

# DASH

## Team

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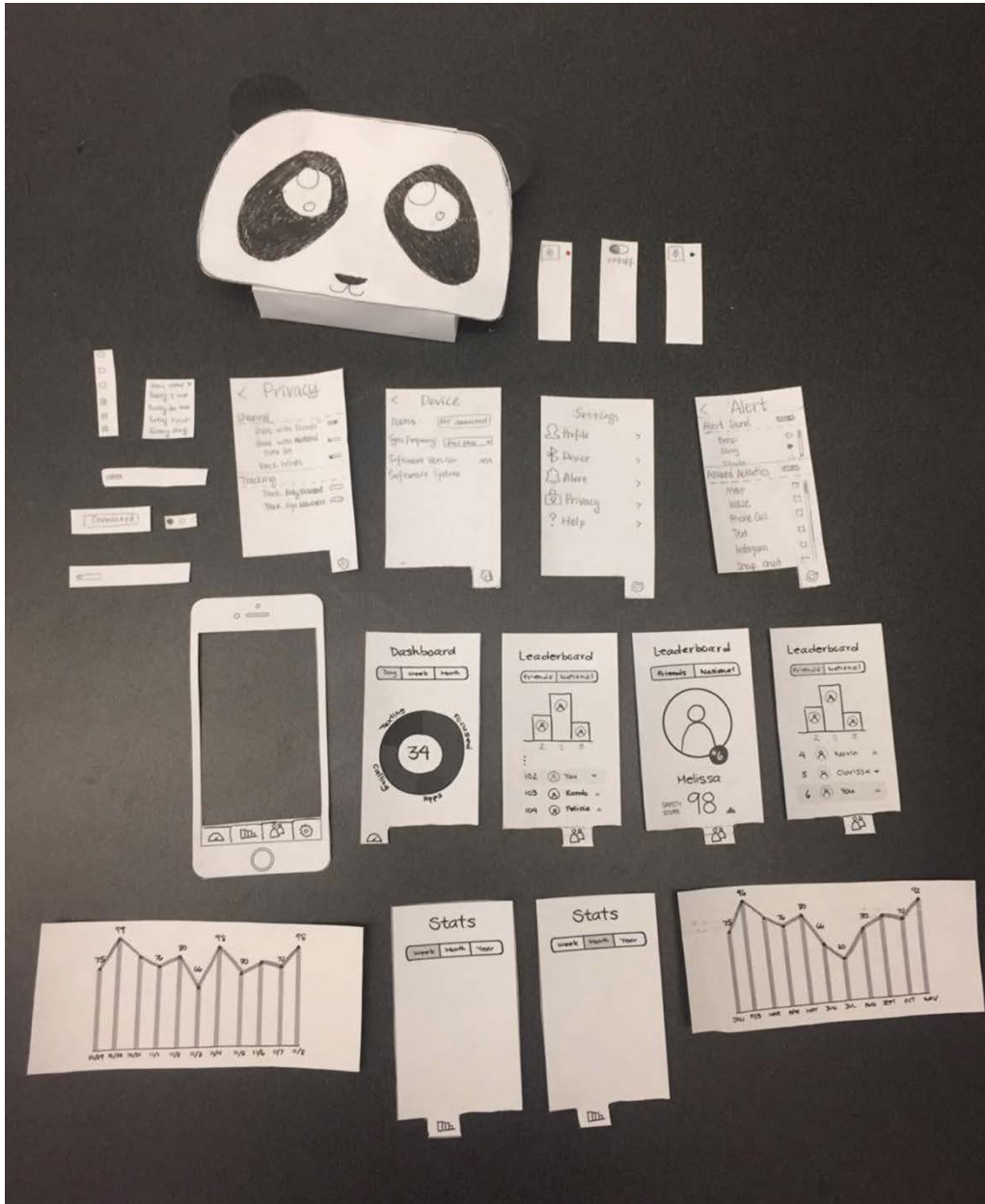
## Problem & Solution Overview

Texting a friend, navigating on GPS, admiring the scenery along a road--these are all common distractions that lead to motor accidents. Distracted driving is a major issue, and many states have enacted laws in response to the alarming correlation between driver recognition error and vehicle accidents. Unfortunately, many people continue to engage in distracting behavior, even though they are aware of the dangers of unfocused driving.

We are designing movement-tracking hardware and a mobile application, DASH, that allows users to visualize and share data on driving behavior. By providing users with information on how they spend their time driving, we can motivate them to be more conscious about road safety. The goal of our project is to track, process, and visualize driving behaviors; prevent potential accidents; and encourage safe driving habits through social sharing of driving safety scores.

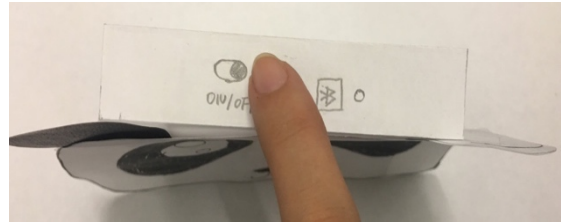
## Initial Paper Prototype | OVERVIEW

Our paper prototype features two components. The first component is a hardware device that tracks eye and body movements. The hardware contains an on/off switch, volume controls, and a Bluetooth indicator light. The second component is a mobile application that visualizes data and allows users to compare their driving statistics with others. There are four main tabs in our app: Dashboard, Statistics, Leaderboard, and Settings.

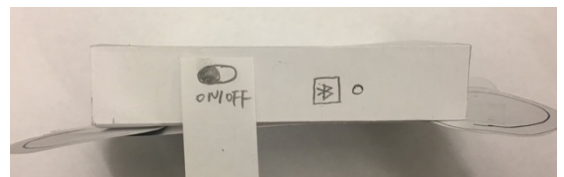




(Figure 1.1) Hardware overview. Kinect-like trackers are located in the eyes of a user-friendly panda.



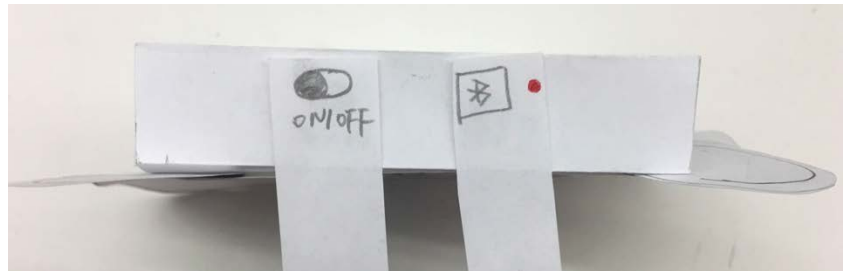
(Figure 1.2) User can switch tracker on/off.



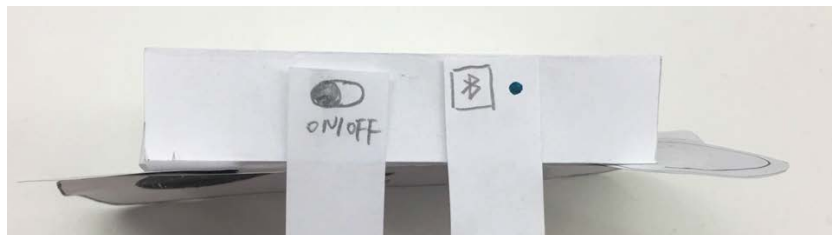
(Figure 1.3) Tracker is now switched off.



(Figure 1.4) Side view with volume controls.



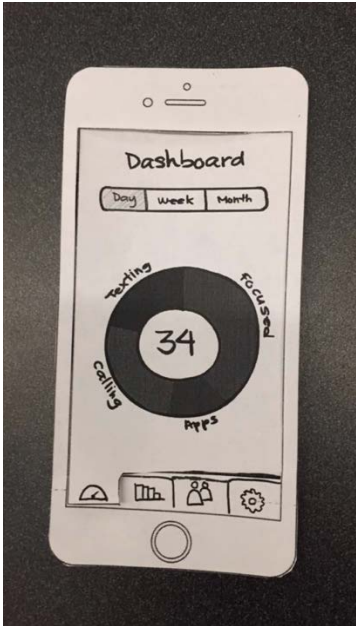
(Figure 1.5) Bluetooth pairing with mobile device is off.



