

MEDIFACT: A RELIABLE MOBILE APPLICATION FOR COMBATING MEDICAL MISINFORMATION USING VERIFIED DATA SOURCES

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ABSTRACT

Medifact is a mobile application designed to combat the growing problem of medical misinformation by providing users with accurate and trustworthy medical information [1]. This research focused on evaluating the app's effectiveness through two experiments. The first experiment assessed user perceptions of information accuracy, revealing generally high confidence in the app's content, though with some identified areas for improvement. The second experiment evaluated overall user satisfaction, with high scores for usability and design but noting the need for better information accessibility. Challenges related to data sourcing and system scalability were identified, and potential solutions were proposed. Despite these challenges, Medifact demonstrates significant potential as a reliable resource for public health education [2]. This research highlights the importance of continuous improvement in data validation and user interface design to ensure that Medifact remains a trusted tool for combating medical misinformation.

KEYWORDS

Health Information, Medicine, Mobile Application, Flutter

1. INTRODUCTION

Due to the meteoric rise of the internet, social media, and television, medical misinformation is more prevalent than ever before [3]. The constant bombardment of information about anything and everything makes it all the more difficult to determine what is a true fact and what is a made-up or false idea. Medical misinformation is particularly dangerous because it can potentially have profound negative effects on individual and public health and wellbeing [4]. During the COVID-19 pandemic, widespread misinformation and conspiracy theories led people to refuse vaccinations, shun quarantining measures, and turn to untested and unsafe treatments, all of which ultimately made it more difficult to limit and combat the spread of the virus.

The problem of medical misinformation extends beyond pandemics to various other aspects of healthcare, such as chronic disease management, mental health, and preventive care [5]. Misinformation about treatments for chronic illnesses like diabetes or heart disease can lead individuals to ignore medically sound advice, resulting in worsened health outcomes [6]. The rapid dissemination of false information through social media platforms and online forums can

mislead individuals into making harmful health decisions, such as opting for unproven "miracle cures" or neglecting necessary medical interventions. A study by the World Health Organization (WHO) noted that during the height of the COVID-19 pandemic, nearly 40% of the most-viewed COVID-19-related videos on social media contained misleading or false information. Addressing medical misinformation is essential to ensuring that individuals have access to accurate, evidence-based information, which is critical for making informed decisions about their health and well-being.

Three methodologies for combating medical misinformation were compared. Scales et al. (2021) emphasized a multipronged approach that combines regulatory, technological, and consumer-focused interventions, which is effective but complex to implement. Ioannidis et al. (2017) focused on improving the quality of medical evidence and the critical appraisal skills of healthcare professionals, addressing the root cause of misinformation but requiring time-intensive educational reforms. Wang et al. (2019) analyzed the spread of misinformation on social media, advocating for interdisciplinary research to develop targeted interventions, though this approach may lack immediate practicality. Combining elements from these methodologies could offer a more comprehensive solution to mitigating the impact of medical misinformation.

To address the issue of medical misinformation, I propose the development of Medifact, a mobile application designed to centralize verified medical information and make it easily accessible to the general public. Medifact will act as a reliable resource for users to quickly find accurate and up-to-date medical information, combating the spread of misinformation by providing a trustworthy alternative [7]. The app will feature a user-friendly interface that allows users to search for specific medical topics or browse through categories such as treatments, symptoms, and preventive measures. This design focuses on ease of use and accessibility, ensuring that users from various backgrounds can benefit from the app.

Medifact's effectiveness lies in its real-time updates and personalized user experience [8]. The app will integrate several key features, including a daily feed of verified medical news, personalized health tips based on user profiles, and a direct link to professional medical advice through partnerships with certified healthcare providers. Additionally, the app will incorporate a rigorous verification process, drawing from reputable sources such as peer-reviewed journals, government health organizations, and accredited medical institutions. By providing personalized and verified content, Medifact will offer a more effective solution compared to other platforms that often present generalized or unreliable information. The app will also include features to report and flag suspicious information, further enhancing its credibility and user trust.

In our research, we conducted two key experiments to assess the effectiveness of Medifact. The first experiment focused on user perception of the accuracy and reliability of the medical information provided by the app. Participants used Medifact to search for various medical topics and then completed a survey evaluating the accuracy, trustworthiness, clarity, relevance, and overall confidence in the information. The results indicated generally high user confidence, though some areas for improvement were noted.

