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# An Intelligent Interface for Human-Computer Interaction in Legal Domain

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**Abstract.** Technological evolution and advances in the field of artificial intelligence have brought about considerable transformations in every area of our lives, also changing our various needs. In particular, the ever-increasing development and use of messaging applications have enabled the growth of services closer to users, as they can be seen as excellent means of advertising, sales and customer service. This is precisely why business models have changed drastically, moving towards new technologies such as ChatBots. The messaging applications nowadays are used daily while ensuring that they can keep up with the pace of this increasingly hectic and demanding world thanks to their 24/7 availability, low costs and customised real-time services. This paper aims to provide a general description and design principle of a ChatBot, designed and developed for the CREA2 (Conflict Resolution with Equitative Algorithms) platform, which includes the management and automatic resolution of disputes concerning the division of assets, trying to avoid costs and bureaucracy.

## 1. Introduction

The word ChatBot comes from the term 'chatterbot', coined by Michael Mauldin (creator of the ChatBot Verbot) in 1994 to describe conversation programmes. It can also be broken down into two different words: 'bot', which indicates a programme that operates on the Internet and performs repetitive tasks, and 'chat', which refers to messaging applications.

A ChatBot is software designed to simulate human conversations with text or voice interactions, allowing users to interface with various computing devices as if they were communicating with actual people.

This software can be extremely simple, answering highly limited queries based on input keywords, or sophisticated, such as digital assistants that exploit advanced natural language recognition and analysis (NLP) systems.

The general interest in this topic is considerable, is evidenced by worldwide searches over the last decade thanks to Google Trend statistics, and can be justified by multiple social, technological and economic factors.

First of all, with regard to social motivations, the spread of ChatBots is linked to the extremely high number of people using messaging applications, which according to a 2018 Business Insider study[13] is greater than the number of users who make use of social networks.

The technological motivations, on the other hand, are linked to advances in artificial intelligence and, in particular, in machine learning, natural language processing and sentiment analysis, which have made ChatBots increasingly high-performance, thus triggering growth in demand in demand in various market sectors[5].

Finally, there are economic motivations in that implementation costs are lower than in other solutions since they can be developed using tools that are sometimes free of charge.

ChatBots were created to increase a company's operational efficiency and offer help to its customers[6].

The main benefits to be gained from using a ChatBot are :

- Availability 24 hours a day, every day, including holidays.
- A fast service which minimises waiting times by being able to process a large number of requests simultaneously, thus improving the user experience.
- Ease of use for users due to the lack of a learning curve.
- Reduction of customer service costs. In the long run, creating and maintaining a ChatBot is much cheaper than hiring an employee.
- Ability to find the information extremely fast by being equipped with a database.

All of these features are relevant in certain corporate businesses, but ChatBots are not always developed to gain benefits as they may also have entertainment as a goal.

Precisely because of these numerous advantages, many sectors are betting on their use, and according to various statistics and forecasts for 2021, it has emerged that: 50% of private companies expect to spend more on ChatBots than on mobile applications; currently, 1.5 billion people use ChatBots; ChatBots can reduce costs by up to 30% and 64% of users think that 24-hour availability is the best feature of a ChatBot[7].

CREA2 project aim to extend the results of its predecessor, CREA (2017-19). It is finalised to introduce Artificial Intelligence (AI) driven tools to assist natural and legal persons in resolving their disputes by applying innovative game-theoretical (GT) algorithms. This work aims to present a chatbot designed for the project CREA2. It will help users to locate information of interest and follow them step-by-step through dispute resolution procedures.

In parallel, this novel approach toward civil dispute resolution will tackle the existing disparities among the national legal systems of the several EU Member States (MS) by establishing a European Common Ground of Available Rights (ECGAR), i.e., putting

aside all the mandatory rules of each MS and operating on the remaining 'rights available'. The main objective is to facilitate users' access to Online Dispute Resolution (ODR) mechanisms and, consequently, to avoid denial of justice or structural difficulties in accessing justice. Hence CREA2 will offer 3 novelties:

- Linking the ECGAR to the developed GT algorithmic model of dispute resolution to provide precise standards for integrating law & AI (WP2);

- Applying AI-driven tools based on machine learning for implementing an innovative smart conversational user

interface, guiding the practitioner, the legal and the regular users in setting and resolving the dispute resolution process (WP3);

- Implementation of Smart-contract Blockchain Technology[10,11] based on DApp Design methodology for the certified agreement between the parties (WP4);

Moreover, a videoconferencing function, allowing the mediator to speak with both parties on the software (WP3), is added. CREA2 will improve the existing CREA platform. The software will be distributed as an open-source project. The project will involve – as the main target groups – a wide range of EU stakeholders, including over 150 lawyers, 30 notaries, 50 mediators, 5 consumer associations, 100 academics, 300 students, 5 legal tech companies, 5 policymakers.

