Project Brainstorm

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Brainstorm:

1. **Hospital room of the future:** Create a device for a hospital room that uses sensors and interactive technology to solve age-old problems for in-patients which exist because of the lack of updated systems in such rooms. These may include:
   a. **Hospital room lighting device**: A hospital room with ambient, possibly gesture-triggered controls for indoor lighting and window position to reduce interruptions, unwanted glare, and give patients a sense of day/ night rhythms.

  i. Aimed at solving hospital induced delirium. Most sources point to lighting as one of many causes, though, so it's unclear how much of an issue lighting actually is. Some user research or interviews will be required.

  ii. Functionalities include:

    1. Gesture controlled, bright to dim, hot to cold light, predictive settings (records information for later analysis and scheduled behaviors allows users to create presets for convenience)

    2. Building monitoring. Make it easier to identify when the lights are left on or when an HVAC system is not working. Not a very good market but a reasonable pitch to investors.

    3. Modular and interactive panels of a room, floor, ceiling, walls

  iii. Resources:

    1. http://www.healthcarefacilitiestoday.com/posts/How-a-hospital-room-can-help-patients-heal--4059

    2. http://www.nytimes.com/2014/08/22/arts/design/in-redesigned-room-hospital-patients-may-feel-better-already.html

    3. http://www.nytimes.com/interactive/2014/08/21/arts/design/a-model-room-becomes-real.html

    4. http://patient.info/doctor/delirium-pro

    5. http://medshadow.org/features/hospital-induced-delirium/

   6. http://www.americandeliriumsociety.org/

b. **Hospital room noise monitoring device:** A device attached to the walls of a hospital room that tracks and categorizes noises in the patient's room over the course of the night and visualizes the data in a simple GUI for nurses and doctors.

  i. Can be used to convey whether patient is having trouble sleeping, etc.

  ii. Note that certain levels of noise are thought to harm newborn infants and that it might be useful to monitor the noise levels in preterm infant care units (NICUs)
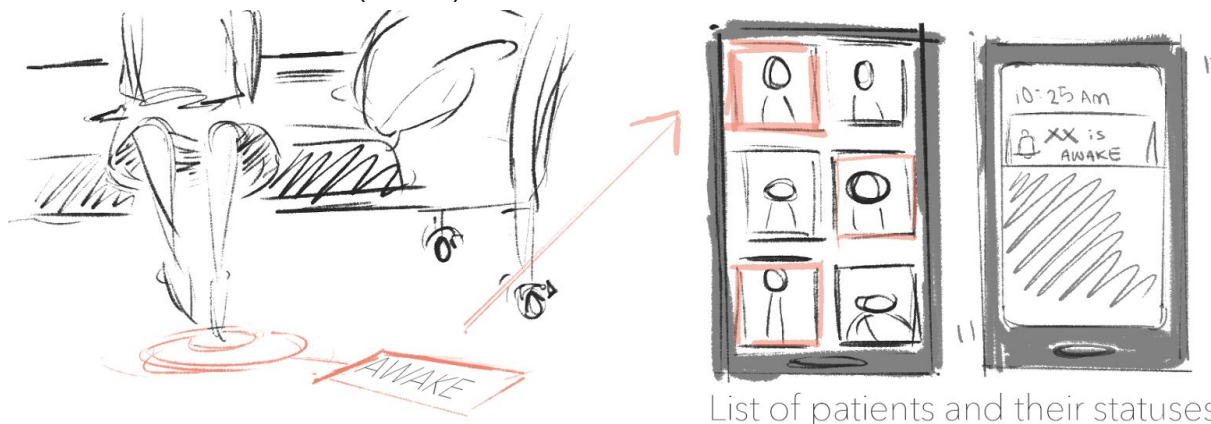

