Enhancing Political Dialogue with Language Models

Wissenschaftliche Arbeit zur Erlangung des Grades

Interdisciplinary Project

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Abstract

At the heart of many developed societies lies the principle of democracy. Thus, it is of the utmost importance that all citizens use their right to vote in the most informed way possible. However, nowadays we see record levels of abstention and society is growing uninterested in modern politics. This phenomenon could potentially lead to negative consequences as it could influence the result of the elections. Faced with such a problematic setting, it is clear that we need solutions that contribute to addressing such a complex and multifaceted problem. In this project, we argue that Retrieval-Augmented Generation (RAG) can help solve this problem by leveraging the scalability of modern Artificial Intelligence (AI) systems to design more efficient mechanisms of communication between voters and political parties. More specifically, we intend to answer the question: Do retrieval-augmented generation technologies attract interest among voters for enhancing access and understanding essential information in political party documents, with the aim of improving political dialogue and informed decision-making?

Contents

1 Introduction

1.1 Problem

Widely regarded as one of the best social systems, democracy relies on the active participation of the electorate to be able to reflect the core values and objectives of society. At present, this problem could not be more relevant given that some consider 2024 to be the year of elections (Koh, 2024), since an historic 64 elections will take place during the course of the year. However, for some countries voter turnout is at worrisome levels as shown in (Fig. 1). Therefore, there is a growing concern that such a phenomenon could undermine the foundations of democracy, which could hinder the social fabric of modern day society.

