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PDF-Document Chatbot Responses using Large Language Models to Enable Smart City Engagement

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Abstract *– Traditional documents, including Rencana Pembangunan Jangka Menengah Daerah (RPJMD), Strategic Plans (Renstra), and e-masterplans, have undergone a remarkable transformation, evolving from their conventional printed formats to the dynamic realm of electronic versions. While this shift offers greater accessibility and convenience, the full potential of these resources remains unrealized due to several challenges, including difficulties in navigating the extensive content and a lack of interactivity On the other hand, a Generative AI approach is employed for the creation of an intelligent chatbot. Our primary contribution lies in the PDF-Document Chatbot Response utilizing Large Language Models (LLMs) GPT 3.5 Turbo from OpenAI, aimed at fostering engagement within Smart City. The dataset consists of Masterplan documents for Smart City development in Yogyakarta City, presented in PDF format and employing the Indonesian language. This research leverages the Large Language Models (LLMs) GPT-3.5 Turbo from OpenAI, in conjunction with user input and prompts. The development process for crafting this chatbot utilizes the LangChain Framework and Pinecone for storing vector embeddings. The results underscore the chatbot's capability to generate coherent responses closely aligned with the context found within the PDF document.*

Keywords: *PDF-Document Chatbot; Large Language Model; Open AI; Smart City.*

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Abstrak *– Dokumen tradisional, termasuk Rencana Pembangunan Jangka Menengah Daerah (RPJMD), Rencana Strategis (Renstra), dan e-masterplan, telah mengalami transformasi luar biasa, berkembang dari format cetak konvensional menjadi versi elektronik yang dinamis. Meskipun pergeseran ini menjanjikan aksesibilitas dan kemudahan yang lebih baik bagi masyarakat, potensi penuh dari sumber daya ini masih belum sepenuhnya terealisasi karena beberapa tantangan seperti kesulitan dalam navigasi konten yang luas dan kurangnya interaktivitas. Di sisi lain, pendekatan AI Generatif diterapkan untuk menciptakan chatbot cerdas. Kontribusi utama penelitian ini terletak pada PDF-Document Chatbot Response yang memanfaatkan Large Language Models (LLMs) GPT-3.5 Turbo dari OpenAI, yang bertujuan untuk meningkatkan keterlibatan dalam konsep Smart City. Dataset penelitian terdiri dari dokumen Masterplan untuk pengembangan Smart City di Kota Yogyakarta, yang disajikan dalam format PDF dan menggunakan bahasa Indonesia. Penelitian ini memanfaatkan Large Language Models (LLMs) GPT-3.5 Turbo dari OpenAI, yang dikombinasikan dengan masukan dan perintah pengguna. Proses pengembangan chatbot ini menggunakan LangChain Framework dan Pinecone untuk menyimpan vector embeddings. Hasil penelitian menekankan kemampuan chatbot dalam menghasilkan respons yang koheren dan selaras dengan konteks yang terdapat dalam dokumen PDF.*

Kata Kunci*: Chatbot Dokumen PDF, Large Language Model, OpenAI, Smart City.*

I. INTRODUCTION

The advent of the digital era has brought about profound shifts that have permeated every facet of contemporary life, fundamentally altering the way information is both disseminated and consumed. This transformative wave has led to significant changes in how various aspects of society function, and this is especially evident in the domain of documentation [1]. Traditional documents, such as Rencana Pembangunan Jangka Menengah Daerah (RPJMD), Strategic Plans (Renstra), and e masterplans, have undergone a notable metamorphosis, transitioning from conventional printed formats to the dynamic landscape of electronic versions. This transition, while promising greater accessibility and convenience, has introduced new challenges in terms of readers' engagement and effective utilization of these invaluable resources [2].

Amid the digital shift, the transition of these crucial documents to electronic formats seeks to facilitate broader access and efficient distribution. However, despite their newfound accessibility, the utilization of these resources remains far from its potential due to certain inherent obstacles such as lack of the metadata, lack of archive, and not in the standard formatting. One significant hurdle lies in the extensive nature of the content presented within these digital documents, often spanning numerous pages of technical specifications, visionary goals, and strategic directions. The depth and breadth of information contained within these documents can be

overwhelming, causing readers to hesitate in engaging with their voluminous content. This challenge is particularly pronounced within local governments, where civic documents serve as pivotal references for shaping policies and fostering community development [3].

Regarding Smart City, as local governments aim to promote transparency and open access to information, the endeavor to grant citizens access to these critical documents is commendable. However, even with the doors of accessibility opened, the effective absorption and meaningful interpretation of the information therein remain limited by an underlying reluctance among readers to delve into lengthy textual material [4]. This phenomenon underscores the need for innovative approaches that bridge the gap between the potential wealth of information stored within these electronic documents and the readers' willingness to engage with it. In this context, leveraging cutting-edge technologies becomes imperative [5].

