DEVELOPMENT OF A COMMON INFORMATION SYSTEM TO CREATE A DIGITAL CAREER CENTER TOGETHER WITH PARTNER HIGHER SCHOOLS

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Abstract. The purpose of the report presented by the authors is to present a methodical development of a software product and the sequence of its implementation to create a common information system of career centers in Technical University of Sofia and the partner organizations. In fulfillment of the contract BG05M2OP001-2.016-0008-C02 "Innovations, Science and Education for high quality and compliance with the labor market" at the Technical University of Sofia and Partnership (INNOTECH PRO), the goal is to create a single Digital Career Center (DCC), to create a single network by upgrading and modernizing the electronic platforms used so far by the partner higher schools.

Through career counseling and guidance and the creation of a Digital Career Exchange (DCE) to give students, graduates, alumni and doctoral students more detailed information and opportunities to find the right job position for each.

Keywords: Software product; General information system; Digital Career Center (DCC); Digital Career Exchange (DCE)

1. Need to create DCC for communication and joint activities with business

Technical University of Sofia (TU-Sofia), in its capacity as a Beneficiary under the INNOTECH PRO project, is creating its own platform for servicing career development centers.

The purpose of the creation of the DCC is to assist students in real time in providing the most suitable offers when choosing vacant and/or new jobs. DCC is also the basis of career assistance for students for internship programs and internships, and for graduates - assistance in finding the most suitable job for them depending on their professional direction, skills and interests. The center will provide information on all fast-growing and high-tech companies in the country, offering a huge selection of opportunities in every technology and/or business sector.

DCC is the main organizer and together with its partner universities – University of Chemical Technology and Metallurgy (UCTM), Technical University of Gabrovo (TU-Gabrovo), Moscow State University and "Angel Kanchev" University of Ruse (UR) provides various educational initiatives for the preparation of suitable personnel in any technical and/or economic field.

The goal of the creation of the DCC is that students can in real time:

- to get advice on which companies to go to when opening the career exchanges in their desired area of development;
- to receive up-to-date information about when and where career fairs will be held in an online meeting;
- to give them the opportunity to receive professional guidance through tests;
- to receive assistance from experts from the DCC in preparing the necessary documents for applying to the career exchange;
- to receive basic guidelines when conducting interviews at the career fair with potential employers, etc. [Yordanov 2023];

The proposed **structure of the DCC** covers the following more important functional activities:

- Information about DCC;
- Announcements;
- Application documents;
- Consultations:

– Separate virtual halls by areas/areas/sectors

- List of employers – grouped by industry;
- Career exchange – button for quick connection in an online environment;
- Chat for quick connection for consultation with experts and employers;
- Discussion forum;
- Frequently Asked Questions
- Team;
- Contacts.

The platform also provides a student tracking system, which includes the following modules:

- **Module 1 "Students"** – aggregates data from an existing academic system for: studied disciplines, credits, courses, etc.
- **Module 2 "Employers"** – aggregates information about employers, job vacancies, working conditions.
- **Module 3 "Educational content"** – collects and analyzes data on curricula, courses, acquired knowledge, provides a connection between attendance at classes and their content, etc. An automated connection with educational platforms and digital learning environment of the Higher Education Institution is foreseen.

● **Module 4 "Realization"** – aggregates data on the career realization of students in the first year after graduation.

The online career development platform provides:

1. Possibility of customized design;
2. Administrative panel with the possibility of unlimited accounts;
3. Mobile interface for all functions;
4. Possibilities to manage students, contacts and companies;
5. Possibilities for one-time integrated identification of users;
6. Possibilities for working with online payments (donations, fees, etc.);
7. Individual and batch sending of e-mail;
8. Update of internship and work announcements with the possibility of notification of positions sought by the user;
9. Integration with the announcement system of external organizations;
10. Options for charging fees for various searches, ads, etc.;
11. Support of online career events;
12. Maintenance of event listings of external companies;
13. Possibility of video interviews in a controlled environment, etc.

2. Need to conduct digital career exchanges (DCE)

The main goal for the periodic conduct of the DCE is, through the permanent partnership of TU – Sofia with a number of digital agencies and industrial companies, to assist its students in their realization as successful experts in the relevant engineering and business sphere, depending on their preferences and goals.

At the career fair, students are expected to:

● meet in an online environment with potential employers;
● submit their documents;
● can ask questions and receive answers from the specific potential employer;
● can easily find out which company to target, with potential employers grouped by areas/sectors, etc. (Sterev 2023).