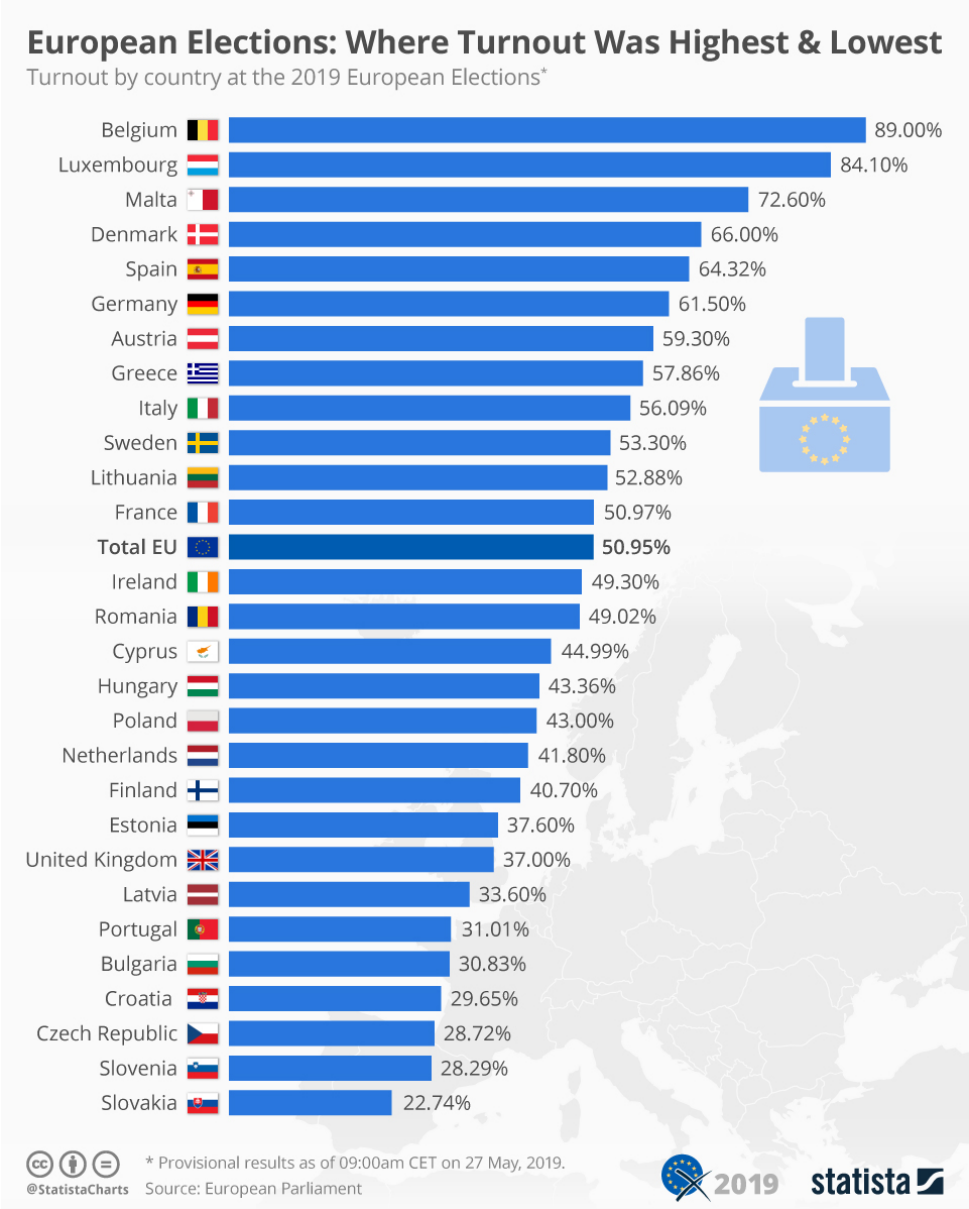

Figure 1: Voter turnout in the european elections of 2019, as originally presented in (Statista, 2019).

1.2 Causes of the Problem

Acknowledging the problems associated with high levels of abstention, the natural follow-up question concerns the potential causes of these record levels. Significant efforts have been made to understand the roots of the problem, some studies explore on rational abstention (Downs, 1957), while other studies examine concrete historical cases (Torreblanca, 2004). Moreover, some authors highlight the link between disinterest in politics and abstention. They suggest that people may abstain from voting due to disenchantment or believing that politicians cannot change their situation (Bourdin and Tai1, 2022). Such a diverse variety of studies makes it challenging to summarize all the efforts made to analyze the problem. Nevertheless, most experts would agree that the indifference with respect to the winners of the electoral process and the lack of interest towards politics are amongst the causes behind this problem.

Ultimately, this motivates the study and development of solutions that aim to address these issues, in which technology can play a significant role.

1.3 Related Work

As seen in many other scientific fields, technology can play a role in implementing scalable and cost-effective solutions. Recent studies have shown that tailoring messages to individual voters based on their behaviors and preferences can significantly boost voter engagement, i.e, personalized emails, letters, campaigns (ElectionBuddy, 2023). Other studies suggest that accessibility also plays a major role, claiming that online voting solutions can effectively reduce the cost of voting (Polyas, 2023). Furthermore, technology can play a crucial role in boosting civic engagement by enabling citizens to communicate with local governments through online platforms for issue reporting, virtual meetings or even civic hackathons to develop solutions to local issues (Fuel Our Democracy, 2024). By implementing these strategies, society can work towards increasing voter turnout, fostering civic engagement, and strengthening democratic processes.

1.4 Project Goals

In this project, we intend to leverage artificial intelligence to scalably and cheaply simplify the access to political documents. For some, the effort associated with carefully and diligently researching political documents is simply too prohibitive to fit in their daily life. Therefore, we believe that Retrieval-Augmented Generation techniques, i.e. techniques that combine the retrieval of relevant information from a large dataset with a language model's ability to generate text, can play a fundamental role in drastically reducing the time to perform such research, while at the same time democratizing the access to information by creating a free-to-use platform.

Due to our own life experience, we decided to create the platform to specifically address this problem for the 2024 Portuguese General Elections taking place on the 10th of March,

however, most of the topics discussed in this report remain relevant for other electoral systems. Additionally, it is important to mention that we do not seek any financial gains from this project.

Concisely, we aim to answer the following research question:

Do retrieval-augmented generation technologies attract interest among voters for enhancing access to and understanding of essential information in political party documents, with the aim of improving political dialogue and informed decision-making?

2 Theory

Even though advanced artificial intelligence systems exhibit unprecedented capabilities in a variety of text generation related tasks (Team et al., 2023), they have a hard time providing the original sources of information used, as well as remembering the exact text used in training (Learn Prompting, 2024). Therefore, for applications that need accurate fact-checking mechanisms we need a framework to 1) provide the model with necessary information and 2) track each specific data source.

