

METAVVERSE Hackathon

Project management in the metaverse

A smart chatbot to help with project management

Written by

— ANEMICHE Samah

2022

Introduction

Artificial Intelligence has taken root in almost every field in many forms, and conversational agents or "Chatbots" are one of the first cases where AI can be applied in practice. They are usually offered to companies as Software-As-a-Service (SaaS) solutions, and consumers know them mainly as personal assistants such as Siri, Alexa or Cortana.

These automated conversational solutions can be used for task automation and data processing, and will be able to meet the requirements for speed and flexibility.

Nearly 1,800 project managers worldwide reported that 54% of their time was spent on "administrative coordination and control tasks, such as scheduling, resource allocation and reporting," leaving behind no less important categories of work such as people development, strategy and innovation[1].

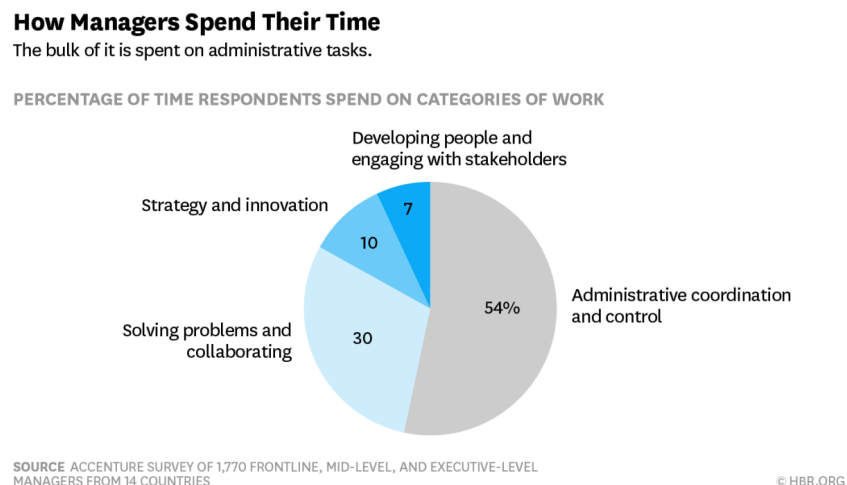


Figure 0.1: Percentage of time spent on different categories of work [1]

While from a business perspective, project managers should focus more on activities that contribute to business growth, leaving routine project management (PM) tasks to the AI.

The use of conversational agents (Chatbots) in project management could therefore benefit both project managers and the project team, they could be useful for the automation of routine tasks, information management and data processing by evolving to a predictive analysis of projects, advice and generated actions to be taken, and thus they would be able to reduce the duration of the project as well as the factors of failure of the latter by improving the quality of decision making.

The chatbot

What are chatbots?

Conversational agents or Chatbots are systems designed to mimic the unstructured conversations characteristic of human interaction to hold a conversation with humans, primarily for entertainment, but also for practical purposes such as automating business processes in different sectors.

These conversational agents can be powered by artificial intelligence (AI) and therefore use natural language processing (NLP) to interact with users.

Types of chatbots

- **Rule-based/Scripted:** user inputs and corresponding answers are defined in advance.
- **AI-Powered** they use AI and NLP technologies, they are able to self-learn the rules of the conversation by training a model on a set of data that they use to deduce regularities and mimic a human interaction

A taxonomy of AI-Powered chatbot models

- **Retrieval-Based** The easiest to implement, they use a repository of predefined an-

swers and a heuristic to choose an appropriate answer based on the input and context. These systems do not generate new text, they simply select an answer from a fixed set. [2].

- **Generative Models** They are more difficult, since they do not rely on predefined answers. They generate new answers from scratch.[2].

