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Specialized Urban Planning Chatbot: A Participatory Approach for Evaluating Efficiency

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Abstract

This research investigates the use of a specialized Chatbot tool in the field of urban planning as a participatory approach and how efficient it is in handling concerns related to this domain. This specialized urban Chabot was prepared during an exhibition at the University of Moratuwa, Sri Lanka in 2023. We argue that specialized chat-bots, which are trained on a dataset including text and code, exclusively involved in urban planning, have the potential to offer more pertinent and useful insights and suggestions compared to conventional chat-bots. It is also suggested that a transition from standard Chatbots to specialized urban Chatbots is essential because AI (Artificial Intelligence) Chatbots possess the capability to comprehend and address a broader spectrum of inquiries and prompts while also exhibiting the capacity to acquire knowledge and adjust their responses over time. Accordingly, we developed a special urban planning Chatbot and tested the results with the general public from different fields. The findings of our study indicate that almost 65% of the total respondents have emphasized the suitability of this application for planning purposes and its importance in the future. The majority of respondents also highlighted the use of specialized Chatbots, designed for urban planning would be beneficial for city planners. Citizens may use them as a means to collect input, suggest prospective solutions to urban planning challenges, and formulate design briefs for upcoming urban development initiatives. The use of Chatbots in the field of urban planning displays considerable potential for study, and we anticipate that our findings will catalyze further advancements in this domain.

Keywords: Urban Planning Chatbot; Specialized Insights; Specialized Chatbots; AI capability; Potential Benefits; Austerity

1. Introduction

Chatbots are computer programs designed to imitate human communication while interacting with people. Chatbots are often used in customer service contexts, although their utility extends beyond this domain to include a diverse range of applications, such as urban planning (Son et al., 2023). In the field of urban planning, Chatbots have the potential to serve several functions such as disseminating information to the public, and fostering citizen engagement, thus. Enhancing the efficiency and effectiveness of planning processes (Adamopoulou & Moussiades, 2020). The field of urban planning entails intricate and demanding responsibilities, necessitating planners to carefully assess a multitude of variables (Peng et al., 2023). The population growth trend is one of them as it has a direct impact on urban form over time. Transportation flow is another factor that has evidently caused many issues in

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urban areas. Further, optimization of the utility of resources, and managing ecological consequences (Shawar & Atwell, 2007; Tanic, 1986) are also areas that need careful evaluation by planners. In recent times, Artificial Intelligence (AI) has gained prominence as a valuable instrument to assist urban planners in enhancing the effectiveness of their decision-making processes (Adamopoulou & Moussiades, 2020). The use of an intelligent Chatbot is a viable avenue for using AI to augment the field of urban planning. Chatbots are software applications designed to imitate human interaction via computer-mediated communication. These devices can provide urban planners with the latest updated data and valuable insights, while also facilitating input from individuals (Leach, 2022).

One of the main advantages associated with the use of AI Chatbots in the field of urban planning is their ability to provide the latest information and valuable insights promptly. The ability to make prompt judgments based on new data is of utmost importance for urban planners. For example, an AI Chatbot has the potential to be used to monitor real-time traffic trends and detect possible bottlenecks (Wang & Biljecki, 2022). This data might thereafter be used to implement modifications to traffic signals or public transit timetables to enhance traffic efficiency. AI Chatbots may also serve as a valuable tool for collecting input from individuals within a given population. This aspect has significance as it enables urban planners to solicit feedback from those who are most impacted by planning decisions. For instance, an AI Chatbot may be used to inquire about the transportation requirements of individuals, gauge their level of contentment with the municipality's parks and recreational amenities, or ascertain their apprehensions about crime. The input obtained may then be used to inform modifications to the urban development strategies, to enhance the overall livability of all residents (Herath & Mittal, 2022). In addition to offering information and insights, AI Chatbot includes the capability to automate operations. An AI Chatbot has the potential to fulfill several functions, such as addressing inquiries from citizens on municipal services, facilitating the processing of permit applications, or managing the scheduling of appointments. The use of AI Chatbot in the field of urban planning is now in its nascent phase, however, it has considerable promise for fundamentally transforming the processes and administration of cities. With the ongoing advancement of AI technology, it is anticipated that there will be a proliferation of novel and efficient applications of Chatbots in enhancing urban planning processes.

Moreover, the integration of AI Chatbots in the field of urban planning presents a very encouraging improvement that can transform the processes involved in the design and administration of cities. AI Chatbots has the potential to enhance urban planning processes by offering real-time information, and insights, and soliciting comments from individuals. This may result in improved decision-making that is more attuned to the requirements of local populations. With the ongoing advancement of AI technology, it is anticipated that there will be a proliferation of novel and efficient applications of Chatbots in enhancing urban planning processes. Therefore, the objective of this study is to investigate the possible use of AI Chatbots in the field of urban planning. This study is going to evaluate the advantages associated with the use of Chatbots in the field of urban planning, while also considering the obstacles that must be overcome. The study will furthermore ascertain particular instances whereby Chatbots have been implemented within the field of urban planning. The results of this study are going to have significance for urban planners, policymakers, politicians, and members of the public as well. This study aims to present valuable insights into the potential use of Chatbots in enhancing the planning procedure and fostering urban livability on a broader scale.