One such technology that holds immense promise in this realm is the application of chatbots powered by Large Language Models (LLMs). These sophisticated AI-driven tools have the capacity to transform the interaction between citizens and complex documentation. By harnessing the power of LLMs, such as Open AI ChatGPT, these chatbots can dynamically generate responses and insights from the expansive content of documents, offering users a more interactive and user-friendly means of accessing information. This synergy of technology and information democratization resonates with the broader vision of enabling smart city through enhanced engagement and effective utilization of resources [6].

On the flip side, a beacon of promise shines through the integration of cutting-edge Generative Artificial Intelligence (AI) techniques, with a particular emphasis on harnessing the capabilities of Large Language Models (LLMs), to give rise to interactive chatbot platforms. These chatbots, underpinned by the prowess of LLMs, exhibit a transformative ability to dynamically generate responses through the process of continuous learning from vast and diverse datasets, rendering the constraints of predefined answers obsolete. One exemplar of this paradigm-shifting technology is the OpenAI Generative Pre-Training (GPT) model, epitomized by the likes of Open AI ChatGPT [7].

Central to the efficacy of this technology is the revolutionary capacity of LLMs to transcend traditional boundaries. They herald an era of unprecedented versatility, with capabilities ranging from translation to summarization, and even encompassing the intricate field of question-answering applications [8]. This paradigm shift in technology is poised to reshape the landscape of information retrieval and interaction. In a world inundated with an abundance of data, the ability of LLM-powered chatbots to sift through intricate details and glean the essence of information ushers in a new era of efficiency and efficacy [9].

The Open AI ChatGPT, representing the forefront of LLM-driven advancements, is a prime exemplar of the transformative potential this technology holds. It epitomizes the amalgamation of Generative AI and LLMs, paving the way for intuitive human-machine interactions that transcend the boundaries of traditional communication systems. As these systems comprehend not just the semantics but the nuances of human expression, they facilitate a seamless exchange of information, transcending the limitations of mere predefined responses.

The ramifications of this integration are profound, especially in the context of addressing the challenges posed by extensive documents like RPJMD, Renstra, and masterplans. LLM-powered chatbots have the potential to decipher the labyrinthine content of these documents, distilling intricate concepts into understandable insights. By translating intricate jargon into accessible language, these chatbots offer a bridge between the complexities of extensive textual content and the users' desire for clarity and convenience [10].

In direct response to the formidable challenge of bolstering engagement with local government documents, our endeavor introduces a groundbreaking approach that exploits the untapped potential of Large Language Models (LLMs). This innovation takes the form of a visionary solution of a PDF-Driven Chatbot [11]. The essence of this concept lies in the amalgamation of cutting-edge technology and the pressing need for efficient and meaningful interactions with extensive documentation. Our proposed solution stands as a bridge, seamlessly connecting individuals to the wealth of information enshrined within documents like RPJMD, Renstra, and masterplans [12].

At its core, this PDF-Driven Chatbot epitomizes the synergistic marriage of LLMs and advanced AI-driven capabilities. This sophisticated fusion empowers the chatbot with the capacity to effectively navigate the intricacies of extensive textual content. Through the keen learning and adaptability inherent in LLMs, this chatbot is poised to decipher the complex linguistic landscape of government documents. Gone are the days of being overwhelmed by voluminous content, as this intelligent assistant can break down intricate concepts into digestible insights, serving as a guide through the maze of information [13].

Imagine a scenario where citizens and stakeholders are no longer daunted by the prospect of delving into lengthy documents. The PDF-Driven Chatbot serves as a virtual guide, effortlessly accessible through natural language conversations. With a simple query or prompt, individuals can embark on a journey of information retrieval, gaining access to relevant content within documents that once appeared formidable. By enabling this

interactive avenue, we triumph over the barrier of extensive textual content, making information consumption not only accessible but also intuitive and engaging [14].

Our visionary approach carries the promise of elevating the smart city engagement paradigm. The PDF-Driven Chatbot, leveraging the prowess of LLMs, has the potential to catalyze a transformation in how communities interact with the invaluable documents that shape their development. Through the convergence of technology and necessity, we strive to empower citizens, stakeholders, and local authorities alike with a tool that enhances information absorption and facilitates informed decision-making. This intersection of innovation and practicality lays the groundwork for a future where engagement with local government documents is not a daunting task, but an enriching experience [15].

Continuing on this transformative journey, the implementation of our PDF-Driven Chatbot solution bears immense significance in revolutionizing the accessibility and utility of critical documents within local communities. As we traverse further into the realm of this innovative concept, we delve into the intricate mechanics that enable this chatbot to seamlessly bridge the gap between comprehensive documentation and effective user engagement [16].

At the heart of our PDF-Driven Chatbot lies the inherent intelligence of Large Language Models (LLMs), such as Open AI ChatGPT. This cognitive prowess empowers the chatbot to interpret and process complex textual content with remarkable finesse. By drawing upon its vast training dataset, the chatbot is primed to decipher the intricate linguistic nuances that underpin local government documents [17]. Such capabilities are pivotal in the context of smart city development, where intelligent systems are increasingly leveraged to enhance public service delivery, streamline administrative processes, and improve citizen engagement [20]. What once presented a challenge for readers now becomes a realm of engagement, where conversational interactions lead to the extraction of valuable insights [18]. Document chatbots equipped with LLMs can facilitate real-time access to policy information, automate responses to public inquiries, and support transparent governance pillars in realizing smart, responsive urban management [23].

