Project Report

# Roman Villa Nennig Bot

Your virtual guide to Roman Villa Nennig!

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# Introduction

Chatbots are one of the many solutions to providing meaningful information to visitors' questions and queries. In addition to helping customers get information, chatbots decrease the workload of customer service staff. While chatbots have been utilized by many different businesses, they are rarely seen as a museum tour guide. In this project, we are going to explore the possibility of using a chatbot as a tour guide for Roman Villa Nennig, a museum located in Saarland, Germany.

Focus of this project is the interaction between users and the chatbot, and not the museum staff. Since most of the visits are from casual visitors, other groups (researchers and school visits) are not included in this prototype. Moreover, to create a user-centered prototype, the development is completed in an iterative process, during which we designed dialogues, paper prototype, working prototype, and tested it with real users.

Knowing that most people do not like to install a standalone application for a single visit, we use Telegram to host this chatbot. Additionally, to increase the speed of the development, we avoided coding by limiting ourselves to using Dialogflow alone. Yet, this prototype can be easily extended with fulfillment code that might be developed later.

In the following, we explain the idea and design approach in detail. While the technical side of the implementation is not completely covered, the most important aspects of each step in the development process is explained. In the end, the challenges and the end result will be discussed.

# Basic Idea

Our idea is to develop a chatbot as a tour guide that helps the visitor while they are planning a visit, and during the visit by answering their questions about the artifacts they see in the museum, in this case mosaics. Additionally, we would like to provide the contact information of the Villa, such that users can get the link of the website, and the phone number right from the chatbot. To this end, three different commands are created, namely planning, visiting, and contact. While these commands can be written directly by the users, they are also visible in a menu list that is automatically created by the Telegram client. The reason for using these commands is that they are accessible at any stage of the conversation, and they can be embedded in a message, just like a hyperlink.

Planning phase is triggered by the planning command, and is used to help users plan their visit. In this phase, users are provided with the possibility to choose from a list of frequently asked questions, or type in the questions themselves. In order to create the list of frequently asked questions, we utilised the quick reply keyboard of Telegram.

The visiting mode acts as a tour guide for the visitors. In addition to the possibility of asking questions about mosaics, it provides a documentary video, and a leaflet that provides information about the history of the Villa. In order to select the mosaics easier, visiting mode provides the user with a mosaic selection tool, which is created using the inline keyboard feature of Telegram. Moreover, users get the possibility to select the next or previous mosaic once they have selected a specific mosaic.

