CareProfSys - Scientific Report Phase I - Executive Summary

The main goal of **CareProfSys** project (http://careprofsys.upb.ro/) is the validation and testing of the intelligent career profile system concept by implementing it in an observed environment - the career development centre within the University POLITEHNICA of 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 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 phase** of the project consists of two main activities: (1) Design and technology choices, (2) Development of the COR ontology and exploitation tools.

During the **"Design and technology choices"** activity, an analysis was conducted to establish the functionalities of CareProfSys, which included detailed study of the literature and existing similar systems, as well as creating online surveys with 317 high school and university students to determine their interests. The results were then materialized into defining use cases and user requirements (visitors, authenticated users – pupils and students, and system administrators). Both traditional counseling practices (psychological or personality tests, one-on-one communication methods between counselor and client, etc.) and modern practices (use of recommendation systems based on content filtering, collaborative filtering, machine learning algorithms, ontologies) were identified. In Romania's educational system, the number of school/university counselors for career guidance is insufficient for the current need, thus new, modern solutions that can improve the counseling and career guidance process are necessary, and the survey responses highlighted young users' trust in automatic recommendation systems and social networks. After analyzing user requirements, we concluded that there are 2 main purposes for using the CareProfSys: (1) to receive personalized career recommendations by students or pupils; (2) to discover if a recommended career suits the user through virtual reality mode and chatbot, but only after a recommendation is provided. The functional requirements that need to be implemented are those that serve the above purposes in a user-friendly manner. Technically, a "microservices" type architecture will be used, where each module will run as a microservice in its own container, communicating with others through HTTP requests: data persistence layer, internal execution layer, services layer, public *endpoints* layer, *front-end* layer. In the design activity, technologies, algorithms were chosen, and software components were designed within the architecture. For the actual recommendation, collaborative filtering models as well as machine learning models (e.g., a transformer model - BERT, an unsupervised learning model - K-means) will be used.

In the **"Development of the COR ontology and exploitation tools"** activity, the following were analyzed: professional identity in industry 4.0, relevant professional bodies, taxonomies, and standards, the "Classification of Occupations in Romania (COR), examples of similar software artifacts - ontologies. COR represents a system for identifying and coding Romanian occupations regardless of their type and location, following the structure of the International Standards of Occupations. The purpose of the COR ontology is to describe the professional competencies required for an individual to access a job in the labor market. The taxonomy of occupations in Romania is the main pillar of the ontology. In addition to the occupation pillar, the ontology contains three more pillars: a) fields of study, thus connecting education with professions, b) characteristics related to occupation (general activities, work context, work style, values, and needs), and c) characteristics necessary to fulfill a certain position (abilities, aptitudes, and interests). The developed framework for exploiting the ontology is in the form of an API that will serve both the public users through public endpoints and the other microservices of the CareProfSys system through private endpoints. The public methods exposed by the API include: extracting the code of a specific job from COR; extracting all jobs from COR, along with their respective codes. The private methods include: adding a new triplet in the ontology, modifying a specific triplet in the ontology, deleting a specific triplet in the ontology, extracting all details related to a specific occupation.

In phase I, **3 deliverables** were produced: (1) Analysis report and user requirements of the system; (2) Report on the software requirements of the system and its design; (3) COR ontology and its description. **The project results were disseminated through 3 articles published in the Proceedings of international conferences** (which will be ISI indexed) and **1 article in an ISI journal**, through the creation of the project website, and by publishing relevant information on ResearchGate.