

**Final Report:** 2004 words

**Apper Essay:** 425 words

# **MindfulME: A mobile journaling device for addictions recovery**

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**Note:** We would appreciate it if our code was not made openly available for at least 6 months. We are attempting to place the app for sale and/or distribution ourselves.

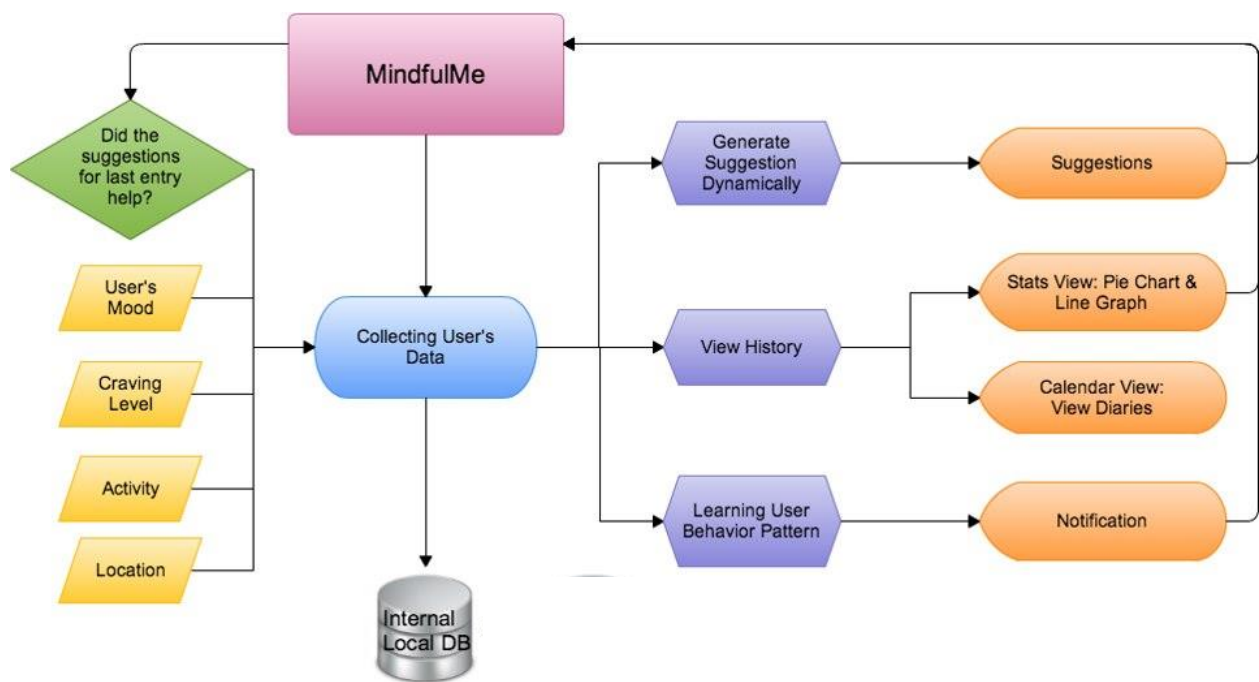
# Introduction

MindfulME is a journaling app to help individuals in addictions recovery. Journaling about thoughts, moods, and triggering scenarios throughout the day is recommended in recovery treatment for a broad spectrum of addictive disorders, ranging from alcoholism, to smoking, cocaine abuse, and even disordered eating behaviors (i.e., binge eating). This practice helps the patients identify people, locations, moods, activities, or even temporal predictors of urges to engage in their addictive behaviors. Such information can be used to identify vulnerable scenarios where an intervention strategy can be practiced to prevent relapse back to the addiction.

Journaling often requires users to carry around paper notebooks with lengthy questionnaires to be filled out several times a day. Journaling in public threatens privacy and the burdensome nature of the task decreases journaling compliance. Thus, we sought to develop a mobile app that would enable users to quickly and discretely record their present emotional state throughout the day. To achieve this goal, we developed an app with a simple interface that prompts users to record their present mood, urges to engage in the unwanted behavior, location, and activities.

An added benefit of using mobile technology for journaling is the data-processing capabilities that can be implemented in smartphone applications. Thus, we enhanced the typical journaling experience by providing graphical feedback regarding overall mood and average urging levels for any selected range of journal entry dates. The data is used to determine which locations, times of day, and activities were associated with the highest propensity to engage in their behavior. We also incorporated intervention strategies into our application, and location data enabled us to send reminders to practice intervention strategies when users approach relapse-prone locations. Prompted feedback regarding the efficacy of these strategies was used to highlight the most effective intervention strategies for each individual based on user feedback. Last, we were able to provide small reinforcers when particular abstinence milestones were achieved to encourage further progress.

## Overall Design



*MindfulME settings (pink).* Users set specific times for ringtone or vibration reminders to input journal entries and view earned rewards.

*Data inputs (yellow).* Self-reported negative or positive mood (sliding scale -3 to 3), the intensity of the urge to engage in addictive behaviors (i.e., “craving level”; sliding scale 1 to 7), the present activity, and the GPS-identified location are all recorded as part of a typical entry. This user data (blue) is stored in the local internal database.

