SootheSync: Anxiety Management Platform

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One of the most debilitating and unpredictable mental conditions out there is anxiety disorder [1]. It doesn't help also that this condition is among the most prevalent psychiatric conditions in Indonesia, especially in adolescents. According to I-NAHMS (2022), anxiety disorder is one of the most common mental conditions in adolescents with mental health problems [2]. This is concerning, especially when we factor in that anxiety disorder is linked to problems in building and maintaining relationships with families and loved ones, hindering the ability to adjust to a new environment, and to substance and alcohol abuse/dependence in the future [3]. Therefore, immediate action to manage and help treat anxiety disorders is required.

According to [4], most anxiety symptoms present themselves as mild following the GAD-7 (General Anxiety Disorder scale). Mild anxiety oftentimes can be treated effectively by relaxation techniques, which can be self-administered. Although not debilitating, mild anxiety could progress further in the future if not managed. More concerning, most of the people who have GAD don't seek professional help – ~25% of people who have GAD and require help seek it [5].

The management of moderate to severe GAD is still lackluster. A crucial metric to assess their development is to monitor the frequency and severity of anxiety attacks [6]. Although tools exist to monitor and record anxiety levels and/or attacks, due to their

nature of relying on human memory, there is a big possibility that a person misses logging for a plethora of reasons.

Moreover, sometimes medications are administered for people with severe anxiety cases. These medications can be consumed long-term as a maintenance drug (SSRIs/SNRIs) or intermittently (benzodiazepines) [7]. A long-maintenance drug relies on continual consumption by the patient, which faces the same problem as logging: the human nature of forgetfulness. For benzodiazepines, overuse and misuse of this class of drug is alarmingly high (~17% of all benzodiazepine users report misuse [8]). With a severe side effect of misuse, we need a way to accurately detect when to administer benzodiazepine and log the use of it for evaluation by a professional. To recap, these are the gaps in the maintenance of anxiety and the solutions in a problem-solution matrix:

Table 1. Problem-Solution Matrix for Gap Analysis in Maintenance of Anxiety

No.	Gap	Ideal State	Current State	Solution
1	Mild Anxiety Relief	Everyone knows how to relieve mild anxiety	Most people don't know how to relieve mild anxiety	An accessible education on how to relieve mild anxiety
2	Reliable data collection	AA can always be logged	Sometimes AA can go unlogged	A way to detect when AA happens and to detect it
3	Drug abuse & forgetfulness	The drug should be used as per the doctor's instructions	Some drug is often abused & some drug can be forgotten to drink	A system to prevent drug abuse and remind the user to take specific drugs

According to this matrix, we propose a prototype for a solution called **SootheSync: Anxiety Management Platform.** This prototype aims to help patients manage their anxiety, and doctors monitor their patient's development and make sure the treatment is administered properly. To close the gaps provided in Table 1, we devised these key features to implement in our prototype:

1. Regulation of medicine – Pill box dispensation system based on doctor's advice
2. Anxiety Management – Logging when anxiety attacks happen & it's severity and a report of it for the doctor's discretion
3. Education – Self-meditated help for mild anxiety attacks & how to mitigate it

Then, to help support these key features, we include some side features: emergency contact notification and notification of significant elevation/decrease in heart rate and/or oxygen levels.

SootheSync will be comprised of three main parts. The first one is a wristband that collects biometric data such as heart rate and oxygen levels, as well as behavioral data such as medication usage frequency and self-reports. The data is sent to the app – the second part of SootheSync, which provides personalized insights, helping users understand their anxiety patterns and helping them adjust coping strategies. The collected data would also be used to generate monthly reports for doctors and caregivers, improving treatment plans and medication effectiveness. The data is securely stored and encrypted, providing users full control over the accessibility of their information.

During an anxiety attack, cognitive function is affected, which leads to difficulty with concentration, memory, and decision-making [9]. Whether it's about the location of the medication or how much to take, SootheSync removes this burden by notifying the user, reducing stress, and making the experience more manageable. Furthermore, the prototype would also notify the emergency contacts listed by the user. With milder anxiety attacks, the Soothesync app provides quick and easy steps to calm the user.

The last part of SootheSync is an automated pill box that unlocks when an anxiety attack is about to happen. To determine when an anxiety attack is about to happen, the wristband will detect early signs of an anxiety attack. It would then unlock the pillbox at the right moment, ensuring that the user has immediate access to their prescribed medication. Since the medicine stored in the pill box is given conditionally, the user will only consume the medication in the correct dosage [8]. Thus, SootheSync reduces the misuse of the drug and prevents overdose.