2. Literature review

The use of AI Chatbots in the field of urban planning is now in its emerging phase, however, it has significant promise for transforming the conventional practices of planning (Das, 2020). AI is already vastly utilized in different fields such as transportation, land use modeling, emergency management, etc. AI has the potential to effectively tackle significant urban concerns that cities are now grappling with, including but not limited to those related to traffic congestion related to transportation, air pollution, and climate change (Peng et al., 2023). Through the ongoing advancement of AI technology, it is expected that there will be a proliferation of novel and efficient applications of Chatbots to augment the efficiency of the process of planning (Herath & Mittal, 2022; Kooli, 2023).

The integration of AI Chatbots within the field of urban planning may be seen as a logical advancement stemming from the evolution of planning support systems (PSS). Public Sector Software (PSS) refers to computer-based solutions that are used by urban planners to facilitate decision-making processes. These platforms generally provide users the ability to access data, models, and analytical tools to evaluate various planning alternatives. AI Chatbots may be regarded as a kind of personalized service system that can engage with users in a manner that closely resembles human conversation (Valz, 2023). Chatbot possesses the capability to address inquiries, provide knowledge, and even make recommendations (Gupta, 2020). This has the potential to enhance their user-friendliness and broaden their accessibility to a more diverse audience.

AI can significantly transform urban planning via its ability to enhance traffic management, safeguard public health, deter criminal activities, and facilitate the development of sustainable urban environments (Peng et al., 2023). Through the examination of real-time data, AI can enhance the efficiency of traffic movement, resulting in a decrease in congestion levels and an enhancement in air quality. In addition, air quality monitoring systems that use AI can detect and analyze pollution sources, as well as forecast pollution levels, thereby allowing precise and focused responses (Mikalef et al., 2023). Regarding the issue of climate change, AI can simulate the impacts of climate change on cities. This may be particularly useful in assisting with resilience planning and providing valuable insights for sustainable urban development (Das, 2020).

In general, AI has significant potential as a tool for enhancing the livability, equity, and sustainability of urban areas (Peng et al., 2023). Nevertheless, it is crucial to use AI responsibly and ethically, to guarantee its equitable advantages for all individuals (Tanic, 1986). Also, the integration of AI Chatbots within the field of urban planning might be seen as a means to enhance the transparency and accountability of the planning procedure (Goralski & Tan, 2020). AI Chatbot has the potential to serve as a valuable tool for delivering input to urban planners. The provided input can serve as a valuable tool in identifying possible issues within the procedure for planning and subsequently implementing necessary improvements. The increasing advancement of AI technology is anticipated to result in a broader and more effective application for AI Chatbots within the field of urban planning (Herath & Mittal, 2022).

Within the domain of Chatbots, there are primary classifications that provide certain purposes such as rule-based bots function based on a fundamental set of pre-established instructions (Goralski & Tan, 2020). These guidelines dictate how individuals should formulate their replies to certain prompts or inquiries. Even though they may not display high levels of understanding, they demonstrate effectiveness in doing elementary duties, such as disseminating information and handling basic queries (Relich, 2023). Furthermore, AI Chatbots are increasingly emerging as highly advanced equivalents.

These entities, enabled by AI, demonstrate the capacity to acquire knowledge and adjust their behavior in response to their environment. These automated systems possess the ability to understand and interpret human language, allowing them to participate in complex and nuanced dialogues (Yigitcanlar et al., 2020). Over time, individuals enhance their performance via various contacts, and therefore, acquire proficiency in managing complex tasks such as the examination of urban informatics. Despite the higher costs associated with their development and maintenance, these solutions provide enhanced effectiveness in dealing with intricate situations (Burry, 2022).

Application-oriented bots are a distinct category characterized by the integration of machine learning capabilities with predefined rules. In addition to being tailored to perform particular duties, these bots are also capable of adapting and gaining knowledge from contextual data. Application-oriented bots combine characteristics from rule-based and AI bots, designed to perform specific functions inside certain situations (Leach, 2022). Illustrative instances include a wide spectrum of applications, including medical diagnostic bots, financial advising bots, and bots that streamline trip plans (Wang & Biljecki, 2022). Notwithstanding their comparatively elevated expenses in comparison to rule-based or AI bots, they demonstrate exceptional proficiency and efficacy inside their specified areas (Burry, 2022). In summary, the use of AI Chatbots in the field of urban planning presents a very encouraging and innovative advancement that can fundamentally transform the processes involved in the design and administration of cities.

