Transforming Career Development Through Immersive and Data-Driven Solutions*

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Abstract. The rapid evolution of technology has created opportunities to transform traditional career guidance methods into dynamic, immersive, and data-driven solutions. XR-CareerAssist, is an innovative platform, that aims to provide career insights and enhance user engagement by integrating Extended Reality (XR) and Artificial Intelligence (AI) technologies. A dedicated tool is built and presented, which analyses over 100,000 anonymised professional profiles. This tool is a key-component of XR-CareerAssist and is used to visualise career trajectories, industry trends, and skill pathways through interactive and immersive experiences. Features such as virtual reality (VR) environments, voice-based navigation, multilingual support, and AI-driven 3D avatars empower users to explore career paths dynamically and intuitively. By merging robust data analytics with immersive visualizations, XR-CareerAssist not only boosts user engagement but also improves accessibility and aids in the clear interpretation of career trajectories. This study explores the envisioned scenarios, highlights results from initial testing with the CV Analysis tool, and examines how XR-CareerAssist enhances career guidance and training, fostering personalised and impactful career development in a globalised job market.

Keywords: Career Guidance · Career Maps · Artificial Intelligence · LLMs · Virtual Reality

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1 Introduction and Related Work

In today's dynamic job market, many individuals struggle to access personalised guidance that effectively supports their unique career trajectories. Traditional career counseling methods are static and do not adapt to the unique experiences and aspirations of diverse users. This results in professionals not being well equipped to make informed career decisions or pursue relevant skill development opportunities [1]. There is a critical need for a dynamic, personalised, and accessible career development tool that uses modern technologies to provide tailored, real-time guidance [2].

Career guidance has evolved significantly with the advent of technology, offering more dynamic, personalised, and flexible solutions compared to traditional methods. Historically, career counseling was conducted through in-person sessions, often limited to specific times and locations, making it inaccessible to many individuals. These traditional methods, while valuable, are often rigid and unable to adapt to the unique circumstances and aspirations of each user. With the rapid development of digital tools, the landscape of career guidance is shifting towards more accessible, scalable, and user-specific interventions, enabling individuals to make informed decisions about their career paths. For instance, computer-assisted career guidance systems (CACGS), help reduce decision-making difficulties, offer career adaptability training, and provide continuous support throughout the user's career journey [3]. However, despite these advancements, challenges such as inclusivity, data accuracy, and limited integration with broader frameworks remain prevalent.

Emerging technologies such as Extended Reality (XR), Artificial Intelligence (AI), and multilingual tools are reshaping the career guidance landscape. These innovations address the limitations of traditional methods by offering interactive, real-time, and tailored solutions for users with diverse needs and backgrounds. XR technologies, encompassing Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR), enable immersive simulations for career exploration. For instance, AR overlays can provide interactive career-related scenarios, while VR environments can simulate workplace settings for experiential learning [4]. Existing research emphasises the VR's potential to deliver "job tasters" during the COVID-19 pandemic, showcasing its ability to close the gap between theoretical advice and practical experience [5]. However, accessibility challenges such as lack of technical expertise, language barriers and localisation of XR tools and hardware costs remain significant barriers to wider adoption.

Recently, AI-driven solutions, such as conversational agents and predictive algorithms, have started enabling personalised career guidance at scale. In particular, chatbots, have been found capable to provide tailored mentorship and advice, while machine learning models have been used to analyse user inputs to predict optimal career trajectories [6]. These systems aim to address key diverse linguistic and cognitive needs, offering multilingual support and inclusivity for underrepresented groups. However, past studies highlight that there are still specific gaps in integrating assistive technologies for users with disabilities [7].

Despite significant advancements in career guidance technologies, several crit-

ical gaps persist that hinder their widespread effectiveness and accessibility. One major limitation is the lack of extensive empirical studies evaluating the impact of Extended Reality (XR) on career guidance outcomes, leaving uncertainties about its practical benefits [8]. Additionally, the potential of Artificial Intelligence (AI) remains underutilised in less developed regions where inadequate digital infrastructure limits the deployment of advanced AI-driven tools [9]. Moreover, the global, diverse workforce continues to face barriers due to the insufficient availability of multilingual platforms, restricting inclusivity and engagement [10].

