IDENTIFY THE NEAREST PHARMACIES WITH THE BEST RECOMMENDATION FOR HEART PATIENTS

Lakshan J.A.T

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Dissertation submitted in partial fulfilment of the requirement for the
Bachelor of Information Technology
Specialization in Information Technology

Department of Information Technology

Sri Lanka Institute of Information Technology
Sri Lanka

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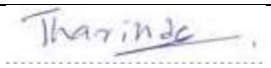
DECLARATION

I hereby declare that this is my original work and that no previously submitted materials for a degree or certificate from another university or institution of higher learning have been used in this proposal. To the best of my knowledge and belief, it doesn't include any content that has already been published or authored by someone else unless it specifically acknowledges it in the text.

Student Name	Student ID	Signature
Lakshan J.A.T.	IT20642150	

The above candidate is carrying out research for the undergraduate Dissertation under my supervision.

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Signature of the supervisor Date

(Dr. Kapila Dissanayaka)

ABSTRACT

Android applications are quite useful, even in the health field, given the growing use of mobile technology worldwide. For efficient quick results while looking up for medical help in case of accidents or medicines and blood requirement emergencies, one can use such mobile-health applications. The proposed paper focuses on making advantageous use of Android and Machine Learning to provide for delivering health-related information on major healthcare units such as pharmacies. Efficiently locating the nearest pharmacies from an individual's current position is a critical challenge in modern healthcare and navigation systems. This research problem revolves around the development of a streamlined method to identify the closest pharmacies, streamlining the process of ordering essential medications. This facility is provided through the developed app in which the data is customized according to the factors viz. user's location, their distance to nearby pharmacies obtained through Google Maps API, availability of medicines and the ratings which are predicted by applying sentiment Analysis method (TextBlob Library) on the customers' reviews. The list of the pharmacies, their reviews, and medicines in pharmacies are all stored in the Database. All pertinent information, including the list of pharmacies, their reviews, and available medications, is stored in a centralized database. By integrating Android functionality with Machine Learning techniques, our proposed solution offers a practical and innovative means of delivering timely and accurate health-related information. This approach has the potential to revolutionize the accessibility and interaction individuals have with healthcare services, particularly pharmacies. By leveraging the capabilities of modern technology, our research endeavors to enhance the efficiency and effectiveness of healthcare delivery, ultimately contributing to improved patient outcomes and overall well-being.

Keywords: Sentiment Analysis, Google maps APIs, Pharmacies, TextBlob Library,

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Furthermore, I extend my gratitude to all the members of our research group who tirelessly contributed to various aspects of this project, from data collection to analysis and interpretation. Your dedication and collaborative spirit have been instrumental in overcoming challenges and achieving our research objectives.

Lastly, I would like to express my deepest appreciation to my family and friends for their unwavering encouragement, understanding, and patience throughout this journey. This research would not have been possible without the collective efforts, support, and encouragement of all those mentioned above, and for that, I am truly grateful.

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01 INTRODUCTION

1.1 Background & Literature Survey

In today's rapidly evolving digital age, the integration of mobile technology into various facets of our lives has become increasingly pervasive. Mobile applications, particularly those running on the Android platform, have demonstrated their utility across numerous domains, including healthcare. The global proliferation of mobile devices offers a unique opportunity to leverage these technologies to enhance the delivery of crucial health-related information, thereby potentially saving lives in emergency situations and improving overall healthcare access.

This research paper delves into an innovative methodology that leverages the synergies between Android applications and Machine Learning to tackle a critical issue prevalent in contemporary healthcare and navigation infrastructure – the prompt identification and pinpointing of nearby pharmacies. Swift access to vital medications during critical situations is pivotal, and this study aims to refine the procedure of pinpointing the closest pharmacies through the development of a tailored mobile health application.The convergence of Android applications and Machine Learning offers an unprecedented opportunity to revolutionize how we address healthcare challenges in our increasingly digitized world. By harnessing the computational power of smartphones and the predictive capabilities of machine learning algorithms, this research seeks to create a solution that seamlessly integrates into people's daily lives, providing them with reliable and efficient access to essential pharmaceutical resources.

Moreover, this research endeavor is not merely about technological innovation; it underscores a commitment to improving public health outcomes and enhancing overall well-being. By facilitating the rapid identification and navigation to nearby pharmacies, particularly in times of emergencies or urgent medical needs, this initiative has the potential to significantly mitigate the adverse effects of delays in accessing critical medications.

Through rigorous experimentation and data-driven analysis, this paper aims to demonstrate the efficacy and feasibility of our proposed approach in real-world scenarios. By offering a comprehensive overview of the technical architecture, implementation strategy, and potential impact, this research aspires to pave the way for future advancements in the intersection of mobile technology, healthcare, and machine learning. Ultimately, our goal is to contribute to the development of smarter, more accessible healthcare systems that prioritize efficiency, reliability, and, above all, the well-being of individuals and communities.

The primary focus of this research endeavor revolves around the creation of an Android application engineered to facilitate seamless access to critical health-related information, with a particular emphasis on the availability of medications within nearby pharmacies. The overarching aim is to bridge the gap between individuals and essential healthcare resources through the utilization of cutting-edge technology. Central to the application's functionality is its ability to harness various data sources and deploy innovative algorithms. Foremost among these is the utilization of GPS technology to pinpoint the user's current geographical coordinates accurately. By leveraging this technology, the application can effectively identify the user's proximity to nearby pharmacies, thereby streamlining the process of locating essential medications.

Furthermore, the integration of the Google Maps API enhances the precision and real-time nature of the geographical data utilized by the application. This integration empowers users with precise location-based results, ensuring that they can access up-to-date information regarding medication availability at nearby pharmacies with utmost accuracy and efficiency. In essence, the research endeavors to harness the power of modern technology to develop a user-friendly solution that addresses the pressing need for easy access to vital healthcare information. Through the strategic integration of GPS technology and the Google Maps API, the envisioned Android application seeks to revolutionize the way individuals' access and interact with essential healthcare resources, ultimately contributing to improved health outcomes and enhanced well-being within communities. Beyond geographical proximity, the application takes into account the availability of medicines at these nearby pharmacies. To assess this, the system collects and maintains a comprehensive database containing information about

the medicines stocked by each pharmacy. Moreover, the application harnesses the power of user-generated content, specifically customer reviews, to gauge the quality and reliability of these healthcare units. To predict ratings for these pharmacies, a Multinomial Naive Bayes algorithm is employed, analyzing the sentiments expressed in customer reviews.

All this valuable information, including a list of nearby pharmacies, their respective reviews, and the medicines they stock, is meticulously stored in a dedicated database. This database forms the backbone of our Android application, facilitating efficient and personalized access to health-related information for users.

this research paper presents a novel and practical solution that combines Android technology and Machine Learning to provide timely and accurate health-related information, ushering in a new era of healthcare accessibility. By simplifying the process of identifying the closest pharmacies and assessing their offerings through innovative algorithms, this research seeks to empower individuals with the information they need to make informed healthcare decisions. In doing so, it promises to revolutionize the way individuals interact with healthcare services, particularly in the context of pharmacies, ultimately contributing to improved health outcomes and well-being in our increasingly mobile-dependent world.

There exist some applications that have been developed using similar technologies or researches based on the utility of mobile-health applications in the community. They contain different functionalities and solutions for different problems in the field of medical health care that are executed through smartphones. One such phone application is proposed in [1], where the details of patients are stored on Firebase which helps the concerned in generating prescription and required doctors. The author in [2], presents the development of a mobile application for an emergency response system which helps rescue service provider in determining the shortest route to incident location and nearby hospitals to it. Another such application is in [3], whose search engine can search hospitals, available doctors and medicines via category, name, and location, blood donation camps. The author in [4], focused on the development of an app that shall improve the health care system in Bangladesh through smartphones by involving features such as hospitals suggestion, cabin booking and appointment scheduling. Their

survey showed that such medical apps are found useful by the people as they are convenient and time saving.

The authors' motivation is to implement some of the significant a feature in the general health care, such as listing of the nearby pharmacies. The listing of this health unit(pharmacy) is based on the distance and factors such as availability of the medicines in pharmacies which is sorted in the order of the ratings that are produced on the basis of reviews given by the users. In [5], the authors have proposed the module for the prediction of star ratings based on the reviews. The reviews are tokenized and the generated feature vectors are passed to Multinomial Naïve Bayes theorem for rating prediction. The experiments in [6], showed that that the TFIDF (Term Frequency-Inversion Document Frequency) conversion to the data greatly improves the results for MNB than the simple Naïve Bayes theorem. Here, in this proposed application, the authors have applied stemming on the words (reviews) for vector generation that undergo supervised learning module to predict ratings for the pharmacies. Based on the factors of distance, availability of resources (medicines) and the ratings, the health units (pharmacies) are listed upon the request of the user for the optimized result.

1.2 Research gap

The Literature Survey delves into the expansive realm of mobile health applications, meticulously exploring their diverse functionalities. Within this comprehensive analysis, particular attention is directed towards the conceptualization and development of a novel application designed to streamline the process of locating nearby pharmacies. This innovative application is poised to revolutionize the accessibility of pharmaceutical resources by integrating crucial factors such as proximity, medicine availability, and user-generated reviews. Beyond merely cataloging existing applications and their attributes, the survey serves as a beacon, illuminating key areas where further investigation is warranted. Through its discerning examination, it illuminates critical research gaps that beckon exploration and inquiry. These gaps represent fertile ground for scholarly pursuit, offering avenues for innovation and advancement within the realm of mobile health technology.

