dactr

EXECUTIVE SUMMARY

ABOUT

At DACTR, we are united by the pursuit to create a more effective approach to depression treatment. With majors spanning from Finance to Computer Engineering, we leverage our wide array of skills to inspire hope and empower the futures of those battling depression by providing them with heightened levels of treatment accessibility.

Haskel Canagarajah, *VP of Communications*
Sean Cullen, *VP of Operations*
Erica Mi, *VP of Research*
Michael Mitole, *VP of Strategy*
Neil Patel, *VP of Finance*
Ankit Garikipati, *Lead of ML*
Divyesh Johri, *Lead of AI Dev.*
TJ Schaeffer, *Lead of Cloud Comp.*
Yajur Tomar, *Lead of AI Data*
Steven Zeng, *Lead of UI Dev.*

FUNDING AND SUPPORT

Funding Request: **$10,500**

- $7000-Backend
  - $3000 - Data and Storage
  - $4000 - Future Developments
- $2000 - Testing
- $1000 - IP related fees
- $500 - Branding

- Professional Advisory Board (Medical and Technical)*
  - Penn State Milton S. Hershey Medical Center
  - Penn State College of Medicine
  - Pennsylvania Psychiatric Institute
  - Penn State College of Information Sciences and Technology
  - Skapex, LLC

PennState Health Milton S. Hershey Medical Center | NittanyAi Alliance | Happy Valley Capital | SKAPEX

PROBLEM

Depression is a global crisis that affects around 264 Million individuals globally and is linked to over 400,000 suicides per year. With such staggering numbers, higher accessibility and more effective treatment approaches are not simply things to be desired; they are absolutely critical. Our "A3 plan" summarizes our key objectives:

1. **Addressing** patient needs during the times they have to wait to see a medical professional, as many have waits upwards of three weeks.
2. **Advancing** remote recovery so that the need for follow-up visits are minimized, thereby increasing accessibility and lowering wait times as individuals who require appointments are prioritized.
3. **Adding** knowledge about both depression and other mental health issues to our users as many don't seek treatment due to social stigmas or lack of information surrounding the disease.

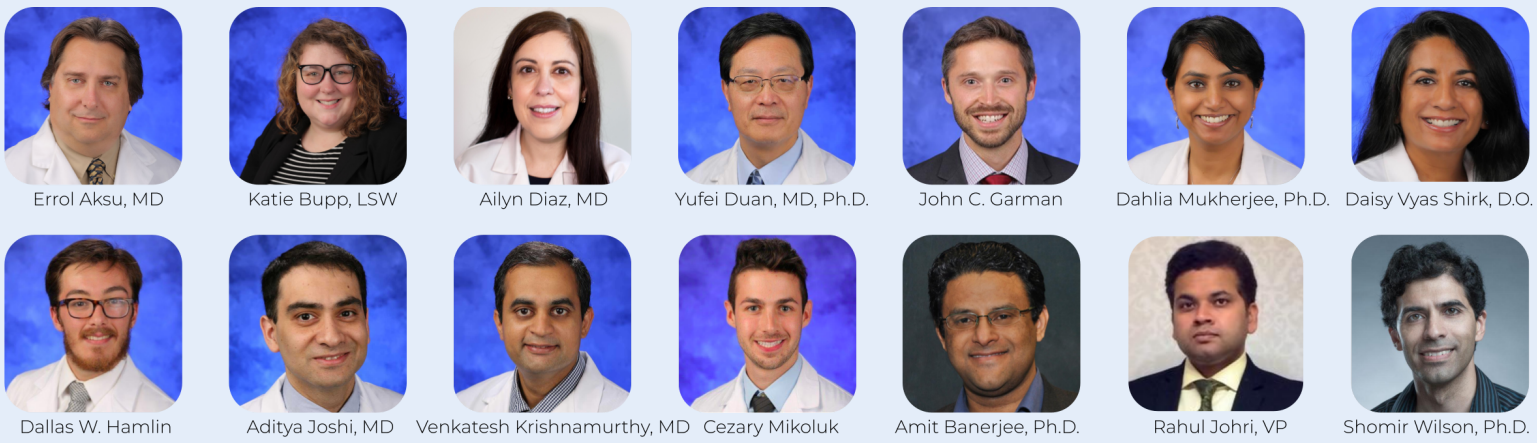
SOLUTION

DACTR currently seeks to **create a mobile application** that bridges the gap between medical professionals and patients and helps to alleviate the symptoms of depression. Our app applies **Behavioral Activation** to help lower symptoms of depression and a journaling feature that gives clinicians heightened insights on their patient's progress outside the office.