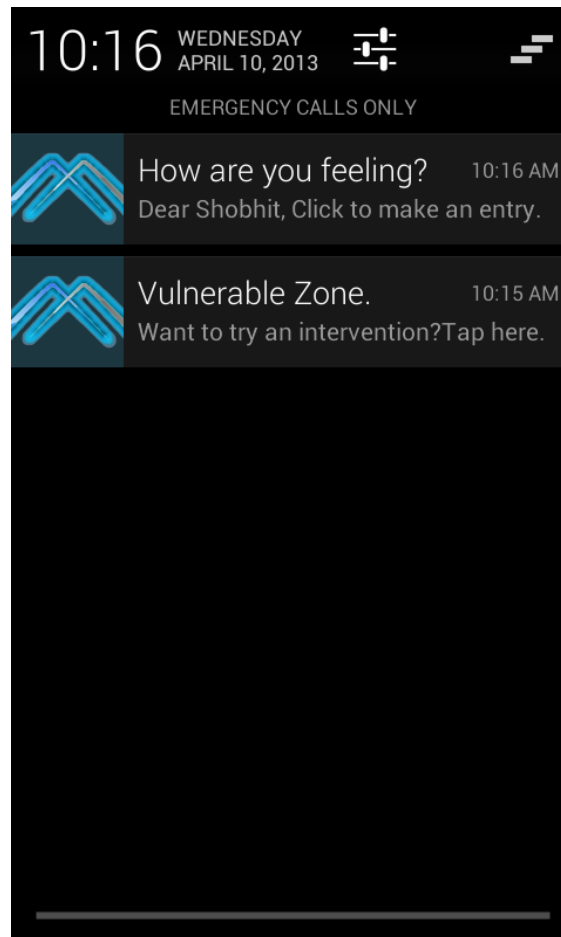
*Intervention survey prompts (green).* This pop-up survey appeared the next time the user logged into mindful me after an entry reporting high craving. The user is asked to identify whether the entry prevented, delayed or did not stop engagement in his/her addiction.

*Data-Driven Functions (purple).* We used the achartengine API (orange) to provide graphical feedback to the user regarding their collected entry data for date ranges selected by the user. We also constructed a calendar where specific dates can be selected to view the full list of entries for that particular day. The location and time data was also used to identify places associated with high craving levels, which were in turn used to trigger notifications (orange) to the user to be mindful of their present setting and practice an intervention strategy. Finally, the intervention survey reports were used to dynamically alter the intervention strategy list to display the most effective and least effective strategies (i.e., suggestions, orange) for each particular user.

## Functionality

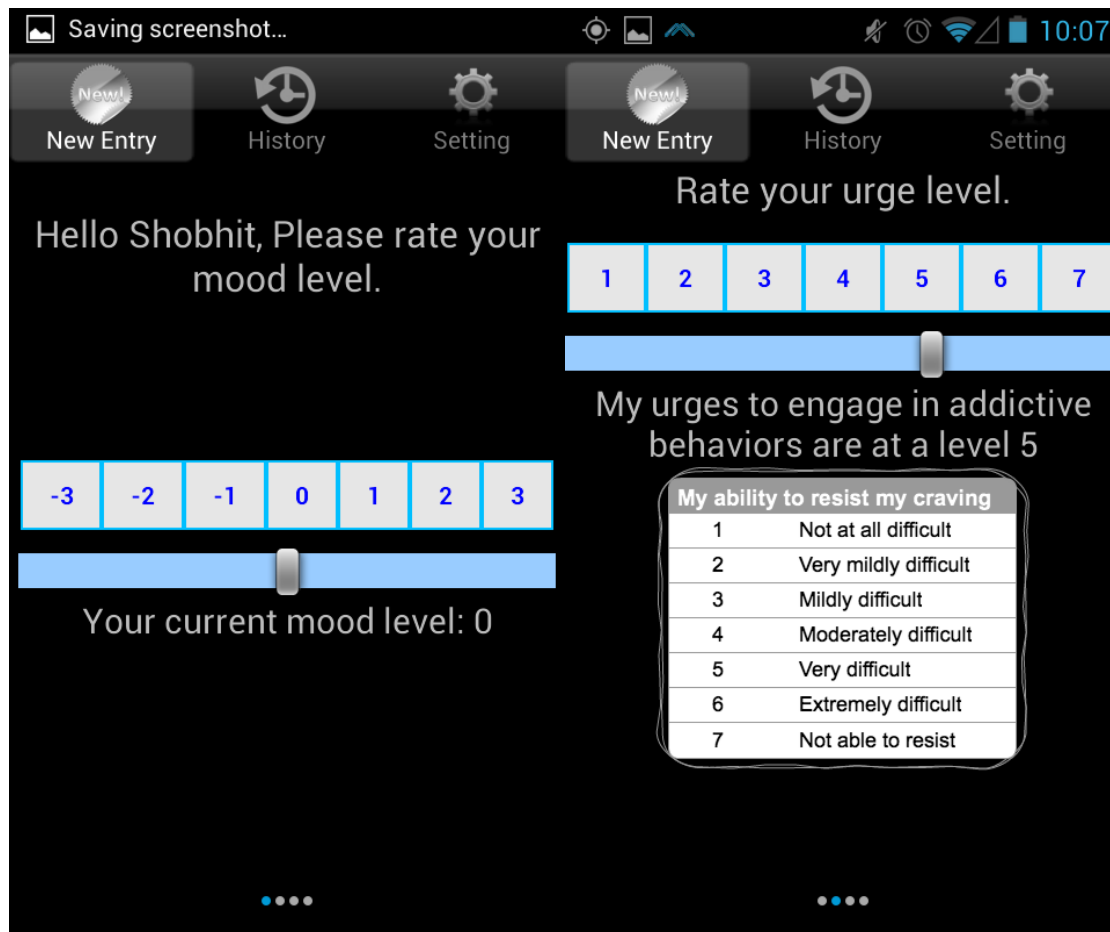
MindfulME is designed to be as simple as possible to allow users to quickly and frequently record their present emotional state and practice intervention strategies to prevent relapse. The app is also dynamic in that it “learns” about each user’s addiction urge patterns and can suggest the most effective intervention strategies for that individual during vulnerable scenarios.