The proposed structure of the **career exchange** covers:

➢ Online employers – list;
➢ Quick Connect Button – What is it looking for? where? (district, city); direction (management, finance, mechanical engineering, etc.)
➢ Search – the student searches in detail according to criteria set by him;
➢ **Employers by areas/regions:**

In this section, employers are selected by sector and by region, so that students can easily find out which of them to target. The information needs to be periodically updated, and only those organizations that have applied for participation in the career exchange should be available, and those that will be in another period of time should be visible, but inactive.

Each business organization that participates is encouraged to have its own video to inspire students to apply for the given position.

Every student should be able to ask questions and receive timely answers from the employer to the questions asked.

Every single business representative must have published clear and transparent criteria for this:

- who can apply;
- necessary documents;
- where they are sent;
- term;
- feedback to the student - approval/rejection, again indicating the time frame in which they should receive the notification.

Students should be able to downloa for example - business cards, online catalogs, flyers and brochures that companies typically present at career fairs,

- ➢ Chat;
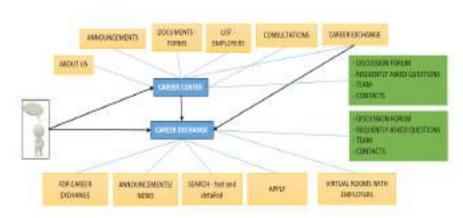- ➢ Announcements;
- ➢ Contacts.

In fig. 1 shows the relationship between student, career center and career exchange.

Source: Custom graphics

Figure 1. Connection – student, career center, career exchange

In fig. 2 shows the detailed relationship between student, career center and career exchange.

Figure 2. Detailed relationship between student, career center and career exchange

Figure 2 shows the detailed relationship between the individual activities. Anyone can directly visit the career fair if they are fully aware o where they want to apply and what documents they need to have (for example, if they have already participated). In this way, it is not necessary to use the services of the career center. If, however, the student is participating for the first time, he must first go through the career center. Through the **"About us"** button, he can familiarize himself in detail with the activities of the DCC, and accordingly be aware of what opportunities for assistance he can expect and how this will be useful for him. In the announcements, the candidate will be able to find relevant news about upcoming Digital Career Exchanges (DCE), upcoming live events that are held in relation to things like how to prepare documents, interview guidelines, etc. (Morris et al. 2013, Dimov 2013, 2022)

3. A practical study on the creation of software for a digital career exchange and a digital career center

The need to create such software was born out of conversations between professors and students. According to a study carried out at the university, 93% of students indicate that they find it a disadvantage that there is no established platform where they can meet companies and apply for internships, as well as receive career guidance advice. The other reason for creating such a platform was due to the fact that many majors require coursework and course projects that are based on real data from companies.

For construction, an inquiry was conducted with a survey in which 136 students from various professional fields of educational and qualification degrees – bachelor's and master's - participated. For the study, the following questions were asked in the survey with the applied Likert scale from 1 to 5:

Question	1	2	3	4	5
1. Are you satisfied with your studies?					
2. Do you find internships through the university?					
3. Do you find the necessary career guidance at the university?					
4. Do you find companies to assist with real data for your coursework and projects?					
5. Do you consider it necessary to build a platform for finding internships and career guidance?					

Rating scales: 1 – Strongly disagree; 2 – Disagree; 3 – Undecided; 4 – Agree; 5 – Strongly agree

Results of the survey are presented in the following table:

Question	1	2	3	4	5
1. Are you satisfied with your studies?	2,00%	9,00%	7,00%	62,00%	20,00%
2. Do you find internships through the university?	63,00%	33,00%	2,00%	1,00%	1,00%
3. Do you find the necessary career guidance at the university?	18,00%	76,00%	3,00%	2,00%	1,00%
4. Do you find companies to assist with real data for your coursework and projects?	27,00%	65,00%	1,00%	5,00%	2,00%
5. Do you consider it necessary to build a platform for finding internships and career guidance?	0,00%	1,00%	3,00%	4,00%	92,00%

WApart from helping to find internships, career guidance for learners, the other advantage of introducing such a survey for the university is that it can receive reliable feedback at any time from the business to monitor the general preparation of the students for the real world of work. environment as well as in what directions for improvement it should work. The business can also expand the horizon for discovering new specialties.

From another point of view, teachers can also be very good consultants in business and thus will always have the necessary practical insight into the disciplines they lead. In this way, the quality of education will be significantly improved, from another point of view, it will be possible to attract many more prospective students. Any university offering such a close relationship with business becomes extremely competitive because it offers three main things - quality of education, practical training, prestige. By completing their training, everyone will feel adequately prepared for the real work environment.

4. Methodological consistency in the development of a software product for the creation of DCC and SCB

4.1. Architecture

The IT platform is a web-based application that is implemented with the three-tier architecture MVC framework based on PHP and mariaDB.

