

# C<sup>2</sup>-PILS: A Chatbot using Chat-GPT for Pharma Industry and Life Sciences

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**Abstract**— A Chatbot is a software application that can interact with people in a humane manner in the form of a well-developed conversation using text or speech. Chatbots warrants the growth of automation and self-service. Chatbots are one of the most widely used applications these days. Chatbot can be integrated into various domains and various fields such as health, commerce, business, banking and many others. One such important application is embedding chatbot into the pharmaceutical industry. A chatbot developed specifically for the pharmaceutical industry can be helpful in handling any queries and doubts posed by the public. Any information regarding any kind of drug, its composition, its use and also side effects can be given to the user by this bot. This research is based on using the pre trained Chat-GPT API provided by OpenAI to develop a model that is both efficient and fast enough in reacting to the queries and also making humane conversations. In recent days, the popularity of Chat-GPT has been increasing very rapidly, which is also based on the same OpenAI API. This AI driven tool has taken the market by storm, and it would potentially be a great support for the pharmaceutical industry. The pharmaceutical industry is a prominent part of life sciences across multiple sub domains, and it ranks third globally in terms of sales and revenue. Hence, to innovate and assist the pharmaceutical industry of the life sciences, we have come up with an implementation of ChatGPT, wherein we would be using natural language processing tools that would help us to boost user interaction by using creative content such as images and information about the medicines, usage of medicinal devices and diseases.

**Keywords**— Chatbot, OpenAI API, Chat GPT, React Components, POST Request, Prompt Engineering, Pharmaceutical Industry, Response and Router, API Key, Davinci Model.

## I. INTRODUCTION

In this age of technology, the idea of using a chatbot has become very common. With the prevail of ChatGPT, it has become even more popular. Coming to the pharmaceutical industry, it has been noticed that there is a lack of usage of this amazing piece of software which is ChatGPT. An ample lot of the companies in today's industry, are focusing on implementing chatbots, and a minute fraction of the

companies have already started implementing the chatbots, where as a considerable number of companies have not yet given the thought to start implementing the chatbots [1]. In the year of 2018, a chatbot named Nina was launched into the market to help patients with insomnia, which helped in giving them suggestions to improve their condition [2]. There are also developments in the chatbot domain to help people with depression and anxiety using behavioral therapy [2].

Artificial Intelligence has eased the lives of software developers, as today there is a massive development in the chatbot arena, where the model gets trained with almost negligible human supervision, this has also led to a lot of satisfiable users with humane interaction [3]. Chatbots have a variety of applications, including and not limited to the pharmaceutical industry, it even expands to education, information retrieval, business, e-commerce and many more. For instance, in the educational sector, we can make use of chatbots to provide assistance with the admission process, which would lead to the awareness among the interested students regarding the institute, also it would reduce the burden upon the admission committee as they won't have to answer each and every query that comes to them. [4], [5].

ChatGPT is a tool based on Artificial Intelligence, developed by OpenAI and was launched in November 2022. ChatGPT has also drawn huge investments from one of the major tech giants. ChatGPT is a well-trained generative pre-trained transformer. With the help of ChatGPT, the time and resources of any company can be utilized to their fullest potential [6]. There are many significant ways to employ ChatGPT in the life sciences industry, such as maintaining comprehensive patient records, strengthening the clinical decision support systems, enhancing patient awareness regarding the diseases, automating the administrative tasks and providing answers to the patients' queries [7].

The main ability of chatbot is to reduce the load on customer service employees by replacing them and giving a faster response to the user with negligible response time. Using this, the customer can get the wanted information with insignificant and meagre wait time [8]. It is necessary to impart awareness among the medical personnel and the patients regarding the appropriate usage of large language

models based on artificial intelligence, such as ChatGPT as it important for them to clearly understand and recognize the advantages and capabilities of the model and make sure that this technology is used ethically [9].

## II. LITERATURE SURVEY

The usage of chatbots has grown tremendously during the past decade, with the rise in chatbot technology, the new age of ChatGPT raised. The application developed is mainly focused on providing a high-minded chatbot which is capable of answering queries regarding the pharma industry and life sciences. There has been a significant increase in providing a better user interface for a increased humane interaction. Also, the content passed to the program should be ethically morale, and should not harm the software in any way [10].

