducting individual interviews [8, 9];
- Technical testing [10];
- Evaluation based on professional outcomes [11].

These methods complement each other and collectively form a comprehensive approach to managing and evaluating programmers in IT companies.

Personal development plans for IT company professionals should consider the following criteria:

- Adaptation to the rapidly changing IT sector [12];
- Maximizing the potential of IT employees [13, 14];
- Reducing the turnover rate of IT staff [15];
- Stimulating innovation [16];
- Efficient resource management [17];
- Enhancing motivation.

Thus, the personal development of programmers plays a strategic role in achieving the business goals of an IT company. It is a tool that enhances the effectiveness of managing project teams, taking into account the specifics and demands of the modern IT sector [18].

In the field of intelligent information systems, several key figures stand out whose works have formed the foundation of modern research. Among them are Stuart Russell and Peter Norvig, authors of the seminal textbook "Artificial Intelligence: A Modern Approach" [19], which covers various aspects from logical programming to neural networks and is one of the most cited works in the field. Geoffrey Hinton, a pioneer of deep learning, has made significant contributions to the development of neural networks [20]. His colleague, Yann LeCun [21], developed LeNet, the first successful deep neural network architecture for image recognition. Michael I. Jordan [22], known for his research in machine learning, particularly in graphical models and Bayesian inference, has also made significant contributions to the field.

These scientific studies from the V. M. Glushkov Institute of Cybernetics play a key role in the development of intelligent information systems, promoting the implementation of innovative technologies in various fields from medicine to industry. These works reflect global trends and the contribution of local domestic scientists to the development of intelligent information systems, which is important for further research and implementation of these technologies.

Presenting main material

For the selection of web programmers in the modern IT market, various information systems and software products are employed to optimize and automate the candidate selection process. Among the most renowned and widespread systems are:

LinkedIn Recruiter - This system provides the ability to search, sort, and engage potential candidates based on a vast database of professionals. The use of machine learning algorithms allows for matching candidates to job requirements based on their professional skills, experience, and recommendations.

Hire by Google - This integrated Applicant Tracking System (ATS) enables companies to efficiently manage the hiring process, from tracking candidates to evaluating them. The system includes tools to automate routine tasks such as filtering resumes and scheduling interviews, utilizing data from other Google products like Gmail and Google Calendar.

Stack Overflow Jobs - This resource allows recruiters to find candidates among the developer community who actively participate in forums, solving complex technical issues. The system provides the capability to filter candidates based on their technical skills and experience using technology tags.

Learning Management Systems (LMS) play a crucial role in training and selecting web programmers, providing a comprehensive approach to learning and skill assessment. These systems not only facilitate structured learning with scalability but also allow for precise measurement and tracking of student competencies throughout the educational process. Thanks to the integration of innovative technologies such as machine learning and data analytics, LMSs enhance the optimization of teaching and assessment methods, enabling educational institutions and companies to more effectively select qualified web programmer candidates. This, in turn, improves the quality of professional training and promotes the development of highly skilled professionals capable of meeting the demands of a rapidly changing technological market.

Moodle represents one of the leading e-learning platforms capable of creating an adaptive learning environment based on a modular object-oriented dynamic principle. The system allows instructors to create comprehensive tests and quizzes focused on assessing technical skills, including programming. Additionally, Moodle supports the assignment of tasks that may involve code submission and provides tools for monitoring student progress, which is critically important for courses aimed at developing web programming skills.

OpenEDX is an open platform for massive open online courses, developed under the initiatives of Harvard University and the Massachusetts Institute of Technology. The platform enables the conduct of courses using automated tests for assessment, which are particularly effective in technical disciplines, including web programming. OpenEDX also includes peer assessment capabilities and data visualization tools for student performance, which facilitate deeper analysis of learning outcomes and provide feedback for optimizing educational processes.

