

Integration of a Chatbot to facilitate access to educational content in digital universities

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Abstract— Digital universities have been developed in several countries, particularly on the African continent, to meet the need for massification in the higher education sector. However, the lack of physical space is a major drawback, preventing learners from succeeding and increasing the drop-out rate compared with a conventional university.

In these digital universities, learners use distance learning platforms to complete their training. For a good training, mastery of the fundamental modules is essential.

With the frequent use of messaging applications, the integration of Artificial Intelligence (AI) could promote and facilitate access to educational content and enhance their learning experience.

In this article, we propose a model for integrating a chatbot that will enable learners to access training modules to increase their knowledge and master core modules through formative skills assessments.

The model we propose is based on the use of Machine Learning (ML) with the Rasa open-source framework and the Moodle Learning Management System (LMS) platform.

Keywords— Chatbot, Moodle, Artificial Intelligence, Machine Learning, Rasa

I. INTRODUCTION

Today, digital universities have been developed in several African countries to meet the need for massification. To mitigate these problems, some virtual or digital universities [1][2][3] have proposed several pedagogical approaches often based on open digital spaces (ODS) to complement the virtual space and offer students a place to work and solve pedagogical, technical, administrative and social problems [3][4].

In these digital learning institutions, learners use distance learning platforms to take their courses.

To reduce the dropout rate and facilitate access to educational content, some universities are integrating a number of solutions into their pedagogical model, including social media and pedagogical supervision by tutors.

Faced with this problem, largely linked to the framing and ergonomics of certain Learning Management System (LMS)

platforms, we propose in this paper the integration of a chatbot to facilitate access to educational content and improve the learning experience for students.

A chatbot is a new form of automated contextual interaction enabling communication between users and machines or systems. This system exploits a conversational approach based on natural language [6].

This article will be structured as follows: after the introduction, we'll review related work in the field, followed by some basic chatbot concepts. After that, we'll talk about the design and implementation of the solution. We'll then conclude with a look ahead.

II. RELATED WORK

A number of researchers have worked in this field, making pertinent proposals. Among them are K. Gaglo, B. M. Degboe, G. M. Kossingou and S. Ouya [5] who have proposed a chatbot, enabling, in the context of covid19, learners to self-train on the parts of the course they have not mastered. This chatbot is connected to a Moodle platform and enables users to continue learning while at home. This proposed chatbot, is developed as a plugin that can be used in other platforms.

K. Souali, O. Rahmaoui, M. Ouzzif and I. El Haddioui [6], who propose and describe a new recommendation approach centered mainly on the use of a chatbot linked to the Moodle platform.

N. Nenkov, G. Dimitrov, Y. Dyachenko and K. Koeva [7], who proposed an intelligent agent in the form of a chatbot on the IBM Bluemix platform. This agent automates interaction between users and the Moodle training platform. This is a very interesting proposal, but it is specific to a technology belonging to IBM.

Authors T. Kita, C. Nagaoka, N. Hiraoka and T. Molnár [8], in their article entitled "Development of a Moodle UI Using LINE Chat for Casual Learning as a Part of a Learner Assistive LMS", set up a chatbot for a mobile application enabling interaction between users and a Moodle LMS platform. This tool is used on a specific LINE Chat application and meets a need in the Japanese community.

W. Kaiss, K. Mansouri and F. Poirier [9], to improve the quality of online learning, have proposed a methodology,

chatbot architectural design, to help learners self-regulate their learning by accompanying them via a chatbot within the Moodle platform, which constitutes a metacognitive virtual assistant.

S. Kesarwani, Titiksha and S. Juneja [10], with their chatbot in place, have enabled their institution's administration to reduce the amount of work they have to do in providing the required information to students, thus reducing their workload in continuing to answer all student questions. They also confirm that chatbot systems can be used in a wide range of sectors, including education, healthcare and marketing.

B. Rawat et al [11] carried out a detailed survey of recent deep learning techniques for chatbots. This has brought developers' understanding closer to good chatbot design.

J. J. Sophia and T. P. Jacob [12], in their article, demonstrate and present the design and development of Student Chatbot software integrated with a user website that manages student queries via defined intents. The article covers the chatbot system with the Recurrent Neural Network (RNN) to handle the language part, the Convolutional Neural Network (CNN) to handle the image part, Dialogflow, accurately illustrating the intention and entity representation and keyword matching techniques.

S. Ondáš, M. Pleva and D. Hládek [13], have developed three chatbots to support teaching at their university's Department of Electronics and Multimedia Telecommunications. The first is the KEMTbot, which is a robot located on the department's web page. It provides information from the Web and about the department's staff. The second chatbot is a bot that accompanies students during exercises in the subject "Databases". The last is an Amazon Alexa chatbot skill, which answers questions about the department on Amazon Echo devices.