The interactions with a chatbot can be in an open domain (an infinite number of topics, there is no particular intention or goal to accomplish from the conversation) or closed domain (the chatbot tries to perform a specific task as efficiently as possible, so the conversation will be task-oriented)

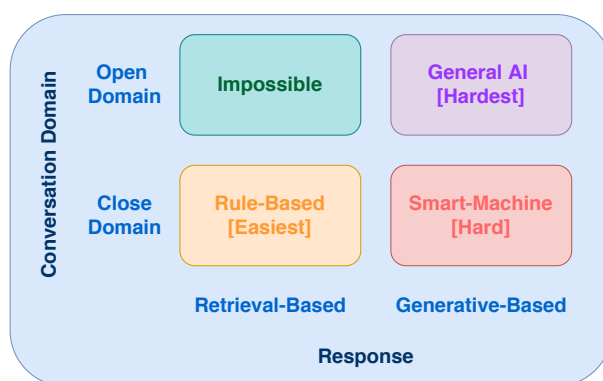


Figure 0.2: Types d'agents conversationnels

Task-oriented chatbot

In the case of a project management chatbot, we talk about task-based conversational agents, where the conversation domain is closed, and for our solution we opted for a language generator model.

The implementation of this type of chatbots requires the creation of several components, as these systems must not only generate consistent responses but also understand the intention of the user through his message and extract the entities in case they are present and then, query the database dynamically during the conversation with the user's preferences. i.e. the extracted entities in order to retrieve relevant information or to ask him more relevant questions so that the task is accomplished in a reasonable time.

Thus, a task-oriented dialogue agent is composed of two main modules:

- **Natural Language Generation**
- **Natural Language Understanding**

Recognition of user intent

One of the main challenges for a task-oriented chatbot is the determination of the user's intention, this is usually modeled as a multi-classification problem whose classes are the possible intentions of the user in the chatbot's activity domain, for a project management conversational agent this could be displaying the list of tasks of a project, adding a project or even modifying the status of a project... so the chatbot has to be able to identify the goal the user is trying to achieve.

Feature extraction

Understanding the user's intention is only part of the problem, extracting the relevant entities (information) from the user's message is no less important, in the context of project management the entities that can be found can be: the status of a project, the priority of a task or the email of a collaborator...etc. The chatbot will have to recognize these entities in order to be able to respond to the user's expectations and accomplish the desired tasks. The entities are inputs that can be optional and are not necessary to perform the task.

Architecture

Now we propose a theoretical architecture of the system:

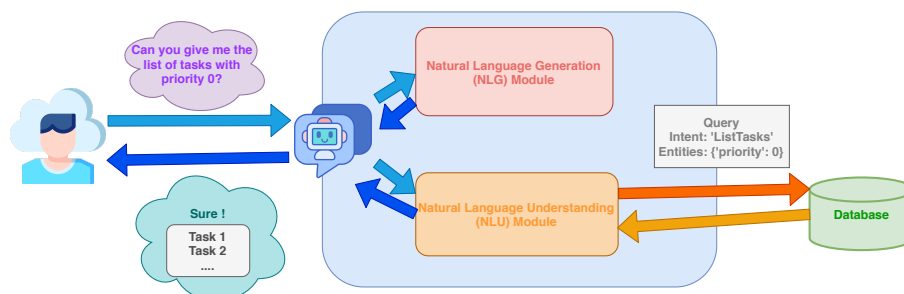


Figure 0.3: Theoretical architecture

NLG module

For our language generation module, we opted for the GPT-2 (Generative Pretrained Transformer 2) pre-trained model, a model published by OpenAI in February 2019 and which has accomplished the state of the art in many natural language processing tasks. Specifically, we chose the DialoGPT pre-trained model, with almost the same architecture as GPT-2, i.e.: 24 layers, 355M parameters, but trained on conversational English text (147M exchanges extracted from Reddit)

NLU module

For our language understanding module, we have chosen another model that has achieved the state of the art: DIET (Dual Intent Entity Transformer) published by Rasa¹ in May 2020, which can perform intent classification as well as entity recognition.

What about the datasets?