The architecture of our chatbot entails an intuitive user interface that transcends the traditional paradigm of information retrieval. Instead of sifting through voluminous documents, individuals are invited into a seamless dialogue with the chatbot. Through natural language conversations, users can effortlessly pose queries, prompting the chatbot to navigate through the intricate maze of information and retrieve relevant details. This transformative shift in engagement eliminates the barriers that previously hindered the effective utilization of these documents [19].

Consider the possibilities that unfold as citizens and stakeholders engage with the PDF-Driven Chatbot. A local resident seeking to understand the development plans for their community no longer needs to embark on a cumbersome journey through lengthy documents. Instead, they can engage in a conversation with the chatbot, extracting specific insights tailored to their inquiries. This not only empowers individuals with information but also democratizes access to knowledge, making it more inclusive and comprehensible.

As the realms of technology and necessity converge, our PDF-Driven Chatbot emerges as a beacon of empowerment and efficiency. By marrying the potential of LLMs with the vital need for accessible information, we aspire to reshape the narrative surrounding local government documents. Our approach echoes the ethos of smart city, where engagement with pivotal resources is not just a matter of duty, but a seamless and enriching experience.

The crux of our approach lies in addressing the gap between the availability of crucial information within documents like RPJMD, Renstra, and masterplans, and the challenges users face in navigating their extensive content. Our PDF-Driven Chatbot stands as a testament to technological ingenuity harnessed for the greater good. By infusing the power of LLMs into the chatbot, we enable it to serve as an intelligent intermediary, adept at comprehending the nuances of user queries and extracting relevant information from the documents [20].

The implications of this innovation resonate profoundly with the ethos of smart city. In a world propelled by data and connectivity, the ability to bridge the information divide holds the key to equitable development. As users interact with the PDF-Driven Chatbot, the experience evolves from a solitary encounter with a static document to a dynamic exchange that fosters informed decision-making. Communities are empowered with the means to access critical insights that drive their evolution, without the burden of deciphering complex textual information.

Consider the possibilities for local government authorities. The PDF-Driven Chatbot can streamline communication, acting as an accessible repository of information that citizens and stakeholders can access on-demand. Whether it's understanding the vision of a strategic plan or deciphering the granular details of development initiatives, the chatbot acts as a knowledge conduit that connects local governance with the aspirations of the people they serve [21].

However, the transformative potential of our approach extends beyond merely enhancing engagement. It also opens doors to data-driven insights. By analyzing the queries posed to the chatbot, local authorities can gain a deeper understanding of the community's concerns, priorities, and areas of interest. This invaluable feedback

loop can shape policies, facilitate responsive governance, and foster a sense of ownership among citizens who witness their contributions being acknowledged.

The main contributions of the paper are as follows:

a. We suggest the PDF-Document Chatbot Response for enabling Smart City engagement using Large Language Models (LLMs) GPT 3.5 Turbo Open AI.
b. The dataset in this case is Yogyakarta Mayor Regulation no 131 of 2021 document. This dataset concerning Masterplan for Smart City development of Yogyakarta City in PDF format and using Indonesian Language.
c. The chatbot here meant a Generative AI chatbot. This Generative AI chatbot include Large Language Models (LLMs), prompt, and input from the user. So that, the chatbot could respond naturally like humans.

This paper is structured as follows: Section I frames the problem by highlighting the underutilization of local government documents despite open access initiatives. It introduces the concept of chatbots empowered by LLMs. Section II provides an overview of relevant research on Generative AI, document-oriented chatbots, and the framework in which they operate. Section III presents our innovative approach for PDF-Driven Chatbots. Section IV covers the implementation and showcases experimental results. Finally, Section V concludes from our research and outlines the potential impact of PDF-Driven Chatbots in enhancing citizen engagement with local government documents.

The landscape of technological innovation has witnessed the rise of chatbots infused with the capabilities of Large Language Models (LLMs), sparking interest and applications across diverse sectors. One notable area of exploration lies in the realm of customer service, where these intelligent agents have been deployed to enhance user interactions and streamline processes. Additionally, the adoption of LLM-powered chatbots has transcended traditional industries, making inroads into the Food and Beverage (FnB) sector. A study by Muangkammuen et al. (2018) delved into this trajectory by investigating the potential of automated chatbots within the context of the FnB business. The researchers harnessed the power of the Recurrent Neural Network-Long Short-Term Memory (RNN-LSTM) architecture, an approach that resonates with the core principles underlying LLMs, such as Open AI ChatGPT [22].

Muangkammuen and colleagues sought to revolutionize the FnB industry by leveraging chatbot technology to automate services. This endeavor aligns intriguingly with the central theme of our research, which is the integration of LLM-driven chatbot responses for facilitating smart city engagement. The utilization of RNN-LSTM architecture in their study echoes the broader drive to enhance natural language processing capabilities, enabling chatbots to comprehend and generate human-like responses. This concept mirrors the fundamental principle behind LLMs, where extensive datasets are employed to imbue chatbots with an understanding of language nuances and contextual nuances [23].