Moreover, the survey not only serves as a repository of existing knowledge but also as a catalyst for future endeavors. It serves to inspire and inform researchers, providing a roadmap for navigating the complex landscape of mobile health applications. By shedding light on both the accomplishments and limitations of current offerings, it empowers researchers to chart a course towards the creation of more effective and inclusive solutions. Thus, the Literature Survey stands as a testament to the ongoing evolution of mobile health technology, propelling the field towards new horizons of possibility and impact.

- **Limited Focus on Pharmacy Listings**

The survey findings underscore a predominant emphasis within existing applications on hospital information, doctor availability, and emergency response systems. However, a conspicuous void emerges in the landscape, revealing a notable dearth of applications dedicated to furnishing extensive details concerning nearby pharmacies, their inventory, and user-generated evaluations. This research lacuna suggests a significant opportunity for innovation and development within the domain of healthcare technology.

While current applications fulfill critical roles in facilitating access to hospital resources and healthcare professionals, they overlook the crucial aspect of providing comprehensive information about local pharmacies. Such data is essential for individuals seeking prompt access to medications and healthcare products, especially in urgent situations or when facing mobility constraints. Furthermore, the absence of platforms integrating user-generated reviews deprives consumers of valuable insights into the quality and reliability of pharmacy services in their vicinity.

Addressing this research gap could lead to the creation of robust applications tailored to meet the diverse needs of healthcare consumers. By offering detailed information about nearby pharmacies, including real-time stock availability and user feedback, such applications could significantly enhance the accessibility and convenience of healthcare services. Moreover, they have the potential to foster greater transparency and accountability within the pharmacy sector, ultimately contributing to improved patient

outcomes and satisfaction. Hence, bridging this gap represents a crucial endeavor in advancing the efficacy and inclusivity of healthcare technology solutions.

- **Integration of User Reviews for Pharmacy Ratings**

The survey acknowledges the utilization of user reviews as a means to anticipate pharmacy ratings; however, it abstains from a comprehensive examination of the precise methodologies or algorithms employed in this process. Consequently, a conspicuous void emerges within the realm of scholarly investigation, necessitating a deeper exploration of sophisticated techniques for sentiment analysis and the integration of user reviews. Enhancing the precision of pharmacy ratings demands a more nuanced understanding and application of advanced analytical frameworks.

To elucidate, the current discourse primarily skims the surface of sentiment analysis methodologies without delving into the intricacies of algorithmic implementations or their potential synergies with user review integration. By bridging this gap, researchers can unlock novel avenues for refining the accuracy and reliability of pharmacy ratings. Advanced sentiment analysis techniques, such as deep learning algorithms or natural language processing models, remain underutilized in this context, representing untapped potential for enhancing predictive capabilities. Moreover, an in-depth investigation into user review integration strategies is imperative for maximizing the informative value extracted from these sources. Traditional approaches often overlook the nuanced interplay between user sentiments and contextual factors, limiting the holistic understanding of pharmacy performance. Exploring innovative methodologies, such as hybrid models combining sentiment analysis with contextual information or collaborative filtering techniques, holds promise for discerning subtle patterns within user reviews and extracting actionable insights.

In essence, addressing the identified research gap entails a multifaceted approach that embraces the complexity of sentiment analysis and user review integration. By embracing advanced techniques and fostering interdisciplinary collaboration, scholars can pave the way for more robust and insightful evaluations of pharmacy services, ultimately benefiting both consumers and healthcare providers alike.

- **Usability and User Experience**

The survey underscores the widespread utility of mobile health applications among users, primarily due to their perceived convenience and time-saving advantages. Nonetheless, a critical gap exists in the realm of comprehensively understanding the usability and user experience dimensions inherent in these applications. This deficiency encompasses various facets such as user interface design, accessibility features, and the efficacy of mechanisms for capturing user feedback.

Delving deeper into this gap reveals an intricate landscape of unexplored intricacies. Firstly, the usability of mobile health applications remains inadequately explored, necessitating a closer examination of how effectively users can navigate these platforms to accomplish their health-related goals. Additionally, the user experience aspect warrants attention, with inquiries into the extent to which these applications satisfy users' expectations and preferences, thus enhancing engagement and satisfaction.

Furthermore, accessibility emerges as a crucial yet underexplored facet in the realm of mobile health applications. Understanding how these platforms cater to users with diverse needs, including those with disabilities or limited technological proficiency, is imperative for ensuring equitable access to healthcare resources.

Moreover, the effectiveness of existing mechanisms for soliciting user feedback poses another significant research gap. Evaluating the extent to which feedback mechanisms incorporated within these applications facilitate meaningful user engagement and contribute to iterative improvements is essential for enhancing their overall effectiveness and user satisfaction.

In essence, addressing these research gaps is paramount for advancing our understanding of mobile health applications' usability and user experience, thereby facilitating their optimization and ensuring their efficacy in catering to diverse user needs and preferences.

1.3 Research Problem

Efficiently locating the nearest pharmacies and streamlining the process of ordering essential medications is a pressing challenge in contemporary healthcare and navigation systems. This challenge arises from the need to bridge the gap between users' immediate healthcare needs and the availability of nearby pharmacies that can fulfill those needs promptly and effectively. The proposed research aims to address this challenge by developing a novel method that leverages Android technology and Machine Learning algorithms to identify the closest pharmacies based on multiple criteria such as the user's location, medication availability, and customer ratings. In modern healthcare landscapes, the accessibility and convenience of obtaining essential medications play a pivotal role in ensuring the well-being of individuals. By integrating cutting-edge technologies, such as Android applications and Machine Learning models, this research seeks to create a streamlined and efficient process for users to access healthcare services, particularly pharmacy services, with ease and accuracy.

The integration of Android technology allows for the development of user-friendly interfaces that can be accessed on a wide range of mobile devices, enhancing the reach and usability of the proposed solution. Moreover, Machine Learning algorithms will be employed to analyze vast datasets encompassing pharmacy locations, medication availability, and customer reviews. This data-driven approach enables the system to provide personalized recommendations to users, taking into account factors such as proximity to the nearest pharmacy, the availability of specific medications, and the reputation of pharmacies based on user-generated ratings.

By combining elements of location-based services, machine learning techniques, and user-generated reviews and ratings, the proposed research aims to revolutionize the way individuals interact with healthcare services, particularly pharmacies. The envisioned mobile application will serve as a powerful tool that not only connects users to the nearest pharmacies but also empowers them with comprehensive information regarding medication availability and quality of service. This holistic approach is designed to enhance the overall efficiency, accessibility, and user experience within the realm of

healthcare services, contributing to improved health outcomes and satisfaction among individuals seeking essential medications.

1.4 Research Objectives

Main Objectives

- Google Maps API to pinpoint a user's location and identify nearby pharmacies. This improves healthcare navigation by helping users efficiently locate pharmacies in their area.

Utilize the Google Maps API to enhance healthcare navigation by pinpointing a user's location and identifying nearby pharmacies. This technology-driven approach aims to assist users in efficiently locating pharmacies within their vicinity, thus streamlining the process of accessing essential healthcare services. By leveraging the capabilities of the Google Maps API, users can easily access information such as pharmacy locations, operating hours, and contact details, empowering them to make informed decisions regarding their healthcare needs.

- Use Machine learning techniques to analyze pharmacy reviews and predict ratings. This helps users find pharmacies with better service

Implement machine learning techniques to analyze and evaluate pharmacy reviews, with the goal of predicting ratings based on service quality. By harnessing the power of machine learning algorithms, this objective seeks to provide users with insights into the overall customer experience at different pharmacies. By aggregating and analyzing customer feedback, such as reviews and ratings, this approach can help users identify pharmacies that consistently offer high-quality services, contributing to improved healthcare outcomes and patient satisfaction.

Specific Objectives

- Develop a Mobile Health Application

Develop a user-friendly Android application focused on providing efficient access to health-related information such as pharmacy locations, medication availability, and user reviews. The application should prioritize ease of use and quick retrieval of vital healthcare data.

- Implement Geolocation Services

Implement geolocation services using the Google Maps API to enable precise tracking of users' locations and nearby pharmacies. This integration will ensure accurate navigation to the nearest healthcare facilities, enhancing the app's utility for users seeking immediate medical assistance or medication.

- Design a Pharmacy Database

Design and implement a robust pharmacy database system capable of storing comprehensive information about pharmacies, including details on available medications, customer reviews, operational hours, and contact information. This database will serve as the backbone for the app's functionalities, ensuring reliable data retrieval and management.

- Machine Learning Integration

Integrate machine learning techniques, specifically a Multinomial Naive Bayes algorithm, to analyze and predict pharmacy ratings based on customer reviews. By leveraging machine learning, the app will enhance its ability to provide informed recommendations to users, helping them make decisions based on reliable feedback and ratings.

- Customization based on User Location

Customize the app's recommendations and services based on users' specific locations. This customization will take into account users' proximity to pharmacies, medication

availability in their vicinity, and other relevant factors to deliver personalized and relevant content tailored to each user's needs and preferences.

- Efficient Ordering Process

Streamline the ordering process for essential medications directly through the application. By facilitating seamless communication between users, pharmacies, and healthcare providers, the app will minimize the time and effort required for users to obtain their prescribed medications, enhancing overall efficiency and convenience in healthcare procurement.

02 METHODOLOGY

2.1 Methodology

Utilizing the Software Development Life Cycle (SDLC) for a one-year research project ensures systematic planning, execution, and delivery of high-quality results. SDLC provides clear stages such as requirements analysis, design, implementation, testing, and maintenance, ensuring thorough coverage of project needs.