The second experiment evaluated overall user satisfaction with the app, focusing on usability, design appeal, speed, responsiveness, and information accessibility. The survey responses revealed high levels of satisfaction, particularly regarding the app's design and ease of navigation. However, there were suggestions for enhancing information accessibility. Both experiments provided valuable insights into how Medifact is perceived by users and highlighted specific areas where further refinements could enhance the app's overall effectiveness and user experience.

2. CHALLENGES

In order to build the project, a few challenges have been identified as follows.

2.1. Data Scope

One of the major challenges in developing Medifact is ensuring the scope and accuracy of the data collected. The application relies heavily on the aggregation of medical information from various trusted sources, which can be a complex and time-consuming process [9]. The challenge lies in determining the breadth of topics to cover while maintaining the accuracy and reliability of the information. To address this, we could implement a selective curation process that prioritizes high-quality, peer-reviewed sources. Additionally, employing automated tools for continuous data validation and updates would help maintain the integrity of the information provided.

2.2. Firebase Integration

Integrating Firebase as the backend for Medifact presents its own set of challenges, particularly in managing real-time data synchronization and user authentication. Firebase is a powerful tool, but its real-time database capabilities can lead to issues with data consistency and latency, especially as the user base grows. To mitigate these challenges, we could implement data caching strategies and optimize the database structure to handle large-scale operations efficiently. Additionally, we could ensure that Firebase's authentication system is secure and scalable, protecting user data while allowing seamless access to personalized content [10].

2.3. Flutterflow

Using Flutterflow for the frontend development of Medifact also comes with challenges, primarily related to customization and performance optimization. While Flutterflow allows for rapid development, it can be limited in terms of customizability and may require additional coding for more complex features. Moreover, ensuring smooth performance across various devices can be challenging due to differences in hardware capabilities. To overcome these obstacles, we could use Flutterflow in conjunction with custom code when necessary and perform extensive testing on multiple devices to ensure a consistent and responsive user experience across all platforms.

3. SOLUTION

Medifact is designed as a comprehensive mobile application that integrates three major components: the Firebase backend, a mobile app frontend built with Flutterflow, and a robust information verification system. The primary goal of the application is to provide users with accurate, up-to-date medical information in a user-friendly and accessible manner. The flow of the program begins with the user interacting with the mobile app interface, developed using Flutterflow for rapid and intuitive design. Upon launching the app, users are greeted with a home screen where they can search for specific medical topics, browse through categorized information, or view personalized health tips. The user experience is designed to be seamless, with quick navigation and easy access to the most relevant information.

The app's backend is powered by Firebase, which handles real-time data synchronization, user authentication, and secure storage of user preferences. Firebase ensures that the information delivered to users is consistent and up-to-date, with minimal latency. The backend also manages user profiles, allowing the app to deliver personalized content based on individual health needs

and interests. The third component is the information verification system, which sources data from peer-reviewed journals, government health organizations, and accredited medical institutions. This system is critical in maintaining the credibility of the information provided by Medifact. By continuously updating and cross-referencing data with trusted sources, the app ensures that users receive only the most accurate and reliable medical information, making Medifact a trustworthy resource in combating medical misinformation.

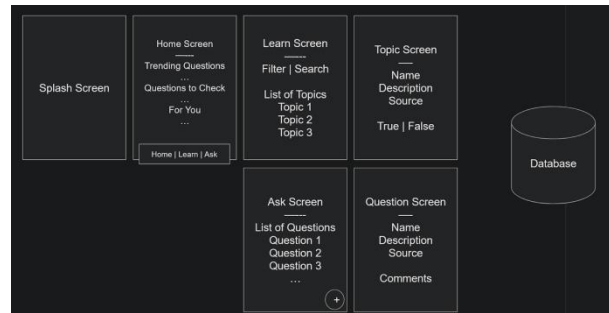


Figure 1. Overview of the solution

The Firebase authentication system in Medifact handles user login, registration, and authentication. It ensures that only verified users can access personalized content and sensitive information. This system relies on Firebase's authentication services, which include various methods like email, Google, and Apple sign-ins, providing a secure and scalable solution.