Moreover, the exploration of automated Thai-FAQ chatbots underscores the global applicability of such technology, transcending linguistic barriers. Just as Muangkammuen and their team aspired to facilitate interactions in the Thai language, our study focuses on harnessing LLM-driven chatbots, like Open AI ChatGPT, to enable smart city engagement across diverse linguistic landscapes. The lessons gleaned from their approach offer insights into optimizing chatbot interactions within specific linguistic domains, thereby contributing to our overarching aim of creating an innovative PDF-Document Chatbot for Enabling Smart City Engagement.

The exploration of chatbots' transformative potential extends beyond the FnB industry, as evidenced by the work of Wang et al. (2022). Their study delves into the realm of automating services within the FnB sector, a domain that thrives on delivering efficient and seamless customer experiences. To achieve this, the researchers employed the Sequence-to-Sequence (Seq2Seq) architecture coupled with Long Short-Term Memory (LSTM), a combination that showcases the versatility of chatbots in streamlining processes and enhancing user interactions [24].

Wang and colleagues' endeavor to apply the Seq2Seq-LSTM architecture exemplifies the adaptability of chatbot technology in different contexts. Just as their study aims to automate services in the FnB industry, our research shares a common thread in the quest for automation, albeit in a distinct domain – the engagement with smart city documents and services. This connection highlights the cross-disciplinary nature of chatbots and their potential to transcend industry-specific boundaries.

The alignment between Wang et al.'s work and our proposed study becomes even more pronounced when considering the objectives. The study's aim of improving user experiences and automating services directly correlates with our goal of leveraging PDF-Driven Chatbots to enhance smart city engagement. By automating interactions with local government documents, we aspire to offer users a seamless, intuitive way to access information and services, thereby fostering informed civic participation.

Furthermore, the application of Seq2Seq-LSTM architecture in automating FnB services underscores the importance of efficient communication in service-oriented sectors. This concept resonates deeply with the essence of our PDF-Document Chatbot, which seeks to bridge the gap between extensive documentation and

users' willingness to engage with it. Just as Wang et al. harnessed technology to optimize service delivery, our study leverages LLM-driven chatbots to optimize the accessibility and usability of critical civic documents.

In the realm of deep learning and chatbot innovation, the study conducted by Khadija et al. (2022) stands as a testament to the transformative capabilities of generative models. Their investigation delved into the realm of Indonesian response chatbots, with a specific emphasis on the context of JKN-KIS [25]. This endeavor resonates profoundly with our research focus on harnessing generative language models, such as Large Language Models (LLMs), for response generation within the framework of smart city engagement [26].

Just as their study aims to create an Indonesian response chatbot to serve a specific healthcare context, our research seeks to utilize LLM-powered chatbots for navigating the extensive and intricate documentation present within local government frameworks. This shared aim underscores the versatility of generative models in adapting to diverse domains and their potential to streamline information dissemination. Deep learning generative models offer valuable insights into the benefits of utilizing advanced technologies for enhancing communication efficiency [9]. This concept aligns seamlessly with our overarching objective of enhancing smart city engagement [27]. As we grapple with extensive datasets and complex documents like RPJMD, Renstra, and masterplans, the incorporation of LLM-driven chatbots has the potential to distill intricate concepts into user-friendly responses, promoting greater understanding and engagement.

The emphasis on efficiency in communication and the provision of relevant information resonates deeply with the fundamental purpose of our PDF-Document Chatbot. By creating an interactive platform for users to access pertinent information effortlessly in health care [28], this parallel reinforces the notion that the benefits of generative models extend beyond individual industries, playing a pivotal role in enhancing information delivery across various sectors.

In the realm of AI-driven interactions and their implications, the work conducted by Kim and colleagues (2023) serves as an illuminating guidepost. Their comprehensive study delves into the landscape of ChatGPT and Large Language Model (LLM) chatbots, particularly within the context of academic medicine. What sets their research apart is its emphasis on understanding the acceptance and formulating guidelines for the responsible utilization of these advanced technologies. This resonates profoundly with the core tenets of our proposed study, which centers on harnessing LLM-powered PDF-Driven Chatbots to revolutionize engagement with smart city documents while upholding principles of responsibility and ethical application [6].

The confluence between Kim et al.'s research and our study becomes evident when we explore the shared focus on guidelines for responsible AI implementation. In an era where technology rapidly evolves, understanding the acceptability of AI-driven interactions and ensuring their ethical usage becomes paramount. Their meticulous examination of the academic medicine landscape lays the groundwork for promoting responsible AI utilization, and this insight extends seamlessly to our endeavor of utilizing LLM-driven chatbots for enhancing smart city engagement.

