Final Report

Critical Making Spring 2016

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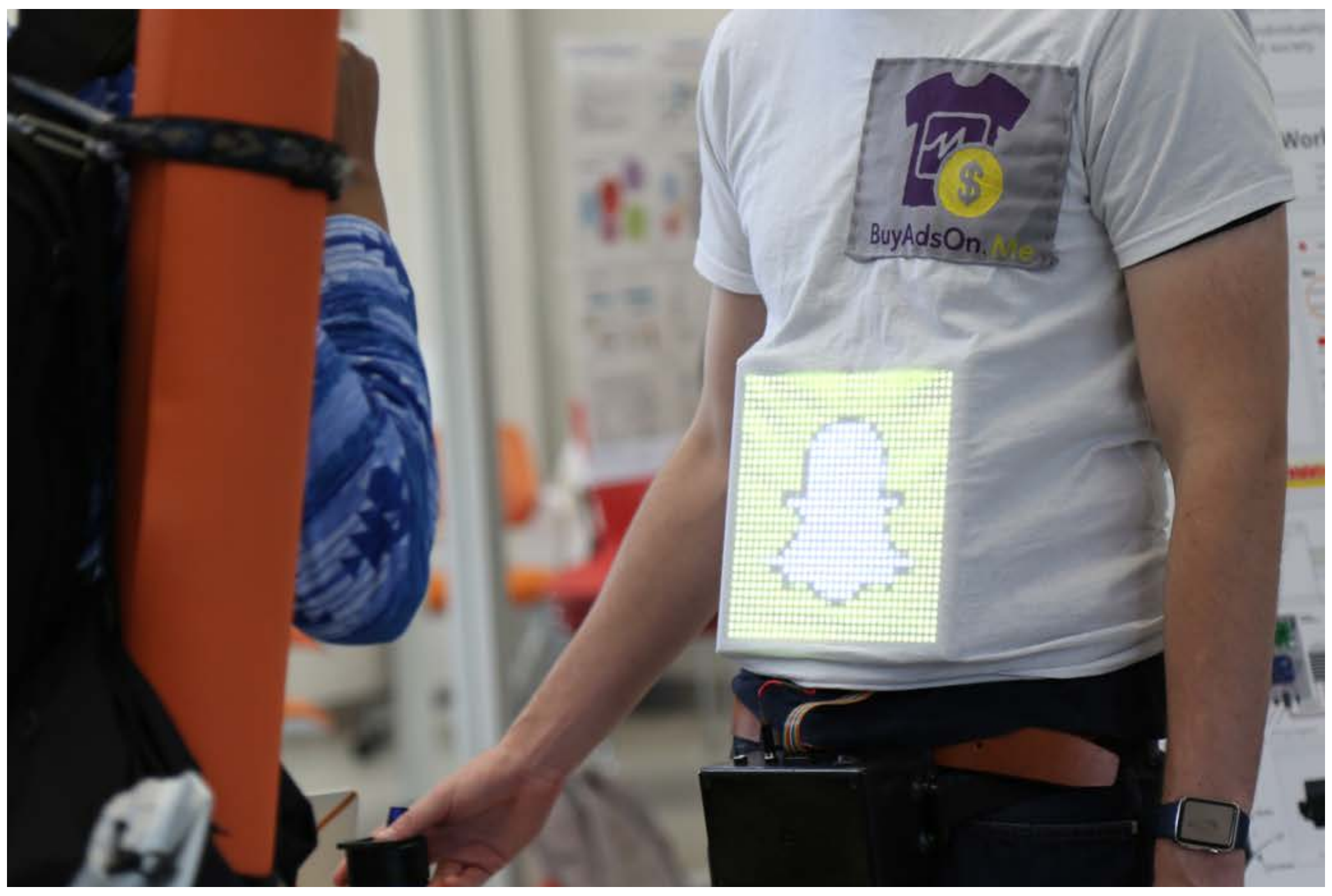
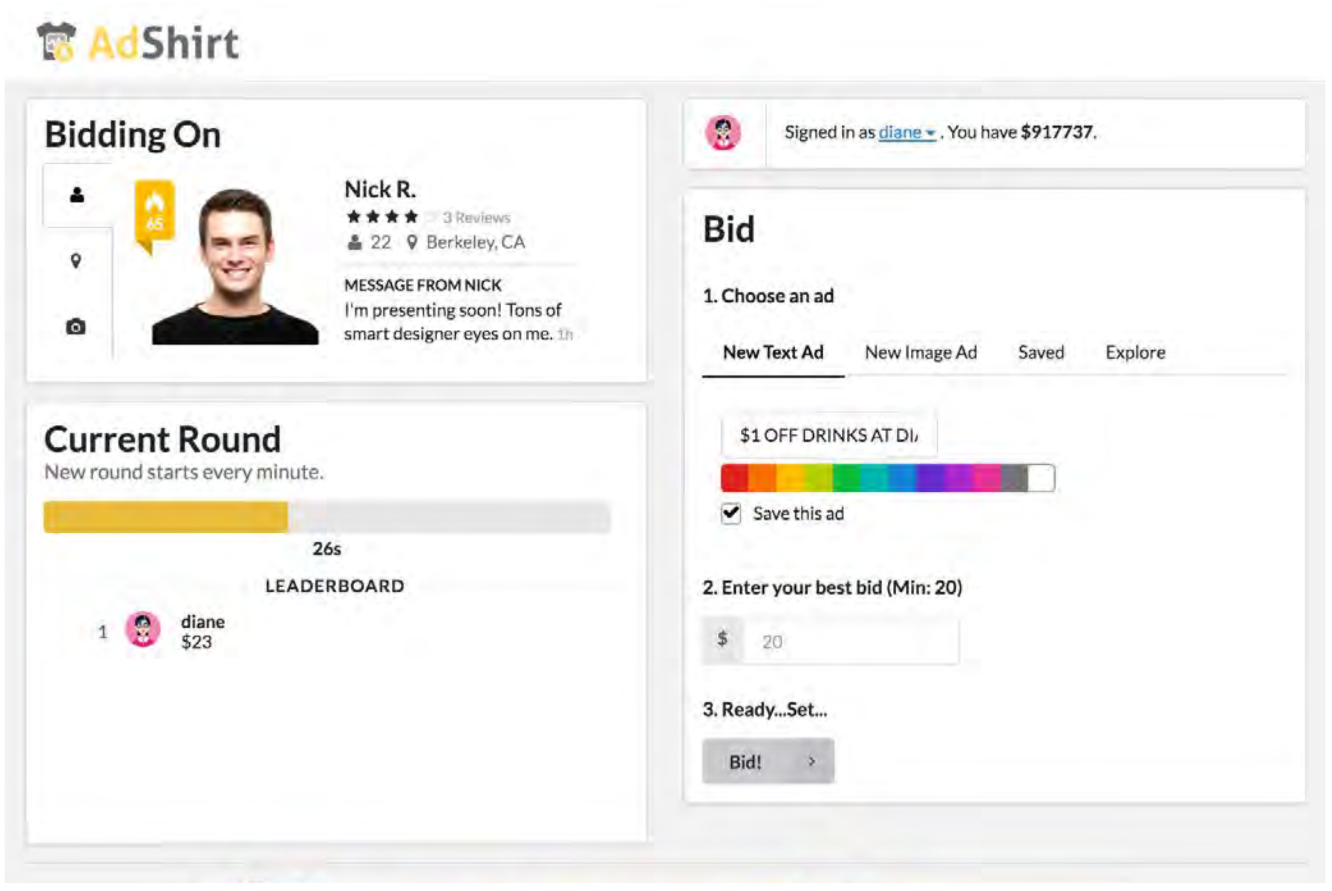
Nick Renda • Diane Wang

Overview

Adshirt transforms your body into a monetization platform. Companies compete for your advertising space through online bids—and you cash out. Build your reputation with trusted reviews, and ensure a profitable minimum bid by spending time near densely populated spaces. Wear the marketing revolution.



AdShirt displaying Snapchat ad



Nick R.
★★★★ 3 Reviews
22 Berkeley, CA
MESSAGE FROM NICK
I'm presenting soon! Tons of smart designer eyes on me. 1h

New round starts every minute.
26s
1 diane $23

Signed in as diane. You have $917737.

1. Choose an ad
$1 OFF DRINKS AT DI
✓ Save this ad
2. Enter your best bid (Min: 20)
$ 20
3. Ready...Set...

AdShirt software interface: BuyAdsOn.Me

AdShirt Display

AdShirt Enclosure

Motivation

The typical outfit in the tech industry consists of a tech shirt and jeans. Students within UC Berkeley Engineering follow this trend by sporting free shirts from career fairs or tech talks. They proudly advertise whichever company hands them a free shirt, all with no compensation. In Japan, women also advertise on their thighs—a space looked at frequently by men. These occurrences motivated the question: we are all walking advertisements, so why not sell our space?

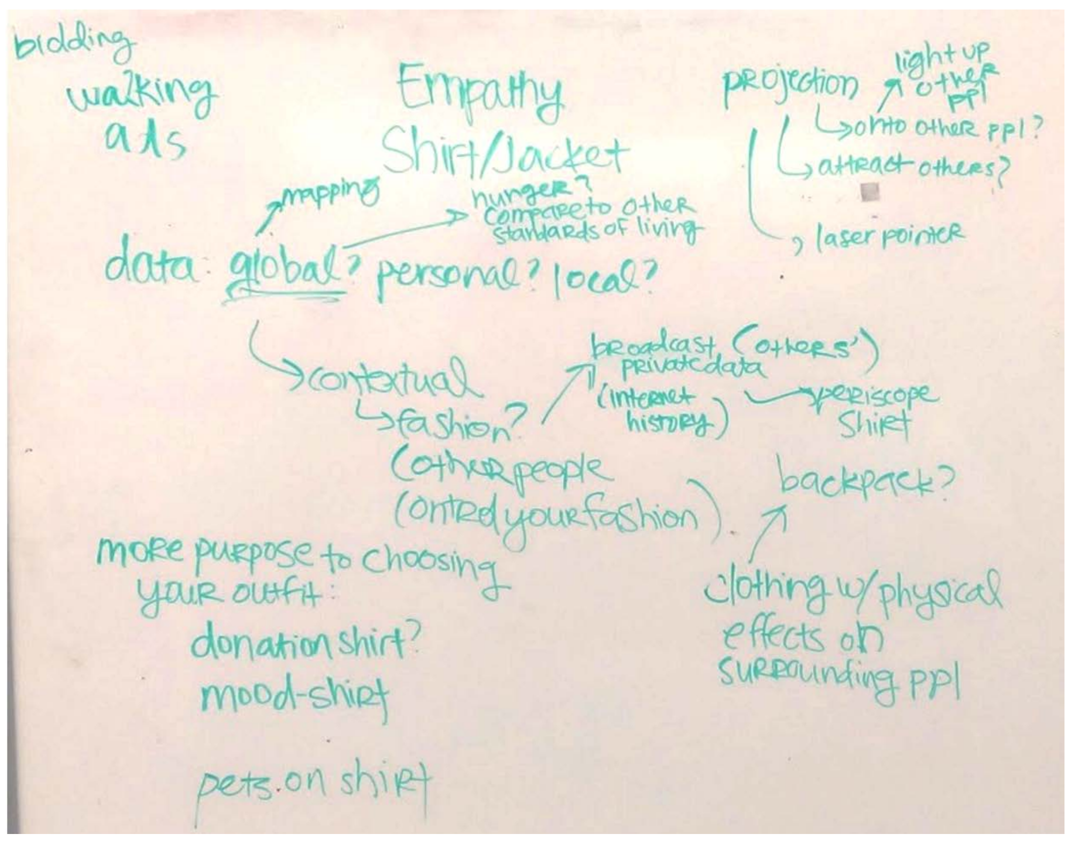
AdShirt critiques the relationship between individuality and capitalism. Where is the line between sacrificing personal expression for making money? In our casual initial interviews, we had polarized responses—some people were stagnant, saying “no way in hell would I ever sell out to this,” while others (who had less than $100 in their bank accounts) enthusiastically asked when they could sign up.