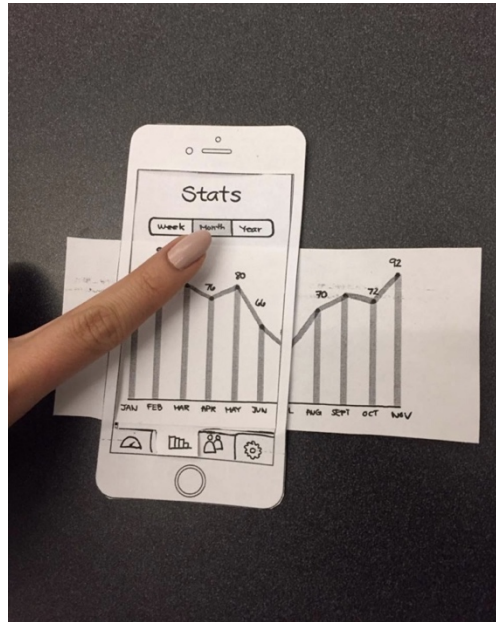
(Figure 1.6) Bluetooth pairing with mobile device is on.

## Initial Paper Prototype | TASK 1: VISUALIZING & PROCESSING (CONT.)

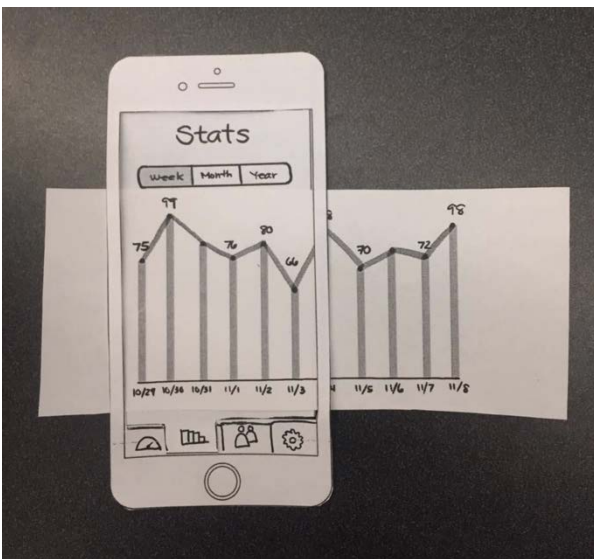
The following mobile app screens demonstrate statistics on overall driving safety.



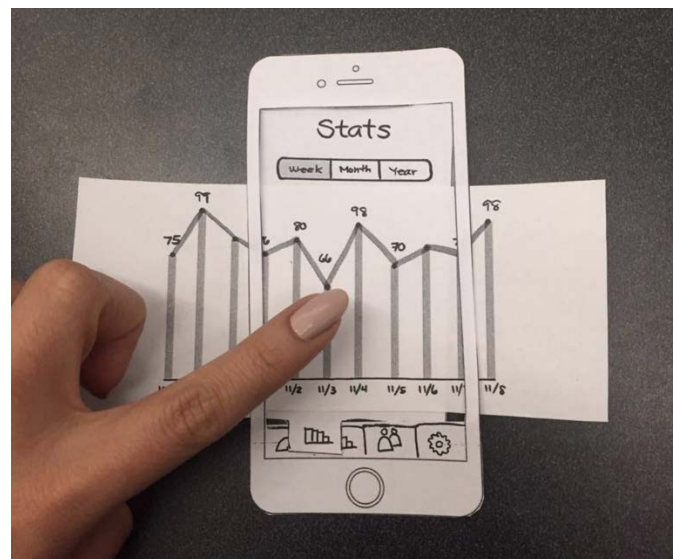
(Figure 1.7) Homepage of recent driving activity, categorized. Center number represents driver's Safety Score (i.e. percentage of time spent focused on road).



(Figure 1.8) Month view of safety scores.



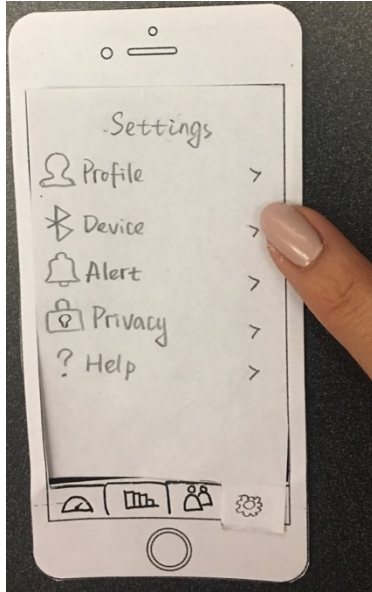
(Figure 1.9) Week view of safety scores.



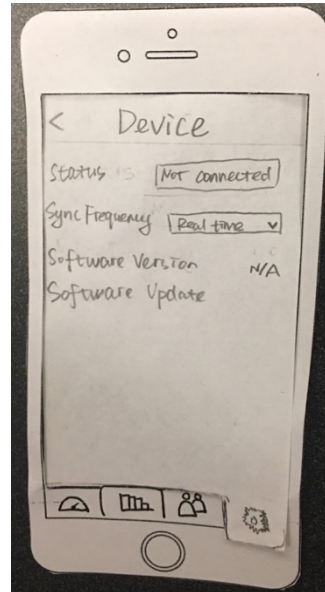
(Figure 1.10) Demonstrating side scroll for viewing average safety scores.

## Initial Paper Prototype | TASK 1: VISUALIZING & PROCESSING (CONT.)

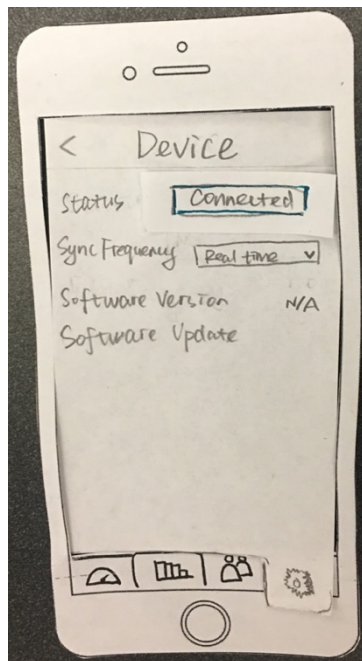
The following mobile app screens demonstrate settings for pairing hardware.



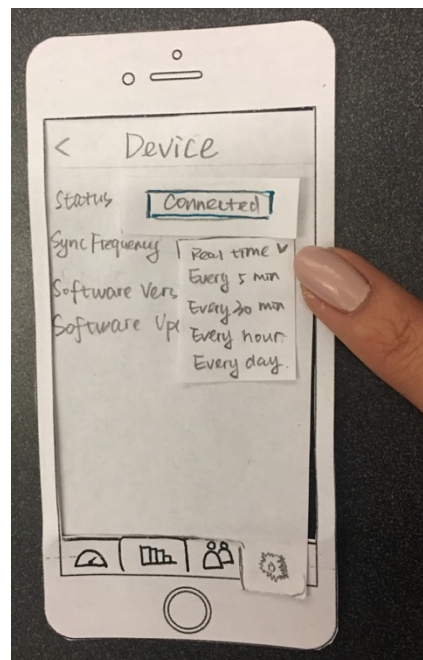
(Figure 1.11) Selecting "Device" takes user to hardware device settings.



(Figure 1.12) Default device settings for hardware.



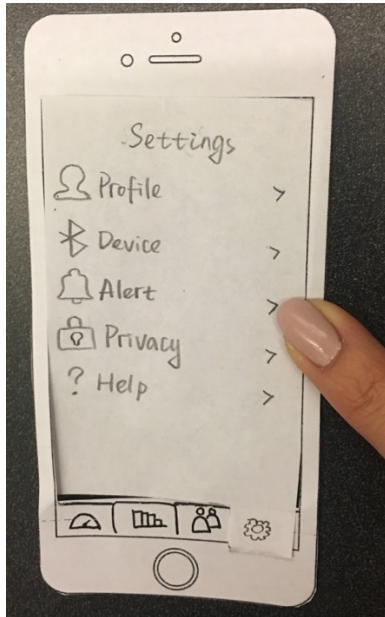
(Figure 1.13) Upon pairing with tracking hardware, the status becomes "Connected"



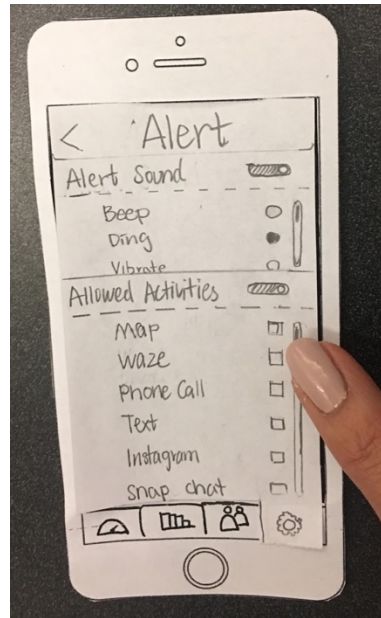
(Figure 1.14) Users can select sync frequency, which determines how quickly data is sent to the mobile app.