Entries are prompted throughout the day (see first reminder below), or the user can choose to input an entry.

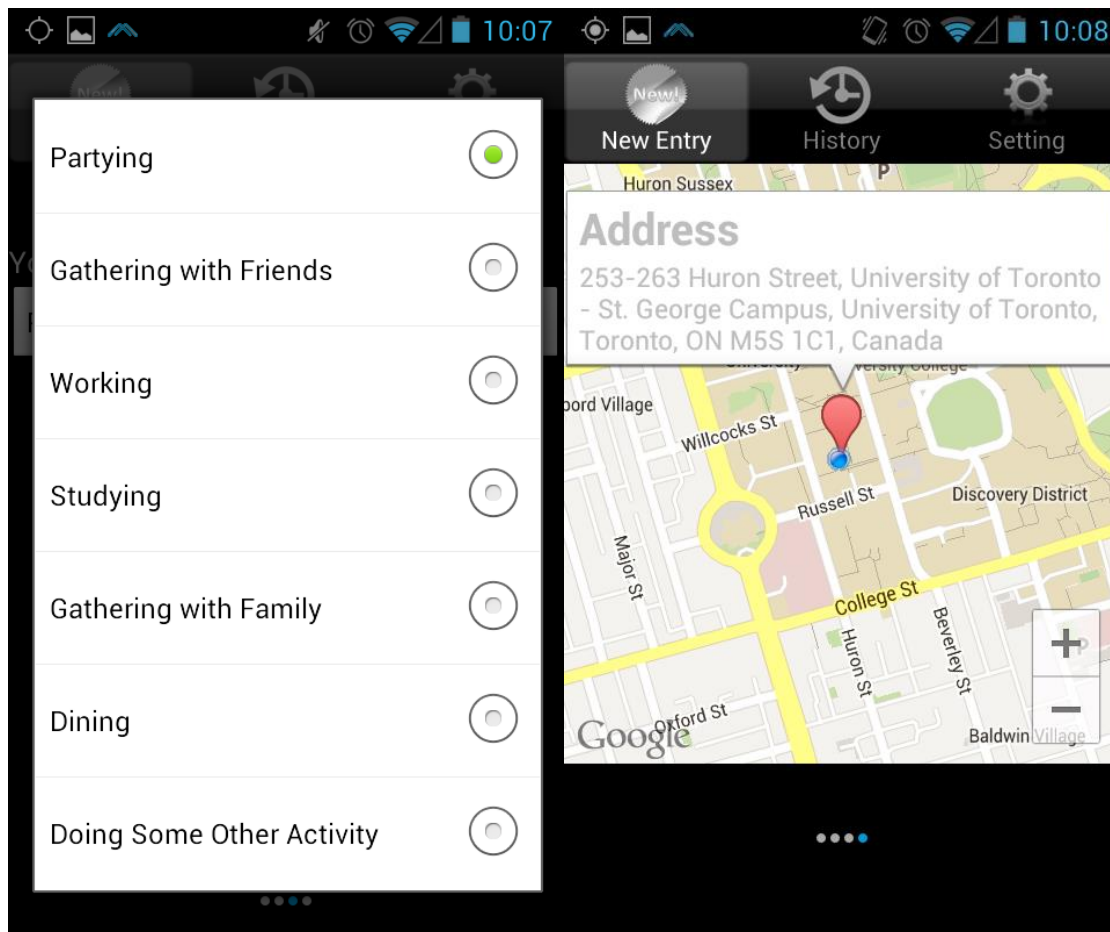


The menu bar at the top of each screen enables the user to quickly navigate from entry input, to the data history, to the settings page.

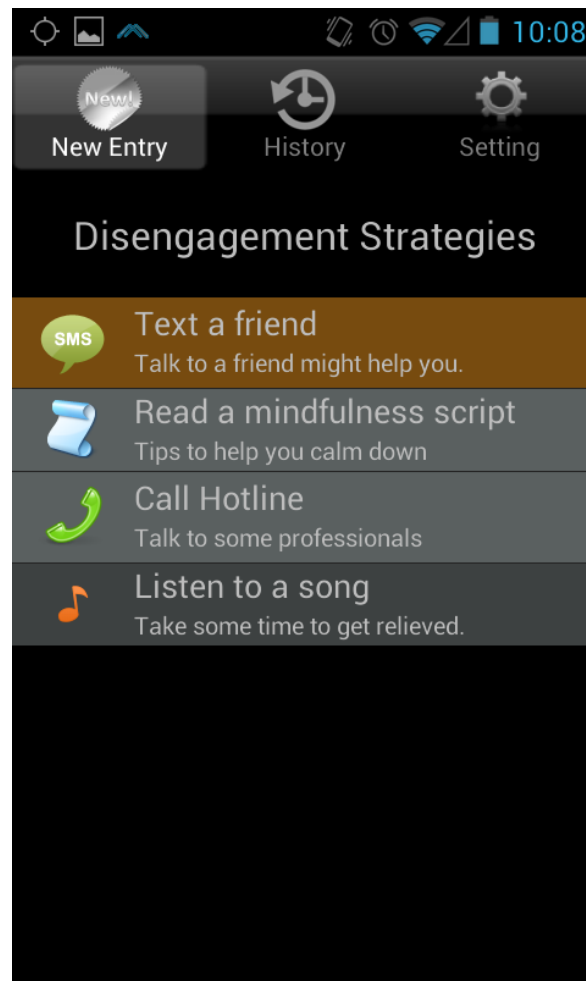
The first two screens simply record basic positive versus negative mood on a bipolar scale and the difficulty in resisting the temptation to engage in addictive behaviors.