Common tech shirts seen around campus

Design Process

Overall Concept

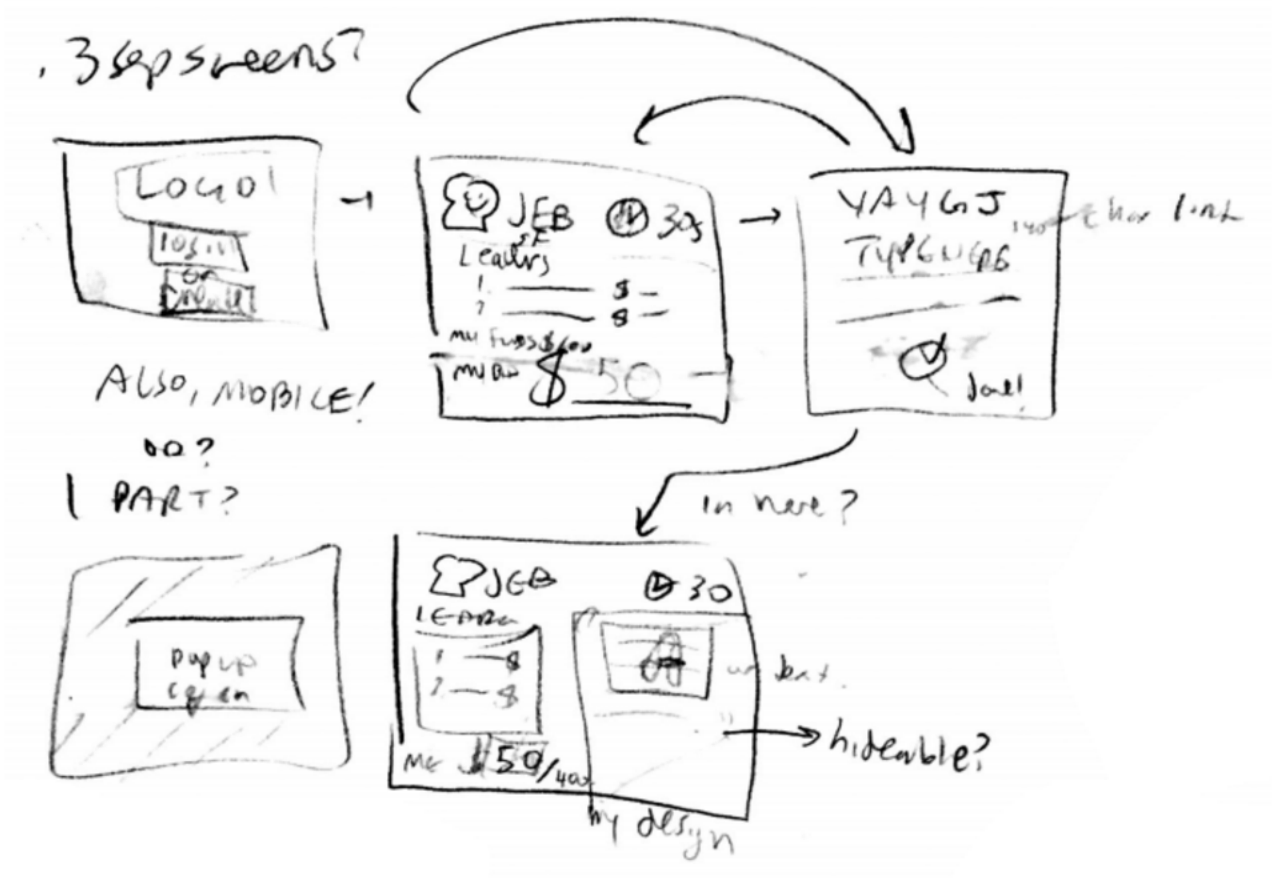
Brainstorm



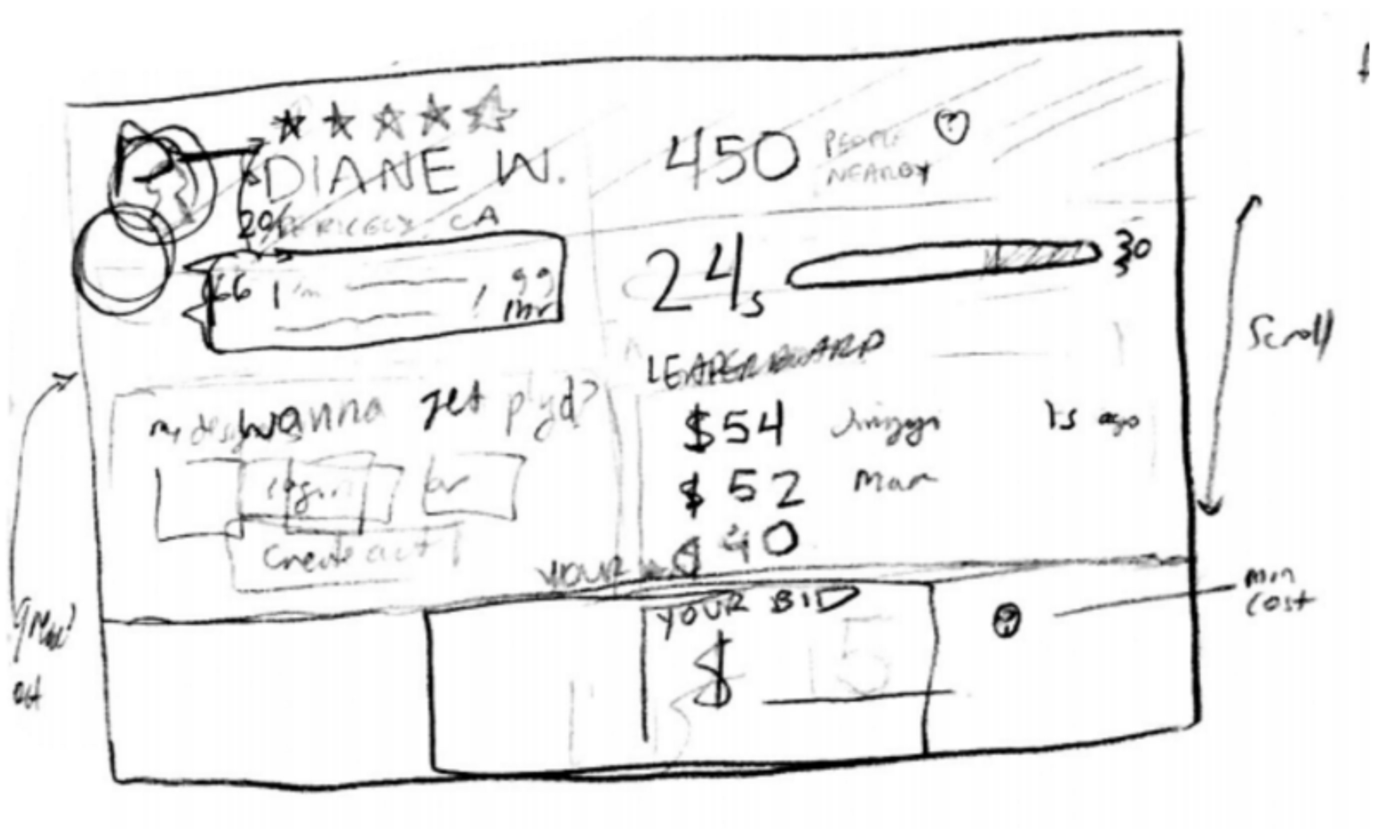
Common Themes:

Critiquing outfit choices
People as walking ads
Clothing as a medium
Clothing with its own mind
Clothing displaying data

Initial Sketches



Initial Wireframes

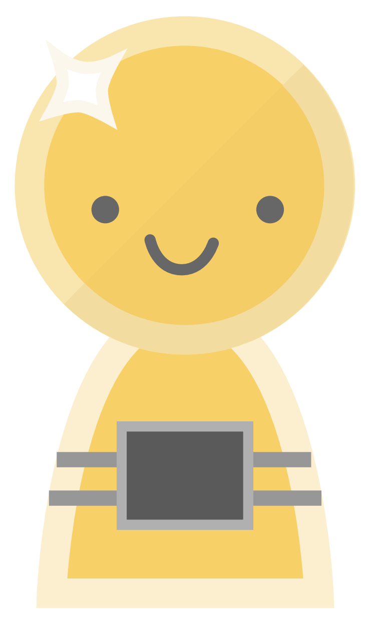


Refined Sketch

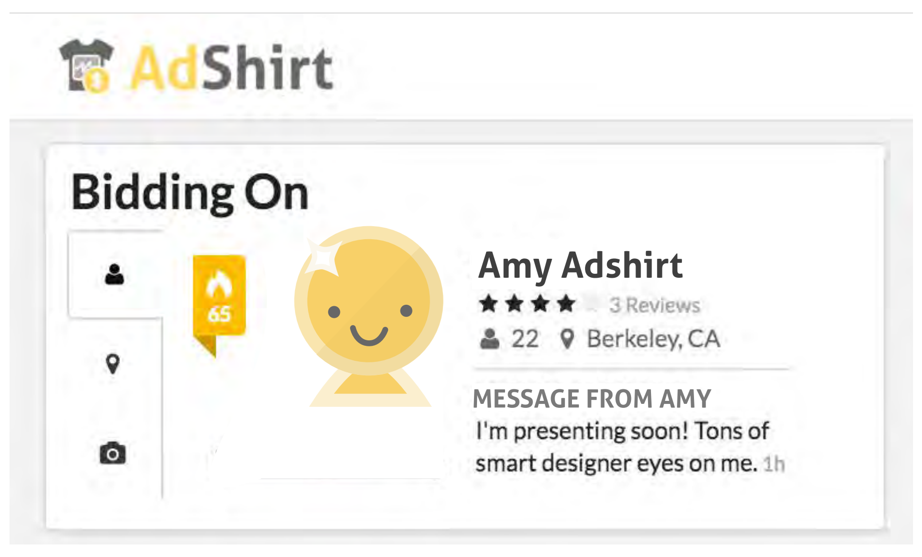
Design Process

Overall Concept

Storyboard



User puts on AdShirt.



AdShirt

Bidding On

65

Amy Adshirt

★★★★ 3 Reviews

22 Berkeley, CA

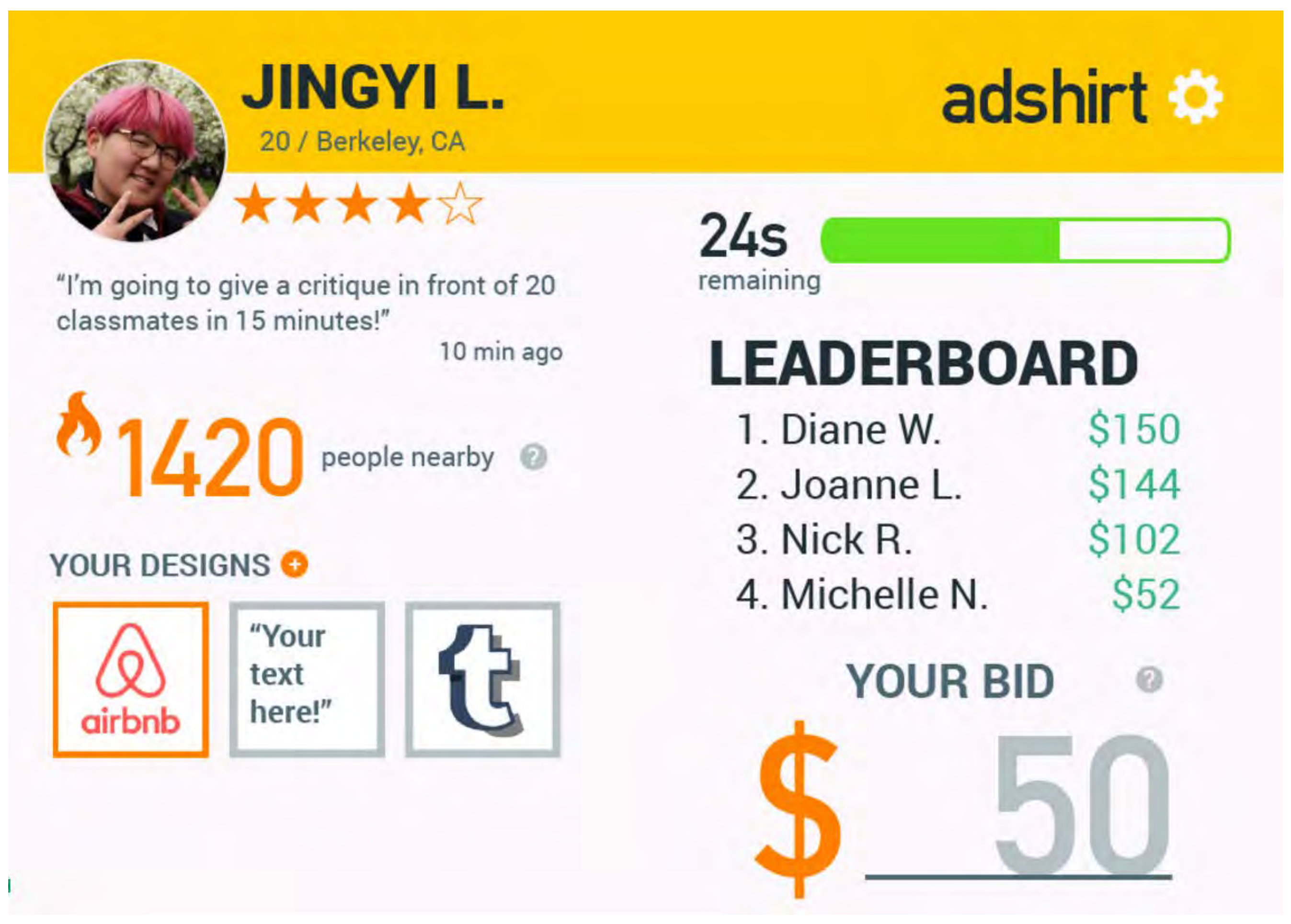
MESSAGE FROM AMY

I'm presenting soon! Tons of smart designer eyes on me. 1h

User appears on Adshirt website. Companies bid on user.

Winning company's ad is displayed on the user. User earns money.

Iterations



JINGYI L.

20 / Berkeley, CA

adshirt

★★★★☆

"I'm going to give a critique in front of 20 classmates in 15 minutes!"

10 min ago

1420 people nearby

YOUR DESIGNS

airbnb

"Your text here!"

24s remaining

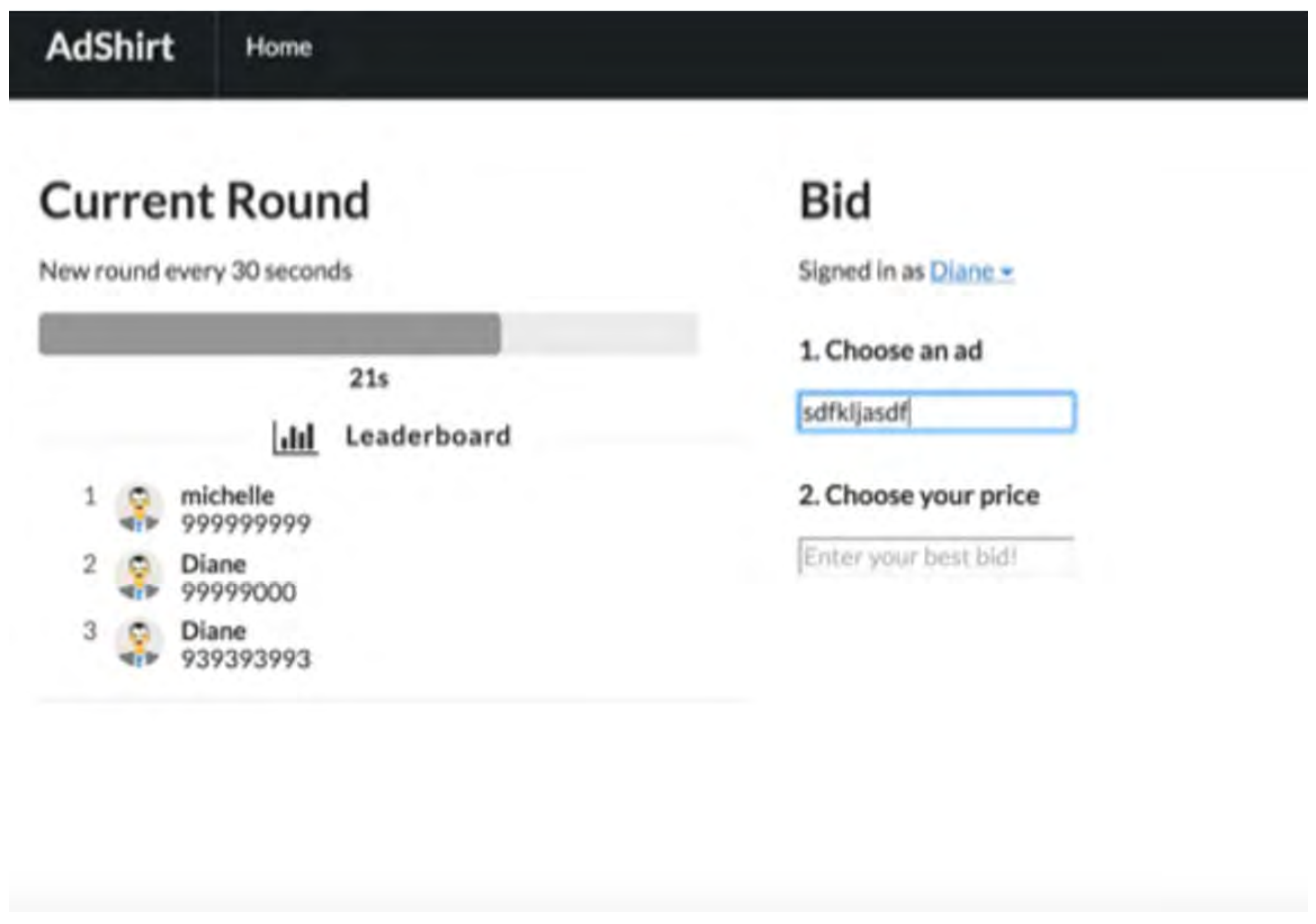
LEADERBOARD

1. Diane W.	$150
2. Joanne L.	$144
3. Nick R.	$102
4. Michelle N.	$52

YOUR BID

$ 50

High-Fidelity Mockup



AdShirt Home

Current Round

New round every 30 seconds

21s

Leaderboard

1 michelle 999999999

2 Diane 99999000

3 Diane 939393993

Bid

Signed in as Diane

1. Choose an ad

sdfkljasdf

2. Choose your price

Enter your best bid!

