Sitless

Members:

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Problem and Solution:

According to JustStand.org, people on average sit for about 7.7 hours a day[1]. Furthermore, the American Medical Association (AMA) says that sitting for extended periods of time is unhealthy behavior. While we might think that regular exercise can offset this, studies have found that the amount of time a person sits during the day is associated with a higher risk of heart disease, diabetes, cancer, and death, regardless of regular exercise[2]. Standing more may also have benefits such as improving energy levels and cognition[3].

Our solution is a smart leg band that we call the Sitless band. It is a device that wraps around your thigh and is worn underneath the pants all day long. It features sensors to detect the orientation of your legs and the tension in your leg muscles. Additionally, this device features a haptic feedback component to notify the user. We chose this design because it can help to track the sitting duration and posture.

[1] http://www.juststand.org/tabid/816/default.aspx
[2] http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3404815/
[3] http://blogs.cdc.gov/niosh-science-blog/2012/12/05/sit-stand/

Contextual Inquiry Target, Stakeholders, and Participants:

Potential Users:

Our integrated system targets those who spend an excessive amount of time sitting, and are willing to make a change to their sitting behavior. In order to better observe this behavior, our contextual inquiries involved people that fit this description, which we narrowed down to people with office jobs and students. They spend a significant part of their days sitting and would therefore provide better insight into the motivations behind this behavior.

Conducting the Contextual Inquiry:

We conducted four contextual inquiries, each for four to six hours. First, we recorded when the participant stands up and when they sit down. We also jot down the motivation behind each of these behaviors and the duration for which they are in these states (sitting and not sitting). Additionally, we recorded the location that this behavior took place, the posture with which they are seated, and the type of seat, accompanied by a picture of the seat. At the end of the inquiry, we asked them to provide a rough estimate of how long they spent sitting, as well as asked them about their opinion on standing desks. All inquiries revolved around the participant's current behavior and we will not ask for anecdotal evidence.

Participant 1 is a full-time at a software engineer at a local technology company. *Participant 1* is a relatively new hire within the company, and works a standard forty-hour work week albeit with a lot of flexibility. He sits in on meetings about once every day, and takes long lunch breaks. The contextual inquiry took place on a Wednesday afternoon in *Participant 1's* work schedule, spanning four hours of observation.

After post-CI questioning, we determined that *Participant 1* is aware of his sitting habits, especially his habit of slouching in his office chair during long periods of sitting. He would also prefer to have access to a standing desk, but would not use it for the entire day.

Participant 2 is a PhD student at the UW CSE department. We spent three hours doing a CI in his work area and had him keep a diary for the rest of the day. Since *Participant 2* is a graduate student, he is allocated his own work area and can give us an insight into working in the CSE building. While he spends the majority of the day sitting, he also spends time walking around the building talking to people and walking to class at different buildings. *Participant 2* is also conscious of the need to stay active and makes an effort to take the stairs up to his office. After post-CI questioning, we determined that while *Participant 2* would like to have a standing desk, he would need a doctor's note to get one.

Participant 3 is a full-time web developer at a local technology company. *Participant 3* spends the entire work day on his desktop computer in his cubicle. At least once every two hours, he gets tired of sitting and opts to get up to use the restroom, or refuel with food and water. His meetings and interactions with coworkers and managers are limited, and therefore, most of his time not sitting is spent on short 10-minute breaks. The data was collected in the form of a self-reported journal.

Participant 4 is a senior studying Business at the University of Washington. She is pretty busy with schoolwork and job-hunting, but she is self-motivated to schedule some hours each week for exercise. The contextual inquiry with *Participant 4* took place in her apartment.

Contextual Inquiry Results and Themes:

Through our contextual inquiries and journaling, we uncovered several shared practices and behaviors between our participants.

Duration of sitting

All of our participants had long episodes of sitting, typically over two hours at a time. This is a practice that we seek to focus our attention on, as reducing the average amount of time spent sitting at a time would boost non-sedentary activity.

Meetings

In many office settings, meetings involve a designated half hour to two hours of sitting. Even if the person wanted to stand up, the social conventions of a meeting dictate that all participants must be sitting. This type of environment makes it very difficult to maintain a desired level of activity.

