Are GPTs the Answer to Small Clinics' Digital Struggles? A Comprehensive Implementation Study

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Abstract

Small clinics in North America often struggle to keep pace with the digital transformation sweeping the healthcare industry due to limited financial resources and technological expertise. This digital divide has become more pronounced with the increasing reliance on digital solutions, such as online booking systems and telehealth services, exacerbated further by the COVID-19 pandemic. This paper evaluates whether Generative Pre-trained Transformers (GPTs), introduced by OpenAI, can effectively bridge this gap by providing a cost-effective and efficient solution for small clinics. We detail the implementation of a GPT-based online booking system tai lored to the needs of small clinics. The methodology includes a flowchart of the system's components and descriptions, supplemented by code and scripts in the appendix. Our findings show that GPTs can significantly improve booking efficiency, reduce administrative workload, and enhance patient experience. However, we also identify drawbacks such as technical issues and the need for staff adaptation. We discuss potential issues, including error handling, privacy concerns, and appointment conflicts. The paper concludes with recommendations for small clinics on leveraging GPT technology to enhance their digital capabilities, ultimately aiming to provide more efficient and accessible healthcare services.

Keywords: AI in healthcare, Digital Health, GPT, Small clinics.

1. Introduction

In recent years, the healthcare industry has experienced a significant shift towards digitalization, driven by the need for enhanced efficiency, improved patient care, and streamlined operations. However, small clinics, particularly those in North America, often find themselves at a disadvantage in this transformation due to limited financial resources and technological expertise. These clinics struggle to adopt advanced digital solutions, such as online booking systems and telehealth services, which larger healthcare institutions can readily implement.

This disparity has created a digital divide that exacerbates existing inefficiencies and limits access to care for many patients.

The COVID-19 pandemic further highlighted the critical need for robust digital solutions in healthcare. During this period, the reliance on digital platforms for patient consultations and care coordination became more pronounced. Yet, small clinics faced significant challenges in keeping pace with these demands due to their constrained resources. Research has shown that while virtual care tools were beneficial during the pandemic, their implementation was fraught with practical challenges, including technical difficulties [1], higher workloads [2], and digital exclusion of certain patient populations [3].

GPT's are a family of neural network models developed by OpenAI [4]. These models designed to generate human-like text. GPT models are pre-trained on a large corpus of text data and can perform a variety of natural language processing tasks, such as text generation, translation, summarization, and more.

In November 2023, OpenAI introduced ChatGPT-4 Turbo [5], which is considered a new class of model within the GPT series due to its enhanced capabilities, cost-effectiveness, and the introduction of features like larger context windows and improved processing efficiency. It includes functionalities such as code interpretation, retrieval, and function calling, which expand its application range significantly compared to previous models [6] and has the potential to revolutionize various aspects of healthcare. These models promise to offer advanced capabilities in natural language processing, enabling more efficient and user-friendly digital interactions. This paper seeks to explore whether GPTs can serve as a viable solution to bridge the digital gap faced by small clinics.

Our study begins by providing an overview of the current state of small clinics in North America, highlighting the specific challenges they encounter in the digital landscape. We then conduct a comprehensive literature review to compare recent academic and commercial efforts aimed at bridging this gap.

Following this, we present our methodology for implementing a GPT-based online booking system tailored to the needs of small clinics. This section includes a detailed flowchart and component descriptions, with supplemental code and scripts provided in the appendix.

Through our implementation, we identify both the advantages and limitations of using GPTs in this context. We illustrate the system's functionality with a practical example and discuss potential issues such as error handling, privacy concerns, and appointment conflicts. Finally, we conclude with recommendations for small clinics on leveraging GPT technology to enhance their digital capabilities, ultimately aiming to provide more efficient and accessible healthcare services.

2. Literature review

Small clinics often face significant challenges, such as financial constraints[7], limited access to advanced medical technologies[8], and workforce shortages [9]. A study highlightedthat small

clinics were pivotal during the COVID-19 vaccination drive, demonstrating their essential role in public health despite limited resources [10].

However, the integration of digital solutions remains a substantial hurdle due to high costs and implementation difficulties. The need for scalable, cost-effective solutions is critical to enhance the efficiency of small clinics [11].

Efforts to address the digital divide in healthcare aim to enhance access to digital health technologies, which can significantly improve the quality and efficiency of primary healthcare services [12]. These technologies include tools such as electronic health records (EHRs), telemedicine, mobile health apps, and remote monitoring devices, which make healthcare more accessible and effective.

The growing integration of digital technology in healthcare not only improves patient outcomes but also streamlines healthcare delivery processes, making it more efficient. This intersection of digital innovation and healthcare presents promising opportunities for better health services, particularly in underserved areas, by providing more equitable access to essential healthcare resources [13].