The third and fourth screens display asks the user what activity he or she is participating in and display GPS-identified location. The user can select from a list of pre-programmed options or input a new activity, which will be incorporated into future lists the next time the user opens the app.

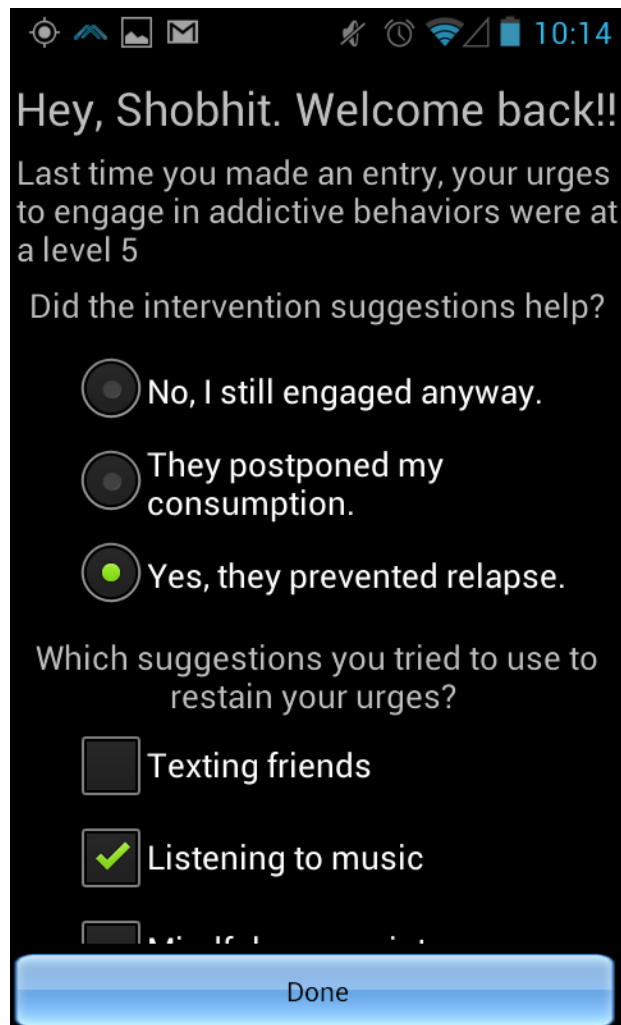


Next, the user is directed to a list of possible intervention strategies. The strategies are color-coded to reflect their efficacy in preventing relapse in the past. Orange indicates an effective strategy, light gray a neutral strategy, and dark gray an ineffective strategy.



Effectiveness is determined and updated from app-prompted surveys. Strategies that prevent relapse are weighted with a +1 value, strategies that delay (i.e., “neutrally effective”) with a 0, and strategies that did not help with a -1 value. The average value is updated by a survey pop-up on the first screen the next time the app is opened after a strategy was used.





A mobile application interface with a black background and white text. At the top is a status bar with various icons and the time 10:14. The main content area contains a greeting, a paragraph about previous engagement levels, a question about intervention suggestions, three radio button options, a question about suggestions used, two checkbox options, and a 'Done' button at the bottom.

Hey, Shobhit. Welcome back!!

Last time you made an entry, your urges to engage in addictive behaviors were at a level 5

Did the intervention suggestions help?

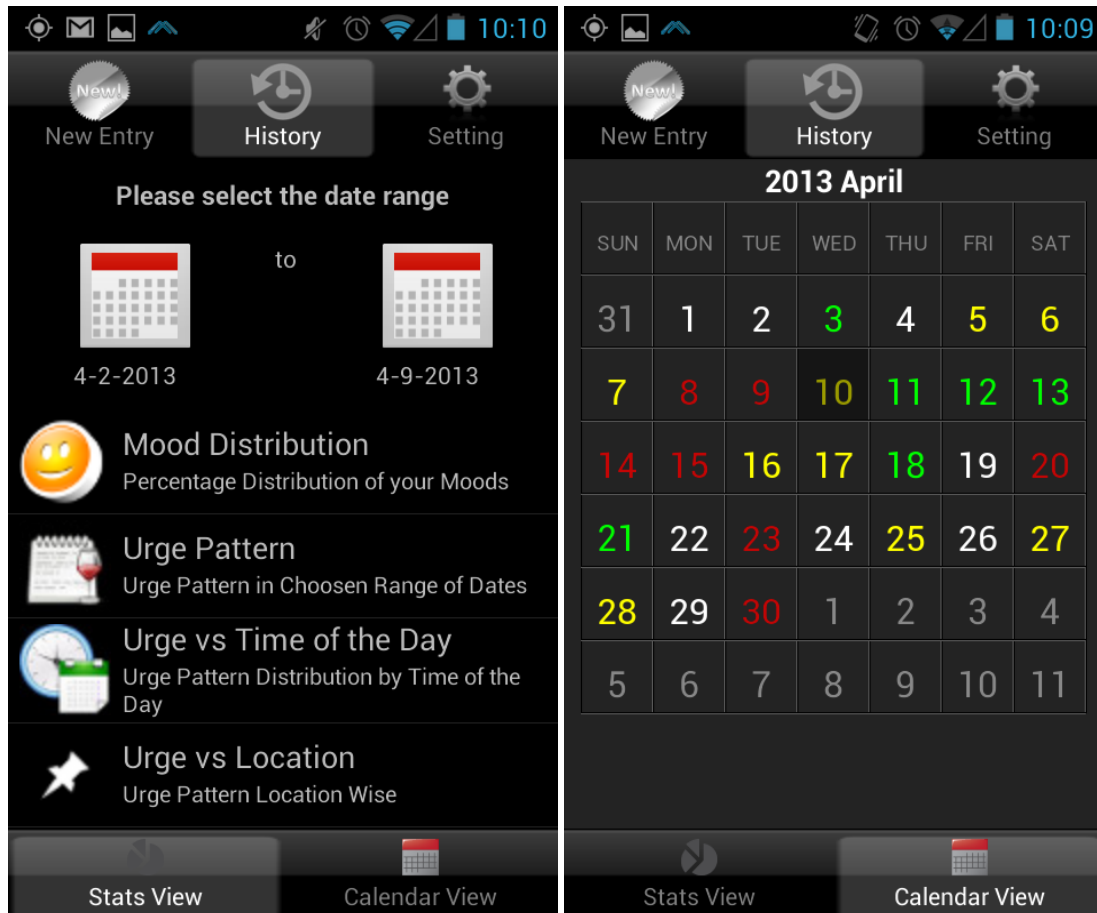
- ☐ No, I still engaged anyway.
- ☐ They postponed my consumption.
- ☒ Yes, they prevented relapse.