A distinctive feature of modern approaches and tools for training and selecting web programmers is that the tools used in practice are not integrated with each other as an information system. Therefore, the development of an intelligent information system for the training and selection of web programmers remains a relevant task. This integration could streamline the educational and selection process, enhance the efficiency of training programs, and improve the matching of qualified candidates to appropriate IT roles, addressing the needs of a rapidly evolving tech market.

Web programming today is one of the most promising fields of activity for IT companies. In the modern world, every business requires visual identification on the Internet, corporate networks, and deep system integration to remain competitive in the global market.

Currently, there are no unified theoretical foundations or universally accepted industry regulations and standards that could unequivocally regulate the assessment of professional skills and abilities of IT specialists in the field of web development at the global level.

Instead, there are international standards, certification systems, and generally accepted but not strictly regulated approaches that cover part of the competencies and allow for the classification and assessment of the knowledge, skills, and abilities of a web developer. The methodological basis of web development is the scientific method of researching various programming languages, frameworks, libraries, component sets, and platforms.

The results of scientific developments in IT form the foundation of methodological principles for web programming. The methodology for selecting web programmers is based on well-known industry standards. The methodological basis for the selection of web programmers is the scientific method of researching all existing key standards, such as PSR, W3C, 1Z0-882, ISO, etc.

Thus, the basis of the system for selecting web programmers should be the requirements formed on a comprehensive scientific approach, which include the requirements for:

- Understanding basic technologies and protocols;
- Understanding algorithms;
- Understanding programming languages and frameworks;
- Understanding database technologies;
- Understanding typical approaches and practices for solving classical problems;
- Mastery of technologies and methods for team interaction;
- Possession of communication skills.

Such a set of professional skills should ensure team support for an IT project. The set of key industrial standards for web development is presented in Appendix A.

One of the key standards for training web programmers is the Drupal framework. Acquia Certification [23] is one of the leading certification programs for Drupal, an open-source content management framework and system.

To formulate the requirements for the knowledge, skills, and abilities of specialists in the area of backend development using the CMF Drupal framework, the Acquia Certified Drupal 10 Backend Specialist Study Guide [24]

was utilized. This guide outlines the essential competencies required for proficiency in Drupal backend development, ensuring that professionals are well-versed in custom module development, API integration, and performance optimization.

For knowledge, skills, and abilities related to database management, the MySQL 5.6 Developer certification standard (1Z0-882) [25] was employed. This certification assesses proficiency in SQL programming, database design, and the ability to manage MySQL databases effectively, which are critical for backend developers who need to integrate and manage data within web applications.

For addressing the knowledge, skills, and abilities related to project management, the ICAgile Certified Professional standard [26] was used. This certification ensures that IT professionals are equipped with the best practices in agile project management, fostering an environment that enhances collaboration, efficiency, and adaptability in project execution.

Collectively, such knowledge enables the determination of a web programmer's professional suitability, ensuring that they not only possess technical expertise but also the capability to contribute effectively to project teams and achieve organizational goals.

For the selection of web programmers using the developed intelligent information system, a skill structure was designed for profiles such as Drupal Backend Developer, Python/Django Backend Developer, and JS Frontend Developer. The gradation of professional levels among web programmers in IT companies creates a framework for assessing and developing technical skills, professional experience, and team collaboration abilities. The professional levels include Trainee, Junior, Middle, and Senior, each with distinct characteristics and requirements.