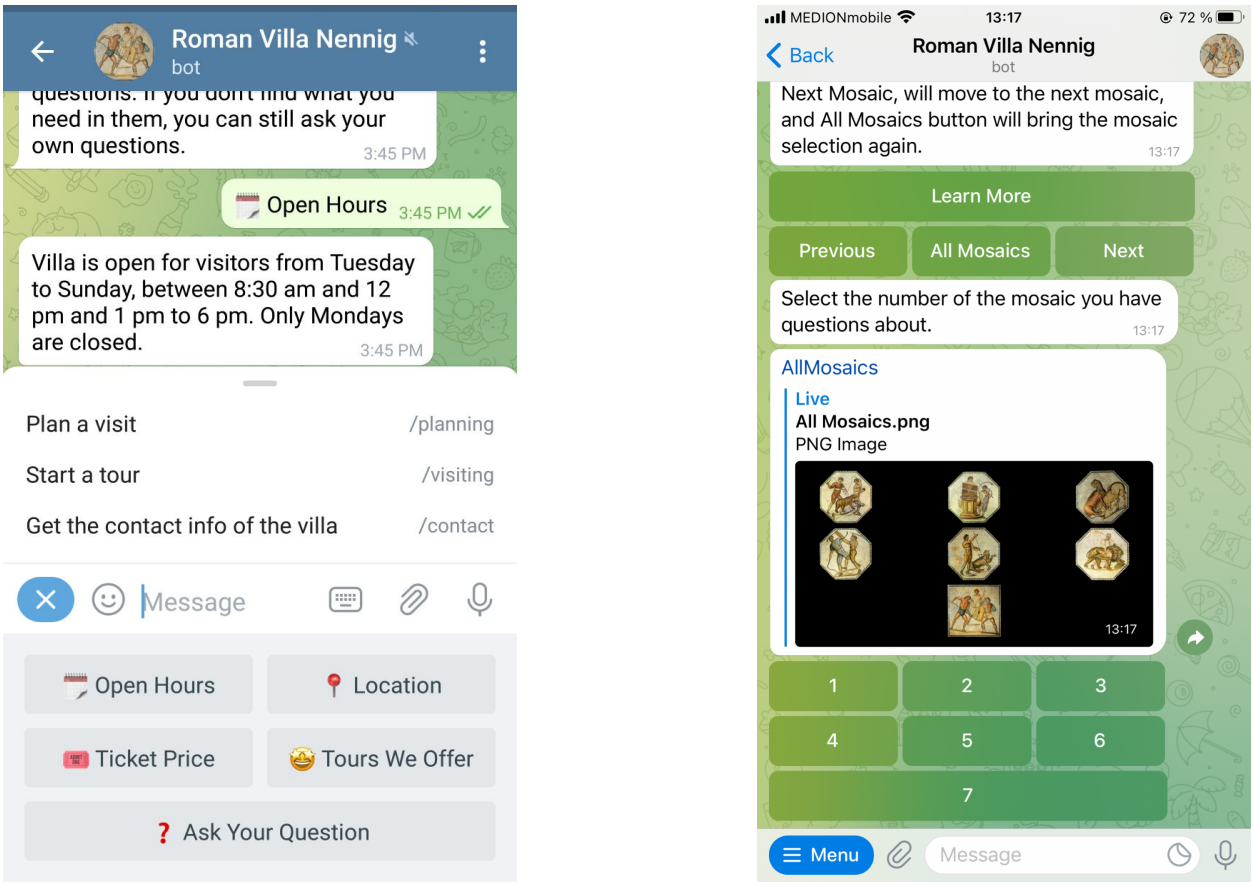


Figure 1 - User interface of iOS and Android showing commands, FAQs, and mosaic selection.

The UI and UX elements used in this chatbot are given here:

- **Menu Commands:** Commands are provided to access planning mode, visiting mode, contact information, etc. These commands are also embedded in the messages when needed.
- **Quick Reply Keyboard:** Dedicated buttons created using a quick reply keyboard for FAQs, leaflet, and documentary video.
- **Inline Keyboard:** Dedicated buttons created using an inline keyboard for mosaic selection.

- **Multimedia Responses:** While responses are static, Medium, OneDrive, YouTube and Google Drive are used to host multimedia files like Images, Videos and Hyperlinks and send to users using custom payloads and card responses.

In addition to these elements, which are necessary to create a pleasant user-experience, we tried to create the dialogs such that the chatbot sounds like a human. Our main approach in the dialogue is a user-initiated conversation. Yet, at some phases of the conversation we practiced bot-initiated dialogue to make the flow of the conversation smooth and natural. This approach constraints users from making mistakes and asking irrelevant questions, at the same time providing easy, quick and simple answers to their questions.

# Personas and Scenarios

The scope of this chatbot is defined such that it best serves the casual visitors. The characteristics of these visitors are provided to us by the Villa Nennig staff, as two distinct personas, namely Markus and Julia. While a complete product should include Villa Nennig management and marketing team as secondary stakeholders, the focus of this prototype is on the interaction of the users with the bot. Therefore, these statistics are not collected, and the Villa Nennig team is not included in the personas. In addition to personas, Villa Nennig staff provided scenarios for each of these personas. While we made some minor changes to the scenarios to include the planning phase, we tried to stick to the original scenarios as much as possible.

In the following, you can see the personas we selected and refined, as well as scenarios that represent the behavior of each persona. As mentioned earlier, these are provided by the Villa Nennig staff, and we did not make major changes to them.