2.1 Large Language Models

Often referred to as Large Language Models (LLMs), these advanced artificial intelligence systems are designed to understand, generate, and interact with human language on a large scale. They acquire these capabilities by learning from a large corpus of text through computationally intensive, semi-supervised training procedures, often involving the task of predicting the next word in a sentence. Typically, LLMs are vast artificial neural networks leveraging the Transformer architecture (Vaswani et al., 2023), or the more recent Mamba architecture (Gu and Dao, 2023). Given the popularity and economic incentives behind models like GPT-4 (OpenAI et al., 2023), extensive development efforts have been made in designing and training various LLMs (Naveed et al., 2024). Moreover, when selecting an LLM for a specific application, it is crucial to consider the licensing of the parameters and the model's performance in the desired natural language, for example, its adequacy for tasks in Portuguese. LLMs demonstrate a good semantic understanding of text and can behave as intended by providing thoughtful system prompts. A system prompt is essentially an instruction explaining to the model how to behave, guiding its responses to align with the user's needs.

2.2 Retrieval-Augmented Generation

Retrieval-Augmented Generation (RAG) (Lewis et al., 2021) is a technique used to enhance the capabilities of language models by combining the retrieval of relevant information from a large database or text corpus with the natural text prowess of LLMs.

This technique, outlined in the process diagram (see Fig. 2), begins by receiving a user query which prompts the system to fetch relevant data from a comprehensive text corpus. The information retrieved is then synthesized with the user's query to form an enriched prompt. This enriched prompt, containing both the original user query and additional contextual information, is fed into an LLM. The LLM processes this prompt and generates a response that is informed by the extended context, thereby producing more accurate and contextually relevant results.

The customization of RAGs to specific applications presents its own set of challenges, namely accounting for the underlying data structure to optimize the document retrieval process. To navigate this, vector databases are frequently employed, where text is converted into vector representations to facilitate efficient and relevant data retrieval by leveraging statistical properties. Additionally, there's an element of prompt engineering involved, it is sometimes necessary to produce distinct prompts tailored to different topics. These prompts are then consolidated to produce a more nuanced and comprehensive response that aligns with the query's context. This process necessitates a strategic approach to ensure that the prompts elicit the most useful information from the dataset for the LLM to use.

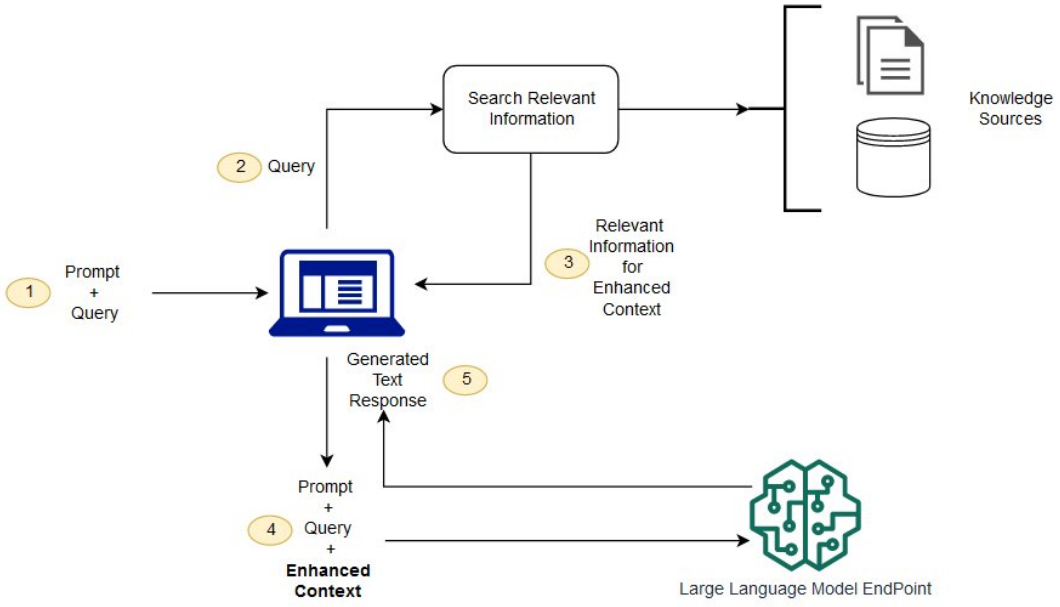

Figure 2: A scheme representing a Retrieval-Augmented Generation framework, as originally presented in (Amazon Web Services, 2023).