However, the incorporation of AI into urban planning has particular challenges that require careful consideration. These challenges encompass the need for greater data accessibility, improved AI resources, and higher public comprehension of AI. (Peng et al., 2023). Also, the ethical issues of using AI in urban planning need thoughtful attention, particularly due to the potential for prejudice within AI systems (Yigitcanlar et al., 2020). One of the primary challenges associated with Chatbots is the considerable costs involved in their development and ongoing maintenance. Another obstacle that arises in the development of Chatbots is the inherent difficulty in effectively training them to exhibit accuracy and provide relevant responses. In addition, it is worth noting that Chatbots are prone to prejudice, hence potentially resulting in the dissemination of false or deceptive information (Rjab et al., 2023). Also, the application of Chatbots in urban planning is complicated by their inadequate comprehension of the complex social interactions that occur within communities (Cortés-Cediel et al., 2023). The implementation of programmed responses possesses the potential to suppress the expression of minority viewpoints and produce biased results. The inadequate quantity of data employed by Chatbots necessitates frequent updates and may exacerbate pre-existing inequalities. Obstacles arise concerning the costs and the availability of high-quality data. When human-centered design, diverse perspectives, and continuous learning are given priority, Chatbots possess the potential to transform inclusive urban planning (Peng et al., 2023).

3. Research design

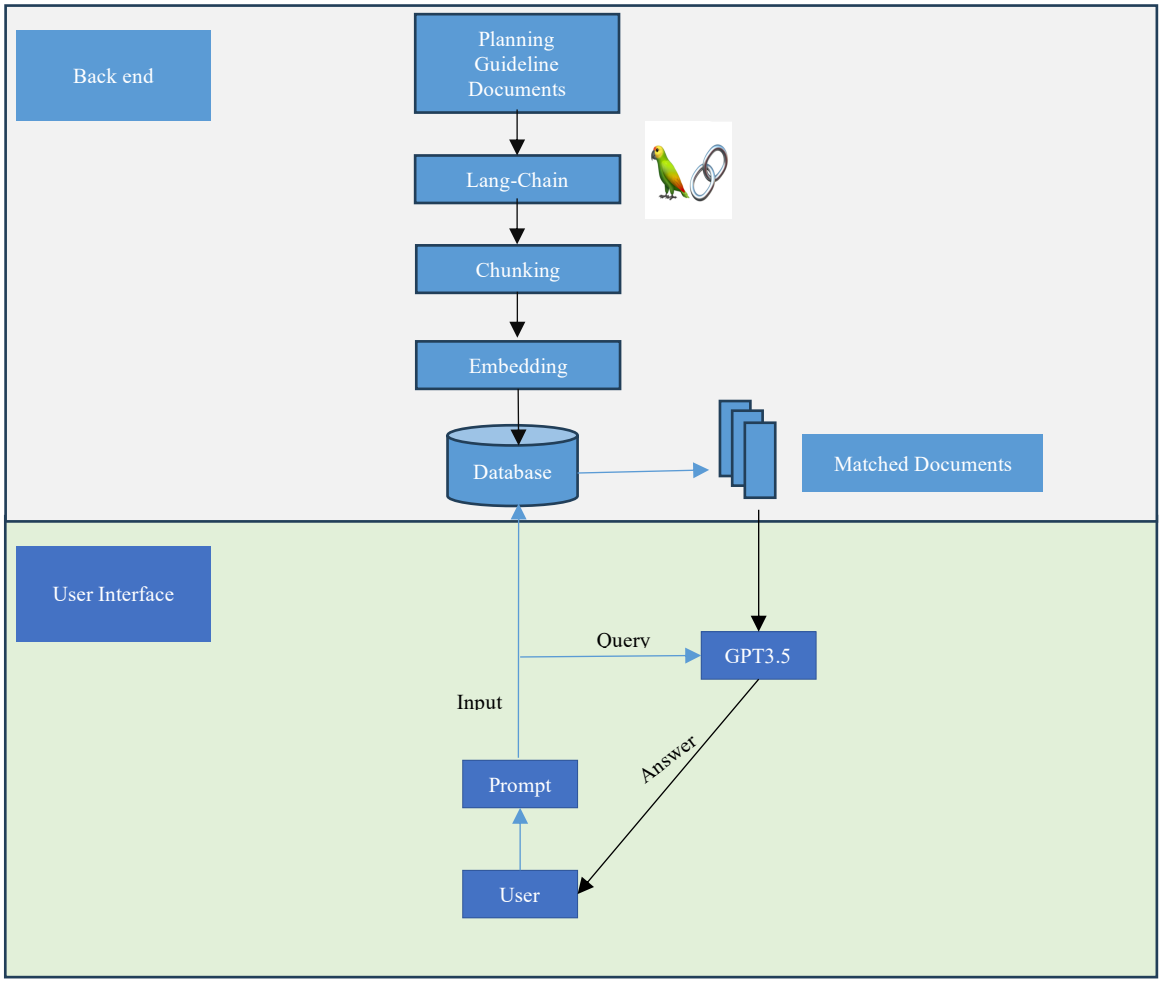

Figure 1: Research design

The AI research team has implemented a well-organized research approach to effectively implement the designated study plan (Figure 01). The chosen methodology involves the implementation of a pragmatic strategy, which involves a methodical advancement via clearly defined phases. This study was conducted at the University of Moratuwa, Sri Lanka during the EXMO exhibit. A total of 91 respondents were utilized for this methodology.