List of patients and their statuses

c. **Automatic sitter (safety attendant):** Smart flooring in a hospital room that can detect when a patient wakes up / gets out of bed. Fall risk is highest when patient first wakes up; higher if they are delirious. This could help alleviate the problem.
   i. Could incorporate ideas about putting sensors into the bed or the patient's hospital gown / hospital-issue socks and shoes
d. **Smart hospital patient band:** All patients get a plastic identification band when they're admitted into the hospital, but that's all they're good for right now. We can make better use of this strip of plastic and have it double as a heart rate monitoring device to help reduce the number of wires and devices on the bed.
e. **Interactive hospital ceiling**: Long-term hospital patients spend the majority of their days staring at a blank ceiling. We could take advantage of this space by turning it into an interactive screen that replicates the feeling of being outdoors and changes to match the weather and atmosphere outside.
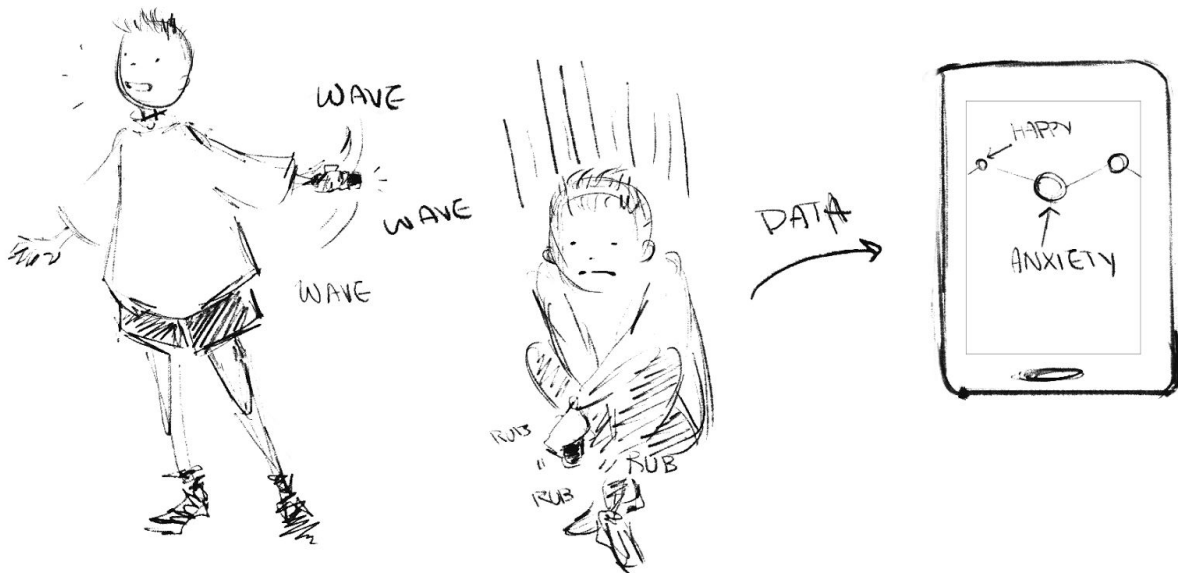

2. **Mood tracking device for bipolar disorder / depression:** Medical professionals suggest that people with bipolar disorder or depression keep mood diaries or keep track of changes in their feelings throughout the day because this can help patients recognize potential triggers or patterns.
   a. There are tons of apps out there for this, but apps that require you to recall how you felt at a certain time or to input your feelings are not natural or simple. Instead, we could create a device, similar to the Moodstone prototype by Tea Uglow, that records information as the user interacts with it all day (represented as the black handheld object in the picture). Certain natural gestures suggest to the device how the user is feeling (constant frantic rubbing for anxiety, etc). We could also sense humidity or temperature to see if the user is sweating, unnaturally cold, etc. This information can be transferred to a mobile device for the user's later analysis, complete with timestamps or a general cluster analysis of the data.

3. **A device to augment senses of deaf people:** A device that helps deaf people increase their capacity to detect sound and from that information, get a visual or tactile clue of its direction and magnitude.
   a. A Microsoft research project worked on a dress, "Flutter" that had the petals on a dress flutter in the direction of sound.

