Bee Balanced
Tech Feasibility

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1. Introduction

1.1 The Big Picture

        The health and wellbeing of the next generation are at a critical point in the fast-paced digital society we live in. Effective health interventions are more important than ever because youth obesity rates have tripled over the past three decades and over 18% of children and adolescents in the United States are considered obese. Youth are becoming alarmingly more susceptible to avoidable conditions like diabetes and heart disease as a result of unhealthy eating habits and inactivity. Additionally, mental health problems are becoming more prevalent. One in five young people has a mental health illness, which is made worse by poor coping strategies and social isolation. Through the creation of an entertaining web application that encourages healthy food and physical activity while also improving social well-being via interactive games and timely alerts, our project seeks to address these urgent challenges. We can empower the next generation to make healthier decisions and enhance their general quality of life by promoting a holistic approach to health. The goal here is to create a resilient, healthier society.

1.2 The Problem

        The current strategies for encouraging young people to lead healthy lives are centered on community projects and conventional teaching techniques. However, these strategies frequently lack the involvement required to effectively reach young people. Our sponsor, Dr. Okim Kang, is a professor of English who specializes in juvenile ethics. Dr. Kang has studied the ethical aspects of health and seeks to put in place workable digital solutions. We believe a tech-driven solution is necessary.

1.3 Our Solution Vision

        Our solution is a web application that integrates game-like interactions, delivers daily notifications, and routinely checks in on users' well-being. The application offers an engaging, simplified approach that can connect more intimately with today's youth. We are creating a web application with a specific objective of encouraging young people to adopt and sustain healthy lives. With its interactive features, this platform will function as an extensive guide that encourages healthy eating habits, physical health, and social well-being.

        One of the application's primary features will be daily alerts that push users to choose healthy foods and exercise, creating persistent routines. We'll also include game-like features that let users keep track of their progress, take part in challenges, and receive incentives for hitting health milestones. This gamification component fosters peer social contact and increases motivation, all of which contribute to the development of a supportive community. Our application offers a unified and dynamic solution that enables young people to take charge of their health in a fun and efficient way by solving the problems of poor engagement and fragmented support.

Now that the critical need for a more successful strategy to encourage young people to lead healthy lives has been established, we can move on to a more thorough examination of the technology issues and solutions our project will deal with. We start by looking at the main technological challenges—such as user engagement, data tracking, and interactive features—that we anticipate running into while creating our web application in this Technological Feasibility Analysis document.

We will examine each of these topics in detail in the following sections, along with possible substitutes and the techniques we used to assess them. We'll explain why we chose the best options, taking into account both their viability and compatibility with the objectives of the project. We will wrap up by providing an outline of our implementation approach, including the following phases and the way we intend to launch this innovative application to successfully involve young people in their health journey.

2. Technological Challenges

2.1 Mobile-Friendly, Responsive Design
- Challenge: Ensure the app is responsive and accessible across multiple device types and screen sizes, without compromising its performance or functionality.
- Details:
    - Frameworks: To accommodate different devices, we might integrate responsive design frameworks such as Bootstrap or Tailwind CSS. These frameworks offer mobile-friendly design options that allow layouts, images, and more interactive components to adapt across different screen sizes.
    - Mobile-First Optimization: When designing elements, we will prioritize the functionality on mobile devices as this is what the app will mainly be used on. This includes simple navigation and touch-friendly controls.
    - Performance Considerations: We will need to limit heavy images or animations on mobile devices and ensure any adaptive features load efficiently. Caching strategies may also help the page load quickly across all devices.

2.2 Notification System for User Engagement
- Challenge: Implement a reliable notification system that delivers timely prompts, reminders, and motivational messages to encourage user interaction.
- Details:
    - Technology Choice: Push notifications can be implemented via the Push API or Web Push Protocol, and SMS/email notifications through services like Twilio or Firebase Cloud Messaging. SMS notifications are the end goal as troubles may

arise getting participants to check their email or notifications from outside sources.

- ○ User Preferences and Consent: To adhere to privacy standards, users must opt-in for notifications, specifying their preferred method and timing preferences.
- ○ Scheduling: A scheduling algorithm will manage periodic prompts at optimal times, ensuring no prompts are sent during undesirable times. This will help balance user engagement with respect for user-specified quiet hours. An outside software on the server side could be used to manage this however, it should not be difficult to implement.