These challenges present significant opportunities for future research and innovation. Integrating AI with XR technologies holds promise for creating immersive and highly personalised career guidance experiences that transcend traditional methods. Developing adaptable tools capable of responding in real-time to users' evolving needs can further enhance the relevance and impact of career counseling systems. Finally, ensuring the accessibility of these technologies, regardless of users' location, language, or abilities, is vital to making modern career guidance tools equitable and universally beneficial. Given the increasing emphasis on sustainable practices across industries, future iterations of XR-CareerAssist could integrate experiential learning modules that not only guide career progression but also promote environmental awareness. Experiential learning can enhance environmental engagement [11]. Furthermore, gamified platforms and interactive digital resources have been proven to promote sustainable practices [12].

2 Design and Methodology

2.1 Existing Solution

The Career Map concept note depicted in Fig 1 serves as a key visual tool for the development of the XR-CareerAssist platform, designed to assist users in visualising their career progression over time, allowing users to track their professional journey, showcasing various career moves, such as role progressions, and industry shifts. Following a comprehensive CV collection process involving over 100,000 professionals across various industries and roles, a detailed database is built and the corresponding web platform and application programmable interfaces (APIs). By leveraging this vast data resource, the platform offers users insights into career trajectories, industry trends, and potential future roles based on patterns identified in the career paths of individuals with similar backgrounds. This data-driven approach to career development allows users to input specific parameters, such as their current job role, years of experience, and target positions. Once this information is provided, the system aggregates profiles from the dataset to generate insights into career trajectories, role evolution, and demographic distributions.

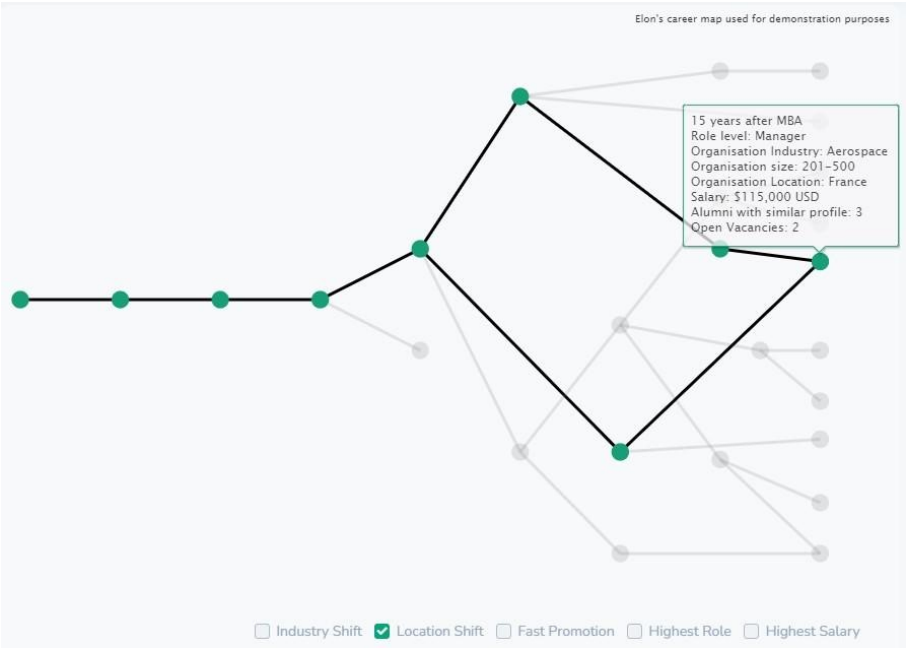

Fig. 1: Career Map Concept note for location shift target

2.2 User Inputs and Profile Identification

The users begin by specifying key parameters such as years of experience, current job role, sector, and skills. For instance, in Fig 2, the user has entered their current profile as a manager in the Information Technology sector with 10 years of experience in the UK and their age group as 31-40 years, targeting a role as a Chief Officer at some point in the future. Based on these inputs, the system searches its extensive database to identify similar profiles. The system aggregates and filters data to provide users with relevant statistics about the filtered dataset. In this case, users can see the number of similar profiles, industries, sectors, companies, and average years it takes to transition between roles who have managed to achieve their role (chief officer) at some point in the future.

2.3 Career Maps and Visualisations

The platform provides users with dynamic career maps, utilizing Sankey diagrams to display potential role and industry transitions over different time periods. In Fig 3, the Role Job Career Path is presented, offering a visual representation of the career progression based on the user's current role for the next 10 years. This diagram helps users visualize potential transitions to higher-level positions, such as moving from a manager to a chief officer, with pathways showing possible detours or accelerations based on different variables like sector and

