

# deeper: The Mental Health Connector for Mental Health Consumers & Loved Ones

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**Project Summary**—The platform to be developed will allow mental health consumers and loved ones to better connect and empathize with one another. The aim of this application is not necessarily to build new connections or provide professional mental health services. There are already so many applications that provide these functionalities; rather, our value proposition comes from strengthening the connections that the user already has. The MVP to be delivered will involve three main functionalities detailed below: NLP journaling system, community forum, and a robust messaging system.

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## 1 EXECUTIVE SUMMARY (NICOLE KWON)

The nature of the problem is that there is miscommunication and misunderstanding between mental health consumers and loved ones. To bridge this unaddressed gap, *deeper* will be focused on connecting these specific groups. As a final deliverable, this project will be tested out on college students in hopes of achieving a >75% accuracy with the machine learning algorithm behind the journal and be a fully fleshed-out mobile application that is deployed on Google Play and Apple's App Store.

The proposed technical approach behind *deeper* involves undergoing the agile practice of planning out sprints through Jira and completing individual tasks while simultaneously collaborating and working on code with Github. With this application, the aim is once again not necessarily to build new connections or provide mental health services, as there are existing platforms that provide these functionalities; rather, an innovative feature comes from this unique value proposition of strengthening the connections within the community that the user already has through the multitude of functionalities behind the application.

## 2 INTRODUCTION (DANIEL LI)

From the survey we conducted, the majority of loved ones participants state that the methods that they used to support the mental health consumer were less than 5 on an effectiveness scale from 1 to 10. Therefore, the app is for mental health consumers and their loved ones. This application is needed because it is difficult for both parties to empathize with each other and understand each other's needs. The loved one wants to support the mental health consumer but does not know the best strategies usually to do so; at

the same time, the mental health consumer wants the loved one to understand and not burden them. Especially on college campuses, mental health resources tend to be difficult to access or there are not enough resources to best support students. This application hopes to solve this issue and provide another supportive mechanism, especially since there are not currently any mental health solutions that target improving the connection between mental health consumers and their loved ones.

We connect mental health consumers and their loved ones to make meaningful mental health services accessible to all. This project involves the design of a mobile application that aims to bridge the gap between those suffering from mental health disorders (focusing on depression/anxiety with college students on college campuses first) and their friends and family. The aim is to improve the connection between mental health consumers and their loved ones. Specifically, this app will contain a monitoring and journaling system for an individual to gauge their own mental wellbeing while bringing awareness to this progress for third-party users associated with the individual. The latter will be done through machine learning in which the application will be able to gather information from an individual's interaction with the app. In addition, with the existing lack of understanding for how to help those with mental illnesses, this app acts as a platform to connect with and keep their family and friends updated with interactive functionalities such as empathizing tips. Our app provides another supportive mechanism; no current mental health solutions improve the connection between mental health consumers and their loved ones. Please see the competitive landscape section for other applications in the mental health space that do not have the value proposition we provide.

### 3 CONCEPT DEVELOPMENT (BYRON MITCHELL)

Bridging the gap between mental health consumers and their loved ones needs the facilitation of communication, convenience, and accessibility. To address these needs, the mental health consumer should have a way to healthily process and express their feelings for themselves and for others, while the loved ones should have a way to properly relay their support and check in on their own mental health. To fulfill and execute all of these functions, we decided to create a mobile application that is simple and easy-to-use, emulating social media for building bonds and familiarity.

The app requires sign-in authentication to differentiate, store, and connect people. It will also incorporate three main functionalities to address the pain points of mental health consumers, and they can be translated into interface requirements: a community page to ask questions or participate in conversations related to mental health, a journal page to safely express feelings and thoughts, and an inbox page to receive reassurance and check statuses of loved ones.

As we have stated, there is a lack of understanding of how to help those with mental health illnesses and we thought that a good solution to this was to integrate a community page into our app. This section of our app will contain additional resources and information regarding mental health, which will allow loved ones to search for any questions they might have regarding mental health illnesses and how to respond to someone that suffers from it. Having this at their fingertips will help with the communication between loved ones and the mental health consumer as they will be more knowledgeable on the subject. Additionally, the community page will allow users within the app to communicate with other users from our app and form a sense of community which would be greatly beneficial for both parties as it will provide them with extra support.