FUTURE

Sep 2020	Nov 2020	Jan 2021	Mar 2021	May 2021
Research Projects	UI Improvements	Testing at PSU	Stronger NLP	Explore Text Messaging
Develop Clinician Side	iOS Compatibility	Log Feedback	Revamp Journaling	Partner with Facilities
HIPAA Certifications	Revenue Strategy	Testing Improvements	Promote DACTR	Assess the Future

PROFESSIONAL ADVISORY BOARD



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Dear Judges,

First and foremostly, thank you for taking time out of your busy schedules to review the hard-work students have put into this competition. Your feedback as seasoned professionals will be instrumental in helping all the teams continue to develop their products post-competition and will propel each team to have a positive impact on the lives of others.

The DACTR Group is excited to show you what we have been working on this summer and we are eager to not only interact with you but receive your feedback which will help us continue innovating in the field of Mental Health.

This documentation serves to inform you about several aspects of our organization and current Minimum Viable Product. We'll talk about why focusing on mental health is imperative, why we believe our product is the best solution, and how we plan to continue our journey of empowering the futures of those battling mental health issues.

Before we dive into the documentation, we do have a couple of announcements to make, just so that you are aware of the additional materials we have prepared and other important information:

- Our Development Team created two supplemental videos that guide you through example journal entries and the app's clinician side. We highly encourage that you take a look!
    - Clinician Side: https://youtu.be/kT8uwkMrfZY
    - Journal Entries: https://youtu.be/2tTkzdhkGiQ
    - Future UI Design: https://marvelapp.com/prototype/88c009h/screen/67322271
- Additionally, please feel free to test the DACTR App! Unfortunately, our Google Play Store approval is currently pending – the instructions to access it through firebase can be found at the end of this document.
- Due to HIPAA concerns, our organization has chosen to refrain from making the clinician side of the app live. However, we are in the process of team HIPAA Certification and, as mentioned in point #1, we have created a clinician side demo so that you can view what we have so far.

At DACTR, we are on a mission: To inspire hope for those who have been shunned from society, empower the futures of those afflicted by mental health issues, and build a bridge between doctors and patients to make the mental health recovery process more efficient and accessible. We hope you see our passion in the work we have provided and are expectant for your responses.

Best Regards,
The DACTR Group
Website: dactrgroup.com
LinkedIn: DACTR Group
Facebook: DACTR Group

Problem Statement & Overview

Open a history book to any century. Through every great empire and age, there are diseases and plagues which have stagnated human progression. From the Black Plague to modern-day SARS, society has been disrupted with matters of life-and-death. These may be clear-cut examples of disease, but many overlook the fact that depression, at its core, is a complex disease. Depression is a disease because it manifests itself from both external and internal factors that corrupt neurological functions. Depression is a global crisis, currently affecting 264 million sons, daughters, wives, and fathers worldwide, contributing to an astounding 400,000 suicides per year.

In terms of college campuses in America, depression is an extremely prevalent issue. According to the Center for Collegiate Mental Health, depression in society has risen over the past 20 years and currently, 1 in 5 college students are affected. As the effects of depression are exacerbated by the stressors of college life, more students find the need to turn to the mental health services of their universities. They further report a significant increase in the number of students seeking mental health services, for example, at Penn State, visits to CAPS have increased by 50% over the past decade. The CCMH finds that 32% of facilities have wait times.

DACTR's primary purpose is to bridge the gap between mental health providers and patients by leveraging the power of technology. The center of the application is the journaling system which prompts the user to answer targeted short answer questions modified from existing resources used in the mental health recovery process. Should the patient consent, their journal entries are then viewable by their medical professional who then have access to more data on their patient and can monitor their progress outside of the office. This remote recovery process is crucial considering that the numerous office visits and rising demand of mental health services strain the current system, resulting in long wait times. With this strategy, medical professionals can prioritize office visits for those who really need them, and accessibility is improved upon as patient's can get treatment on their own schedule.

The second aspect of DACTR is that it uses Natural Language Processing to identify user inputs and then applies a common theory used to treat mental health problems called Behavioral Activation. Behavioral Activation is essentially the recommending of activities that are proven to help lower the symptoms of mental health issues, thereby providing better mitigation for patients. DACTR's users not only get activity recommendations through our app, but also receive locations where they can perform such activities as well as a full bank of activities should none of the recommended ones interest them. Finally, DACTR incorporates an emergency page, so that when users feel overwhelmed they can reach national and regional hotlines in simply a few taps.

Use Case

A user (most beneficial when they have a diagnosis and a designated mental health professional) dealing with anxiety, depression or stress issues will create an account, log in, and begin creating journal entries every day. After journal entries are recorded, the user will be recommended activities to do according to their mood and the types of interests they show. Location data will further be used to help the user find places near them to perform the activities that are recommended.

