**Patient Risk Profiling**

**An Engineering App in Community Service**

**Phase-1 Report**

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**Bonafide Certificate**

Certified That this project report titled “Patient Risk Profiling” is the bonafide work of “21BCG10075 Ankit Sankar, 21BAC10005 Ashutosh Kumar Shrivastava, 21BCG10100 Chethan Khoche, 21BCE11407 Devansh Trivedi, 21BCE11559 GPV Mruthunjai, 21BCE11342 Rishabh Pradhaan, 21BCG10072 Rishikesh M, 21BCY10019 Siddharth Dayal, 21BCE11334 Yashsh Sujithkumar Randive” who carried out the project work under my supervision.

This project report (Phase 1) is submitted for the Project Viva-Voce examination held on 13/12/2023

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# 1. Introduction

In today's rapidly evolving world, access to affordable and accessible healthcare remains a critical challenge for many communities. This project aims to address this issue by developing a mobile application that empowers individuals to proactively manage their health and contribute to valuable health data collection.

# 1.1 Motivation

Lack of access to healthcare professionals, limited diagnostic resources, and insufficient data on local health trends often contribute to preventable health complications and impede effective community healthcare planning.

# 1.2 Objective

The application aims to provide

* Simple diagnostics: The application will incorporate self-assessment tools and basic health monitoring features, allowing individuals to assess potential health risks and identify early warning signs.
* Health status identification: The tool will be equipped to assess an individual's health status through the collection and analysis of relevant data. This data could potentially include physiological readings, self-reported symptoms, and other pertinent information. By employing various analytical techniques, the tool will be able to generate an overall picture of the individual's health.
* Health stratification: The application will use personalized data and algorithms to generate user-specific risk profiles for various health conditions. This information can empower individuals to make informed decisions about their health and seek necessary medical attention. Based on the identified health status, the tool will further stratify the individual's health condition. This stratification will categorize individuals into different risk groups, allowing for targeted interventions and resource allocation.
* Early identification of high-risk individuals: The tool's stratification capabilities will enable the local healthcare community to proactively identify individuals at high risk of severe illness or requiring immediate hospitalization. This early identification allows for timely interventions and potentially prevents adverse health outcomes.
* Care coordination platform: The tool will function as a platform for healthcare professionals involved in the participant's care. This platform will facilitate communication and collaboration among different healthcare providers, ensuring coordinated and comprehensive care for the individual.
* Surveying health trends: By aggregating user data, the application will contribute to the creation of valuable data sets on local health trends. This data can be used by healthcare organizations and policymakers to improve resource allocation, disease prevention programs, and overall community health outcomes.

# 2. Existing Work / Literature Review

The concept of mobile health applications (mHealth) for self-assessment, risk analysis, and health trend monitoring has gained significant traction in recent years. Several existing applications offer features similar to those proposed for the application. A review of these applications and relevant research will provide valuable insights into the current landscape, identify potential challenges, and best practices, and inform the development of CHEA.

2.1 Existing mHealth Applications:

* Symptom checkers: Apps like Ada, WebMD, and Babylon Health offer symptom checkers that help users identify potential causes of their symptoms and recommend next steps.
* Risk assessment tools: Applications like MyGeneRank and Promethease analyse users' genetic information to assess their risk for various diseases.
* Health monitoring apps: Apps like Fitbit and Apple Health allow users to track their physical activity, sleep patterns, and other health metrics.
* Disease-specific apps: Several applications cater to specific health conditions, such as diabetes (mySugr) and asthma (AsthmaMD).

2.2 Relevant Research:

* A systematic review by Ventola (2014) found that mHealth interventions can improve patient engagement, self-management, and health outcomes.
* A study by Klasnja et al. (2017) showed that mHealth apps can effectively promote healthy behaviors and reduce risk factors for chronic diseases.
* A study by Mitesh et al. (2019) demonstrated the feasibility and potential benefits of using mobile apps for early detection and prevention of non-communicable diseases.

2.3 Challenges and Best Practices:

* Data accuracy and reliability: Ensuring the accuracy and reliability of self-reported data is crucial for generating meaningful risk profiles.
* Privacy and security: Secure data storage and adherence to ethical guidelines are essential for building trust with users.
* Accessibility and usability: The app should be user-friendly and accessible to individuals with diverse technological backgrounds and abilities.
* Cultural sensitivity: Adapting the app content and interface to local cultural contexts and languages is important for wider adoption and effectiveness.

# 3. Topic of the work

At its core, the application functions as a comprehensive platform for personalized health assessment and risk analysis. Users can input their symptoms, medical history, and other relevant health data. This information, combined with the power of pre-trained machine learning models, fuels the generation of accurate and insightful risk profiles. These profiles equip individuals with invaluable knowledge about their potential for various health conditions, facilitating proactive decision-making and early intervention strategies.

Beyond individual insights, the application transcends its personal scope and impacts the health of the broader community. By aggregating and anonymizing user data, it creates a rich and dynamic dataset on local health trends. This treasure trove of information serves as a powerful tool for healthcare organizations and policymakers, enabling them to optimize resource allocation, tailor disease prevention programs, and develop more effective community health initiatives.

Furthermore, the application fosters a sense of community and connection by providing a platform for users to share their experiences and offer support to one another. This collaborative environment empowers individuals to feel less isolated and encourages them to actively participate in their own health journey.

Ultimately, this mobile application embodies a vision for a future where individuals are empowered to proactively manage their health and contribute to a healthier community. Through its combination of personalized health management functionalities and community-driven data collection, this application lays the foundation for a transformed landscape of healthcare, one where informed decision-making, early intervention, and collective well-being reign supreme.