## Markus

Markus likes to go to museums frequently or make trips to cultural sites such as castles and palaces. Mostly alone, now and then with friends - with pleasure also in combination of nature and culture experience e.g. with a hiking tour. He likes museums for art the most, but also History, archeology and ancient cultures inspire him a lot. Markus is on the lookout for works of art that appeal to him. When an exhibit arouses his curiosity, he stops longer, looks at the artifact, reads labels and texts thoroughly, looks at the exhibits around it, and searches for connections and contexts. He has no particular preference for certain art movements, epochs or cultural circles - he can be just as enthusiastic about a hand axe from the Stone Age as he is about a painting by Picasso. Markus rarely takes part in guided tours, because he then has to follow a predefined path and hear details about exhibits that don't interest him very much. Markus has had different experiences with audio guides, because that way he discovered things he wouldn't have seen otherwise. Some questions that came to him spontaneously about some exhibits remained

unanswered even with the audio guide. For Markus, a visit to a museum is worthwhile when he discovers something new and can learn something that corresponds to his areas of interest and takes him further in what he already knows.

## Julia

Julia often takes city vacations and then wants to see everything that is important. She usually only visits well-known museums, large special exhibitions, and attractions that are especially touted as tourist highlights - she is really driven to be able to check off the top ten list in her PocketGuide travel guide. Julia rarely takes guided tours or audio guides. Guided tours usually don't fit into her schedule. The audio guide is too lengthy for her. She also usually doesn't feel like reading in advance to prepare for a visit. She looks for the highlights of a museum while still looking, albeit always briefly. In her unguided tours, she tries to look at as much as possible for fear of missing or overlooking something. Therefore, when she finally finds the "must see" object, she is often overwhelmed and exhausted. Julia intrinsically likes to be shown what is really important. She wants a brief general overview of the museum or exhibition. Then she wants to be led directly to a few really important exhibits. Questions, like Markus, usually don't come to her in the first moment - nor does her patience usually allow for a deep engagement with the object. That's why she's all the happier when she learns one or two interesting anecdotes or special features that she can remember and then tell her friends about. For Julia, a museum visit was successful when she feels she has seen everything there is to see and when she can remember one or two nice stories about one of the objects because they touched her.

## Markus in the villa

Since he is interested in museums, he already knows Villa Nennig, but he still needs help to learn more about the working hours and interesting areas of the Villa. He Googles Villa Nennig and the results lead him to the CHIM. Since he likes to try out new things, he decided to test the chatbot. As CHIM is integrated into an instant messaging platform he already uses, he doesn't really need any extra application on his phone.

Once he opens the chatbot CHIM introduces itself as a virtual guide to the Villa and explains how it can help the visitors. Markus asks for the open hours, and what route he should take while he is visiting the Villa. CHIM sends a link to Google Map that could be used in order to find the way to the Villa. CHIM asks for some basic information as well as his preferences. CHIM also asks about his prefered “visiting mode” which for Markus is of course “free tour”. After receiving the answers from Markus, it offers him a list of interesting areas to visit and their location in the villa with important details.

A few days later Markus visits the Villa. First he strolls around the grounds and through the shelter a bit without using CHIM, until he notices a detail on the large mosaic floor - it looks like

a group of musicians with a French horn. Markus again remembers CHIM and messages it to ask about the mosaic. CHIM replies that the Nenniger mosaic shows a musician scene. After looking at the octagonal picture field at leisure, Markus looks at what CHIM offers about this detail. The system suggests a reading that reveals more about the cultural-historical background. In the text, Markus learns that musical interludes were common in the amphitheater to liven up the program and that the mosaic features the oldest representation of an organ in the world. CHIM offers him two additional photos, which he can select. One shows an archaeological organ find and leads to an explanation of the comparative find and how the water organ works, the second leads to audio files through which he can listen to audio samples recorded on reconstructed musical instruments from Roman times. Markus is fascinated and curiously walks through the other picture panels on the mosaic, each of which CHIM leads to a different thematic thread, such as the world of Roman gladiators and animal fighters, ancient mosaic art and the rediscovery of the villa in the 19th century. He jumps on his own tour, which he puts together with the help of CHIM, through the centuries from the origin of the villa, its use in Roman times, its disappearance and its excavation in the 19th century. His common thread are his preferences, but also his spontaneous discoveries.