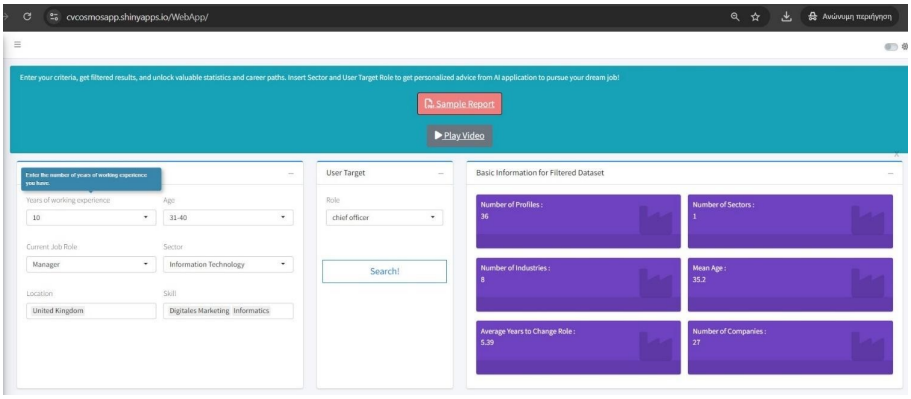

Fig. 2: User Input fields to identify similar profiles and User Targets

Fig. 3: Job Role Evolution Career Map for specified user input for the next 10 years

industry. Moreover, Fig 4 illustrates the Industry Career Path, highlighting the movement of individuals between various industries over the next 2, 5, and 10 years. This diagram shows how users can transition between different sectors, helping them understand the experience necessary to navigate between industries.

The platform, while providing a robust data-driven approach to career development, faces several challenges that impact user experience and engagement. Users may struggle with low engagement due to limited personalisation and a lack of interactive or dynamic features that make the platform intuitive and enjoyable. Additionally, the platform's complex user interface can be difficult to navigate, often leading to confusion about how to input parameters or explore available features effectively. Another significant issue lies in the difficulty users face when interpreting the career maps, Sankey diagrams, and statistical insights, which can hinder their ability to translate the provided data into

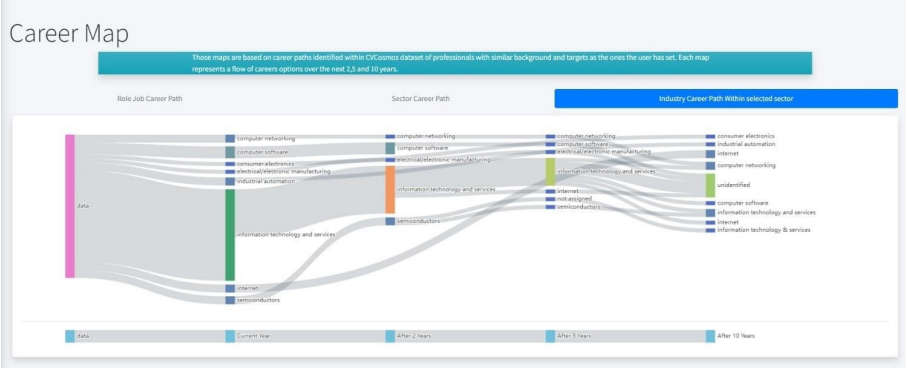

Fig. 4: Industry shift evolution for specified user input for the next 10 years

actionable steps. Accessibility barriers further compound these challenges, as individuals from non-technical backgrounds or those with limited familiarity with career tools may find it difficult to leverage the platform's full potential. Moreover, the platform's lack of robust multilingual support limits its accessibility to users from diverse linguistic backgrounds, who may struggle to understand the content or interact with the system effectively.

2.4 Planned Pilot Study

To evaluate the usability and effectiveness of XR-CareerAssist, a pilot study is planned involving 25–40 participants, including professionals, career counselors, and users with non-technical backgrounds. Participants will interact with a dedicated VR environment on Meta Quest 3.0 featuring voice-based navigation, interactive career maps, multilingual support, and a 3D avatar interface.

Participants will be exposed to three primary scenes: (1) a questionnaire input interface; (2) immersive visualisations using Sankey diagrams; and (3) dynamic, AI-generated feedback sessions. Usability will be assessed using task completion rates, time on task, and satisfaction ratings. Qualitative feedback will be collected via open-ended questions and analyzed thematically. These insights will guide platform improvements.

3 Envisioned Scenario

3.1 Architecture Overview and Integration with AI Models

The integration of CVs database into the XR-CareerAssist platform has involved the import and structuring of this data within the system. The data repository currently feeds into the backend of the platform, ensuring that users can access up-to-date information about career trends and opportunities in real-time. The enhanced user experience made possible through this integration offers more

than just static career advice. By utilising CVs' data and AI models, the XR-CareerAssist platform currently provides users with highly tailored career development plans and real-time insights into industry shifts. Moreover, users are able to compare their profiles against a network of successful alumni with similar backgrounds, receiving recommendations based on real-world career data.