The implementation of a task-based conversational agent proved to be quite complicated given the lack of a domain-specific dataset for the Chatbot, and the quality of the corpus used is of great importance to generative language models.

Unfortunately, such a corpus wasn't available for the specific task of project management, therefore, creating one remains the only solution.

To overcome the problem of lack of datasets, we used Chatito², to help us generate datasets for training and validating the models of the system.

After some data preprocessing, which is different between the NLG and the NLU module, we end up with some datasets that we can use to fine-tune the models.

1. <https://rasa.com/>

2. <https://rodrigopivi.github.io/Chatito/>

The application

A very simple app was made to showcase a use case for the chatbot, the app was made using: Angular+Ionic, Node.js and firebase. It has some very simple CRUD operations such as: authentication, adding, updating and deleting: projects, tasks and team members, and a page where we can chat with the chatbot (there will be a powerpoint document with the code to showcase the app) but some screenshots of the final result are shown at the end.

Discussion of results

The NLG module (GPT-2) ended up overfitting very fast to the conversations schema (after a few epochs only) probably because of the problem of poor quality and insufficient size datasets. The model adapted to the format of the dialogue given as input, to overcome this problem, reducing the size of the chat history provided as input was tried, however, in this case, we noticed that the model loses the context of the conversation more faster and what is a task oriented chatbot if it can't keep on with the conversation?

What to do from now on?

Well, for a start we'll need to gather more data in order to have better smooth and fluent conversations, thus improve the quality of the dataset to have more conclusive human-computer dialogue results.

Also working on adding a consistent and coherent personality to our conversational agent in order to have more pleasant exchanges with the user.

Adding features such as a forecasting and alerting system, digital management of project files (contracts, agreements, ...), and adapting it to SCRUM methodologies.

As well as the implementation of voice input for conversation.