Apart from allowing the mental health consumer to express their feelings and thoughts, the journaling page will also serve as a mood assessment. If the user allows it, the journal entry will be passed through our machine learning algorithm which will detect the user's mood based on the text. The mood index will allow the mental health consumer to track their own progress and to indicate to their loved ones how they are doing today. By providing this information, it will facilitate the communication between the two parties as the loved ones will be aware of the mental health consumer's daily mood and reach out when it is most needed. To allow for ease of reaching out with one another we came up with the inbox page. This section will provide the means of communication between the two parties in our app. Through it, the user will be able to send and receive

messages to and from loved ones or mental health consumers.

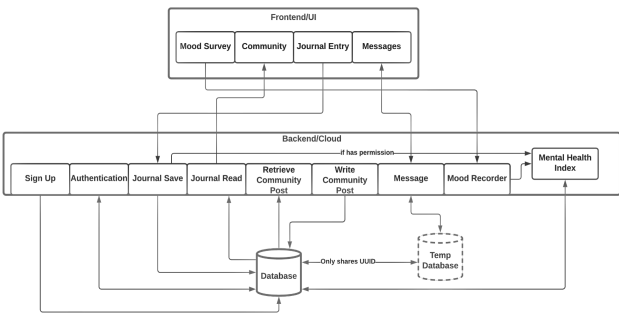
Another solution we considered but abandoned is a hardware wearable device that would be attached to a user. This device will monitor the users' stress levels to determine their health index. However, we abandoned this idea since our research found that not many people would enjoy having to get another wearable device in order to use our application. Additionally, the measurements may not be accurate. Therefore, we settled for a mental health index based on a journal entry. With extensive training, we could build a successful mental health index model.

### 4 SYSTEM DESCRIPTION (HARRY LI)

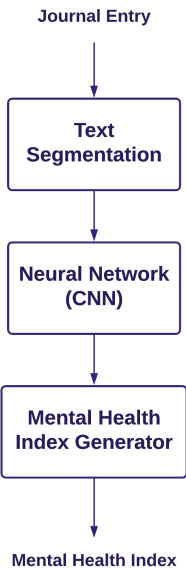
Our system is designed to focus on the consumer's mental health quality while bringing the users' loved ones even closer and becoming their mental health supporters. We want to do this by introducing several functionalities of our system to provide such service.

First and foremost is our journal entry system. This allows users to write a journal to keep recording their daily activities and mental health qualities. Then, we have the community to support the users even more. Users can post a question in the community to ask for help or show their support towards other people. Users can choose to post/answer questions either anonymously or show their username. Also, we have an instant messaging system. This allows users to contact each other and their loved ones instantly without switching to other apps. Lastly and most importantly, we have our mental health index system. This is the key to our app, and we believe this could be extremely useful. It uses an NLP (Natural Language Processing) algorithm to process journal entries. It'll understand the emotions in the entry and give an overall score of the user's mental health quality by accessing the user's mood. Eventually, the index will be charted and shown on the dashboard of the app.

For our system design, there are 3 parts of the system: the frontend for UI (User Interface), the backend, and the database. The frontend communicates with the APIs of the backend. What it means is that the frontend will have the user's input and send it to the backend to be processed, and the backend will return the processed info back to the frontend to be displayed. APIs are just the paths for different information to be sent to the backend. Here, we're using PyFlask and NodeJS as our backend framework, and React Native as our frontend coding framework. And for the database, we're using MongoDB to store user information, journal entries, community posts, etc. And for the mental health index system, since it is going to be using the NLP algorithm, which is machine learning at its core, we need to use the PyTorch library to realize its functionality.



Our machine learning algorithm consists of three main parts: text segmentation to filter out words that don't have emotions, a neural network to process the condensed version of the journal entry, and a scoring system to give one single index for the user's mental health quality. The neural network will give an evaluation of emotions presented in the journal and the percentage of their weight in the entry. The scoring system will value those emotions and their indices again and give an index to show the user's mental health.



5 FIRST SEMESTER PROGRESS (DANIEL LI)

We were able to clarify our problem and narrow down the scope of the main features we want to accomplish this semester: journal entry with machine learning, mental health index, messaging system, and community forum. We narrowed it down to these features after conducting extensive user surveys. Then, we were able to create a Figma prototype of our application. From there, we did extensive research to find the best service to convert the prototype into React Native code. However, even the best service resulted in a lot of bugs. Therefore, we took a lot of time to fix it to have the shell of our app

working for Android and IOS users. We were also able to create a full login front end and back end. From our First Deliverable Testing, the simulator was able to run successfully, the user was able to navigate through the different screens, the user was able to navigate through different tabs by clicking on the buttons, and the UI reflected the Figma design. For the login functionality, the user was able to sign up for a new account, the user was able to log in to an existing account, the user was denied if the password and email combo are wrong, and the user could not register a new account if the email address is already registered.