Below is a summarized table of the professional levels of web programmers, their skills, roles in IT projects, and areas of responsibility:

Table 1

Generalized characteristics of professional levels of web programmers

Level	Experience	Skills	Role	Responsibilities
Trainee	students or graduates	Basic knowledge in the chosen field, such as programming, testing, and system administration.	They work under the guidance of more experienced colleagues, perform simple tasks, and actively study to gain experience.	Minimal, focused on learning and developing their skills.
Junior	1-2 years	Good basic technical knowledge and some practical skills.	Perform relatively simple tasks under the supervision of more experienced colleagues.	Responsible for their specific tasks, begin to work more independently, but still need guidance.
Middle	2-5 years	Deep understanding of technical aspects, and ability to solve complex tasks.	Active work on the main parts of the project, less experienced colleagues can begin to manage.	Responsible for a significant part of the project, often contributing to technical solutions
Senior	over 5 years	High level of technical knowledge, strategic thinking, and ability to lead a project or team.	Take the lead in medium-sized projects, develop the architecture of simple projects, and solve complex technical problems.	Great responsibility for the success of the project, team management, and mentoring of junior specialists.

Career growth in the IT industry requires continuous education, development of technical skills, communication skills, project management, the ability to work in a team, and adaptability to changes in technologies and methodologies. The balance between soft skills and hard skills for a web programmer changes depending on the level of professional development, ranging from Trainee to Senior level. Here's how these dynamics of skills can be represented in Table 2.

The development of programmers, particularly web programmers in the IT industry, requires both systematic improvement of technical knowledge and the development of soft skills. These skills are crucial for managing IT projects, team development, and effectively interacting with clients and colleagues. This balance is key for comprehensive professional development in the IT field.

The methodology for constructing and operating an intelligent information system for the selection of web programmers has a hierarchical structure, where the primary element is knowledge control in accordance with an automated "Web Programming" course developed by the authors.

Table 2

Comparison of soft and hard skills of web programmers

Level	Soft skills	Hard skills
Trainee	Learning skills, openness to new knowledge, communication, and ability to work in teams	Emphasis is placed on acquiring basic technical knowledge and skills. Interns focus on learning programming languages, tools, technologies, and fundamentals of programming and systems analysis.
Junior	Communication skills, the ability to accept feedback, and the ability to work effectively in a team become more important. The ability to effectively solve problems is also important.	Continue to develop their technical knowledge as they begin to work on real projects, but still require some level of supervision.
Middle	Critical thinking, the ability to manage time and projects, and leadership skills begin to gain more importance. Middle specialists often start acting as mentors for younger colleagues.	They have deep knowledge in their field and can independently solve complex technical tasks.
Senior	At this stage, soft skills are critically important. These include strong leadership qualities, the ability to manage a team, developed communication skills to interact with customers and stakeholders, and the ability to effectively resolve conflicts.	Having broad and deep technical knowledge, they are responsible for high-level planning and strategic technical decisions in projects.

The educational environment offers a candidate for the position of a web programmer a set of automated services:

- Informational and reference services;
- Problem-solving from the course;
- Knowledge control by the system.

A decision-making system built on top of the automated educational course controls and manages the learning process and knowledge verification at all levels when working with the intelligent information system (see Figure 1).

This integrated approach not only standardizes the training and assessment of potential web programmers but also ensures that candidates are well-prepared to meet the demands of modern IT projects and corporate environments. The system's layered architecture allows for ongoing updates and adaptations to the curriculum and evaluation methods, reflecting the rapid pace of technological advancement in the field.

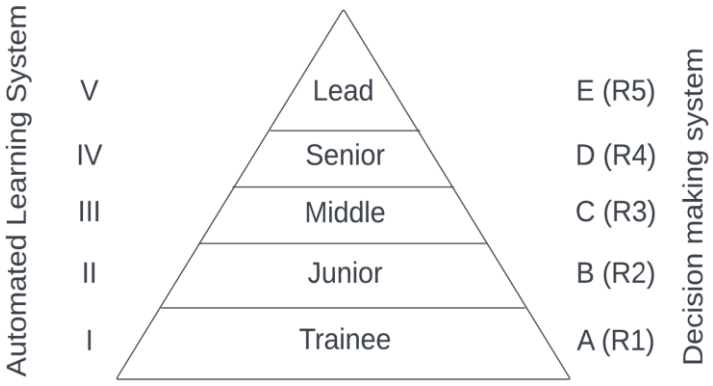

Figure 1: A multi-level model of an intelligent information system

The architecture of the automated educational course for the Intelligent Information System (IIS) is based on a five-level model of the learning process:

First Level (Trainee): contains educational content K1, which covers basic concepts of web programming designed for beginner web programmers at the Trainee level.

