SCS 3214 / IS 3113 - Group Project II

University of Colombo School of Computing

Ayura

A Personalized Health Application

Group 01

Details of Project Supervisor, Co-supervisor, Advisors and Clients

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Name of the supervisor: Dr. Thilina Halloluwa

…………………………….   …………………

Signature of the supervisor   Date

Proposed Project Co-Supervisor (Assigned by Course Coordinator),

Name of the co-supervisor: Ms. Sanduni Thrimahavithana

…………………………….   …………………

Signature of the co-supervisor   Date

Project Advisors: (External industry advisors, if any)

…………………………………………………………………………………….

The client of the Project (If applicable, otherwise supervisor will be considered as the client)

Name of the client:

Address of the client:

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1. The Goal and Objectives

Goal:

To empower Sri Lankans to take control of their health despite cultural and linguistic barriers, while raising awareness and promoting healthier lifestyles to enhance the overall well-being of the population.

Objectives:

- Provide comprehensive information on the significance of maintaining personal health, the importance of early symptom recognition, and the benefits of adopting healthy habits.

- Encourage users to engage in regular physical activities by providing personalized activity suggestions and offering challenges to motivate and maintain a healthy level of physical activity.

- Offer a feature that generates personalized meal plans based on individual calorie needs, considering local food preferences, while emphasizing nutritious choices and portion control.

- Incorporate tools to monitor sleep patterns, offer sleep hygiene recommendations, provide resources for managing stress, promoting healthy sleep habits, and supporting mental well-being.

- Ensure user-friendly interface and language localization.

2. Tentative Problem Definition

Due to busy lifestyles and a lack of awareness, individuals often neglect physical, mental well being and personal health until they are faced with serious health issues. Following are some of the major issues that were noticed in the current context.

- Lack of motivation in engaging in physical activities

- Lack of knowledge regarding the significance of maintaining personal health

- Lack of awareness in nutritious food choices

- Disregarding early stage symptoms of illnesses due to lack of awareness

- Lack of emphasis on healthy sleep routines and mental health

The use of a mobile application that can assist users in proactively maintaining their personal health in daily life would be the best solution for this issue. However most of the applications in this domain are not specifically designed for Sri Lanka with all the required functionalities. Most of the popular health applications in the domain are not specifically designed for Sri Lankans with all the required functionalities and needs while they are also focussed on isolated functionalities.

3. Introduction to the Project

Ayura is an all in one mobile application where users can proactively maintain and track their personal health. It serves as the user's constant companion, providing them with the tools, guidance, and support to stay on top of their well-being, all conveniently accessible through their smartphone.

Through Ayura, users can track various aspects of their health, get meal plans according to their need for calories and also get workout suggestions. The application collects data from monitoring their daily footsteps, heart rate and more user input data regarding health issues / symptoms to understand their health status. With this information at fingertips users get the chance to set goals and challenge themselves to improve their fitness and wellbeing.

3.1. How is 'Ayura' unique from existing health related applications?

Catered to Sri Lankan LifeStyle

Unlike most of the other applications 'Ayura' addresses the specific needs of the Sri Lankan lifestyle. It overcomes the language barrier by providing all services in local languages (currently in Sinhala and English with plans to provide Tamil language in future)

Locally accepted meal plans

Most of the existing applications lack accurate meal plans for local Sri Lankan foods, often failing to consider the unique context of Sri Lankan cuisine. For instance, a typical rice and curry meal in Sri Lanka includes a significantly larger portion of rice compared to some other countries, where a smaller cup of rice may be served. Similarly, meat consumption differs between Sri Lanka and countries like the United States, as meat is typically treated as a side dish rather than the main component of a meal in Sri Lankan cuisine.

Indigenous food sources with specific nutritional properties

Existing applications do not provide localized meal suggestions tailored to Sri Lanka, which incorporate indigenous nutritional elements for specific health conditions like diabetes.