- The journal log tab on the home screen allows users to go back and view their previous journal entries. This can be great for them to see their progress and see the thoughts they once wrote when times get tough.

- Users can view their recommended activity history under the activities tab and can also access the entire bank of activity recommendations should they not find interest in any of the recommended activities.

- When the user is feeling especially negative, he/she can either use the emergency button to connect with local and national helplines along with other available professional personnel.

Part of DACTR's core value proposition is the bridge we build between mental health professionals and their patients via the clinician side of the app. Through this side, designated professionals can view their patient's journals and monitor them outside of the office. This is beneficial for the professional, as they can gain more data on their patients which increases the efficiency of the recovery process and allows them to make more educated decisions. It is further beneficial for the patients as they can now do treatment on their own schedule (as opposed to cut out office visit times) while knowing that their designated professional is paying close attention to them on the clinician side of the app.

The app's main goal is to promote remote recovery for patients by providing activity recommendations that help them to mitigate the symptoms that come with mental health issues. This increases accessibility and efficiency in the process and leverages the emerging field of telehealth to help professionals provide the most beneficial care for everyone. The app has a secondary goal of lowering wait times in the industry as they are notoriously long (sometimes reaching over 3 weeks), and by prioritizing office visits for those who truly need them, we believe this application, when integrated with facilities, could significantly lower wait times.

Future Implementations

Text Message Journaling: To further increase accessibility and convenience, we plan on allowing the patient to journal through text messages. This allows them a more subtle way to engage in recovery in a format they are likely more familiar with.

Clinician Endorsements: If a clinician feels that one of DACTR's recommended activities would be great for the patient to try, they can issue an endorsement. This would rank the activity higher than all other recommended activities and would appear with a checkmark next to the activity name to display to the user that the medical professional believes such an activity would be beneficial.

Direct Line of Communication from Clinician to Patient: By having a direct line of communication from the clinician to the patient, DACTR hopes to make communication between the clinician and patient more frequent due to the ease of messaging. This allows clinicians to stay in constant contact with their patients and makes it easier for patients to reach out should they have questions or concerns.

App Connects: To help facilitate behavioral activation and provide a better activity experience, we plan on encouraging users to download certain apps and connect them with DACTR so that the activity experience is most efficient. For example, we may recommend jogging apps that track routes so we can see how far a user truly ran and the time they ran for. Other times, we may recommend applications that can further educate the patient on activities or mental health in general.

Schedule Integration: A lot of times, when the busyness of life hits, mental health recovery is often first to get pushed away. Through scheduling integration, we hope to have user's input their schedules into the app, which will allow the app to recommend activities that fit the user's schedule.

Social Groups: Avoiding isolation, one of the most common (and deadly) symptoms of depression, is key with any mental health app. Our vision is to utilize a feature called social groups to help users engage with existing friends and discovers new ones. This allows them to avoid isolation and have a healthy amount of interaction with others. This part of the app can direct individuals to Facebook interest groups, can direct them to websites of organizations with a social focus, and pair DACTR users up in groups to engage with people in similar situations.

Heightened Security: In the future, to pair clinicians and patients we are going to institute a code system in which both the clinician and patient have a unique, randomized code and each party will need to input each other's codes in order to match and be connected via the app. Security questions and additional information may need to be provided depending on certain cases.

Simplified Progress Tracking: Through the usage of graphs and statistics relating to the user's mood and tracked activity history, we hope to give clinicians easy to read data concerning their patient. Further incorporate their health history will serve to make the decision-making process more efficient for doctors.

Health Networks: A potential idea is to integrate health providers like Aetna and Blue Cross/Shield into the process so that patients can be managed through a health network side. This can allow health networks to assign patients different medical professionals in the mental health space depending on specialty.