The significance of Kim and colleagues' study resonates deeply with the overarching goals of our research. As we venture to bridge the gap between extensive local government documents and citizens' willingness to engage with them, the importance of responsible AI utilization cannot be understated. By embracing guidelines that ensure transparent, ethical, and accountable AI-driven interactions, we aim to empower users with accurate, relevant information while maintaining the highest standards of integrity.

Moreover, the context of academic medicine shares certain parallels with the complexities inherent in navigating documents like RPJMD, Renstra, and masterplans. Just as their study recognizes the intricacies of AI utilization within a specialized field, our research acknowledges the intricate details within civic documents. The guidelines advocated by Kim et al. provide valuable insights into how we can ensure that our PDF-Driven Chatbot's interactions are informative, user-friendly, and aligned with ethical standards.

Kim and colleagues' study offers a roadmap for responsible AI utilization, and their insights extend beyond the realm of academic medicine. Their emphasis on guidelines and acceptability resonates deeply with our endeavor to introduce LLM-powered PDF-Driven Chatbots to enhance smart city engagement. By drawing parallels between their findings and our objectives, we underscore the pivotal role that responsible AI application plays in shaping meaningful interactions and fostering informed civic participation.

Collectively, the literature review has unveiled a tapestry of research endeavors that collectively emphasize the transformative potential of chatbots fueled by Large Language Models (LLMs). The threads woven by Muangkammuen et al., Wang et al., Khadija et al., and Kim et al. converge to highlight the versatility of LLM-driven chatbots in domains as diverse as customer service, Food and Beverage (FnB) automation, healthcare, and responsible AI utilization. These studies underscore the overarching premise that LLMs can bridge the gap between intricate information and user-friendly communication, a notion that resonates deeply with the proposed study's ambition to empower individuals to engage with the multifaceted documents that shape smart city.

The potential applications showcased across these studies dovetail seamlessly with the overarching objective of the proposed research: the development of PDF-Document Chatbot Responses using Large

Language Models (LLMs) through Open AI ChatGPT. By harnessing the capabilities of LLMs, our study aspires to revolutionize the interaction between citizens and complex documents like RPJMD, Renstra, and masterplans. The bedrock of insights gleaned from Muangkammuen et al.'s automated Thai-FAQ chatbot, Wang et al.'s FnB service automation, Khadija et al.'s deep learning generative response model, and Kim et al.'s guidelines for AI utilization collectively inform the conceptual foundation of our PDF-Driven Chatbot.

The convergence of these studies lays the groundwork for the envisioned conceptual framework and the practical implications that our study strives to unfold. By blending the transformative power of LLMs with the urgent need for improved access to civic documents, our research seeks to pioneer a tool that enhances engagement, fosters understanding, and propels smart city into a new era of informed participation. As we embark on this journey, the reviewed literature serves as a beacon, illuminating the path forward as we endeavor to create a tangible solution that bridges the gap between citizens and the vast reservoirs of information that define the landscape of modern urban living.

II. METHODOLOGY

This study looks at how pdf documents can be automatically created chatbots to make it easier for the public to access government information in order to move towards enabling smart city. In this research, using the Large Language Models (LLMs) Open AI GPT 3.5 Turbo method to create a chatbot that uses data from PDF document files. Figure 1 depicts the proposed method for making PDF-Document chatbot using the Large Language Models (LLMs) Open AI GPT 3.5 Turbo method.

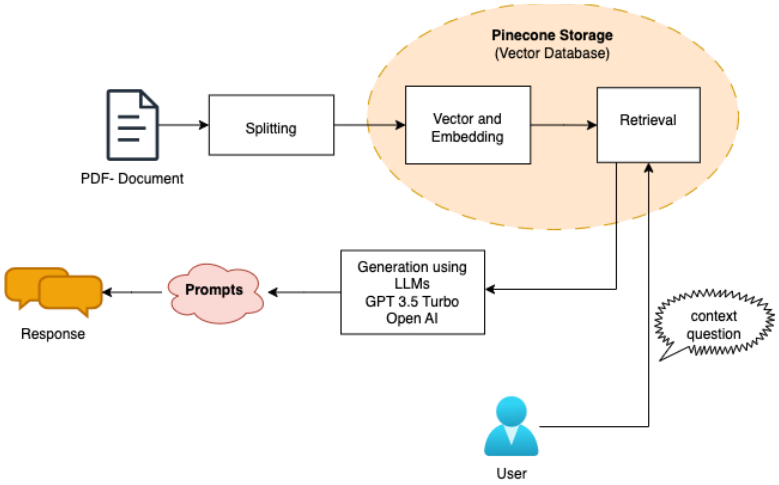

Figure 1. The architecture of the proposed method

Each of these phases is carried out through the utilization of the LangChain Framework. LangChain operates as a platform crafted for the construction of applications powered by language models. It streamlines the process of creating applications that enable a language model to establish links with supplementary data sources, thus enabling the language model to actively interact within its immediate environment [17]. LangChain is designed to accelerate the process of creating and developing Artificial Intelligence applications such as chatbot, NLP, and POS utilizing Large Language Models (LLMs). It serves as an initial guide for rapidly constructing extensive applications centered around large language models [29]. The steps taken in this research are divided into several phases:

A. PDF-Document Loading

This research use a dataset from Yogyakarta Mayor Regulation no 131 of 2021 document. This dataset concerning Masterplan for Smart City development of Yogyakarta City has PDF format. The dataset is shown in Figure 2.