Customized Sleep Recommendations for Sri Lanka Climate

'Ayura' offers tailored sleep suggestions and default routines designed specifically for Sri Lanka, considering the absence of major seasonal changes such as winter, autumn, summer in this tropical country located near the equator. Additionally, it provides valuable information on sleep cycles and the biological clock, empowering users with tools to calculate and achieve optimal levels of sleep.

Analyzing user data and providing personalized suggestions

While numerous existing applications offer the ability to track vitals, symptoms, and moods, they typically lack comprehensive data analysis. In contrast, the proposed application will analyze this data to provide personalized suggestions and health tips tailored to each individual.

Also it will be providing mechanisms to mental well being based on moods such as white noise, guided meditation etc.

All-in-One Health Management: Consolidating Tracking, Nutrition, Mood, and Sleep in a Single App

Unlike existing fragmented solutions where users have to install separate apps for activity tracking, meal calculation, mood monitoring, and sleep routines, our application integrates all these functionalities into a single, comprehensive platform. This eliminates the need for multiple app installations, providing users with a centralized and streamlined experience for managing their overall health and well-being.

4. The scope of the project

Personal Health Monitoring

Activity Tracking

Vitals/Symptoms and Mood Tracking

Medical Report Keeping

Sleep Tracking

Medication Tracking

Calorie / Water Intake Tracking

Personalized Suggestions

General Health Tips

Weekly Health Overview

Meditation / Mindfulness

Localized Meal Plans

Physiotherapy / Yoga Suggestions

Nearby Government Hospitals

Community

Community Creation

Leaderboards

Community Challenges

Gamification of Personal Health

4.1. Users (possible actors) of the system:

End User

4.2. Main functionalities of the system:

Registration

- User shall be able to register to the system by creating an account using an email and password and entering the required information such as,

    ○ Name (For identification purposes)

    ○ Birthday (To calculate age for BMI, suggestions, notifications etc)

    ○ Gender (For index calculations and specific health conditions)

    ○ Nationality (For providing seasonal updates)

    ○ Height, Weight (For providing suggestions on BMI, calorie & water intake etc.)

    ○ Activity level (For providing suggestions on physical fitness)

Activity and Sleep Tracking

- Users shall be able to track daily activities such as walking, running, cycling, staircase steps with the use of smart devices and also by adding details manually.

- Users shall be able to track their sleep with the use of smart devices and by adding details manually.

- User shall be able to set up sleep and wake up time reminders

- User shall be able to get sleep time suggestions upon entering wakeup and sleep times (Sleep cycle calculation) and health tips about sleep

Medication Tracking

- User shall be able to add medication reminders at intervals

- User shall be able to track medication intake and get overall details of intake over time

Vitals / Symptoms and Mood tracking

- User shall be able to track vitals such as heart rate, blood pressure and stress levels with the use of smart devices, through uploaded reports and by manually updating them

- User shall be able to record symptoms and moods daily and get health suggestions according to the frequency and severity of symptoms and moods over the time

- User shall be able to see collective visual representations of vitals and symptoms weekly, monthly etc

Medical Report Keeping

- User shall be able to upload medical reports to the system with the dates

Health Tips & Suggestions

- User shall be able to receive health tips based on vitals, symptoms and mood history. Tips will include,
    - Graph showing the recent records
    - Nearby government hospitals in google map
    - General health tips for that respective symptom
    - Breathing exercises (for mood problems)
    - Physiotherapy/ Yoga suggestions
    - Mental health suggestions (meditation, mindfulness)
    - Meal suggestions
    - Water Intake Monitoring

Water Intake Tracking

- User shall be able to see the amount of daily water consumption required according to body weight and height

- User shall be able to enter the water intake daily

Meal Plans

- User shall be able to see daily calorie requirements according to the weight and height

- User shall be able to create meal plans for the amount of calories as per preference

- User shall be able to receive customized meal plans according to related health conditions
  - In the first ever meal plan recommendation, the user shall be able to select dietary preferences and any allergies

