XR4LAW: Implementing an Immersive Ergonomic User Interface for Legislative and Deliberative Institutions

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ABSTRACT

XR4LAW is an innovative project included in the ERC project HyperModeLex that aims to investigate a new methodology of work of parliamentarians through the use of Virtual Reality (VR) and Mixed Reality (MR) technologies. XR4LAW creates a Virtual Dashboard, with the goal of integrating legislative work into the metaverse. The bidimensional metaphor used for navigating the legislative documentation is limited considering the complexity of the material that a member of parliament should navigate and search. For this reason, the current project intends to provide an immersive environment where to find relevant documents using an easy human-computer interaction interface. The application is connected to the eXist-db database, where all legislative documents are available in XML format using the Akoma Ntoso OASIS XML standard applied to the European legislation. The primary goal is to develop an ergonomic and intuitive user interface that capitalizes on MR's capabilities, such as real-world visibility and utilizing physical spaces to overlay virtual elements. This immersive environment empowers end-users to explore and analyze legal documents in a whole new way, improving the accessibility and efficiency of parliamentary work.

CCS CONCEPTS

• **Human-centered computing** → **Virtual reality**; **Mixed reality**; **User experience**; **Metaverse**; • **Applied computing** → **Legislative and deliberative institutions**.

KEYWORDS

Virtual Reality (VR), Mixed Reality (MR), Parliamentary, Legislative, eXist-db, XML, Metaverse, User Experience (UX)

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1 INTRODUCTION

The use of immersive technologies is revolutionizing the way we work and interact with information, offering new ways to visualize it. These technologies are also revolutionizing various fields of work, such as architecture, engineering, education, entertainment, and gaming [1, 2, 4, 7]. XR4LAW fits into this new use case as an innovative project, offering an immersive environment in VR or MR, which allows parliamentarians to modernize their work of iterating legal documents through an efficient and intuitive interface. XR4LAW is inspired by previous studies such as "Spaces to Think: A Comparison of Small, Large, and Immersive Displays for the Sensemaking Process." [6] and "Immersive Space to Think," [5] which explain the effectiveness of using and placing virtual panels within an immersive three-dimensional space, taking full advantage of spatiality. The project then aims to expand this concept into the legislative arena where the complexity of the legal documentation and the correlated material can't allow an easy consultation of the knowledge and informative objectives in bidimensional environment. Thus, the project provides an immersive virtual environment, as in figure 1a, which through Quest 3 combines the real world with virtual elements. XR4LAW thus not only digitizes some parliamentary tasks but also transforms it into an interactive and immersive experience. This first prototype focuses on creating a user interface that is not only functional but also ergonomic, to ensure that end users have a comfortable approach for prolonged use of the application. This is important since prolonged use of VR/MR viewers, can be a cause of physical and visual fatigue. Secondly, several legal principles, related to the democratic rules and the parliamentray regulation, should be implemented in the system by-design to guarantee the legal legitimacy of the law-making process. For this reason the team of research is interdisciplinary and models also some parliamentary rules (e.g., transparency, accountability).

2 SYSTEM ARCHITECTURE

XR4LAW is a project under development within Unity, a graphics engine used for creating immersive experiences in VR or MR. The project architecture causes the application to connect to the eXist-db database, where all legal documents are stored locally in XML

format according to the AKN schema (Architecture for Knowledge-Oriented Management of African Normative Texts using Open Standards and Ontologies http://docs.oasis-open.org/legaldocml/akn-core/v1.0/akn-core-v1.0-part1-vocabulary.html). The AKN has become an international standard for structuring and representing executive, legislative, and parliamentary documents. Through the use of VR/MR headsets, such as the Quest device, end users can navigate within eXist-db and access legislative documents of interest directly within an immersive space. For instance the amendments to a bill of law should be voted one by one, but to have a immediate integration in the text of the modifications approved, helps to understand the consequential changes to vote. This approach provides immediate and intuitive access to legal documents, enhancing efficiency, participation and user experience.

3 USER EXPERIENCE (UX)

The development of the XR4LAW user interface prioritizes ergonomics and usability, leveraging features such as the passthrough functionality of the Meta Quest 3. This allows virtual elements to seamlessly blend with the real world, enhancing the immersive experience. Key aspects considered during development include the intuitive positioning of application elements within the user's surroundings and ensuring effective visualization under various conditions [3].

3.1 Field of View

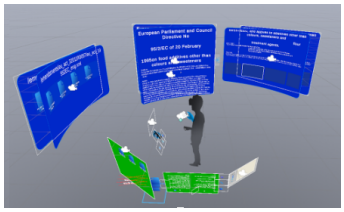
Meta Quest 3 allows users to view the real world with overlaid virtual elements from the application. The virtual elements representing legal documents are centrally positioned at spawn time to facilitate user visibility, limiting head movements by using a grid layout for content display. Additionally, the semicylindrical shape of the user interface elements enhances the user's viewing and interaction experience, making the visualization and interaction with the virtual elements in the scene more comfortable.

3.2 Ergonomy

Ergonomically, the interface is designed to ensure that the user remains in the center of the scene, and is able to maintain a comfortable posture, thus positioning UI elements on the natural "trajectory" of his or her field of vision. This improves the user's interaction with the application, reducing his physical and visual fatigue (hands, neck, eyes). For efficient use of spatiality, the interface also tries to limit the user's movements as much as possible, since the user is limited by the physical reality around him, despite the fact that the virtual space instead is infinite. However, in reality users never stand completely still, but move. From an ergonomic point of view, therefore, it would be appropriate to trace the virtual elements within the three-dimensional space, anchoring their position, so as to ensure a softer and more natural perception of MR.

3.3 Depth

Another aspect considered is the concept of depth. Depth exploits a kind of "hierarchy" between virtual elements, so as to improve the perception of UI elements. For example, a virtual panel with eXist content may be further back in space, compared to the panel of database navigation control buttons (home button, back button, etc.) that will be closer to the user. This also allows an improvement in the usability of the application, as in the figure 1b. XR4LAW also uses smooth animations for opening/closing the various UI components, so as to accommodate the user's movements to the new virtual panels and prevent any disorientation situations. Depth also allows the user's attention to be manipulated, for example by highlighting a virtual panel in the foreground.



(a) Immersive space

(b) Depth, and Background color contrast

Figure 1: User Interface Design

3.4 Typography and Color

The first prototype of XR4LAW is designed for reading documents and therefore it is essential to improve their readability, making it easy and comfortable, using a single font, making it uniform in its use, to ensure consistency in the text and clarity in its reading. An important aspect is the background color for the virtual panel that houses the text, which must contrast with the color of the text, so as to emphasize the reading of legal documents, as in the figure 1b. Thus, to improve the readability of the text, contrast with the background UI component, bold for headings/headings, and medium/regular size for the body of the text should be considered.

4 CONCLUSION

XR4LAW represents a new field for the integration of immersive technologies, precisely considering the legislative context for helping the participation of the member of the parliament during the law-making process in the plenary. The project plans to exploit the potential of VR and MR, for the creation of an immersive environment, which improves access to legal documents. It is intended to implement an ergonomic user interface, offering end users as intuitive and comfortable an experience as possible. This first prototype, therefore, lays the groundwork for what will be future implementations and optimizations to the system, opening new avenues for the use of these immersive technologies, as in this case in the legal field.

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