## Initial Paper Prototype | TASK 1: VISUALIZING & PROCESSING (CONT.)

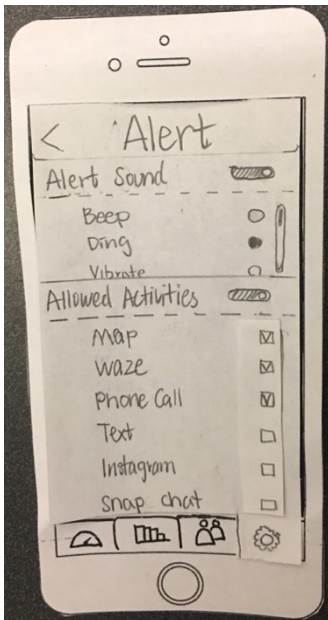
The following mobile app screens demonstrate settings to adjust alerts.



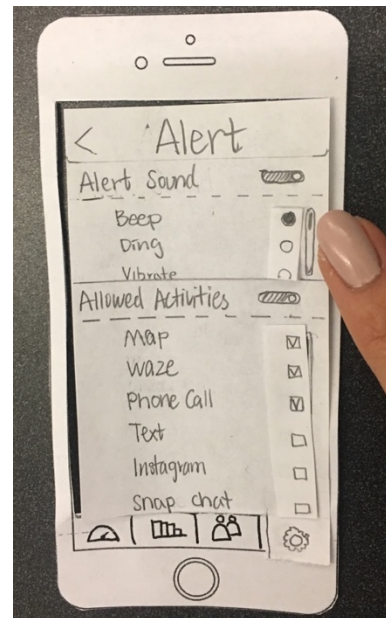
(Figure 1.15) Selecting "Alert" takes user to Alert settings



(Figure 1.16) User can select allowed activities while driving. See Figure 1.17 for result of selection.

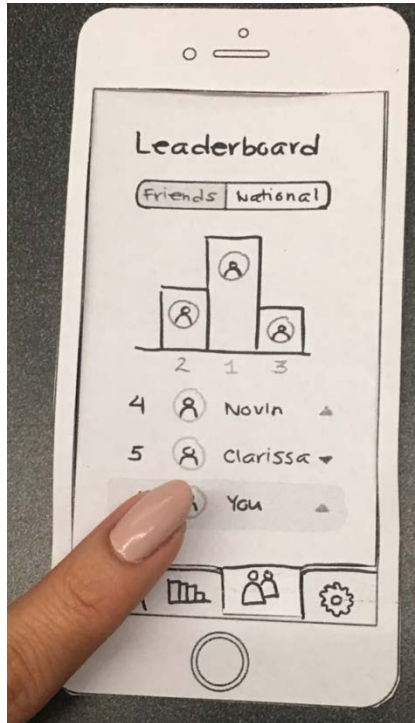


(Figure 1.17) Result of selecting allowed activities after Figure 1.15.



(Figure 1.18) User can select alert sound for distracted driving.

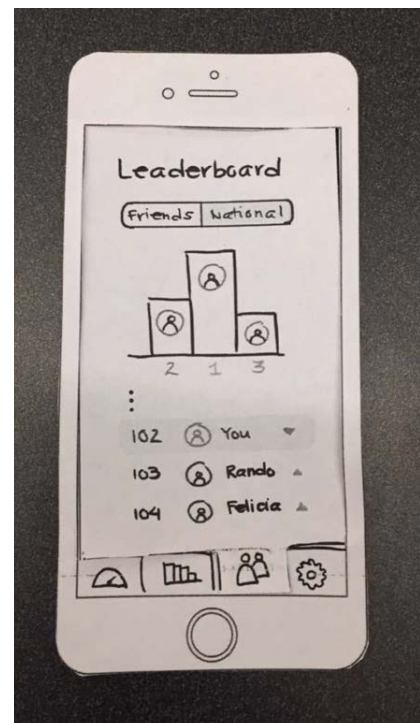
The following mobile app screens display the Driving Safety Score leaderboard.



(Figure 2.1) Friend view of leaderboard. User can select a user to be directed to their profile.



(Figure 2.2) Result of clicking on a user's profile.



(Figure 2.3) National view of leaderboard.

## Testing Process

When choosing our participants, we considered both male and female drivers. We also varied driving experience between our participants. Our first participant was a male UW student. As an inexperienced driver who is currently looking to purchase his first car, he was an appropriate potential user of our product. Our second participant was also an inexperienced driver and received his driver's license recently. We chose this participant because we wanted to have a participant who had fresh experience from driving school. Finally, our third participant was a female driver who drives frequently for running errands and her commute to work. We chose this participant because we want to have some opinions from a more experienced driver (5+ years) and a female driver, since our last two participants were inexperienced male drivers.

To emulate a realistic setting, we conducted the "hardware installation" actions in a car; for the remainder of the test, we chose a quiet room to test the mobile application. We split our testing into two parts. *First*, we wanted to put our users through how we imagined the user to use the app for their first time, and *second*, we wanted to test the activities we imagine they would want to perform after having used the app for a while.

We first introduced them to the panda tracking hardware as if they had just bought it and asked them to pair it with the application it came with. Then, we had them imagine that they've been using it for some time and that the app has developed some statistics about their habits. We then asked them to navigate around the app and check their dashboard, stats, and leaderboard standings.

During our first usability test we simply handed the user the panda device and asked them to turn it on, then gave them the first screen of the app, and asked them to pair the device with the app. This confused the user about what they are supposed to do with the panda. So for the other tests, we told the user to put the device on a computer monitor as if it was their rearview mirror. This cleared up the confusion.

We learned from our first test that we should be more organized with our paper prototype, so in our second and third usability tests, we laid out all parts beforehand. We also learned that wording of questions affected our results. When giving unrealistic situations or providing too much context for a particular task, we found that our users could accomplish tasks with no trouble, leading to less helpful feedback. We found that providing ample time was important in uncovering more usability issues.



## Testing Results

### Heuristic evaluation

We identified several valuable issues during our heuristic evaluation. Overall, the tabs and buttons were intuitive because the participants had no problems finding them. However, the initial design lacked some basic functionalities (e.g. back buttons, detailed data views). One other problem we found is that the prototype did not have enough instructions on how to connect to the device. There were also a couple of minor problems, like missing indications about the scrolling functionality in Stats bar chart. With these valuable feedbacks, we made several modifications to our paper prototype. First of all, we added a pop-up instruction page that helps user pair their phone with the device. Then, we added the feature that when you click on the graph (pie chart on Dashboard or bar chart in Stats), you can see the details within. In the end, we fixed all the confusing designs so that the users should be easily to tell if a part is clickable or not.

### Usability testing 1

We identified some important issues during our first usability test. First we learned that the placement of the buttons on our panda device might be awkward especially if we were going to put it on the rearview mirror so we moved them all to the left side of the device, which faces the driver. We also learned that we did not have functionality to add friends so we added this functionality in. The user was also confused as to what the score on the dashboard was, so we added in an information button that pops up an explanation of what the safety score is. We also found that the up and down arrows in the leaderboards was easy to understand.

### Design critique

We also received two valuable feedback from TAs and peers during “design critique” section. The first design issue was the “allowed activities” functionality in alert setting. It was pointed out that the primary goal of our application is to track data, and allowing users to choose what activities/app are allowed while driving is out of the scope of our application. Thus, we deleted the “allowed activities” functionality, modified it to compute and show the most frequently used app, and add it the new functionality “Top App” in Stats page under day/week/month/year views. The second design issue was the unlimited number of people we are showing in the national view of leaderboard. Showing that many people’s ratings does not only hinder user’s ability to find their own ranking, but also overload user cognitive space with unnecessary information. In results, we updated our national leaderboard to show the ranking of the top 20 people. And, we made sure user’s ranking will always be visible either among the top 20 or after the top 20, so it was easily accessible.