Community

- User shall be able to get community suggestions based on health conditions

- User shall be able to search for communities and join them

- User shall be able to post text, media in communities

- User shall be able to like and comment on posts in communities

Challenges

- User shall be able to take part in individual and community challenges related to health goals and wellbeing

- User shall be able to get challenge recommendations based on health conditions

- User shall be able to search for challenges and take part

- User shall be able to share challenge winnings in communities

Notifications

- User shall be able to set up notifications and reminders for activity tracking, medication reminders, symptoms and mood tracking, sleep routines, water intake, meal reminders, challenge and community notifications

Weekly Report

- User shall be able to receive a weekly report about health overview of past week, which is shareable in communities and downloadable

Multilingual Facilitation

- All functions of the applications will be available in both English and Sinhala languages.

4.3. Out of Scope Functionalities

Future Works:

- Providing all functionalities of the application in Tamil language
- Using machine learning for providing health tips, meal recommendations, sleep routines, community suggestion etc when the application collect enough data to train machine learning models

4.4. Component Diagram
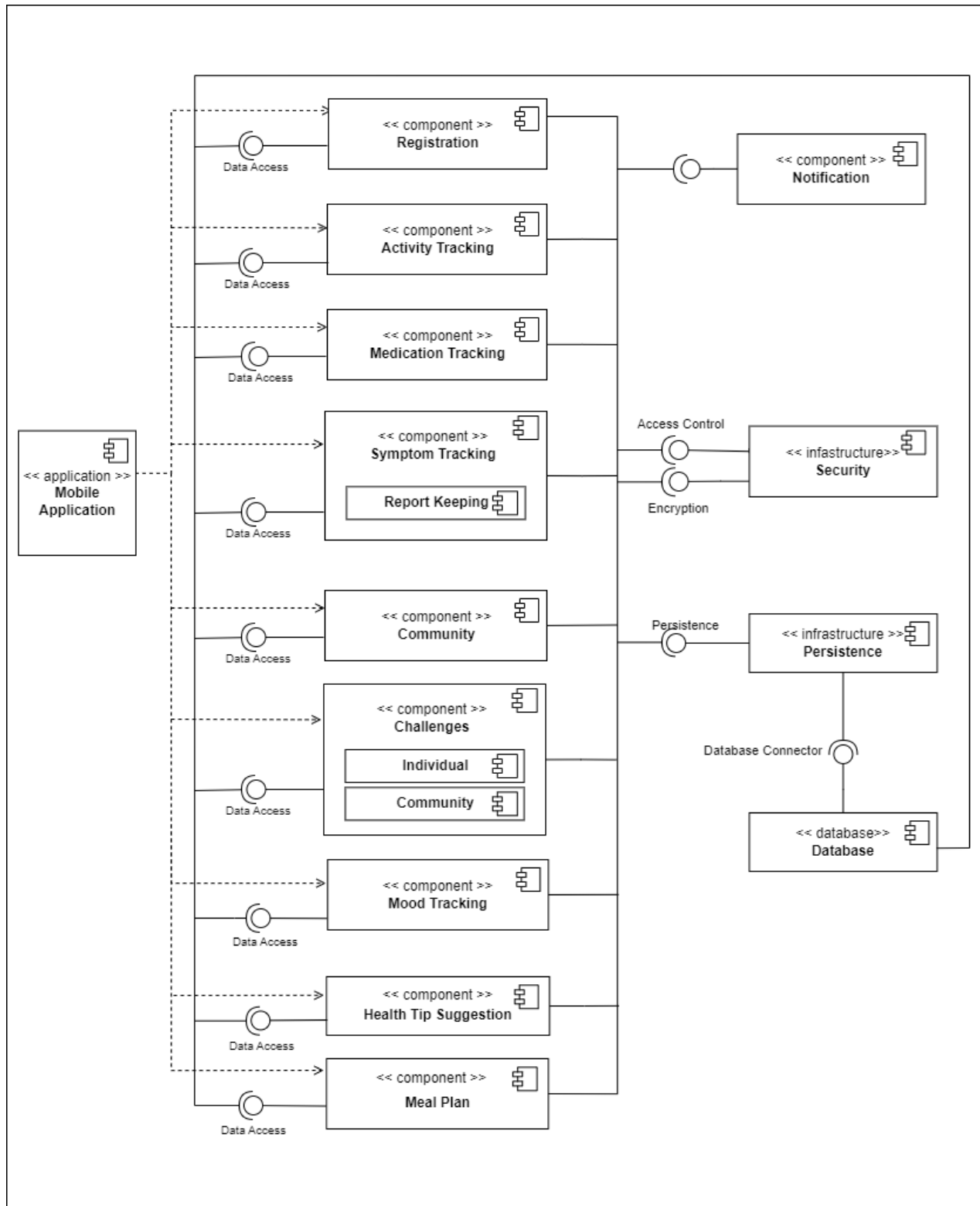

Figure 01: Component Diagram

5. Tentative Technologies

Frontend Development   :   Flutter

Backend Web API   :   .NET

Database   :   MongoDB

Hosting   :   Azure

Frontend Design   :   Figma

Graphic Design   :   Canva, Illustrator

Version Management   :   Git & GitHub

Project Management   :   GitHub Projects

Documentation   :   LaTeX, Google Drive, Google Workspace

UML Diagrams   :   Draw.io

6. Feasibility Study

6.1. Social Feasibility