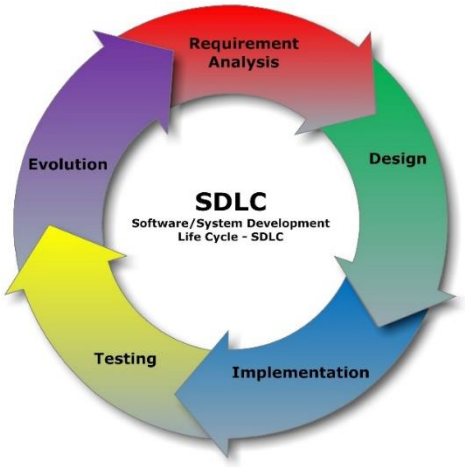


Figure 1. 1 Software Development Life Cycle

Requirement Gathering

The most important component of the research process is the phase that entails acquiring and analyzing requirements. It is necessary for us to create a document that will be referred to as the requirement definition document and contain all of the potential requirements that are gathered in this stage. The following methods are utilized by our team for collecting requirements.

- Reading research papers and publications that are relevant to study subjects and referring to previous work.
- Utilizing and doing research on existing systems.
- with a medical professional on important concepts and procedures.

My research followed a well-defined Work Breakdown Structure (WBS) to ensure a systematic approach. The WBS breaks down the research process into manageable.

I began with data collection, followed by data preprocessing. With the data prepared, Data preprocessing follows, including cleaning and feature engineering. I can now move forward with making predictions and presenting the results to the relevant parties. This section can be further expanded to explain the specific methods used.

Functional Requirements:

1. Location Services:

Location services play a crucial role in apps that provide location-based information or services. By accessing the user's current location using GPS or other location-based services, the app can offer personalized features such as finding nearby pharmacies, recommending healthcare providers, or providing localized health information. This enhances convenience and relevance for users based on their geographical context.

2. Pharmacy Search:

The ability to search for nearby pharmacies based on the user's current location is a key functionality for a healthcare app. By leveraging services like the Google Maps API to fetch accurate pharmacy locations, users can quickly locate nearby healthcare providers, check their operating hours, and even get directions, ensuring timely access to medications and services.

3. User Reviews and Ratings:

User-generated content such as reviews and ratings provide valuable insights to other users and help them make informed decisions. Allowing users to read and write reviews for pharmacies and displaying ratings based on these reviews fosters transparency and trust within the app's community. It also incentivizes pharmacies to maintain high-quality services.

4. Machine Learning Algorithm:

Implementing a Multinomial Naive Bayes algorithm to predict ratings based on customer reviews demonstrates a sophisticated approach to enhancing user experience. By analyzing patterns in reviews and ratings, the app can provide

automated recommendations or highlight pharmacies with exceptional service quality, enriching user interactions and decision-making processes.

5. Database Management:

Efficient database management is crucial for storing and retrieving data related to pharmacies, medicines, user profiles, reviews, and ratings. A well-organized database ensures data integrity, scalability, and smooth app performance, enabling seamless user experiences across various functionalities.

6. Customized Recommendations:

Leveraging machine learning algorithms to provide personalized pharmacy recommendations based on user location and preferences elevates the app's value proposition. By understanding user behaviors, preferences, and historical interactions, the app can deliver tailored recommendations, enhancing user satisfaction and engagement.

Non-functional Requirements:

1. Scalability:

Designing the system to handle an increasing number of users and pharmacies ensures scalability and performance under varying loads. Scalability considerations encompass backend infrastructure, database optimization, and application architecture to accommodate growth without compromising user experience or system stability.

2. Data Accuracy:

Ensuring data accuracy across pharmacy locations, medicine availability, and user reviews is paramount for maintaining trust and reliability. Regular updates, data

validation processes, and integration with reliable data sources contribute to accurate information delivery, enhancing user confidence in the app's content.

3. Compatibility:

Ensuring seamless functionality across various Android devices and screen sizes enhances accessibility and user reach. Compatibility testing, responsive design practices, and platform-specific optimizations contribute to a consistent user experience regardless of the device used, promoting inclusivity and usability.

4. Usability:

Designing an intuitive and user-friendly interface is essential for engaging a diverse user base, including those with limited technical expertise. Usability considerations encompass clear navigation, informative prompts, accessibility features, and feedback mechanisms to enhance user interactions and overall satisfaction.

5. Maintainability:

Designing the app for easy maintenance and updates facilitates agility in responding to evolving user needs and technological advancements. Modular code architecture, version control, documentation practices, and continuous integration/deployment pipelines streamline development workflows and ensure the app remains adaptable and efficient over time.

6. Performance Monitoring:

Implementing performance monitoring tools is crucial for proactively identifying issues, optimizing app performance, and improving the overall user experience. Monitoring metrics such as app response times, error rates, server performance, and user engagement metrics enables data-driven optimizations and timely interventions to maintain a high-quality app experience.

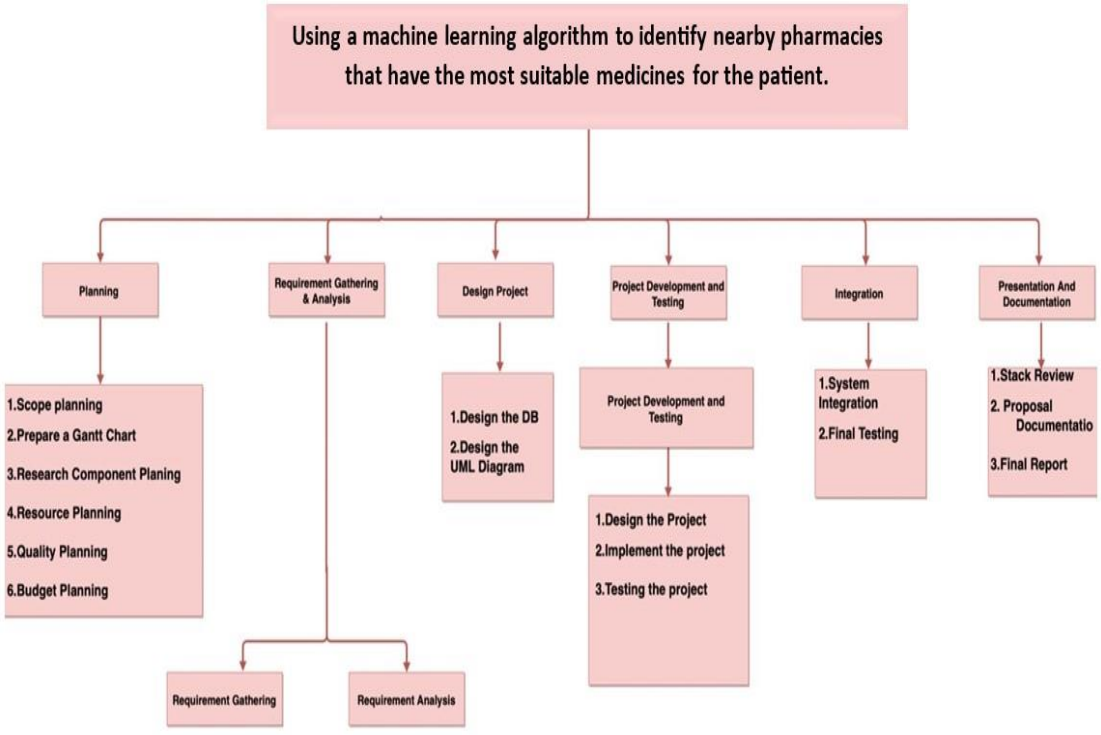


Figure 1. 2 Work Breakdown Structure

I started doing my research. Accordingly, I did the data collection first. Then I did the data preprocessing part. Accordingly, my expectation is to make the prediction and give the results to the patient. Below is a simple diagram to illustrate the process.

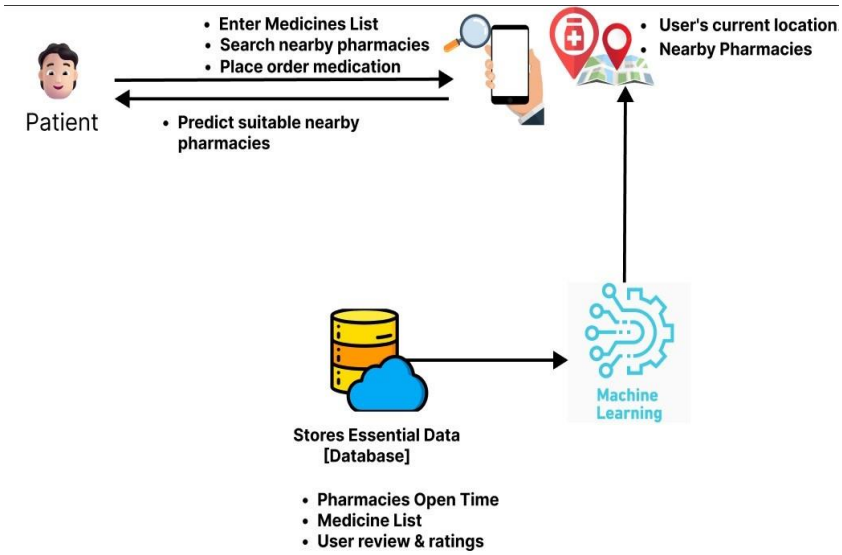


Figure 1. 3 The process of System

The system under consideration is designed to address the growing need for quick access to health-related information and services using mobile technology. It revolves around an Android application that leverages Machine Learning algorithms and integrates with various data sources to deliver valuable healthcare information. The primary focus is on streamlining the process of locating and ordering essential medications from nearby pharmacies

The core of the system is an Android application. This application serves as a gateway for users to access health-related information, primarily related to pharmacies. It provides a user-friendly interface and efficient features for locating pharmacies, checking medication availability, and reading reviews. To efficiently locate nearby pharmacies, the application integrates with the Google Maps API. This enables real-time tracking of the user's current position and the identification of the closest pharmacies. The system employs Machine Learning techniques, specifically the Multinomial Naive Bayes algorithm, to predict and display user ratings based on customer reviews. This adds a layer of personalization and helps users make informed decisions when choosing a pharmacy. The system customizes data based on various factors, including the user's location, distance to nearby pharmacies, medication availability, and predicted ratings. This ensures that the information presented to the user is highly relevant and tailored to their needs. A database stores a comprehensive list of pharmacies, their reviews, and the availability of medicines in these pharmacies. This data is regularly updated and forms the backbone of the application's functionality. The proposed system leverages the capabilities of Android and Machine Learning to create a mobile health application that transforms the healthcare access landscape. It offers a user-friendly platform that seamlessly integrates geolocation, machine learning-driven predictions, and a comprehensive. database of pharmacies, ultimately making it easier for individuals to access essential healthcare services.