## Testing Results (cont.)

### Usability testing 2

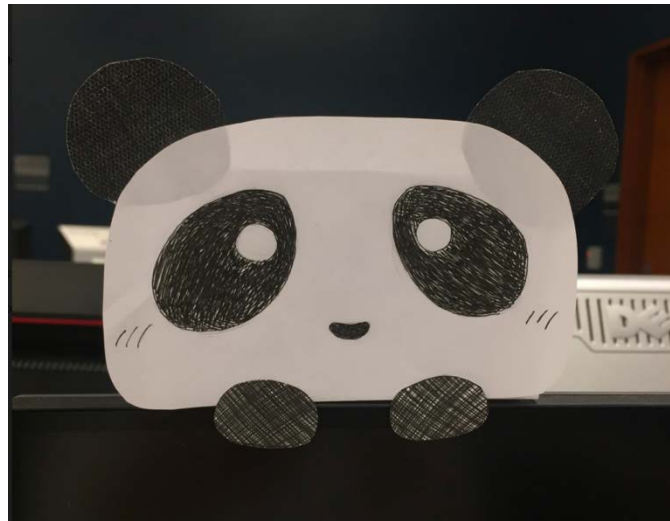
After improving our testing process, such as rephrasing our questions, we encountered some critical incidents, both positive and negative, that helped to improve our application's functionality and design to a higher level. One positive incident we had was that the participant liked the green and red arrows indicating the changes in safety scores. Regarding to negative incidents, we discovered that our application lacked the functionality of navigating to a different day/week/month on the Dashboard view. In addition, once the participant click on a specific portion of the pie chart to view detailed analysis, there wasn't a way to go back to the overall dashboard view. Therefore, we added an bar on top of the pie chart to specify the date that the dashboard is showing and the ability for users to switch between days/weeks/months. We also added a back button on each detailed analysis page. Another improvement we made was on the Stats page. The usability test showed that the week view with individual dates listed is still misleading and user would like to access detailed analysis through Stats page by clicking on the bars. In results, we changed the label of the bar graph for week view to only show the beginning date and end date of the week. We also allowed access to detailed analysis through clicking on the bar in Stats page.

### Usability testing 3

The third usability test went smoothly, as we have discovered and fixed most of the issues in the previous iterations. We were glad to hear the positive feedback that our third participant gave us. There are only two problems that we found in this usability test. The first one was that the participant did not realize that she could click at each individual bar in the bar chart to check out details until we told her. To fix that, we made the bars blue and fatter, and then removed the connecting lines between bars. The second problem, pointed out by our third participant, was that users might remove friend by accident and there was nothing to prevent that user error. Hence, we added a pop-up confirmation page before a friend was actually removed.

# Final Paper Prototype | OVERVIEW

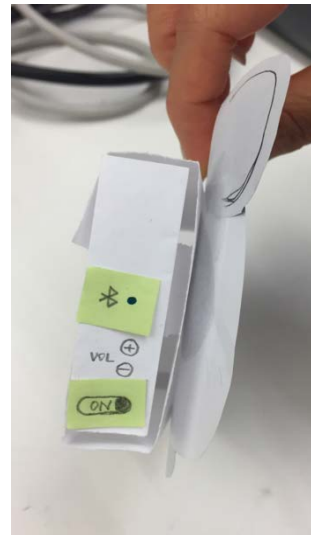




(Figure 1.1) Hardware overview. Kinect-like trackers are located in the eyes of a user-friendly panda. The panda clips onto the car's review mirror. Controls are located at the left of the device.

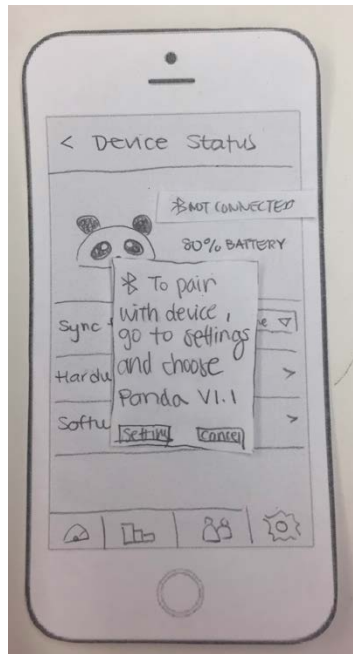
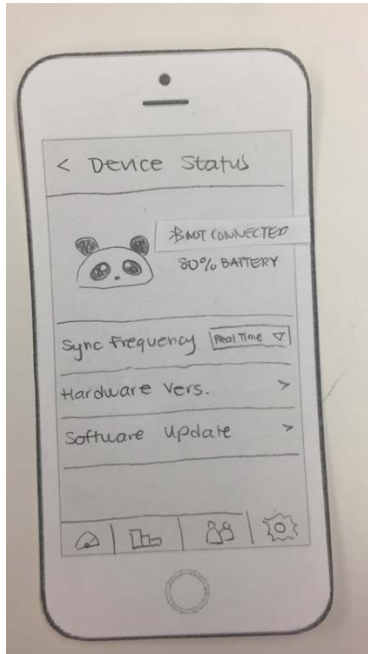


(Figure 1.2) Left side view of panda contains Bluetooth indicator light (green for on and red for off), volume controls, and power switch.



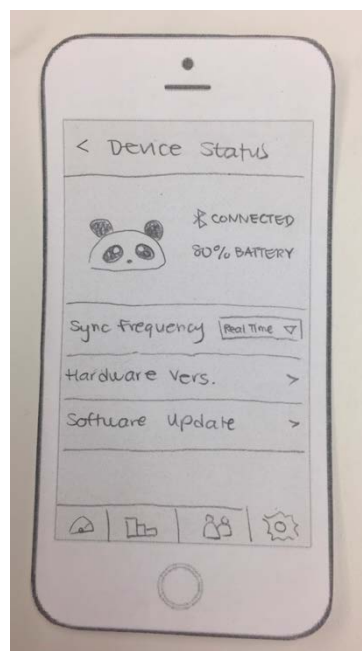
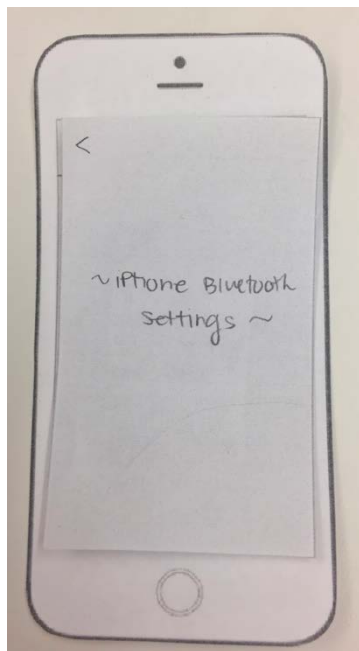
(Figure 1.3) Side view after device has been switch on and paired to phone via Bluetooth

The following mobile screens demonstrate how to pair the panda hardware with the app.



(Figure 1.4, Left) Under Settings > Device Status, the user can pair their device with their app.

(Figure 1.5, Right) The app automatically detects the lack of a connected device, so prompts the user to pair their device. Clicking on "Settings" takes the user to Figure 1.6.

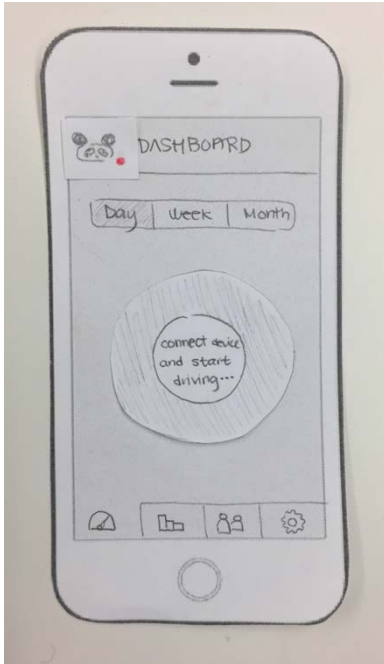


(Figure 1.6, Left) The action in Figure 1.5 leads user to their iPhone Bluetooth settings, where they can pair their device.

(Figure 1.7, Right) The device status is updated to "Connected".