## 2    Related Work

Although ChatBots are a current topic and technology, Alan Turing formulated the criteria for establishing machine intelligence as early as 1950 in his article 'Computing Machinery and Intelligence and the Turing Test.

Turing was a British mathematician and cryptographer and was the first to question whether or not a machine was capable of thinking. His test involved a text conversation between three people via a device and then replacing one person with a machine that imitated human behaviour and interactions. If the other people did not notice the substitution, then the test indicated that the device was capable of thinking.

The first real example of a ChatBot, however, dates back to 1966 when Joseph Weizenbaum designed ELIZA. This programme simulated a conversation during an initial visit between a psychotherapist and a patient. The algorithm was very simple, analysing and substituting elementary words into predefined sentences, thus giving for the first time the illusion that the machine could understand what was being formulated by the user.

Chatbot systems usually fall into two main categories, as described as follows.

### 2.1 Retrieval-Based and Generative-Based

An initial differentiation is made between Retrieval-Based and Generative-Based ChatBots, based on the model with which responses are generated.

Retrieval-Based ChatBots do not generate new answers but merely choose the most appropriate answer from a predefined list. Therefore, starting from the question posed by the user and using a certain criterion, the ChatBot identifies the best answer from

the predefined list, called candidate response. The selection is done by associating a score based on how appropriate the answers are to the context and obviously choosing the one with the highest score which will be sent to the user.

The selection criteria can vary and be very simple, such as systems based on text-matching rules, or more complex ones that exploit machine learning and natural language processing.

The advantage of these systems is that they will definitely give grammatically correct answers as they belong to a predefined list, they are also very easy to implement and do not require a large amount of data for training.

The disadvantage is related to the creation of a database of predefined answers and the choice of selection criteria[12].

Generative-Based ChatBots, on the other hand, involve the generation of new answers with each user interaction. These systems make use of the same comprehension techniques as translation systems, i.e. neural networks and Deep Learning, but instead of performing a translation between two languages, they transform an input question into an output response.

A seq2seq architecture is often used, which takes a sequence of words as input and outputs another sequence of words, using a recurrent neural network.

The advantage of this system is the absence of a database of predefined answers and a selection system. In fact, it is autonomous in the generation of answers as it is based only on the training received.

Although it is an advantage to create new answers at each iteration, it can also be a major problem as answers may be constructed either grammatically incorrectly or totally out of context. Furthermore, in order to achieve discrete performance with accurate answers, a very large training set is required.

## 2.2 Open Domain and Closed Domain

Another differentiation is made between Open Domain and Closed Domain ChatBots, depending on the operating domain.

Open-domain ChatBots are those capable of answering questions on any topic or theme. They aim to engage in general conversation even in the absence of a specific context.

Precisely for this reason, it is impossible to realise an Open Domain and Retrieval Based ChatBot since an infinite set of predefined answers would have to be provided.

On the other hand, an Open Domain and Generative Based ChatBot is feasible, but not simple, as it requires a large amount of training data and it is very difficult to control how it will answer individual questions.

Closed-domain ChatBots, on the other hand, operate in a well-defined context and are therefore responsible for answering questions related only to their domain of competence.

Thus, to realise a Closed Domain and Retrieval Based ChatBot one must construct an answer set relating only to the domain of interest, while to realise a Closed Domain and Generative Based ChatBot one must carry out training based on data relating to the chosen domain in such a way as to answer the questions with sufficient precision.

## 2.3 Chatform Platform Typologies

Different paths can be followed to develop a ChatBot, and it is, therefore, possible to group the main platforms available, of which there are generally three:

• Platforms without programming do not require prior knowledge and are, therefore, easy to use[17]. They allow the development of fundamental systems that have very little natural language processing and are, therefore, unsuitable for complex ChatBots.

• Conversation-oriented platforms, which aim to have a flexible dialogue without considering a specific domain. These systems use languages such as AIML (Artificial Intelligence Markup Language) to develop communication with the end-user, but even then, performance in terms of information extraction quality is limited.

• Platforms of technology giants aim for high expressiveness and a low learning curve.