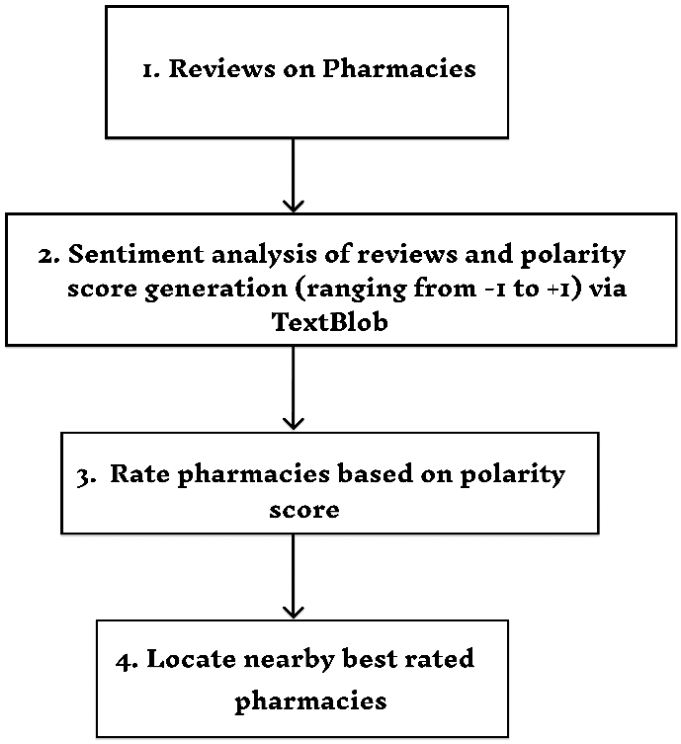


Figure 1. 4 Model Development

Data Collection

- Collected data on various factors such as Patients Reviews for pharmacies and given ratings. (For DATASET)

Data Preprocessing

- The reviews are composed by users, there may be errors or certain words and punctuation marks that won't be required to classify the data. The steps followed are:

  i. Removal of Punctuations

ii. Removing Stopwords

iii. Tokenizing

iv. Stemming

- **Local Pharmacy Retrieval:** The application generates a unique token ID for each user, which is stored in Firebase, a cloud-based database service. This token ID is crucial for interacting with the Google Places API, which is used to find nearby pharmacies within a specific radius around the user's location. The app leverages Geofire, a library designed for real-time geolocation queries, to efficiently manage and query location data in Firebase. Geofire sorts the pharmacies by their proximity to the user, ensuring that the closest options are displayed first. This streamlined process helps users quickly find the nearest pharmacies.
- **Sentiment Analysis using TextBlob:** To assess the overall user experience with pharmacies, the app employs sentiment analysis through TextBlob, a library that simplifies text processing tasks. Unlike traditional rule-based methods that rely on predefined lists of positive and negative words, TextBlob uses a machine learning approach. This approach examines the frequency and relationships of words within user reviews to determine the sentiment. TextBlob assigns a polarity score to each review, ranging from -1.0 (indicating a highly negative sentiment) to 1.0 (indicating a highly positive sentiment). By classifying reviews based on these scores, the app can identify whether user experiences are generally positive or negative.

- **Ranking Pharmacies based on Reviews:** To highlight the most favorably reviewed pharmacies, the app further processes the reviews using the a polarity score. This algorithm, often used for text classification tasks, works by converting the text reviews into numerical vectors through a process called vectorization. Once vectorized, the reviews are analyzed to assign a sentiment rating, which quantifies the overall user feedback. The pharmacies are then ranked based on these ratings, with those receiving the most positive feedback

appearing at the top of the list. This method ensures that users are presented with the best-reviewed pharmacies first, enhancing their overall experience

Tools and Materials

Category	Tool / Technology / Library
Development	Python, Flutter, Dart , FireBase
Version Controlling	GitHub
Technologies	Python Libraries: numpy, pandas, Google Colab, Android Studio Google Map API
Library	TextBlob

Development

- Python is a versatile and widely-used programming language known for its simplicity and readability. It offers extensive libraries for data manipulation, analysis, and machine learning, making it suitable for developing predictive models.
- Flutter & Dart: Flutter is a UI toolkit from Google used for building natively compiled applications for mobile, web, and desktop from a single codebase. Dart is the programming language used for Flutter development. Flutter provides a rich set of pre-designed widgets and offers fast development cycles.

Advantages of Choosing Python and Flutter

- Python's simplicity and readability make development easier and more efficient.
- Flutter allows for cross-platform development, reducing the need to de-velop separate applications for different platforms.

- Dart's strong typing and Just-In-Time (JIT) compilation contribute to the performance and stability of the application.

Version Controlling

- GitHub is a widely-used platform for version control and collaboration on software development projects. It provides features such as code hosting, version control, and collaboration tools like issue tracking and pull re-quests.

Advantages of Choosing GitHub

- GitHub facilitates collaboration among developers by providing a central-ized platform for version control and project management.

- It offers robust features for code review, issue tracking, and team collabo-ration, enhancing the overall development process

Technologies

- Python Libraries (NumPy, Pandas): NumPy is a powerful library for nu-merical computing in Python, providing support for arrays, matrices, and mathematical functions. Pandas is a library built on top of NumPy, offering data structures and data analysis tools.

- Google Colab: Google Colab is a cloud-based platform provided by Google for running Python code, especially for machine learning and data analysis tasks. It offers free access to GPUs and TPUs for accelerating computa-tions.

Advantages of Choosing NumPy and Pandas

- NumPy and Pandas provide efficient data manipulation and analysis capabilities, essential for preprocessing and analyzing data for the heart attack prediction model.

- Google Colab offers a convenient environment for developing and running machine learning models, with access to powerful computing resources without the need for expensive hardware.

Library

- TextBlob is a Python library for processing textual data. It provides a simple API for diving into common natural language processing (NLP) tasks such as part-of-speech tagging, noun phrase extraction, sentiment analysis, classification, translation, and more. It is built on top of the Natural Language Toolkit (NLTK) and Pattern libraries, making it a powerful tool for developers working with text data

Advantages of Choosing TextBlob Python library

1. Fine-Grained Analysis:

- Sentiment Analysis : TextBlob can provide sentiment scores (polarity and subjectivity) at a more granular level. This is useful when different paragraphs

in a document convey different sentiments. By analyzing each paragraph separately, you can detect shifts in tone and sentiment more accurately.

- Detailed Insights : Processing text in smaller chunks allows for a more detailed understanding of the text. This can be particularly beneficial for

  applications like content summarization, where different paragraphs might need to be weighted differently.

2. Improved Accuracy :

- Contextual Relevance : Paragraphs often represent coherent units of thought. By analyzing text paragraph by paragraph, you maintain the context better than if you split the text into arbitrary smaller units (like sentences), which can sometimes lead to loss of contextual information.

- Error Minimization : Large blocks of text can sometimes introduce noise and reduce the accuracy of linguistic features. Smaller, more manageable chunks can improve the overall accuracy of tasks like part-of-speech tagging, noun phrase extraction, and translation.

3. Resource Efficiency :

- Memory Management : Handling smaller text chunks can reduce memory usage and computational load, making the processing more efficient, especially for large documents.

- Parallel Processing : If you have a large document, processing each paragraph independently allows for parallelization. This can significantly speed up the overall processing time when using multi-threading or distributed computing techniques.

4. Flexibility and Customization :

- Targeted Processing : Different paragraphs might need different types of processing. For instance, some paragraphs might be narrative, while others might be expository or technical. Processing paragraphs individually allows you to apply customized processing techniques suited to the nature of each paragraph.
- Modularity : Paragraph-level processing can be easily integrated into larger data pipelines, allowing for modular and reusable code. This modularity can simplify debugging and maintenance.

5. Enhanced Output Quality:

- Readable Summaries and Outputs : When generating summaries or translations, processing paragraph by paragraph can result in outputs that are more coherent and readable. This is because the logical structure of the original text is better preserved.

- Context-Specific Adjustments : Certain language features, such as idiomatic expressions or references, might be better handled when the text is processed in contextually relevant chunks like paragraphs.

  processing text paragraph by paragraph with TextBlob allows for more nuanced and accurate analysis, efficient resource use, flexibility in handling different types of text, and improved quality of output, making it a powerful approach for many natural language processing tasks.

