# TECHNICAL PROPOSAL

# PROJECT NAME: FITSWANA AI Health Coach

## MOTIVATION

The AI Health Coach project started to help solve common health problems like high blood pressure, high cholesterol, obesity, and diabetes. These issues are becoming more common because people don’t have access to affordable and personalized tools to manage their health.

Traditional health coaching is expensive, hard to scale, and doesn’t offer frequent support, leaving many people without the help they need to make and stick to healthy choices.

Most current health tools give general advice that doesn’t consider a person’s unique health data, daily habits, or risks. This makes them less effective in helping people improve their health over the long term.

The AI Health Coach aims to solve this by using artificial intelligence to give personalized, affordable, and easy-to-use health advice. It looks at a person’s health data, provides recommendations that fit their specific needs, and updates the advice as their health changes. This helps people take better care of their health and prevent problems before they happen.

## Evidence of Need:

* The World Health Organization (WHO) says that lifestyle diseases, like obesity, are a top cause of death worldwide. Over 650 million adults are affected by obesity alone.
* A study in The Lancet shows that health advice tailored to a person’s needs works much better than general advice.
* Surveys show that more than 70% of people want affordable, AI-powered tools to help them stay on track with their health goals. This project seeks to meet this unmet demand by combining cutting-edge AI technology with user-centric health management.

## SOLUTION DESIGN FOR AI HEALTH COACH

The AI Health Coach is designed to address the growing need for personalized, proactive, and accessible health management by leveraging artificial intelligence to bridge the gaps in traditional health coaching. The solution integrates advanced machine learning algorithms and AI models to analyze individual health data, lifestyle habits, and risk factors to deliver real-time, tailored guidance.

## FEATURES AND FUNCTIONALITIES

1. Personalization; The AI Health Coach should be able to tailor its advice to individual users based on their health data.

2. Accuracy; the system should provide scientifically valid and current health information.

3. Real-Time Feedback; the AI Health Coach should be able to monitor the user’s health metrics in real-time and provide timely alerts.

4. Goal tracking; the platform should allow users to set personal health goals and track their progress over time.

5. Integration with Wearables and Health Apps; the system should integrate with wearable devices (e.g., Fitbit, Apple Watch, etc.) and other health apps to collect data and synchronize metrics.

## DEVELOPMENT APPROACH

The web app utilizes Web3 technology, which utilizes blockchain. It offers decentralized data storage, giving users more control over their personal information and ensuring better privacy and security. Combining Web3 with Artificial Intelligence (AI) creates an innovative solution for health apps. AI can analyze large datasets and provide personalized health advice, from meal plans to workout suggestions and mental health tips, based on individual goals.

**Methodologies:** agile methodology

**Frameworks and Tools: react, typescript and Motoko**

## UNIQUE AND INNOVATIVE ASPECTS

Data privacy and security: In Web2, the data and infrastructure are usually controlled by centralized entities (e.g., cloud providers or application servers), which can lead to issues like data privacy concerns, single points of failure, and reliance on a few large companies. With Web3, the system operates in a decentralized manner, leveraging blockchain technology and decentralized storage, giving users more control over their health data, enhancing privacy, and reducing the risk of data breaches.

The ability to leverage smart contracts and decentralized applications (dApps). These enable trustless interactions and automatic execution of agreements, which could be beneficial in ensuring privacy, compliance with healthcare regulations, and facilitating secure sharing of health data without intermediaries. Additionally, Web3 can facilitate better integration with decentralized healthcare models, including peer-to-peer health data sharing, where users can securely share data with medical professionals or third-party services. This contrasts with Web2, where data is typically stored and controlled by central authorities.

Scalability and accessibility. In Web2 systems, scaling applications can be costly, especially when dealing with large amounts of user data. Web3 technologies, such as the Internet Computer Protocol (ICP), provide scalability through decentralized computing power, allowing the AI model to grow and serve users without the limitations or high costs associated with central cloud infrastructure. This could make the AI Health Coach more accessible globally, even to those in underserved or remote areas.

## LESSONS LEARNT

This project helped us learn a lot about front-end development, back-end development in Motoko and deployment on the ICP. Also, Ai integration in web3 projects with the use of HTTPS outcalls and cycles involved.

For future versions of the AI Health Coach, we will focus on getting various types of health data for various testing techniques and to make the advice even better from AI. Adding data from wearable devices or health trackers could give the AI real-time information, which would help it make more accurate suggestions.