WALIKOTA YOGYAKARTA
DAERAH ISTIMEWA YOGYAKARTA

PERATURAN WALIKOTA YOGYAKARTA
NOMOR 131 TAHUN 2021
TENTANG
MASTERPLAN PENGEMBANGAN *SMART CITY* KOTA YOGYAKARTA TAHUN
2022 – 2026

Figure 2. Yogyakarta Mayor Regulation no 131 of 2021 as dataset

B. Splitting

During this phase, the PDF documents undergo segmentation into more compact segments to facilitate their integration and storage as vectors within the model. The procedure of partitioning the PDF documents is executed using the LangChain framework. The most straightforward strategy for segmenting documents is to divide them according to length, a simple yet effective method that ensures each segment remains within a defined size limit. In this study, we employ token-based splitting, which partitions the text based on the number of tokens [22]. The size of the chunk is 200 with no chunk overlap.

C. Vector, Embedding and Retrieval

Enabling Large Language Models (LLMs) necessitates a substantial quantity of vector embeddings. This data serves as the foundation for AI applications to acquire comprehension and uphold a reservoir of enduring memory, which can be accessed during the execution of intricate operations. Pinecone is employed to serve as the repository for these vector embeddings. Pinecone operates as a platform that efficiently indexes and stores records containing vector information. For this purpose, Cosine Similarity is employed to ascertain the resemblances among entities by evaluating the distances between their respective vectors. This metric of distance aids algorithms in discerning the commonalities between content. In the context of cosine similarities, the extent of angular separation between two documents or vectors is gauged. This specific metric is particularly applicable when the magnitude disparity between vectors holds minimal significance, with the focus primarily resting on their orientation [23]. The following is an equation in Cosine Similarity:

$$a \,.\, b = \|a\| \, \|b\| \;\; cos \; cos \;\; \propto \qquad (1)$$

The user will ask a question related to the PDF-Document. Upon the retrieval of a user query, it transforms into embeddings, subsequently dispatched to the vector database to identify text exhibiting the highest semantic proximity, as determined by similarity scores.

D. Generation

In this phase, all of the queries will be stored in Pinecone and go through the model. We use GPT 3.5 Turbo from Open AI and also use their prompts as Large Language Models (LLMs) to get the response. GPT-3 and GPT-3.5 represent a sequence of language models formulated by OpenAI to produce natural language text that closely resembles human expression. In 2022, OpenAI unveiled the code-davinci-002 model for tasks involving code generation. This model laid the groundwork for the subsequent GPT-3.5 series. Through supervised fine-tuning, OpenAI developed the text-davinci-002 model, and further enhancements were introduced using the RLHF (Reinforcement Learning with Human Feedback) training approach to create the text-davinci-003 model. This strategy bolstered the model's proficiency in comprehending instructions and generating coherent text. Building upon the advancements of text-davinci-003, OpenAI optimized the gpt-3.5-turbo variant tailored for chat applications. While gpt-3.5-turbo outperforms its predecessors in tasks like Natural Language Inference (NLI) and word similarity comparison (wSC), it does encounter challenges when attempting to follow instructions in tasks related to Part-of-Speech (POS) identification [30].

Prompts serve as the input for Large Language Models (LLMs). These prompts are typically generated on the fly during the utilization of an LLM application and encompass the user's input in the form of a text string, a collection of few-shot examples designed to enhance the language model's response generation, along with instructions intended to guide the LLM in processing user-generated input. LangChain offers a range of classes

that facilitate the composition of prompts, leveraging specialized Prompt Templates inclusive of their respective parameters. The process use Zero-Shot Prompting. Zero-shot prompting refers to a natural language processing (NLP) technique in which a model is provided with a prompt and tasked with generating a relevant response, despite having no prior exposure to similar prompts during training [24].

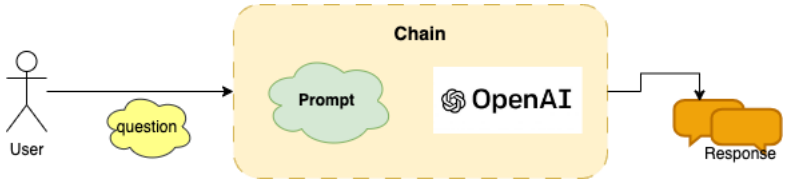

Figure 3. The process of Generation LLMs GPT 3.5 Turbo Open AI in LangChain

D. Response

The chatbot will respond to the answers provided in response to user input questions. This response is generated by processing the input questions from users and the PDF documents stored in a vector database, in conjunction with prompts and GPT-3.5 Turbo from OpenAI.

