Creating Visuals of Data Patterns to Implement a Behavioral Intervention System

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Abstract:

Obesity is one of the top health issues around the globe. Overeating is one of the main reasons behind obesity. Research shows that the vast majority of weight loss apps in the market place do not go beyond deploying tracking based strategies that are burdensome to the users. Contrastingly, SlipBuddy puts less burden on users and implements stimulus control strategy to help users lose weight. The app has an intervention system that generates a decision tree based on the individual's inputs. The goal of this project was to take those decision trees and create a visualization of the top intervention for the user. We made several designs and modifications on these designs. This document goes over the major designs we created throughout this project, our final designs, and the pros and cons of each design. We hope that the use of these visualizations will help add to the effectiveness of the app by increasing user engagement and user understanding of interventions.

Background:

Obesity: affects 30% of the US population and 13% of the world's population.

Slip Buddy: instead of having to constantly record their food intake and exercise, users only have to enter their data in two forms:

1. Morning, afternoon, and evening check-ins with very quick questions (i.e. sleep, hunger, stress)
2. A "slip" or anytime a user eats more than they planned to (overeat)

Factors considered (from both data entries): sleep, stress, activity (what the user was doing), location, hunger, and weight gain; these have all been linked to overeating in the past.

SlipBuddy then creates a custom decision tree for the user by analyzing their data to determine what factors or patterns (overeating triggers) are most likely to cause them to overeat.

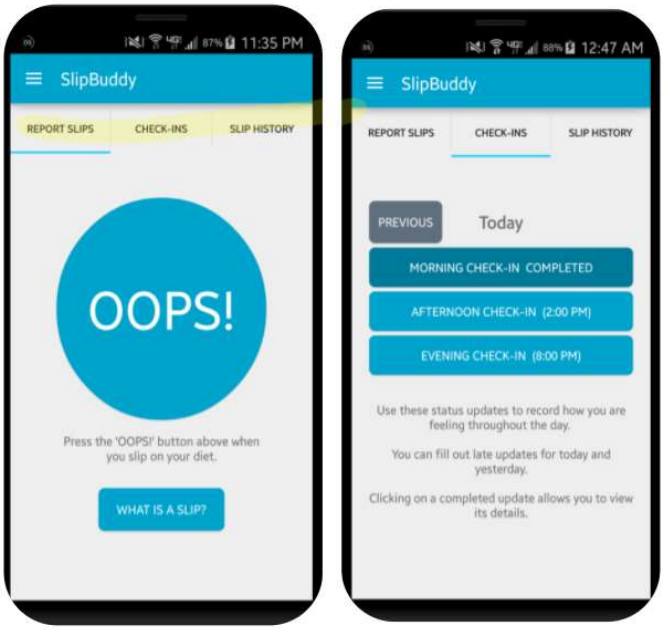


Fig 1. *The introductory pages of SlipBuddy. On the left, the user records a slip. On the right, the user records their stress levels at different times of the day. The user can navigate between the tabs using the navigation bar.*

Objective:

The SlipBuddy App uses Artificial Intelligence, in particular machine learning and data mining, to create decision trees (shown on right) for each individual. The decision trees reveal overeating patterns that the individual has. These patterns are referred to as interventions. The goal of this project is to design and implement a clear, concise, and engaging visualization to display the individual's top intervention.

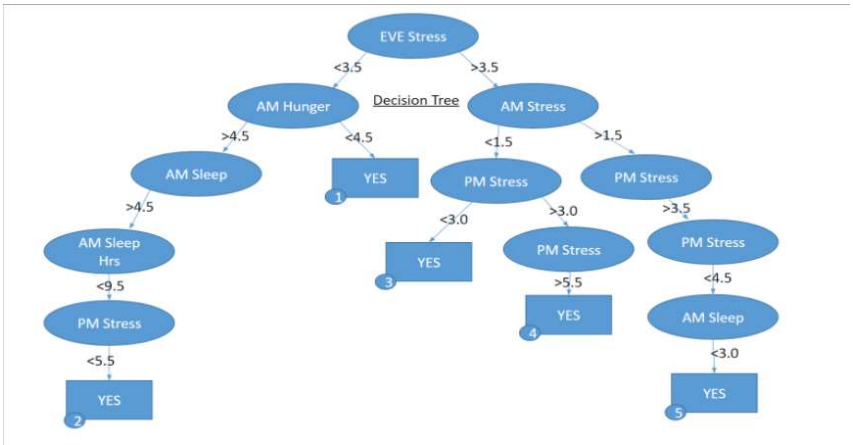
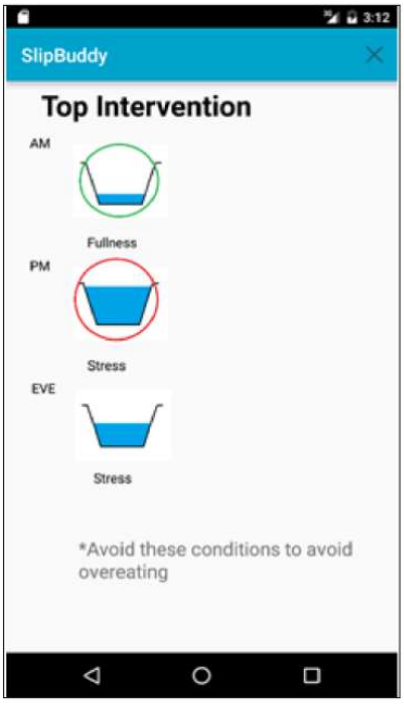