Initial Interactive Prototype

Design Process
Hardware

Once the team had settled on the idea of creating a LED display, we began to look for what components we would need. We initially wanted to create the display ourselves, but after some research decided it was outside the scope of the class, and that purchasing one would allow us to focus our efforts on the rest of the project instead.

Component Selection

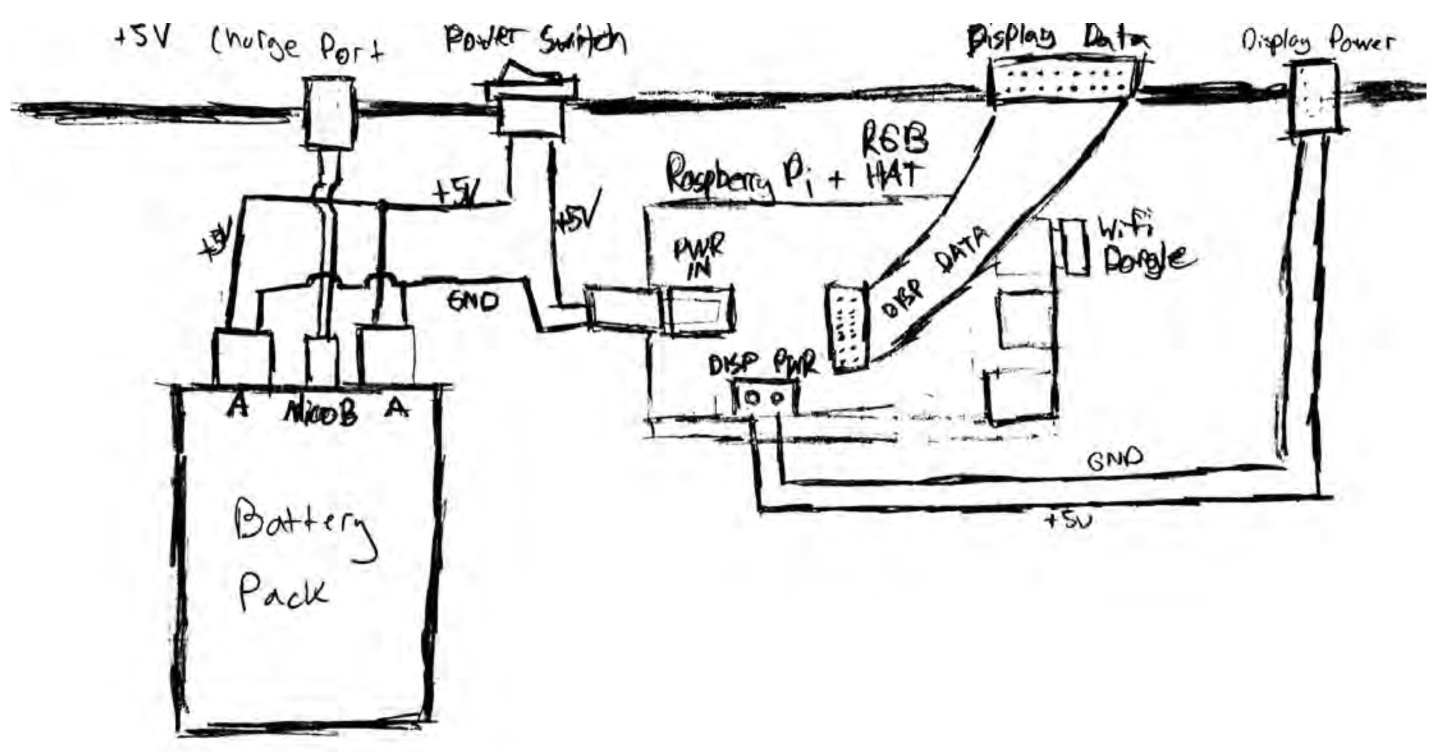
To start the hardware design process, we made a list of major hardware components we would need:

- Raspberry Pi Model B+ Version 2
- Adafruit 32x32 RGB LED Matrix, 6mm pitch
- Adafruit RGB Matrix HAT + Real Time Clock
- RAVPower 16750mAh 5V Battery, 4.5A

The Pi served as our main microcontroller, and the Adafruit hat allowed for easy communication between the Pi and the LED matrix. The battery sourcing was an initial challenge: the display has 1024 LEDs, which are capable of a peak current draw of 4A!

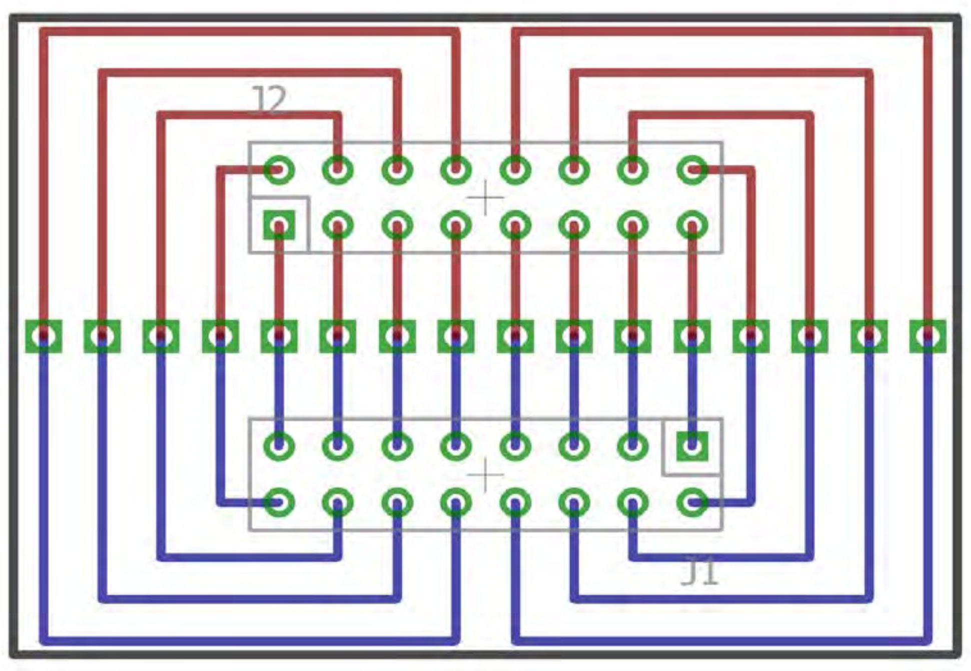
Wiring Design

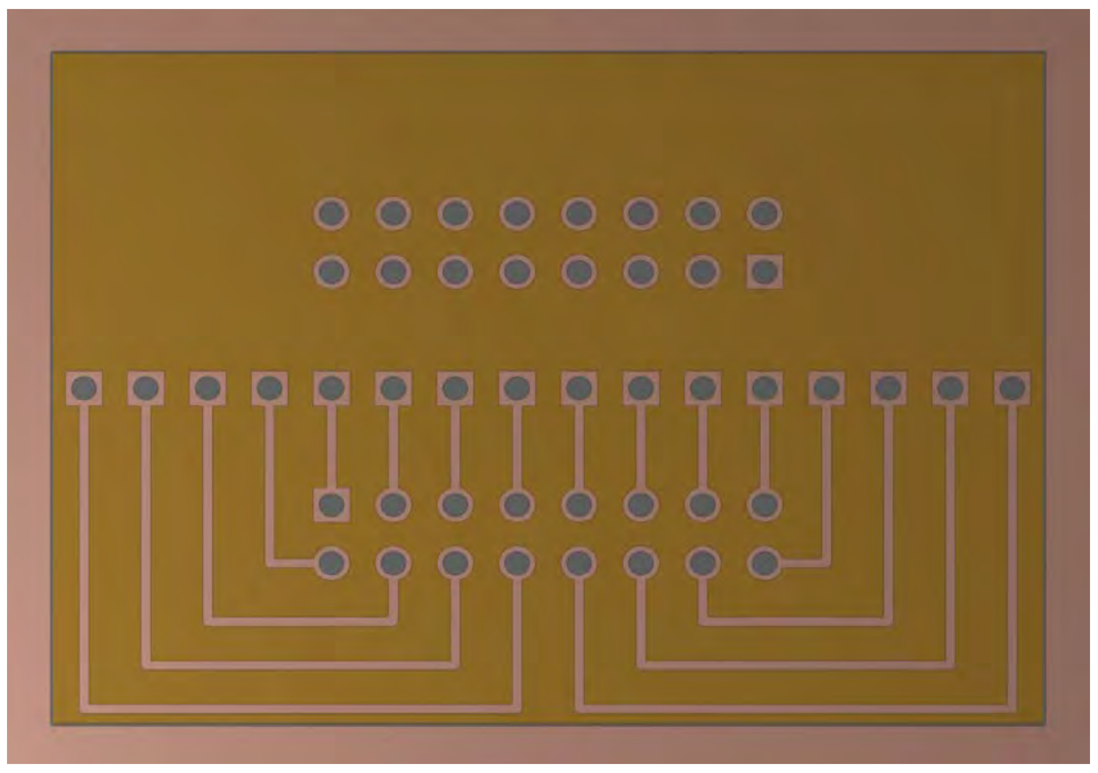
We then drew a preliminary wiring diagram, to make sure we had thought out all the connectors we would need to order.



Design Process
Hardware

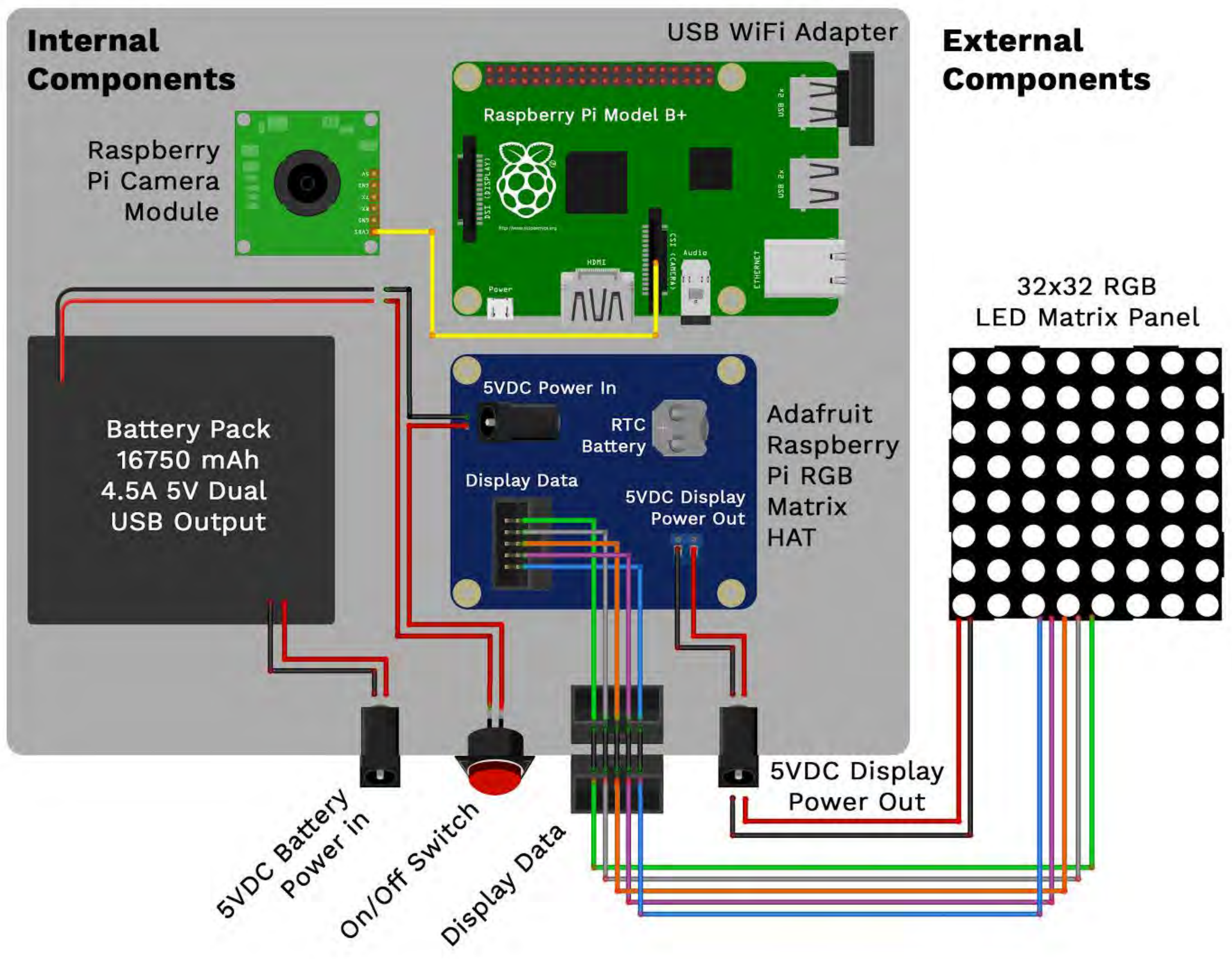
In order to connect two male IDC cables together, we decided to create a custom double-sided PCB to connect the pins of two female IDC headers. It would have been possible to do this with just wires, but it would have been messy!