The most widely used channels are Facebook Messenger, Telegram and Slack, although the native website ChatBots has developed a lot in recent years, as they allow better user interfaces, avoid third-party applications and have lower maintenance costs[8,9].

Precisely in order to enable the development of these various types of platforms, a large number of free, open source and paid-for development software have sprung up. Table 1 contains only a few examples of the main ChatBots of 2021, many of which provide a Freemium plan, i.e. some of the functionalities are free of charge, while other more specific and advanced ones are accessible through paid versions.

**Table 1.** List of Chatbot Projects

| Name of the Chatbot | Project Link | License |
|---|---|---|
| Landbot | https://landbot.io/ | Freemium |
| ManyChat | https://manychat.com/ | Freemium |
| RIVE Chat | https://www.revechat.com/ | Premium |
| Xenioo | https://www.xenioo.com/ | Freemium |
| Flow Xo | https://flowxo.com/ | Premium |

Later on, more powerful software was developed such as A.L.I.C.E., Jabberwacky and DUDE, which provided a basic knowledge that enabled it to recognise certain words and phrases provided by the user in order to associate them with categories of topics and create relationships. Finally, modern technologies have abandoned rule-based patterns in favour of systems based on Machine Learning. These systems exploit natural language processing or neural networks in such a way as to increasingly increase performance and adapt to ever more varied demands.

## 3. The Chatbot Design Principles

The chatbot must be able to receive questions from users, understand these questions and provide relevant and grammatically correct answers[14,15].

It will have to convert a natural language sentence into a query referring to a relational database.

The aim is to provide the end user of the CREA2 platform with non-pervasive but user-friendly support. The chatbot will assist the user during login and registration to the CREA2 platform.

It will guide the user in consulting open disputes, help him open new ones and give information about the usage of the different functionalities.

It will also provide a glossary of terms and concepts specific to the legal branch. The user can select a phrase, word or law within the text written in the CREA2 platform and ask the chatbot for a suggestion.

Irrelevant user input will be reported to users as not relevant (e.g., "what's the weather like in Naples?" Is not relevant to our context).

Figure 1 depicts the activity diagram schematising the general behaviour of the chatbot. Once activated by the user, the chatbot[16] will provide online help on the Platform functionalities and give explanations regarding the general EU Regulamentory and Common Grounds, and information regarding Divorce & Inheritance per EU Country divided by Countries.

These functionalities specifications are written in accordance with the "IEEE Recommended Practice for Software Requirements Specifications' referenced IEEE Std 830-1993 (Revision of IEEE Std 830-1984)[1,2,3].

The ChatBot software system is an integral part of the CREA2 platform and will have to integrate seamlessly with it, finalised to offer the best user experience for the end user[4,18].

Facilitating efficient access to justice for people remains one of the main goals of EU member states and European institutions, both nationally and across borders within the EU (see Article 47 of the EU Charter of Fundamental Rights). Implementing effective dispute resolution mechanisms would require, among other things, the provision of legal and extra-legal frameworks, tools (including software), considerable guidance, and increased user awareness. For this reason, dispute resolution technology models are gaining ground as efficient means to improve and increase access to Justice.