3 Method

3.1 Description

Typically, before an election, every political party publishes a manifesto describing what they intend to achieve if they are elected. Thus, aiming to address the disconnect between the elec-

torate and political parties, we decided to facilitate access to political manifestos using artificial intelligence. We envisioned a platform where everyone can post questions about political parties, and an AI agent would not only answer these questions but also provide the exact document passages where such answers can be found. For example, a question could be 'How does party X intend to solve problem Y?', with the answer being 'As written in document Z, party X aims to solve problem Y by ...'. Moreover, we decided to include a document viewer feature, where users could directly navigate the document with the sections of text relevant to the answer highlighted. Additionally, there is a Multi-Party question feature, where users can compare the positions of different parties on a specific topic.

All these features aim to make access to unstructured political data significantly more efficient and less time-consuming, thereby reducing the cost of obtaining the necessary information for an educated vote.

3.2 Design Goals

From the beginning, it was clear that the project had to fulfill key criteria for fairness, transparency and unbiasedness reasons. Thus, we encapsulate our view by enumerating the project's design goals.

- Efficient and easy to understand communication.
- Free and equitable access to the platform's core features.
- Answers should paraphrase official documents with a clear indication of each text source.
- Nonpartisan impartial messaging derived from an apolitical stance.
- Just and fair display of documents.
- Public access to the codebase to ensure maximal transparency.

In a nutshell, all the design goals could be summarized in the single goal of democratizing access to a platform that would help the electorate in understanding political information more efficiently without providing any unfair advantage to one of the political parties.

3.3 Features

3.3.1 Single-Party Questions

At the core of our work are Single-Party Questions. Put simply, a user can ask directly any question about a specific political party and the LLM provides an answer based on information written in the party's own political manifesto. In Fig. 3 we display an example of that. The interface provides the desired answer with the option (if the user were to press the left arrow) of

knowing exactly, which information was used to formulate the reply. Furthermore, it is possible for the user to continue the conversation like with any other chat engine, thus making it easier to dissect minute details and to interact with the AI agent. Ultimately, this allows users to gather information from a specific political party that they might be interested in voting for or even just understanding their core principles and values.

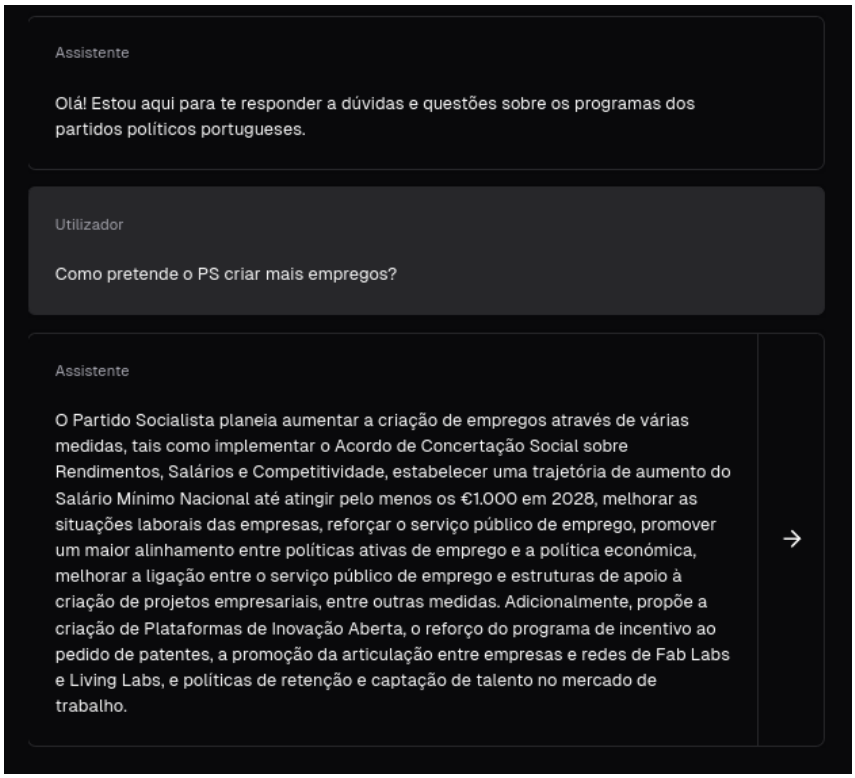

Figure 3: Example of a Single Party Question where the user asks how the Portuguese Socialist Party aims to create more jobs (in Portuguese).