Development Timeline

September/October 2020	1) Begin weekly sprints 2) Consider feedback gained from the Nittany AI Competition 3) Research and consult advisory boards on CBT-oriented feedback a) Look into ways on improving our behavioral activation feedback as well 4) Obtain HIPPA Certifications a) Work with advisor on HIPPA oriented development b) Begin work on the Clinician App
November/December 2020	1) Continue Work on Clinician app 2) Continue research on CBT, begin looking into NLP systems that would work with it a) Meet advisors for assistance 3) Align user data to fit HIPPA regulation 4) Work iOS compatibility 5) Work on UI improvements a) iOS UI & improve art and general UI b) Scalability on large devices 6) Revenue Strategy
January/February 2021	1) HIPPA regulations fully satisfied 2) Clinician App DONE a. Gain feedback from medical advisory board 3) iOS and Android DONE and in Alpha for testing 4) Organize testing groups with PSU students and begin user testing on iOS and Android a. Perhaps partner with CAPS or seek assistance from medical board 5) Work on improvements from feedback 6) Begin implementation of CBT feedback system
March/April 2021	1) Continue work on CBT feedback system 2) Continue improvements using user testing feedback 3) Begin and COMPLETE dynamic short answer system a. Consult with medical board on expanding short answer options 4) Begin inclusion of third-party app support and similar features (support for Activity app, Google Calendar, etc.) a. Begin text message journaling system as well 5) Consult with tech. advisory board on improving NLP System a. Choose a method and begin development 6) DACTR advertising campaign (begin promoting on campus and online)

May/June 2021	1) CBT Feedback System DONE 2) Third Party App support features and text messaging system DONE 3) NLP improvements DONE 4) Upgrade Alpha to Beta Testing a. Increase testing size/groups b. Look into partnerships with facilities for clinician side testing 5) Assess future development and changes needed till publication of the app.

Development Timeline – Agile

To develop our MVP, we adopted two Agile frameworks with our business and technology teams to ensure we minimized scope creep, allowed flexibility for design changes and kept an open, communicative atmosphere for all involved.

The two frameworks, Scrum and Kanban, were used in conjunction to maximize flow and remain focused on what mattered to our end users. Every week we held a sprint retrospective and a planning meeting where the business team would describe the contacts they developed and the feedback they received from health professionals and the tech team would go over research and development goals met. Throughout the sprint, we would use Trello as our Kanban Board to track our workflow and ensure we were meeting requirements in a timely manner.

Because of these frameworks, our software has gone through numerous trials from the idea phase to now. Initially, we had hoped to create a recommendation-based AI for clinicians that took patient physical and emotional data, cross-referenced them with data on treatments and the patients they were effective for, and outputted the resulting best treatments for the patient to pursue. However, after consulting with numerous health professionals and psychologists, we found two problems: such data was not available and such recommendations were not actually helpful in our goal of reducing treatment wait times.

Because of the flexibility and empirical-focus of the Scrum and Kanban framework, we were able to shift our project from this faulty system to one that truly benefited our user base: an AI-feedback journaling system. Combined with feedback gained from judges in the prototype phase and our advisory boards this summer, throughout the MVP phase our successes and failures have been turned into real, working software.

We have confidence in Agile development and plan to continue it moving forward, improving the ways we measure our workflow to better analyze our team's capabilities (WIP limits, etc.)

Technology

To analyze journal entries in our prototype, we use Google's NLP API, a pre-trained model provided by the Google Cloud. Although we looked into many other options for natural language systems and consulted our advisory board on the matter, we found it would take too much time and money to develop our own and gain a mass amount of training data that could compete with Google's. In the future, depending on our funding, we may reconsider options for NLP and try to improve the system.

The API analyzes the entry and provides sentiment scores and syntax analysis. Based on these outputs, we can analyze user journals, identify potential activity interest, and provide appropriate feedback in accordance with behavioral activation.

As described in the video, our mobile app utilizes Firebase as its backend. We use Firestore as a real time storage system and Cloud service for handling Natural Language API calls. The Google Cloud Platform (GCP) is used for its APIs (Maps, NLP), as well as service account management for Firebase. Firebase works excellently as a mobile backend service due to its ease of use, intuitive testing, and SDKs, as well as its nearly unlimited scaling capabilities for account authentication and data. Thus, we plan on continuing development with both Firebase and GCP.

The app itself is developed using Nativescript-Angular, a mobile app JS/TS framework that allows us to build Angular Typescript apps compatible natively with both Android and iOS. Not only has this made learning mobile app development easier, but it's dissolved our worries for cross platform compatibility. Its plugin environment has also made integration with Firebase and Maps SDKs simple and efficient, allowing us to focus our efforts on our journaling systems and UI/UX rather than the "nitty-gritty" of mobile SDKs. Due to these benefits, we will continue using Nativescript in our app development.

Data Sources

DACTR primarily relies on professional medical advice in order to create the most effective app to address mental health issues. In addition, the DACTR team continually engages in research projects in order to heighten internal knowledge that can be applied to the product.

To source reliable medical information and ensure our operations remain under a medical and professional light, DACTR has established an advisory board segmented into two parts: The Medical Advisory Board and the Technical Advisory Board. The Medical Advisory Board is comprised of eleven medical professionals with decades of experience working in the mental

health space in institutes including, Pennsylvania Psychiatric Institute, the Penn State Hershey S. Medical Center, and the Penn State College of Medicine. Through the advisory board, they are given opportunities to monitor our progress, impart their extensive knowledge onto our team, and support our ventures.