The basis of this study is rooted in the systematic gathering of extensive data, which includes a wide array of textual sources and relevant documents aligned with the project's goals. The dataset serves as the fundamental basis for later algorithmic implementations. By using a combination of quantitative and qualitative research methods, the research team diligently creates and improves the Lang-Chain model, continuously optimizing each stage to achieve improved performance. The incorporation of embedding, which is aided by semantic representation approaches, amplifies the system's comprehension of context and semantics. Fundamental to this technique is the use of search engine algorithms to select documents that are relevant to user queries. The evaluation of retrieval effectiveness is primarily focused on accuracy and recall metrics.

The process reaches its apex in the development of a user interface that is designed to be intuitive and effectively engage people with different levels of technical expertise. This phase integrates repeated user testing and feedback loops to achieve a smooth user encounter. The research technique aims to integrate the technical capabilities of NLP (Natural Language Processing) algorithms with a user-centric design philosophy, enabling a

comprehensive and significant achievement of the research goals of the AI Team.

4. Developing a Chatbot for Planning Assistance in Sri Lanka

In this section, we will explore the methodology behind the development of the AI Chatbot. The creation of this Chatbot involved a systematic and innovative approach that combined technological advancements with user-centric design and rigorous validation. This section outlines the step-by-step process followed to develop, refine, and assess the tool, highlighting the key considerations and milestones along the way.

4.1. Data Collection and Processing

The first step in developing the Chatbot was to collect and process the necessary data. Planning guideline documents in PDF format were acquired to form the foundation of the knowledge base. Accordingly, six urban councils in the Western province were chosen. Following that, the planning guideline documents are fed into the Lang chain model, which is a large language model. To efficiently process this content, the documents should be segmented into smaller, coherent units (chunking). This segmentation allowed for easier data processing and analysis. To facilitate further analysis and retrieval, the segmented content was converted into Vectorized embeddings. By encoding the textual information in a numerical format, the Chatbot could effectively understand and interpret the data. These Vectorized embeddings were stored in a dedicated database, enabling quick and efficient access during the Chatbot's operation.

4.2. Integration of OpenAI Technology

The integration of OpenAI technology was a pivotal stage in the development process of the Chatbot. OpenAI's advanced language capabilities, specifically its GPT model, were interfaced with the Vectorized embeddings. This integration empowered the Chatbot with the ability to comprehend and generate contextually relevant responses. By leveraging the power of OpenAI's language model, the Chatbot was able to engage in human-like conversations and provide valuable insights. The combination of the Chatbot's inherent knowledge and external planning documents allowed it to offer comprehensive and accurate guidance to users.

4.3. The User Interface Design

A significant focus was placed on creating an intuitive and user-friendly graphical user interface (GUI) for the Chatbot. The GUI served as the medium through which users could interact with the tool. The interface was designed to enable users to effortlessly input their queries, fostering a natural and engaging conversation flow. The GUI acted as a bridge, connecting users with the underlying capabilities of the Chatbot. It provided a seamless and visually appealing experience, ensuring that users could easily navigate and make the most of the Chatbot's features.

4.4. Chatbot Validation with Planning Regulations

Ensuring the accuracy and reliability of the Chatbot's responses was of utmost importance. To achieve this, a systematic comparison was conducted between the generated responses and the stipulations outlined in official planning regulation documents. This validation process aimed to ensure that the Chatbot's guidance was aligned with established legal and regulatory frameworks. By validating the Chatbot's responses against official planning regulations, users could trust the tool's recommendations and rely on its assistance when navigating the complex landscape of planning guidelines.

4.5. User Feedback and Usability Assessment

To gauge the effectiveness and user-friendliness of the Chatbot, a structured survey approach was implemented. Users were invited to share their experiences and

opinions regarding the Chatbot's assistance. The feedback collected through these surveys provided valuable insights into response quality, user satisfaction, and overall usability. This iterative feedback loop allowed the development team to refine the Chatbot based on real-world user perspectives. By incorporating user feedback, the Chatbot could continuously improve and enhance its performance, ensuring that it met the needs and expectations of its users.

4.6. Expert Evaluation

In addition to user feedback, an additional layer of validation was introduced through expert evaluation. Domain experts and professionals in the field of planning were invited to interact with the Chatbot and provide their assessments. Their perspectives offered an institutional viewpoint on the accuracy, relevance, and practicality of the Chatbot's responses within the context of professional planning scenarios. The expert evaluation further ensured the Chatbot's reliability and effectiveness, as it underwent scrutiny and validation from individuals with extensive knowledge and experience in the field.