Social feasibility covers how the target audience is willing to accept the proposed solution. A survey was conducted to get an idea of user experience with health related applications and their expectations. Several questions were asked from a sample of the target community through a Google Form.

Following are the questions that were asked regarding the user experience and expectations about personal health applications.

The survey participants were asked whether they use any health related mobile applications in their day to day life
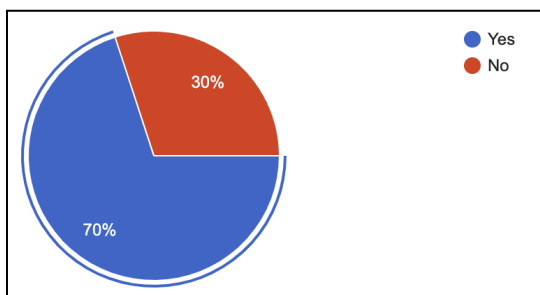
As per the response of 70% of participants, they do not use any health related mobile applications in their day to day life.

Figure 02: Survey Data - Usage of any health related mobile applications

Then the participants who said that they do not use any health related mobile application were asked whether they are aware of the existence of any such applications such as Samsung Health, Apple Health, Google Fit etc.
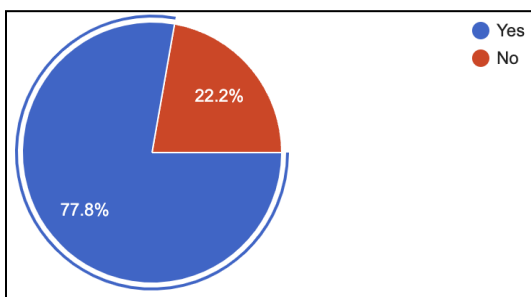
According to the responses, nearly 78% of them were aware that such applications exist. Then they were asked for reasons why they are not using those applications if they know such applications exist.

Figure 03: Survey Data - Awareness of the existence of health related mobile applications

Among the answers of participants, the following points were prominent reasons for not using such applications.

- I am not familiar with the English language
- Those applications are not suitable for Sri Lankan lifestyle
- There is no single application to cater for all health requirements
- Those applications are very complicated, I do not understand

With this feedback it is clear that although there are existing health applications, those are not very user friendly to the local community of Sri Lanka.

One of the main features of the proposed application is to localize it to the needs of the Sri Lankan community, matching the lifestyle, food patterns and linguistic convenience. Hence introducing this application to the local audience seems feasible.