Data privacy is of the utmost importance to us, and we will ensure all data collection and handling is secure and complies with HIPAA before any testing. Firebase and GCP are platforms that already offer top-of-the line security features and HIPAA compliant services. Additionally, our privacy policy can be viewed on our website.

Depending on our funding, if we were to reconsider options for NLP systems and decide to create/train our own, we would incorporate a supervised example journal data set made through a collection of free online data from healthcare centers, open source databases, and in collaboration with professionals in psychology, relevant hospitals, and CAPS. The goal of such a system would be to beat the effectiveness of Google's sentiment and semantic systems in our use cases, which could be possibly given we are able to narrow down the types of journals entries we may expect to receive.

Whether we can utilize journals submitted during our alpha and beta testing phases as described in the development timeline will be dependent on HIPPA policy. If we were able to, the chances of training a new NLP system would be much higher. We wish to take our users' data seriously and will do our utmost to ensure their security and upkeep the trust they have placed on us for utilizing our service.

Team Capabilities

Our team consists of six STEM and four business majors from a variety of backgrounds and skill domains to contribute to the project. Members of the business-oriented side possess skills including financial management, interpersonal relations, and strategic thinking, all of which have been practiced through consulting case studies and business development organizations. On the technology-oriented side, individuals bear skills such as data-science analysis, design thinking, and program development, which have been strengthened through personal endeavors and coding projects. Students have participated in hackathons, design challenges, and case competitions. Currently, all six STEM majors work closely with each other in coding and managing backend services, designing the UI, connecting the two, utilizing cloud resources, and further researching the availability and methodology of implementing APIs. Each task is entrusted to a team lead, who oversees all research on the task.

We've also brought in a team that functions as our advisory board to ensure that our product is as potent and technically rigorous as can be. This team consists of doctors, psychologists, and mental health professionals—who ensure that our operations remain under a medical light and support our endeavors. These individuals have decades of experience in the fields of depression, psychology and mental health and impart their knowledge to us to

ensure that we not only find success in this pursuit, but have the ability to change the lives of individuals affected by mental health problems.

Strategy Team

Haskel Canagarajah – VP of Comm
Sean Cullen – VP of Operations
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Neil Patel – VP of Finance

Development Team

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Yajur Tomar – Lead of Data

User Interface

The design of the UI phase began with the logo as well as other small interface pieces through Adobe Illustrator and Adobe Photoshop. These elements were then combined into the first phase of front-end development for a potential mobile app UI design for the MVP through the typical user's end as designed through Marvel, a collaborative application design software. Each screen was designed and linked together to create a more interactive demonstration of what the user would see if the app were to be launched. The current UI design is not fully flushed out and has yet to include more features; however, it gives a general idea of what the final app should look like.

The next step is to follow through with a UX design by combining the designed interface with the working prototype as shown previously. Our first projected alpha user testing will be a soft launch with around 10 - 50 PSU students that would use the app for one to two weeks with a feedback survey following usage about improvements the app can undergo in regards to ease of use, functionality, and further improvements. The second beta launch would be increasing the user base to approximately 100 - 200 individuals, following the same general process. The individuals we target will mostly be people associated with the Counseling and Psychological Services (CAPS) on the Pennsylvania State University's campus. The focus of the tests will be in correspondence with CAPS as the target audience will first be Penn State students as further expansion will be implemented in the future. Due to Firebase's ability to easily scale data storage and accou7nt authentication, we are fully capable of scaling for alpha and beta testing, and even publication.

We especially wish to leverage our connections with the faculty of CAPS, specifically after our discussion with Benjamin Locke, the Senior Director of CAPS. He was able to provide us with sufficient information to help us move forward as well as provide us with feedback and further improvements in regard to feasibility and development. By focusing our tests with CAPS,

we are able to have access to a small pool of students as well as experienced faculty who will also be able to provide us with valuable feedback on future improvements during our next app revamping phase.

Access Through Firebase

All you need to do if follow the instructions given by Firebase. In general, you will need to download the Firebase App Tester through the email sent from the link, then login to the app with your email and accept our invitation. After that, you can download and test the app.

It is recommended for the best UI experience, you keep your device in Light Mode.

We would love feedback, comments, and questions! Details on our plans with the app and the technology behind it are in the Documentation and the Tech Demo.

Make sure to open the link on an Android Device.

Firebase Testing: https://partnerdash.google.com/apps/appdistribution/pub/i/957efcae3c2acfc0