After testing the battery, we realized the LED Matrix could be sufficiently powered by only one of the 2.5A USB ports, so we removed the second USB cable from the wiring diagram.

The only other change to the final wiring diagram was that we added a camera to the Raspberry Pi so we could show a live view of who was watching the AdShirt.

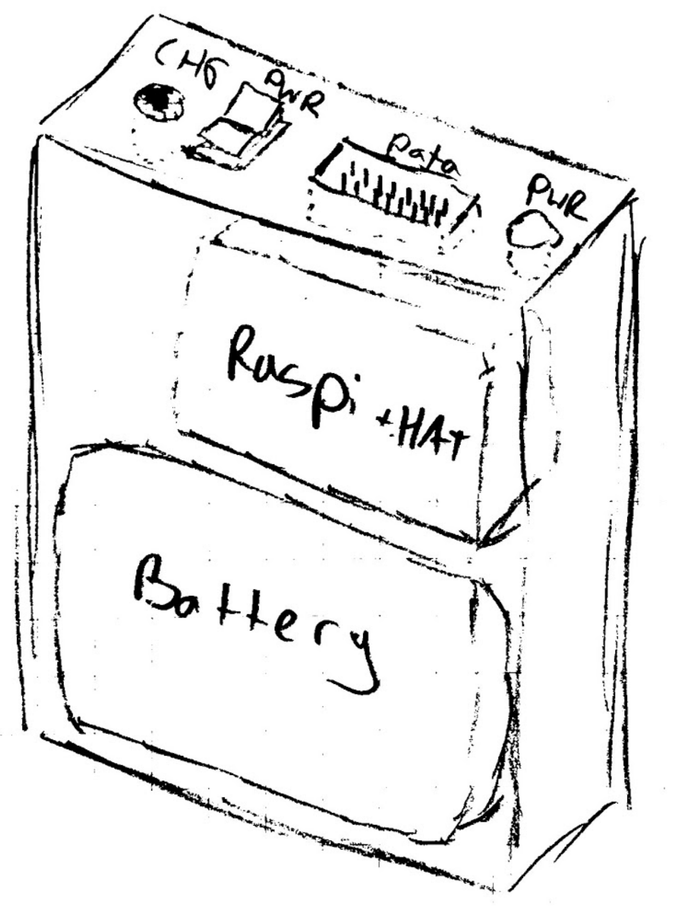


Final Wiring Diagram

Design Process
Hardware

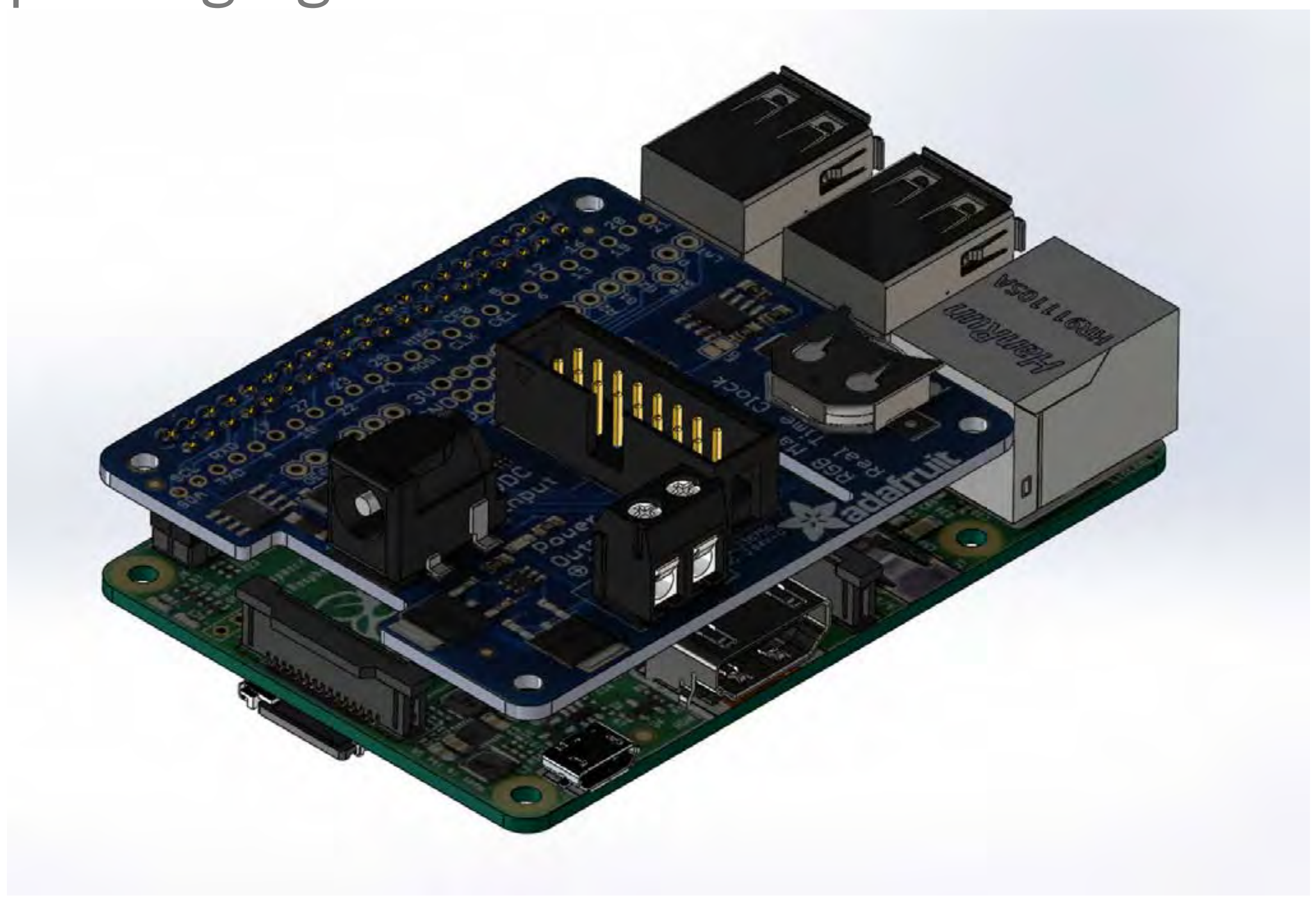
3D Modeling

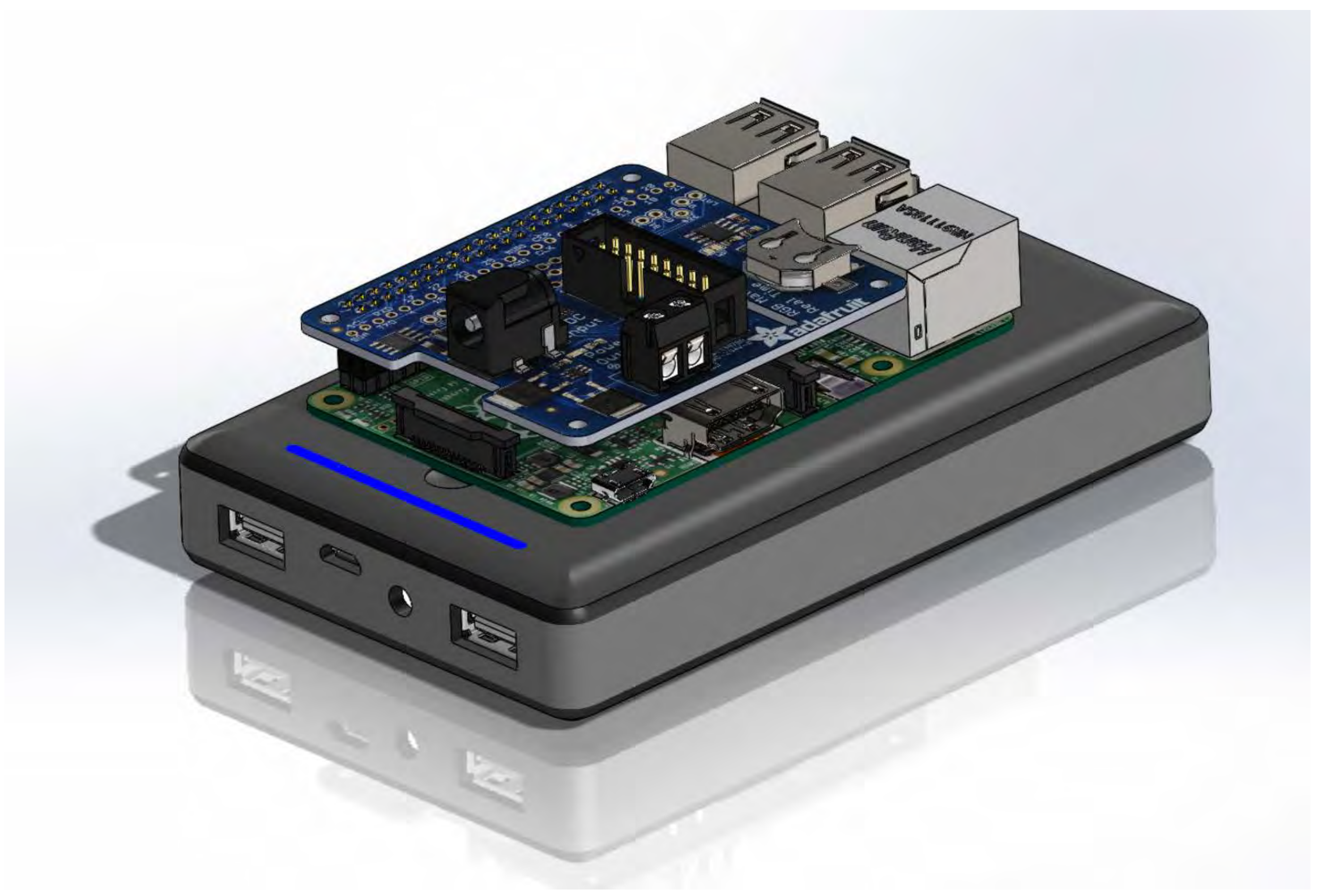
Once we had the components figured out, we moved onto packaging them in 3D space. We wanted to mount the display under a t shirt on either the chest or the back, which would make it inconspicuous until an ad appeared. To accomplish this we decided to split the display from the rest of the electronics.