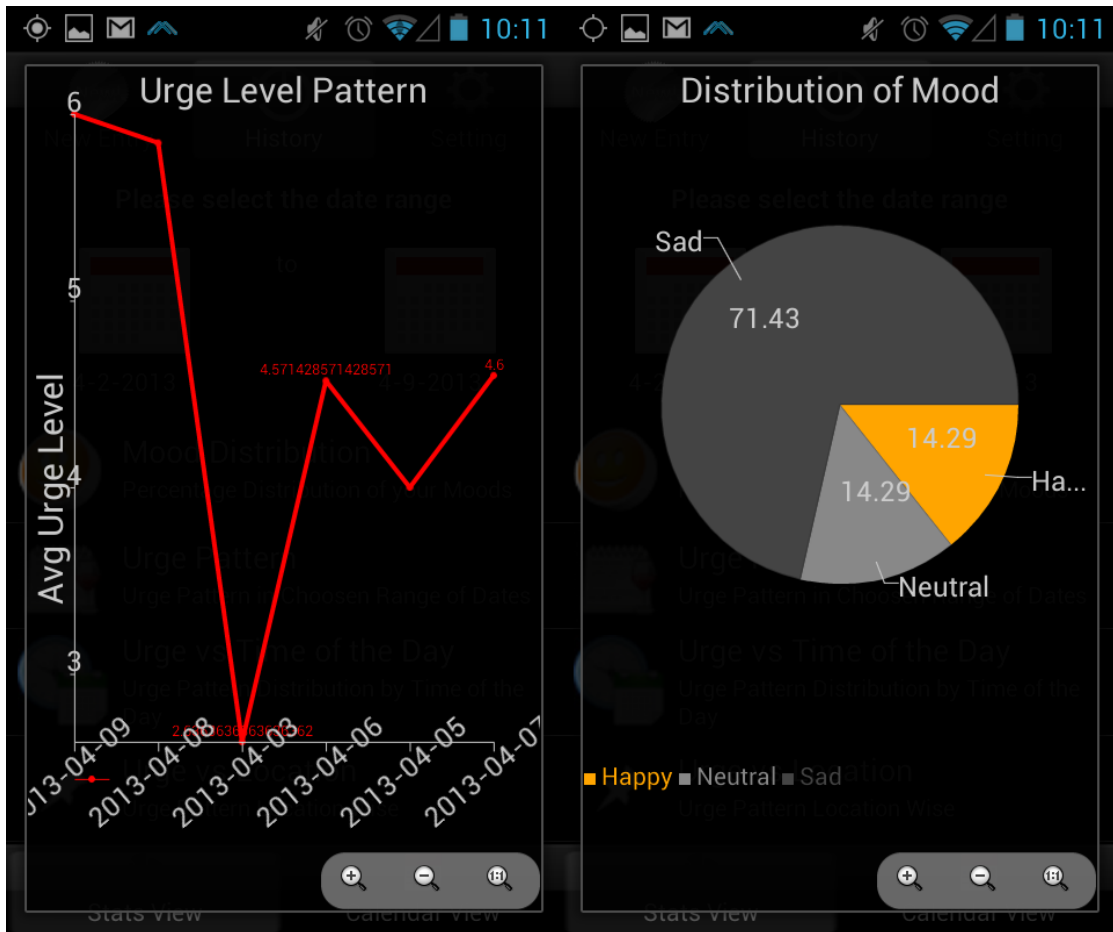
Which suggestions you tried to use to restrain your urges?

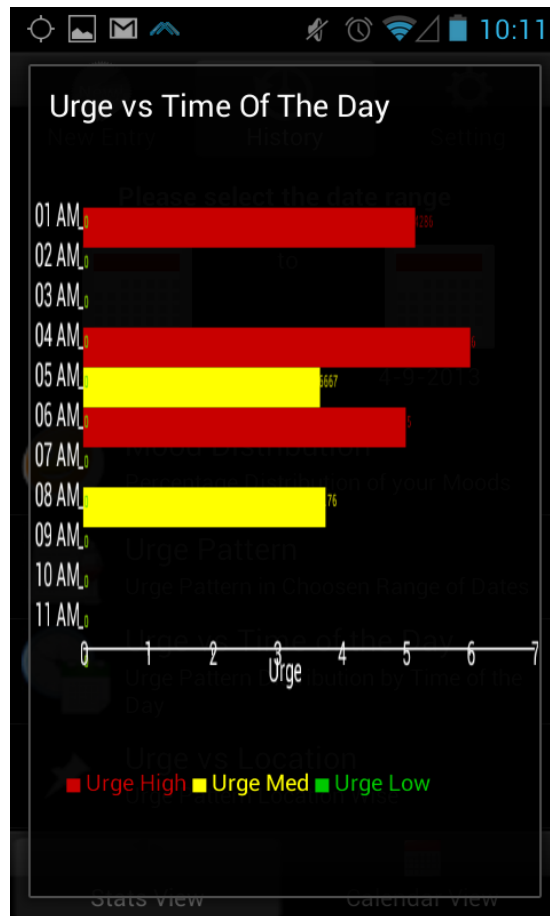
- ☐ Texting friends
- ☒ Listening to music
- ☐ ...