2.2 Commercialization Aspects of the Product

Commercializing our Android-based pharmacy locator and review application involves understanding and addressing market demand, leveraging unique features, identifying the target audience, establishing robust revenue models, and executing effective marketing strategies. By navigating potential challenges with strategic planning and

continuous innovation, our app has the potential to revolutionize the way individuals' access and interact with pharmacy services, ultimately contributing to improved healthcare outcomes and enhanced user convenience**.**

The commercialization of the product involves several key considerations to ensure its successful adoption and sustainability in the market. Firstly, market analysis should be conducted to identify target demographics and assess the demand for such a solution among healthcare providers and patients. Understanding competitor offerings and pricing strategies is crucial for positioning the product effectively.

Additionally, partnerships with hospitals, clinics, and healthcare organizations are essential for gaining access to the target market and establishing credibility. Collaborations with insurance companies can also facilitate reimbursement and coverage for the product, increasing its accessibility to patients.

Furthermore, a scalable business model should be developed, considering revenue streams such as subscription-based licensing for healthcare institutions, pay-per-use models, or freemium offerings with premium features. Strategic marketing efforts, including digital marketing campaigns, participation in industry conferences, and educational seminars for healthcare professionals, are essential for raising awareness and driving adoption.

Finally, ongoing product development and updates based on user feedback and advancements in medical research are critical for maintaining competitiveness and relevance in the market.

Market Demand

The growing reliance on smartphones globally, with over 3.8 billion users as of 2021, underscores the immense potential of mobile applications in addressing everyday needs, including healthcare. The demand for health-related mobile applications is robust, driven by the increasing emphasis on convenient access to healthcare services.

This trend is particularly pronounced in urban areas where the density of pharmacies and healthcare providers is high. Moreover, the ongoing COVID-19 pandemic has heightened awareness and reliance on digital health solutions, thereby creating a fertile ground for the adoption of our pharmacy locator and review app**.**

2.3 Testing and Implementation

Unit Testing

Unit testing involves individually testing the smallest parts of the app, known as units. Each function or method within the app's code is tested to ensure it performs as expected. In this component, unit tests would cover:

- The creation and validation of special token IDs.
- Interaction with Firebase to store and retrieve token IDs.
- Retrieval of local pharmacies using the Google Places API.
- The functionality of the Geofire library to find and sort pharmacies within a specified radius.
- The sentiment analysis process, including the calculation of polarity scores using TextBlob.

Integration Testing

Integration testing examines how different units work together. This type of testing ensures that the interaction between components, such as the Firebase token retrieval and the Google Places API calls, functions smoothly. Tests would focus on:

- Successful data flow from the token ID generation to the retrieval of local pharmacies.
- Accurate geolocation filtering and sorting of pharmacies by Geofire.
- Seamless integration of sentiment analysis on user reviews with the subsequent ranking of pharmacies based on polarity scores.

System Testing

System testing evaluates the complete system's functionality to ensure it meets the requirements. It involves end-to-end testing of the entire application to verify that all integrated components work together as intended. For this app, system testing would include:

- A full user journey from creating a token ID to displaying sorted pharmacies based on sentiment analysis.
- Validation of the user interface to ensure all elements are functional and user-friendly.
- Ensuring that the app responds appropriately to different input scenarios and error conditions.

Acceptance Testing

Acceptance testing is conducted to determine whether the app meets the acceptance criteria and satisfies the end user's needs. This testing involves scenarios based on real-world use cases, ensuring the app's functionality aligns with user expectations. For this project, acceptance testing would focus on:

- Verifying that users can successfully retrieve and view local pharmacies.
- Ensuring the sentiment analysis accurately reflects user reviews, providing reliable rankings of pharmacies.
- Checking that the app's performance is satisfactory in terms of speed, responsiveness, and reliability.

Usability Testing

Usability testing evaluates the app from the perspective of end users to identify any usability issues. This type of testing ensures the app is intuitive, easy to navigate, and provides a positive user experience. For this project, usability testing would include:

- Observing users as they interact with the app to identify any navigation difficulties or confusing features.
- Gathering user feedback on the app's design, layout, and overall ease of use.
- Making improvements based on user feedback to enhance the app's usability.

Performance Testing

Performance testing assesses the app's responsiveness, stability, and resource usage under various conditions. This type of testing ensures the app performs well under expected and peak load conditions. For this app, performance testing would involve:

- Measuring the app's response time for retrieving and displaying pharmacies.
- Evaluating the performance of the sentiment analysis feature under different loads.
- Ensuring the app remains stable and performs efficiently with large datasets.

Security Testing

Security testing aims to identify vulnerabilities within the app that could be exploited by malicious users. This type of testing ensures the app protects user data and maintains privacy. For this project, security testing would include:

- Verifying that token IDs are securely stored and transmitted to Firebase.
- Ensuring that the Google Places API interactions do not expose sensitive information.

- ❖ Conducting vulnerability assessments to identify and mitigate potential security risks.

By systematically conducting these tests, we can ensure that the mobile app is robust, user-friendly, and secure, ultimately providing a reliable tool for users to find and review local pharmacies.

I. Importing the Dependencies

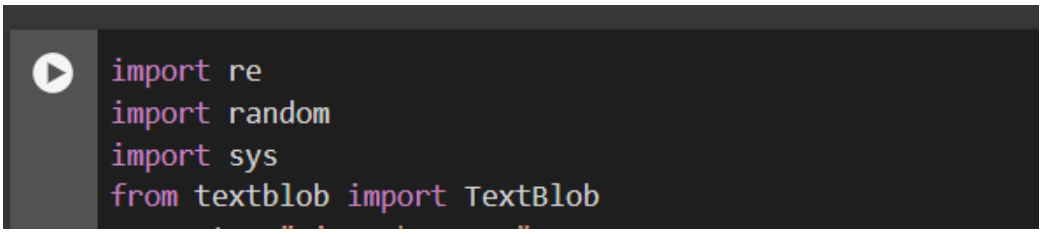


Figure 1. 5 Dependencies

- **`import re`**

The `re` module in Python provides support for regular expressions, which are a powerful tool for matching patterns within text. Regular expressions can be used to search, edit, and manipulate strings based on specific patterns. For instance, you might use `re` to find all instances of a particular word in a text, to replace substrings, or to validate text inputs such as email addresses or phone numbers. The `re` module includes functions like `re.search()`, `re.match()`, and `re.sub()`, each serving different purposes in pattern matching and text processing.

- **`import random`**

The `random` module in Python is used for generating pseudo-random numbers and performing random operations. This module can produce random integers, floating-point numbers, and select random elements from a list, among other capabilities. For

example, `random.randint(a, b)` generates a random integer between `a` and `b` inclusive, and `random.choice(seq)` returns a randomly chosen element from a non-empty sequence. The `random` module is often used in scenarios requiring simulation, random sampling, or in gaming applications where random behavior is desired.

- **`import sys`**

The `sys` module in Python provides access to some variables used or maintained by the interpreter and to functions that interact strongly with the interpreter. It allows for interaction with the Python runtime environment. For example, `sys.argv` provides a list of command-line arguments passed to a Python script, and `sys.exit()` can be used to terminate the program. The `sys` module is crucial for tasks that require interfacing with the underlying operating system or controlling the execution flow of a Python program.

- **from textblob import TextBlob`**

The `textblob` library in Python is a natural language processing (NLP) library that provides a simple API for common NLP tasks. `TextBlob` is used for processing textual data, and it offers functionalities such as part-of-speech tagging, noun phrase extraction, sentiment analysis, classification, translation, and more. By importing `TextBlob`, you can easily manipulate and analyze text data. For instance, `TextBlob("I love programming").sentiment` can be used to determine the sentiment of the given text, returning a polarity and subjectivity score. This makes `TextBlob` a powerful and user-friendly tool for performing NLP in Python.

Figure 1. 6 Path

- **from google.colab import drive:**

This line imports the drive module from the google.colab package. This module provides functionality to interact with Google Drive, allowing you to mount your Google Drive on the Colab environment.

- **drive.mount('/content/drive'):**

This line mounts your Google Drive onto the Colab environment. It prompts you to authorize access to your Google Drive and generates an authentication code to enter in a prompt.

II. Code Explanation

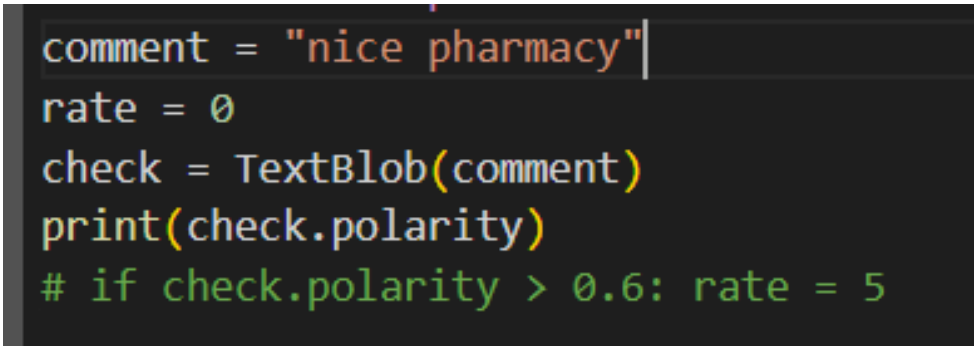


Figure 1. 7 Code

- comment = "nice pharmacy": A string variable comment is initialized with the text "nice pharmacy".

- rate = 0: A variable rate is initialized to 0. This variable might be used later to store a rating based on the sentiment analysis.
- check = TextBlob(comment): A TextBlob object check is created using the comment. This object can be used to perform various NLP tasks.