5. Results

The efficacy of the urban planning Chatbot was evaluated through the participation of a diverse range of participants, which includes urban planners, students, and individuals from the wider public. The input received by those participants was mostly favorable. The participants saw the Chatbot as a valuable source of information, expressing gratitude for its conversational interface that allowed them to pose inquiries and get informed responses. The Chatbot demonstrated proficiency in delivering precise and reliable information on urban planning rules, zoning legislation, and other pertinent subjects. Furthermore, the system demonstrated the capability to respond to a wide range of inquiries, including some that were ambiguous or difficult. The Chatbot proved to be a helpful educational resource for acquiring knowledge in the field of urban planning, catering to a diverse audience including students, professionals, and the general public. To enhance the comprehensiveness of the Chatbot, it would be beneficial to include more information about other domains within the field of urban planning. For instance, the scope of the analysis might be expanded to encompass other aspects such as transportation, infrastructure, and consequences for the environment. The potential for enhancing the Chatbot's interactivity lies in the incorporation of a mechanism that enables users to engage with comments and ideas. This would contribute to the continuous enhancement of the Chatbot's performance and further augment its use for consumers. One potential approach to enhancing the affordability of the Chatbot is its distribution as a cost-free or open-source program and currently, it was tested with the paid Open-AI API key prices. Accordingly, this measure would enhance the accessibility of urban planning technology, hence fostering its widespread adoption across diverse populations. The feedback obtained from the process is analyzed in seven core sections such as first, it will discuss the user experience and unity, second, the context of features and functionality, third, the potential improvements that could be placed and the possibility for expansion, fourthly, the user interface and accessibility for the users, fifthly, the integration process with the AI and other technologies, sixthly, prospects and future recommendations, and finally the overall satisfaction for the users who experienced the tool.

5.1. User Experience and Utility

The urban planning Chatbot has garnered notable good feedback from consumers due to its user experience, user-friendliness, and usability. The response received aligns with the notion that the Chatbot accomplishes its intended objective by offering significant information for the field of urban planning. The potential significance of the notion has been widely acknowledged and accepted by users, who

see its ability to revolutionize longstanding techniques. The acknowledgment of the Chatbot's usefulness goes beyond the domain of urban planning and includes several areas of affiliations such as civil engineering, as seen by users. One noteworthy characteristic of the feedback is the users' inclination towards forward-thinking, as shown by their recommendations to enhance the application's scope via the inclusion of data from other regions and even worldwide settings. The input provided by several sources highlights the potential of the Chatbot in the field of urban planning and its ability to surpass limitations, functioning as a flexible instrument with wide-ranging social implications. Further analysis related to the user experience and utility:

Figure 2: Word cloud for the user inputs

The word cloud analysis reveals that the terms "good" and "application" were among the more often used words, indicating that the individuals who evaluated the urban planning Chatbot saw it as a very beneficial instrument. The term "good" is often used to convey a sense of approval or contentment, whereas the term "application" commonly denotes a software program that is purposefully developed to fulfill a certain function. Within this particular framework, the terms "good" and "application" imply that the evaluators saw the Chatbot as being educational, functional, and user-friendly. The prominence of the terms "good" and "application" in the word cloud analysis of the Chatbot is indicative of a favorable outlook for its prospects. The statement suggests that the researchers have successfully developed a Chatbot that effectively caters to the requirements of its users. As the process of Chatbot development progresses, it is advisable to prioritize enhancements in key areas that have significant value for consumers, including accuracy, comprehensiveness, and user-friendliness. Additionally, we have tested the need for the corresponding application in the future from the participants and those who have experienced the application.

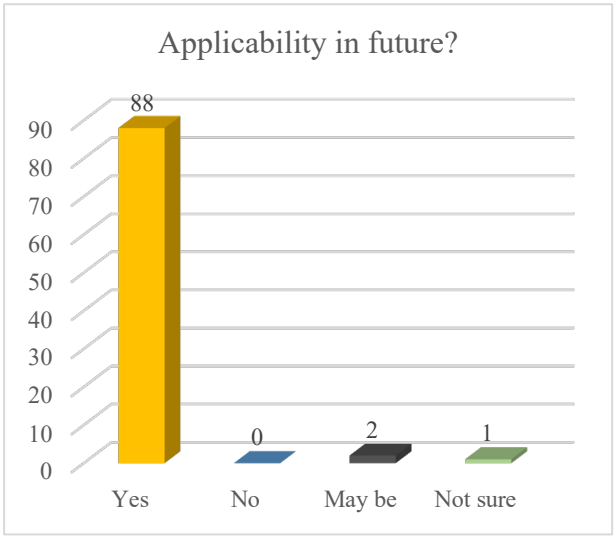

Figure 3: Need of the application

Out of the total number of respondents (91), 88 individuals have indicated that they believe these types of applications will remain necessary in the future. Two of the participants said that this application may be required in the future, whereas only one participant expressed uncertainty. In the future, we will assess the relevance and suitability of this application for users in terms of planning.

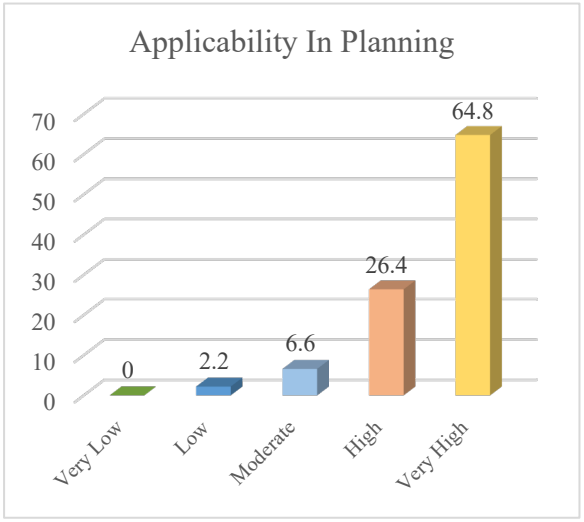

Figure 4: Applicability in Planning

64.8% of the total participants voted for the highest importance, which indicated that this application would apply to urban planning contexts. Altogether 91.2% of total respondents, voted for numbers 04 and 05 in the slider for this question.