The "Health" app on Apple products serves as inspiration for SootheSync, influencing both its core features and minimalist UI design. Key features like medication and cycle tracking have inspired SootheSync's anxiety and pill tracking functions, ensuring accurate user data and proper medication management according to doctor prescriptions. Additionally, health data summaries are designed for easy readability, helping users manage anxiety attacks and providing valuable data for medical professionals if needed.

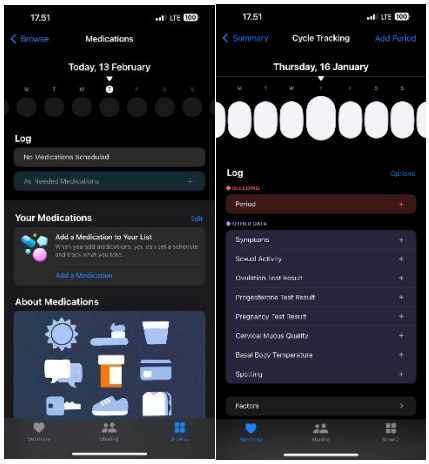

Figure 1. The "Health" App On Apple Devices

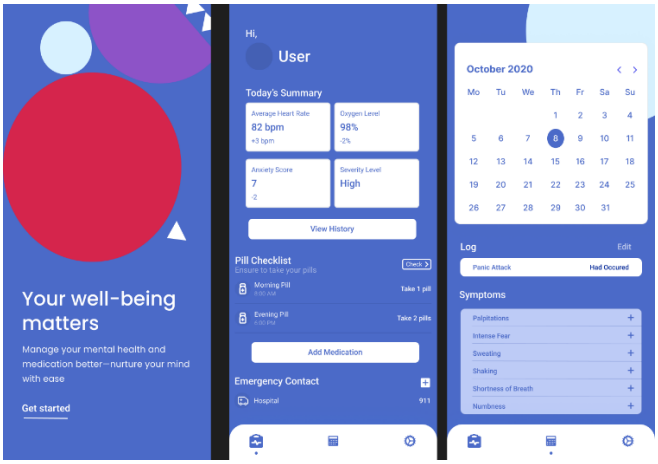

Figure 2. Mockup of SootheSync App

Soothesync features a scheduled pill case, inspired by devices like e-pill MedTime XL, to ensure timely medication and prevent missed doses or overdoses. Designed as a wearable wristband, it monitors heart rate and oxygen levels to detect potential anxiety attacks, providing continuous support for users with anxiety disorders.

Figure 3. e-pill MedTime XL (Source: epill.com)

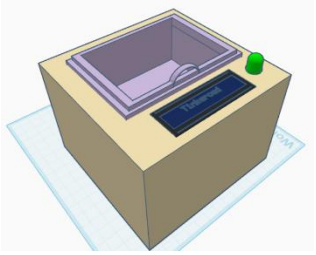

Figure 4. 3D Mockup of SootheSync Pillbox

Soothesync's wristband monitors heart rate, oxygen levels, and movement in real-time, notifying users of potential anxiety attacks. Once confirmed, the app logs the event, allowing users to record symptoms and attack intensity. The pill dispenser opens on schedule or during anxiety episodes, ensuring timely medication access.

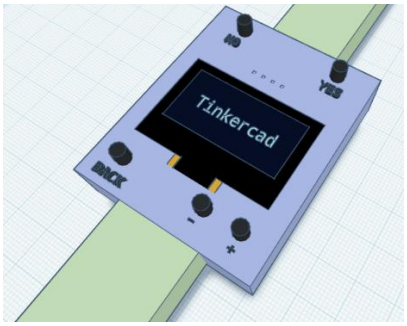

Figure 5. 3D Mockup of SootheSync Wristband

To achieve the project's purpose of managing anxiety, we are considering making two devices for the user to use. First is the wearable device in the form of a smartwatch. The second is a smart pill box. We will develop the ideas and design by integrating all of the sensors, screens, buttons, hardware, and electronics into one. Users will be able to access all of the information and change the desired settings of the pill box system in the form of an application.

Using various data to determine anxiety attacks, we find a few physical symptoms that we could detect using sensors. To test the whole system, first of all, we need to test the sensor as the input of the system itself. Using reliable data, using another device specifically for giving the output desired, or using a voltage meter, we could see if the sensor is sensitive enough to be used as an input, and the output can be manipulated in the code of the program.

After making sure the output from the sensor is reliable, we need to test the mechanical aspects of the system by considering the material of the hardware of the material and the object (various pills), the motor strength, etc. We can move into testing the whole system after combining all of the components by giving various inputs and seeing if the final output is correct.

Following the main function of these devices, we could manage a patient's anxiety by gathering all of their data correlated with anxiety, preventing overdose, etc. Even so, for future implementation, we could use this system for other cases, for example, epilepsy, heart problems, etc. By changing some of the components or code of the system, we could implement this idea for more advanced problems.

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