The next action step is to fill the shell of our current application. We need to create the ML algorithm for the mental health index/journal entry page, community forum, and messaging system as the next features to tackle.

6 TECHNICAL PLAN (NICOLE KWON)

Task 1. PyTorch ML Algorithm Development

A machine learning algorithm for calculating a mental health index based on the user's journal entries shall be designed, coded, and tested. It shall utilize a natural language processing library to then provide a metric (most likely a number from 1-10) to quantify the current mental state of the user. The design should be tested and have at least an accuracy rate of 75%. Lead: Harry; Assisting: Byron.

Task 2. Subpages Design

The subpages (daily check-up page, mental health index monitoring page, mediation page, and resources page) on the homepage of the application shall be designed, coded, and tested. It shall be interactive with UI/UX components and navigation, as well as being connected to the homepage. The daily check-up page and mental health index monitoring should be smart and intuitive (i.e. it should update based on the passage of time and the user input from the journal page). Lead: Nicole; Assisting: Daniel.

Task 3. Settings Page Design

A page for a user's profile and settings shall be designed, coded, and tested. It shall include information from when the user signed up and allow for them to customize their experience on the application (i.e.

they can choose what to share with loved ones, whether that be their journal entries, their mental health indices, etc.). Lead: Daniel; Assisting: Nicole.

#### Task 4. UI/UX Design Additions

Additional UI/UX components for the existing pages shall be designed and incorporated into the frontend. They shall elevate the user interface for more intuitive interactions by creating more buttons, tabs/pages, etc., and editing the existing layout of the different pages. The design should be tested to gauge the overall usability, convenience, and experience of the app. Lead: Byron; Assisting: Daniel.

#### Milestone 1. Accuracy Testing for ML Algorithm

User interviews with mental health consumers who are also college students shall be conducted and recorded. They shall be utilized to understand the efficacy of the PyTorch ML algorithm and should reach at least 75%, as well as be iterated to approach the 100% mark. Lead: Harry; Assisting: Daniel.

#### Task 5. General User Testing

User testing with mental health consumers and loved ones shall be conducted and recorded. It shall answer questions regarding the functionality and aesthetic behind the application, as well as build empathy and receive feedback from potential users. Lead: Daniel; Assisting: Byron.

#### Milestone 2. User Interface Design Review

A design review regarding the current state of the user interface shall be conducted and recorded. It shall be based on the specifications of functionality, aesthetics, and other aspects mentioned from the user and accuracy testing. The client should be present for this to gain additional feedback. Lead: Byron; Assisting: Nicole.

#### Task 6. Quality Assurance Test

The quality behind the code and overall Agile development process shall be reviewed and tested. It shall first be manually looked over by the

team, with a conversation facilitated regarding the current state of the frontend and backend. This should be followed by integrating SonarQube or another tool into the code to detect any bugs, code smells, and security vulnerabilities. Lead: Nicole; Assisting: Harry.

#### Task 7. Final Touches/Code Clean-Up

A plan for cleaning up and finalizing the code shall be designed and implemented. It shall be done by the whole team, who should follow proper software practices. They should ensure that the code is well-documented (i.e. commented and clean) and that MongoDB and Azure are efficiently up and running. The Github repository should also be refactored and include a proper ReadMe. Lead: Daniel; Assisting: Byron.

#### Milestone 3. Application Deployment

The cross-platform application shall be deployed on the Google Play Store and Apple's App Store. The frontend and backend should be running on Azure rather than locally to allow the app to be functional after downloading. Lead: Harry; Assisting: Nicole.

## 7 BUDGET ESTIMATE (NICOLE KWON)

Item	Description	Cost
1	Azure Cosmos DB	\$50
2	Azure App Service	\$50
3	Incentivizing user testing	\$60
4	Apple's App Developer account	\$99
5	Google Play Store's One-Time Fee	\$25
	Total Cost	\$284

Because our project is software-focused, all of our costs stem from utilizing online services versus needing and buying tangible hardware components. In terms of budget implications, this means that most of our purchases are easily accessible instead of accounting for shipping time or costs, as well as our purchases being on the cheaper side.

Items 1 and 2 are costs from our chosen cloud computing service, Azure, and were calculated based on the monthly plans. We will be using Azure Cosmos DB to host MongoDB globally, and we will be using Azure App Service to deploy our frontend and

backend services to eliminate the impracticality and inconvenience of hosting locally. Additionally, we plan to incentivize user testing, as shown in Item 3, by randomly giving out 3 \$10 gift cards when sending out user surveys and 3 \$10 gift cards when gauging the accuracy of the ML algorithm based on user interviews. Finally, Items 4 and 5 are costs from our final deliverable of deploying our cross-platform app onto the Apple App Store and Google Play Store. This all leads to the total cost being \$284, and with our \$1000 budget constraint in mind, we have the flexibility to elevate our app in other aspects if time permits and expand on user testing and incentivization if warranted.