Markus was impressed by how diverse the topics were at that location, and the fact that the system kept offering him new ways to continue his tour while allowing him to switch to a new detail or topic when something caught his eye.

## Julia in the villa

Julia is on her annual club trip in a coach with her yoga group. A visit to Villa Nennig is on the tightly scheduled itinerary for this day. The tour group has not booked a guided tour, instead everyone can discover the complex on their own, but the stop only lasts a maximum of 45 minutes until the onward journey. Julia found a link to CHIM, when she had to wait briefly for her companion at the hotel the night before. When she arrives at the villa she has already done the entry dialog. CHIM asked her how much time she had and then suggested the tour "The Century Find of Nennig in 30 minutes". Julia chooses this compact, guided highlight tour.

First she gets into an introductory text, which she listens to comfortably in the sun on a bench in the outdoor area. She briefly learns about the history of the site and its rediscovery and excavation. Then she follows the invitation to go inside into the shelter to the mosaic. Here she first listens to some basic information. Julia is pleased to find that the information, including the audio, is short and crisp, but also includes some things she hadn't imagined, such as about gladiators in ancient Rome. To Julia's own astonishment, she looks at all the topics on offer, even some that she would otherwise tend to pass over, such as the technical production of a mosaic and the history of research. Julia is satisfied and has gained a coherent overall impression of the facility. She has seen everything important in a good half hour.

She still has time to take a few selfies and photos for her Facebook and Instagram page of a few details that particularly fascinated her before she has to head back to the bus. At the end of the visit, she received a message from CHIM asking for feedback to which she could give responses anytime in future, CHIM asked what she enjoyed the most during his visit, and if there are any other unanswered questions. At dinner, she enthusiastically tells her traveling friends, some of whom were too lazy to bother with the villa and just sat carelessly in the meadow without CHIM, about the Nennig inscription forgery scandal in the 19th century and about the much sought-after gladiators, the sports celebrities of Roman times, and is delighted that she can shine with her new knowledge.

# Implementation

Our approach to prototyping is user-centered design, which is iterative by nature. As demonstrated in figure 2, we start by understanding what our users need, then move on to designing. In the design stage, we first designed the dialogues, then used the dialogues to create a paper prototype (using inVision Freehand tool). Based on this paper prototype, we designed our working prototype, which was used during our test stages. We refined this prototype iteratively using the feedback from testing with the real users. In total, we completed two iterations, and our final test led to results that could be used in a third iteration.