- print(check.polarity): The polarity of the comment is computed and printed. The polarity score indicates the sentiment of the text.

- if check.polarity > 0.6: rate = 5: This commented-out line suggests that if the polarity of the comment is greater than 0.6 (indicating a strongly positive sentiment), the rate would be set to 5. This part is currently inactive as it is commented out.

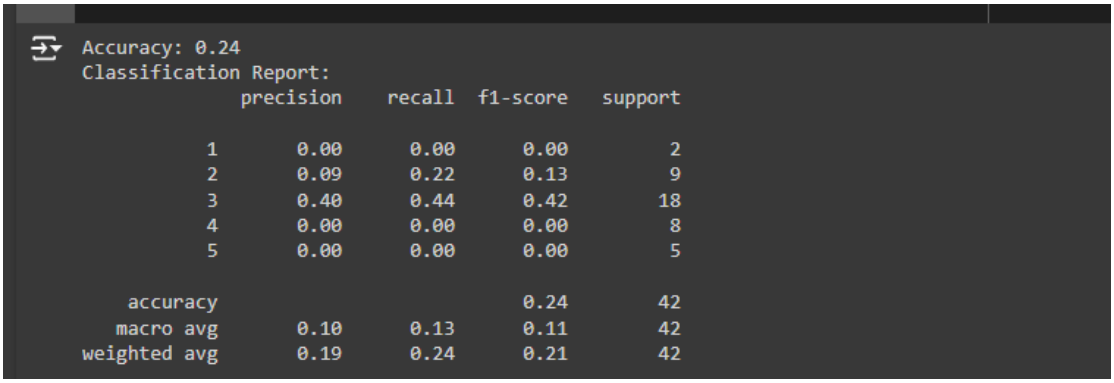
Model Training

The model training involved experimenting with several models, including logistic regression. Each model was trained using labeled data and evaluated based on metrics such as accuracy, precision, recall, and F1-score. Hyperparameter tuning was conducted to optimize each model's performance. Cross-validation techniques were employed to ensure robustness and prevent overfitting. Finally, the best-performing model was selected based on its overall performance across the evaluation metrics. The best-performing model was TextBlob.

Approach_01:- Logistic Regression

```python
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import accuracy_score, classification_report

# Load the dataset
df = pd.read_csv('/content/drive/MyDrive/Heart App 2/models/Pharmacy Indexing/Pharmacies_Datasets.csv', encoding='ISO-8859-1')

# Preprocess the data
# (Add more text cleaning steps based on your specific requirements)
df['comment'] = df['comment'].str.lower()

# Split the data into features (X) and target variable (y)
X = df['comment']
y = df['rate']

# Split the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

# Text Vectorization using TfidfVectorizer
vectorizer = TfidfVectorizer(max_features=5000)  # Adjust max_features as needed
X_train_tfidf = vectorizer.fit_transform(X_train)
X_test_tfidf = vectorizer.transform(X_test)

# Build a model (Logistic Regression in this case)
model = LogisticRegression()
model.fit(X_train_tfidf, y_train)

# Make predictions
y_pred = model.predict(X_test_tfidf)

# Evaluate the model
accuracy = accuracy_score(y_test, y_pred)
print(f'Accuracy: {accuracy:.2f}')

# Display classification report
print('Classification Report:')
print(classification_report(y_test, y_pred))
```

Figure 1. 8 Logistics Model



```
Accuracy: 0.24
Classification Report:
              precision    recall  f1-score   support

           1       0.00      0.00      0.00         2
           2       0.09      0.22      0.13         9
           3       0.40      0.44      0.42        18
           4       0.00      0.00      0.00         8
           5       0.00      0.00      0.00         5

    accuracy                           0.24        42
   macro avg       0.10      0.13      0.11        42
weighted avg       0.19      0.24      0.21        42
```

Figure 1. 9 Accuracy

The test accuracy score of Logistic Regression is 0.24

Sentiment analysis, also known as opinion mining, is a field of study that analyzes people's opinions, sentiments, evaluations, appraisals, attitudes, and emotions towards entities such as products, services, organizations, individuals, issues, events, topics, and their attributes. The goal is to determine the polarity (positive, negative, or neutral) of a given text. One of the most popular methods for sentiment analysis is logistic regression, a statistical model that is well-suited for binary classification problems. Logistic regression is a type of regression analysis used for predicting the outcome of a categorical dependent variable based on one or more predictor variables. It is particularly useful when the dependent variable is binary (e.g., positive or negative sentiment). Unlike linear regression, which predicts continuous values, logistic regression predicts probabilities of class membership, which are then thresholder to produce a categorical outcome. Logistic regression is a robust and effective technique for sentiment analysis, particularly when dealing with binary outcomes. Its simplicity, efficiency, and interpretability make it a popular choice among data scientists. While it has some limitations, with proper preprocessing and feature selection, logistic regression can yield valuable insights into sentiment from text data. By leveraging logistic regression, businesses and researchers can better understand and respond to the sentiments expressed in vast amounts of textual information.

Limitations

- Linearity Assumption: Logistic regression assumes a linear relationship between the independent variables and the log odds of the dependent variable.

- Limited Complexity: It may not perform well with highly complex data or when interactions between features are crucial.

- But there are some restrictions. The necessity of the internet being one of them. For the application to function and display results in real time, internet connectivity is required. The verification process for the availability of beds or medications at pharmacies has another disadvantage. For better/accurate findings, the management of the relevant health unit must approve the use of these resources. Since the server receives the request for rating prediction, the outcomes are also dependable in terms of the server's operation.

Mobile Application Implementation

This study explores leveraging mobile platforms for the development of mobile applications, specifically targeting touch screen mobile devices. Given the widespread adoption of smartphones, Android emerges as a prime candidate due to its intuitive user interface, which is primarily touch-based, mimicking real-world actions such as swiping, tapping, pinching, and reverse pinching. Android stands out as a popular choice for high-tech gadgets owing to its pre-built nature, cost-effectiveness, configurability, and lightweight design. Moreover, its open-source nature makes it

accessible for developers. With Android boasting the largest installed base globally, including in the United States, it has remained a dominant force in the mobile operating system landscape for years. Therefore, the research suggests utilizing Android as the development platform for mobile applications.

For mobile development, we utilize Flutter and Dart for frontend development, leveraging Android Studio as our primary IDE. Our backend infrastructure is secured by a firewall to ensure data protection and system integrity.

User Interfaces

A separate login has been created for the doctor and the patient. This is the doctor's login. That is, only the patient can perform this process.

The patient should first login here and select the "Medicines" icon. Then show pharmacies around the patient’s location. After that, the patient can select the best-rated pharmacy, then navigate to Google Maps to show the pharmacy's location. Finally, the user can add some comments for the selected pharmacy