Screenshots

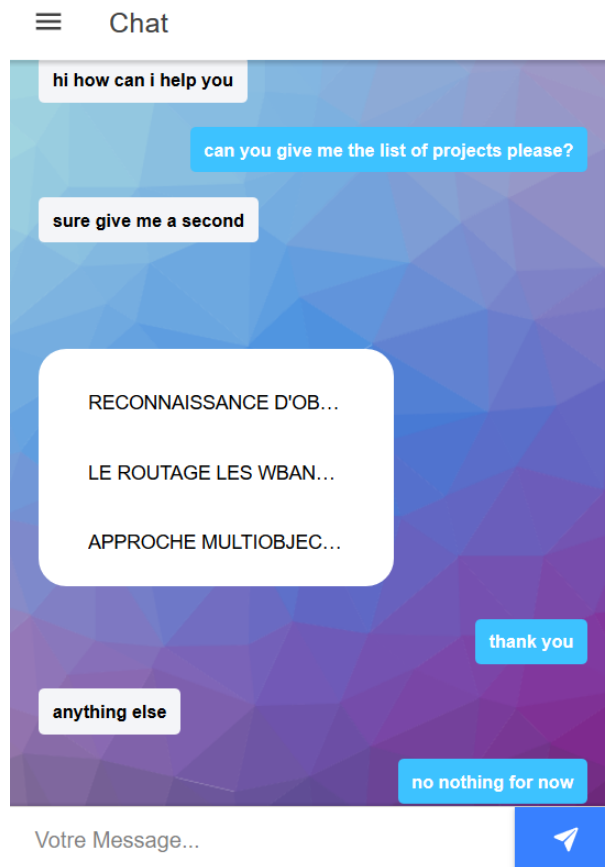


Figure 0.4: Conversation with the chatbot

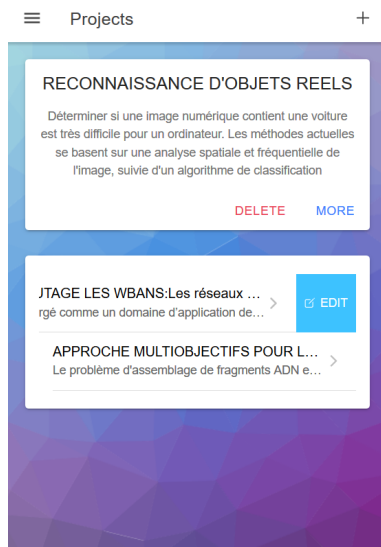


Figure 0.5: List of projects

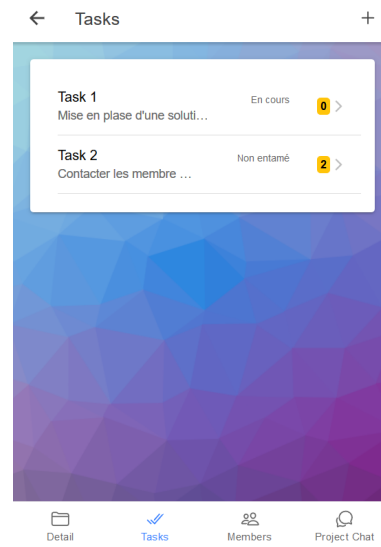


Figure 0.6: List of tasks

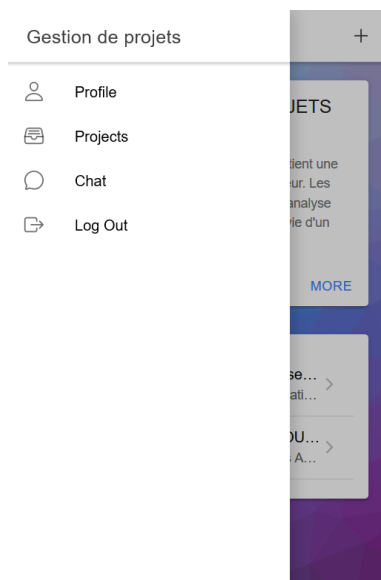


Figure 0.7: Side menu

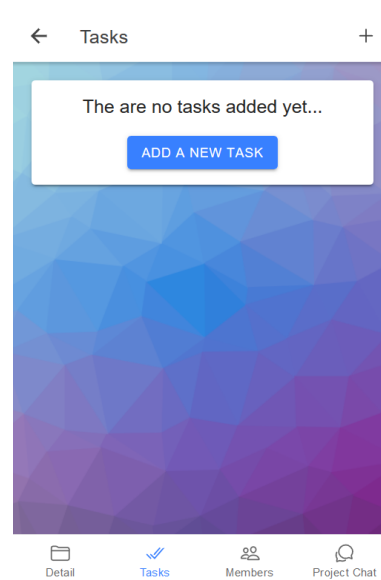


Figure 0.8: Project tasks

Bibliography

- [1] Richard Amico Vegard Kolbjørnsrud and Robert J. Thomas. How artificial intelligence will redefine management, 2016. <https://hbr.org/2016/11/how-artificial-intelligence-will-redefine-management>.
- [2] Denny Britz. Deep learning for chatbots, part 1 – introduction, 2016. www.wildml.com/2016/04/deep-learning-for-chatbots-part-1-introduction/.
- [3] Dace Cīrule and Solvita Bērziša. *Use of Chatbots in Project Management*, pages 33–43. 10 2019.
- [4] Marc Lahmann. Ai will transform project management. are you ready?, 2018. <https://www.pwc.ch/en/insights/risk/ai-will-transform-project-management-are-you-ready.html>.
- [5] Christian Mendieta. Project management & ai: a vision for the next decade., 2018. <https://christianmendieta.ca/project-management-and-artificial-intelligence/>.
- [6] Jay Alammar. The illustrated gpt-2 (visualizing transformer language models), 2019. <http://jalammar.github.io/illustrated-gpt2/>.
- [7] Tanja Bunk, Daksh Varshneya, Vladimir Vlasov, and Alan Nichol. Diet: Lightweight language understanding for dialogue systems, 2020.