

CareProfSys – Final Scientific Report – Executive Summary

The **main goal of CareProfSys** project (<http://careprofsys.upb.ro/>) is the validation and testing of the intelligent career profiler system concept by implementing it in an observed environment - the career development center within the National University of Science and Technology POLITEHNICA Bucharest. CareProfSys aims to provide career counselling to students and pupils using advanced analyses of user profiles, automatically extracted from various data sources, through occupation recommendations for people with similar profiles using ontological inferences and machine learning classification algorithms. The project has three phases: (1) System design and COR ontology development – in 2022, (2) System development and testing – in 2023, (3) Implementation of the CareProfSys at the UPB-CCOC center– in 2024.

The first stage of the project consists in: the system design and technology choices and development of COR ontology and its exploitation tools. To establish the functionalities of the CareProfSys system, existing similar systems were studied, but online surveys were also conducted with 317 high school students and students to determine their interests. The results obtained were then concretized in the definition of use cases and user requirements. The taxonomy of Romanian occupations is the main pillar of the COR ontology of the project. In addition to the pillar of occupations, the ontology contains three more pillars: a) fields of study, thus connecting education with professions, b) characteristics related to the occupation (general activities, work context, work style, values, and needs) and c) necessary characteristics to fulfill a certain professional position (skills, aptitudes, and interests). The framework developed for the exploitation of the ontology is in the form of an API. **The second stage** is the development and testing of the system. The CareProfSys system has a tier-based architecture. The data required for the system is extracted through the web interface, the users' access point to the system, the data being extracted from several sources, following an authentication process, and then processed. All users' information is saved in a MongoDB database. The development of the system services consisted of the development of career recommendation services, access to scenarios in virtual reality on the Web (WebVR) and the CareerBot conversational agent/chatbot. **The recommendation engine contains two recommendation methods: an ontological inference and a machine learning algorithm-based recommendation.** The professions indicated by both algorithms are offered as primary recommendations to our users, followed by all the other recommendations (indicated by any of the two algorithms), giving thus the user the possibility to explore as many careers as possible. Every time a user uses the CareProfSys system, answers questions, uploads a CV and indicates his social media profiles, an electronic profile is attached to him/ her in the system, and then an individual is instantiated within the COR ontology, an individual who, with the help of of the HermiT reasoner, will be classified as being of the type of a class that represents a profession from the COR ontology, which means that the respective user fits that profession. At the same time, using the *K-Nearest Neighbors* algorithm from the sklearn Python library, we trained a machine learning model that allowed the recommendation of professions, based on 8 features extracted from filling out the form by the authenticated CareProfSys user. Since the development of 3D animated scenarios is not easy, we chose to develop scenarios for only six professions, within the project, to exemplify the **concept of representing the recommended professions through VR**, all of which have a lot of gamification elements: specialist in computer networks, civil, industrial and agricultural construction engineer, web and multimedia systems designer, chemical engineer, university professor and similar, project manager. For the development of a VR application that can be executed directly from a Web browser, we used the Unity Engine game engine along with specific packages such as WebXR / VRTK Tilia. The virtual career advisor chatbot was developed using the Pandorabots platform and the AIML tag-based language. During development, we applied modular testing performed by our developers, alpha and beta functional testing. **The 3rd stage** is the implementation of the CareProfSys system in the UPB-CCOC center, which consisted of the execution of two rounds of experiments with 47 users, in the UPB-CCOC Career Counseling and Guidance Center/ the laboratories of POLITEHNICA Bucharest, according to an internal protocol. The applied test procedure had 5 stages, and the results of the experiments were measured by various tools: questionnaires, the performance recording module during VR simulations, interviews. The obtained data were analyzed, and system optimizations were carried out based on them. CareProfSys was very well received and considered useful both by the participants in the experiments and by the more than 65 pupils and students who were present at the final project dissemination workshop.

Within the project, **6 deliverables were created** (5 technical and the description of the final workshop). **The results of the project were disseminated through 7 journal articles (5 ISI), 11 participations in conferences (9 with articles published in Proceedings), 1 book chapter and 5 popularization media articles**, through the creation of the **project website** and social media page, but also by participating in 3 educational fairs.