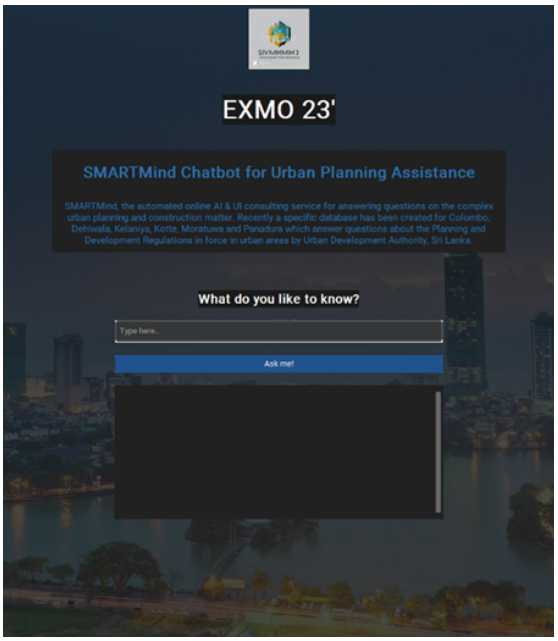

Figure 5: Graphical User Interface prepared for user evaluation.

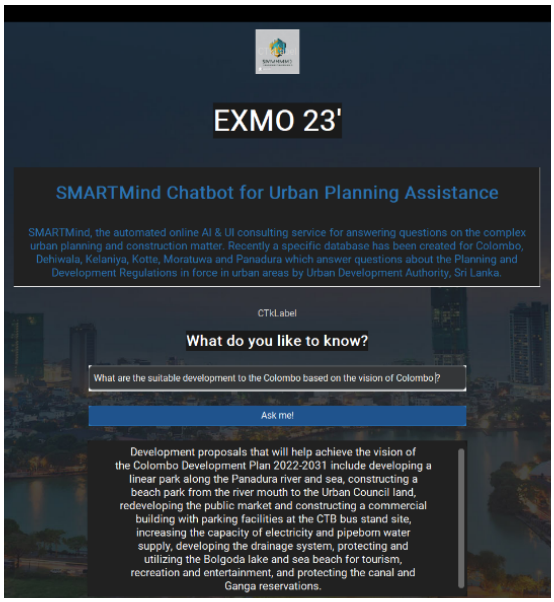

Figure 6: Question and answers obtained from the Chatbot

5.2. Features and Functionality

The evaluation of characteristics and capabilities has generated valuable information from users. Significantly, the favorable response to the clarification technique and conceptual dissemination highlights the efficacy of the Chatbot in effectively transmitting information. The participants have shown a strong inclination for improved visualization through generating maps in both two-dimensional and three-dimensional formats. This suggests a clear preference for more thorough and immersive representations. The recommendation to include photographs and drawings serves to underscore the significance of visual assistance in enhancing users' comprehension. Furthermore, the recognition of the notion of AI-driven map development aligns with the progressive mindset of using technology to achieve precise and effective planning. The aforementioned findings jointly emphasize the need to include strong and diverse characteristics to enhance the user-friendliness of the Chatbot and its capacity to transform urban planning methodologies.

5.3. Potential Improvements and Expansion

The observations made on prospective enhancements and the need for growth highlight the strong need among users for a more complete Chatbot focused on the designing of cities. The recommendations put forward revolve around expanding the Chatbot's scope to include a more extensive range of domains, hence emphasizing an increasing need for its versatility throughout various geographical contexts. Users demonstrate a distinct preference for enhanced material, which includes supplementary location-specific information, regulatory details, and extensive analyses of environmental impact variables. The consumers' preference for information references indicates their tendency to rely on confirmed and trustworthy sources, highlighting the need for openness in the display of data. In aggregate, these recommendations provide a strategic approach for augmenting the Chatbot's range and comprehensiveness, following users' desires for an increasingly comprehensive and enlightening urban planning resource.

5.4. User Interface and Accessibility

The evaluation of the user interface and approachability of the urban planning Chatbot is of utmost importance as it plays a critical role in improving its usefulness and expanding its reach. The preference of users for a chat interface with a single window highlights their inclination towards simplified interactions, prioritizing ease along with a smoother user experience. The proposal to adopt an open-source model for the application aligns with the need to enhance inclusivity, exemplifying a collaborative approach that has the potential to democratize the availability of urban planning resources.