Chatbots can be a valuable resource to any organization, as they reduce the load upon their employees to answer queries of the user, the chatbots have a wide area of applications including educational institutions, research, journalism, mass communication, information technology, retail, healthcare [11]. The scope of chatbot application in the healthcare industry has been growing rapidly since the past few years, the usage of chatbot would regulate the human errors and try to overcome it as it is specially trained to do so [12].

ChatGPT has been also described as a tool which is future ready, and capable to support any organization with is witty skills, it would give suggestions specifically customized for the organization's needs and according to the market trend, which would help the organization to take a leap ahead of its competitors [13]. The digital era has boosted the use of chatbots, as the users tend to the chatbots first to answer their query, which has made chatbots a first line of contact. For instance, when a user enters specific symptoms of their disease, the sentence is broken down using natural language processing, then the indexing of the keywords is done to the respective disease and then the symptoms are classified to a particular disease [14].

Studies have shown that ChatGPT has outperformed the already existing chatbot performances, it has also been very understanding of the problem and has given effective solutions with caution, and disclaimers in simple wording, which is easily understandable by the users. It emphasizes the fact that ChatGPT has very genuine and trust worthy sources of information [15]. It has been seen that the usage of chatbots has stimulated positive reviews from its users regarding the quality of service offered to them, and the potential prospect of using chatbots in customer service has been heightened. In this marketing era, the advantages of having a reliable customer service system by an organization, provides a competitive advantage over its rivals [16].

ChatGPT can also be used to analyze customer feedback, which is a crucial part of software product development cycle. It would boost the performance of the company, it can be customized and tuned according to the company goals. Prompt engineering is also seen as a major super power in utilizing and implementing ChatGPT [17]. Prompt engineering is an effective way to enforce rules and communicate our requirements to the model within the application context [18].

ChatGPT has expanded to a vast area of applications, in the recent times it has been seen expanding to healthcare, education, research, and many other domains. This has risen to be a very promising software application, it has brought a revolution to the existing ways, it is indicated to use the application with care and attention. It is a very dependable and valuable resource to the tech world. Studies have even shown that ChatGPT has emerged to be a prominent interface in healthcare as well, with it being utilized in aligning the workflow, cost cutting, tailored learning, customized medication, increasing awareness regarding health issues etc. [19].

## III. METHODOLOGY

At present only a few top companies in the pharma industry have successfully implemented a well-trained chatbot which is reliable. The techniques and models that have been used by those organizations are very sophisticated and require a lot of human supervision. These models usually require a lot of training and must be capable of Natural Language Processing (NLP) to converse with people in a humane manner. It also involves working with humongous amounts of raw data on which the chatbot program must be trained to improve its accuracy and efficiency. But this may not be an efficient way for all the organizations, especially for small start-ups and budding institutions.

Whereas, the C<sup>2</sup>-PILS uses a pre trained API provided by OpenAI to implement the functionality of a chatbot. This API model is the one that is utilized in the ChatGPT application whose popularity has been booming recently because of its promptness and accuracy regarding any kind of query. OpenAI has constantly been providing updates to this API model including GPT-3, GPT-3.5 and GPT-4. In this application, the same version of the API has been implemented, by connecting to the API using the backend system of the chatbot application.

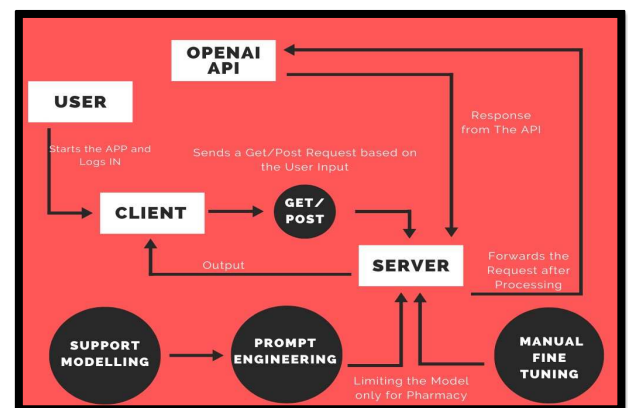


Fig 1. Architecture and working of the C<sup>2</sup>-PILS

The architecture of the C<sup>2</sup>-PILS application consists of 3 main modules which are namely, the front-end (client side), the back-end module (server side) and the API utilized by ChatGPT that is incorporated from OpenAI. The user interacts with the client side of the application that provides a usable and visually appealing interface through which the user can ask queries to the chatbot related to the pharma industry and life sciences.