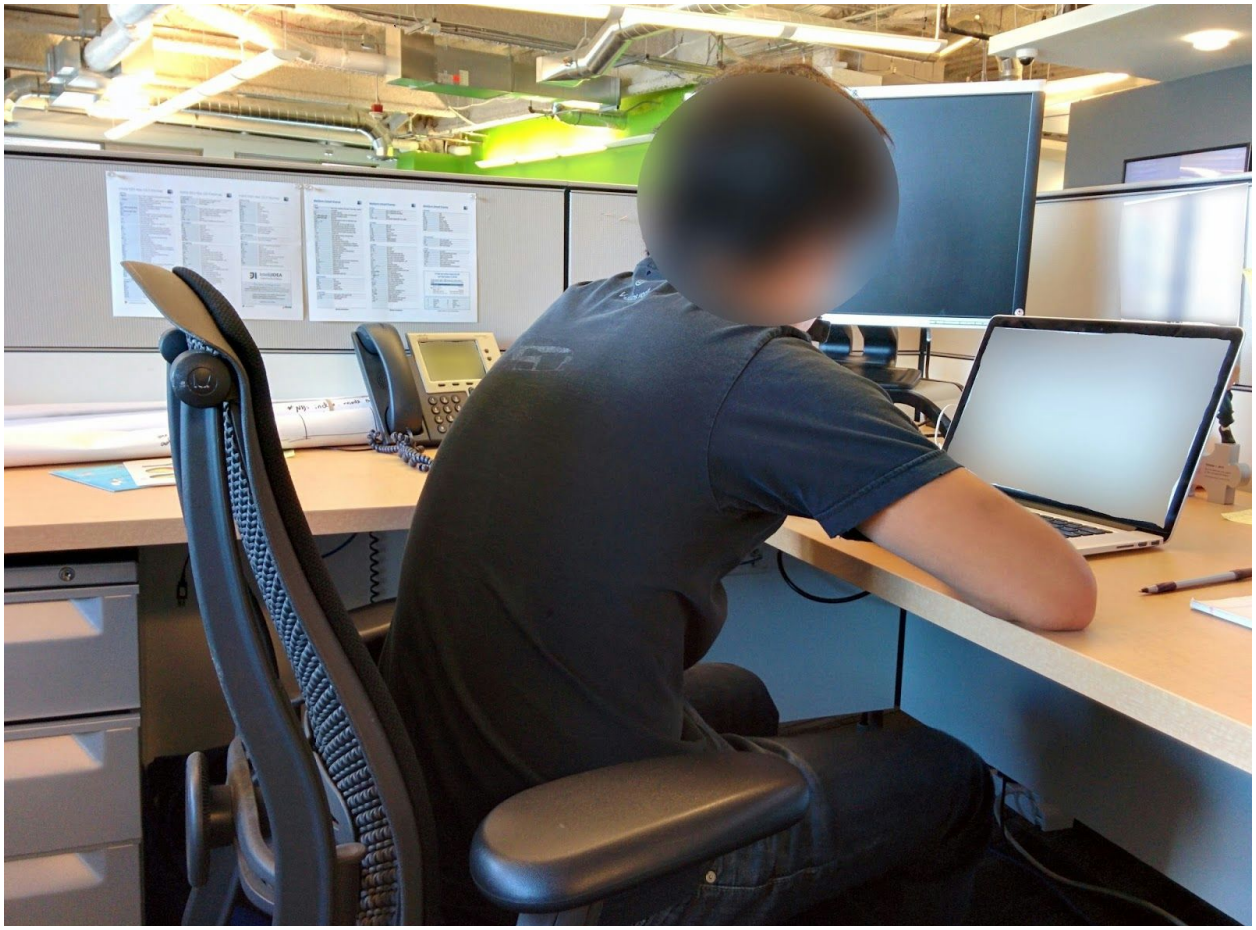
Short breaks

We noticed that most of our participants took very short (2-10 minute) bathroom and food breaks, between long intervals of sitting. As a task, we would like to give the user incentives to extend their breaks.

Talking with other people

We noticed that posture changes when surrounded by other people. Several of our participants, when working in pairs, would improve their posture. Pairing could be a way to motivate good posture, should the participant need to sit for a long period of time

Posture



Participant 1's work environment. Note the posture.

We noticed many different postures, and many different possible culprits of bad posture. Sometimes participants would sit straight with their back against a chair. Other times, their posture would not be optimal. Examples of bad posture include slouching back, leaning forward, tilting your head down for a long time (i.e. working on the phone), curved back, feet off the floor. However, it would seem that our participants are generally aware of their posture. *Participant 3* in particular expressed that he was aware of his slouching behavior and even explained that, "when trying to fix a bug and I'm hating the world, I'll be slouched with my face in the computer. If I'm not stressed, I'll lean back". This demonstrates that participants desire a motivation to improve this behavior. Another example of conditional posture is *Participant 4*, who has great posture when doing work, but opts to slouch and relax when she is eating. Some of the culprits of bad posture are: the existence of an arm rest, being eye-level with the monitor, being at a comfortable distance from the desk, the table being a good height. Posture is not an issue we initially intended on solving, but might be something we will have to incorporate into a task, as it also affects user health and is directly related to sitting.

Awareness of health

As mentioned, many of our participants were fully aware of the amount of time they spent sitting and of the time they spent slouching, yet know this is not desirable behavior. This shows us that these participants are at least conscious of their habits, and motivated to change.