Second Level (Junior): contains educational content K2, which includes concepts of web programming, algorithms, approaches, and techniques suitable for the Junior level.

Third Level (Middle): contains educational content K3, which includes advanced concepts of web programming, optimization techniques, and features of frameworks and libraries, tailored to the Middle level.

Fourth Level (Senior): contains educational content K4, which encompasses advanced web programming concepts, design principles, optimization methods, and integration of web applications, intended for the Senior level.

Fifth Level (Lead): contains educational content K5, which includes high-level concepts of web development suitable for the Lead level.

Compared to the traditional model of selecting web programmers, the developed intelligent information system has demonstrated its effectiveness by:

- Reducing the duration of the recruitment cycle through the intensification and automation of the interview process.
- Lowering recruitment costs by automating the selection process.
- Enhancing the quality of candidates' knowledge and skills by expanding the initial applicant funnel and using automated selection of candidates.

This systematic approach not only streamlines the recruitment and training process but also ensures that candidates are better prepared and more closely aligned with the specific needs and challenges of modern web development roles.

As a result of the systemic analysis of the existing personnel management processes in IT companies, particularly with web programmers, key requirements were identified the boundaries of the automated system were determined, and the business processes were formalized. The research led to the proposal of a high-level structure (see Fig. 2) which was developed in accordance with the C4 notation [27].

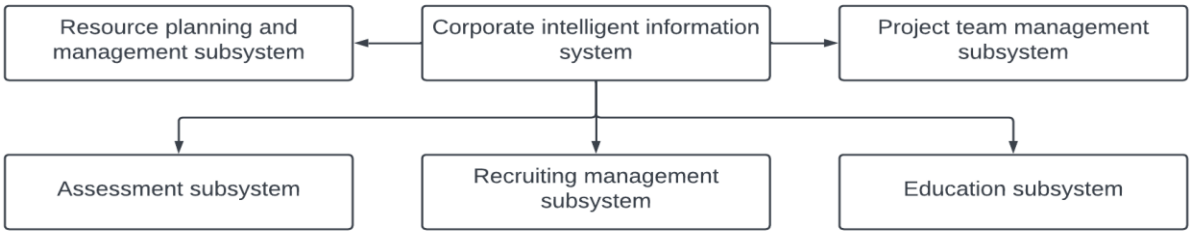

Figure 2: The structure of the intelligent information system

The application of machine learning algorithms and artificial intelligence for automating and optimizing staff selection processes, analyzing employee performance effectiveness, and predicting training and development needs has enabled the integration of AI technologies into the information system. This integration was accomplished using AutoGPT technology, which leverages OpenAI GPT-4 [28] as a technological foundation for implementing data analysis processes and supporting decision-making.

Integration with external systems such as ERP (Enterprise Resource Planning), CRM (Customer Relationship Management), and other IT resources of the company ensures data integrity and efficient resource management. Based on previously defined boundaries, cross-system integration was performed (see Figure 3).