# Final Paper Prototype | TASK 1: PROCESSING & VISUALIZING (CONT.)

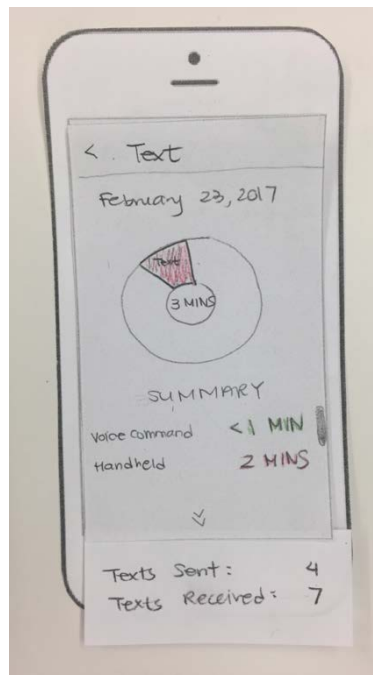
The following mobile app screens display the Dashboard view of driving behavior.



(Figure 1.8, Left) Homepage of recent driving activity. This is the screen that appears upon entering the app if the driver has not driven yet and/or has not paired the device.

(Figure 1.9, Right) Today's driving activity, summarized. The center number represents the driver's Safety Score.

Clicking on the left arrow on the date switches the graph to

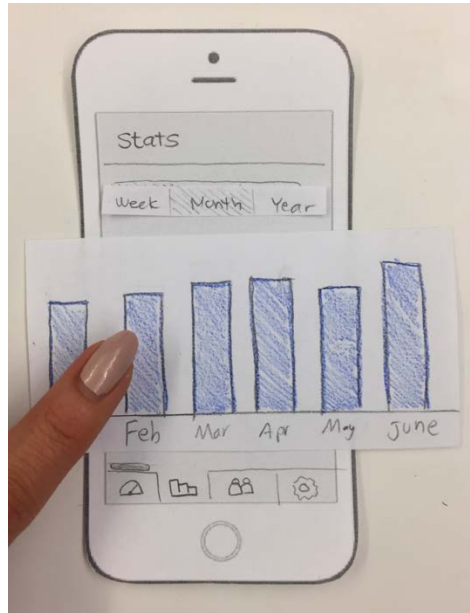


(Figure 1.10, Left) Driver clicks on the "Text" section of the pie chart.

(Figure 1.11, Right) The result of the action performed in Figure 1.10. The driver is taken to a scrollable detail view.

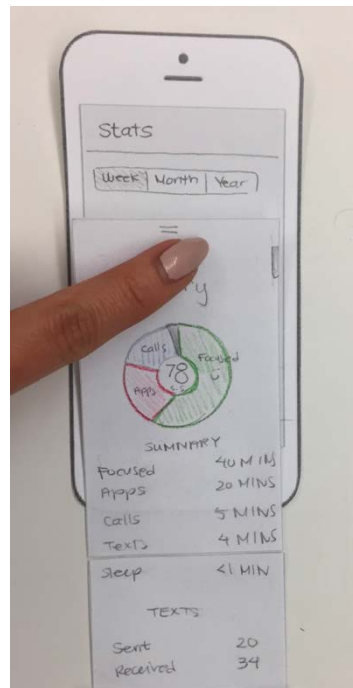
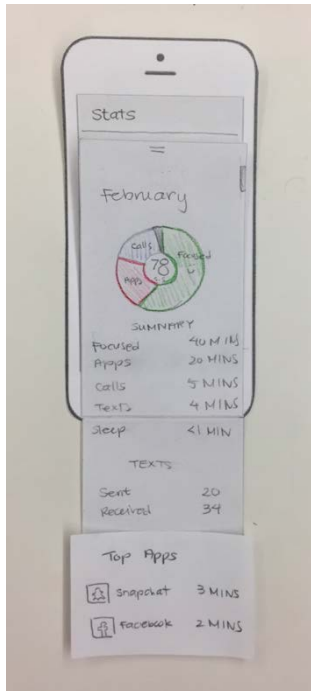
# Final Paper Prototype | TASK 1: PROCESSING & VISUALIZING (CONT.)

The following mobile app screens display the Statistics view of driving behavior.



(Figure 1.12, Left) Statistics view can display Safety Scores for weeks, months, or years.

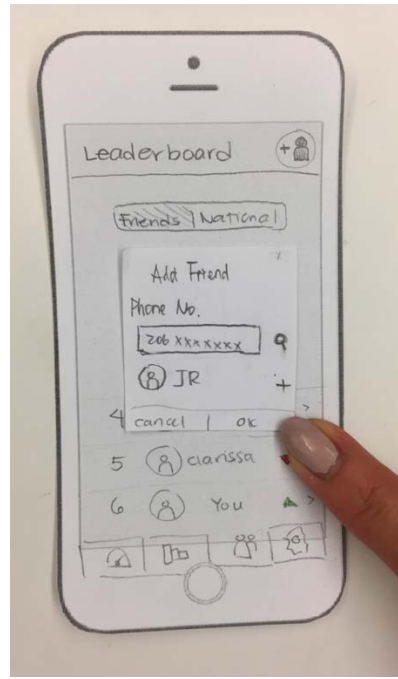
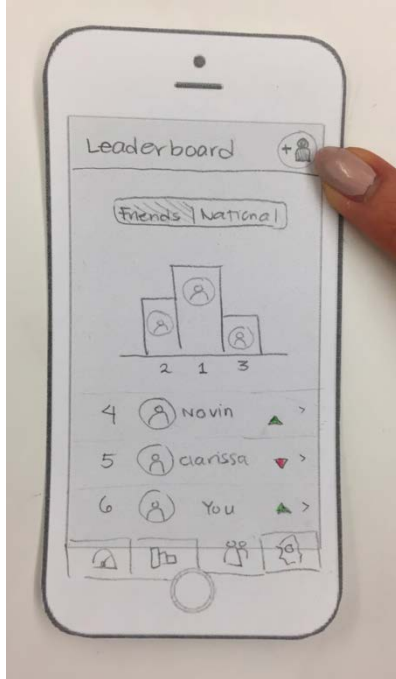
(Figure 1.13, Right) Swiping left and right allows user to navigate the graph. Clicking on a bar leads to the detail view shown in Figure 1.14.



(Figure 1.14, Left) Scrollable detail view for a particular bar in the overview graph.

(Figure 1.15, Right) Swiping down dismisses the detail view.

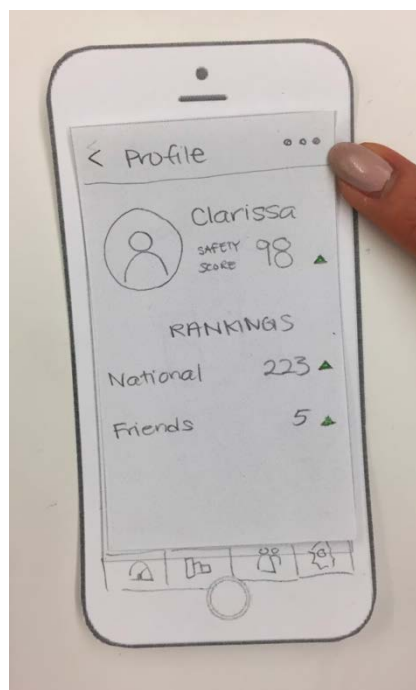
The following mobile app screens display the Leaderboard view.



(Figure 2.1, Left) Default view of the Leaderboard allows driver to see their ranking among friends. Green triangles pointing up indicate that the user has increased in his/her ranking.

Here, our driver is clicking on the "Add Friend" button. See Figure 2.2 for response.

(Figure 2.2, Right) The result of the "Add Friend" action.

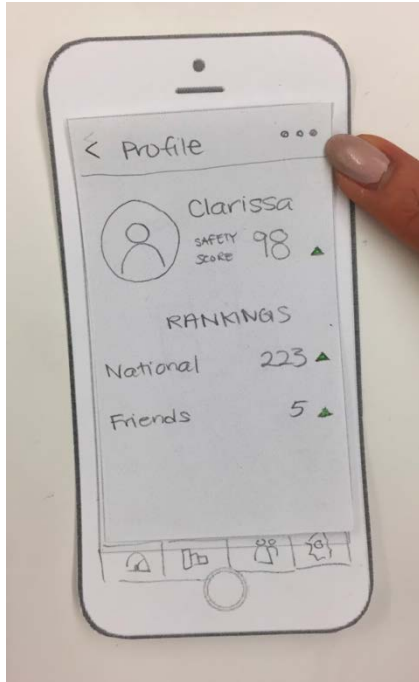


(Figure 2.3, Left) Clicking on the name row of a user leads to their profile (Figure 1.15)

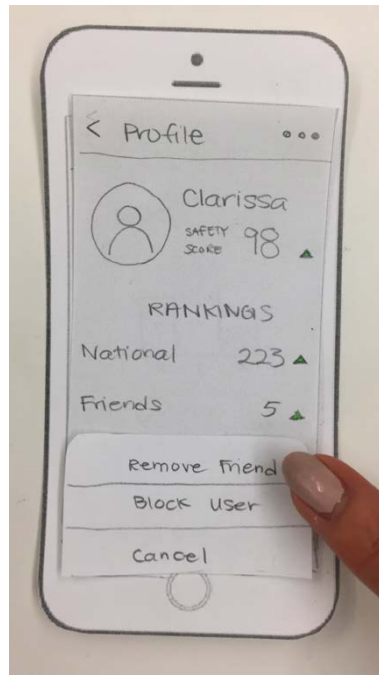
(Figure 2.4, Right) Profile page for a user displays their current safety score and ranking among Nation and friends.