3.3.2 Multi-Party Questions

When faced with challenging choices, we often want to compare our alternatives and understand the pros and cons of each option. The same applies to politics, making Multi-Party Questions quite useful. For instance, when considering issues like addressing climate change, it can be particularly interesting to compare how two political parties plan to tackle such a problem (an example of this is shown in Fig. 4). Ultimately, Multi-Party Questions allow users to discern the differences and similarities between various political parties, facilitating a more efficient understanding of their distinct views on specific topics.

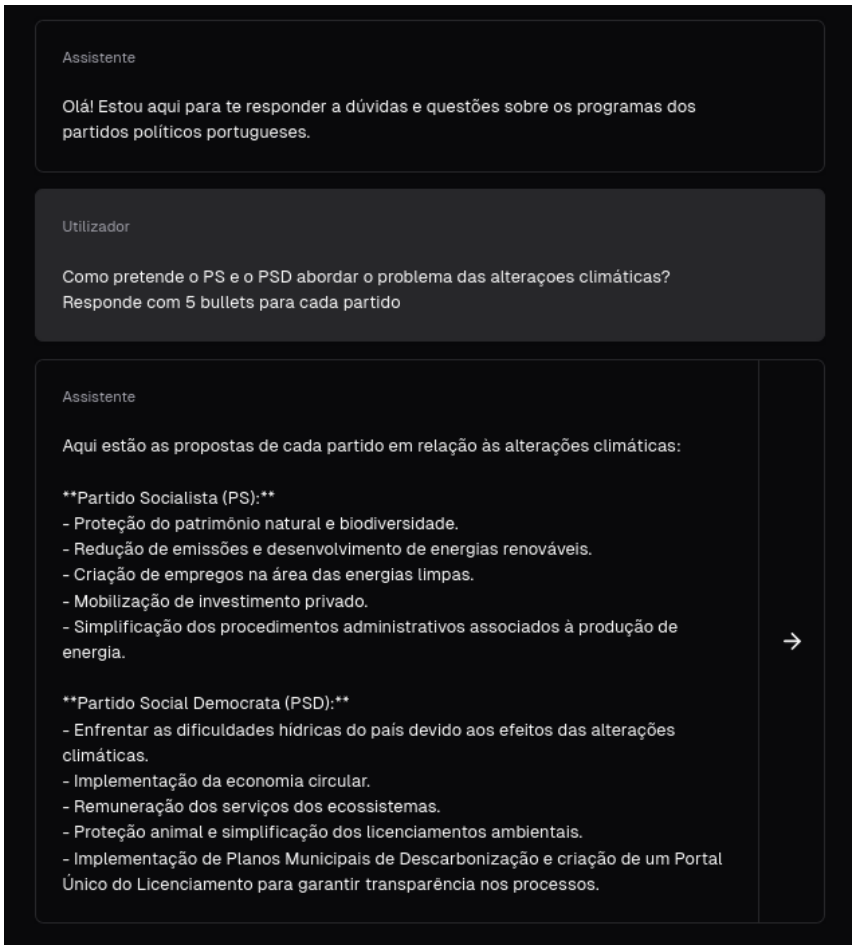

Figure 4: Example of a Multi Party Question where the user asks how the Portuguese Socialist Party and the Social Democratic Party intend to tackle climate change (in Portuguese).

3.3.3 Political Party Selection

The way our system was built, it was crucial to identify in each question which political parties the question refers to. For example, when asking, 'How do the Socialists and the Social Democrats aim to solve rising inflation?' we needed an automated way of identifying that the question relates to the PS and PSD political parties. Thus, our first implementation directly prompted the user to select the parties they aimed to ask questions about. However, this was cumbersome and time-consuming for the user, which did not help us in delivering an efficient and intuitive interface. Therefore, we decided to automate this procedure, and with some clever engineering that leverages LLMs, we were able to identify the exact political parties to which the question refers. With that being said, our approach is not error-free, and there is a small probability that this mechanism does not work as intended, which constituted a trade-off we were willing to take given our own experiments and the observed error rate.