Done

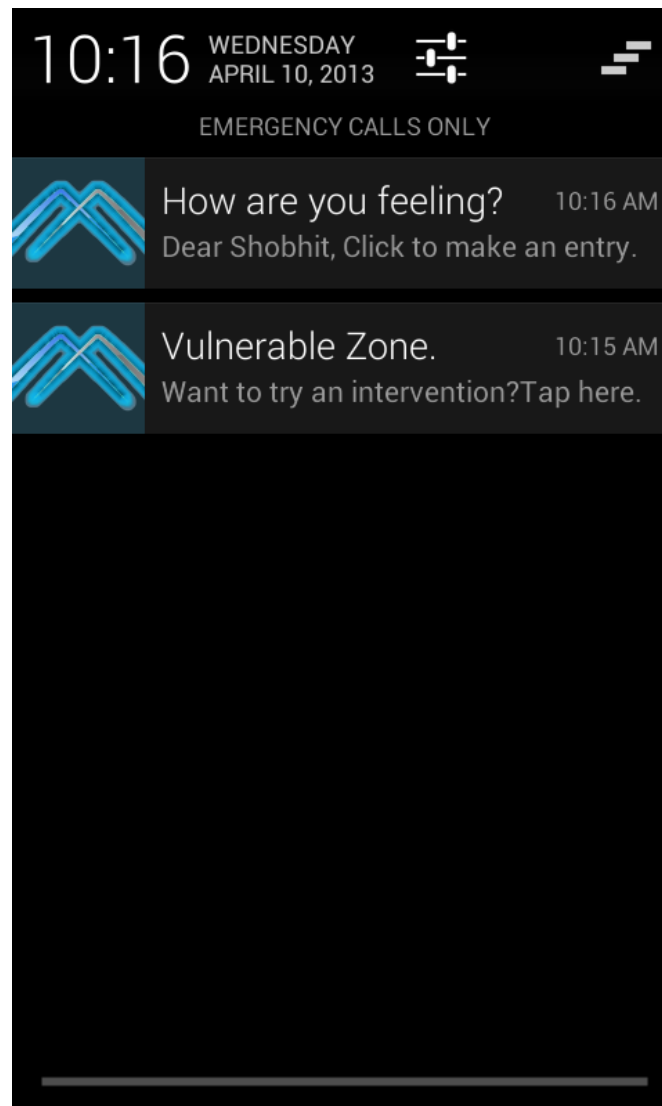
The history page allows the user to either select a view of the calendar of entry dates or the graphical feedback. Calendar dates are colored to reflect high (red), neutral (yellow) or low (green) levels of urging. The stats view allows the user to select a date range and then view either a line graph of the average urge levels across the selected time period, or see the distribution of positive, negative, or neutral mood in a pie chart. Average Urge levels by location and time can be viewed here.