MVC is an abbreviation of model-view-controller and is a widely used design template in software development. It is based on the separation of business data and processes from the graphical interface. He is widely involved in the development of web-based information systems. The abbreviation of the template comes from the main modules of interaction:

- Model: The model represents the data that is exchanged between the application and users. These data are structured in a model, with validation rules of different types attached to them. The model is the basis of an application, as it contains the basic information needed for communication between a user and a system.
- View: The view is the visual representation of the data. It is only on the users' side and its change does not affect the consistency or validity of the model data. In the web, it is important that the view can be easily changed to meet the requirements and expectations of users.
- Controller: The controller is the part of the application that knows which data model with which view to be visualized to users. It is the connecting link without which the system cannot function.

All modules of the vertical infrastructure have been built using an interface design approach reducing dependencies between modules and components. This reduces the risk that changes to a module will lead to unexpected changes to other modules. This also leads to greater flexibility in adding modules, replacing modules and changes in the operation of individual modules.

In the design and development of the system we have followed SOA-Service-oriented architecture.

Layer	Description
Users	This is the entry point for the users of the application. Provides different channels for access to applications.
Business processes	Responsible for providing services.
Services	Components provide business services A business process uses the services at a certain stage in the course of execution.
Components	The components are responsible for the implementation of business services. There are two types: functional and technological. The former realize the functional requirements. Technological components are a set of libraries and support functional components.

Existing applications and data	Existing applications - systems that are under the control of the system under development and with which the developed application must exchange information. Data - physical organization of data in the form of databases, schemas, tables, views, index files, file system, etc. Also includes DBMSs, operating systems, virtual machines, etc.
Integration	Through the building blocks in this layer, the integration of the various modules is carried out, as well as the connection with external systems. Implements virtualization of services, converts data from one format to another and exchanges information using different protocols.
Quality of the offered Services (QoS)	Functionality related to identification, authorization, access to system resources, monitoring, system journal, services for verification of entered information, etc.
Information model	Data Access Management, Logical organization of data, meta-data, nomenclatures, archiving. Generate reports. Data extraction, transformation and loading (Extract-Transform-Load) from a variety of information sources
Management	Responsible for administration and business monitoring of components, lifecycle support of business services.

4.2. User interface

The functionalities of the user interface of the System are designed to be independent of the Internet browsers and devices used by users, provided that the latter are versions during the maintenance period by the respective manufacturers.

The System's public web pages are designed, developed and optimized for efficient and fast indexing by search engines in order to promote among users and improve search ability by keywords and phrases. In the development of the pages and in the preparation of the automated procedures for the deployment of a new version of the System, we have used tools to minimize and optimize the size of the source code (HTML, JavaScript etc.) in order to reduce the volume of files and faster loading of pages. (Istatkov 2018)

We have used the harmonized standard version EN 301 549 v3.2.1, accessibility of ICT products and services.

4.3. Digital career center

The Digital Career Center (DCC) contains the following sections:

DCC information – provides static information that can be managed through the administrative part of the system.

Notices – provides dynamic information in the form of news arranged by last publication, which can be managed through the administrative part of the system

Application documents – provides ready-made templates of CVs, job application recommendations that can be managed through the administrative part of the system.

Discussion forum – provides an opportunity for registered users to share information or ask questions – managed by the administrative part.

List of employers – provides a register of employers who are registered in the system, with over 1400 so far.

Frequently Asked Questions – provides functionality for searching for static questions and answers that can be managed through the administrative part of the system.

Team – in this section is visualized the team of Career Center TU – Sofia.

Contacts – provides functionality for contact form with Career Center TU – Sofia.

4.4. Digital Career Center (DCC)

This section presents information about the career exchange and the opportunities it provides, how it functions and what results can be achieved.

There is an opportunity for students, graduates, alumni and PhD students from all partner universities more detailed information and finding the right job for each job in each city in Bulgaria, different types of work: temporary, permanent, part-time and others. Users can choose different types of filters to facilitate their search for a suitable position, and the system offers functionality for subscribing the published new positions by e-mail.

4.4.1. Employers

In search you can find the specific employer and has the same functions as in DCC, but has additional extensions, such as: information when this employer has participated in a career boss event and when one will be forthcoming, if there is information about announced positions and ways to apply, including the option to attach a CV and a cover letter in a *.pdf format.

It is envisaged that the applicant will receive an email notification that he has sent his application successfully. Accordingly, it is envisaged that he will receive feedback on how soon he will be notified of his approval or disapproval.

In virtual rooms with employers, the presence is required with a camera, with a reliable connection provided.

Discussion forums are provided for both activities in which students will be able to ask their questions and have an open discussion.