In conclusion, the most recent version allows the user to formulate any question they wish, and our system will identify the corresponding parties, allowing for a seamless and intuitive utilization of the platform.

3.3.4 Document Viewer

As mentioned before, our goal is to facilitate access to political documents. Therefore, we believed it would be much easier for users to directly scroll through the documents on our platform. Furthermore, creating appropriate links between the topics related to a specific question and the pages where that information can be found is crucial. Thus, in the document viewer feature, as shown in Fig. 5, users can select the relevant pages (top right), and the document viewer will immediately navigate to those pages. This makes viewing documents much more time-efficient.

Figure 5: Example of the Document Viewer feature, here the user is scrolling through the Portuguese Socialist Party manifesto for the 2024 Portuguese General Elections.

3.3.5 Text Highlighting

To make it even more intuitive for users to understand which text was used as context by the LLM, we decided to visually highlight that text. Thus, when navigating through the document viewer feature, the relevant text will be highlighted in yellow, as shown in Fig. 6. This visual aid allows users to quickly identify which text passages are most relevant to the question at hand. Furthermore, users gain a complete understanding of which information was used to formulate the answer, thereby maximizing the transparency of the platform's inner workings.

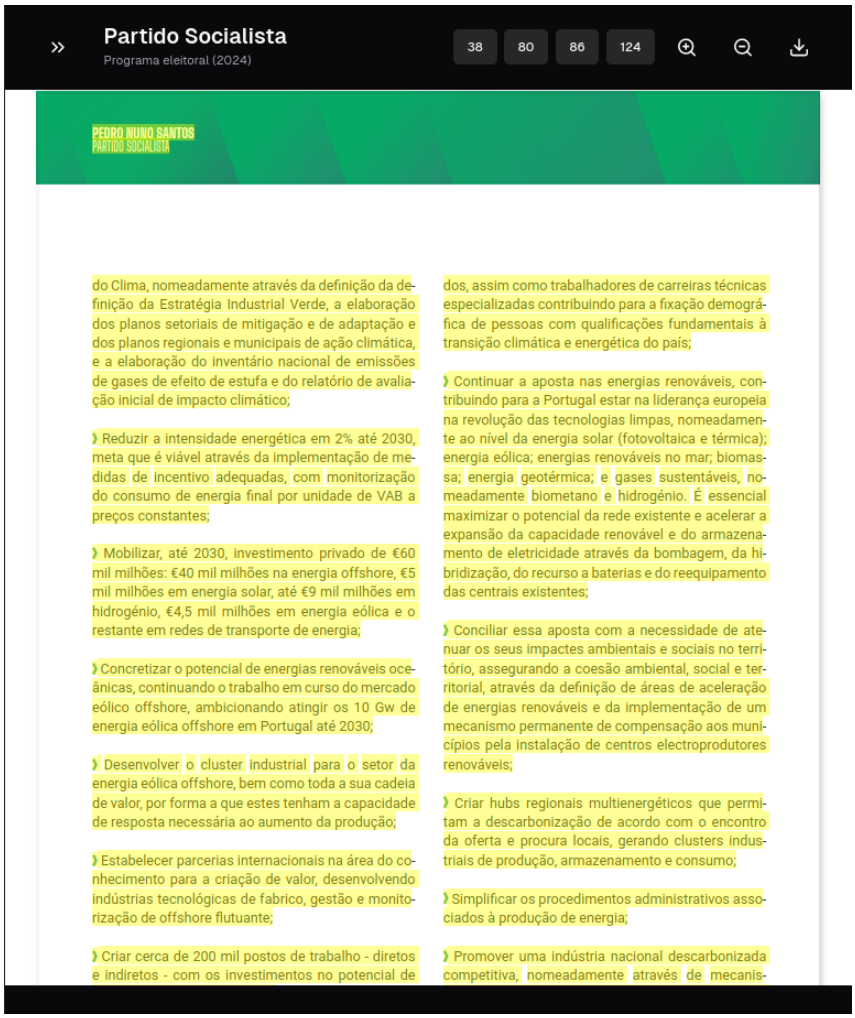

Figure 6: Example of the Text Highlighting feature, here the platform highlights the relevant text passages for the example in Fig. 4.