4. **Smart Thermostat:** A device for commercial buildings (hotels, offices, etc) that tailors an immediate environment to match the needs of the current occupants through a phone application.
   a. Targets the problem of office spaces often feeling too cold for some people and too hot for others.
   b. Temporary temperature setting and behavior learning.
   c. Software for monitoring many thermostats remotely - can monitor which sections of building HVAC System is not working.
   d. Designed to account for the difference between the occupant and the owner.
   e. Cannot modify settings from interface without password.
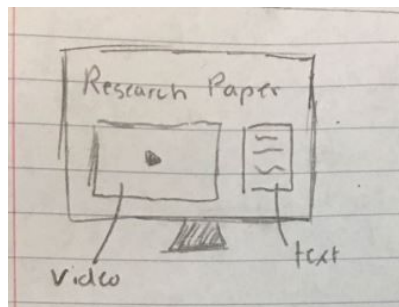
5. **Video -Based Research Publications:** App/website to publish videos or live demonstrations of research to make it easier to understand.
   a. Add-on for current text-based paper entries where applicable.
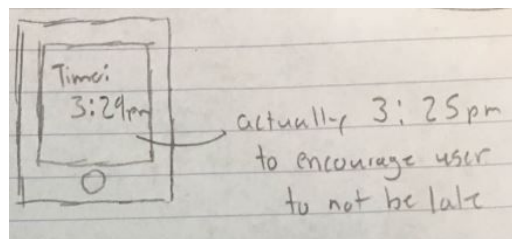
6. **NeverLate**: Purposely sets the time on your smartphone or computer a few minutes forward (1-5min) to trick your brain into leaving earlier.
   a. The discrepancy between the shown time and actual time randomly resets on a daily basis.
   b. Actual time can still be accessed if need be.

7. **Long Distance Rideshare:** An app that automatically pair drivers and passengers who are heading in the same direction and quote prices based off of driver.
   c. App similar to Uber/Lyft but for long distance (over 50mi)
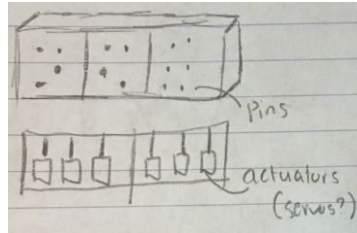
8. **Braille tablet for reading**: A tablet that has a tactile surface that can translate pages to Braille for vision impaired users. Input is with a keyboard that includes 6 dynamic dots that can be selected to enter different letters of the alphabet.
    a. Input can be implemented using 6 tiny actuators.
    b. Software implementation could implement dynamic text to Braille converter.

9. **Smart mirror:** A device that feeds the user a brief summary of information that is important to them, including things like weather, transportation schedules, etc.
    a. http://m.youtube.com/watch?v=lvtfD_rJ2hE
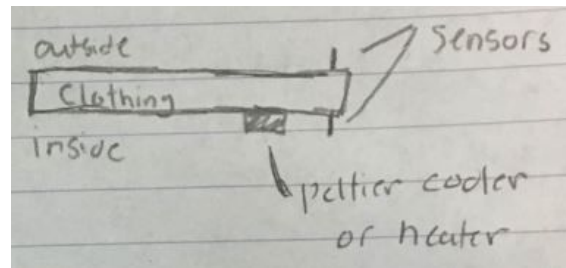
10. **OneJacket:** A wearable that dynamically detect environment and your own vitals and cool you down or warm you up.
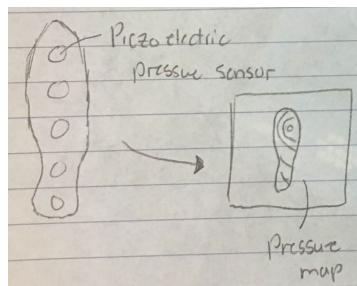