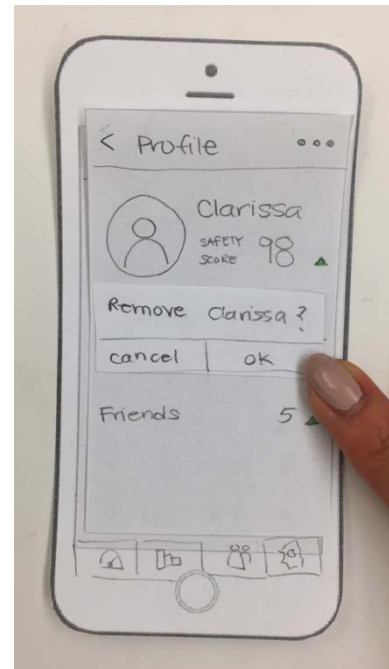
The following mobile app screens display a user's profile.



**(Figure 2.5)** Clicking on options menu in upper hand corner of user profile.

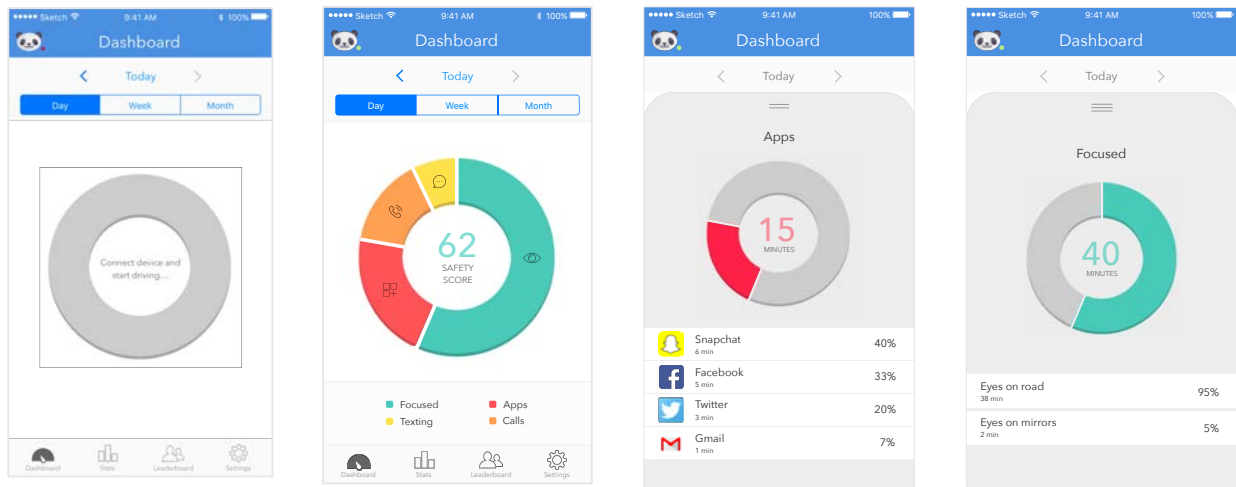


**(Figure 2.6)** Result of action in Figure 2.5. A menu appears with the options to Remove/Block this user.

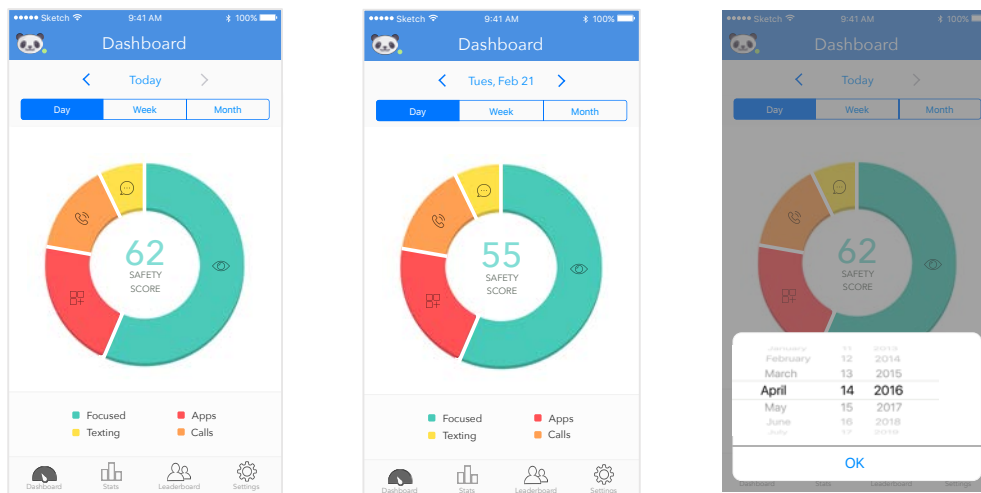


**(Figure 2.7)** Confirmation window appears when attempting to remove or block this user.

# Digital Mockup | TASK 1: VISUALIZING & PROCESSING DRIVING BEHAVIOR



These screens are found on the Dashboard tab of the app. The first screen will appear if the driver has not driven during the current day and/or their panda tracking hardware is not paired (upper left panda graphic has a connection indicator light). Upon driving, the dashboard will be populated with an interactive graph. The driver will be taken to a detail view if he/she clicks on any section in the pie chart; information is provided on duration of activity.

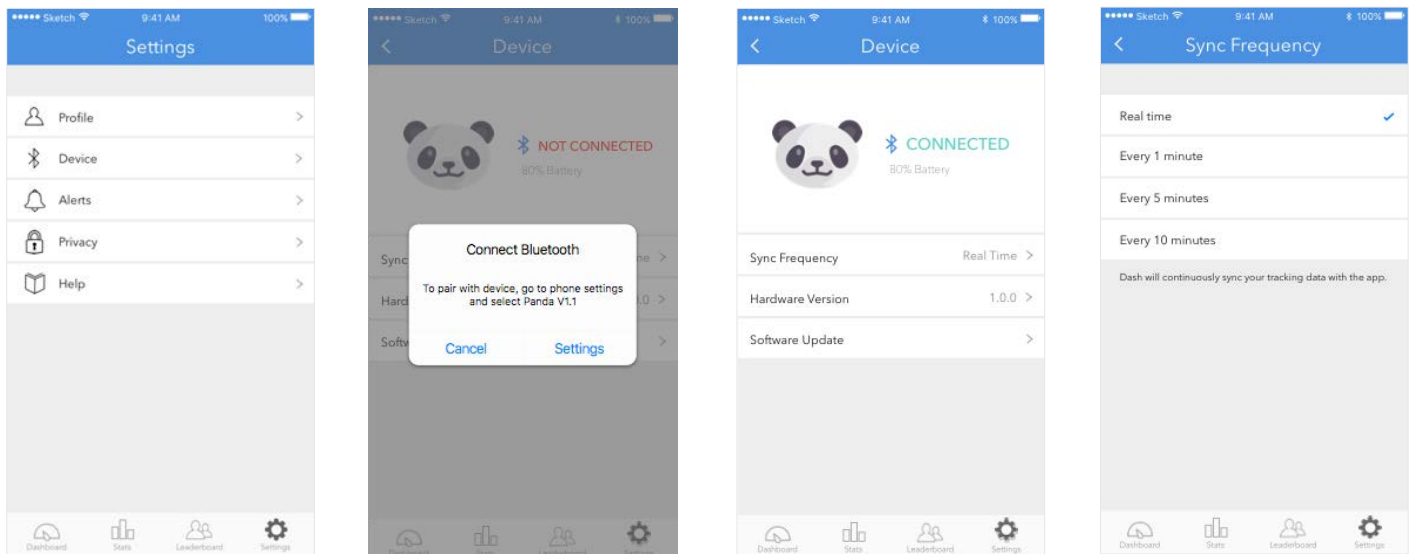


These screens demonstrate the app's ability to show different dates of driving data. Clicking on "Today" (or whatever is the date at the top of the screen) will allow the driver to select a date. Clicking on the left and right arrows leads to different days/weeks/months, depending on the current selection below.