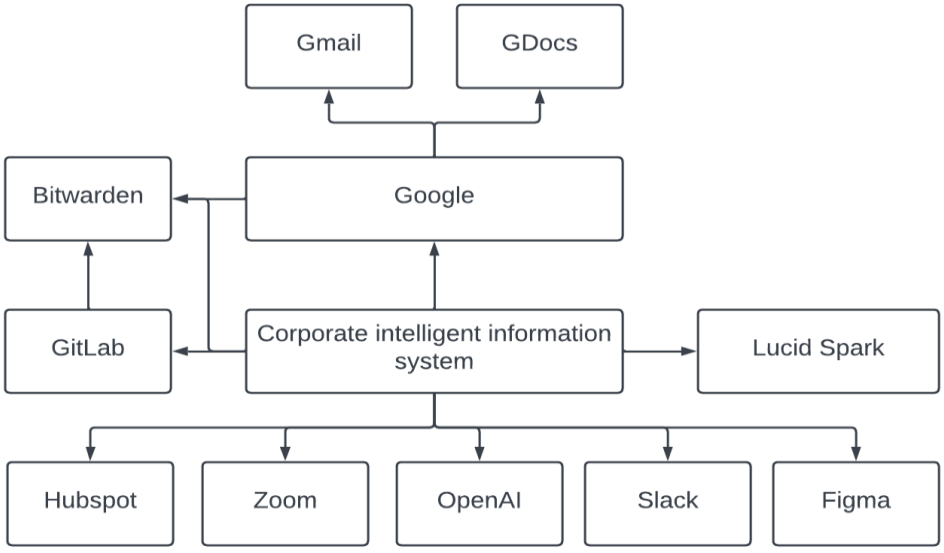

Figure 3: Scheme of integration with external systems

The intelligent information system that was developed has been integrated with various cloud platforms to enhance its functionality and streamline communication, data management, and project coordination within the IT company. Here's a breakdown of the integrations:

- HubSpot: Integrated as a CRM platform to manage sales and client communications efficiently. This integration allows the system to access customer interaction data, which can be used for analytics and improving customer engagement strategies.
- Slack: Used as a communication platform for management and project teams. This integration facilitates real-time communication and collaboration, making it easier to manage project workflows and internal communications.
- Zoom: Integrated for organizing video conferences. This enables the company to conduct remote meetings, interviews, and discussions effectively, which is particularly useful for teams that operate in different geographical locations.
- Lucid Spark and Figma: These platforms are used for prototyping and visual prototyping, respectively. Integration with these tools allows for seamless design and review processes, where design teams can collaborate and share their work directly through the intelligent information system.
- Bitwarden: A secure platform for managing protected data repositories. This integration enhances the security of sensitive data by ensuring that all credentials and important information are stored in a secure, encrypted format and are accessible only to authorized personnel.
- GitLab: Integrated as a code management and continuous delivery platform. This allows the system to handle source code management, automate the build and release processes, and monitor the deployment pipeline, ensuring that development practices are streamlined and efficient.
- Google Mail and Google Documents: These Google Cloud platforms are used for managing emails and documents. The integration ensures that all correspondence and document management tasks are centralized, providing easy access and collaboration capabilities.

In addition to these integrations, a robust and scalable database architecture was developed to ensure a high level of security, availability, and performance in data processing. This comprehensive approach to data storage is shown in Figure 4 of the system's documentation.