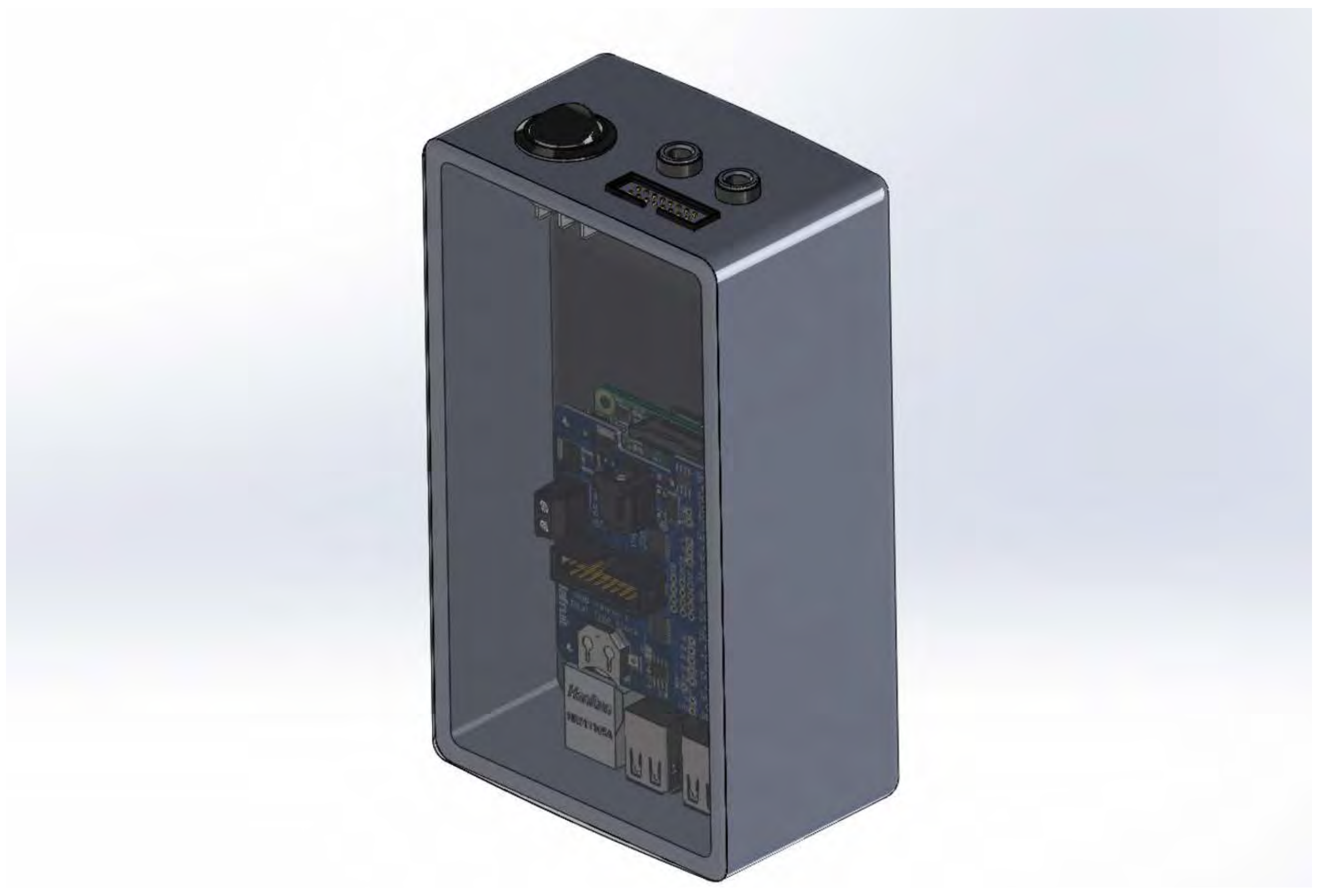
First Conceptual Sketch of Enclosure

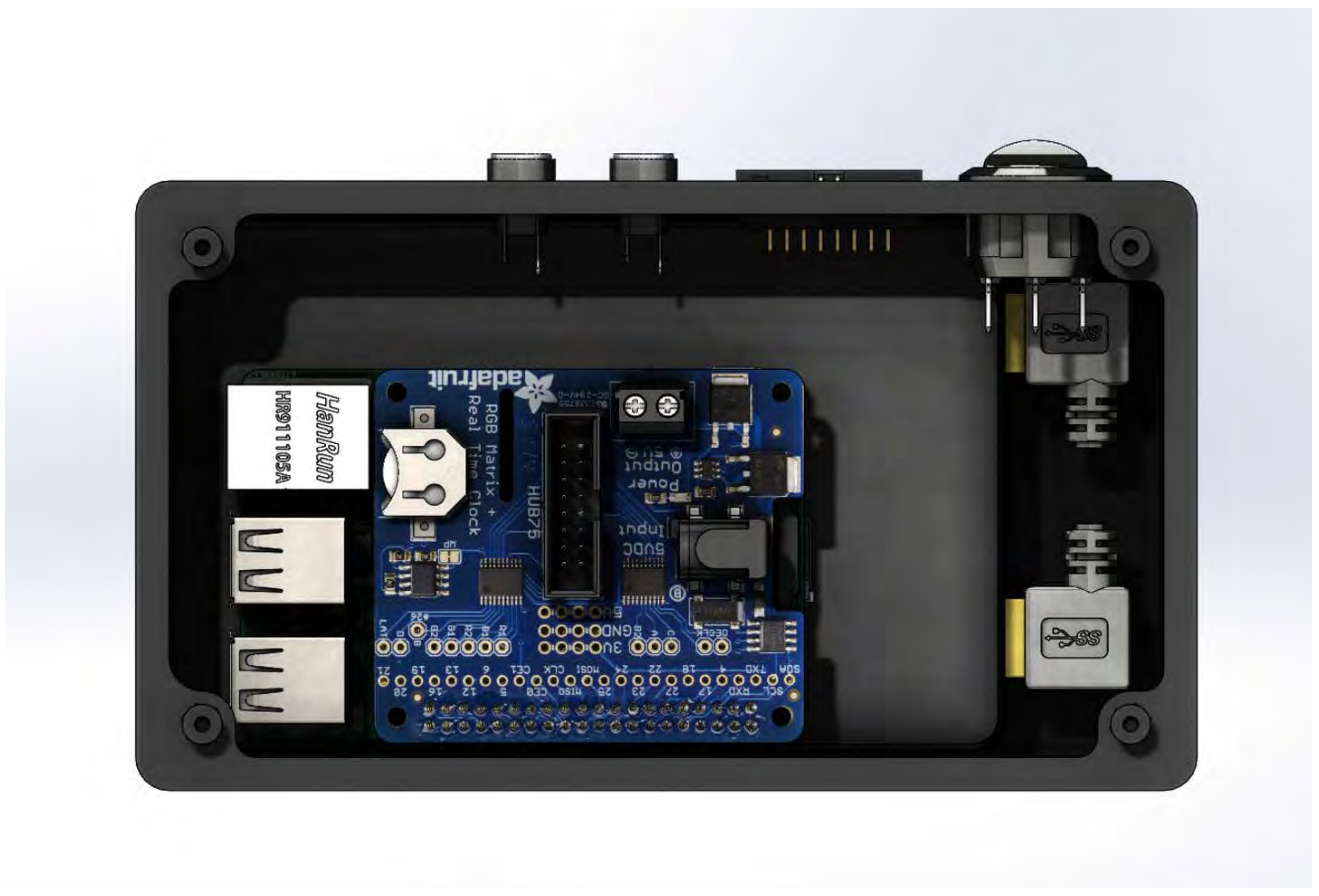
Once we had the components in hand, we created 3D models of them so we could more accurately design the enclosure. The following photos show how the packaging evolved.

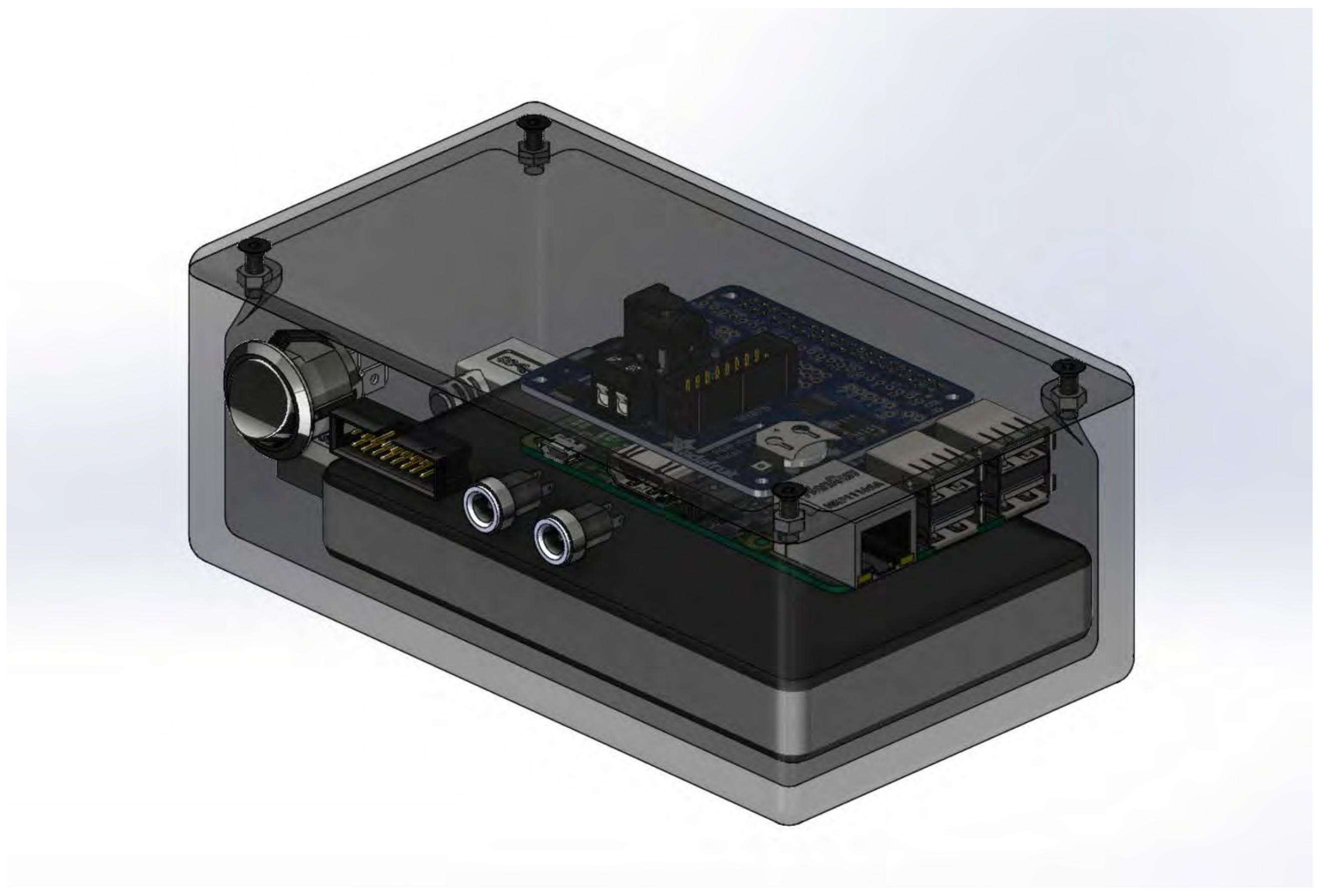




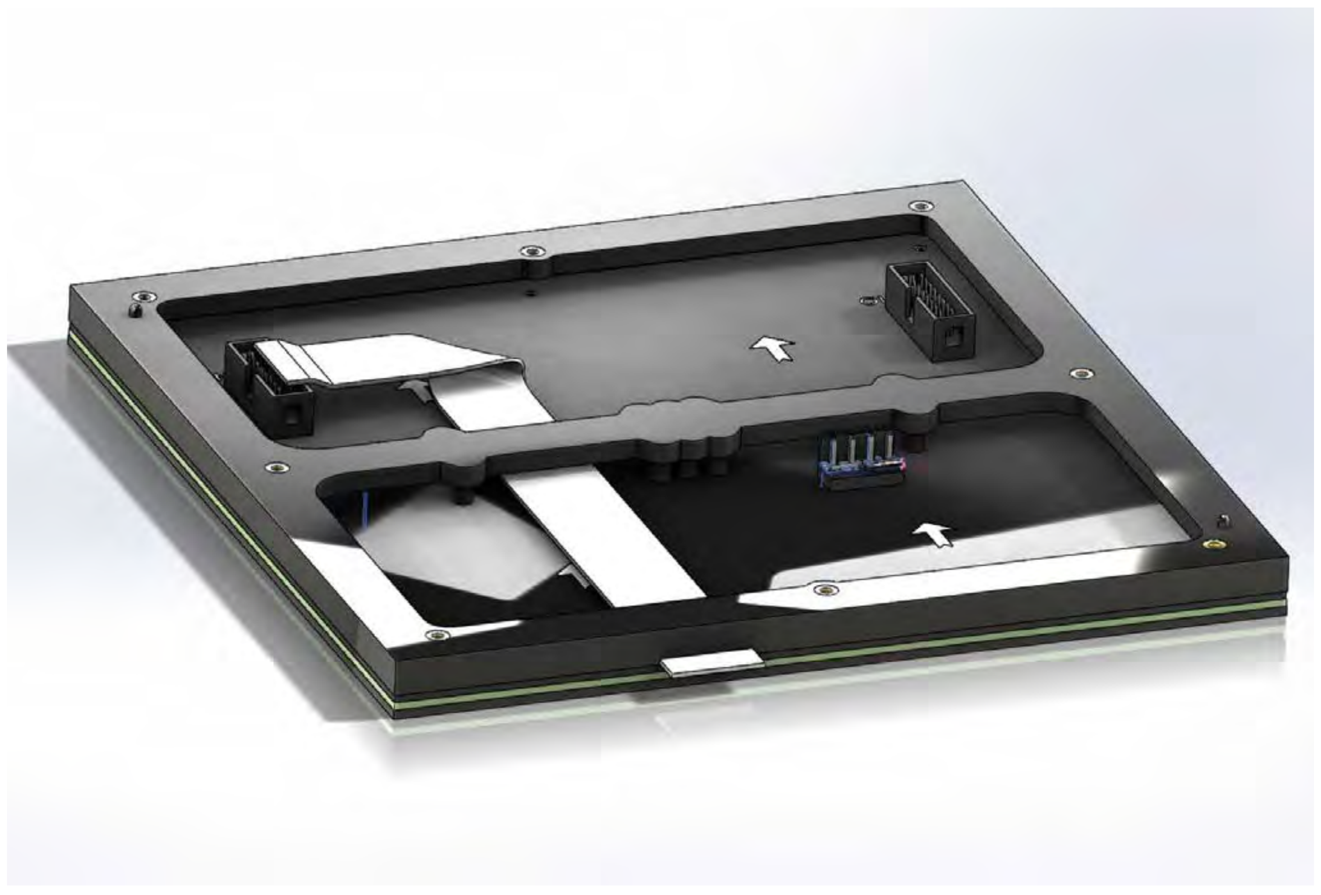
Design Process
Hardware

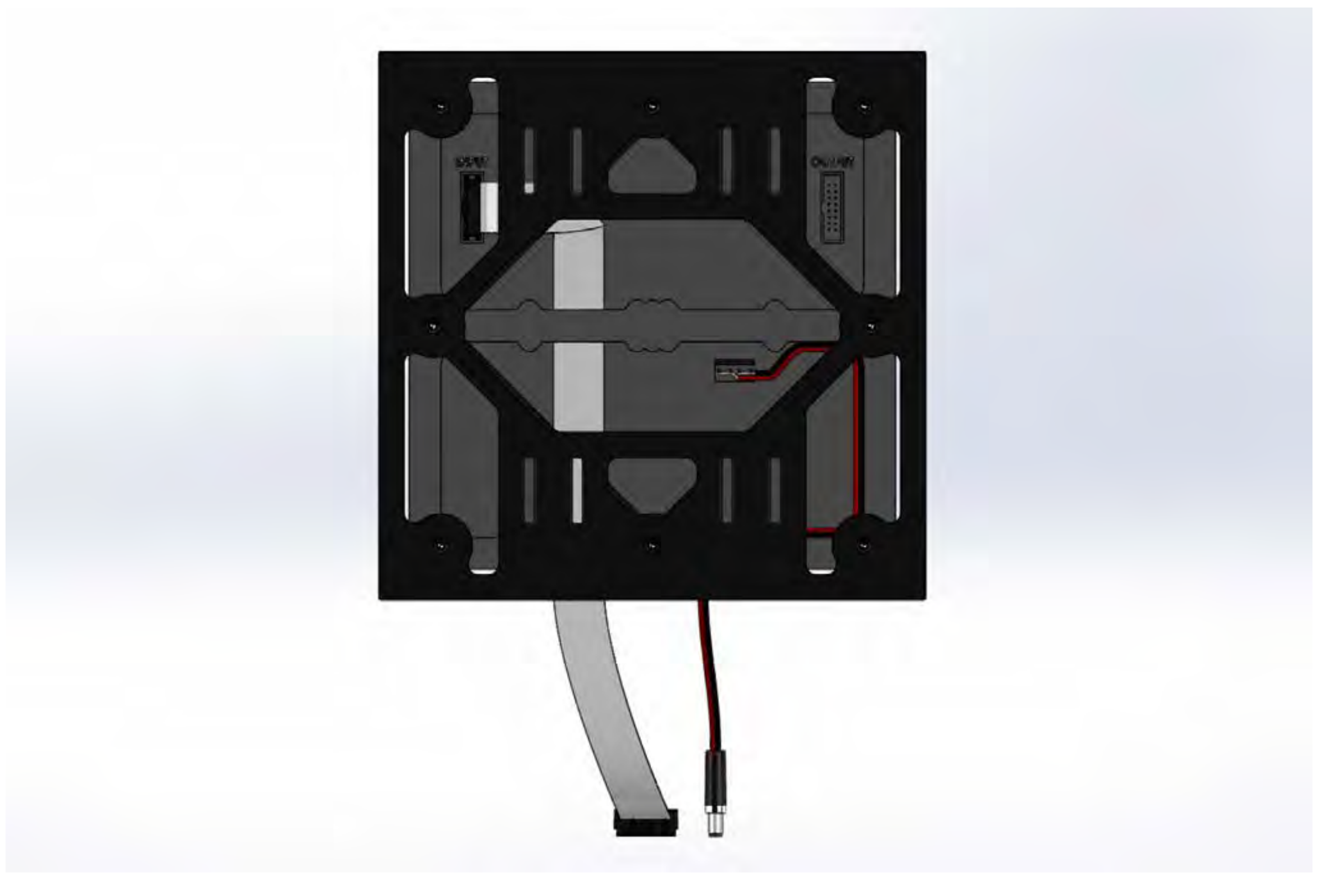






The LED Matrix was also accurately modeled, and we created a 3D printed part to protect it and remove the sharp lines when it was placed under a t-shirt. This part also allowed us to attach velcro straps, which mount the display to the user's chest.