III. RESULT AND DISCUSSION

In this study, we employ the LangChain Framework in conjunction with ChatGPT (GPT-3.5 Turbo) provided by Open API to obtain responses. To store vector databases, Pinecone [25] is utilized. Within Pinecone, the embedding dimension is set at 1536, and the metric used is the Cosine Similarity. API keys are required from both Pinecone and OpenAI. The result of this research is the user could type the question in the chatbot related to the context of a PDF-Document and the chatbot can respond to it. The example context, input, prompts, and the output as shown in Table 1.

TABLE 1
THE 1ST EXAMPLE OF QUERY AND RESPONSE IN CHATBOT

Context	The user wants to know the component of Smart Governance.
Input	“apa saja yang termasuk smart governance?”
Prompts	`You are a helpful AI assistant. Use the following pieces of context to answer the question only and only in the Indonesian language irrespective of the question language in a good and beautiful answer” If you don't know the answer, just say "maaf, chatbot tidak mengerti" and improve your answer based on the context. If the question is not related to the context, politely respond that you are tuned to only answer questions that are related to the context. {context} Question: {question}
Output	Komponen-komponen dari smart governance adalah sebagai berikut: Public Service: Peningkatan kinerja pelayanan publik. Bureaucracy: Peningkatan kinerja birokrasi pemerintah. Public Policy: Peningkatan efisiensi kebijakan publik. Smart governance merupakan tata kelola pemerintahan yang cerdas yang terdiri dari komponen-komponen tersebut.
Condition	Appropriate with the PDF-Document context

Illustrated in Figure 4, the chatbot's response becomes evident, while Figure 5 displays the authentic paragraph extracted from the PDF document. The chatbot derives its response by juxtaposing the question against the PDF content and prompts, effectively establishing a connection between the two, as depicted. For the evaluation, we used Bilingual Evaluation Understudy (BLEU) Score. BLEU Score is an automatic scoring method used to evaluate the quality of text produced by document-PDF chatbots. It functions by comparing the chatbot's output to reference responses, focusing on overlapping n-grams and incorporating a brevity penalty to discourage overly short answers. Scores range from 0 to 1, with higher values reflecting greater lexical similarity. In this chatbot,

has 0.81of BLEU Score. The BLEU score is high approaching 1, suggesting that this chatbot closely aligns with the human-generated conversation through the document. To anticipate errors in the chatbot, in the generation process uses Zero Shot Prompting.

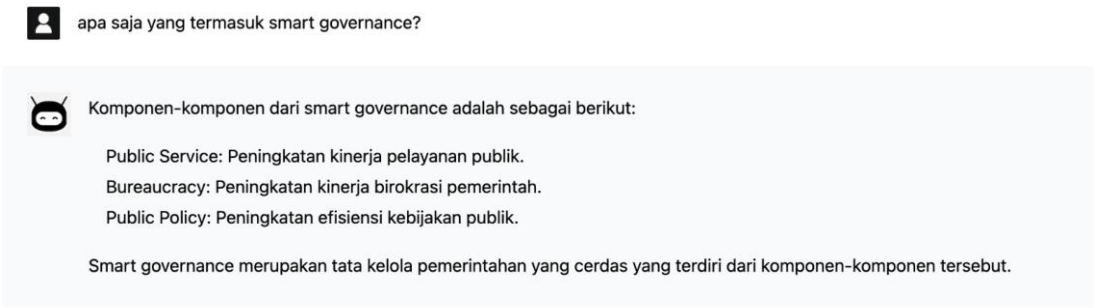

Figure 4. 1st Sample Response from PDF-Driven Chatbot

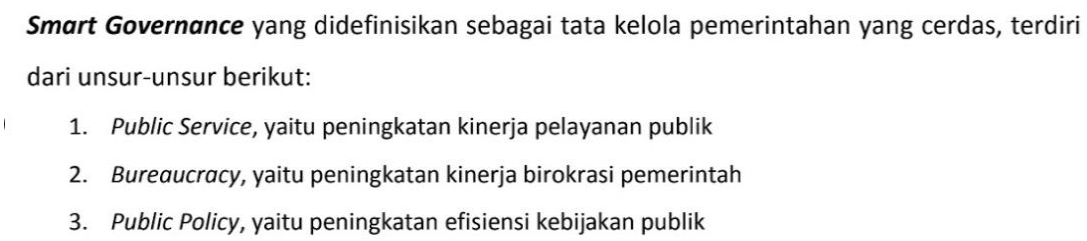

Figure 5. 1st Sample Paragraph from PDF-Document

Related with the coherence of text, this chatbot could also summarize the text in a contextually relevant and coherent. An example of 2nd context, input, prompts, and output is shown in Table 2.