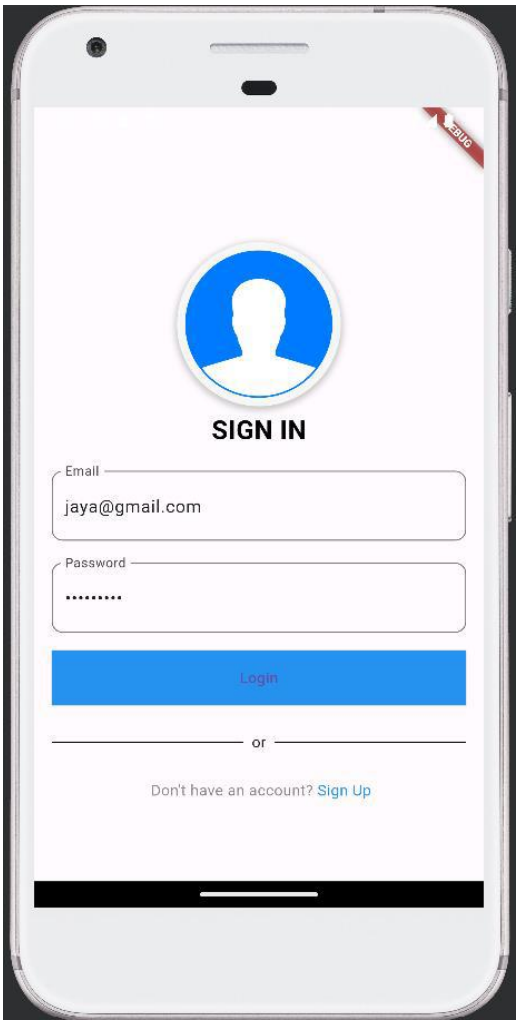


Figure 1. 11 Login

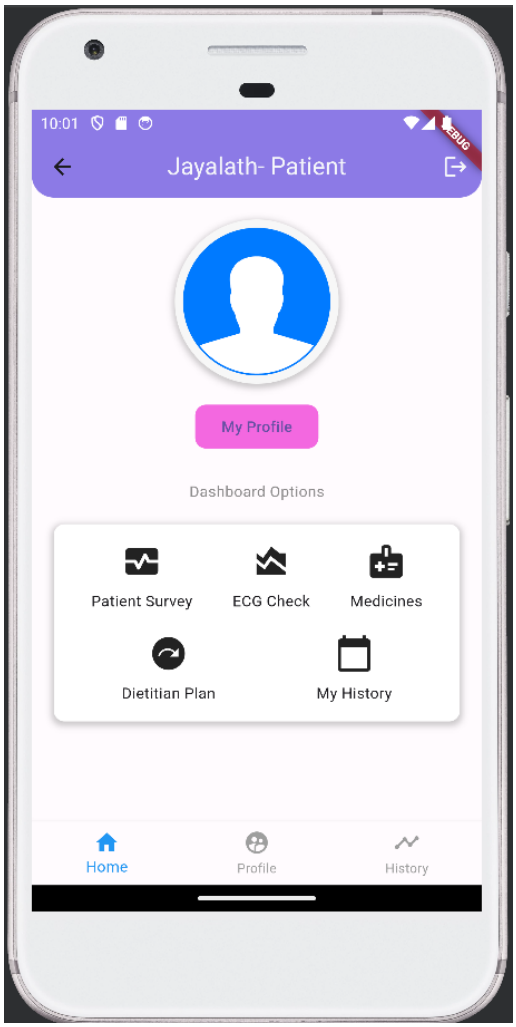


Figure 1. 10 Dashboard

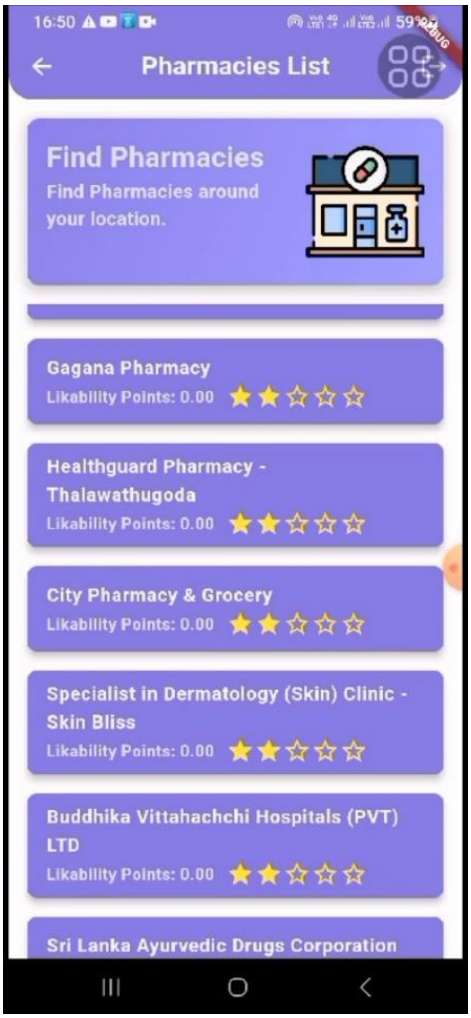


Figure 1. 14 Pharmacies List

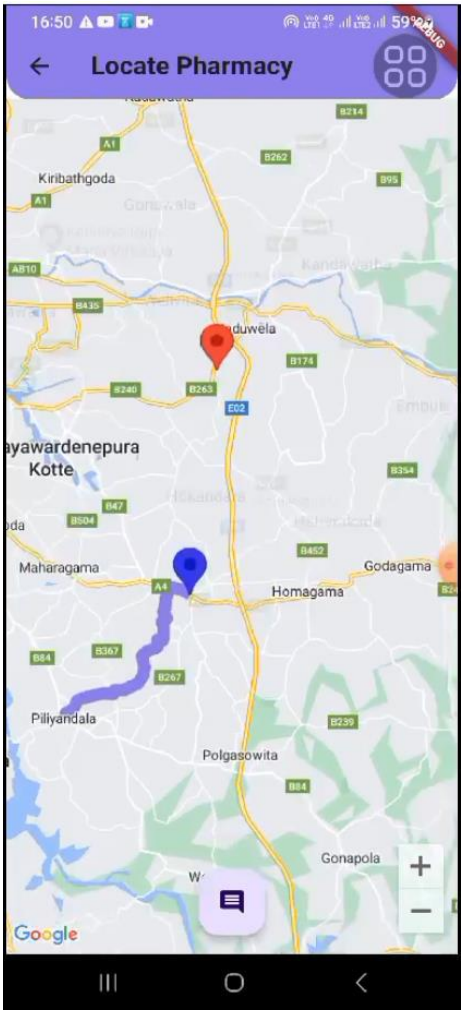


Figure 1. 12 Google Map

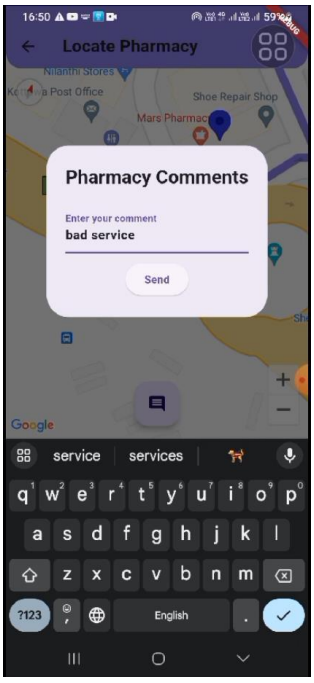


Figure 1. 13 Put a Comment

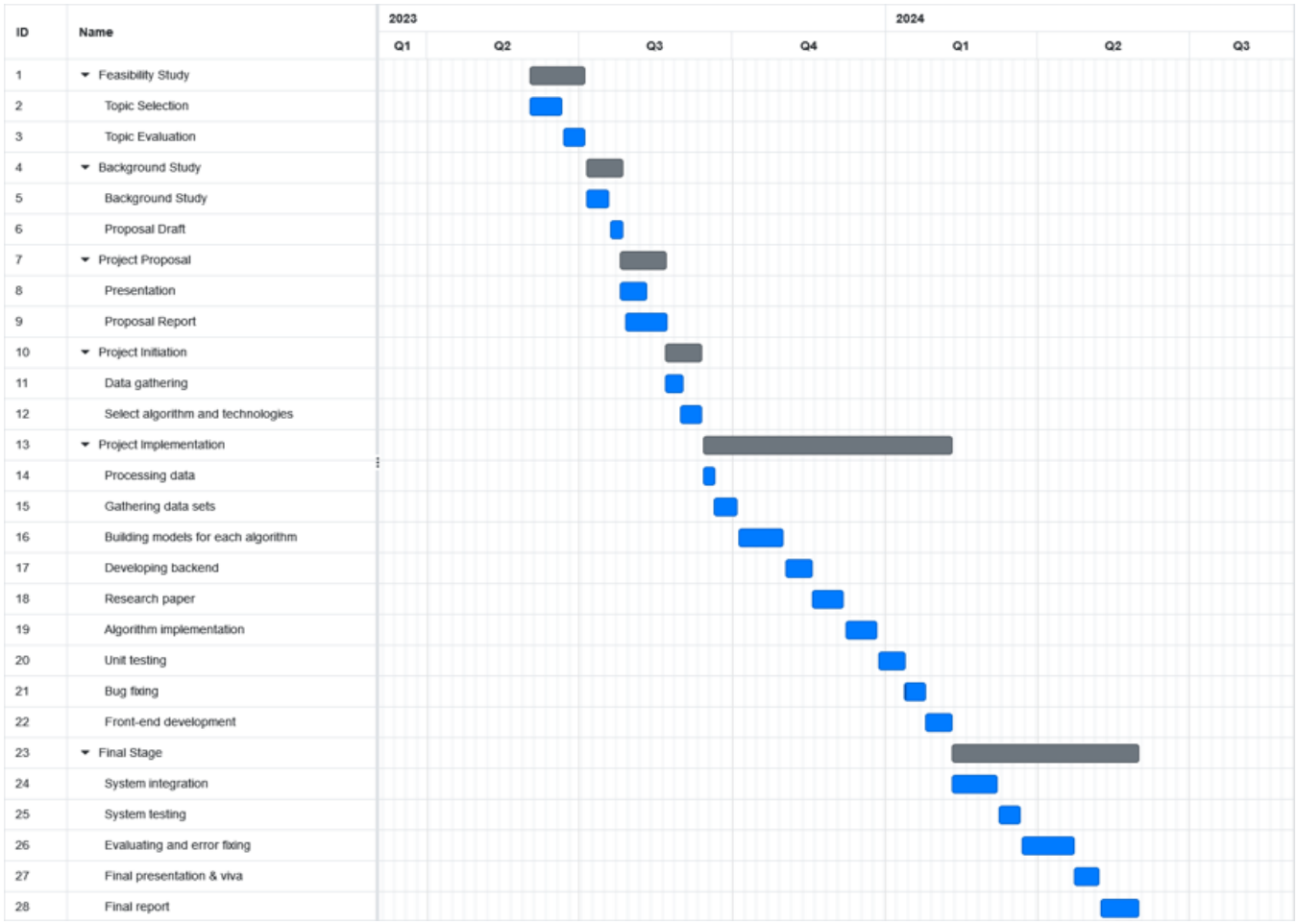


Figure 1. 15 Gannt Chart

03 RESULTS & DISCUSSION

3.1 Results

In the realm of modern healthcare services, the integration of technology has revolutionized the way we access essential resources. One significant area of innovation lies in optimizing pharmacy selection through mobile applications. Our research delves into the intricacies of this integration, focusing on the multifaceted aspects that contribute to an enhanced user experience and efficient service delivery.

At the core of our system is a sophisticated model that leverages diverse data inputs to facilitate various functions seamlessly within the developed mobile app. The pivotal data points utilized include user location, distance to nearby pharmacies (acquired through the Google Maps API), availability of required medicines, and user ratings. Let's dissect how each of these elements contributes to the overall functionality and optimization of the pharmacy selection process.

Firstly, the user's location serves as the anchor point for initiating the search process. By pinpointing the user's geographical coordinates, the app can tailor results based on proximity, ensuring convenience and timely access to pharmaceutical services. This aspect is crucial, especially in scenarios where urgency and accessibility play pivotal roles in healthcare decision-making.