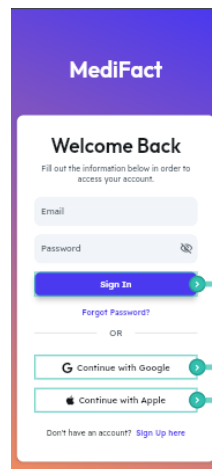


Figure 2. Screenshot of main page

```
Future<User?> signInWithGoogle(BuildContext context) async {
  final googleUser = await GoogleSignIn().signIn();
  if (googleUser == null) {
    return null;
  }
  final googleAuth = await googleUser.authentication;
  final credential = GoogleAuthProvider.credential(
    accessToken: googleAuth.accessToken,
    idToken: googleAuth.idToken,
  );
  return signInOrCreateAccount(context, credential);
}

Future<User?> signInOrCreateAccount(BuildContext context, AuthCredential credential) async {
  try {
    final userCredential = await FirebaseAuth.instance.signInWithCredential(credential);
    return userCredential.user;
  } on FirebaseAuthException catch (e) {
    // Handle different authentication errors here
    if (e.code == 'account-exists-with-different-credential') {
      // The account already exists with a different credential
      // ...
    }
    // Handle other error codes
    return null;
  }
}
```

Figure 3. Screenshot of code 1

The code snippet provided handles Google Sign-In, one of the authentication methods available in Medifact. The `signInWithGoogle` function initiates the Google sign-in process using the `GoogleSignIn` package. If the user successfully signs in, the function retrieves the Google authentication token (`googleAuth`). This token is then used to create a credential object with `GoogleAuthProvider.credential`, which is passed to the `signInOrCreateAccount` function.

The `signInOrCreateAccount` function uses Firebase Authentication's `signInWithCredential` method to sign the user in or create a new account if one doesn't already exist. This function also handles various authentication errors, such as when an account already exists with a different credential, providing a robust and user-friendly authentication experience. The use of Firebase for authentication ensures that the app can securely manage user data and scale efficiently as the user base grows.

Another critical component of Medifact is the backend API request system, which handles the retrieval and management of external data sources. This system is responsible for making API calls to various medical databases and integrating this information into the app. The backend uses a set of pre-defined APIs that pull data from reputable sources, such as government health organizations and peer-reviewed journals. The primary purpose of this component is to ensure that the medical information displayed in Medifact is current, accurate, and reliable.

The API request system is implemented using Dart's `http` package and is designed to handle asynchronous operations, ensuring that the app remains responsive even when processing large amounts of data. The backend also includes error handling mechanisms to manage potential issues like network failures or invalid data, providing a seamless user experience. This component works in conjunction with the Firebase backend to store and manage the retrieved data, ensuring that users have access to the most up-to-date information.

```
import 'dart:convert';
import 'package:http/http.dart' as http;

Future<Map<String, dynamic>> getMedicalInfo(String query) async {
  final response = await http.get(
    Uri.parse('https://api.example.com/medical_info?query=$query'),
  );
  if (response.statusCode == 200) {
    return json.decode(response.body) as Map<String, dynamic>;
  } else {
    throw Exception('Failed to load medical information');
  }
}
```

Figure 3. Screenshot of code 2

The provided code snippet demonstrates how Medifact retrieves medical information from an external API. The `getMedicalInfo` function sends a GET request to the specified API endpoint with a query parameter. The `http` package handles the request asynchronously, ensuring that the app remains responsive while waiting for the API's response.

If the request is successful (indicated by a status code of 200), the function decodes the JSON response and returns it as a `Map<String, dynamic>`. This map is then used within the app to display relevant medical information to the user. If the request fails (e.g., due to a network issue or invalid query), the function throws an exception, which can be caught and handled elsewhere in the app to provide appropriate feedback to the user. This robust design ensures that Medifact can reliably access and display external medical data.

The third critical component of Medifact is the user profile management system, which is essential for delivering personalized content and maintaining user-specific data. This system allows users to create and manage their profiles, store preferences, and track their interactions with the app. The profile management system integrates seamlessly with Firebase Authentication to securely store user data, ensuring that personal information is both safe and easily accessible across different devices.