2.3 Real-Time Interactive Feedback and Gamification
- ● Challenge: Provide engaging and meaningful feedback, along with gamification elements, to keep adolescent users interested over extended periods of time.
- ● Details:
  - ○ Front-End Frameworks: Using front-end frameworks like React, the application can provide real-time interactivity with quick response times, giving users immediate and rewarding feedback based on their input.
  - ○ Gamification Mechanics: Features such as points, badges, and levels can be integrated to motivate users through a rewards system, creating incentives for proper use and improvement of one's lifestyle. We will carefully design these gamification mechanics to offer clear, achievable milestones.
  - ○ Responsive and Lightweight Gamification: These features need to be lightweight to avoid issues with performance, especially on mobile devices. We can achieve this by limiting animations or effects while still maintaining a balance between engagement and functionality.

2.4 *Robust Data Storage*
- ● Challenge: Ensure the app can store a robust amount of data and can efficiently and safely recall any and all information that has been stored.
- ● Details:
  - ○ Database Choice: Considering the high volume and frequency of data submissions, relational databases such as MySQL offer solid support due to their scalability. MySQL supports data consistency, which is essential for accurately tracking user progress and history.
  - ○ Data Structuring: Proper indexing and partitioning strategies will need to be applied to manage large datasets. The query performance needs to be optimized to ensure data retrieval remains efficient as the user base grows.
  - ○ Data Security and Compliance: Sensitive data will be stored and encrypted, ensuring privacy and compliance with security standards if applicable. Regular

backups and automated data monitoring could also prevent data loss and mitigate some risks.

2.5 Scheduled User Prompts Based on Preferences
- Challenge: Develop a personalized scheduling system that sends prompts to users at their chosen intervals, while avoiding disruptive timings.
- Details:
    - Scheduling Technology: Our task scheduler will need to enable us to set up periodic prompts, adjusting based on user preferences. The app's backend will maintain schedules for individual users and manage different time zones if needed.
    - Flexible User Settings: To enhance the user experience, we will incorporate an interface that allows users to define specific times for notifications or to set "do-not-disturb" windows. User-friendly settings will allow individuals to tailor prompt timing to their lifestyle.

2.6 Progress Monitoring and Visualization
- Challenge: Create a feature that allows users to track their health progress over time with interactive visualizations.
- Details:
    - Data Tracking Tools: A tracking system will record metrics such as user responses, activity frequency, and any relevant health scores. This data will then be stored and organized for easy retrieval and analysis.
    - Visualization Framework: D3.js or Chart.js could be employed for dynamic, interactive data visualization, allowing users to see their progress trends over time. Visualizations must be responsive and adjustable for mobile displays with compromising clarity.
    - Progress Insights: Beyond raw data, our design should provide users with meaningful insights and patterns derived from their data, highlighting their achievements and progress towards any set goals. These insights can be personalized, to maintain a sense of engagement based on the user's preferences, especially if their end goal is to progress only their mental or physical health.

3. Technology Analysis

3.1 Introduction

The main technological challenge in this project is the development of a mobile application. However, after a detailed evaluation of the difficulties and available resources, we have opted for a web app as the most viable solution. This web app will be accessible through browsers, offering an accessible experience, accompanied by a notification system to keep users engaged. The choice of notification method is critical, as it must be effective but not intrusive, ensuring that reminders are useful and direct users back to the web app.

In addition, to ensure an optimal experience, the app must be compatible with mobile devices, with a responsive design that works seamlessly on mobile and desktop. We will also need to implement a real-time interactive feedback system and gamification elements that keep users, especially teenagers, engaged. Finally, a robust storage system will need to be developed for large volumes of data, with the ability to monitor user progress and send reminders at intervals throughout the day.

3.2 Application

We decided to build a responsive web app rather than a mobile app. This choice lets us create a platform that works well on many devices, making it easy for adolescents to access. A web app is more affordable and simpler to maintain than a mobile app, which fits well with our project budget. This approach also allows us to add interactive features, like progress tracking and reminders, to keep users engaged. By choosing a responsive web app, we ensure we can reach more people and easily adapt to their needs.

3.2.1 Desired Characteristics

In considering alternatives for our platform, we explored both web and mobile applications to determine which would best support *Bee Balanced*'s goals. A dedicated mobile app offers higher user engagement through features like push notifications and a more integrated user experience. However, mobile apps require significant resources for development, updates, and app store approval, which increases costs and limits accessibility to users with compatible devices. On the other hand, a responsive web application is easier and more affordable to maintain, as it's accessible directly through a web browser and doesn't require installation. By selecting a web app, we ensure that the platform remains accessible and cost-effective while still delivering interactive features that appeal to adolescents.