The integration of the Google Maps API adds another layer of sophistication to our model. Leveraging this API not only provides accurate distance calculations but also enables real-time updates on traffic conditions and route optimization. Consequently, users receive not just a list of nearby pharmacies but also intelligent suggestions on the most efficient routes to reach them, thereby saving valuable time and resources.

The availability of required medicines is a critical determinant in the selection process. Our model considers real-time data on medication stock across different pharmacies, ensuring that users are directed to establishments where their needed medications are in supply. This feature not only enhances user satisfaction but also contributes to better inventory management for pharmacies, promoting efficient resource allocation.

User ratings serve as a qualitative metric that adds a layer of trust and reliability to the selection process. By incorporating ratings and reviews from fellow users, our app empowers individuals to make informed decisions based on community feedback. This social aspect not only fosters a sense of community within the app but also helps in identifying pharmacies that consistently deliver quality service and products.

Upon user request, the app generates a curated list of pharmacies, prioritized based on a combination of factors including proximity, medication availability, and user ratings. This optimization ensures that users receive tailored results that align with their preferences and requirements, streamlining the entire pharmacy selection experience.

It's important to note that all these intricate functions are seamlessly performed within the mobile app interface we have developed. This cohesive integration of data analytics, API utilization, and user-centric design underscores our commitment to creating a comprehensive solution that bridges the gap between technology and healthcare accessibility.

our research underscores the transformative potential of mobile app integration in optimizing pharmacy selection processes. By harnessing the power of data, technology, and user feedback, we pave the way for a more efficient, personalized, and user-friendly healthcare experience

3.2 Discussion

Integration of Google APIs and Firebase

The use of Firebase for storing unique device token IDs is a crucial step in ensuring that user-specific data can be efficiently managed and retrieved. Firebase's real-time database capabilities allow for seamless storage and retrieval of token IDs, which serve as a key to access personalized information, such as nearby pharmacies. By leveraging the Google Places API, the app can dynamically find and present local pharmacies based on the user's current location. This integration ensures that users receive accurate and up-to-date information, which is essential for making informed decisions about where to obtain pharmaceutical services.

Geolocation Services with Geofire

Geofire's role in finding pharmacies within a specified radius enhances the precision of location-based searches. By using geolocation data to sort pharmacies automatically, the app can provide users with the most relevant options quickly and efficiently. This feature is particularly beneficial in urban areas with a high density of pharmacies, where users need to compare several options to find the best one. The automatic sorting based on proximity ensures that users are presented with convenient choices, thereby improving the overall user experience.

Sentiment Analysis with TextBlob

Sentiment analysis is a pivotal component of this methodology, enabling the app to assess the quality of pharmacies based on patient reviews. TextBlob's machine learning approach to sentiment analysis offers a robust mechanism for determining the polarity of reviews. By calculating a polarity score for each review, ranging from -1.0 (highly negative) to 1.0 (highly positive), the app can classify reviews accurately. This classification is essential for aggregating sentiment data and ranking pharmacies accordingly.

TextBlob's use of pre-trained models allows for the efficient processing of natural language inputs, making it a suitable choice for analyzing patient reviews. The machine learning aspect of TextBlob, as opposed to rule-based sentiment analysis, offers a higher degree of flexibility and accuracy. This is because machine learning models can identify subtle nuances and correlations in the text that rule-based systems might miss. The resulting sentiment ratings provide users with a clear indication of the quality of service provided by each pharmacy, based on real user feedback.

Application of Multinomial Naïve Bayes Algorithm

To further enhance the reliability of the sentiment analysis, the Multinomial Naïve Bayes algorithm is applied after the reviews have been vectorized. This step is crucial

for transforming textual data into a format that can be effectively processed by machine learning algorithms. The Multinomial Naïve Bayes algorithm, known for its efficiency in handling text classification tasks, contributes to the accurate ranking of pharmacies based on the sentiment scores derived from user reviews. This method ensures that the sentiment analysis results are not only accurate but also actionable, allowing users to see the highest-rated pharmacies prominently.

Implications and Future Directions

The implementation of this methodology has several positive implications. Firstly, it empowers users with the ability to make well-informed choices about which pharmacy to visit, based on both proximity and quality of service. Secondly, it encourages pharmacies to maintain high standards of service, knowing that their ratings directly impact their visibility and attractiveness to potential customers.

Moving forward, there are several avenues for further development and refinement. One potential improvement could involve enhancing the machine learning models used for sentiment analysis by incorporating more sophisticated techniques such as deep learning. Additionally, expanding the dataset with a more diverse range of reviews could improve the robustness and generalizability of the sentiment analysis.

In conclusion, the integration of Firebase, Google APIs, and TextBlob, combined with the application of the Multinomial Naïve Bayes algorithm, creates a powerful tool for locating and evaluating pharmacies. This methodology not only enhances user experience but also promotes a higher standard of service within the pharmaceutical industry. As technology continues to evolve, further advancements in machine learning and data processing will likely yield even more sophisticated and effective solutions for healthcare applications.

Future works

The app's distinctive selling point is that it provides a workable answer based on three variables: availability, distance, and health unit ratings. The process creating a token for every user that installs the app, and then utilising the Google Places API to find the user's location as well as the hospitals in the area. "GEOFIRE" is used to improve it by displaying the health units that are in the vicinity of the user, within the designated radius. The data is filtered according to the resources that are available, and the data is stored in "FIREBASE" so that it is updated dynamically.

In keeping with the community-based app concept, the user has the opportunity to contribute reviews and update the availability of these resources.
Using the Multinomial Naive Bayes theorem, the filtration mechanism is used to rank the results based on ratings of these units.
The authors hope to build on this work by adding doctors' expertise in their specialized service areas to the hospital data, and then forecasting the ratings for the same to display the best outcomes following the integration of reviews and distance.

Including a feature that allows users to submit their symptoms in order to anticipate diseases. The database contains a list of physicians who specialise in treating specific illnesses, as well as patient reviews, the doctors' current locations, and their availability. The user may receive status updates on the subscribing doctor, if accessible.

04 CONCLUSION

The research culminates in a vision that not only addresses current healthcare challenges but also presents a blueprint for a transformative healthcare ecosystem. At its core, the app's uniqueness emerges from its intricate fusion of technology and human-centric solutions, manifesting in three pivotal factors: distance, availability, and ratings of pharmacies.

Firstly, the app's functionality starts with a seamless user experience, where each installation generates a unique token. Leveraging the power of Google Places API, the app pinpoints the user's location and identifies nearby healthcare facilities. This integration is bolstered by the use of "GEOFIRE," optimizing the search within specified radii, ensuring prompt access to critical health services.

Secondly, the app embraces a dynamic data ecosystem facilitated by "FIREBASE." Here, the availability of resources is continually updated, creating a real-time repository crucial for informed decision-making. What sets this system apart is its community-driven ethos, empowering users to contribute firsthand experiences, update resource availability, and provide reviews. This participatory model not only enhances data accuracy but also fosters a sense of ownership and trust within the user community

Thirdly, the app employs sophisticated filtration mechanisms, incorporating Multinomial Naive Bayes theorem to sort results based on unit ratings. This not only streamlines the search process but also elevates user experience by presenting highly relevant and reputable healthcare options.

Looking forward, the research envisions an expanded framework that transcends mere convenience to offer holistic healthcare solutions. By integrating information about doctors' specialized service areas and leveraging predictive analytics to forecast ratings, the app seeks to enhance user decision-making significantly. This holistic approach, combining distance, reviews, and predictive ratings, promises optimized results tailored to individual needs, ensuring quality care and user satisfaction.

Moreover, the app's foresight extends to predictive healthcare, where users can input symptoms to receive tailored recommendations. By integrating doctor specialization, patient reviews, and real-time availability, the app not only assists in proactive health management but also fosters timely interventions, potentially mitigating health risks.

In essence, the app represents a paradigm shift in healthcare delivery, leveraging technology's power to bridge gaps, empower communities, and elevate user experiences. As it continues to evolve, embracing predictive analytics, expanded data integration, and user-centric features, it stands poised to redefine healthcare access and engagement in profound ways, heralding a future where healthcare is not just a service but a seamless, personalized experience for all.

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06 GLOSSARY

Term	Definition
Texblob	Texblob is a service or tool designed for processing and analyzing text data. It typically involves functionalities like text extraction, sentiment analysis, keyword identification, and other natural language processing tasks. Texblob is used in various applications such as content analysis, customer feedback evaluation, and data mining
Google Maps	Google Maps is a web-based mapping service developed by Google. It provides detailed geographical information, including maps, satellite imagery, street views, real-time traffic conditions, and route planning for traveling by foot, car, bicycle, or public transportation. Google Maps is widely used for navigation, local business searches, and geographic exploration
Python Backend Development	The use of Python programming language for developing the server-side logic of an application. Python is chosen for its simplicity, versatility, and extensive library support for machine learning and web development.
Mobile Health Applications	Software applications designed for mobile devices to assist users in managing their health and wellness. This project involves developing a mobile app to provide dietary recommendations to heart condition patients.

Figma UI Design	A web-based design tool used to create user interfaces for applications. Figma allows for collaborative design and prototyping, making it suitable for designing intuitive and user-friendly mobile app interfaces.
Google Colab	A cloud-based platform that provides free access to powerful GPUs and TPUs, facilitating the training of machine learning models. It is used in this project for training the TextBlob model efficiently.
Firebase	A cloud-based platform by Google that offers a variety of services, including real-time databases, authentication, and analytics. It was used in this project for managing and storing user data efficiently.

07 APPENDICES