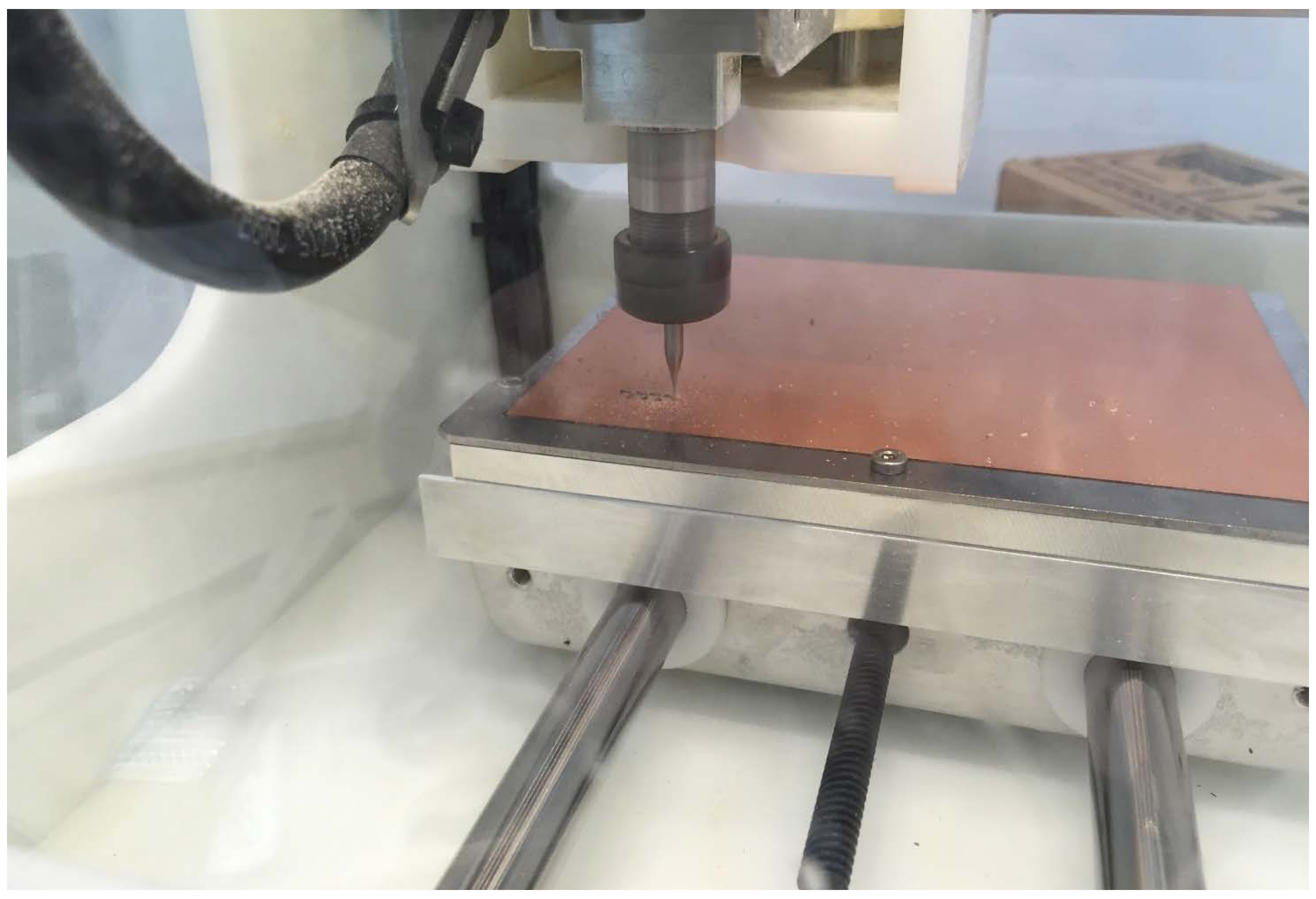


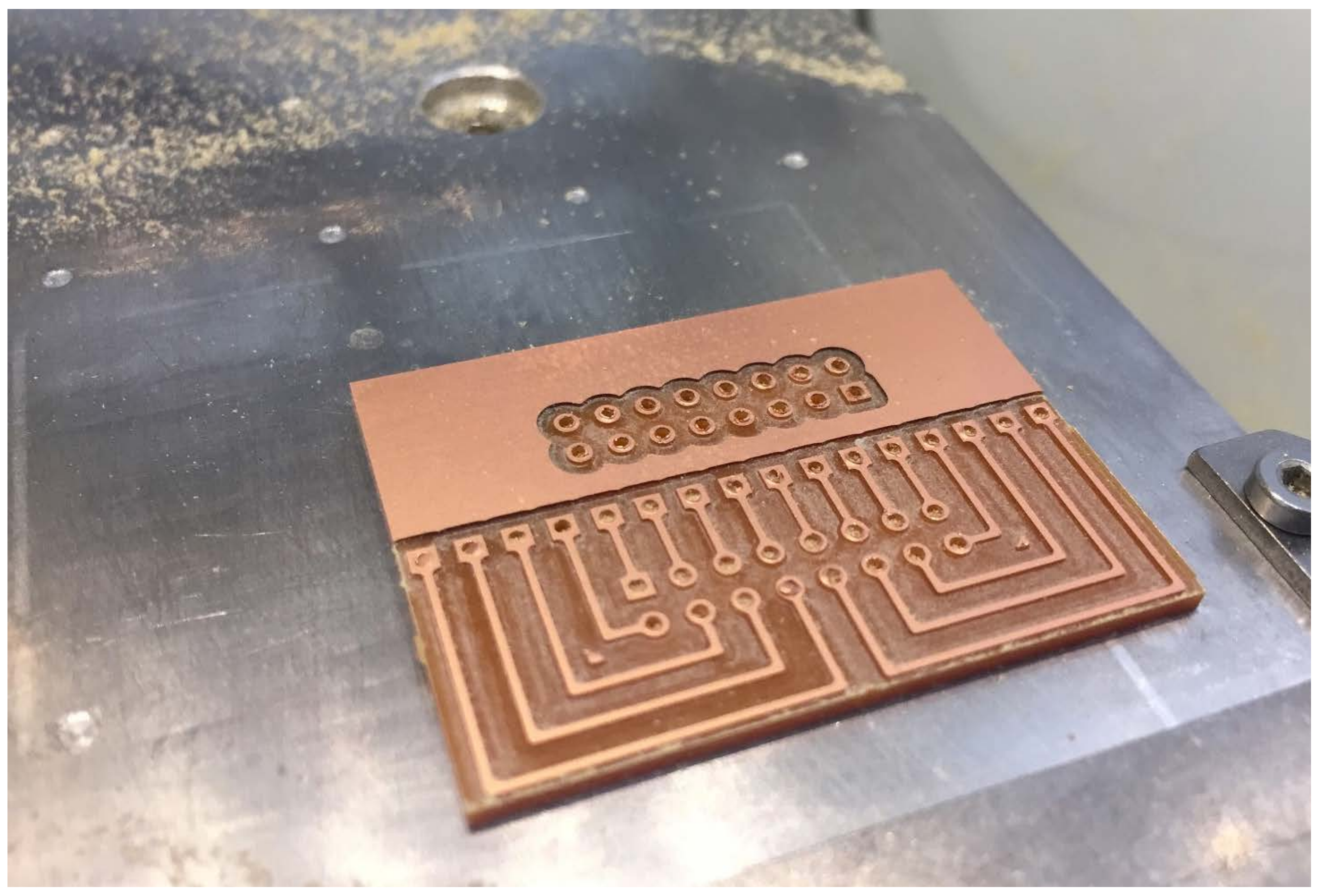


Manufacturing & Assembly

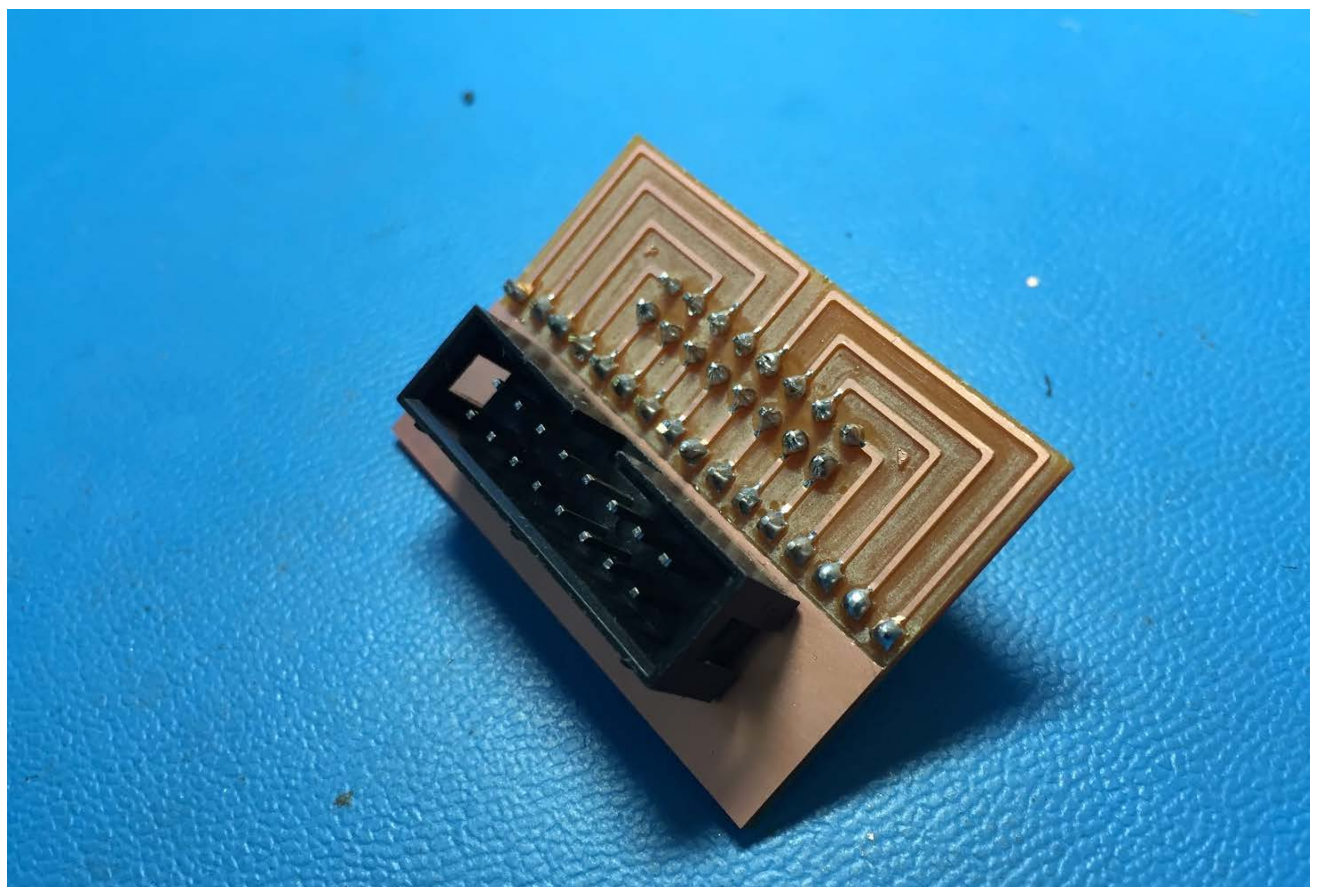
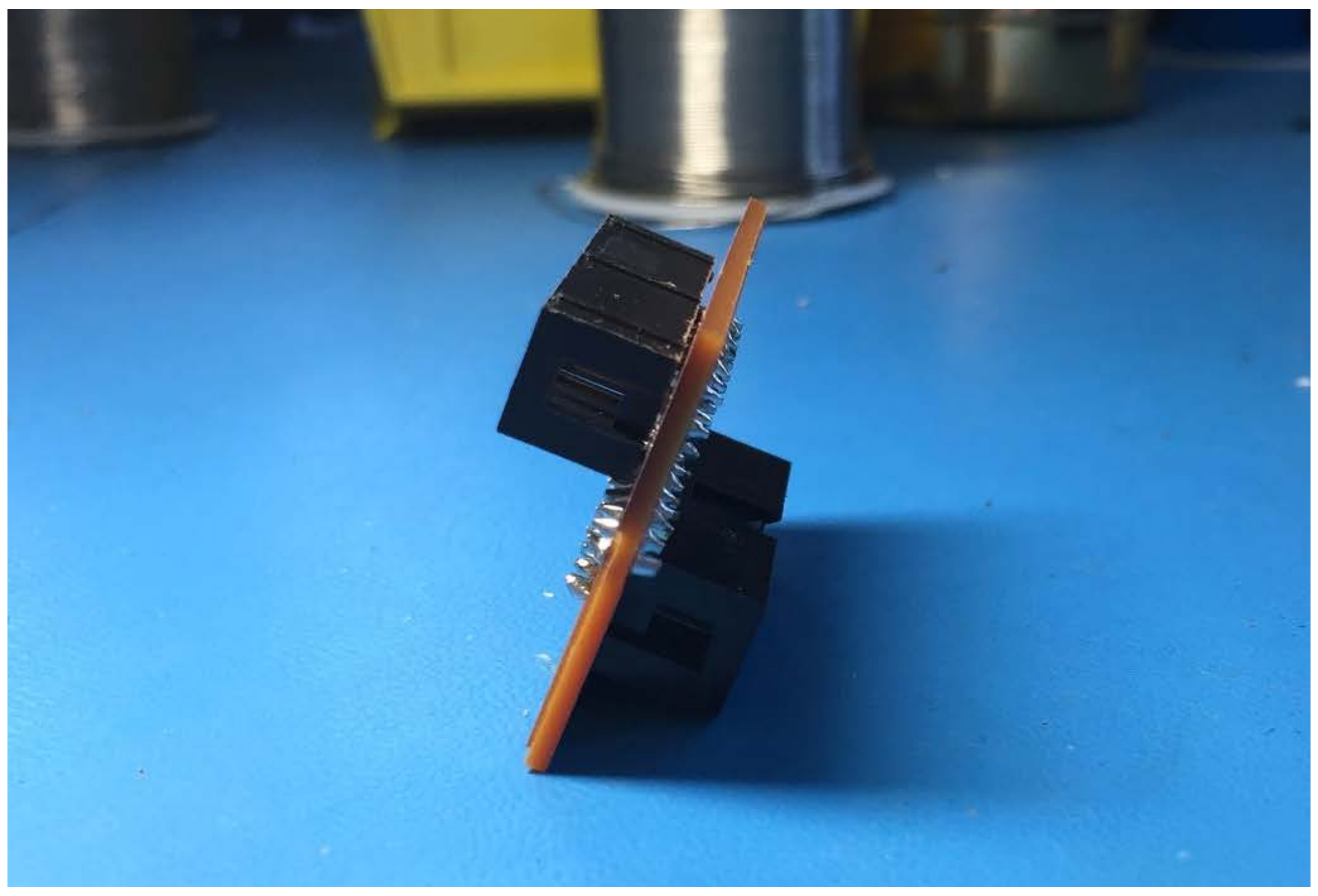
We started by 3D printing the electronics enclosure. We used the Dimension 1200es printers on the 3rd floor of Jacobs, as the printed material is higher quality and can maintain tighter tolerances when compared to a print from the Type A machines.