After that the participants were asked what are the features they expect from a health related mobile application.
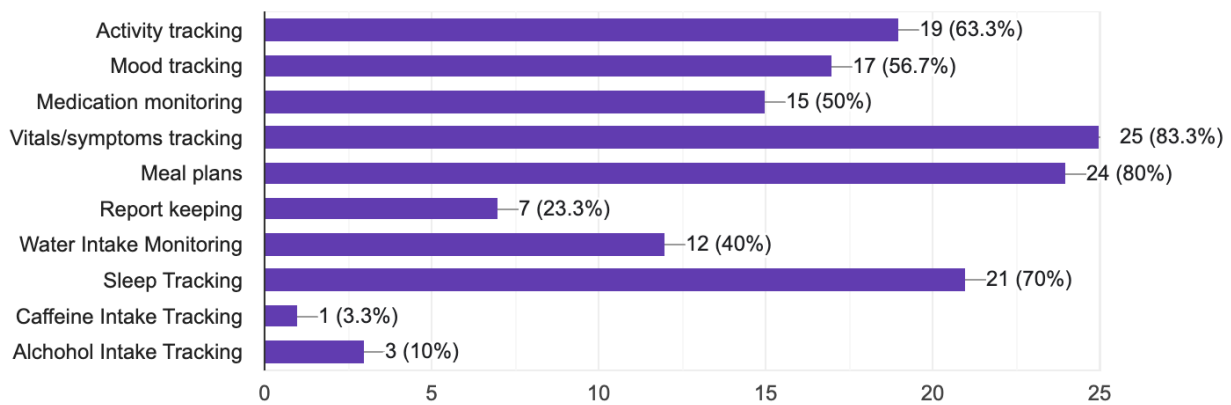

Figure 04: Survey Data - Features expected from a health related mobile application

Accordingly, most of the participants prefer to monitor and track their vitals, symptoms, meal plans, sleep, activity and moods. These features will be included in the proposed application hence it is clear that the audience is ready to embrace these features.

6.2. Operational Feasibility

Operational feasibility is concerned with how the defined system solves the targeted problem within the scope of the requirements.

The proposed application will feature user-friendly, modern user interfaces (UIs), ensuring that users can easily navigate and utilize the application even with basic knowledge. Moreover, to eliminate language barriers, the application will be available in both Sinhala and English languages. This language flexibility allows users to comfortably use the application in their preferred language, making it accessible to a wider audience. By prioritizing the UI design and offering language options, it aims to provide a seamless and inclusive user experience.

6.3. Technical Feasibility

The application will be a mobile application which can be easily downloaded from Google Play Store (for Android) and Apple App Store (for iOS). All tentative technologies that will be used for the development of this application are mentioned under section 5, Tentative Technologies.

All these tentative technologies are either free and open source or freely available for university students. And as almost all those are prominent technologies among developers, there is a huge online community of users to seek support from. Also all those frameworks, technologies are well documented making it easy to comprehend underlying mechanisms by referring to the documentations.

6.4. Resource and Economical Feasibility

Resource feasibility involves assessing the availability and sufficiency of resources required to gather accurate and reliable data for the application. To ensure the integrity of the data, it is crucial to collect information from trustworthy sources such as the World Health Organization[1], the Ministry of Health[2], and the Department of Ayurveda[3] and Biodiversity for Food and Nutrition[4]. These reputable websites will serve as reliable references for obtaining the necessary data.

By utilizing these reliable sources, it can be assured that the information incorporated into the application is accurate, up-to-date, and credible. This approach will enhance the trustworthiness and reliability of the application, providing users with valuable and trustworthy insights into their health and well-being.

All development team members have access to a computer or laptop, and most of the software and tools used by the developers are available for free (open source) at no additional cost.

Users will only require a smart mobile phone with an internet connection to use the system. Initially, the application development will be financed through investments from developers. There are plans to generate revenue and recover the costs through various means, including premium packages, in-application advertising, and a subscription model, once the application is deployed.