Types of chair

There are several types of chairs that people used throughout our inquiries. A yoga ball allows for constant movement, which prevents muscles from getting stiff and maintains a level of physical activity, even in the sitting position. A wood chair has bad lower back support, and is therefore not comfortable to lean back on. This forces participants to sit forward, attentively. However, this often causes slouching because the participant gets tired. An office chair was very popular, which has good support, but encourages reclining. Reclining, in turn, results in back muscles stiffening due to no exertion.

Standing desk

Every participant, when asked, opted to have access to as standing desk, but would not want to spend their entire time standing. However, in many big companies, access to standing desks is restricted, requiring a doctor’s note. For smaller companies, standing desks may be prohibitively expensive, which presents another barrier to those who wish to sit less while working.

Answers to Tasks Analysis Questions:

1. Who is going to use the design?

The people who are going to use the design are students and full time office employees. Additionally, anyone who spends a significant amount of their day sitting, and would like to make a change, could benefit from our system.

2. What tasks do they now perform?

While many people are aware of the need to be active and not sit for too long, it is common to find people in office environments and schools sitting for long periods of time. People also lack the information and motivation needed to improve their sitting behavior. It is currently up to the person to self-motivate and practice healthy sitting habits.

3. What tasks are desired?

The main motivation for our design is to help users reduce the amount of time spent sitting, by providing positive motivation to un-sit. While we would like to remind to user to not sit for too long, we also do not want to become a nuisance, especially when the user is concentrating on a task. Therefore, we would additionally like to provide suggestions for a good sitting posture, when the user needs to sit for a long time.

4. How are the tasks learned?

The tasks can be learned by informing the user about good posture and good sitting (and un-sitting) habits. The users may first need to be informed about their current posture and seating habits. With the continuous use of our system, and making use of the suggestions provided by our system, the user will be able to develop good sitting behavior and posture.

5. Where are the tasks performed?

The tasks can be performed anywhere someone spends a significant amount of time sitting, which may be at school, at the office, or at home.

6. What is the relationship between the person and data?

Using the data collected, our system can analyze it to inform the person to un-sit and/or fix their sitting posture. There can also be long-term reports that can give the user feedback on how

much time they spend sitting and how well they are managing their sitting time. A historical view can also provide the user with a view of their progress since they started using the system.

7. What other tools does the person have?

Some people have access to standing desks at work and they can adjust the height of their desk to stand up for some period of time. Some people are self-aware of their posture. For example, they might intentionally sit straight with this mindset.
There are many activity tracking applications on the market. For example, Spine Hero uses a webcam to detect sitting posture. Apple Watch reminds people to stand up every hour. UpRight uses sensors to detect when people slouch and signals them to sit up.

8. How do people communicate with each other?

For the current version, we target mainly towards individual users, and usually users do not need to communicate with each other. However, we understand that community and support networks can be a great way to motivate better sitting habits, especially in the school or in workplace settings.

9. How often are the tasks performed?

The tasks will initially need to be performed more frequently, as the user is learning better sitting habits. As the user gets better at reducing the amount of time spent sitting and gains a better understanding of how to improve their posture, the tasks will need to be performed less frequently.

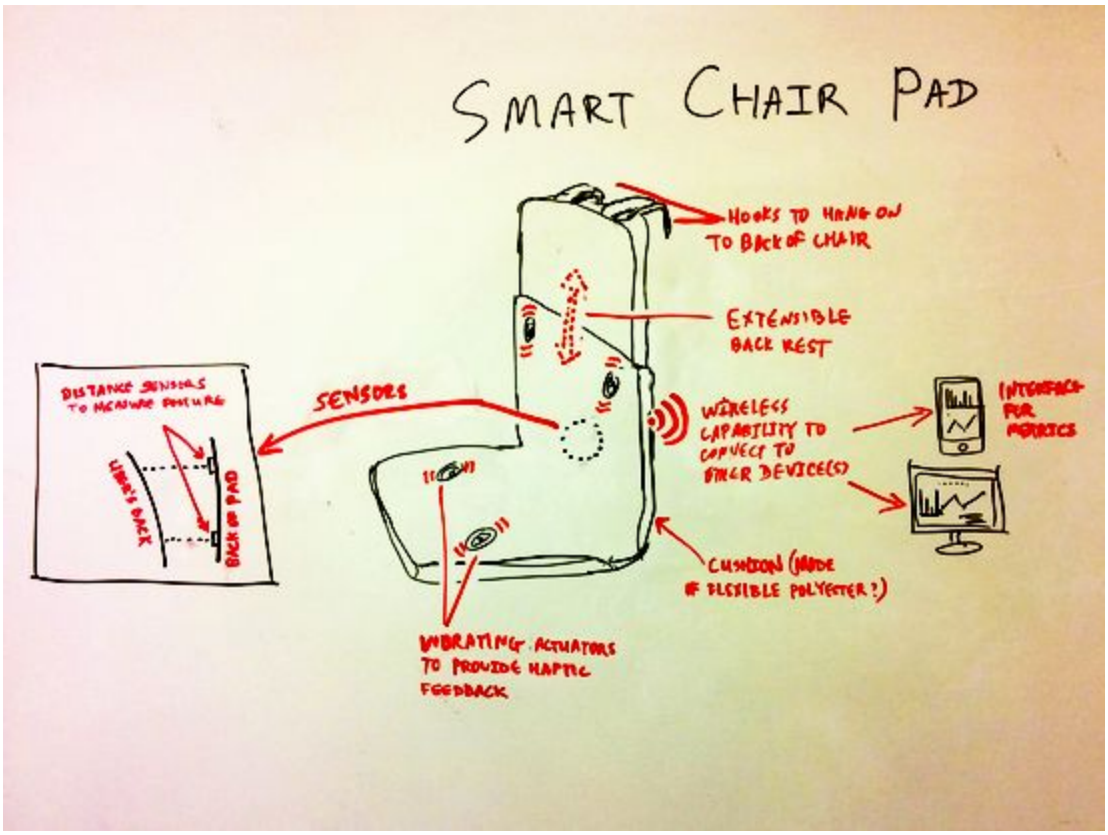
10. What are the time constraints on the tasks?