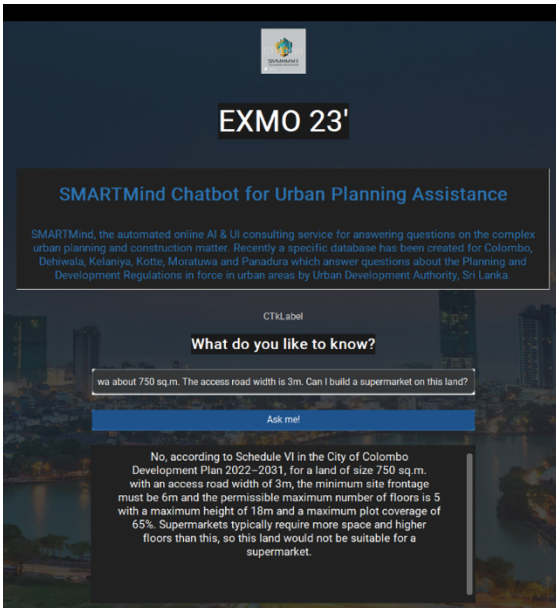

Figure 7: Graphical User Interface

Furthermore, the analysis of the possible constraints associated with a premium edition provides insights into the significance of accessibility and cost, emphasizing the need for fair and equal dissemination. The aforementioned observations highlight the need to adopt a user-centric design approach and promote equitable access to enhance the efficacy and use of the Chatbot for many stakeholders involved in urban planning as well as related disciplines.

5.5. Integration with AI and Technology

The feedback provided by users highlights the potential synergy between AI and urban planning since they exhibit favorable attitudes toward the incorporation of AI technology. The use of AI to provide insights has been well-recognized for its ability to enhance urban planning procedures.

One noteworthy recommendation put forward by users is the enhancement of the Chatbot via the integration of sophisticated AI technology. This suggests that consumers acknowledge the Chatbot's potential to go beyond its present condition and become a more advanced tool, in line with the progressing field of AI technology. The users' indicated enthusiasm for AI-generated maps and forecasts underscores their curiosity about using the predictive powers of AI to improve the results of urban planning.

5.6. Prospects and Recommendations

The respondents' preference for future-oriented thinking is seen in their eagerness for the eventual public release of the Chatbot. The Chatbot's projected potential influence on urban planning practices is underscored by the emotion of enthusiasm and anticipation. The users' trust in the direction and prospective worth of the program is evident in the encouragement they get to continue its development and expansion. The Chatbot's desire to integrate with other areas and businesses demonstrates a comprehensive perspective, portraying it as a flexible tool with potential uses outside the realm of urban planning. The aforementioned suggestions highlight the users' confidence in the Chatbot's potential for future success and its capacity to have significant impacts in many fields.

5.7. Overall Satisfaction and Impact

Most users express a predominant favorable emotion towards the application's idea and functionality, indicating their overall contentment.

The recognition of the Chatbot's use in the context of urban planning serves to reinforce its efficacy in tackling difficulties related to urban planning. This emotion has a broader scope, as consumers anticipate its possible impact on the development of urban planning practices in the future. The user's acknowledgment of the work involved, and the potential advantages provided by the program highlights the good influence it is currently having on its user community. The evident passion and acknowledgment shown towards the Chatbot provide a robust basis for its ongoing growth and implementation within the field of urban planning.

5.8. Summary of User Feedback

The comments received about the urban planning Chatbot indicate a favorable reaction and a strong interest in its possible applications. The Chatbot's usefulness in aiding urban planning choices and the ability to revolutionize existing methodologies are highly valued by users. The good comments underscore the efficacy of the material in clarifying ideas and disseminating information. The participants in the study conveyed a significant inclination towards the incorporation of advanced functionality, such as the ability to generate 2D and 3D maps, the inclusion of images to enhance visualization, and the integration of AI-driven features. The feedback also indicates users' keen interest in expanding the Chatbot's scope to include a wider range of topics, particularly supplementary geographical data, legislation, and information about environmental effects.

The significance of user-friendly design is emphasized by users, who propose the implementation of a chat interface with a single-window layout to enhance convenience. Additionally, they advocate for the program to be made available as open-source software, therefore increasing its accessibility to a wider audience. Although there is a prevailing sense of optimism about the potential application of AI in urban planning, users have also expressed the need for more advancements in the AI capabilities of Chatbots. This is particularly important to provide more sophisticated insights and predictive functions. The participants have optimistic expectations about the potential good influence of the Chatbot within the domain of urban planning, and they express a sense of optimism for its potential integration into many other sectors. In general, the feedback provided by users demonstrates a robust conviction about the Chatbot's capacity to influence the trajectory of urban planning methodologies in the future.

6. Conclusion

The user feedback received on the urban planning Chatbot highlights its significant potential within the dynamic and ever-changing field of urban planning. The Chatbot's creation and deployment may benefit greatly from the important guidance provided by users via their favorable reception and ideas. The acknowledgment of its practicality in informing urban planning choices and its profound influence aligns with the overarching goal of using technology to improve urban development processes. The evaluation of the Chatbot's functionalities, including its technique of explanation and integration of AI, underscores the alignment between user requirements and technical progress. The Chatbot's anticipated capability to produce two-dimensional and three-dimensional maps, integrate photos to enhance visualization, and use AI for predictive analysis demonstrates its connection with the current requirements of urban planning.