3.2.2 Alternatives

We evaluated three main alternatives: a responsive web application, a dedicated mobile app, and a hybrid approach. A responsive web app is accessible across various devices without needing to download, making it easy to reach a broad audience and reducing development and maintenance costs. However, it lacks some engagement features like native push notifications. A dedicated mobile app, in contrast, offers high engagement through features like push notifications and a more immersive experience but requires more resources to develop, update, and maintain, along with compatibility constraints. A hybrid approach could combine the benefits of both, but it demands complex development and is resource-intensive. After weighing these options, we found that a responsive web app best aligns with our project's budget, timeline, and accessibility goals.

3.2.3 Analysis

In analyzing our options, we compared each platform's strengths and limitations against our project's goals. A responsive web app emerged as the most practical choice due to its accessibility, cost-effectiveness, and ease of maintenance. Although it lacks the direct engagement features of a mobile app, like native push notifications, it compensates by being accessible on any device with a web browser, which broadens our reach and ensures a seamless user experience without installation requirements. While a mobile app offers an immersive experience and potentially higher engagement, it demands greater development time, budget, and upkeep, which could limit the project's scope and availability. By choosing a web app, we meet our objective to create a widely accessible, interactive platform that adolescents can use easily, ensuring the project's feasibility and alignment with our goals.

3.2.4 Chosen Approach

Where this product is able to be accessed is the very basis for this project, making this decision imperative for the rest of production. In the below figure, we have compared our desired characteristics with web and mobile implementations for our product. Ultimately, it was decided that a website would fulfill our requirements, while avoiding issues that a mobile application would run into. A website would be less expensive to maintain, simple to create due to our shared experience as a team with creating web applications, would avoid any problems of commercializing our product that a mobile app would encounter, and could still engage users when including a notification system.

Desired Characteristics	Web Application	Mobile Application
User Engagement	3/5	5/5
Cost Effective	4/5	1/5
Simplicity	5/5	2/5
Avoiding Commercialization	5/5	0/5
Total Scores	17/20	8/20

3.2.5 Proving Feasibility

To test utilizing a web application, it would be important to test cross-browser compatibility to check consistent performance and design across browsers such as Chrome, Safari, or Microsoft Edge. In addition, we will conduct performance tests to guarantee quick loading and response times for a seamless web experience. The goal with these experiments is to make sure a website would provide a similar feeling that a mobile application would, saving time concerning learning to deal with creating a mobile app and money that would go into creating our product for an app store.

3.3 Frameworks

For our project, we evaluated frameworks to support responsive design, user engagement, and streamlined development. Bootstrap, Tailwind CSS, and custom design emerged as options. Bootstrap offers quick, mobile-friendly layouts; Tailwind CSS provides flexible styling; and custom design allows full control over the app's look. Our goal is to select the framework that best enhances accessibility and interactivity for adolescent users across devices.

3.3.1 Desired Characteristics

    3.3.1.1 Ease of Use

        Importance: Users must be able to interact with the web app without complications.
        Key Characteristics: The design must be adaptable to mobile and desktop devices, using frameworks such as Bootstrap to ensure that the application works correctly on different screen sizes and devices. In addition, the interface should be simple enough to allow quick access to the web app from notifications, while maintaining interactivity with the help of frameworks such as React.

3.3.1.2 Interactivity and Gamification

Importance: It is important to keep users, especially teenagers, engaged and motivated so that they do not lose interest over time.

Key Characteristics: The feedback system should provide interactive responses based on user input. Gamification elements such as points, levels or badges could be included to make the experience more engaging. It is essential that these features do not sacrifice application performance, especially on mobile devices.

3.3.2 Alternatives

3.3.2.1 Bootstrap Frameworks

Research: Bootstrap is a CSS framework widely used to create responsive designs that work well on different devices.

Description: It provides predefined components and templates that make responsive design easy to implement. Bootstrap allows content to automatically adjust to any screen size.

3.3.2.2 Custom Design without Frameworks

Research: It is also possible to create a custom design without the use of frameworks.

Description: Designing and developing manually can offer more control over the final appearance, allowing specific optimizations for certain devices and screens. However, this requires more development time and resources.

3.3.2.3 Tailwind CSS Frameworks

Research: Tailwind CSS is another popular option for responsive designs.

Description: It is more flexible and allows for custom styles, but requires a higher level of configuration and effort compared to Bootstrap.

3.3.3 Analysis

3.3.3.1 Bootstrap Frameworks

It is a proven and efficient solution, which facilitates the creation of responsive designs quickly and is widely compatible. It is ideal if you are looking for a fast and standard implementation.