Our system informs users to un-sit when we detect if they've been sitting for too long or with a bad posture. We plan not to place too much burden on the user to input feedback. At the end of a long sitting day, users can spend a few minutes viewing feedback from the system and develop better understanding of their sitting behavior.

11. What happens when things go wrong?

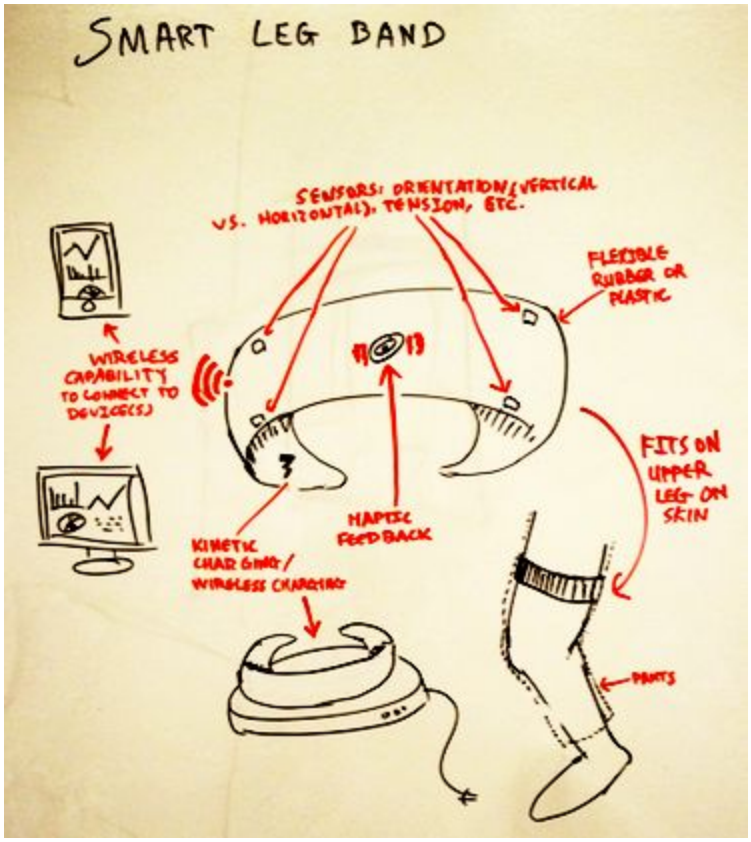
In the case where the user is not in close proximity of the system, our system may not be able to inform the user to un-sit. If we notify the user to un-sit at the wrong time, they may ignore the system for a while (or maybe even permanently for the catastrophic case). We will focus on the accuracy of system and make sure that we have some ways to identify the meaning of data after we collect it.

Proposed Design Sketches:



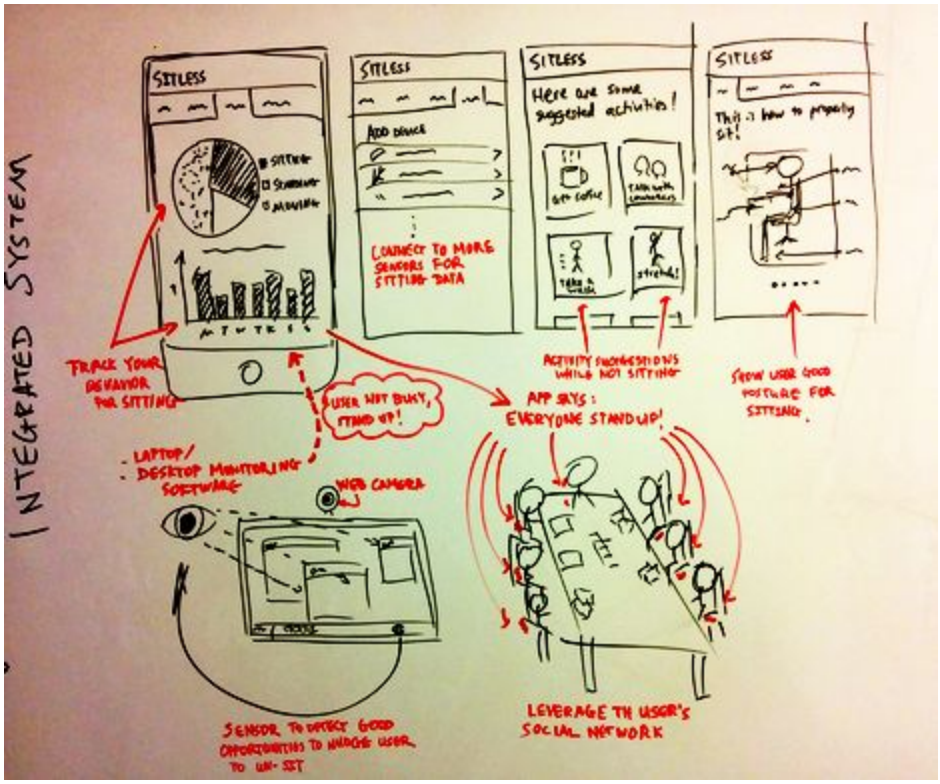
The first design is a smart chair pad, which is a thin and lightweight mat that can be laid on top of an existing chair. The pad will have sensors, wireless connectivity, haptic feedback and air cushions. The sensors will sense how long the user has been sitting and the posture of the user, while the wireless connectivity can let the pad connect to other devices to share data. Also, haptic feedback will allow the mat to remind the user to stop sitting and the back air cushion can help correct the user's posture, such as to prevent slouching.

- **Improving sitting posture:** the pad will detect slouching and use haptic feedback to remind the user to sit up and adjust posture
- **Smart reminders to sit less:** when the smart chair pad detects the user has been sitting for too long, it will remind the user to get up using haptic feedback
- **Activities suggestion while not sitting:** when the smart chair detects the user is not sitting, it will use the user's mobile design to suggest activities to do while not sitting
- **Understanding sitting patterns:** the smart chair pad will be able to send data to be displayed on a website or mobile device



The second design is a smart leg band. This is a device that wraps around your thigh and is worn underneath the pants all day long. It features sensors to detect the orientation of your legs and the tension in your leg muscles. Additionally, this device features a haptic feedback component to notify the user. It comes equipped with a long-lasting battery, which has both a kinetic charger and a docking wireless charger. In order to display data and provide configuration options, this device wirelessly connects to your devices through bluetooth.

- **Smart reminders to sit less:** when the smart band detects the user has been sitting for too long, it will remind the user to get up using haptic feedback
- **Activities suggestion while not sitting:** when the band detects the user is not sitting, it will use the user's mobile design to suggest activities to do while not sitting
- **Understanding sitting patterns:**the smart band will be able to send data to be displayed on a website or mobile device
- **Tracking progress towards healthy sitting habits:** data from the smart band is relayed back to the app, which can be used to track progress towards sitting goals



The third design is an application. With a screen display, our app is able to facilitate better communication and interaction with our users. For example, it educates users what a good posture is like, and suggests them activities they could do while not sitting. Additionally, it shares a daily activity report and keep track of users' progress. Other sensors or devices are connected with this application, so users don't have to self-report all the information.

- **Improving sitting posture:** the application will include interactive tutorials and diagrams to educate the user about good posture
- **Smart reminders to sit less:** the application connects to a desktop or mobile device to keep track of what the user is doing, so that reminders can be based off of the user's current attention level
- **Activities suggestion while not sitting:** the application keeps track of user behavior and recommends activities to do while not sitting
- **Tracking progress towards healthy sitting habits:** by tracking user behavior, the application can be used to track progress towards sitting goals
- **Using social networks to motivate healthy sitting habits:** the application can connect with other people's Sitless applications, allowing the application to trigger everyone in a meeting to stand up

Choice of Designs and Tasks:

Our group decided to choose the design of a smart leg band and the tasks of smart reminders to sit less and progress tracking towards healthier sitting patterns. Our smart leg band is a device that wraps around your thigh and is worn underneath the pants all day long. It features sensors to detect the orientation of your legs and the tension in your leg muscles. Additionally, this device features a haptic feedback component to notify the user. We chose this design because it can help track the sitting duration and posture. From our CI, we noticed that people sometimes forget to maintain good posture, and we hope to detect that and remind them in a friendly way. Compared to our other design, the chair pad, this leg band is portable and costs less to produce, therefore making it more affordable for our users. We chose these two tasks because from our CI, we learned that most of our participants are aware that they sit too long, but they sometimes forget to un-sit when they are focused. So we aimed to track their duration of sitting and remind them accordingly. Additionally, we noticed that even motivated users would have a difficult time recognizing their habits and improving them. Therefore, we decided on a way to track and graphically display sitting habits, with the added bonus of working towards a goal to further motivate the user to improve.