The CREA2 project builds on the achievements of its predecessor, CREA. It aims to introduce (within the existing CREA platform) innovative AI- and blockchain-based features that facilitate online dispute resolution in cases specifically related to asset division. At the same time, this new approach to civil dispute resolution will also address existing disparities between the national legal systems of the various EU member states through the establishment of a common European base of available rights, i.e., setting aside all mandatory rules of each member state and working on the remaining "available rights." The development of AI and digitisation on a larger scale affects the law and our perception of it.
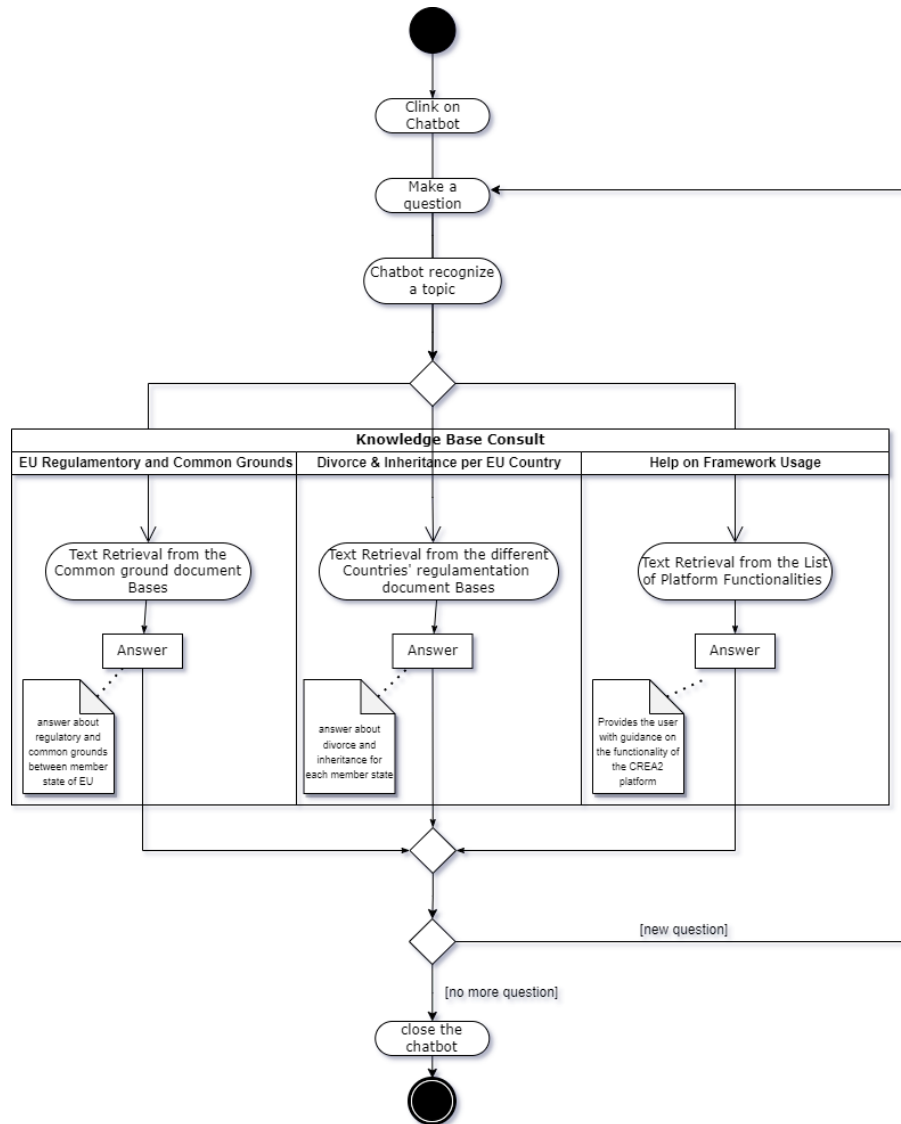
**Fig. 1.** Activity Diagram depicting the chatbot functionalities

There must be a propaedeuticity regarding the services offered by the bot:
- The bot cannot provide the user with assistance without the user first logging into the system.
- The bot should not allow the user to register or log in if the user is already logged into the platform.
- The bot must take care of the user's sensitive data, as already mentioned in previous Sections.
- The bot is only required to work on issues related to its scope of application

- The bot will report and deal appropriately with queries that deviate from the CREA2 platform.

In particular, the services offered must be unlocked by the login action, as the diagram of figure 2 suggests. The system will fully comply with the following Legal Domain Constraints:
- Directive 2013/11/EU
- Regulation (EU) No. 524/2013
- GDPR.

System interfaces must be specified appropriately and efficiently accessible for third-party integrations.
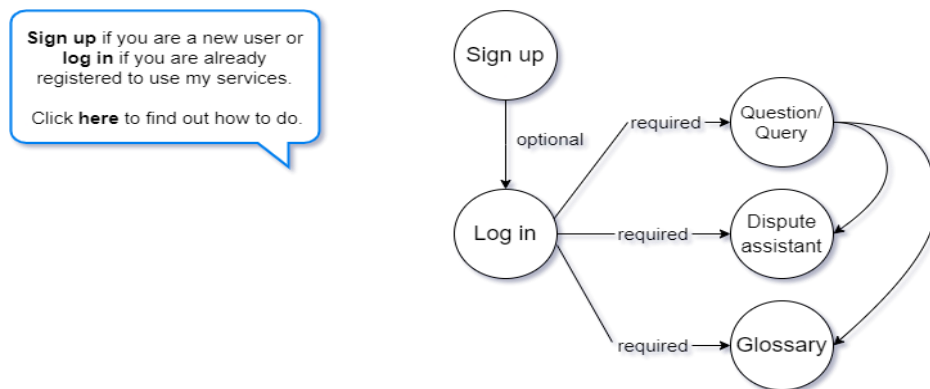


**Fig. 2.** List of allowed services

## 4. Conclusions

The paper provided a general overview of a ChatBots specifically develoed for CREA2 Project (Conflict Resolution with Equitative Algorithms), which provides for the management and automatic resolution of disputes concerning the division of assets, trying to avoid costs and bureaucracy. A description of chatbot functionalities is reported. This is a first step for a good design and highlighting the functional and performance requirements. Finally, a general overview of the various platforms for creating a new ChatBot will be provided, analysing features and differences, and then proceeding to the realisation of an elementary prototype of the final product.

