CS Interactive Devices
Final project report
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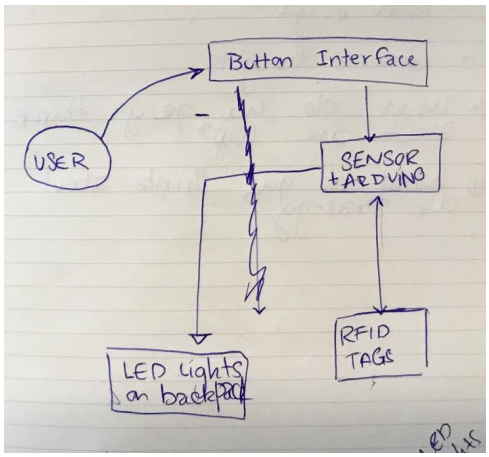
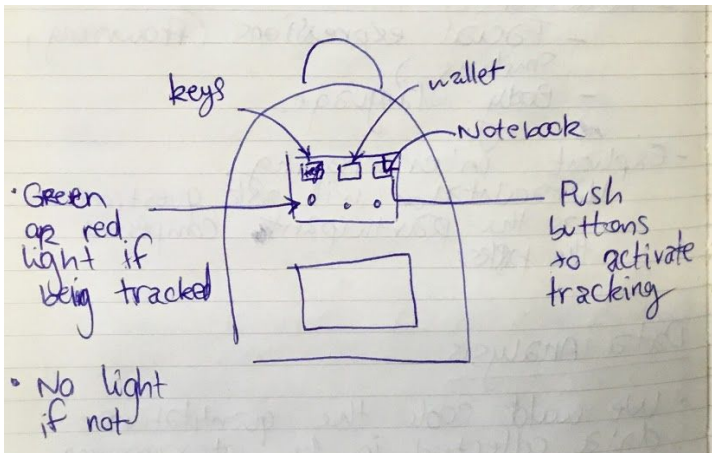
SmartBag

Most of us can relate to the stressful realization that we've forgotten our phone on a restaurant table or forgotten to bring our laptop charger for a presentation. How much easier would life be if we could track all our most important items inside our bag so that we never leave anything behind? Keeping this issue in mind and in partnership with the Kipit Startup Studio team, we decided to create a smart bag which can track the objects inside it and let us know if we are missing anything. We could also decide whether to track a particular item or not.

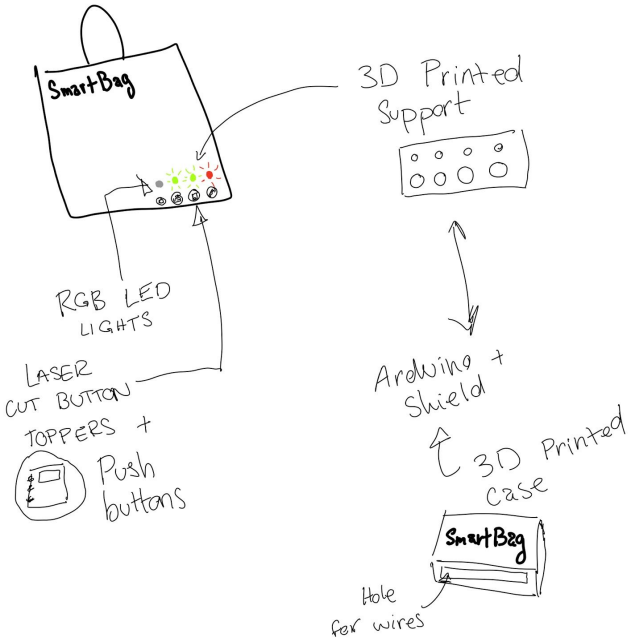
Ideation:

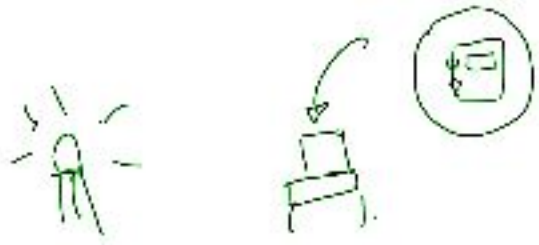
We started off by throwing ideas on the board and coming up with a system architecture of how our product would work and what hardware parts we would need. We focused on differentiating our product from the Kipit prototype by creating a physical interface for the object detection system.