6.5. Legal & Ethical Feasibility

Legal and ethical feasibility is how the project legally adheres to the relevant laws, such as data protection of the users and use of sensitive and confidential data, licences, copyrights, and ethical requirements. All client data handling and privacy policies will adhere to the National eHealth guidelines[5].

The users can log in to the system using their login credentials and access the system from their profile. User's profile data will not be shared with any third party and there are no potential/harmful risks when using the system by users.

Open-source software will be used to develop software and document the software. Google Drive and other products are being used to document and manage the documentation. Discord will be the main communication platform. Emails will be used to contact the supervisor, co-supervisor, and other professional bodies as per requirement. Surveyed to collect data from the existing users of the university and guaranteed that there will be no sensitive data being collected.

If any GPL-licensed software is being used, the team will ensure to make the code open as well. Otherwise, licences such as Apache, MIT, and BSD will be used.

Git-hub will be used to manage source code as well as the project management Kanban board. Coding IDEs and other licence-paid software will be used, which are available for student-free usage, or free and open-source software will be used. All the developments are done by adhering to the country's laws and regulations.

6.7. Schedule Feasibility

The development team consists of six members and the project will be spread over a time period of four months from June 2023 to the end of September 2023.

System Development Phase	Estimated Man Hours
Problem Identification	80 hours
System Analysis	100 hours
System Design	220 hours
System Implementation	420 hours
System Testing	120 hours
System Deployment	10 hours

Table 01: Estimated man hour breakdown

An iterative and incremental software development methodology will be used as certain technological implementation methods of some system requirements are yet to be clearly defined.

7. Main Deliverables of the System

- Complete working software and source code

- Complete Software Requirement Specification

- User manual

- Administrators manual together with deployment instructions

8. The Project Plan

	PROJECT WEEK:	JUN 1	2	3	4	JUL 1	2	3	4	AUG 1	2	3	4	SEP 1	2	3	4	OCT 1	
1	Problem Identification	█																	
2	Requirement Analysis		█																
3	Feasibility Study		█																
4	Proposal Defense			█															
5	System Design		█	█	█														
6	Implementation Phase I				█	█	█												E
7	Testing Phase I					█	█												N
8	SRS							█											D
9	Interim Presentation								█										
10	Implementation Phase II									█	█	█	█						
11	Testing Phase II										█	█	█	█	█				
12	System Deployment															█			
13	Final Presentation																	█	

Table 02: Project Timeline

9. References

[1] "World Health Organization (WHO)," World Health Organization, https://www.who.int/ (accessed Jun. 16, 2023).

[2] "Ministry of Health," Ministry Of Health - HOME, http://www.health.gov.lk/moh_final/english/ (accessed Jun. 16, 2023).

[3] "World Health Organization (WHO)," World Health Organization, https://www.who.int/ (accessed Jun. 16, 2023).

[4] "Nutrition fact," Biodiversity for Food and Nutrition Project Sri Lanka, https://bfnsrilanka.org/nutrition-facts (accessed Jun. 16, 2023).

[5] National eHealth Guidelines and Standards, http://www.health.gov.lk/moh_final/sinhala/public/elfinder/files/publications/list_publi/NeGS_v_1.pdf (accessed Jun. 16, 2023).

S. Telgave, "What ASP.NET core is and advantages of using it," C# Corner, https://www.c-sharpcorner.com/article/what-is-asp-net-core-and-advantages-of-using-asp-net-core-how-to-setup-asp-net/ (accessed Jun. 16, 2023).

"What is flutter? benefits and limitations," Codemagic blog, https://blog.codemagic.io/what-is-flutter-benefits-and-limitations/#:~:text=The%20biggest%20advantage%20that%20Flutter,%2C%20Web%2C%20Desktop%2C%20etc (accessed Jun. 16, 2023).