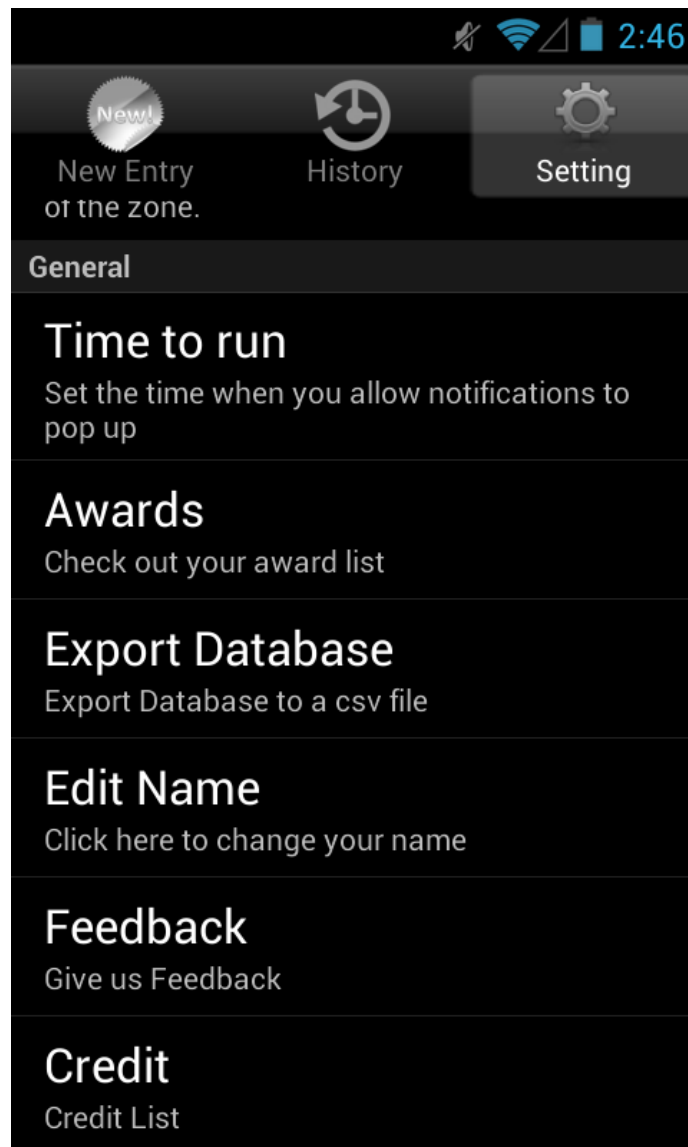


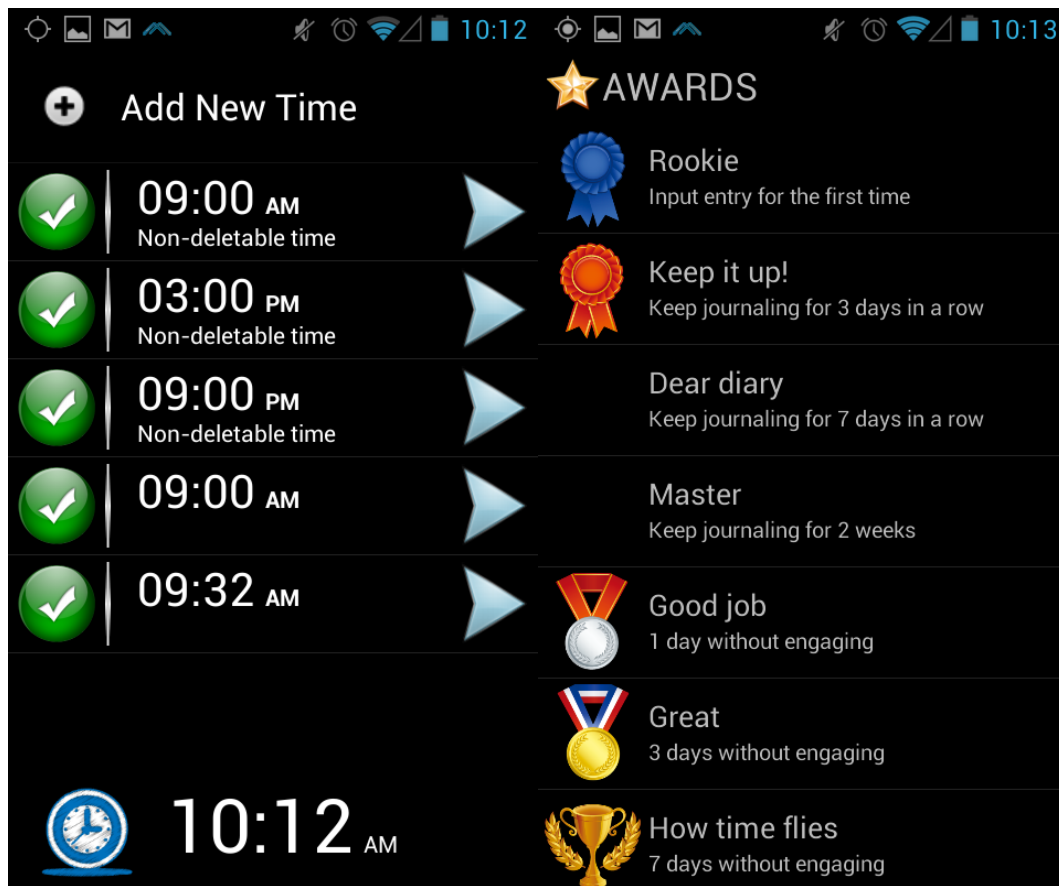


When users are near a location previously associated with high craving levels (average score of 6 or higher), they are asked to try an intervention strategy (see second message below).



Settings can be modified to indicate the time of day entry input will be prompted and the type of prompt used (i.e., ring or vibration). At least three prompts are required. “Mindful” reminders for a certain location may be turned off here, if needed. The individual’s data may be exported in a CSV format via email for visualization in a spreadsheet program. This is also the screen where users can view a list of their achievements, which are awarded based on consistent journal entry input and maintaining reported abstinence for certain time periods.





## Learning Process

Key learning components were mostly organizational. We would have set up an online task billboard to indicated tasks to be completed, tasks in progress, and completed components. We could also use this task to prioritize the most important functions for the product to be viable, ensuring that time would not be spent refining one task at the expense of another key feature.

We also would have set up an online code repository, like Git Hub, were both programmers could work on different features of the same code and easily integrate their code online. This would ensure that both programmers would be working on the same versions and bugs that arise from integration could be quickly eliminated. It would also ensure that the most recent version of the application was available to all users at all times. It was often difficult for all three project members to know how the development of the app was progressing in order to provide effective direction and feedback to each other.

## Contributions

**Elizabeth:** I developed the overall design of the app with a focus on incorporating key components of journaling supported by the addiction recovery literature. I also designed the basic UI mockups, and organized group meetings. I found intervention strategies that have been reported to effectively curb addiction urges and helped my programmers design implementations of the strategies into the app. I also researched the potential use of statistical analyses for the development of the algorithms to trigger “mindful” reminders and helped design of the algorithms used in the final version. To ensure our app reflected current practice and research in the addiction field, I contacted researchers at CAMH, the national institutes on drug abuse (NIDA), and a local therapist to ask for their feedback and suggestions and conveyed this information to the programmers. I also did a majority of the writing and powerpoint designs for the presentations.

**Shiying:** Based on the mockup originally designed by Elizabeth, I did most of the re-designing and execution job. The work includes the logo, launching page design and almost all the user interface implementations and basic functionalities (such as the tab view, the entry pages, the intervention page, the calendar, settings components, etc.).

Apart from the user interface, my other contribution can be concluded as enhancing the user’s interaction experience. I introduced a lot of HCI principles to make the app easier to operate, such as fling to between pages, a lot of alerts to tell the users what’s going on and make the intervention strategies dynamic and color coded according to the users’ favor.