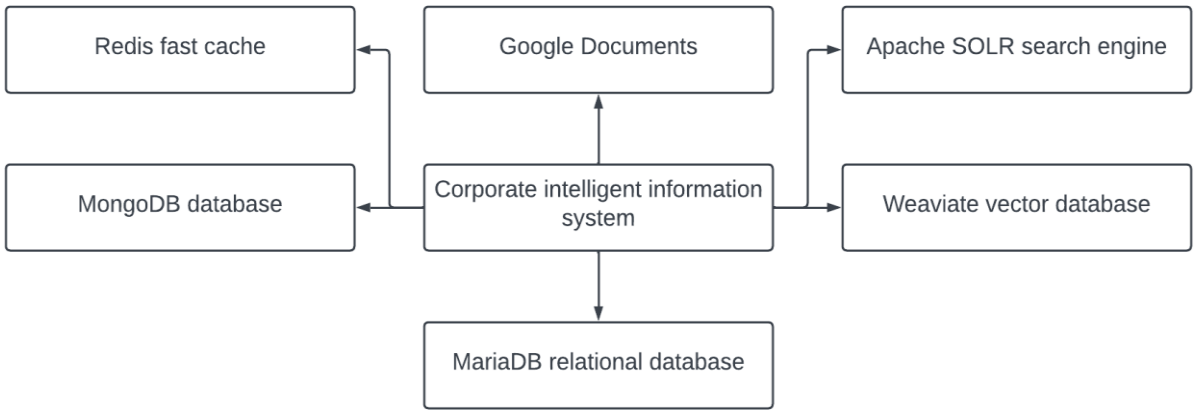

Figure 4: The structure of data management in an intelligent information system

This architecture not only supports the efficient storage and retrieval of data but also integrates with the aforementioned platforms to ensure that all data, whether it be emails, documents, or customer information, is managed in a coherent and integrated manner.

By leveraging these integrations, the intelligent information system offers a holistic solution that supports various aspects of the IT company's operations, enhancing overall efficiency and productivity.

An automated system developed by the author is used to test the knowledge of elementary web programmers, which is an integrated environment that allows for interaction between the candidate and the recruiter.

The evaluation process is stepwise and consists of four main stages:

- formation and filling of the questionnaire of technologies;
- test generation and passing;
- test check;
- report validation and delivery of results.

The process of filling out the questionnaire therefore does not require additional knowledge, skills, and abilities from the web programmer (Figure 5):

An additional tool for analyzing the results of both the web programmer himself and his mentor and manager is the report, which is formed in the questionnaire, and is the primary tool for reflection and primary conclusions for making changes to the personal development plan.

Skill	Level	Statement	Weight	Score	Status
PHP					
Basic syntax	50%	**0%** - Completely do not understand about PHP syntax **25%** - General understanding about PHP file sructure, defining variables, basic syntax, basic operators **50%** - understanding pricipals of basic outoput with print/echo **75%** - understanding of principals of commenting and formatting **100%** - understanding using "include", "require", "require_once", understanding constants	Required	0.5	Passed
Conditional operator if	50%	**0%** - Do not understand conditional operator **25%** - Understanding how to use simlpe contitional operator **50%** - Understanding how to use full statement if - elseif - else **75%** - Understanding Ternary operator **100%** - Understanding conditional operator micro-optiomizations	Required	0.5	Passed
Switch operator	50%	**0%** - Do not understand conditional operator **25%** - Understanding basic statement **50%** - Understandsing full statement **75%** - Understanding optimal distribution of the selectors **100%** - Understanding effective usage if / switch	Required	0.5	Passed
Cycles: for, foreach, while, do-while	25%	**0%** - Do not understand conditional cycles **25%** - Understanding for and foreach cycles **50%** - Understanding for, foreach, while, do-while cycles **75%** - Understanding incremental and decremental cycles **100%** - Understsnding cycles micro-optimizations	Required	0.25	Failed
Functions and arguments	25%	**0%** - Do not understand functions **25%** - Understanding functions definition syntax **50%** - Understanding passing arguments, returning results **75%** - Understanding default arguments, passing by value and reference **100%** - Understanding recursive functions	Required	0.25	Failed

Figure 5: The structure of the questionnaire for the initial assessment of knowledge (hard skills) of the candidate

As we can see from Figure 6, the report allows you to evaluate the relationship between the results of the programmer's self-assessment, the mentor's assessment (optional), and the basic minimum required level of knowledge determined by the competency matrix. Visualization of the results of the assessment analysis allows even novice web programmers who do not have deep knowledge in the field of management and personnel development to make preliminary decisions.