In the first version of our interface, we decided to use buttons to check the status of items and initialize tracking. Each button would be associated with an object and we could press it to see if the object was present or not. We initially envisioned that the buttons would be used as input from the user with RGB LEDs reflecting the output. We imagined that we could keep the LEDs off to communicate that an item was not tracked and turn the LEDs red if not present and green if present.





Then, we started thinking about what kind bag we would want to use and the placement of our hardware. This was important because as it is a prototype, we would be using a lot of loose wires which may create connection errors while running the code. We also decided to use RFID tag stickers so that the user has freedom of the number of objects they want to use and can eventually configure the system themselves.

Final system architecture and state diagram:

Below are the hardware parts we were looking to use. We would be using a Sparkfun RFID shield, buttons corresponding to each item, passive RFID tags, an arduino and LED lights. We were also looking into the kind of bag which would be suitable for our project and also material to create a case for the hardware. Eventually, we replaced the LED lights with a LCD screen as described below.

Hardware setup:

As we continued performing research and understanding different interactions with RFID and exploring new hardware parts, we learned that instead of using LED lights we could use an LCD screen to communicate with the user. This decision was partially made due to a lack of pins on the Arduino. Additionally, LED lights and buttons would have a learning curve and user would have to remember which button corresponds to what. We decided to use an LCD screen instead and this way the user would be able to see which object they are selecting and decide on if they want to track it or not. This allowed us to display more information at once and to create a clearer interface.

Below is a hardwire hookup guide. We used LCD screen, arduino, RFID scanner and RFID tags, buttons, prototyping shield, resistors and wires.

Process photos:

Final product:

Github link: https://github.com/sdl83/InteractiveDevicesFinal
Project Code:
https://github.com/sdl83/InteractiveDevicesFinal/blob/master/RFID_LCD_Time3.ino
Demo links:

- Interface: https://drive.google.com/file/d/1pOZdnwkIMPYb3ZxekXVsxB_WegeLu5jR/view?usp=sharing
- Tag registering: https://drive.google.com/file/d/1lyp3-BEcYpfe6bfHnOgN0U6e4-qh_rk7/view?usp=sharing

Tasks:

- Narrowing down idea & changes from the Kipit product
- Research on RFID and scanner
- Collecting equipment: Bag, Arduino, RFID Scanner, RFID Tags, buttons, RGB LED lights, laser cutting material, LCD Screen
- State diagram and UI planning
- New Technical Diagram and sketches
- Formal technical diagram
- Power and heat calculations -- http://www.sengpielaudio.com/calculator-ohm.htm
- Establish need for and plan implementation of venting / heat sink

- Test connection to Arduino
- Testing Range on Scanner and Tags
- Exploring the Reader Software
- Hardcoding RFID tags to items
- Detecting and changing state of objects and system
- Establishing the timing of detection
- Adapting code to buttons and LCD display
- Displaying proper messages in correct format on LCD
- Checking for missing items
- Add timers on messages
- Final UI decisions (what does it mean to press a button 1 time? 2 times? etc.)
- State Diagram

- Bring and select bag
- Design of logo buttons (not used)
- Soldering pins onto shield
- Re-Solder one of the pin sets
- Deciding on physical button interface & LCD screen
- Wiring LCD display and buttons
- Fix wiring of display
- Wiring batteries together in series to augment power
- Soldering and electrical tape on battery attachment

- Adapt bag for hardware version 1 (attaching arduino and surface, sewing in the support raft)
- Adapt bag for hardware version 2 (cut holes, sewing in the support raft)
- Wiring diagram