I also carried out things like customized notification pop-up times, awards, export database to csv files and email sending (to request for technical support and backup the database) to meet the general demand of the users.

**Shobhit:** I had set up the database to store all the journaling data that the user inputs. I took care of the getting time of the input and the current location of the user which includes coordinates and address of the user. I also did the Google Map part. I took care of color coding of calendar and for retrieving information when user clicks on calendar dates. Another contribution was identifying the vulnerable zones of the users and pop up the notifications whenever they are in the 100 meter proximity of those vulnerable zones. I worked at providing user with the list of vulnerable zones along with the average cravings and there current distance from them. It also enables user to disable the notification alarm for specific locations. I implemented the notification alarm to remind the users to make journal entry on their chosen times. I did the data visualization part. To help users become aware of their behaviors, moods, and cravings, I worked at providing them various graphical patterns showing percentage distribution of moods, craving pattern and average craving levels at different times of the day



for the given range of days. This, along with color coding of calendar, helps them identify their mood and craving patterns.

## Apper Context

This app has potential to impact both the addictions research field as well as clinical practice in addictions recovery. In relation to research, most studies currently rely on monitoring abused substance-reactivity among individuals in an artificial setting. A few researchers use experience-sampling methods (ESM) to probe users at fixed intervals throughout the day regarding their emotional state, reported location, and drug use. However, these studies utilize outdated palm pilot devices for their data collection. These devices cannot be dynamically modified in real time to alter questionnaires in reaction to location changes. Information regarding location must rely on accurate self-reporting, rather than GPS tagging. Smartphones are virtually ubiquitous and apps can quickly be implemented across a broad range of devices. Thus, this archaic system of data collection could benefit from the use mobile platforms, which can provide more dynamic and accurate reporting for addictions researchers interested in ESM.

Researchers wishing to empirically test intervention strategies for relapse currently rely on controlled observations in artificial settings, or depend on accurate self-reporting by participants. The incorporation of intervention strategies in our app provides the potential to test the efficacy of novel interventions in real time within an ecologically valid setting (i.e., a location where the user has actually used drugs in the past). Targeted reminders to engage in an intervention strategy when study participants enter relapse-prone areas also may improve the likelihood that participants actually engage in the strategy, enabling more reliable research in real-life settings.

Clinicians often report difficulty in journaling compliance among their patients. This is influenced by the lengthy nature of paper-based forms and resistance to journaling on such forms in a public context due to privacy threats. If users choose to complete their forms at a later time in privacy (e.g., home), this can introduce distorted recall effects that may compromise accurate reporting. Smartphones offer a means to discretely journal in real time. Our application also lowers “barriers to entry” by making the journaling process quick and simple; with sliding-scale reporting, automatic location and time logging, and dropdown location selection. We can also encourage journaling activity with the incorporation of rewards for achieving milestones for consistent entry logging and reported maintenance of abstinence. Furthermore, the useful data garnered for journaling can be quickly displayed in a graphical format to help the user identify scenarios that are most associated with the propensity to

relapse and this information can be shared with practitioners to aid in intervention strategy development. In conclusion, this application offers many opportunities to enhance the efficacy of journaling practice in addictions recovery.

## Future Work

We are interested in further development and marketing of our application. We hope to gain additional funding for this endeavor through the Ontario Brain Institute's Entrepreneurial Fellowships, which awards \$50,000.00 to support the development and marketing of technological therapeutic devices for individuals with neurological disorders, such as drug addiction. We also plan to add a website that will allow users to view their data on their home computer screen and customize features on the device, such as selecting or deleting additional emotional reporting (e.g., guilt, shame, joy, excitement). We wish to expand the reward list to incorporate more prizes that may be more reinforcing to the individual, and extend this function to allow users to share their accomplishments on social media platforms, such as Facebook groups for addiction recovery. We would also like to allow users, practitioners, and researchers the ability to incorporate their own intervention strategies into the framework of our app. This may be done by requests to the development team for a small fee. This feature enables our device to be used in a research context where intervention strategies can be tested in real-life settings with multiple, real-time reports for accurate data collection. Last, we would like to enable report sharing between patients and their practitioners so they may share their progress in addiction recovery.

## Entrepreneurial Class

We would be interested in working with the business school to effectively market our app for widespread distribution. Learning how to generate interest in our product, raise capital for further development, and project management skills would certainly substantiate the skills already garnered from participation in this course.

### Beneficial resources:

- Basic Android Development guide: found most of the documentations and references here at the official Android developer page.  
<http://developer.android.com/index.html>
- Google Map API and Sherlock ActionBar Library: to show the map and get the current location strings, we used the Google map API and primarily consulted the source code

from the recommended textbook.

<http://actionbarsherlock.com/>

<https://developers.google.com/maps/>

- AChartEngine: To create chart  
This open source chart engine creates the charts that we used in our app. Though it's still an on-going project, it provides basic ability of drawing the nice-looking charts and it's created locally, which doesn't require internet connection when generating the charts.  
<https://code.google.com/p/achartengine/>
- Opencsv: To import and export database from/to a csv file  
We provided the user with the option to backup the database and, most importantly, hopefully cc the researcher their data when they're sending the csv file to their own email account. Opencsv is a very useful project to execute such features.  
<http://opencsv.sourceforge.net/>
- Some other useful website:
  - Stackoverflow: almost every problem you have can find a solution and some experts there. It's extremely recommended because of the big user pool.  
<http://stackoverflow.com/>
  - Android Developers Google group: a lot of questions can also be solved or find some examples here.  
<https://groups.google.com/forum/?fromgroups#!forum/android-developers>