TABLE 2
THE 2ND EXAMPLE OF QUERY AND RESPONSE IN CHATBOT

Context	The user wants to know the most important apps in Smart City.
Input	"aplikasi penting yang ada di smart city apa saja ya?"
Prompts	`You are a helpful AI assistant. Use the following pieces of context to answer the question only and only in the Indonesian language irrespective of the question language in good and beautiful answer" If you don't know the answer, just say "maaf, chatbot tidak mengerti" and improve your answer based on the context. If the question is not related to the context, politely respond that you are tuned to only answer questions that are related to the context. {context} Question: {question}
Output	Dalam kerangka Arsitektur Aplikasi Smart City, terdapat beberapa komponen aplikasi yang penting. Pertama, terdapat aplikasi Sistem Informasi Manajemen/Aplikasi dari OPD yang diperlukan untuk menangani kebutuhan proses bisnis yang berkembang. Kedua, terdapat platform IoT, surveillance, dan sensor yang memberikan informasi dan data situasional secara real-time baik melalui perangkat yang ditanam oleh Pemerintah Kota atau bekerjasama dengan Komunitas. Ketiga, terdapat aplikasi eksternal yang merupakan aplikasi dari pihak ketiga seperti korporasi, startup, atau organisasi yang mendukung tersedianya layanan smart city. Semua aplikasi ini berperan penting dalam mendukung pengembangan dan pengoperasian Smart City.
Condition	Appropriate with the PDF-Document context

As depicted in Figure 6, the chatbot's response is observable, while Figure 7 illustrates the exact paragraph extracted from the PDF document. The chatbot derives its reply by aligning the question with the PDF content, facilitated through the integration of prompts.

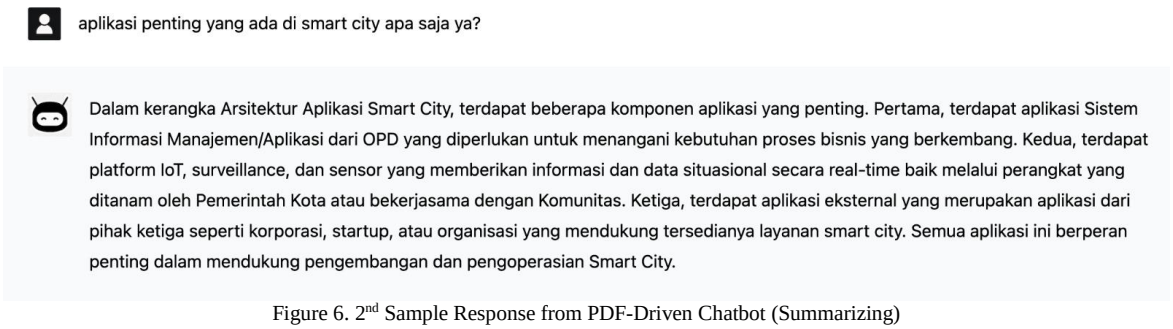

Figure 6. 2nd Sample Response from PDF-Driven Chatbot (Summarizing)

Pengembangan aplikasi *Smart City* dilaksanakan dengan mengkonsolidasi dan mengkordinasi dukungan aplikasi-aplikasi yang ada kedalam kelompok

1. Sistem informasi Manajemen / Aplikasi dari OPD: Sistem informasi manajemen dan aplikasi yang menjadi inisiatif dari OPD dan diperlukan untuk menangani kebutuhan proses bisnis yang berkembang.
2. Platform IoT, surveillance dan sensor : Peralatan dan pendukung yang memberikan informasi dan data situasional didalam Kota dan masyarakat secara real time baik melalui perangkat yang ditanam oleh Pemerintah Kota atau bekerjasama dengan Komunitas.
3. Aplikasi Eksternal : aplikasi dari pihak ketiga dalam hal ini korporasi, startup, organisasi yang mendukung tersedianya layanan smart city

Figure 7. 2nd Sample Paragraph from PDF-Document

IV. CONCLUSION

In this research, we have successfully designed a PDF-Document chatbot responses using a Large Language Models (LLMs) approach, particularly focusing on the creation of a PDF-Driven Chatbot using GPT 3.5 Turbo OpenAI for enabling Smart City Engagement. The chatbot is designed to reply to the responses given by users in reaction to their input queries. This reply is created through the analysis of user-inputted questions and the PDF documents stored within a vector database in Pinecone [31] which is then integrated with prompts and GPT-3.5 Turbo from OpenAI. All of this process developed in the LangChain Framework. This chatbot, which derives its input from PDF documents, falls under the category of generative AI chatbots. These chatbots, propelled by artificial intelligence, serve as conversational agents programmed to generate responses resembling human language. In contrast to rule-based chatbots that hinge on predetermined scripts and structures, generative AI chatbots harness advanced deep learning frameworks such as transformers to understand and produce responses that are contextually relevant and coherent. The findings from the research showcase the chatbot could tackle questions that pertain to the context of the PDF document. Additionally, the chatbot's responses not only furnish solutions but also skilfully modify the context using sophisticated language and provide the ability to create summaries. In the context of smart city, this chatbot is designed to simplify the process of public awareness regarding government actions. It is the government's responsibility to uphold transparency and openness in terms of policy implementation, particularly concerning the smart city' master plan policy, with the community being the primary focus. Through the utilization of this chatbot, individuals can gain insight into matters associated with Smart City development. This enhances public awareness and encourages active participation in propelling Indonesia towards achieving smart city status. In future research, prompt strategies should be used to improve the response of the chatbot and the formatting instead.

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