Written Scenarios:

Task 1 (Storyboard 1): Smart reminders to sit less

Bob is a typical software developer that spends most of his day sitting on his desk writing code. At the start of his day, he puts on his Sitless band and goes to work wearing it. The band can wirelessly communicate with the Sittless app on his phone and work computer to help gain a better understanding of what Bob is doing.

As Bob begins his workday, he sits down and starts working on his computer. The Sitless band can detect that Bob has been sitting for a while and would like to remind Bob to take a break. However, since the Sitless band can communicate with the work computer of Bob, the Sitless band also knows that Bob is being productive on his computer and delays the reminder to prevent interrupting Bob.

When Bob eventually gets less productive, maybe due to Bob being distracted by Facebook or watching videos on YouTube, the Sitless band will get this information from the computer and remind Bob to take a break. With this, we can give Bob reminders that are smarter and less of a nuisance than regular reminder apps.

Task 2 (Storyboard 2): Tracking progress towards healthy sitting habits

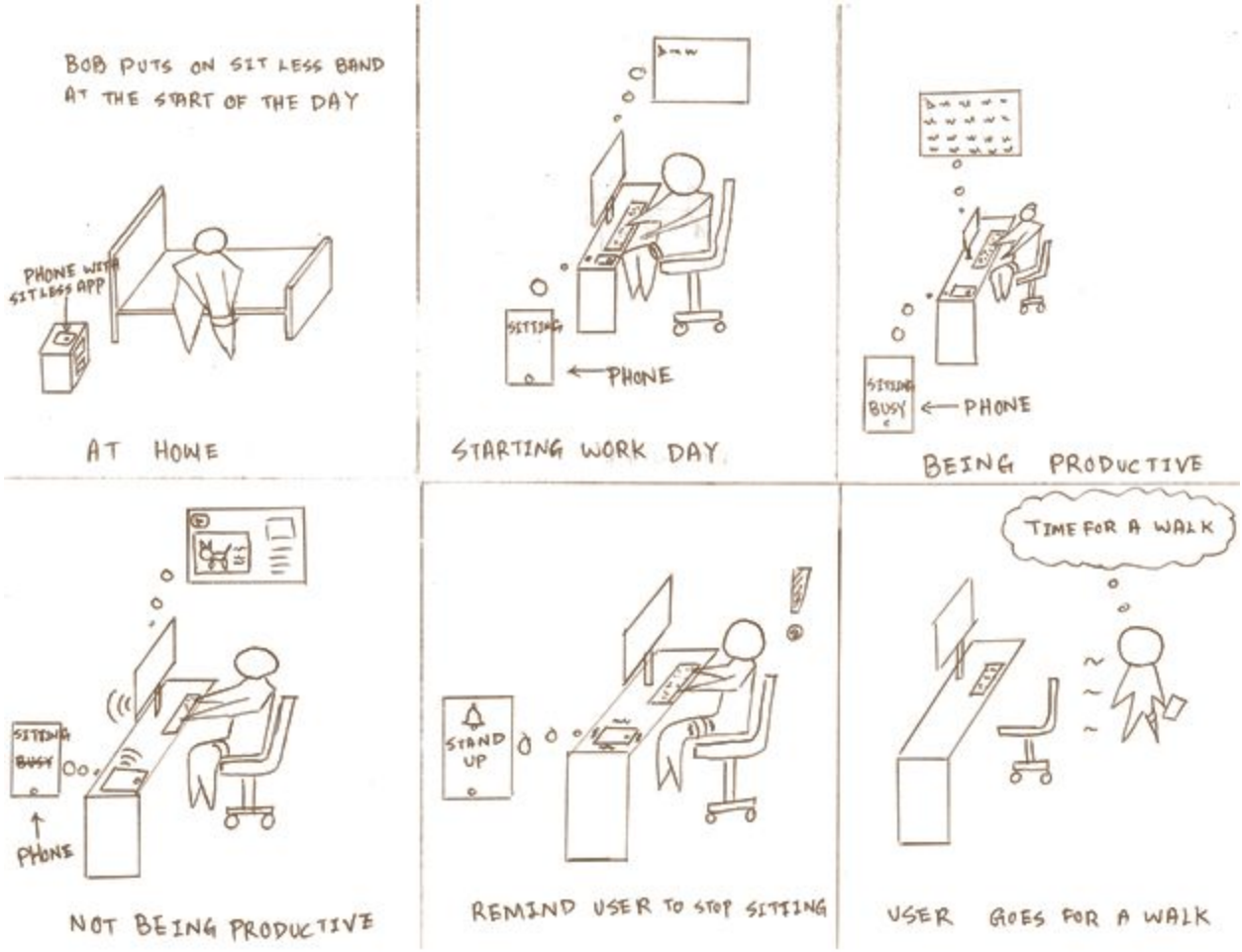
Taylor is a 19-year old college student who is taking a full load of classes and has many commitments outside of school. In addition, Taylor commutes to school by bus every day, which adds to the time he spends sitting down.