#### IV. IMPLEMENTATION

The Front-End of the chatbot application is developed using the ReactJS framework. As ReactJS provides the component model for the development of our C2-PILS application that makes it easier to integrate the chatbot into multiple websites and web applications very easily. We include an input text box field in which the user types his/her query. The text given as input in the text box by the user is then processed to fetch the answer. This query is displayed on the screen in the chat area and then the same query is sent to the Server side (Back-End) of the application is the POST method. The GET/POST methods are generally used by the clients of various applications to send request to the servers and fetch responses from the same. So, in this C2-PILS application as well the same POST method is used in order to send the query to the server and fetch the answer of the query from the server.

On the server side of the things, the server is constantly active and keeps listening for any GET/POST request coming in from the front-end. When it receives the query in the form of POST request, it generates the validated response. The response generation on the Back-End implementation mainly includes of 3 main components which are Multiple Model Support, Prompt Engineering and Manual Fine Tuning. Multiple model support and Prompt Engineering are totally related to each other and they are part of each other as we require efficient Prompt Engineering for the model to work flawlessly. In this application we will be using 2 models that are both created by the createCompletion() method. By using the createCompletion() method we create an instance of ChatGPT API that will be acting as our model. First model works on the process of protecting the chatbot from any unnecessary and toxic content. As, the C2-PILS is a bot that is being developed to handle the queries related to only a specific sphere, the other kinds of doubts and queries must not be accepted. This is very important to restrict the C2-PILS from any kind of redundant content [9]. The second model is based on working or acting as a chatbot answering the queries according to the situation provided. Each model of the API works with a technique Prompt Engineering.

Prompt Engineering is where a context is provided to the Chat-GPT API on how it should interact with the user and the type of responses that are to be generated. In the first model, the prompt is given as "Return 0 if the message is related to pharmacy or return 1 if the message is not related to pharmacy". The model processes this prompt and acts according to the given context which is it process the input query to check if it is related to pharmacy or not. If it is then 0 is returned otherwise 1 is returned as the output of the model. Whereas moving on to the second model the prompt given is as following: "assume yourself as a chatbot and answer the questions in the context of pharmacy". This context is going help us convince the Generative Pre-trained Transformer that it is a chatbot, so that the responses generated by the model are similar to that of a normal chatbot. We connect both the models by using a simple if-else statement where if the output given by the first instance of the API (i.e., the first model) is 0 then the query entered by the user will be answered accordingly by the second one, in the other case the particular question will not be answered. This prompt is provided as one of the parameters to the createCompletion() method.

The other parameters include the max\_tokens that specifies the maximum number of characters that can be obtained as output from the model. And another parameter temperature that takes in a float value between 0 and 1.0 which indicates the creativity and the percentage of non-plagiarized answer that should be given as response by that model. There is also another unused parameter known as the context. The context takes in the argument in the form of a string and it is similar to that of the context provided in the prompt. This context argument is used to provide additional context to the model, so that it can process the exact situation on which the posted queries must be answered.

For the Manual Fine Tuning, some edge cases can be taken care of such as if a person asks the chatbot to find the nearest pharmacy to his current location. In this instance it is not possible for the API to answer that accurately. For that we either need to integrate the location services with the API itself or handle them separately. Handling them separately is done by defining a new method that's sole purpose is to find whether the question asked by user is related to nearest store and point the user towards the particular medical store. This can easily be implemented by using the Regular Expressions to match the query or check it if it contains the keywords' nearest location or not. This section of handling the edge cases is labelled as Manual Fine Tuning in the architecture of C2-PILS. Finally, the response generated by the server is sent to the Front-End client side where it is displayed in the chat area.

#### V. RESULTS

The results that are obtained from C<sup>2</sup>-PILS are phenomenal in terms of accuracy and also in terms of efficiency. The research behind ChatGPT has very precise information in its database which has been collected from legitimate sources all across the internet such as medical journals, doctor suggestions, medical professional ideas, medicine textbooks, research papers and articles related to medicine and pharma industry etc.