11. **Smart Shoe:** Analog piezoelectric pressure transducers to read pressure readings from different areas in the shoe to track fitness, pressure, etc.
   a. Readings and insight can be displayed on a external device to improve quality of life.
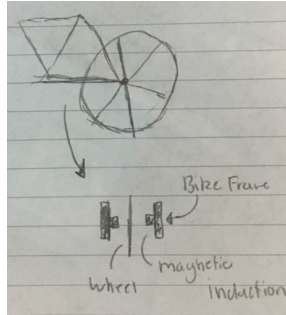
12. BikePower: Universal product/kit that allow users to install regenerative braking and power electronics (gps, phone, turn signals)
   a. Magnetic braking mechanism can be turned off or on depending on instantaneous condition
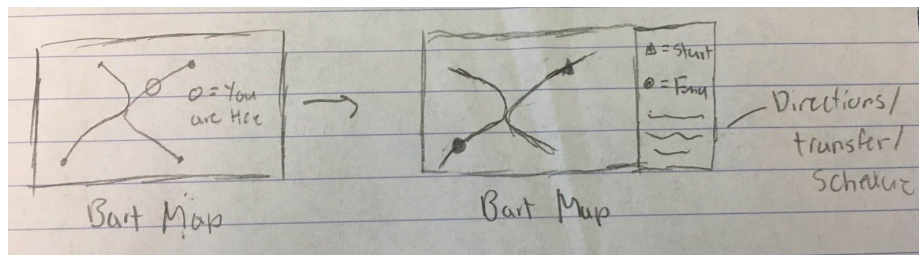

13. **Interactive bart map:** Both the BART and MUNI are incredibly confusing services, with unhelpful station signs and maps. The interactive BART map aims to make travel, especially for first-timers, more intuitive and natural by allowing users to easily discover where they are, where they want to go, and how to get there, as well as what times they need to depart and when they'll likely arrive.
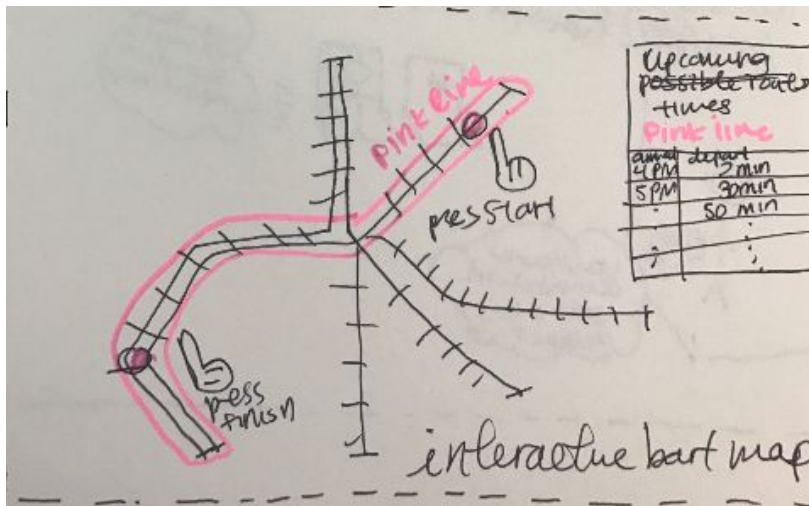

   a. The interactive map might be available in every BART car and on the walls of every station.
   b. Your desired path should be easily transferrable to your phone, so you can bring the directions with you on the train.