The transition from EHRs to clinical management systems marks a significant evolution in healthcare services. This shift has been pivotal in integrating patient data, facilitating better clinical decision-making, and improving overall healthcare service delivery. Advanced clinical management systems enable seamless data sharing across various departments and healthcare providers, which enhances interoperability. These systems also provide improved analytics and decision support tools, aiding healthcare professionals in making more informed and timely decisions. However, the implementation of such systems is not without challenges. Data privacy and security remain significant concerns, as does the high initial cost of these systems. Overcoming these barriers is essential for maximizing the benefits of digital transformation in healthcare [14].

Innovation in healthcare technologies plays a crucial role in driving digital transformation. AI has been particularly transformative, enhancing diagnostic accuracy and enabling personalized treatment plans. Telemedicine has expanded access to healthcare by facilitating remote consultations. Big data analytics enable healthcare providers to gain insights into health trends and outcomes, thereby improving decision-making processes. Despite these benefits, there are several challenges, such as resistance to technology adoption among healthcare providers and patients, as well as regulatory hurdles that complicate the integration of new technologies [15]

Literature regarding the digital Transformation offer a review of the evolution of digital technologies in healthcare. Key milestones include the introduction of EHRs, the rise of telemedicine, and the incorporation of AI into healthcare practices. Current trends are increasingly focused on patient-centered technologies and the integration of Internet of Things devices. However, there are some persistent challenges, such as the difficulty of upgrading legacy systems and the need to ensure that new technologies can be effectively scaled across different healthcare settings [16]

Strategies for Digital Transformation in Clinical Laboratories Focusing on clinical laboratories, the paper" Crossing the Chasm: Strategies for Digital

Transformation in Clinical Laboratories" discusses the strategic approaches necessary for successful digital transformation in this specific context. It underscores the importance of effective change management, leadership, and stakeholder engagement.

Engaging all stakeholders, including laboratory staff, clinicians, and patients, is crucial for the acceptance and successful implementation of digital initiatives. The paper also stresses the need for seamless technology integration with existing laboratory information systems and the importance of continuous training programs for staff to adapt to new technologies. The primary challenges identified include resistance to change among staff and the allocation of sufficient resources to support digital initiatives. Addressing these challenges is critical for the successful digital transformation of clinical laboratories [17] Successes and Limitations. Technological tools in healthcare have improved administrative tasks by enhancing efficiency, accuracy, and patient-centered services, however, there are some limitations such as implementation costs, the need for continuous updates to comply with evolving regulations, and potential integration challenges with existing systems. Additionally, ensuring data security and user-friendly interfaces remains critical to avoid breaches and ensure widespread adoption among healthcare professionals and patients. [18]

2.1 Commercial Solutions for Small Clinics According to Market research published by Fortune Business Insights, some commonly used appointment booking systems include [19].

Block, Inc. (Square) [20]. A booking system that integrates with Square's payment processing and business management tools. It's suitable for small to medium-sized businesses needing a combined solution for appointments and payments.

Pros. - Integrated Payments. Seamless payment processing with Square.

User-Friendly. Easy to use and navigate.

Cons. - Customization. Limited options compared to more specialized systems.

- Support. Mixed reviews on customer service responsiveness.

Appointy [21]. An online scheduling software offering tools for scheduling, customer management, and marketing.

Pros. - Versatile. Suitable for a wide range of industries, including healthcare.

- Customizable. Allows good customization to fit specific needs.

Cons. - User Interface. Some users find it less intuitive. - Integration Issues.

Occasional difficulties with third-party integrations.

2.2 Integration Challenges and Success Stories Integrating advanced AI models like ChatGPT into healthcare systems presents a range of challenges and opportunities. Understanding these challenges and learning from successful integrations can provide valuable insights for future implementations. This section explores the primary challenges faced during integration and

highlights some success stories that demonstrate the potential benefits of incorporating ChatGPT into healthcare.

Some of the challenges are Data Accuracy and Reliability Ensuring that ChatGPT has access to precise and up-to-date medical data is crucial for providing trustworthy suggestions and treatment options [22], Privacy and Security; Handling sensitive healthcare data poses significant privacy and security risks. Data interactions with AI systems like ChatGPT are often processed on cloud servers, raising concerns about data breaches and unauthorized access [23], Ethical and Legal Issues; Ethical considerations include medical ethics, data interpretation, and patient consent. These issues become more pronounced when AI models are used for making clinical decisions [22] [23] and Technical Limitations; ChatGPT and GPT-3 can generate biased outputs based on the data they were trained on. For instance, if the training data lacks diversity, the models might produce skewed results [23] [24].

On the other hand, some Success Stories are the following.

Patient Interaction and Support. ChatGPT has enhanced patient experiences by providing timely information, answering queries, and offering reminders, thus reducing the workload on healthcare professionals [22] and Educational Support.