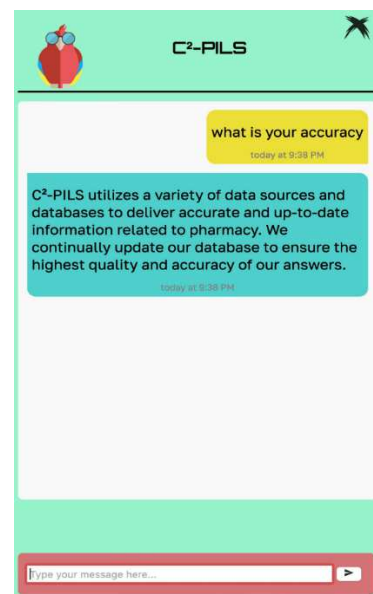


Fig 2: Depicting the accuracy of C2-PILS

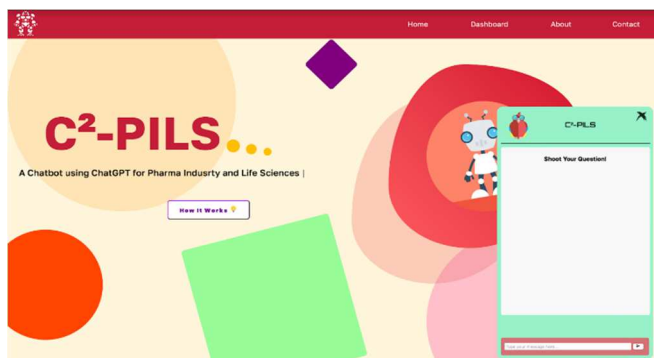


Figure 2: Website for C2-PILS

The C2-PILS website has amazing user interface, which is very user friendly, which has been developed using html, css and reactjs.

The C<sup>2</sup>PILS application on which this research is based generally answers only the questions related to pharmacy. If any other topics or unrelated stuff is posted in the chatbot the response will be similar to “Please enter Pharmacy related questions only”. Coming to the two models used to develop C<sup>2</sup>PILS the first model outputs 0 and 1 based on the query relativeness to the Pharmacy and Life Sciences Industry. As shown in the figure.