## REQUIREMENTS DOCUMENTATION

## FUNCTIONAL REQUIREMENTS

* Personalization: The AI Health Coach should tailor its advice to individual users based on their health data.
* Accuracy: The system must provide scientifically valid and up-to-date health information.
* Real**-Time Feedback**: The AI Health Coach should monitor health metrics in real-time and provide timely alerts.
* Goal **Tracking**: The platform should enable users to set personal health goals and track their progress over time.
* Integration **with Wearables and Health Apps**: The system should integrate with wearable devices (e.g., Fitbit, Apple Watch) and other health apps for data collection and metric synchronization.

## NON-FUNCTIONAL REQUIREMENTS

* Performance: The AI Health Coach should respond to user inputs in under 2 seconds for most actions, like loading the dashboard, updating metrics, or generating recommendations.
* Security: Ensure confidentiality and security of user health data through encryption methods like AES and SSL/TLS for both storage and transmission.
* Usability: The platform should be easy to navigate, with a user-friendly interface that supports accessibility features, such as color contrast and screen readers, to accommodate users with disabilities.
* Scalability: The system must scale efficiently to handle increasing numbers of users and health data without a decline in performance.
* Availability: Maintain high uptime (e.g., 99.9%) to ensure continuous access to health data and recommendations for users.

## DESIGN DOCUMENTATION

## TECHNOLOGY ANALYSIS

In recent years, Artificial Intelligence (AI) has emerged as a transformative tool for solving problems in health and wellness. AI can analyze user data, learn patterns, and provide recommendations that are specifically tailored to individual users. For example, AI-powered applications can suggest personalized meal plans, recommend fitness routines, and even offer mental health support. These AI-driven solutions make health guidance more effective by addressing the unique needs of each user, ensuring a better experience and improved outcomes.

The development of Web3 technology has introduced a new era for web applications. Unlike Web2, Web3 is built on blockchain technology, which decentralizes data storage and management. This means users are no longer reliant on a single organization to store and manage their information. Instead, Web3 provides a secure, transparent, and user-controlled environment, addressing many of the privacy and security concerns associated with Web2. With Web3, users have full control over their data, and transactions or interactions are more transparent, fostering trust and accountability.

Combining the capabilities of AI with the security and decentralization of Web3 presents a unique opportunity to revolutionize health and wellness applications. By integrating AI’s ability to provide personalized health guidance with Web3’s secure and private data management, this project aims to address the limitations of existing systems. The result is an AI Health Coach web application that empowers users to take charge of their health in a way that is safe, accessible, and effective.

This background study highlights the importance of creating a modern platform that not only meets the health and wellness needs of users but also prioritizes their privacy and autonomy. It sets the foundation for a solution that blends cutting-edge technologies to overcome traditional barriers and improve the overall user experience.

## DESCRIBING WEB2

A diagram of a diagram

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In a typical Web2 setup, the user's device, such as a computer or smartphone, interacts with the system through a web browser. The browser sends HTTP requests to the web server, which is responsible for routing these requests to the appropriate application server. The application server then processes the business logic, engages with the database to store and retrieve necessary data, and communicates with external APIs as needed. Additionally, the authentication server ensures secure user login and manages access control. External APIs allow the application server to fetch or send data to third-party services, enhancing the system's functionality and integration capabilities.

## DESCRIBING HOW AI WORKS ON WEB2

AI systems like GPT and others rely on intensive computational power, primarily through GPUs (Graphics Processing Units) and TPUs (Tensor Processing Units), to process large amounts of data and execute complex mathematical operations for training and inference. These computational demands make it challenging for individual users without access to high-end hardware to run such models locally.

## How GPT Works on Web2

GPT in Web2 is hosted on centralized servers, typically in data centers equipped with powerful GPU/TPU clusters. Here's how it works:

* User Request: A user sends a query through a web app or API.
* Server Processing: The query is transmitted to servers where the AI model is hosted.
* Inference Execution: The model processes the input using GPU resources, generating a response.
* Response Delivery: The output is sent back to the user.

This system centralizes computation, meaning users only need an internet connection and a device to access the AI. However, the computational load remains on the service provider, which incurs high costs for maintenance, scaling, and energy consumption.