III. BASIC CONCEPTS & TOOLS USED

With the progress made in the field of Artificial Intelligence (AI) and Machine Learning (ML), conversational agents are playing a key role in various business sectors. Many organizations are opting for this type of solution, on the one hand to reduce the number of physical staff in the company, and on the other to enable a rapid, automatic response based on criteria defined at the time of implementation [14].

A conversational agent, chatbot or dialogue system is a tool for interacting with users in natural language. As a result, this system is able to understand and converse with a user as if it were humans talking. These types of systems can be text-based or voice-based [15].

These systems are applied and used in a wide range of sectors, including human resources, healthcare and education. [14][15].

A. Moodle

Moodle (Modular Object-Oriented Dynamic Learning Environment) is a free Learning Management System distributed under the GNU General Public License. It is developed in PHP. In addition to the possibility of creating

courses with integrated tools and categorizing content by course, cohort level, sub-category, etc., the platform offers the possibility of being interconnected with external tools via secure APIs [16].

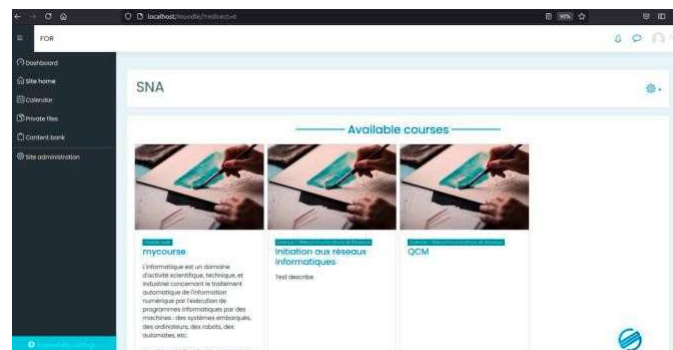


Figure 1: Moodle platform home page

B. Interoperability between the chatbot and the Moodle platform using APIs

An API (Application Programming Interface) is a tool enabling different systems to communicate with each other. It defines the methods by which the two systems can communicate.

Moodle offers several APIs for interaction between the chatbot and its system. To retrieve data from the Moodle platform, authentication is required via a time-limited Token. To enable the chatbot to access the APIs, an authentication function must be implemented [16].

C. Natural Language Processing (NLP)

NLP (Natural Language Processing) is a branch of computer science focused on developing systems that enable computers to communicate with people using everyday language [17][18].

The intelligent conversation system is the foundation on which all Chatbots are built. It enables us to understand user requests and respond in a relevant way. This type of system is often built on top of an understanding and categorization algorithm. Let's now focus on the different elements of language processing: NLG (Natural Language Generation) and NLU (Natural Language Understanding).

Most chatbots operate on a basic model of these three properties, namely: Entities, Intentions, Response [18].

D. Key stages in the learning process

The first part consists of creating the NLU and discussion models, commonly known as the training phase. As Rasa is based on Machine Learning, it requires training data [19].

- For the NLU part (Rasa-NLU), the training data are sample sentences that the user might utter, in which intent and entities are specified. A configuration file is also required to set the algorithm parameters.
- For the discussion part (Rasa-CORE), a set of stories must be defined so that the agent learns to choose its next action. The configuration file accompanying the

stories contains lists of intentions, entities, slots and actions.

IV. SOLUTION IMPLEMENTATION

The implementation of a conversational agent involves several stages, including preparation and selection of the solution, development, and finally management and continuous improvement.

A. Overall solution architecture

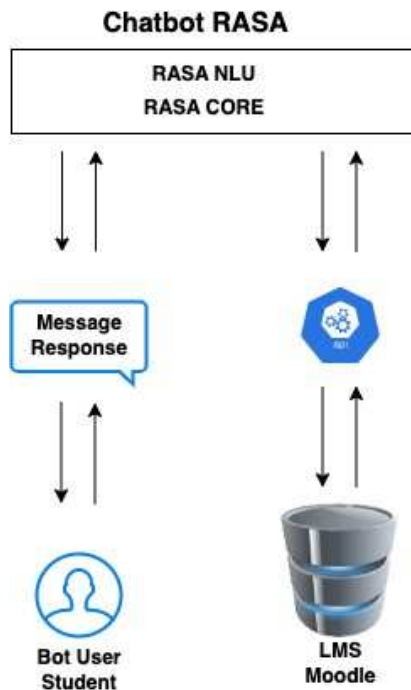


Figure 2: System architecture

B. Solution development

There are several stages in the development of the solution:

- Step 1: Installing Rasa
- Step 2: Project creation
- Step 3: Defining intentions and examples
- Step 4: Defining responses
- Step 5: Creation of dialogue stories
- Step 6: Model training and testing