14. **Biker communication device:** Device that attaches back of a bike and used to improve biker communication between pedestrians and other drivers.
    c. Used to communicate that a user wants to change direction or accelerate, via light signals displayed in certain patterns and at certain speeds.
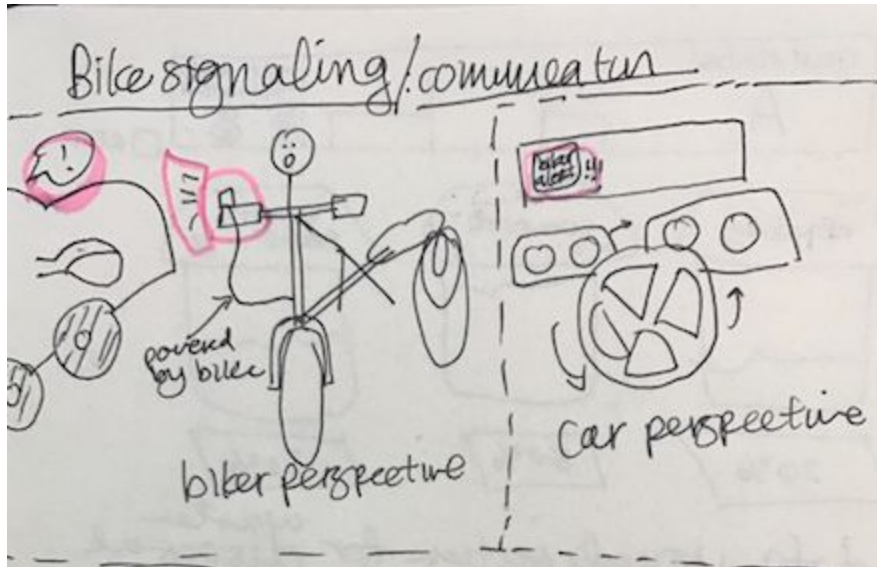
15. **Protecting drunk drivers from themselves:** Non-removable device that can be attached to vehicles, that senses ethanol concentration.
    a. Prevents the driver from turning on the ignition / locks steering wheel when they are detectably legally drunk.
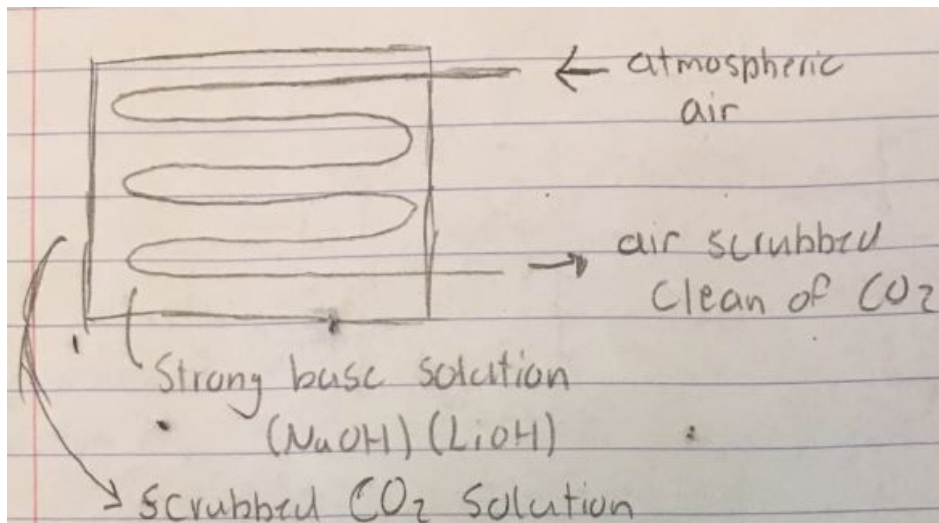
16. **Carbon scrubbing device** Strong bases such as Sodium Hydroxide or Lithium Hydroxide can chemically react with atmospheric CO2 to remove and sequester from air.