3.4 Project Implementation

Throughout the project implementation, we utilized the Scrum framework (Schwaber and Sutherland, 2020) to ensure a seamless project management flow. Consequently, we held meetings every two weeks (sprint) to plan and assess the workflow for the next sprint.

Behind the scenes, we managed two key codebases, intuitively named frontend and backend. For each codebase, we employed a Kanban board (Anderson, 2010) to monitor our current tasks, backlog, and task status. In line with our commitment to transparency, all these boards are publicly available in the project repository.

These frameworks enabled us to better coordinate our efforts and plan task execution, with a particular focus on the prioritization of time-sensitive tasks. Additionally, given the social component of our project, we opted for short iteration loops to capitalize on valuable feedback from friends, colleagues, and family.

4 Results

4.1 Publicity Efforts

In order to better inform voters of the existence of our platform and ensure that as many people as possible could leverage our project to understand the political landscape more effectively, we created accounts on a variety of social media platforms. On these platforms, we posted videos and images showing how to interact with our platform. For reference, we display the Social Media Posting Schedule in Table 1.

Table 1: Social Media Posting Schedule

Date	Twitter	Instagram	LinkedIn	WhatsApp
27-01-2024				X
03-02-2024			X	
23-02-2024	X	X	X	X

For brevity, we won't delve into the specifics of each post. However, it is worth mentioning that, as expected, our existing following on each social media platform played a pivotal role in the popularity of our posts. Additionally, the underlying recommendation systems of each platform significantly impacted the visibility of our posts.

With all factors considered, LinkedIn emerged as one of the most effective channels. This effectiveness is attributed to the fact that post reactions from a user's connections are usually displayed in the feed, facilitating discovery. Conversely, Instagram reels were also highly engaging, with one of the posts getting over 7,500 views. However, the click-through rate was lower because hyperlinks cannot be included in the reels' descriptions.

4.2 Usage Analytics

4.2.1 Time-Series

As expected, the number of visits spikes whenever there is meaningful social media posting. Hence, the spikes on the 27th of January, 3rd of February, and 23rd of February, as shown in Fig 7. Additionally, we observed that even on days when no social media posting was done, there were around 50 visits per day. With that being said, we did not observe any clear increase in the number of visits over a one-month period, which suggests that there were not many recurrent users. Ultimately, the data indicate that there was general excitement towards the platform, but the platform still lacks the incentives for users to return.

Figure 7: Number of Website visits between 25 of January and 26 of February.

4.2.2 All-time Usage

As shown in Table 2, there were only 500 Accounts Created out of the 2675 Website Visits, which implies that creating an account is a cumbersome barrier and some visitors decide not to do it. Moreover, we also note that on average each user only sent 2 messages, thus further improvement on the UI/UX experience of the user could be crucial to drive more usage.

Table 2: All-Time Platform Usage Statistics

Metric	Total
Website Visits	2,675
Accounts Created	500
Messages	928

5 Discussion

5.1 Open-Source Efforts

Even though traditionally most software was created privately, nowadays, there exist many incentives to open-source such software, namely improved transparency, easier auditing, and higher community involvement, among others (Shaabana, 2023).

For our specific project, open-sourcing was beneficial for 1) maximal transparency, as it allows users to more easily trust the platform to provide accurate, fact-checked information, and 2) greater community involvement, since other developers can easily contribute to a project with clear positive externalities. Therefore, we decided to publish all the code in this public repository https://github.com/politica-aberta, where it is possible to contribute by posting pull requests and issues.

5.2 Sustainable Development

Due to the amount of time spent and resources used to develop this project, it would be unfortunate if it were not possible to keep the platform running for future elections. Sadly, every message that a user sends to our platform costs roughly €0.01, which means the cost can become prohibitively high with widespread adoption. Furthermore, like with any other project, the operational overhead of maintaining and updating the codebase isn't inexpensive either.

As mentioned before, the project was designed from its very foundation to not be profit-oriented. However, given such costs, we devoted some thought to understanding how to make the project financially sustainable. We concluded that the best way was to have a donation model, where charitable organizations and generous individuals could donate funds to keep the project alive.