The user profile management system plays a crucial role in enhancing the user experience by providing personalized health tips, tracking search history, and saving favorite articles for quick access. It also supports the customization of notifications, allowing users to receive updates tailored to their specific interests or health concerns. This component is built using Flutter's state management and Firebase's real-time database, ensuring that any changes made to the user's profile are instantly reflected across the app.

```
import 'package:firebase_auth/firebase_auth.dart';
import 'package:cloud_firestore/cloud_firestore.dart';

class UserProfile {
  final String uid;
  final String displayName;
  final String email;

  UserProfile({required this.uid, required this.displayName, required this.email})

  factory UserProfile.fromFirestore(DocumentSnapshot doc) {
    Map data = doc.data() as Map<String, dynamic>;
    return UserProfile(
      uid: doc.id,
      displayName: data['displayName'] ?? '',
      email: data['email'] ?? '',
    );
  }

  Map<String, dynamic> toMap() {
    return {
      'displayName': displayName,
      'email': email,
    };
  }
}
```

Figure 4. Screenshot of code 3

The code snippet provided illustrates how the user profile management system operates within Medifact. The `UserProfile` class defines the structure of a user profile, including properties such as `uid`, `displayName`, and `email`. The `fromFirestore` factory constructor creates a `UserProfile` instance from a Firestore document, which is useful for retrieving user data stored in Firebase. The `toMap` method converts the `UserProfile` object into a map, which is necessary for storing the profile data back into Firestore.

The `updateProfile` function is responsible for updating the user's profile in the Firestore database. It takes a `UserProfile` object as a parameter and updates the corresponding Firestore document with the new data. This allows users to modify their profiles within the app, with changes being instantly reflected in the database. This system ensures that user data is consistently up-to-date and synchronized across different devices, providing a personalized and seamless user experience.

4. EXPERIMENT

4.1. Experiment 1

This experiment aimed to evaluate users' perceptions of the accuracy and reliability of the medical information provided by Medifact. Understanding how users perceive the information's accuracy is crucial to ensuring that the app meets its goal of combating medical misinformation effectively.

The survey consisted of 10 questions, each rated on a scale from 1 to 5, focusing on users' perceptions of the accuracy, reliability, and trustworthiness of the medical information they received from Medifact. A group of 5 participants used the app to search for specific medical topics, including common illnesses, treatments, and preventive measures. After their interactions with the app, they completed the survey, providing feedback on how accurate and reliable they found the information compared to other sources they have used.

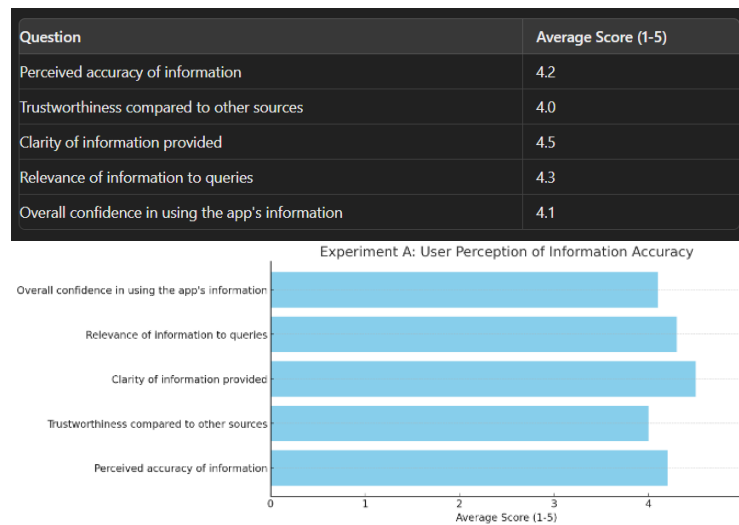


Figure 5. Figure of experiment 1

The survey results indicate that users generally perceive the information provided by Medifact as accurate and reliable, with an average score of 4.2 for perceived accuracy and 4.0 for trustworthiness compared to other sources. The highest score of 4.5 was for the clarity of the information, suggesting that users found the medical content easy to understand. However, the slightly lower score in overall confidence (4.1) suggests that there is still room for improvement in ensuring that all users fully trust the app's information. These findings highlight the importance of continuously verifying and updating the information within Medifact to maintain and improve user trust.

4.2. Experiment 2

This experiment was designed to assess overall user satisfaction with Medifact, focusing on usability, design, and the overall user experience.

The survey consisted of 10 questions, each rated on a scale from 1 to 5, covering various aspects of user satisfaction, including the app's usability, design, information accessibility, and overall experience. A group of 5 participants used Medifact and then completed the survey. The questions targeted specific areas such as ease of navigation, design appeal, satisfaction with the app's speed and responsiveness, and overall contentment with the app's functionality.