    a. We can prototype a device that runs atmospheric air through this chemical solution and then treat the solution to capture and sequester the excess CO2
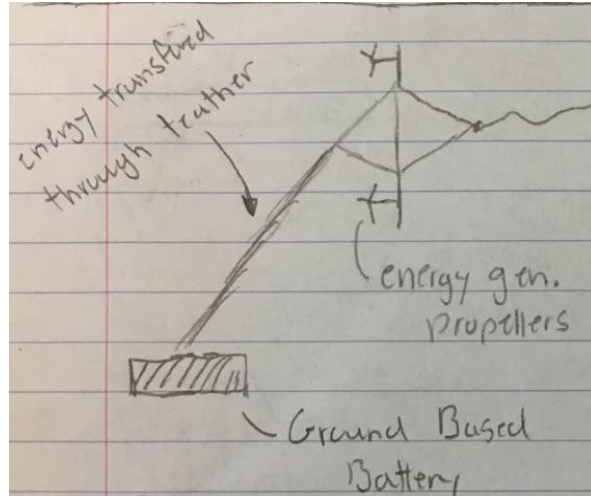
17. **Energy harvesting kite**: A kite that harvests wind energy. It will be tied to a tether and will intrinsically orient itself to face the wind. The kite will feature propellers that harvest energy and transmit through tether to battery on ground.
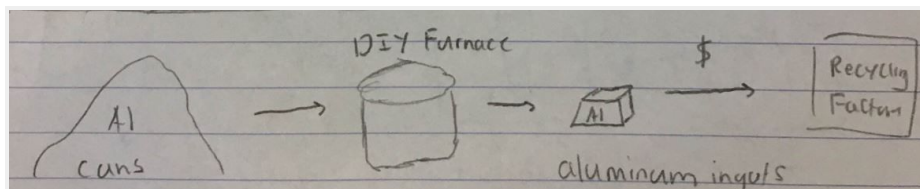
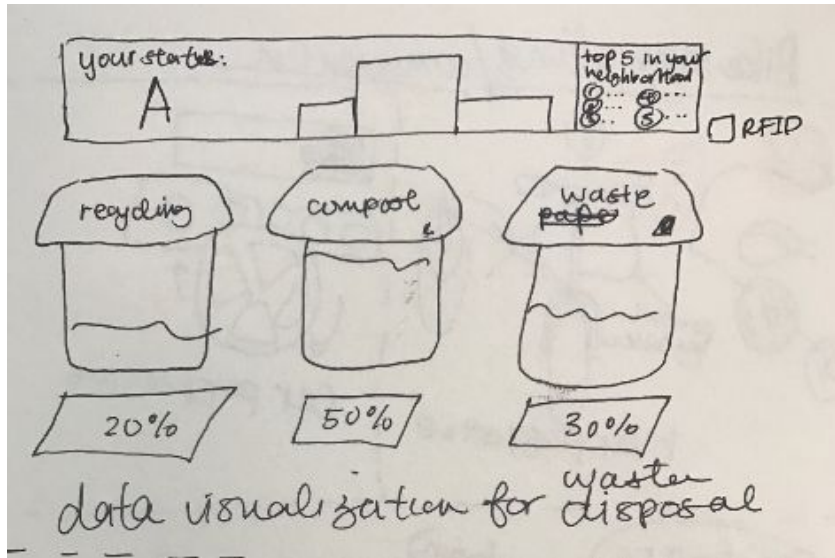18. **Personal Recycling:** A high temperature furnace to melt and recycle plastics and aluminum
    b. Can have pickup services (similar to garbage pickup infrastructure we have today)