The "chat" function is set to ask a specific question that requires a short answer, such as: When will there be a next career exchange event? – Answer: 28.11.2023 at 16:30 at link: https://abc.com

Contacts show the team that participates in the respective activity with their coordinates indicated.

4.4.2. Candidates

Employers are given the opportunity to find students, graduates, alumni and PhD students from all partner universities with information about the appropriate knowledge for them, studied specialties from each city in Bulgaria. Employers can

choose different types of filters to make it easier to find the right candidate.The system provides an opportunity for students, graduates, alumni and PhD students from all partner universities to enter specific information in their profiles in order to facilitate the search for Employers.

Additional functionality that the system provides is the generation of a digital resume from the entered user data.

5. Conclusion

The common information network provides information and analysis in two directions:

From higher schools to employers – data on the current state of the educational process, etc.;

From employers to higher education institutions – available and planned job positions (temporary, permanent, internship, etc.), etc.

The two systems work simultaneously on a common network disk array, acquired and administered by TU – Sofia.

The software product is fully installed and configured with the full version on the Beneficiary's server equipment. Specialists from the three partnering higher schools were trained – UCTM; Moscow State University; University of Forestry (UF) and UR, which started entering and transferring data and information to the updated website for career center and career exchanges. Continuous monitoring and analysis of attendance is done; visitor statistics by time, location, browser used, etc. It is monitored for anomalies in the functionality of the hardware and software and for the timely removal of any deficiencies.

Acknowledgements

REFERENCES

DIMOV, D., 2013. Prouchvane sred rabotodatelite za umeniJata na kandidatite i vazmozhnostite za karierno razvitie. *XI MNK „Menidzhmunt i inzhenering ,13". Sozopol*, pp. 409 – 418. ISSN 1310-3946, ISSN 1314-6327. [in Bulgarian].

DIMOV, D., 2013. Prouchvane sred rabotodatelite za umeniata na kandidatite i vazmoshnostite za karierno razvitie. *XI mezhdunardona nauchna konferencia "Menidzhmant I Inzhenering'13*, Sozopol, pp. 409 – 418. ISSN 1310-3946, ISSN 1314-6327. [in Bulgarian].

DIMOV, D., V. TOSHEVA, 2022. Prouchvane otnosno onlajn platformite i metodite za tarsene na rabota, XX *mezhdunardona nauchna konferencia "Menidzhmant I Inzhenering „22"*. Sozopol, pp. 110 – 115. ISSN 1310-3946, ISSN 1314-6327. [in Bulgarian].

DIMOV, D., V.TOSHEVA., 2022. Prouchvane otnosno onlain platformite I metodite za tarsene na rabota, *XX mezhdunardona nauchna konferencia "Menidzhmant I Inzhenering"'22*, Sozopol, pp. 110 – 115. ISSN 1310-3946, ISSN 1314-6327. [in Bulgarian].

YORDANOV, D., 2023. Toolkit for Assessing Entrepreneurial Competencies Among Learners. *Strategii na obrazovatelnata i nauchnata politika – Strategies for Policy in Science and Education*, vol.31, no. 3s, pp. 25 – 44. http://doi.org/10.53656/str2023-3s-2-too. [in Bulgarian].

MORRIS M.H.; WEBB J.W.; JUN FU & SINGHAL S., 2013. A Competency-Based Perspective on Entrepreneurship Education: Conceptual and Empirical Insights. *Jornal of Small Business Management*, vol.51, no.3: Measuring the Impact of Entrepreneurship Education, pp. 352 – 369. https://doi.org/10.1111/jsbm.12023.

STEREV, N., 2023. Pre-Incubation Toolkits for Academic Entrepreneurship Fostering: Bulgarian Case. *Strategii na obrazovatelnata i nauchnata politika – Strategies for Policy in Science and Education*, Vol.31, no. 3s, pp. 90 – 103. http://doi.org/10.53656/str2023-3s-7-pre.

ISTATKOV, M., 2018. Sistema ot pokazateli za ocenjvane na efektivnostta na informacionnite I komunikacionnite sistemi v upravlenieto na malkite predpriatia. *Journal "Industrial Management"*, vol. 1, Prosseding TU – Sofia, ISSN 1312-3793. [in Bulgarian].

ISTATKOV, M., 2018. Ekserimentalno prilojenie na Sistema ot pokazateli za ocenjavane na funkcioniraneto na informacionnite I komunikacionnite sistemi v upravlenieto na malki predpriatia. *Journal "Industrial Management"*, vol. 1, Prosseding TU-Sofia, ISSN 1312-3793. [in Bulgarian]**.**

Internet sources

https://www.oesterreich.gv.at/themen/arbeit_und_pension/jobboersen_und_stellenangebote/2/Seite.2880142.html.

https://www.virtuelle-karriereboerse.de/home.html.

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