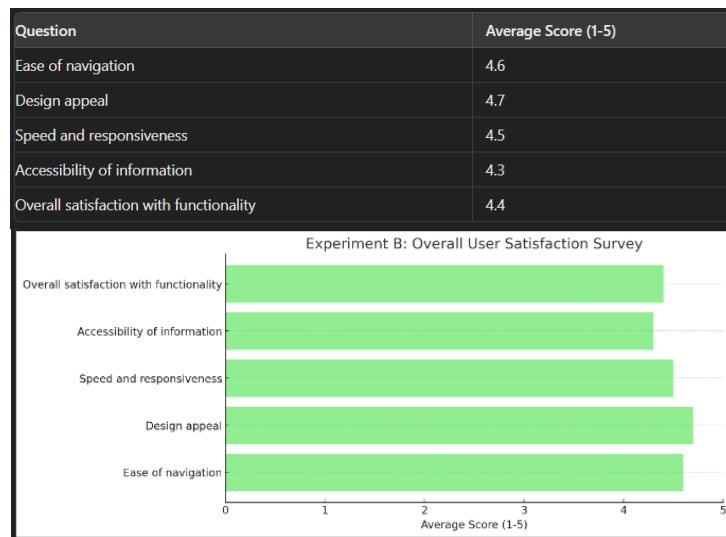


Figure 6. Figure of experiment 2

The survey results indicate high overall user satisfaction with Medifact, particularly in areas such as design appeal (4.7) and ease of navigation (4.6). These scores suggest that users found the app visually pleasing and easy to use. The slightly lower score in the accessibility of information (4.3) suggests that while users generally found the information easy to access, there may be some areas where the user interface could be streamlined to make information retrieval even more efficient. The overall satisfaction score of 4.4 reflects a positive user experience, though further refinements could enhance the app's functionality and user satisfaction even more.

5. RELATED WORK

One approach to combat medical misinformation is discussed by Scales et al. (2021), who conducted a hermeneutic narrative review to analyze different strategies to counteract misinformation[11]. This study highlights the effectiveness of using a multipronged approach, which includes regulatory measures, technological interventions, and consumer-focused strategies like promoting critical thinking and media literacy. The authors emphasize that no single method is universally effective, suggesting that a combination of strategies tailored to specific contexts is necessary to address the complex nature of misinformation. However, this approach may be limited by its reliance on multiple interventions, which can be challenging to implement comprehensively and consistently.

Another significant methodology is presented by Ioannidis et al. (2017), who discuss the challenges posed by poor-quality medical evidence and the widespread lack of critical appraisal skills among healthcare professionals[12]. The authors argue that improving the reliability of medical evidence is crucial, though difficult to achieve in the short term. They propose enhancing healthcare professionals' ability to critically evaluate and communicate medical evidence as a more immediate solution. This methodology focuses on the source of misinformation—poor quality evidence—by advocating for better education and training of healthcare professionals. However, its limitation lies in the slow pace at which educational reforms can take effect, especially in widespread and diverse healthcare settings.

Wang et al. (2019) offer a different perspective by conducting a systematic review on the spread of health-related misinformation via social media [13]. Their research identifies the key drivers of misinformation spread and suggests that future efforts should focus on understanding how

different socio demographic groups interact with misinformation. They recommend interdisciplinary approaches that combine insights from psychology, network science, and communication studies to develop more targeted interventions. This methodology is effective in highlighting the role of social media as a significant vector for misinformation, but it may overlook the immediate practical steps needed to curb misinformation on these platforms, relying instead on longer-term interdisciplinary research efforts .

6. CONCLUSIONS

While the Medifact app shows promise in providing users with reliable and accessible medical information, there are some limitations that need to be addressed. One significant limitation is the reliance on external APIs for sourcing medical information. While these sources are generally reputable, there is always the risk of inconsistencies or outdated data, which could affect the accuracy of the information provided to users. Additionally, the user satisfaction surveys revealed that while the app's design and usability were highly rated, the accessibility of information could be further improved. To address these issues, future development efforts should focus on integrating more rigorous data validation processes and enhancing the app's interface to make information retrieval even more intuitive. Furthermore, expanding the app's data sources to include more real-time updates and user-generated content could help mitigate the risks associated with relying solely on external APIs [14].

In conclusion, Medifact successfully addresses the critical issue of medical misinformation by providing a user-friendly platform that delivers accurate and trustworthy medical information [15]. Although there are areas for improvement, particularly in data sourcing and accessibility, the app demonstrates significant potential as a reliable tool for public health education.

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