8 ATTACHMENTS (NICOLE KWON)

8.1 Appendix 1 - Engineering Requirements

Team #6 Team Name: deeper  
Project Name: deeper

Requirement	Value, range, tolerance, units
Frontend	Should be cross-platform and integrate with backend (React Native)
Backend	Should be cross-platform and integrated with frontend (Node.js, PyFlask)
Database	Should be connected to frontend and backend (MongoDB)
Cloud computing service	Should be connected to frontend, backend, and database (Azure)
ML algorithm	Should have >1 library related to mental health indexing and be compatible with frontend and backend (PyTorch)
ML algorithm accuracy rate	> 75% accuracy during user testing

8.3 Appendix 3 - Other Appendices

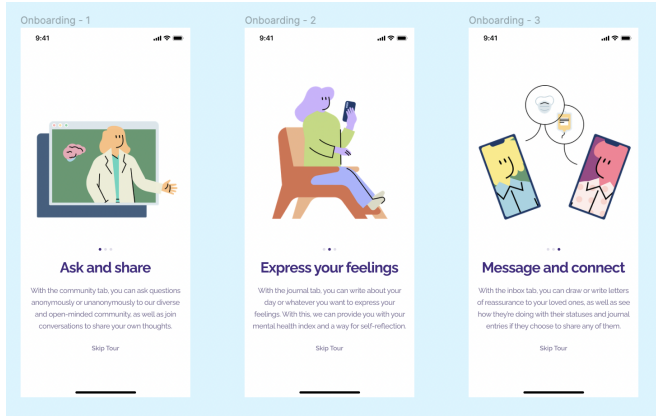


Figure 1.1 This is a wireframe of the onboarding screens when the user signs in. It details what they can do with the app (ask and share with the community tab, express feelings with the journal tab, and message and connect with the inbox tab).

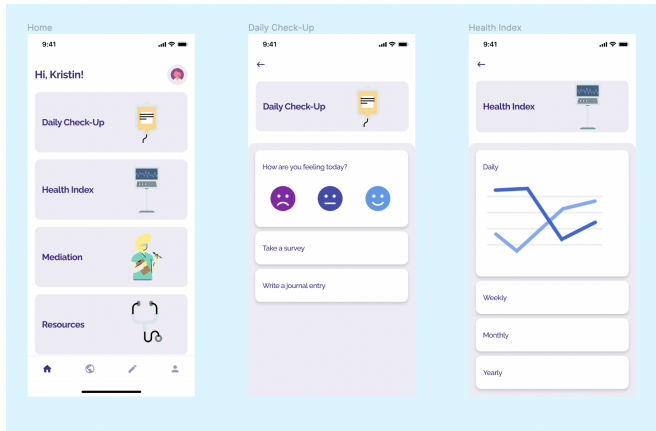
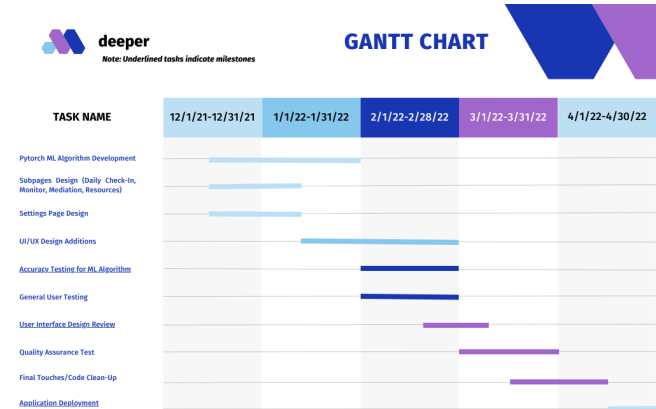


Figure 1.2 The left-most screen is a wireframe of the homepage, as well as some prompted functionalities (daily check-up, health index, meditation, and resources). Next to it are screens showing how the daily check-up and health index look and work.

8.2 Appendix 2 - Gantt Chart



Link to rest of Figma wireframe:  
<https://www.figma.com/file/8lHPYkZNsIN37Y4j8CfBP6/Healthcare-App-with-Blush-Illustrations-Community?node-id=6%3A0>