Every morning, before he heads off to school, Taylor puts on his Sitless band. The band monitors Taylor's activities throughout the day -- when he is in class, waiting for the bus, in line for lunch, or sitting in front of the computer, doing homework. During his daily routine, the band syncs with an application on Taylor's phone, sending data such as time spent sitting, postures assumed, and other relevant metrics. In his downtime, Taylor checks his phone to learn about his daily sitting behavior and progress towards healthier sitting habits. Thanks to the Sitless band, Taylor now has a better idea of exactly how long he sits every day.

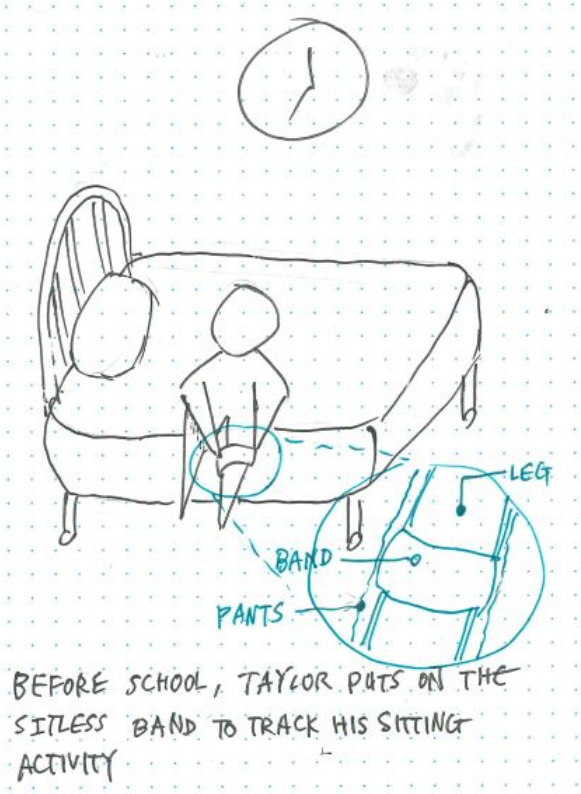
With this awareness, Taylor begins to consciously change his habits for the better, including using a standing desk and not sitting at the bus stop. During this entire time, the application provides motivation for Taylor, generating a positive feedback loop as Taylor continues to improve his sitting habits.

Storyboards of the Selected Design:

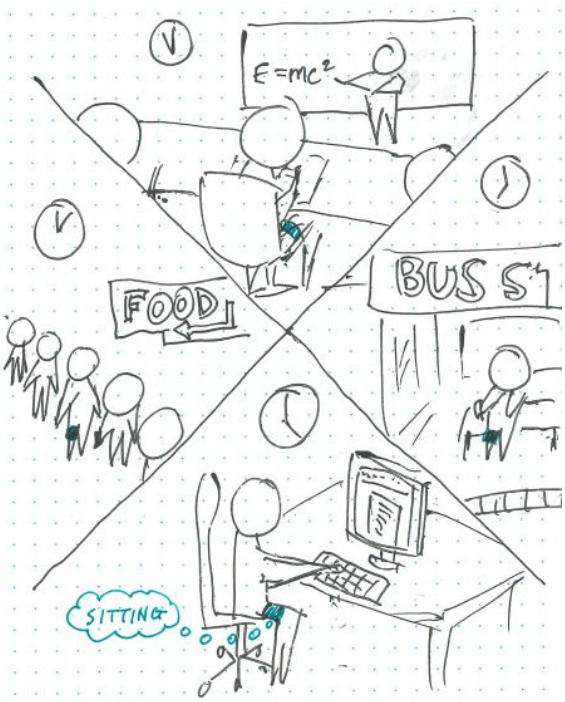
Storyboard 1: Smart reminders to sit less