Next, we milled the PCB out on the othermill, soldered pins into the vias, and soldered the IDC headers onto the board.

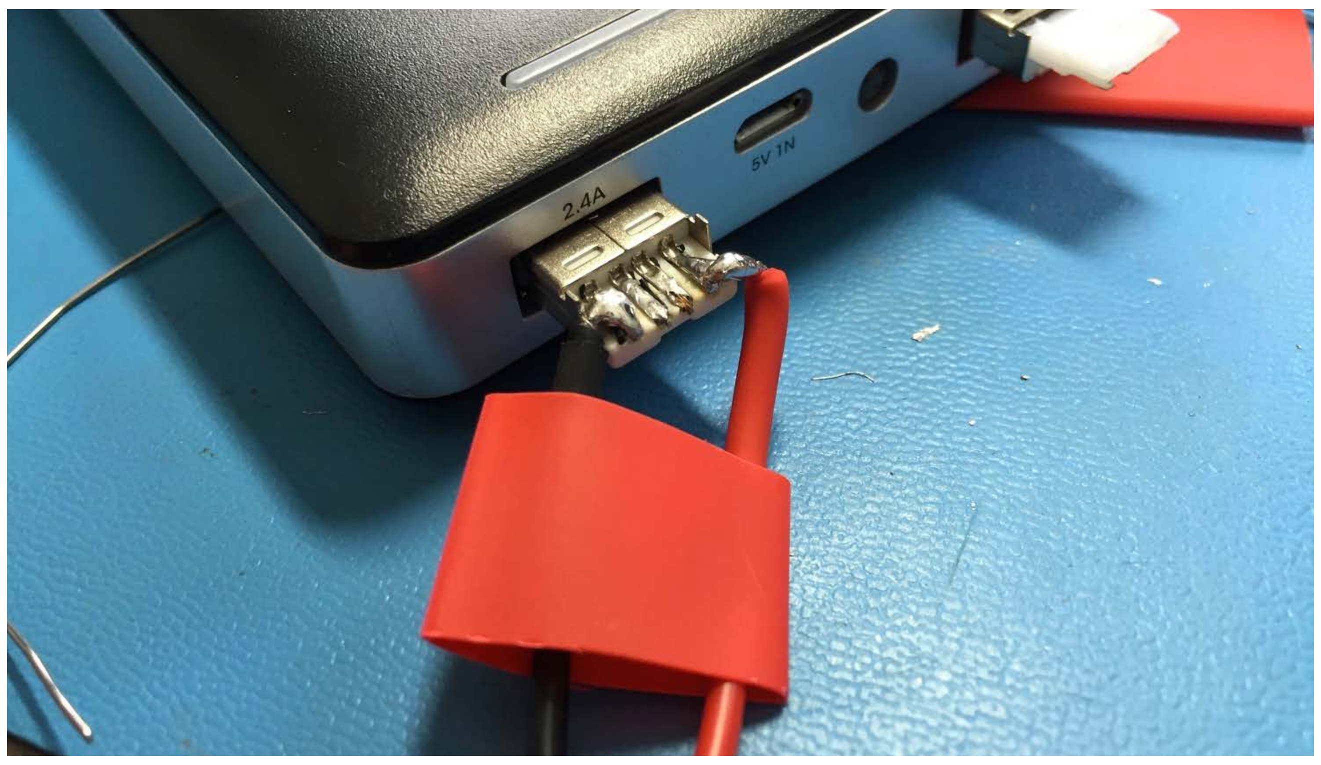




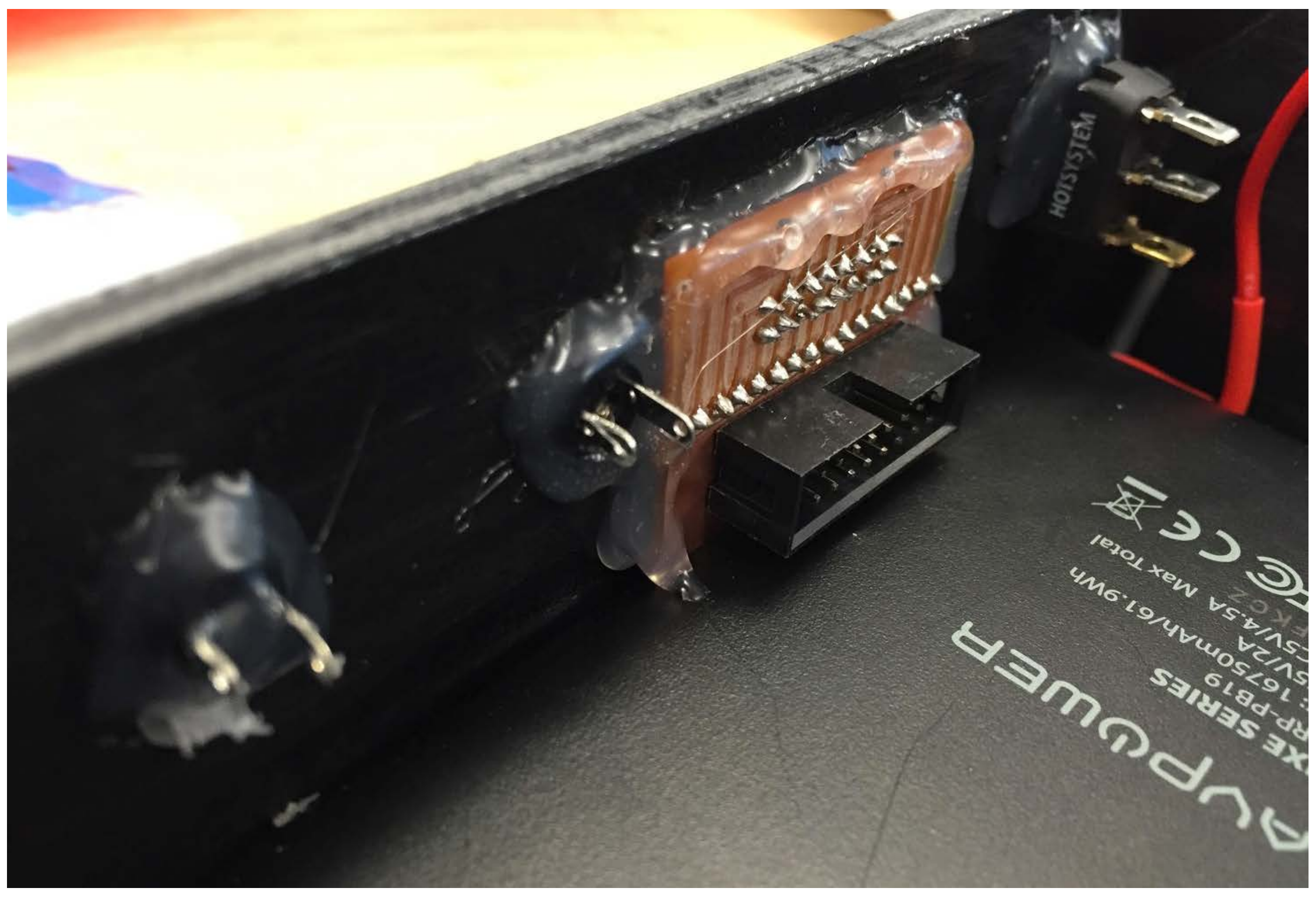
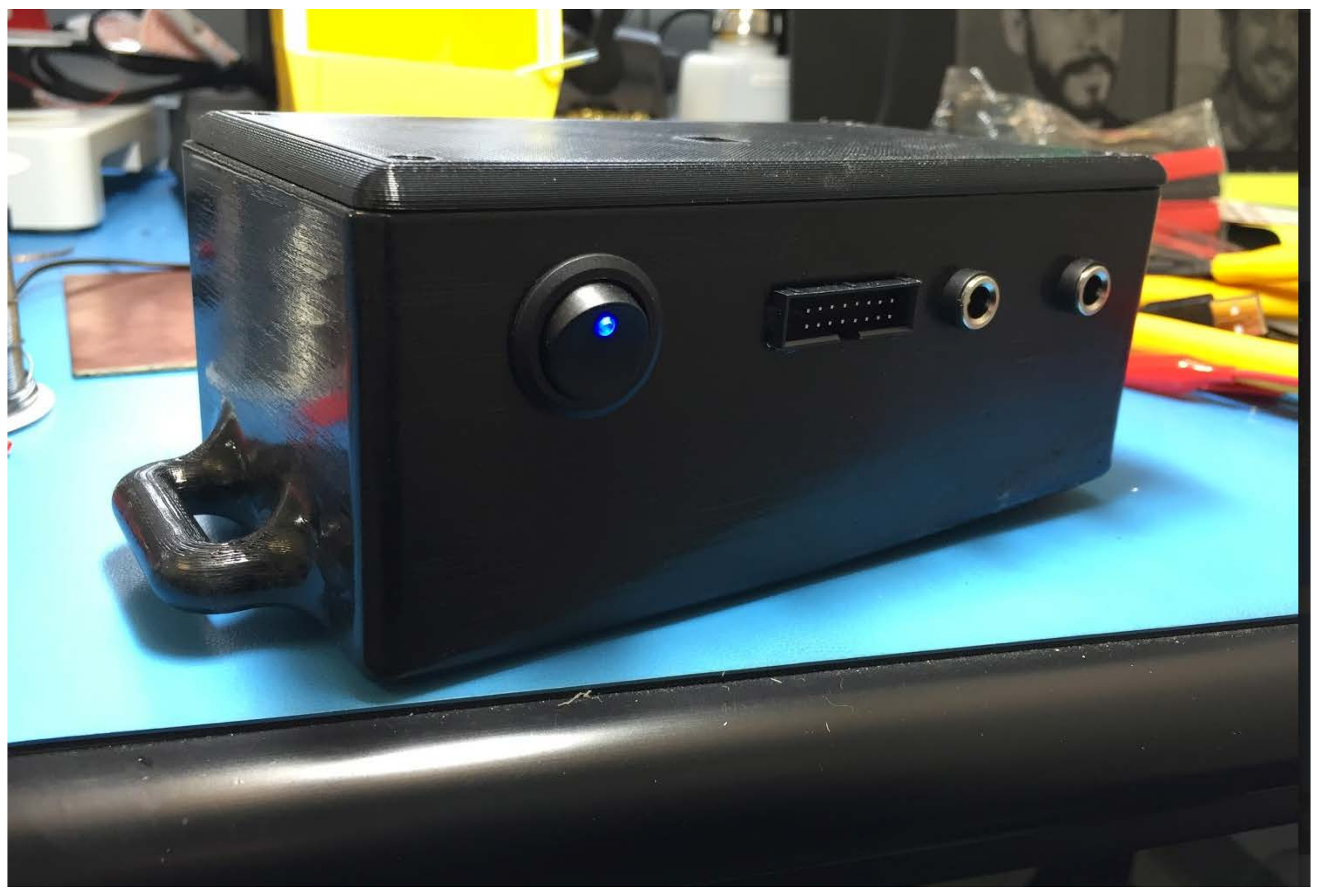
Design Process
Hardware

To power our project, we used the +5V and ground wires from the USB output of our battery. We hacked apart a standard USB cable, and soldered wires directly to the lines of the plug.