Fig 2. *An example of an individual's decision tree. Each branch constitutes an intervention.*

Intermediate Designs:



1st Prototype

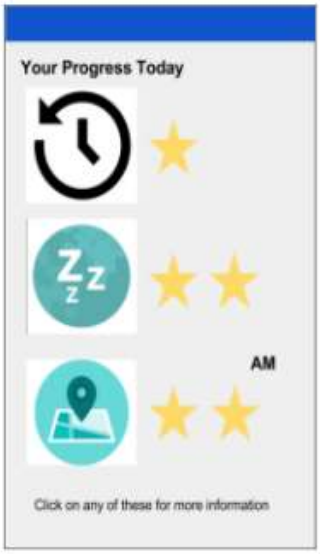
The left shows the first design created by a WPI student.

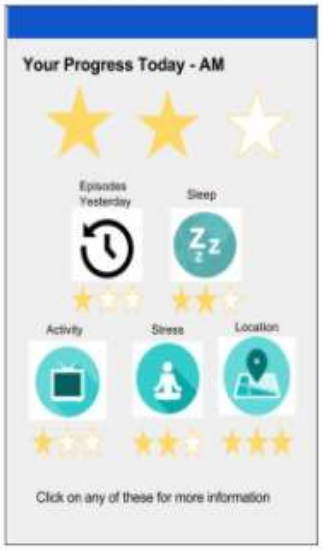
Our improvements:

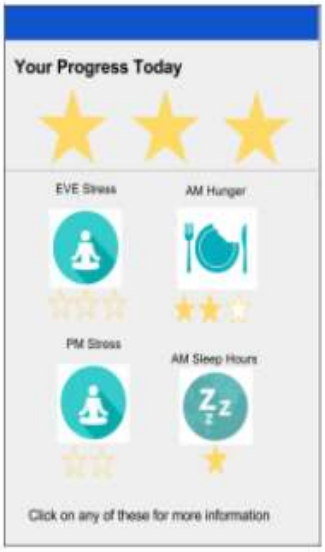
- 2 columns so user can compare current status to triggering pattern
- Emoticons - visual feedback

Things to improve:

- Replace bucket with a less confusing symbol
- Replace red and yellow emoticons with more positive icon







2nd prototype

Our improvements:

- Stars instead of buckets for more encouragement and clarity
- New layout to indicate that the factors are all connected
- Using icons for quick visual information about pattern
- Weight of factors thru different amounts of stars
- Overall progress bar to make the status more game-like

Your Overeating Pattern

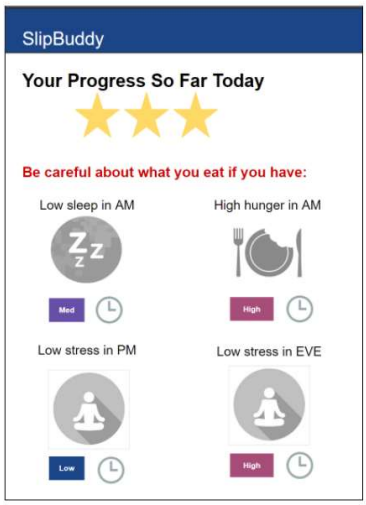
You are likely to overeat if the following happen:

- Sleep in the morning less than 9.5
- Hunger in the morning more than 4.5
- Stress in the afternoon less than 5.5
- Stress in the evening less than 3.5

Fig 3. *Example dialog box accessed by tapping on the overall pattern. Provides the user with specific information about their overeating patterns. Determined from their decision tree.*

Things to improve:

- Descriptions of icons and time indicators
- More personalized information and clarity of what actions the user should take in the future