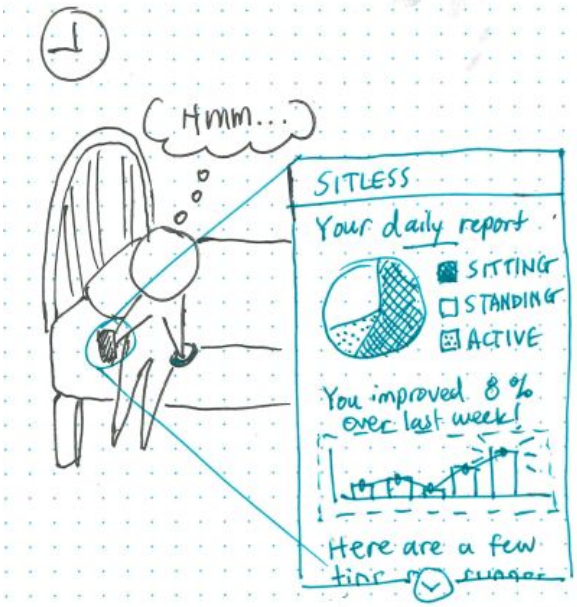
Storyboard 2: Tracking progress towards healthy sitting habits



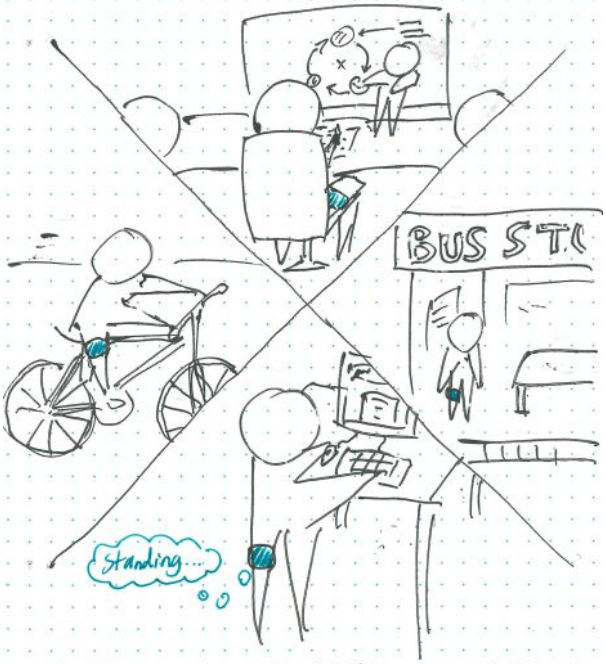
BEFORE SCHOOL, TAYLOR PUTS ON THE SITLESS BAND TO TRACK HIS SITTING ACTIVITY



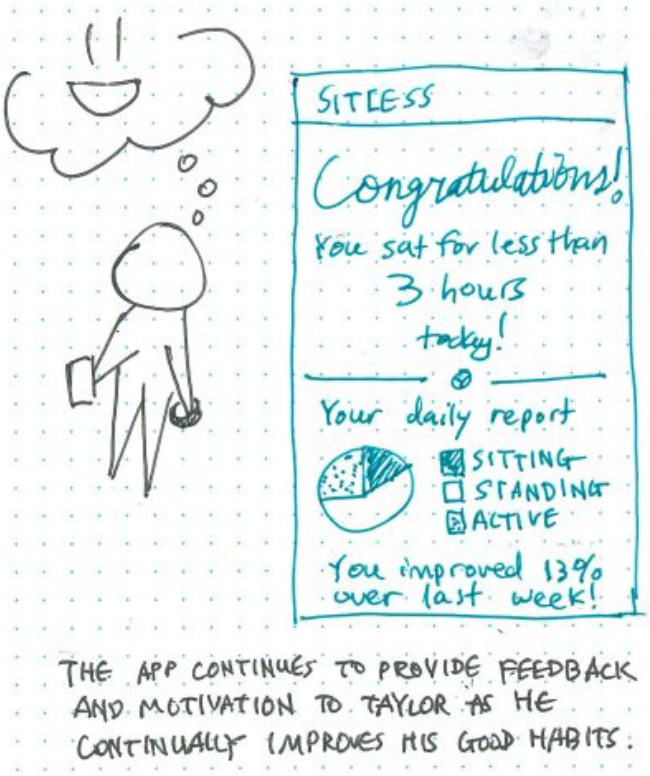
DURING THE DAY, THE BAND PASSIVELY MONITORS TAYLOR'S ACTIVITIES AND RELAYS THE DATA TO TAYLOR'S PHONE



TAYLOR CAN CHECK HIS PHONE DURING HIS DOWNTIME TO SEE HIS DAILY REPORT AND PROGRESS TOWARD HEALTHIER SITTING HABITS.



ARMED WITH THIS KNOWLEDGE, TAYLOR IMPROVES HIS SITTING HABITS, OVER A LONG PERIOD OF TIME.



THE APP CONTINUES TO PROVIDE FEEDBACK AND MOTIVATION TO TAYLOR AS HE CONTINUALLY IMPROVES HIS GOOD HABITS.