19. **Interactive recycling/waste/compost bins:** A set of waste disposal bins that make proper waste disposal convenient for users, by only offering one opening into which waste can be thrown (the bins will automatically sort using computer vision), and featuring a visualization of where the waste goes/is going after disposal.
    a. The visualization compiles data per week and a fun (optional) competitive aspect of how you stand compared to your neighbors.

your status:
A

top 5 in your neighborhood

RFID

recycling   compost   waste ~~paper~~

20%   50%   30%

data visualization for waste disposal

20. Human powered gym: Exercise machines that generate energy from gym members, and use the power to help offset the energy cost of running the machines, and to perform other tasks such as heat shower water.

21. Gamified recycling bins: A device that can be attached to recycling/trash/compost bins, that reduces cognitive load in figuring out what type of waste is recyclable and what isn't, while also making the process entertaining for the user. (Ex. A matching game with LEDs that eventually direct the user to the proper bin.)

22. Interactive Cutting Board: An electronic cutting board with a built-in scale and volume measuring capabilities.

23. Refrigerator inventory: Low cost and reusable RFID tags that attach to the packaging of commonly spoiled items, and all tags can send an alert to an external device depending on how many days since the tag was installed.
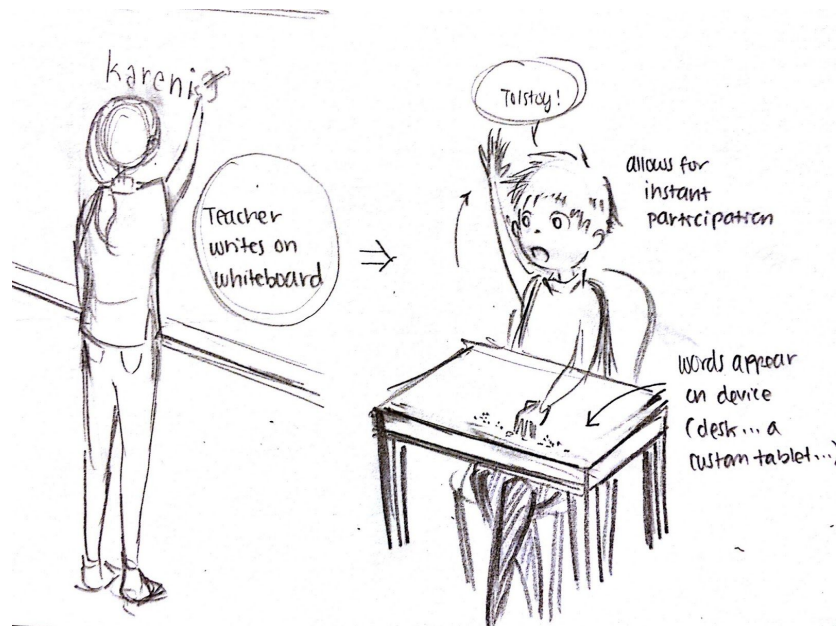
24. **Classroom learning for the blind**: A handheld device or interactive desk surface that reflects, in braille, what is being written on a wirelessly connected whiteboard/blackboard. (Inspired by last part of: https://www.ted.com/talks/dennis_hong_making_a_car_for_blind_drivers)

25. **Less-open open office:** A portable, retractable "cubicle" device (may feature movable walls) that allows people to have their privacy when they need it. It could also include other customization options, such as temperature regulation, since different people have different senses of cold/hot.
    a. Open office plans used in many modern companies are to encourage collaboration. But this sometimes backfires, as everyone has their own working styles and sometimes being with your colleagues is more of an unwanted distraction.
    http://www.huffingtonpost.com/entry/open-office-flexibility_us_5618127be4b0dbb8000e8b8d

26. **Better test-taking surface** for institutions like Berkeley that have major exams in crowded lecture halls where the "desk" surface is less than 1ft x 1ft: Create a better lecture hall seat, that includes an extendable table and has a backrest that encourages you to pay attention rather than lean back and fall asleep

Idea Selection: "Hospital Room of the Future"

We've decided to focus on the creation of a better, more modern hospital room for the 21st century. The project description, as listed above, is to create a device for a hospital room that uses sensors and interactive technology to solve age-old problems for in-patients which exist because of the lack of updated systems in such rooms.

We picked this idea among all the others in our brainstorm because we believe modernizing hospital rooms is an area that will not only allow for excessive creativity on our part, but is very necessary now and in the future. Hospital room design is something that is likely to affect all of us at some point in due to family, friends, or personal misfortune. Further, this project aligns with our collective group goals of creating something that has a meaningful impact on the lives of others.
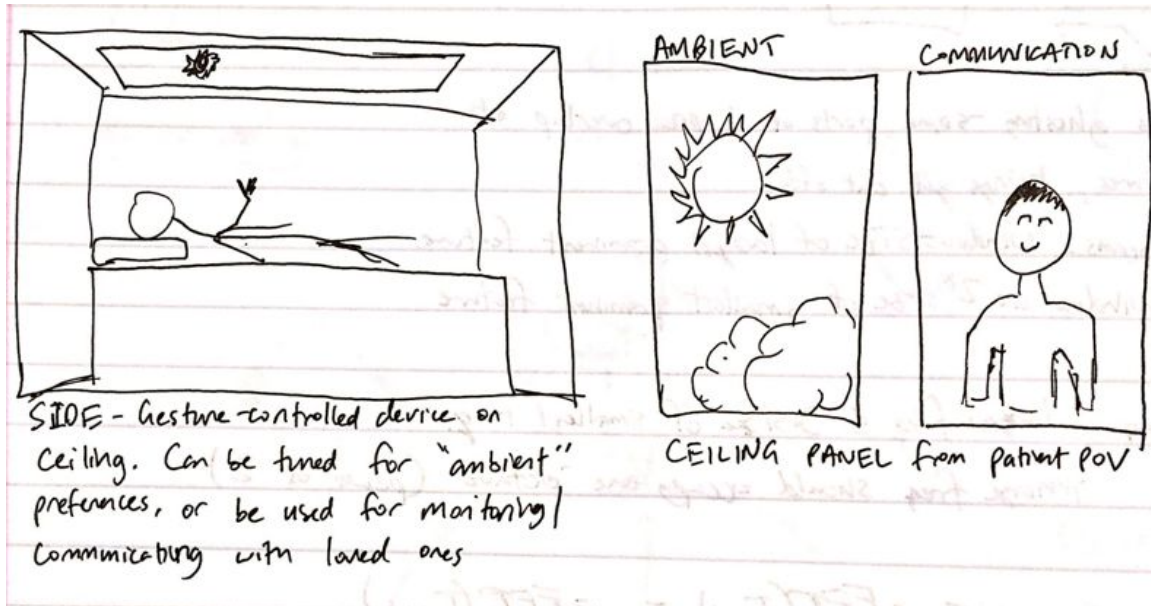
Project Description