Module	Total	Status
PHP	6.45	Failed
PHP OOP	3.8	Passed
Databases	2.5	Passed
Drupal Site Building	5.7	Passed
Drupal API & Development	5	Passed
Drupal Theming	2.05	Passed
Drush	0.5	Passed
Git	0.5	Passed
Docker & DevOps	0.5	Passed
Solution Providing	1	Passed
Total status:	28	Failed

Assessment results

Module	Total	Status
PHP	5.75	Passed
PHP OOP	3.8	Passed
Databases	2.5	Passed
Drupal Site Building	6.25	Passed
Drupal API & Development	4.75	Failed
Drupal Theming	2.05	Passed
Drush	0.5	Passed
Git	0.5	Passed
Docker & DevOps	0.5	Passed

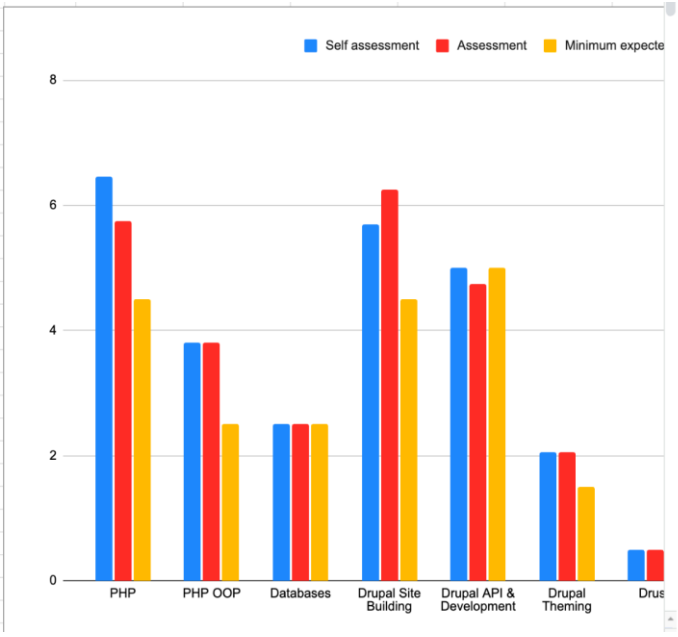

Figure 6: The structure of the report of the comparative analysis of the results of the survey

The subsystem for evaluating the knowledge of web programmers, integrated into the intelligent information system, was implemented on the basis of the OpenEDX framework and was developed in order to provide an effective, flexible, and scalable assessment of students' competencies.

The main attention during the development of the intelligent information system was paid to the automation of assessment processes, the integration of modern programming technologies, and ensuring a high level of adaptability to the individual characteristics of each student's education.

Conclusions

As a result of the analysis conducted on contemporary methods and means of developing intelligent information systems, the content of training for web programmers, general principles of training programmers in the specialty of 121 Software Engineering, general principles of team development of IT projects, methodological and scientific aspects of programming knowledge, and multilevel presentation of knowledge for training and selecting web programmers, the following tasks have been resolved:

- An intelligent information system has been developed using AutoGPT artificial intelligence technology for analyzing the professional competencies of web programmers, the dynamics of initial and intermediate assessments, and the automated formation of their professional IT development plans.
- AutoGPT artificial intelligence technology has been applied to IT projects for solving the multi-criteria optimization problem of forming project teams.

- Developed an intelligent information system using AutoGPT artificial intelligence technology to analyze the professional competencies of web programmers during the training and selection processes in an IT company; evaluated the dynamics of the results of initial and intermediate assessments of web programmers, and automated the formation of their personal professional IT development plans.
- A hard skills matrix for Drupal developer profiles at trainee, junior, middle, senior, and lead levels was developed.
- A matrix of weight coefficients was applied as a digital means to determine the importance of skills and competencies for effective decision-making regarding the level of knowledge, abilities, and skills across grade/competence and differentiated assessment according to the title.
- The competency matrix for IT professionals was enhanced by introducing a ranking of web programmer competencies across grades/competencies.
- The mathematical model for decision-making in an IT company was enhanced to utilize the matrix of weight coefficients.

The developed intelligent information system facilitates the automation of various forms of educational activities for multilevel training of web programmers and automates the process of selecting web programmers for positions such as trainee, junior, middle, senior, and lead web programmer in IT companies.

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