3rd prototype

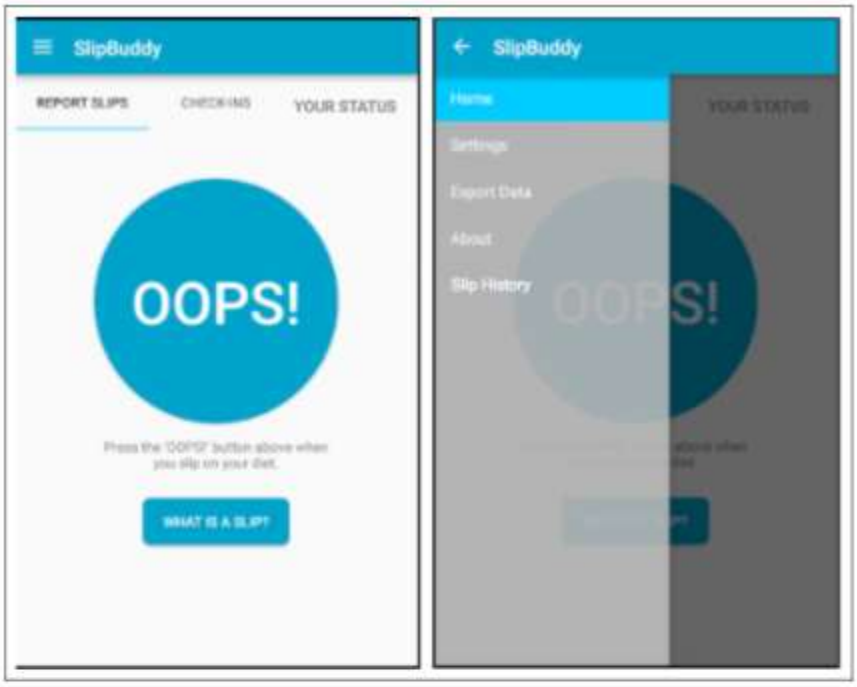
Our improvements:

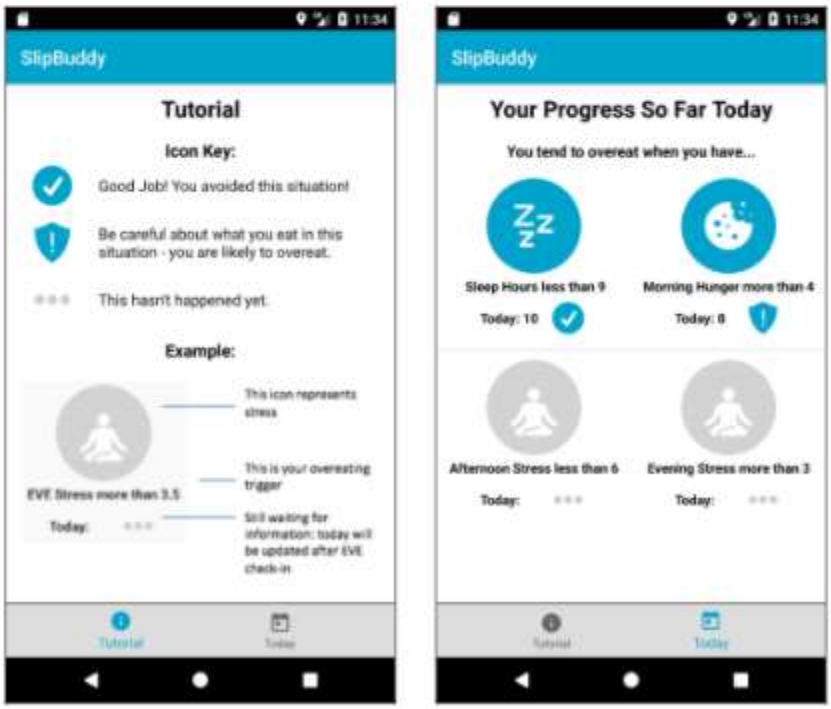
- Tutorial page and navigation bar
- Less stars; more color
- Fixed wording to cover abnormal situations

Things to improve:

- Visual busyness of page
- Stars context
- More personalization

Final Design:





Changes to Current App:

The two images on the left show the few changes we made to the current app.

Our improvements:

- We moved the Slip History tab to the navigation bar
- We changed the Slip History tab in the top navigation to a Your Status tab which displays out final design shown below

Final Design:

The two images on the left show our final design. The navigation on the bottom allows you to change between the tutorial and today tabs.

Our Improvements:

- Example added to the tutorial page
- Removed overall progress stars
- Removed High, Med, Low icons
- Removed math symbols and used words instead
- Removed decimals and rounded up or down
- Added a today section that displays today's information along with the check or warning icon
- Changes icon for something that has not happened yet

With the final design we decided the best way to display certain information would be with words rather than using so many icons. We also decided an example would help the user out a lot. The removal of some icons and the addition of more words gives the design a more simple feel. It also makes the design easy to interpret.

Conclusion:

Our team used Android skills and knowledge of behavioral interventions, decision trees, and human-computer interaction principles to create informative visuals that will hopefully improve the pre-existing SlipBuddy app by increasing feedback to the user and allowing the user to view their personalized intervention data. Our team interpreted the top branch of the user's overeating decision tree and created a clear, concise, and engaging visual display for the user to view their progress throughout the day. We then proceeded to implement the responsive design in android studio and receive the data from the pre-existing database.

Future Work:

- Give the user the ability to customize their intervention messages
- Allow the user to see more than one potential triggering pattern
- Present information to the user about common overeating trigger patterns if we do not have enough information to determine their custom pattern
- Make the design compatible with location and activity triggers along with the current triggers