Target User Group: Our target group would be long-term hospital patients who stay for multiple weeks. These patients could be in the hospital for a variety of reasons, from surgery complications to extended stays because the exact nature of an illness is unknown. We will be focusing more towards the elderly population of urban areas because this demographic receives the most number of hospital patients and is more susceptible to ailments caused by the condition of the local environment, such as delirium. However, there are many user variables we must also consider such as the patient's physical or mental constraints, the need for constant or frequent monitoring, or the need for assistance with routine tasks such as urination, eating, and bathing.

Problem Description & Context: Hospital rooms are currently horribly mundane for the long-term patient. In a TED Talk by IDEO, and representative showcased clips from a 6-minute video of the ceiling from a patient's point of view. Not only would this environment leave the patient feeling bored or helpless, it may cause delirium for long-term patients, and certainly does not help reduce the duration of their hospital stay. With any hospital, staffing is limited - doctors and nurses must be on call for multiple patients at a time, and might miss out on an emergency situation if they are not paged, the patient does not call for them, or a bed alarm does not go off. There is currently no way for the user to personalize their room or customize it to their ambient preferences. If a room has no windows, the patient cannot sense the time of day outside and may fall into delirium because of their lack of contact with the outer world. At certain hospitals, nurses check patient's vitals every four hours (consists at least checking temperature, pulse rate, breathing, and blood pressure), which doesn't allow patients to keep a consistent sleep pattern.

Possible high-level goals (Will likely focus on executing one or two of these. If we focus on multiple goals, we will likely need multiple interactive devices to communicate with one another):
- Modular room setup (sketch of possible ceiling panel device below)
- Offer round-the-clock patient monitoring
- Automatically alerts medical staff when patient needs attention
- Ambient controls (refer to lighting sketches above)
- Tracking and categorizing noises
- Automatic sitter

SIDE – Gesture-controlled device on ceiling. Can be tuned for "ambient" preferences, or be used for monitoring/communicating with loved ones

CEILING PANEL from patient POV

Why is a new interactive device a good solution for the problem?
A new interactive device would allow the user to have increased control over their room environment and allow nurses to monitor patients more effectively. Technology could help automate processes that currently require manual labor and attention, from monitoring vitals to emergency paging. Many patients may have loved ones who want to visit them in the hospital but are not able to be physically present. Technology could help connect patients with their loved ones virtually. Finally, an interactive environment can simulate the outside world to keep the patient's body in rhythm and prevent delirium.

What are open technical questions you'll need to answer to determine feasibility?
This project idea is currently very broad, and requires significant scoping. We need to determine what user interactions we wish to support in order to determine what sensors we need and how easily can we develop them to coexist in the same device. Ideally, we'd like to incorporate some sort of gesture-controlled interaction. We need to assess the feasibility of this because we do not have advanced experience in computer vision or prior work with gesture controls. Further, depending on more specific constraints related to our target group (whether these are elderly patients with arthritis or living in a hospice), gesture control might be too taxing. In creating the "room of the future," we need to determine whether we want to demo an entirely redesigned modular space or focus on a smaller installment to an existing room. From the user's standpoint, we need to answer questions of how much direct and indirect real time interactions we want the doctors and patients to have.