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# What would you like to visit next? - Using a Knowledge-Graph Driven Museum Guide in a Virtual Exhibition

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**Abstract.** Conversational agents have been recently incorporated into Virtual Heritage to provide more immersive and interactive user experience. However, existing chatbot guides lack the capacity to leverage the rich background knowledge graphs (KGs) to provide better interactions between visitors and cultural collections. In this paper, we present a KG driven conversational museum guide that answers visitor's questions and recommend relevant art objects in a virtual exhibition, while modelling user interest to offer personalised information and guidance.

**Keywords.** Knowledge Graphs, Conversational Agents, Virtual Heritage

## 1. Introduction

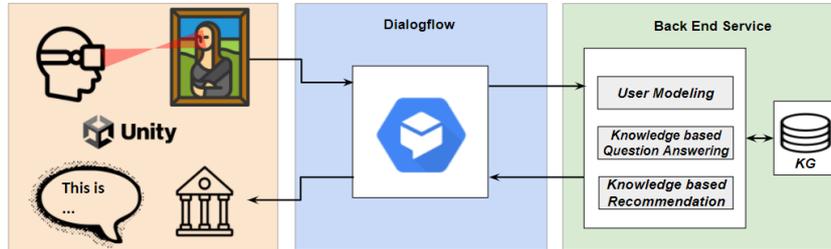
A number of immersive and interactive technologies have started to play a role in Virtual Heritage (VH) to cater for a wider audience, create personalized visitor experiences and preserve its relevance in a fast-paced, technology focused society [1]. Utilizing conversational agents to guide virtual museum visitors is a recent addition in VH [2–10]. However, existing work places emphasis on aesthetics, chat interfaces, visitor engagement and the transfer of basic information about museums and exhibits to visitors, mostly through rule-based methods. They lack the ability to give personalized and relevant recommendations, or respond to more complex questions from visitors. In this paper, we present a demo of a conversational museum guide in a web-based virtual exhibition based on a previous physical exhibition of the Het Rembrandthuis in Amsterdam. Our museum guide utilizes a cultural heritage KG to answer visitor's questions and recommend relevant art objects in the exhibition, while user's interests is modelled during the conversation for more personalised interactions.

## 2. KG-driven conversational museum guide

Figure 1 presents an overview of the current prototype,<sup>1</sup> which consists of a virtual guide embedded in a WebGL virtual museum in Unity [11]. Via Dialogflow, the museum guide

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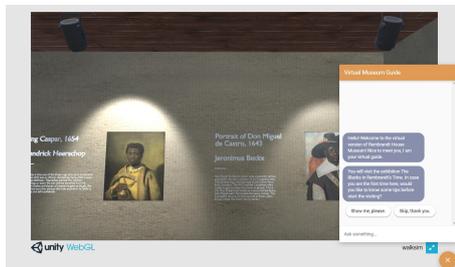
<sup>1</sup>The demo is accessible at <https://bit.ly/3I8UN22>. A demo video is available at <https://bit.ly/3FvN3aN>



**Figure 1.** An overview diagram of knowledge driven virtual guide in virtual museum.

takes input from users, detects the intention, then provides the appropriate reply based on the intention category. If the input's intent requires further processing, such as asking questions or requesting recommendations, it sends the input to the webhook service and wait for corresponding responses before getting back to the user.

The webhook service consists of three components. **User Modeling** keeps track of a user's interests based on the conversation and interaction history to form a weighted interest table, allowing the virtual guide to offer personalized options and recommendations based on those interests. **Knowledge based Question Answering** classifies the question, detects the entity, generates a Cypher query [12] and gets answers from the KG that are filled in a template and sent to the user. **KG-based Recommendation** firstly selects an attribute that the user may be interested in, then utilises entity embedding to suggest the entity with that attribute and the highest similarity score for the user.



**Figure 2.** Interface of the virtual guide in web-based virtual museum



**Figure 3.** Two rooms in the virtual museum.

As shown in Figure 2 and 3, users can access the prototype through a web browser and engage in a text-based dialogue with the virtual guide who takes input via text or buttons and responds via text or images.

### 3. Conclusion

In this paper we present a prototype of a KG-based conversational museum guide, demonstrating the benefits of using KGs in the domain of interactive applications in Virtual Heritage. Our museum guide leverages rich background KGs to answer user's questions and recommend relevant art objects that the user is interested in. A systematic user study is planned to evaluate the usability of the prototype.

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