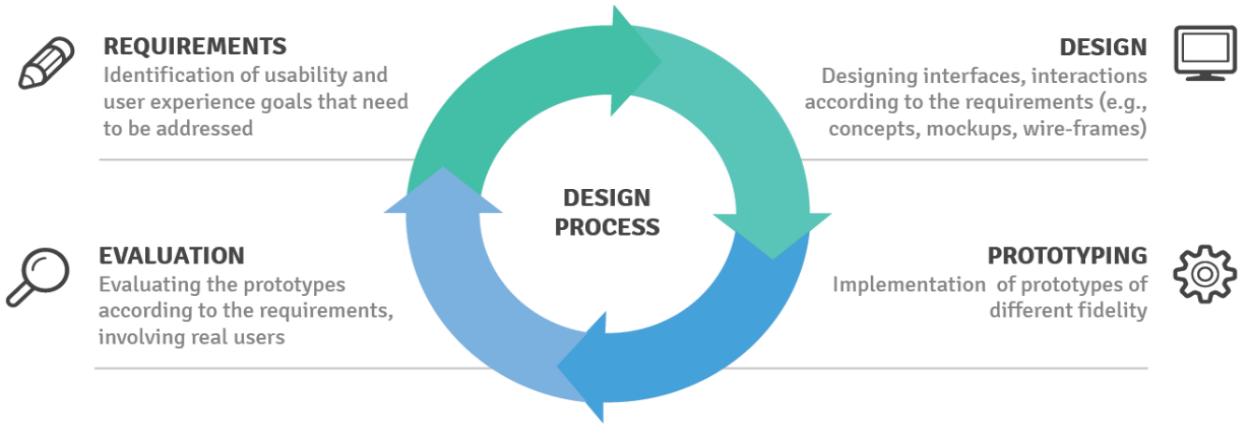


Figure 2 - Design Process

To implement this prototype, we utilized DialogFlow Essentials as the natural language understanding tool, and Telegram messenger as the front-end. Using Dialogflow, we designed an Agent, called VillaAgent, which includes training phrases with their intention, as well as the answer to each of these questions. These training phrases are gathered through a question gathering that was done by the DFKI. Since the question gathering was in German language, we translated the collected questions from German to English using tools like DeepL, Google Translate, and the Google Translate plugin of the Google Sheet. To make a more extensive list of

phrases, we also included our own questions. Finally, we collected a list of more than 250 questions and answers.

During the question gathering, we realized that some of the questions have the same answer for all the mosaics. Instead of creating different intents to address these questions, we created a mosaic entity. Entities are similar to variables in programming languages, thus the user can ask the question for different mosaics, and the answer will be generated such that the user does not notice it is a generic response. Moreover, having too many training phrases leads to many different intents, we created a naming convention to better organize our agent. The naming convention is such that it first specifies the bot functionality (context), then the sub-context, and the topic (if necessary). Figure 3 shows a picture of how this naming convention is used.

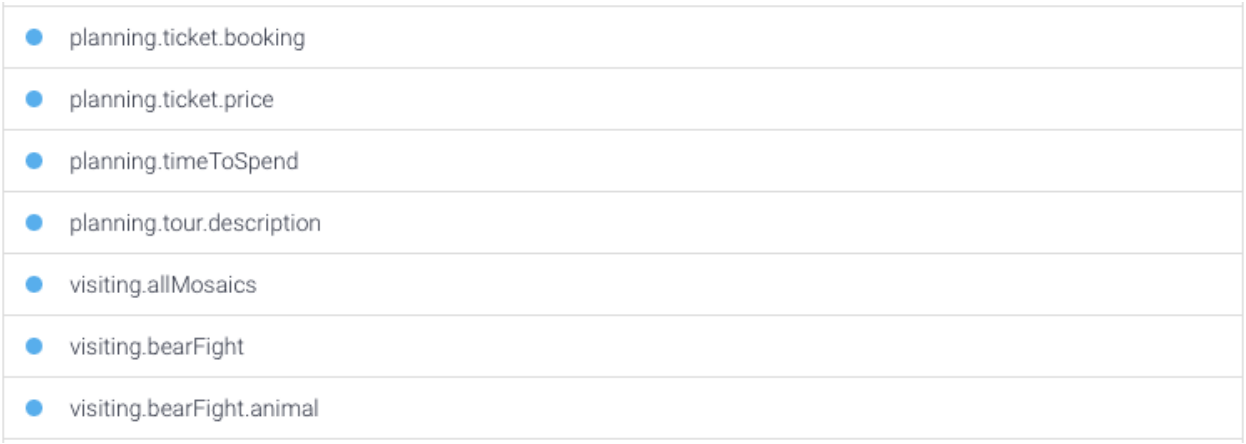


Figure 3 - Naming Conventions

In order to export the agent to Telegram, Dialogflow provides a built-in agent. Using this agent, you can also create messages that are specific to your target platform. We used the tools provided by the integration, like cards, we used custom payloads to format texts in markdown, and create Telegram quick reply and inline keyboards. Furthermore, custom payload and integration tools were used to send multiple responses by the chatbot, which makes the conversation look more natural.