# 3.1 System Design / Architecture

3.1.1 Components:

1. Mobile and Desktop App:
   * Developed using Godot game engine.
   * Responsible for:
     + User interface and interaction.
     + Symptom and health data collection.
     + Self-assessment tools and risk analysis based on user data and pre-trained models.
     + Visualization of health trends and risk profiles.
     + Secure communication with the backend server.
2. Website:
   * Developed using plain HTML, CSS and Javascript
   * Offers functionality similar to the mobile and desktop app.
   * Provides access to additional features such as detailed health information, community forums, and educational resources.
3. Backend Server:
   * Hosted on Google Cloud Platform (GCP) or Firebase.
   * Responsible for:
     + Database management (user data, health records, model files).
     + Processing and analysing user data.
     + Running machine learning models for diagnosis and risk assessment.
     + Securely storing and transmitting data.
4. Machine Learning Model:
   * Developed and trained in Google Colab.
   * Uses computer vision and machine learning algorithms for diagnosis and risk prediction.
   * Model files are copied to the data branch for integration with the mobile, desktop, and website components.

3.1.2 Data Flow:

1. Users interact with the app (mobile, desktop, or website) to input data (symptoms, health information, etc.) and utilize features.
2. User data is securely transmitted to the backend server.
3. The backend server stores user data in the database and performs data analysis.
4. The server runs the machine learning model on the user data to generate diagnoses and risk assessments.
5. Results and visualizations are sent back to the user's chosen interface (mobile, desktop, or website).
6. When the machine learning model is updated in Google Colab, the updated model files are copied to the data branch for integration with other components.

3.1.3 Technology Stack:

1. Mobile and Desktop App: Godot game engine
2. Website: Web framework (e.g., Django, React)
3. Backend Server: GCP or Firebase
4. Database: Google Cloud SQL or Firebase Realtime Database
5. Machine Learning: Google Colab
6. Computer Vision: TensorFlow, OpenCV
7. Programming Languages: Python, JavaScript (for website), GDScript (for Godot)

# 3.2 Working Principle

This app aims to empower individuals to manage their health proactively and contribute valuable data to community health research. It utilizes a simple but effective approach, combining questionnaires with machine learning to generate personalized risk profiles and offer actionable insights.

Risk Profile Creation:

The app begins by inviting users to complete a questionnaire covering their medical history, symptoms, and lifestyle habits. This information is then fed into machine learning models trained on a vast database of previously recorded health profiles and diagnoses. These models analyse the data and generate individual risk profiles for various health conditions.

Simple Diagnostics and Recommendations:

Based on the generated risk profile, the app offers a simple diagnostic assessment, highlighting potential health concerns and their associated likelihood. This information is presented in an easy-to-understand format, empowering users to make informed decisions about their health. Additionally, the app provides personalized recommendations, advising users to visit a healthcare facility if their risk for specific conditions falls above a certain threshold.

Data Aggregation and Health Trend Mapping:

Once a user receives a proper diagnosis or undergoes treatment for a health condition, they can update their profile within the app. This anonymized data is then aggregated and analysed to generate dynamic health trend maps. These maps provide valuable insights into prevalent health concerns within the community, enabling healthcare professionals and policymakers to identify areas needing targeted interventions and resource allocation.

Local Storage and IoT Integration:

To ensure user privacy and security, the app stores risk profiles locally on individual devices. This eliminates the need for storing sensitive health data on a central server, minimizing potential data breaches. Additionally, the app integrates with various Internet of Things (IoT) devices, such as wearable health trackers. These devices provide the app with real-time health data, further enhancing the accuracy of risk profiles and personalized recommendations.

Medical Professionals and Quicker Deductions:

By integrating with IoT devices and storing risk profiles locally, the app empowers medical professionals to access relevant health data and make quicker deductions about patients' conditions. This streamlined approach can lead to earlier diagnoses, more effective treatment plans, and improved patient outcomes.

# 3.3 Expected Results

The successful implementation of the application is expected to lead to significant positive impacts, including:

* Increased access to basic healthcare resources, especially in underserved communities.
* Improved early detection and prevention of health problems.
* Enhanced community awareness of health trends and risk factors.
* Empowering individuals to take control of their health and well-being.
* Providing valuable data for informed decision-making in local healthcare planning.

This project aims to contribute to a healthier and more resilient community by empowering individuals and creating a data-driven approach to community health management.

3.4 Individual Contribution

# 4. Conclusion

Despite initial challenges and the inherent complexity of the project, significant progress has been made in developing this innovative health application. The core backend infrastructure has been established, laying the foundation for further development and integration of key functionalities. Additionally, a foundational machine learning model capable of discerning specific health conditions has been successfully implemented, demonstrating the application's potential for personalized health assessment.

While substantial work remains to be done, the current progress provides a solid starting point for the project's next phase. Ongoing efforts will focus on expanding the application's functionalities, including the integration of additional health assessment tools, risk analysis models, and user-friendly interfaces. Additionally, collaborative efforts will continue to refine and improve the existing machine learning models and explore the integration of new algorithms for broader health diagnosis capabilities.

With continued dedication and focus, this project has the potential to revolutionize the way individuals manage their health and contribute to improved community well-being. The positive momentum established in the initial phase provides a foundation for continued progress and the development of a truly impactful mobile application for proactive health management.

# 5. References

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# 6. Biodata

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