That being said, under the current legal structure, it was difficult to receive donations from institutional entities, since our project was not formally registered as a non-profit. Thus, we concluded that any medium- to long-term planning for the project would have to include the creation of a legal non-profit entity.

5.3 International Potential

When it comes to potential future work, one consideration is whether it is feasible to implement a version of the project for other countries' elections, since the results mentioned previously only stem from the implementation of the project for the 2024 Portuguese General Elections. Given that most of the work involves developing the software, there does not exist significant cost overhead in adapting the same platform for other elections, other than the costs associated with researching the political structures of countries with which we might not be familiar and the subsequent downloading of their political parties' manifestos.

Naturally, there is a language barrier; thus, it would be challenging to ensure meaningful quality assurance by non-native speakers. Furthermore, there could be degrading performance in the LLM if it is prompted to answer in languages from which it used less data for training, as some studies suggest that we don't really understand the performance of LLMs outside the top 20 languages in the world (Hada et al., 2024). Additionally, reaching out to the respective populations is more challenging, since, unlike the Portuguese case, our own social networks likely won't be helpful in this regard.

Nevertheless, we believe there is significant international potential, provided that local partnerships are established to more easily navigate the problems mentioned above.

6 Reflections

Overall, the project's flow was smooth and free-flowing. We believe choosing the Scrum and Kanban methodologies was the right decision, as it allowed us to better coordinate our efforts and prioritize the most important tasks. That being said, working on the backend of the platform was quite challenging due to the shifting nature of this constantly evolving field. This meant that we had to perform some rollbacks and refactoring whenever we found a more efficient way to address a problem. In hindsight, all those development inefficiencies seem illogical; however, we don't think our work method and architecture selection were wrong, as such phenomena are inevitable when working on engineering problems.

Another detail we believe the team perfected was the integration of user feedback into the platform. Understanding user needs and product development is often not easy, thus user feedback is key in that regard. However, it is not obvious how to process and act on some feedback, as it often involves a trade-off between improving the quality of the interface and consuming time. Our objective was to understand this and try to reasonably assess which issues were worth tackling. In general, we were happy with the resulting interface and consequently our planning efforts in that regard.

Despite the positives, we consider the publicity efforts to be sub-optimal in a couple of aspects. First, the timing was not ideal as we couldn't fully capitalize on media attention from newspapers, radio, and TV channels because the natural underlying processes of communicating with these entities take time. Thus, we believe that starting the marketing efforts earlier could have improved overall usage, as more voters would have been aware of the project. Second, the posting methodology was not ideal; we should have better understood the power of our individual social networks as a means to boost our following. In hindsight, creating an unknown account and trying to organically amass a large following seems unrealistic. It would have been better to promote the project by leveraging our own following on LinkedIn, Twitter, Instagram. Additionally, we were not successful in addressing the key issue of sustainable development, and we could have spent more effort on solving this problem by trying to lower the cost per prompt, which could have been attempted by leveraging open-source models. How-

ever, it is hard to pinpoint how we could have dedicated more time to such a task given the time restrictions we had throughout the project.

7 Conclusion

Taking a step back, we had the original goal of understanding whether retrieval-augmented generation technologies attract interest among voters for enhancing access to and understanding of essential information in political party documents. The results suggest that such interest definitely exists; however, it is difficult to assess the volume of this interest and its widespread nature.

Throughout the project implementation, it remained clear that publicity and marketing were strongly linked to adoption. Thus, like with other software products, it is crucial to correctly present and inform voters about what the product enables. To that extent, it might have been more productive to start the social media campaign much earlier, as there was potential for more interviews and newspaper articles, which we didn't fully take advantage of due to time constraints. With that being said, the usage numbers were quite exciting, and the overall feedback was generally positive.

Another consideration that we couldn't fully address was how to think through and come up with a project structure that would allow for sustainable development. As mentioned earlier, there still exist some cost barriers to maintaining the project and no convincing way of solving them at scale. Had we approached things differently, perhaps we could have integrated such considerations into the overall project execution, leading to potentially less costly practices and easier-to-maintain code.

All things considered, we regard the project as an overall success, since we managed to solve some of the anticipated problems, like LLM hallucination, bias, and lack of sources, while providing an easy-to-use, intuitive platform that is free to use.

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