Furthermore, the recommendations provided by the users regarding the expansion of the Chatbot's scope, integration of supplementary data, and guaranteeing accessibility via an open-source methodology exemplify a shared desire for inclusiveness and extensive functionality. The users' prospective outlook, along with their eagerness for the Chatbot's general availability and its incorporation into many domains, highlights its potential influence on not

only urban planning practices but also wider industries. The feedback provided by users acts as a positive validation of the Chatbot's feasibility and capacity to foster advancements in the field of urban planning. As the ongoing study progresses, the knowledge acquired from user viewpoints will undeniably shape the Chatbot's advancement as a potent instrument for promoting sustainable and efficient urban development. The suggestions provided by users reflect the collaborative mentality seen in contemporary urban planning, which emphasizes the integration of technology and community interaction to develop more intelligent and sustainable urban environments.

Within the ever-evolving domain of urban planning, the incorporation of state-of-the-art technology has become known as a symbol of groundbreaking progress, with Chatbots assuming a prominent position as a catalyst for transformational change. The significance of this technical achievement for the field of urban planning is underscored by the culmination of user comments on the urban planning Chatbot. With the expansion of urban centers and the rising difficulties they encounter, the effectiveness of urban planning is becoming more closely connected to the seamless integration and analysis of data, anticipatory perspectives, and user-friendly interfaces. Chatbots have the natural ability to meet these essential objectives, as shown by user recommendations and optimism. The importance of Chatbots in the field of urban planning is emphasized by their capacity to address disparities, improve availability, and promote the democratization of information. The favorable welcome and passionate recommendations on the expansion of coverage, integration of varied data sets, and facilitation of open-source accessibility reflect the pursuit of inclusion and equitable urban development. The combined elements of the Chatbot indicate its potential to function as an essential instrument, not alone for urban planners, but also for a range of stakeholders. These stakeholders include policymakers, architects, residents, and entrepreneurs, who collaborate in shaping dynamic and environmentally conscious urban environments. Furthermore, the knowledge obtained from user input demonstrates a mutually beneficial connection between technology and user requirements. The increasing dependence on data-driven decision-making in urban planning has led to a strong demand for features such as AI-generated maps and forecasting information. The customers' expectation of the Chatbot's capabilities in domains outside its original scope highlights the flexibility and flexibility of this technology, enabling it to progress and address developing difficulties throughout several industries.

In summary, the user response about the urban planning Chatbot reflects a shared sense of optimism about the potential of technology to bring about significant changes in the field of urban planning. Chatbots have the potential to revolutionize both the approaches and underlying principles of urban planning, placing significant emphasis on inclusion, accessibility, and forward-thinking solutions. The progression of the Chatbot, from its first conception to its eventual engagement with users, serves as a compelling illustration of the intricate relationship between innovation and the collective ambitions of society. The growing complexity of urban difficulties underscores the importance of Chatbots in the field of urban planning. These Chatbots serve as valuable tools for guiding the development of resilient, sustainable, and human-centered cities in the future.

7. Limitations

As the primary limitation, the constructed Chatbot cannot resume conversations with users or recall previous conversations with them. Even though it is integrated with ChatGPT, the capacity to continue conversations still requires development. The second major limitation is that the designed Chatbot cannot browse through

images or comprehend geo-referenced locations or map-related details. Consequently, it cannot comprehend or discern any images. Therefore, it is expected to develop our Chatbot, which will be capable of reading and comprehending images as well as image processing.

Apart from the above-mentioned limitations, there are some other content-specific restraints as well. One primary obstacle arises due to their limited breadth of knowledge, despite having undergone training using huge datasets. Within the realm of urban planning, where studies may include sophisticated and multifaceted topics, this constraint has the potential to impede the delivery of comprehensive responses. Another significant limitation is their restricted capacity to comprehend contextual subtleties. Even with their proficiency in comprehending literal English, Chatbots often have difficulties grasping the contextual nuances associated with a given inquiry, affecting the precision and reliability of their replies. Moreover, the issue of possible bias arises as a significant problem, given that Chatbots are educated on data that is selected by humans. This makes them vulnerable to propagating the prejudices that are present in the data they are trained on. The matter at hand has significant ramifications for the field of urban planning since the availability of impartial data plays a pivotal role in ensuring fair and just decision-making processes. Moreover, the continuous development phase of the Chatbot may lead to instances of inaccuracy. In light of the need for meticulousness in urban planning affairs, any mistakes have the potential to compromise the reliability of the Chatbot's observations.

The financial component presents an additional constraint since the development and upkeep of Chatbots might incur significant costs. The presence throughout could impede the broad accessibility to urban planning Chatbots, hence possibly limiting their overall usefulness and influence. In conclusion, the future application of Chatbots in urban planning is promising. However, it is crucial to address their limitations through continuous improvement, integration of contextual understanding, mitigation of biases, and implementation of cost-effective strategies. These efforts are essential for fully harnessing the Chatbots' capabilities to become essential tools for contemporary urban development.

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