10. Appendix

10.1. Technology Justification

10.1.1. Flutter framework with Dart for front-end development

- Development efficiency - Availability of a vast number of pre-built widgets that cover practically every part of the development process as well as the flexibility to personalize to meet specific needs and specifications.

- High performance - Consistent native-like performance results in fluid user experience.

- Resources and documentation - Availability of a broad range of resources ranging from official documentation to huge active community support.

- High scalability - No need of code rewriting when deploying applications to the other platforms such as web or desktop (Cross platform capabilities).

10.1.2. .NET for back-end development

- Development productivity - Availability of an ecosystem of libraries, frameworks and other tools make it easier to develop.

- Faster compilation - .NET is built on the foundation of a statically typed language, namely C#. This inherent characteristic provides it with the advantage of faster compilation as opposed to back-end frameworks that utilize dynamically typed languages like JavaScript.

- Accuracy and type safety - It is worth noting that real-time functionalities such as step count and heart rate measurement require efficient information transition between the client and server. Consequently, this framework proves highly advantageous in situations where accurate data representation and type safety are of utmost importance.

- Simple communication structure - Simple and convenient communication with Flutter frontend using appropriate Web APIs.

- API development - Provision of powerful tools and frameworks for building personalized lightweight and high performing Web APIs that meets specific requirements.

- Security features - Makes the application more secure with the pre-built security features.

10.1.3. Reasons to use a NoSQL database

- Schema less behavior, Can easily scale the database (horizontally) and distribute scale among multiple clusters. Health records evolve from time to time with different attributes, document oriented NoSQL databases provide such flexible data structures.

- Since this is a personal health application, the main collection would be 'users' and there may be few of top level collections as challenges, and community etc. The dependencies are less hence a clear separation of concerns and single responsibility principle can be applied clearly (a collection has one main purpose).

- No need for adding multiple related tables in RDBMS because almost all the fields can be nested inside a single collection ~ document. relationships slow down the performance. Can reduce the number of reads by nesting sub collections inside collections.

- Since applications have features which associate with Google's fit API and the responses are json objects and can be directly used with NoSQL databases. reduce the transformation delay.

10.1.4. MongoDB for Database

- High compatibility - The object oriented nature of Flutter and .NET works perfectly with MongoDB's document-oriented data model. It ensures the simplification of data mapping between the application and the database as a result of storing data directly as JSON-like documents.

- High performance - Rapid real-time read and write operations enhance the application's performance.

- Data security - User information can be securely stored and managed without facing any difficulty.

10.1.5. Smartwatches APIs

- Real time tracking - Real time tracking of user activities such as walking, running and sleeping as a result, this eliminates the need for manual input of these data. As a result, the application can be utilized to provide real time feedback enhancing the user interactions. Tracking these indicators inspires users to become more active, helps them set goals, and shows them how far they've come in terms of being healthier.

- Heart rate monitoring - Integrating the user's heart rate data allows for the analysis of trends over time as well as tracking the user's heart rate during exercises or other activities.

- Personalized Insights and Feedbacks - Utilization of smartwatch APIs allows for providing personalized recommendations and feedback for each user after collecting and analyzing the data.

10.1.6. Conclusion

From the client's perspective, the application's long-term maintenance and customization will be simple and convenient as the technologies stated above are well-known and in high demand in the industry. Clients will also be able to satisfy the changing needs of their users in the future due to the adaptability and flexibility offered by these technologies.

Finally, the Flutter(Front-End), .NET(Back-End) and MongoDB technologies will be greatly beneficial in terms of development, performance, cost effectiveness, scalability and maintenance.

11. Declaration

We as members of the project titled 'Ayura', certify that we will carry out this project according to guidelines provided by the coordinators and supervisors of the course as well as we will not incorporate, without acknowledgement, any material previously submitted for a degree or diploma in any university. To the best of our knowledge and belief, the project work will not contain any material previously published or written by another person or ourselves except where due reference is made in the text of appropriate places.

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