## Digital Mockup | TASK 1: VISUALIZING & PROCESSING (CONT.)

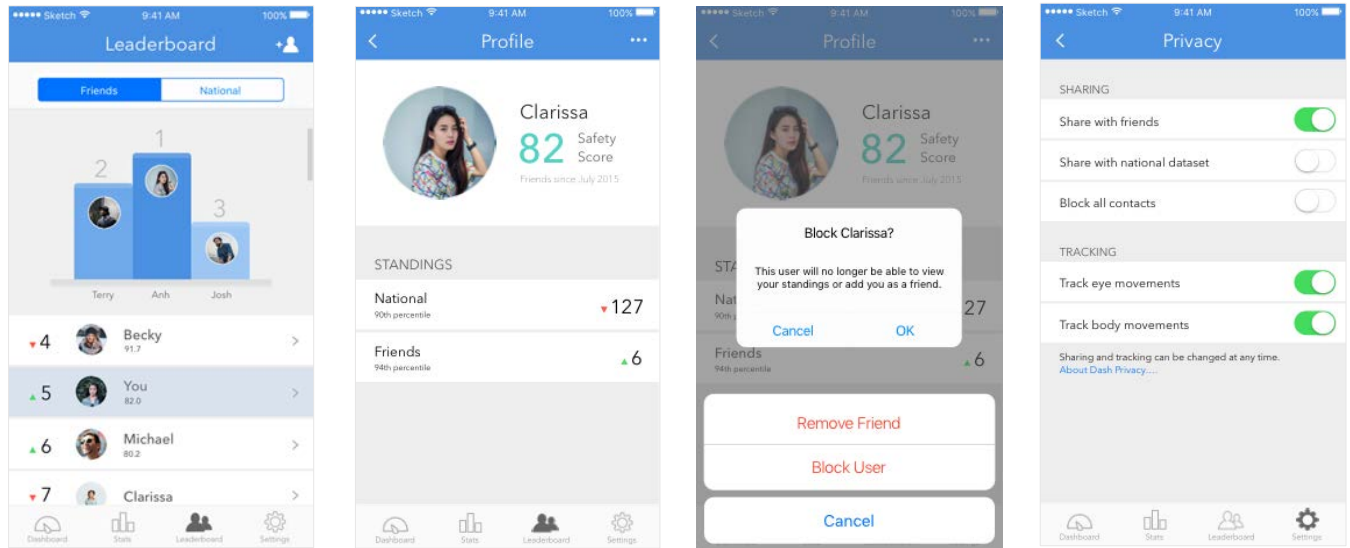


These screens are part of the Stats tab of the app. The graphs are interactive, so scrolling left and right will display data for different weeks/months/years depending on the selected date type. Clicking on a bar will lead to a detail view, which includes a percentage breakdown of activities, list of top apps, texts, and more.

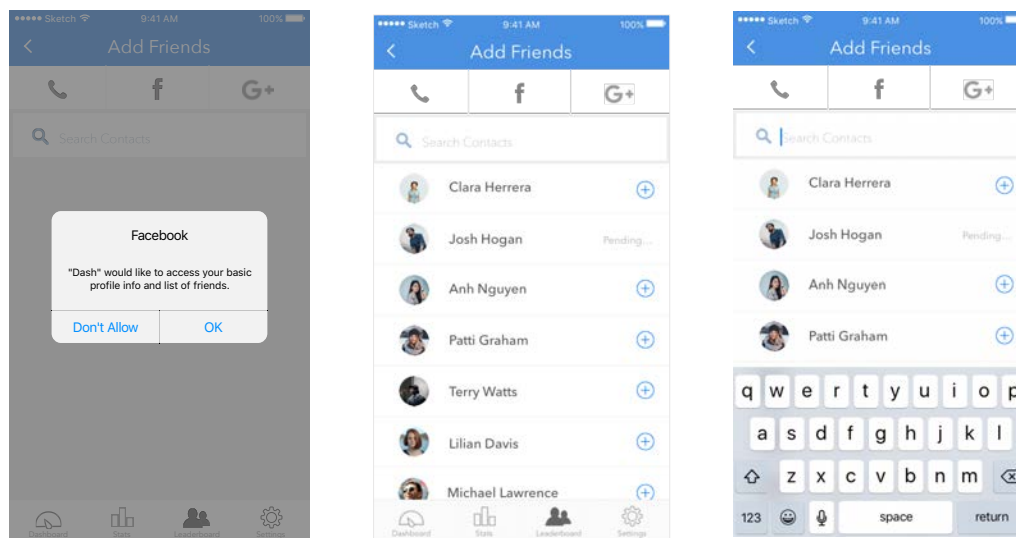


Device settings can be adjusted from the Settings tab of the mobile app. Upon entering the "Device" page, if the app does not detect a paired device, it will prompt the user. The third screen displays a connected device. Finally, the driver can choose the sync frequency between the hardware and app (defaults to real-time tracking).

## Digital Mockup | TASK 2: SHARING & COMPARING DRIVING HABITS

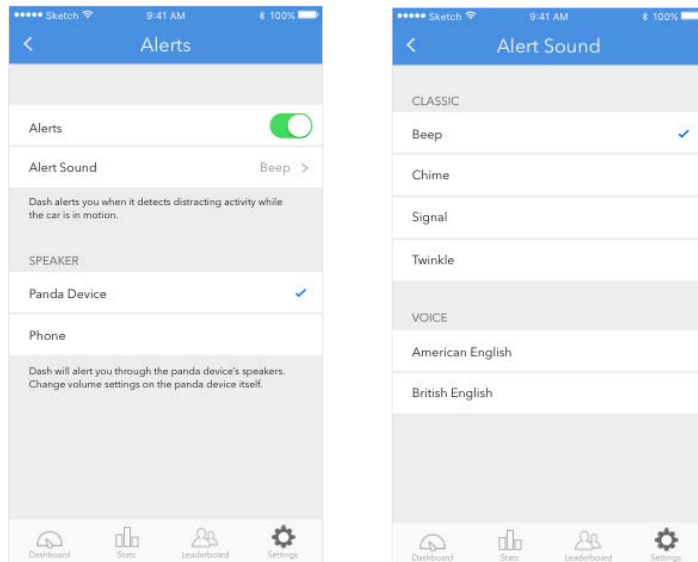


The Leaderboard tab allows drivers to accomplish Task 2. Users have the choice to compare their standings with contacts or with a national dataset. Clicking on anyone on the leaderboard list leads to their profile, which lists their safety score standings. Triangles pointing up indicate a user has increased in standing in the past day (and otherwise for a triangle pointing down). Friends can be removed or blocked anytime via the ellipsis button in the upper right hand corner of the second screen. Users can update sharing and tracking settings anytime in the Settings > Privacy page.



Adding contacts is essential to sharing information with friends. The Add Friends view is accessed by the upper right hand icon in the Leaderboard tab. Drivers can add friends from their phone contact list, Facebook, or Google+, which they specially allow Dash to access. Finally, friends are searchable by name as shown in the last screen.

## MISCELLANEOUS SCREENS



Alerts settings for Dash.

## DECISIONS, CHANGES, AND CRITIQUE

While designing the mockup, we turned to our peers and potential users for feedback on aesthetics (e.g. color palettes, icons, whitespace, and etc.) We had friends and family interpret our mockup to see if it matched their expectations.

Many small cosmetic and documentation changes were added to the design. For example, in many of the settings screens, there are sentences below setting titles that explain the current state of the system. These helpful hints were inspired by Apple's current Settings pages.

In the Dashboard view we included two visual elements to the screen: a legend for the pie chart and an iOS date picker for choosing time frames. We included these elements for readability and ease-of-use. To remain consistent with our Statistics detail view, we made the Dashboard detail view a pull-down frame as well. These were changes that were desired in the digital mockup because we realized that there was too much unused whitespace.