## DESCRIBING WEB3 (decentralized Web)

In Web3, the user accesses the application through a Web3-enabled browser or app, such as MetaMask. Unlike Web2, where HTTP requests are sent to centralized web servers, Web3 transactions are processed and validated by decentralized blockchain networks. Instead of traditional backend servers, business logic in Web3 is executed via smart contracts, which are self-executing contracts on the blockchain. Data is stored on decentralized networks like IPFS, and user authentication is managed through cryptographic wallets instead of usernames and passwords, giving users full control over their data. External data, such as health information from wearables, is fetched through decentralized oracles. Additionally, Web3 applications leverage decentralized computational units called canisters (in platforms like ICP) to manage logic, storage, and interactions without relying on central servers. This decentralized approach ensures transparency, security, and user control, as all processes business logic, data storage, and authentication are handled through distributed networks, smart contracts, and cryptographic methods.

A diagram of a blockchain system

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The user interacts with the decentralized application (dApp) through a browser interface, enabling them to perform various actions seamlessly. The dApp serves as the intermediary, communicating with the blockchain to handle transactions and ensure secure data storage. Validators play a crucial role in this ecosystem, as they confirm transactions and uphold the integrity of the blockchain network. To manage user-generated content or application-related data, decentralized storage solutions are utilized, offering a reliable and distributed data storage mechanism. Furthermore, the integration with crypto wallets enhances the dApp's functionality by providing secure authentication and facilitating transactions, ensuring that users can efficiently and safely engage with the blockchain.

## DESCRIBING HOW OUR AI (FITSWANA) WORKS ON WEB3

User devices establish internet communication with various nodes of the Internet Computer, which act as intermediaries in the system. These nodes are responsible for running the frontend and backend canisters, facilitating seamless interaction between the user's interface and the system's core functionalities. To ensure efficient computation and data processing, HTTPS outcalls are utilized to link the backend canisters to an AI server, which relies on a robust GPU/TPU Data Center. This setup enables the AI server to handle complex computations required for processing data and generating accurate results. Additionally, decentralized cloud servers play a crucial role in this architecture by securely storing user data, ensuring that information is both safe and easily accessible when needed. This comprehensive infrastructure supports a reliable and secure user experience on the Internet Computer.

A diagram of a computer network

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## DESCRIBING THE GAP BETWEEN USING WEB2 AND WEB3

Data privacy and security: In Web2, the data and infrastructure are usually controlled by centralized entities (e.g., cloud providers or application servers), which can lead to issues like data privacy concerns, single points of failure, and reliance on a few large companies. With Web3, the system operates in a decentralized manner, leveraging blockchain technology and decentralized storage, giving users more control over their health data, enhancing privacy, and reducing the risk of data breaches.

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## FITSWANA SYSTEM ARCHITECTURE AND DESIGN

## Software logical design for FITSWANA AI (the Health coach)

A diagram of a computer server

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The Frontend Canister is responsible for managing the user interface and facilitating communication between the user and the backend system. This interaction is essential for ensuring a smooth and responsive user experience. The Backend Canister, on the other hand, plays a crucial role in managing HTTPS outcalls to the AI server. It also interacts with decentralized storage to handle data efficiently. Meanwhile, the External AI Server is tasked with processing the AI model, which involves complex computations and data analysis. Once the AI server has processed the necessary information, the results are transmitted back through the canisters, ultimately reaching the user. This seamless flow of data ensures that users receive accurate and timely responses from the AI system, enhancing the overall functionality and reliability of the application.

## Frontend canister

Which is responsible for handling the user-facing components of the application. It manages how the application looks and how users interact with it. It will include.

* User Interface (UI): The part of the application that users directly interact with.
* User Input: It collects user data and sends it to the backend canister for processing.
* Interaction with Backend: The frontend canister communicates with the backend canister to fetch and display processed information.
* Rendering Data: After receiving data from the backend canister, the frontend canister is responsible for displaying it to the user in a meaningful way, such as visual graphs, health statistics, or personalized suggestions.

## Backend canister

Which processes the business logic, handles computations, and manages data storage. It includes.

* Business Logic: The backend canister processes complex computations, rules, and workflows.
* Data Storage: The backend canister manages the application's data and interacts with decentralized storage.
* Interactions with External APIs: The backend canister is responsible for integrating with external services, such as wearables (e.g., Fitbit, Apple Watch) or other health apps. It communicates with these external services to fetch real-time data, such as heart rate or exercise activity, and processes that information for the frontend canister.
* Business Processes: It manages core application processes such as validating user data, making decisions about health advice, tracking goals, and sending alerts.