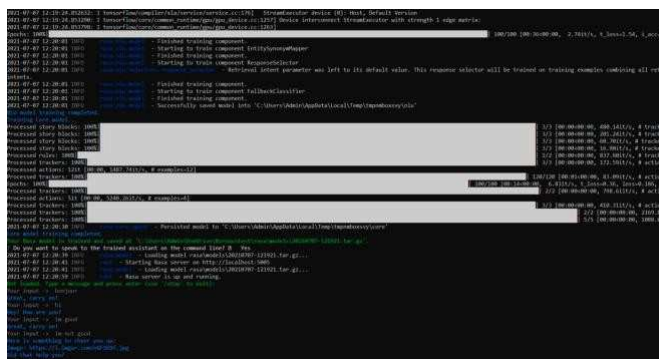


Figure 3: Model training

Once the prerequisites have been set up, the next step is to train the model and test it in console mode.

Step 7: Creating the graphical interface

After configuration and testing, it's important to set up a graphical interface enabling users to interact with the system. This interface defines the access parameters for the Rasa chatbot.



Figure 4: Moodle authentication and token recovery function

After finalizing the creation of the chatbot in console mode, we created the graphical interface enabling us to interact more easily with the chatbot.

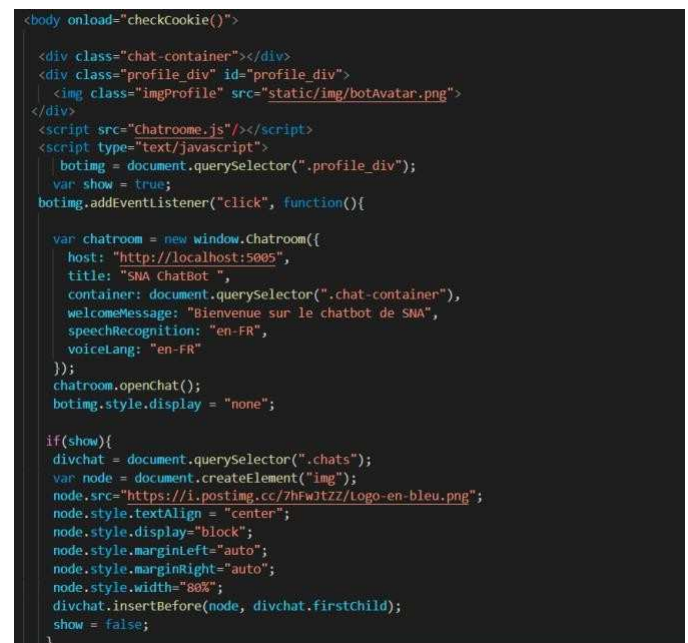


Figure 5: Code of Chatbot graphical interface

C. Steering and Continuous Improvement

Depending on the indicators set to measure the system's performance, it is important to measure the rate of understanding of the entities' performance, and to make continuous improvements by adding responses as the system is used.

V. RESULTS AND ANALYSIS

After implementing the various tools and tests required, the chatbot was set up and the following captures were taken.

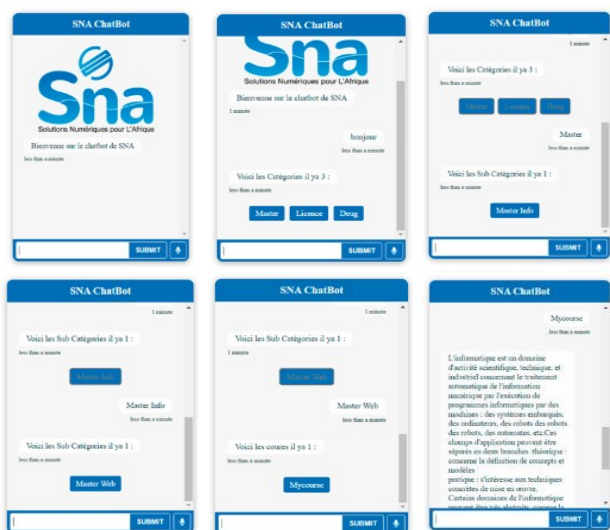


Figure 6: Chatbot graphical interface

In these images, after clicking on the chatbot icon, the interface opens, displaying the different course categories available on the platform.

After selecting a given category, the corresponding sub-categories are displayed in turn.

After that, if there are no sub-categories, the course content is displayed on the chatbot, with the option of scrolling through the content.

VI. CONCLUSION AND PERSPECTIVES

A chatbot is a new form of automated contextual interaction enabling communication between users and machines or systems. This system exploits a conversational approach based on natural language.

The chatbot implemented in this article with Artificial Intelligence (AI), Machine Learning (ML) and Rasa tools, then interconnected with the Moodle training platform, enables learners to self-train by considering the basic modules for training in the IT field.

With the advancement of AI, our next objective will be to interconnect this chatbot with ChatGPT to be able to answer questions from learners who are not on the Moodle training platform. This will make the tool complete and accessible to users in all training streams.

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