Since ChatGPT provides an interactive learning environment for medical students, offering real-time feedback and clarifications on complex topics [22].

2.3 Gaps in the Current Literature and Potential of GPTs

The integration of GPT models into healthcare systems presents both opportunities and challenges. While there is significant potential for these technologies

to revolutionize health care, there are notable gaps in the current literature that need to be addressed. This section explores these gaps and highlights the potential benefits of GPTs in healthcare. some of these gaps are listed below.

There is a lack of comprehensive validation studies that establish the effectiveness and safety of ChatGPT and GPT-3 in real-world healthcare settings [24]. Furthermore, detailed frameworks and guidelines for integrating ChatGPT with existing healthcare systems, such as EHRs, are sparse [22]. The literature lacks robust strategies for seamless and secure integration of AI tools in clinical workflows [23].

On the other side, some Potential of GPTs are the fact that GPTs can significantly aid in clinical decision support by analyzing patient data and providing evidence-based recommendations [22]. They can also automate routine administrative and clinical tasks, such as appointment scheduling and medication reminders, allowing healthcare professionals to focus on more complex and critical aspects of patient care [22]. Implementing GPT models can streamline administrative and clinical workflows, reduce operational costs, and improve the overall efficiency of healthcare delivery [24].

3. Methodology

Overview of the Research Design

This research employs a practical approach to demonstrate the creation of a custom GPT-based online appointment booking system for a clinic with three different doctors. The design is centered around utilizing Google Apps Script and

ChatGPT to facilitate appointment scheduling without the need for third-party integrations, which would add cost to the process. The methodology involves detailing the system architecture, implementing the necessary scripts, and ensuring seamless interaction between the GPT and the Google Apps Script.

System Components and Architecture.

The system is mainly made of the following main components.

ChatGP. A customized version of GPT-4 tailored to handle user queries and interact with the booking system.

Google Apps Script. Used to manage calendar events and facilitate appointment scheduling.

Google Calendar. The calendar where appointments are scheduled.

The architecture is designed to ensure that the interaction between ChatGPT and the Google Apps Script is seamless, with the GPT handling user queries and the Apps Script managing the backend processes of booking appointments.

GPT Process Flowchart

The process is as follows.

-User opens custom GPT.

-User provides input for appointment details. such as desired time slot, name and email.

-GPT analyzes the input from user. if information is incomplete; GPT requests complete information from user. If information is complete, GPT communicates the information to Google APP Script, using the JAVA code in the

”actions” section of the custom GPT.

-Google App Scrip retrieves calendar availability.

-If there are no available slots, Appscript communicates with the GPT and the GPT informs user that the slot is taken and gives the user the opportunity to request a different Slot. If there are available slots, App Script Books appointment in the calendar.

-Google App Script sends confirmation of appointment booked to the GPT.

-The GPT receives App Script Confirmation and provides Feedback to user.

-User receives an email confirming their appointment.

See Flowchart in Fig. 1

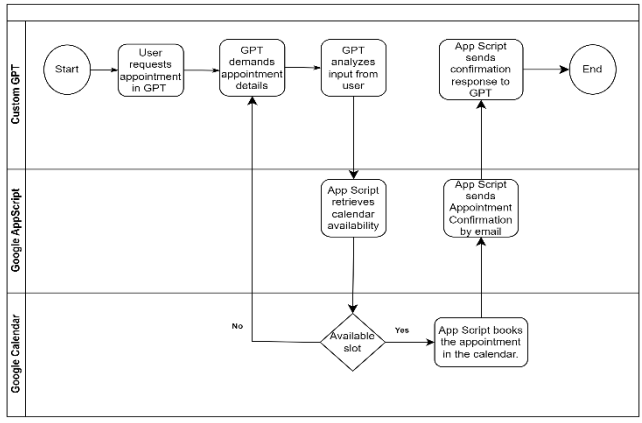

Figure 1

4. Implementation and Findings

Creation of Appscript and GPT

The implementation of the custom GPT-based online booking system involves several key steps such as the Development of a Google Apps Script which handle checking availability, booking appointments, and managing calendar events.

After creation of the Appscript comes the Deployment of the scripts as a web app to enable external HTTP POST requests.

In terms of the GPT, the first step is creation of a customized version of GPT- 4 in the GPT store and then training and configuration of that GPT to handle user queries related to booking appointments extracting relevant information

from users and interacting with the Google Apps Script.

Integration and use

In this process we Connect the custom GPT with the Google Apps Script through

HTTP requests, using the Web app URL of the Appscript previously developed.

Once integration is performed, the user will be able to interact with the GPT to book appointmens.

User initiates a conversation with the GPT by requesting an appointment.