The integration and validation of key AI models into XR-CareerAssist are ongoing and aim to address the challenges identified and enhance the platform's functionality. A fine-tuned Automatic Speech Recognition (ASR) model [13] as presented in [14], is integrated to process voice inputs and transcribe them into text. This feature addresses the issues of low user engagement and accessibility barriers by offering a more inclusive interface, particularly benefiting users who prefer verbal interaction. Following this, a Neural Machine Translation (NMT) model [14], [15] translates the transcribed text into the user's selected language, ensuring robust multilingual support. This model directly addresses the multilingual accessibility challenges identified, enabling users from diverse linguistic backgrounds to interact with the platform in their native language and improving comprehension and inclusivity.

A Dialogue System (DS) based on the Llama2-Chat 7B [14] facilitates real-time, dynamic interactions with users, allowing for natural and intuitive communication. By providing instant responses and tailored guidance, the DS addresses difficulties in understanding results and the current limitations in personalisation. It enables users to navigate complex career maps and access actionable insights with ease. Additionally, a Vision Language model (VLM) based on ViT-GPT2, tailored for spatially-aware image captioning and question answering [14] is utilised. This VLM, currently offering scene captioning capabilities, will be further explored and trained with thousands of sankey diagrams to analyse and interpret data from career maps. This enhancement will empower the model to provide simple, relevant insights into these visualisations, helping users better understand their career trajectories and potential opportunities. Figure 5, provides an overview of the XR-CareerAssist platform including the integration of the AI models, highlighting their functionality and the user experience they aim to improve.

3.2 User Journey and Models Outputs

Within the platform, users start by completing a simple questionnaire, which collects key career-related information. This data is processed by the platform's backend system, providing users with tailored career recommendations, interactive simulations, and real-time insights. The virtual scene in Fig. 6 demonstrates the immersive visualisation of career pathways, where users interact with a Sankey diagram after completing their questionnaire through the help of a 3D Avatar, getting meaningful career-insights.

Table 1 outlines the user input, the model/process, and the output for each step in the user journey.

Step	**User Input**	**Model/Process**	**Output Description**
The user completes a questionnaire in the VR environment providing details about their career background and goals.	Job role, years of experience, skills, target role, and industry preferences	user inputs processed by the CV's database via API and matched to similar career profiles	user inputs are compated against a database of professional profiles to generate Sankey diagrams in VR, visually representing potential career transitions.
The user navigates the platform or asks a question using their voice.	Voice-based navigation and queries	ASR Model: Converts spoken input into text	Transcribed text to be used as input into the NMT model.
The user interacts with the platform in their preferred language.	Text output from ASR	NMT Model: Translates text into the user's chosen language	Provides multilingual accessibility, allowing users from diverse linguistic backgrounds to interact effectively.
The user selects a visualised career map in the form of a Sankey diagram for insights into career transitions.	User requests insights for Sankey diagram	VL Model: Processes and interprets Sankey diagrams to extract relevant career insights	Displays career progression and transitions through text; further model training enables the model to explain Sankey diagrams in simple terms.
The user asks specific questions about their career options and progression.	User queries about career paths	Dialogue System: Responds to user questions and provides personalised career advice in real-time	Delivers tailored guidance based on user data and preferences, utilizing the output of VL model and the text of NMT model where needed to produce text.
The user listens to the platform's spoken responses and interacts with a 3D avatar.	Continued interaction with the platform	Text produced by the Dialogue System is converted into spoken responses delivered by 3D Avatar for delivering speech from the Dialogue System using WhisperAI	Enhances engagement through spoken responses and an interactive, personalised avatar experience.