3.3.3.2 Custom Design without Frameworks

Offers more customization, but increases development time and maintenance complexity. Can be useful in cases where custom design is key to branding.

3.3.3.3 Tailwind CSS Frameworks

Offers great flexibility, but requires more setup time and may not be the most efficient option if a quick fix is needed.

3.3.4 Chosen Approach

Evaluating each of these approaches is necessary in building the most adjustable web application for a wide variety of users, considering how they access the website. Overall, Bootstrap was decided to be the most effective for our product due to its responsiveness of adjusting to different screen sizes, its flexibility through pre-build components that can be easily customized, and the straightforward structure simplifying implementation.

Desired Characteristics	Bootstrap	No Framework	Tailwind CSS
Responsiveness	5/5	3/5	5/5
Flexibility	4/5	5/5	5/5
Simplicity	4/5	1/5	2/5
Total Scores	13/15	9/15	12/15

3.3.5 Proving Feasibility

We will validate using Bootstrap for our product through responsive pages in our web application and conduct tests on various devices for screen size adaptability. This will happen by using developer tools to simulate mobile, tablet, and desktop screens and checking that the layout grids, navigation, and that miscellaneous interactive elements adjust smoothly. Additionally, touch responsiveness is important for mobile and tablet views, therefore we would test interacting with the web application on a phone screen to ensure that pressing buttons through touch is just as fluid as clicking them on a desktop.

3.4 Notification System

To keep users engaged, we evaluated three notification methods: push notifications, SMS, and email. Push notifications offer immediate engagement but require permissions; SMS is effective

but can be costly; and email is less intrusive but often overlooked. We aim to choose the method that balances cost, effectiveness, and user engagement, with email currently preferred as the simplest, most cost-effective option for maintaining contact.

3.4.1 Desired Characteristics

3.4.1.1 Effective Notification Method
Importance: Keeping users informed and engaged is essential to product success.
Key Characteristics: Notifications should be customizable, easy to receive and real-time to ensure relevance and effectiveness. Different options should be considered such as implementing APIs for push notifications (Push API or Web Push Protocol), and possibly SMS or emails. It is essential that the user agrees to receive notifications according to their preferences.

3.4.1.2 Reliability
Importance: Notifications must arrive consistently and without failures.
Key Characteristics: The system must be robust, minimizing failures so that users do not miss any important notifications. Implementing a progress monitoring system that stores large amounts of data is crucial, using databases such as MySQL or PostgreSQL to handle the workload. It must also be ensured that the notification and feedback system works efficiently in real time.

3.4.2 Alternatives

3.4.2.1 Push Notifications (Push API / Web Push Protocol)
Research: Push notifications can be sent directly to mobile devices and browsers, ensuring immediate delivery.
Description: This option enables real-time notifications that are intrusive but effective. It requires the user to grant permissions, which may be a barrier for some.

3.4.2.2 SMS notifications
Research: Sending SMS notifications is a traditional form of direct contact with users.
Description: Although intrusive, SMS has a high open rate. However, it can generate additional costs for each message sent.

3.4.2.3 Email notifications
Research: Email notifications are less invasive but often ignored.

Description: They are ideal for less urgent notifications, as users can read them at their convenience, but effectiveness is reduced due to the passive nature of email.

3.4.3 Analysis

3.4.3.1 Push Notifications:
These are highly effective and in real time, ideal for maintaining user engagement, but require the user to grant permissions. It is an ideal solution if you are looking for immediacy.

3.4.3.2 SMS Notifications:
Although costly, they are very effective for reaching users quickly. It would be useful for critical or urgent situations.

3.4.3.3 Email Notifications:
This is the least intrusive option but also the least effective for immediate responses. It is suitable for less urgent notifications.

3.4.4 Chosen Approach

Comparing user engagement with the actual cost of implementing these notification systems is important in order to make sure that users stay consistent with using our application while not spending too much unnecessarily. With this, we have decided to default to email notifications as they are not as costly as the other options, while still achieving our goal of sending notifications. This would be effective among high school and college students as they are more likely to check their emails and more likely to use the application voluntarily in comparison to a younger audience. Users may not feel comfortable supplying their phone number or may find downloading a separate application for push notifications to be tedious or unnecessary.

Desired Characteristics	Push Notifications	SMS Notifications	Email Notifications
User Engagement	5/5	4/5	3/5
Cost Effective	1/5	2/5	4/5
Simplicity	3/5	1/5	4/5
Total Scores	10/15	7/15	11/15

3.4.5 Proving Feasibility

For further validation with an email notification system, we will test the engagement of our users via checking responses from users clicking a link connected to our website. This would give us results on how often users listen to the sent emails and the effectiveness of using emails as reminders to fill out surveys. If this experimentation shows to be successful, then it will prove that an email notification system would be the most practical option, rather than spending extra time and expenses on the other costly options.