One prompt would be for Example" I would like to book an appointment with Dr. Smith on June 20th at 10 AM." The GPT performs the Information Extraction by processing the query,

extracting relevant details such as the doctor's name, preferred date, and time. One Example of extraction would be "doctor-

Name": "Dr. Smith", "date": "2024-06-20", "time": "10:00" . After that, the GPT checks Availability, by calling the getAvailableSlots function via an HTTP request to the Google Apps Script. The script checks the doctor's calendar for availability on the specified date. One example of a System Output would be "slots": ["10:00", "11:00"], "nextPageToken": null . After that, If the desired slot

is available, the GPT calls the bookAppointment function with the extracted details and the script books the appointment in the Google Calendar and sends a

confirmation link to the user and the GPT answers user a propmpt similar to "Your appointment with Dr. Smith on June 20th at 10 AM has been booked.

Observed Advantages

Improved Booking Efficiency

Automated Process. The system automates the entire booking process, eliminating the need for manual intervention and also users can review real-Time Availability and book appointments instantly. Another advantage is that automated

scheduling reduces the likelihood of double bookings and other errors and offers Convenience, since patients can book appointments at any time, without the need to call the clinic or restrict to the operational hours. The fact that the

system provides immediate Confirmation provides patients with peace of mind.

Reduced Administrative Workload

The use of the GPT for appointment booking gives the clinic less Manual Work, so staff are relieved from handling booking calls and managing schedules manually and they can focus on Patient Care, leading to an enhance overall clinic efficiency.

Observed Drawbacks

Some of the observed drawbacks include the potential for technical Issues, in the event that a system Downtime happens either in the Google Apps Script or GPT system, it can disrupt the booking process. Another point to consider is the Integration Challenges. Ensuring smooth communication between the GPT and Google Apps Script can be technically challenging. One special concern is Data Security, since handling sensitive patient data securely is crucial and requires robust security measures. In this sense, to minimize the collection of sensitive data, minimum information is requested from users to book appointments such as name

and email. Another consideration to keep in mind is the Staff Adaptation Challenges that may come with the use of this technology. Staff may require training to understand and manage the new system effectively, and even resistance to

Change may be present, as some staff members might resist transitioning from traditional methods to an automated system and an adjustment Period may be needed where staff and patients get accustomed to the new system.

5. Discussion

The implementation of the custom GPT-based online booking system demonstrated the potential for improvements in booking efficiency, and administrative workload. The system successfully automates the booking process, providing real-time availability and instant confirmations. However, challenges such as technical issues, system reliability, and the need for staff training and adaptation

may be encountered. The reliability of the system depends heavily on the continuous availability and performance of the Google Apps Script and GPT infrastructure, meaning that any downtime or interruptions in these services can disrupt the booking process and negatively affect user experience. Ideal error-handling mechanisms should include real-time monitoring to detect issues promptly, automated fallback procedures to maintain functionality during outages,

detailed logging for troubleshooting, and user-friendly error messages that provide clear instructions for resolving problems. Privacy and data security are critical concerns; the system must securely handle sensitive patient information,

with measures against data breaches such as regular security audits, and strict access controls. To prevent unintended use of data, the system will request only the minimum necessary information from users, such as name, email, and desired slot. This approach minimizes the data collected, reducing the risk of misuse.

Compared to traditional phone-based booking systems, the GPT-based system offers superior convenience, efficiency, and accuracy. Patients can book appointments at any time without waiting for office hours or dealing with busy phone lines. as for existing online booking platforms, they offer similar functionalities, but often come with higher costs and require third-party integrations.

The custom GPT-based system provides a cost-effective and tailored solution for small clinics, with the added benefit of seamless integration with existing Google services.

6. Conclusion

The integration of GPT with Google Apps Script offers a powerful, cost-effective, and efficient solution for managing appointment bookings in a clinic setting. This system enables seamless interactions between patients and the clinic's scheduling system, allowing for direct appointment bookings, automatic calendar updates, and appointment confirmation via email.

Some of the key benefits are Automation and Efficiency; by automating the appointment booking process, there is a reduction in the administrative overhead.

Also, the system provides a User-Friendly Interaction where Patients can easily book appointments through conversational interfaces powered by GPT, enhancing user experience and accessibility. Another advantage is the Customization available since Google Apps Script provides the flexibility to customize booking rules, appointment durations, and availability slots, ensuring the system meets the clinic's specific needs. This is also a Cost-Effective solution, using free tools like Google Apps Script and existing calendar infrastructure minimizes costs associated with web development and third-party booking systems. And last is the Scalability. The system can be scaled to accommodate multiple doctors and various appointment types, making it suitable for clinics of different sizes.

As a result, the integration of a custom GPT with Google Apps Script for appointment booking provides a robust, scalable, and user-friendly solution that enhances operational efficiency in clinical settings.

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