Fig 6: Outputs of first model

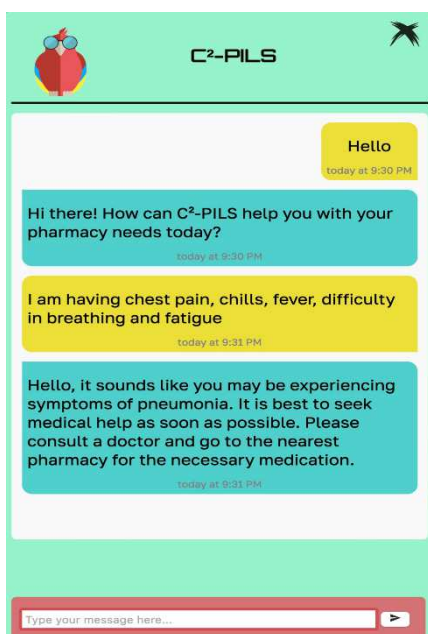


Fig 4: Initial interaction with the chatbot

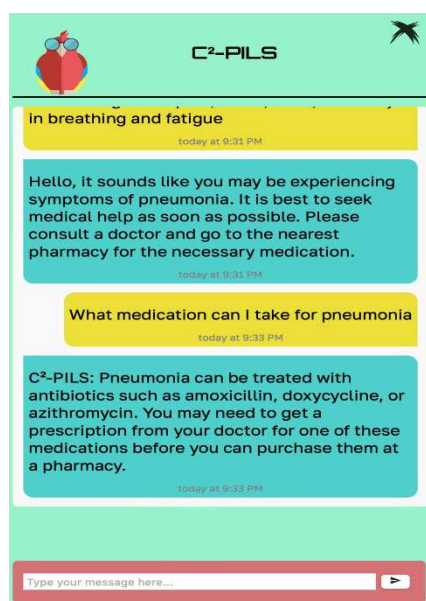


Fig 5: Asking the chatbot for medication

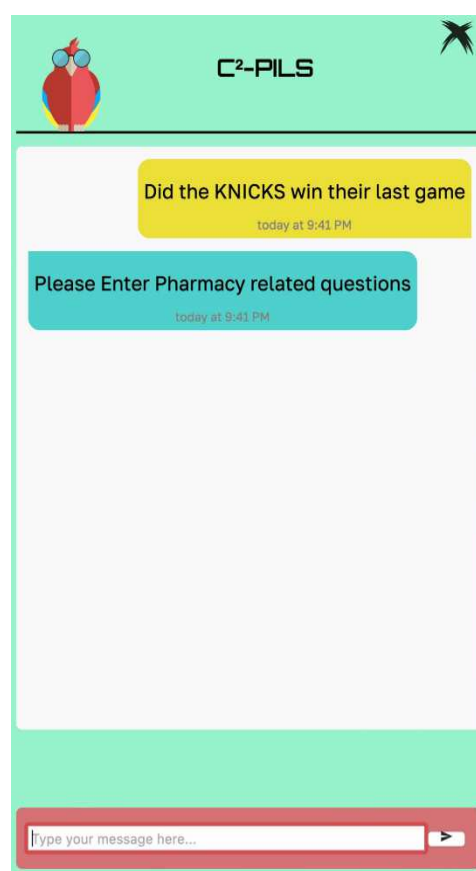


Fig 7: Asking the chatbot an unrelated question to pharmacy

The term compounding in pharmacy means different than the common English word compounding which relates to the interest rates; thus, we can say that the C2-PILS chatbot only answers questions in regard with pharmaceuticals and the pharma industry. If a person wants to know about the symptoms of any disease or composition of any drug or side effects of the drug, the C<sup>2</sup>-PILS application can accurately and appropriately present the information to the user. The bot can also suggest appropriate measures if someone is suffering with a kind of disease.



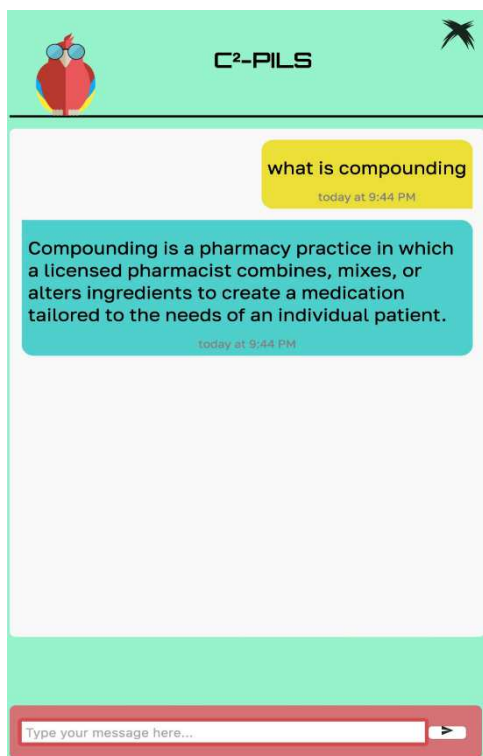


Fig 8: Asking a general term

## VI. CONCLUSION

In the wake of artificial intelligence, the next era of technology has already begun. This application of ChatGPT focuses on helping the pharma industry. The main end product of this application is to provide the users with apt information which is both accurate and genuine regarding any of the diseases mentioned by them. The queries asked by the user have been limited to the arena of life sciences and pharmaceuticals by using two models. The first model works with verifying whether the query is related to the pharma industry or not, and the second model fetches the result from the API. This would definitely be the ice breaker in the industry, as it provides answers in a simple click right away. The building of the application is very economic, it would require a small set of skilled technological professionals to develop the application, using which even smaller companies in the industry can benefit from.

React js makes use of all the functionalities present in JavaScript, it improvises the concepts and gives better and faster results. The maintenance of the website would be very minimal, as the changes and updates to the ChatGPT would be done by OpenAI itself, which would result for this application to be very cost effective. As of today, this will turn out to be a major helping and guidance factor for the public health regarding their queries in life sciences and the pharma industry, it is a step up to the existing medical chatbots which is way better and has up its game in the market.

## VII. FUTURE ENHANCEMENT

As this application is mainly focused upon the pharma industry and life sciences, in the future it can be expanded to an ample lot of domains and fields including technology, sciences, business, retail, education, commerce, banking, e-commerce, government agencies etc. As this application is

based upon the usage prompt engineering, further steps can be taken to improve its implementation. As ReactJS is one the booming technologies, it has been utilized in the implementation of this application, it is seen that many new emerging technologies can further improve this application in the future as well. In the future, it can be incorporated into public health websites, wherein even the common public can be made aware of the disease, its symptoms, treatment and care to be taken. As public health has been an important aspect in any country's growth and the well-being of its population, we can install this on government websites, to educate the public about new diseases, maintaining hygiene, taking proper care of their surroundings etc. This application is destined to improve its capabilities and it would never decline in its ability to serve the people, as it will be constantly updated with new information from trusted sources, surveys and observations made in the medical field.

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