## Discussion

*What did you learn from the process of iterative design?*

We found the prototyping and testing iterations process extremely effective in identifying areas of improvement. Although we tried our best to make the initial design perfect, there were always problems that we were not expecting. We modified our design based on the feedback we got in every iteration. Doing this iteratively were particularly rewarding, because we gathered different opinions from participants and it helped us identifying new problems that came up in the revised designs. We also learned that low-fidelity prototypes are more efficient at early design stages because we tried to make nice-looking paper prototypes on a Surface but we changed most of them after iterations.

*How did the process shape your final design?*

Our design changed drastically through the process of iterative design. With the help of the feedback from usability tests, the critiques from peers and TAs, we improved our design in each iteration. We conserved most of the basic functionality we had in the initial design, and added a couple of new features that we found valuable to our product. In addition, we identified and fixed a lot of widgets that are not intuitive to users. For example, we added detailed information to each section in the Dashboard summary, we changed the design for the bar chart in Stats so that the users won't miss the app's capability, and we now support adding and removing friends, etc. In a word, our design becomes more and more mature over this process.

*How have your tasks changed as a result of your usability tests?*

Our tasks were more specific for our first test, but we found that this was holding the user's hand through the task and causing us not to get all the feedback we could be getting. This led us to generalize the task and instead of presenting all the steps to the user, we defined the end goal of the task and the tools they would need to accomplish that goal.

*Do you think you could have used more, or fewer, iterations upon your design?*

The number of iterations we went through was ideal. It was not so few as to where we wouldn't find all the important issues with our design but it was not too much so that we would obsess over the smallest issues. It led us to a clean and useful design with most or all of the major flaws kinked out. That being said, it would have been helpful to conduct a formal usability test for the digital mockup.

## Appendix

### Usability Test Instructions



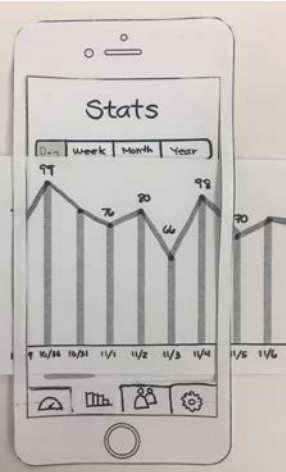
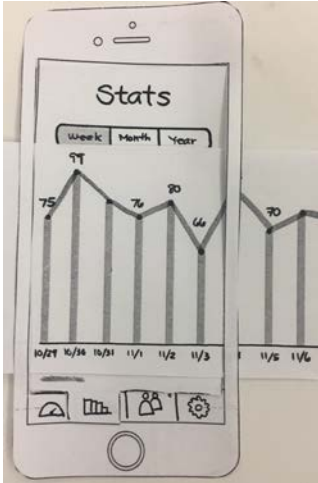

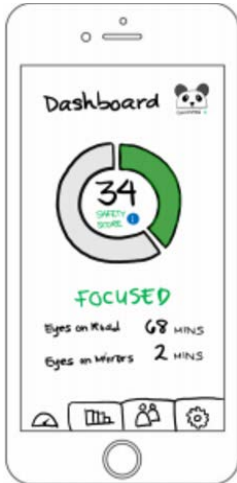
#### **Set up hardware and mobile app:**

- Place the device on the dashboard of a car
- Pair hardware with phone app using Bluetooth
- Adjust alert settings, volume settings
- Update privacy for tracking settings

#### **Check driving statistics and leaderboard** (*assuming device has been used for 2 weeks*):

- Understand how you have been driving today and in the past week
  - Overall score
  - Trends
- Compare Driving Safety Scores within contacts (friends)
- Compare self to national scores
- Add and delete a friend

# Critical Incidents | TEST #1


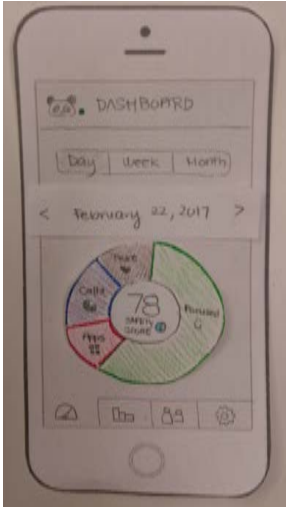
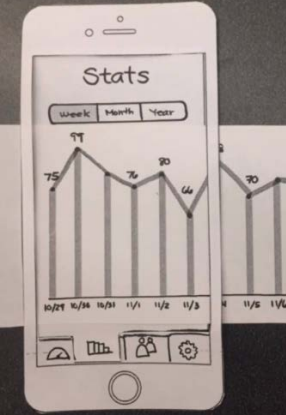



Image	Issue	Severity	Change	Fixed Image
	<p>Does not support adding new friends.</p> <p><b>Heuristic:</b> Consistency and standards</p>	2	<p>Added an add friend button in leaderboard. A pop up window will show up and the user can search and add friends through their registered phone number.</p>	
	<p>The day view does not make sense as it shows the data for a whole week.</p> <p><b>Heuristic:</b> Consistency and Standards</p>	2	<p>Changed back to the tabs we used to have: week, month and year.</p>	
	<p>Not enough information about the different sections represented in the pie chart.</p> <p><b>Heuristic:</b> Help and Documentation</p>	3	<p>Able to expand the section user clicked on and show the details.</p>	



Critical Incidents | SECTION CRITIQUE

Image	Issue	Severity	Change	Fixed Image
	<p>"Allowed activities" is a misleading title, since many of these activities are illegal in the first place. It is unhelpful since the main purpose of the app is to track data.</p> <p><b>Heuristic:</b> Match between system and the real world</p>	<p>2</p>	<p>Delete "allowed activities" in Alerts and replaced with simple controls to change alerting speakers and sound.</p> <p>Add "Top Apps" in stats under day/week/month/year view to show what's the most frequently used app.</p>	
	<p>Leaderboard for "national" shows too many people in the ranking. It is unnecessary and causes users trouble when they try to find themselves among other drivers.</p> <p><b>Heuristic:</b> Aesthetic and minimalist design</p>	<p>2</p>	<p>Leaderboard "national" ranking can only shows the top 20. User's personal ranking will always show up at the bottom of the ranking if they are not a top 20 user.</p>	

Critical Incidents | TEST #2

Image	Issue	Severity	Change	Fix Image
	<p>Unable to go to a different day/week/month on Dashboard view.</p> <p><b>Heuristic:</b> Visibility of system status</p>	4	Added bars to navigate to a different day/week/month on Dashboard view.	
	<p>Week view in stats is still confusing with day views</p> <p><b>Heuristic:</b> Match between system and the real world Recognition rather than recall</p>	2	Changed the label on the bar graph to make it clear that it is a week view.	
	<p>In detailed dashboard view, participant didn't know how to go back to overall dashboard view once they clicked on to the focused view</p> <p><b>Heuristic:</b> User control and freedom</p>	2	User goes into a different page to view detailed stats. Back button is added to the page to allow user to go back to their previous dashboard	



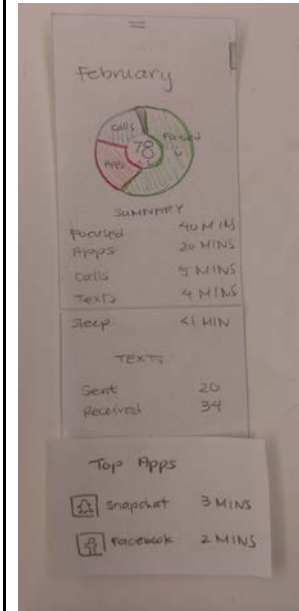
User wanted to click on a bar, but there is no breakdown of the numbers

Unable to view detailed stats on week/month/year


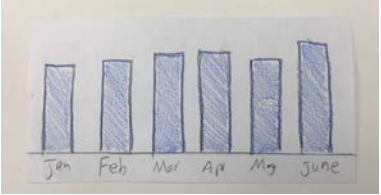

**Heuristic:**  
 Visibility of system status  
 Match between system and the real world

4

Allow user to click on bars in month/year view, and click on week as a whole in week view.



## Critical Incidents | TEST #3

Image	Issue	Severity	Change	Fixed Image
	<p>The participant did not know that she could click on the bars in Stats page to check out the details.</p> <p><b>Heuristic:</b> Recognition rather than recall</p>	3	Remove the connecting lines between bars and make the individual bars wider.	
	<p>Do not have warning when removing or blocking friends, so user might remove friends by accident.</p> <p><b>Heuristic:</b> Error prevention</p>	2	Add a pop-up confirmation page before a friend is removed.	