4. Technology Integration

Narrowing down technologies for this project ensures consistency and puts this product on the path of success. However, putting these technologies together will be the key to creating a cohesive system.
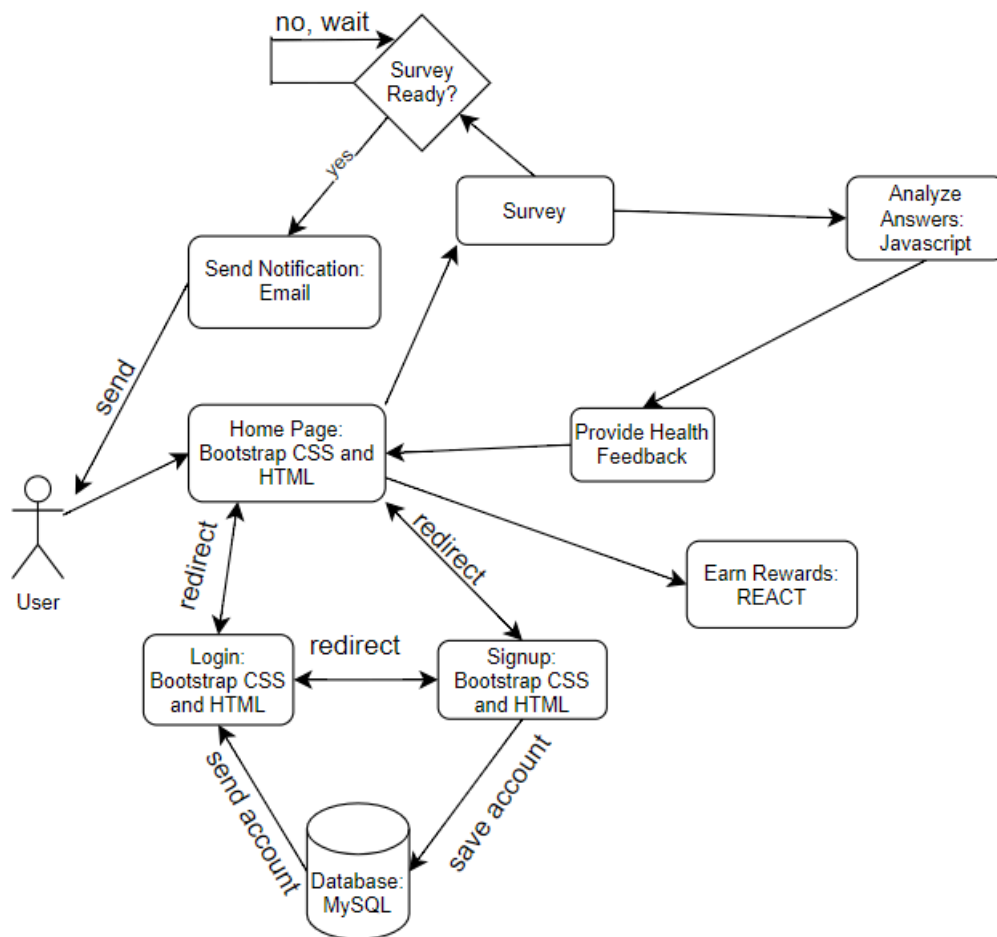
The database serves as a foundation for many elements, such as storing information about a user's login credentials, scheduling preferences, where to send notifications, and current status regarding earned rewards and badges. Holding a user's information for their account personalizes the website for their health and what works best for them, rather than making it a simple research website that collects data on their health. Everything will be accessible through the homepage of the user, from the personalized surveys to the user's rewards, all stored within the database.

5. Conclusion

Understanding the current status of adolescent health is imperative to improve upon their lives through adulthood. Bee Balanced will allow adolescents to understand their physical, mental, and social health patterns in order to improve them. Figuring out which technologies that are essential for creating this product is the foundation for this project, ensuring its success. Combining technologies such as REACT, Bootstrap, MySQL, and methods for sending email notifications will create an interactive web application that will appeal to students and leave them motivated to help their health.
We are confident in our technological decisions for this project and that these are the necessary elements to move forward in making our product. Our next steps will be creating the basis of this web application, specifically with the database to ensure we can save a user's information and implement the basic visuals for the website, making the product welcoming to users.