Table 1: User Journey and Models Outputs

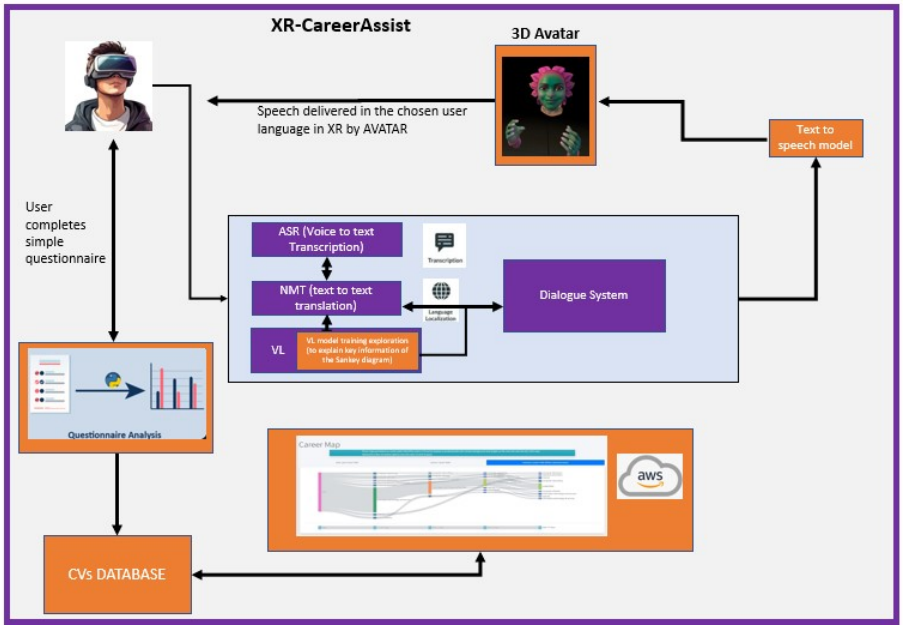

Fig. 5: Envisioned Scenario of XR-CareerAssist

4 Future Work

Future work will focus on iteratively refining XR-CareerAssist based on pilot results and expanding its capabilities for diverse user populations. Enhancements will include improved visualisation clarity, more intuitive avatar interactions, and additional language models for broader multilingual support. The AI models—ASR, NMT, the Dialogue System, and the Vision Language Model (VLM)—will be further fine-tuned based on interaction logs, user feedback, and emerging datasets.

These components are accessible via secure, private APIs that ensure GDPR compliance and will continue to support real-time interaction in future deployments. As the VLM becomes more proficient in interpreting Sankey diagrams, additional training data will be generated through simulated trajectories and annotated examples.

The long-term vision includes deploying XR-CareerAssist in educational, vocational, and public service settings to support inclusive and engaging career guidance on a broader scale.

Acknowledgements This research is supported by FSTP Funding from Horizon Europe under grant agreement no. 101070521 (VOXReality)

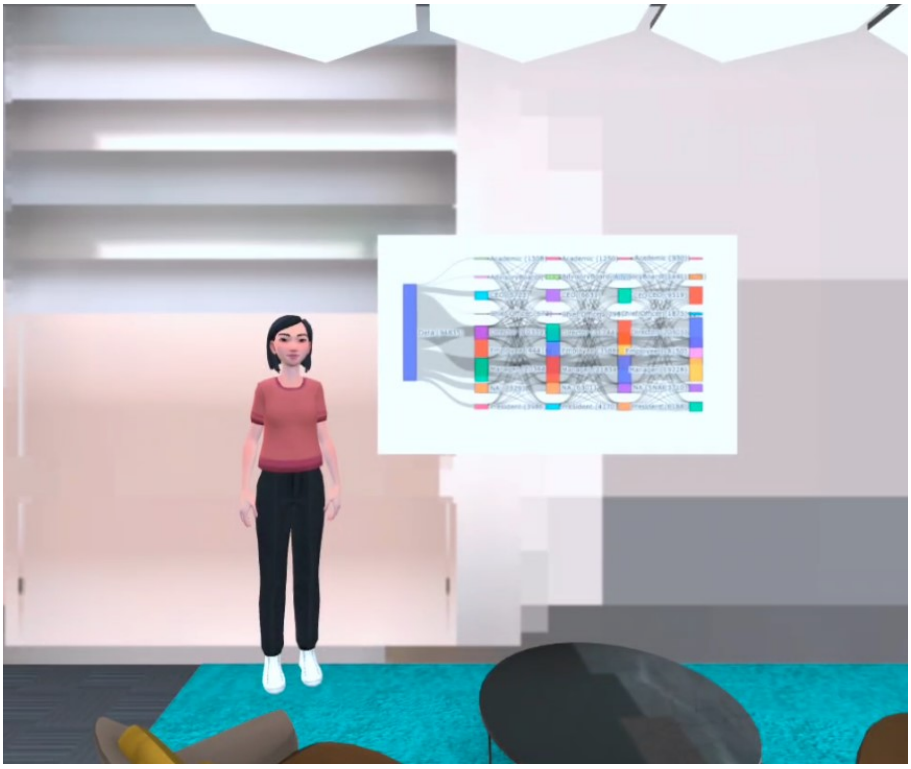

Fig. 6: VR scene on Meta Quest 3.0, showcasing the Sankey diagram following a successful user input of the career questionnaire, built using Meta SDK 2.0.

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