# References

1. IEEE Recommended Practice for Software Requirements Specifications IEEE Std 830-1993 (Revision of IEEE Std 830-1984). https://ieeexplore.ieee.org/document/392555/definitions
2. Key words for use in RFCs to Indicate Requirement Levels. Request for Comments: 2119. S. Bradner.Harvard University. https://www.ietf.org/rfc/rfc2119.txt
3. SRS Examples. Annarita Fasolino. http://wpage.unina.it/fasolino/is/materiale/SRS/SRS-esempio.pdf
4. Chatbot Magazine. chatbotsmagazine.com,_https://chatbotsmagazine.com/how-to-document-chatbot-requirements-7df81275cc66, 30/06/2022
5. Amato, F., Moscato, F., Moscato, V., Pascale, F., & Picariello, A. (2020). An agent-based approach for recommending cultural tours. Pattern Recognition Letters, 131, 341-347.
6. Amato, F., Casillo, M., Colace, F., De Santo, M., Lombardi, M., & Santaniello, D. (2019, December). Chat: a cultural heritage adaptive tutor. In 2019 IEEE international conference on engineering, technology and education (TALE) (pp. 1-5). IEEE.
7. Lalwani, T., Bhalotia, S., Pal, A., Rathod, V., & Bisen, S. (2018). Implementation of a Chatbot System using AI and NLP. International Journal of Innovative Research in Computer Science and Technology (IJIRCST) Volume-6, Issue-3.
8. Almansor, E. H., & Hussain, F. K. (2019, July). Survey on intelligent chatbots: State-of-the-art and future research directions. In Conference on Complex, Intelligent, and Software Intensive Systems (pp. 534-543). Springer, Cham.
9. Toxtli, C., Monroy-Hernández, A., & Cranshaw, J. (2018, April). Understanding chatbot-mediated task management. In Proceedings of the 2018 CHI conference on human factors in computing systems (pp. 1-6).
10. Walter Balzano, Marco Lapegna, Silvia Stranieri, and Fabio Vitale. Competitive blockchain-based parking system with fairness constraints. Soft Comput., 26(9):4151–4162, 2022.
11. Silvia Stranieri. An indoor smart parking algorithm based on fingerprinting. Future Internet, 14(6), 2022.
12. Maubert, Bastien, et al. "Concurrent games in dynamic epistemic logic." Proceedings of the Twenty-Ninth International Conference on International Joint Conferences on Artificial Intelligence. 2021.
13. ai4business.co.uk, https://www.ai4business.it/robotica/chatbot/chatbot-cosa-cosa-ce-dietro-successo/#Il_mercato_internazionale_delle_chatbot, 04/07/2022
14. Amato, F., Moscato, F., Moscato, V., Pascale, F., and Picariello, A. (2020). An agent-based approach for recommending cultural tours. Pattern Recognition Letters, 131, 341-347.
15. Amato, A., Cozzolino, G., & Ferraro, A. (2020, October). Artificial Intelligent ChatBot for Food Related Question. In International Conference on P2P, Parallel, Grid, Cloud and Internet Computing (pp. 235-240). Springer, Cham.
16. Amato, Alessandra, Giovanni Cozzolino, and Antonino Ferraro. A Smart Interface for Provisioning of Food and Health Advices. International Conference on P2P, Parallel, Grid, Cloud and Internet Computing. Springer, Cham, 2020.
17. Di Martino, Beniamino, and Francesco Moscato. An ontology based methodology for automated algorithms recognition in source code. 2010 International Conference on Complex, Intelligent and Software Intensive Systems. IEEE, 2010.
18. Castiglione, A., Cozzolino, G., Moscato, F., & Moscato, V. (2020). Cognitive analysis in social networks for viral marketing. IEEE Transactions on Industrial Informatics, 17(9), 6162-6169.