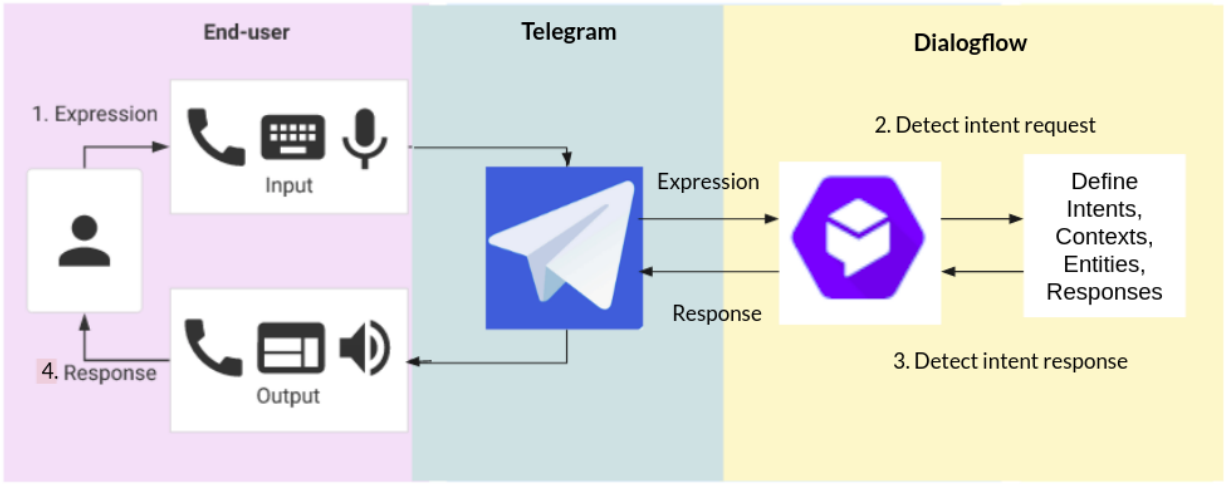


Figure 3 - Dialogflow Built-in Integrations

# Testing

As mentioned earlier, we completed two iterations, thereby two evaluation stages have been completed. The first evaluation was focused on the design of the chatbot itself. In particular, the effect of the quick reply keyboard on the user's thinking during the conversation. This test is done with the help of four participants. Two of them were given different versions of the chatbot i.e. with and without a quick reply keyboard, and the other two participants were provided both versions. We used latin square to mitigate the learning effect. We realized that while many users preferred quick replies, they did not notice the possibility of typing their questions. Therefore, we added another button to the FAQs, which would make it explicit that they can ask other questions too.

The final test is performed to find out about the user's feelings while using the chatbot. This test is also performed with the help of four participants. These users used our chatbot for almost twenty minutes, with no specific tasks given. These participants were chosen such that they are similar to the target users. After observing those participant, we concluded the following findings:

- The usage is easy and clear, both for people with, and without a computer science background.
- Information provided through the menu and buttons is satisfying.
- The number of training phrases in the database is not enough, and translation from German to English led to sentences that are not actually used in English.
- Unnatural conversation while answering mosaic related questions.

# Final Results

In order to turn this prototype into a market-ready product, some improvements need to be made. Firstly, we can improve the training phrases by fine tuning the intents and adding more phrases written initially in English, to improve the accuracy of responses, as well as gathering unanswered questions asked users, to and further improve the usefulness of the chatbot.

Another interesting improvement is to collect statistics like what kind of age group most visit the villa, what kind of questions visitors generally ask, etc. from the data provided by users. Furthermore, this chatbot could be used to collect feedback from users, in order to improve their experience at the Villa.

In conclusion, we were able to create an intuitive and easy to learn chatbot, with a mostly smooth and natural conversation. We successfully provided users with enough information for the planning and the duration of visit, while avoiding irrelevant questions.

# Our Chatbot

You can access the Roman Villa Nennig chatbot using following link and QR code:

https://t.me/villa_nennig_bot