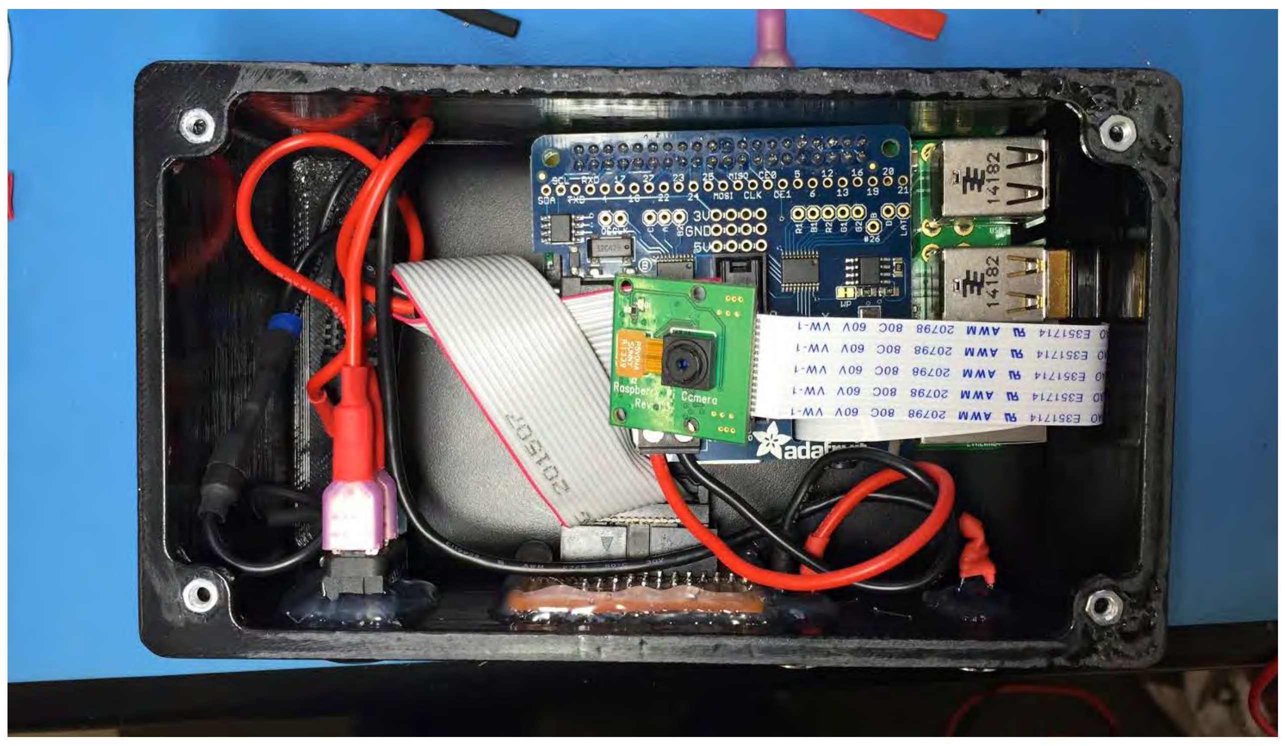


We then attached our ports and switch to the enclosure. They fit snugly, but we added some hot glue for extra strength.

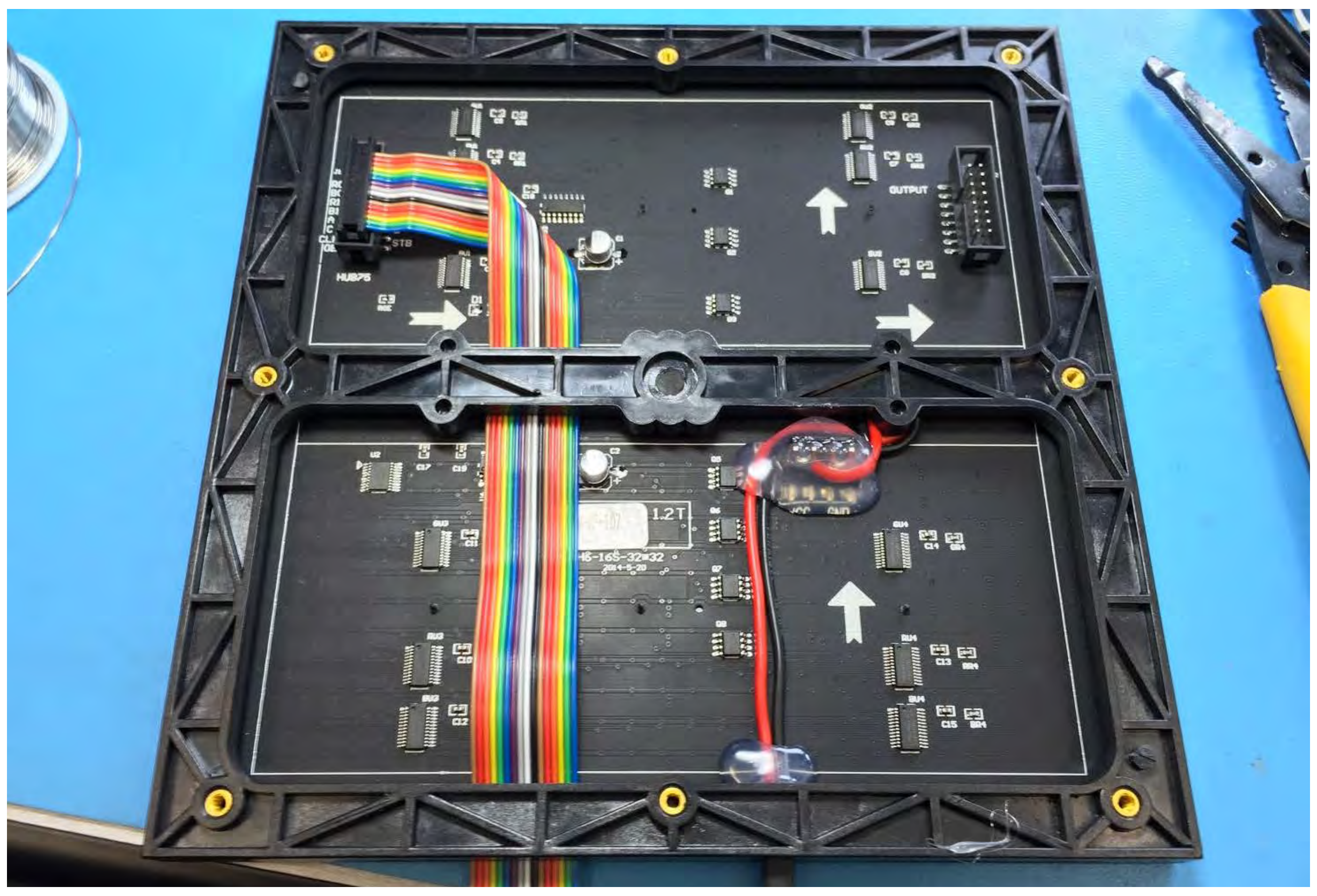



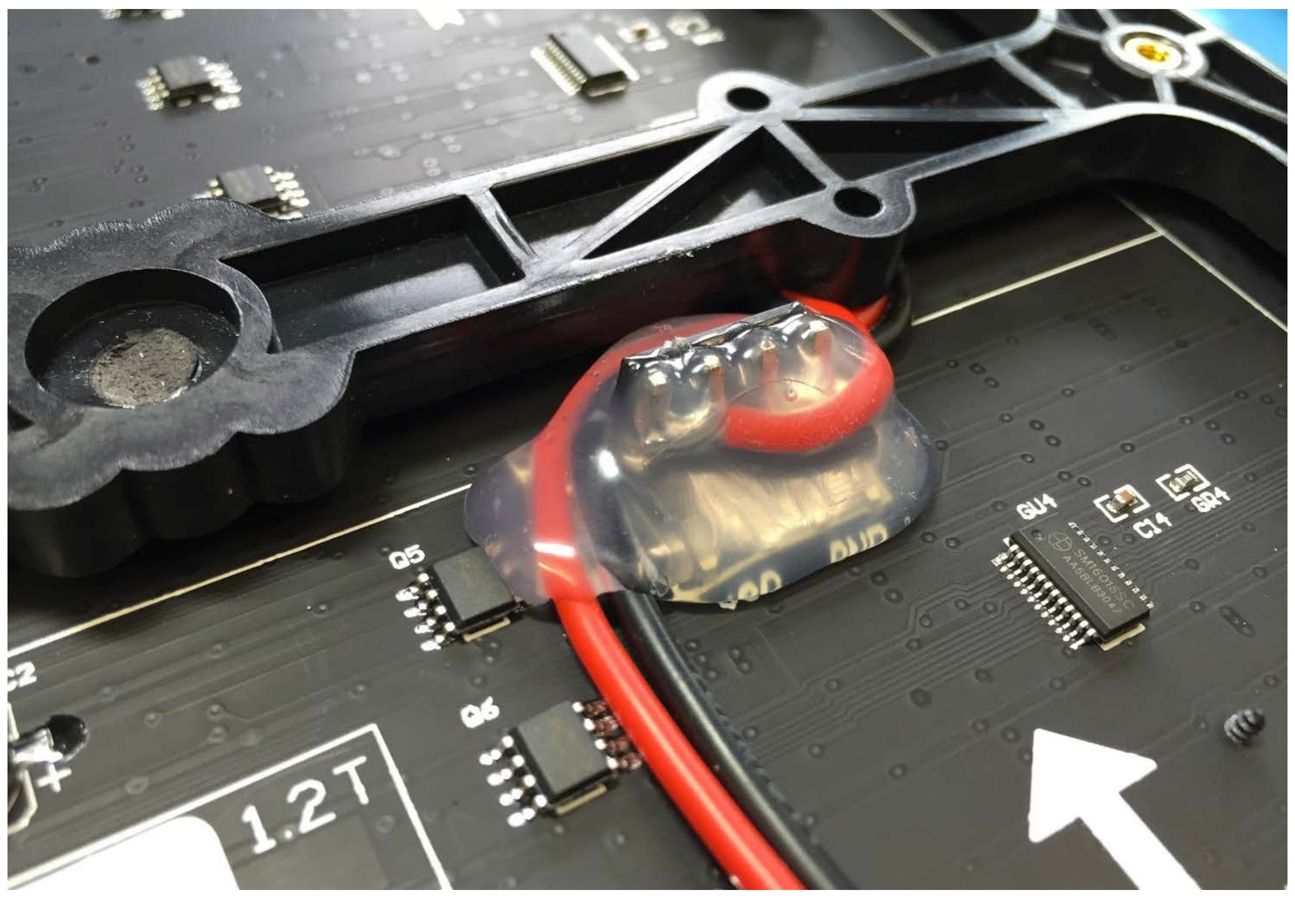
Design Process
Hardware

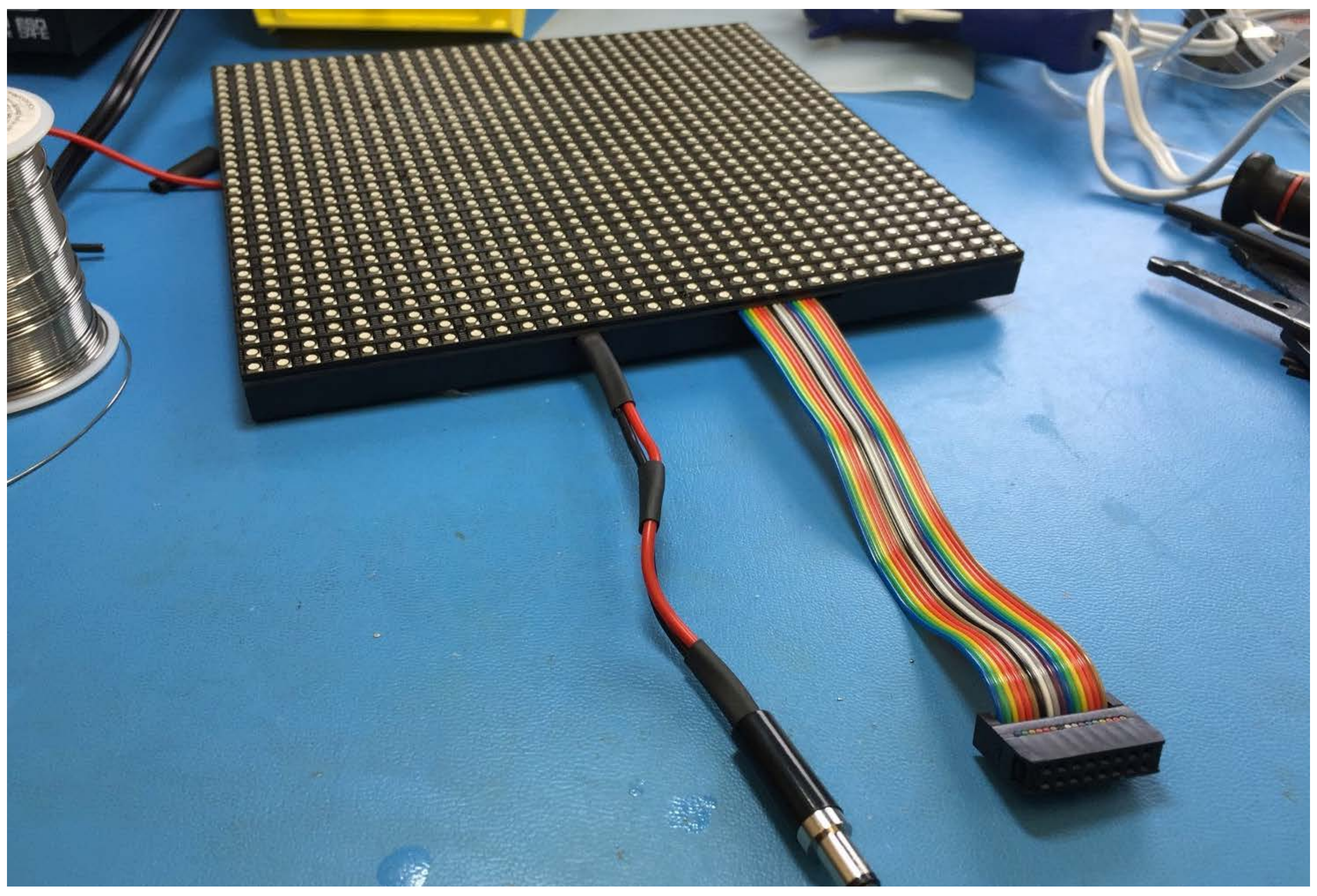
Next was the actual wiring. We used terminal disconnects when possible, so the connections are easily removeable. All connections were covered with heatshrink material to identify polarity, prevent shorting, and provide strain relief.



We modified the LED matrix slightly so that cables could be routed out the bottom. We decided to solder our power wires directly to the header instead of using a connector, as using the supplied cable made the module much thicker.



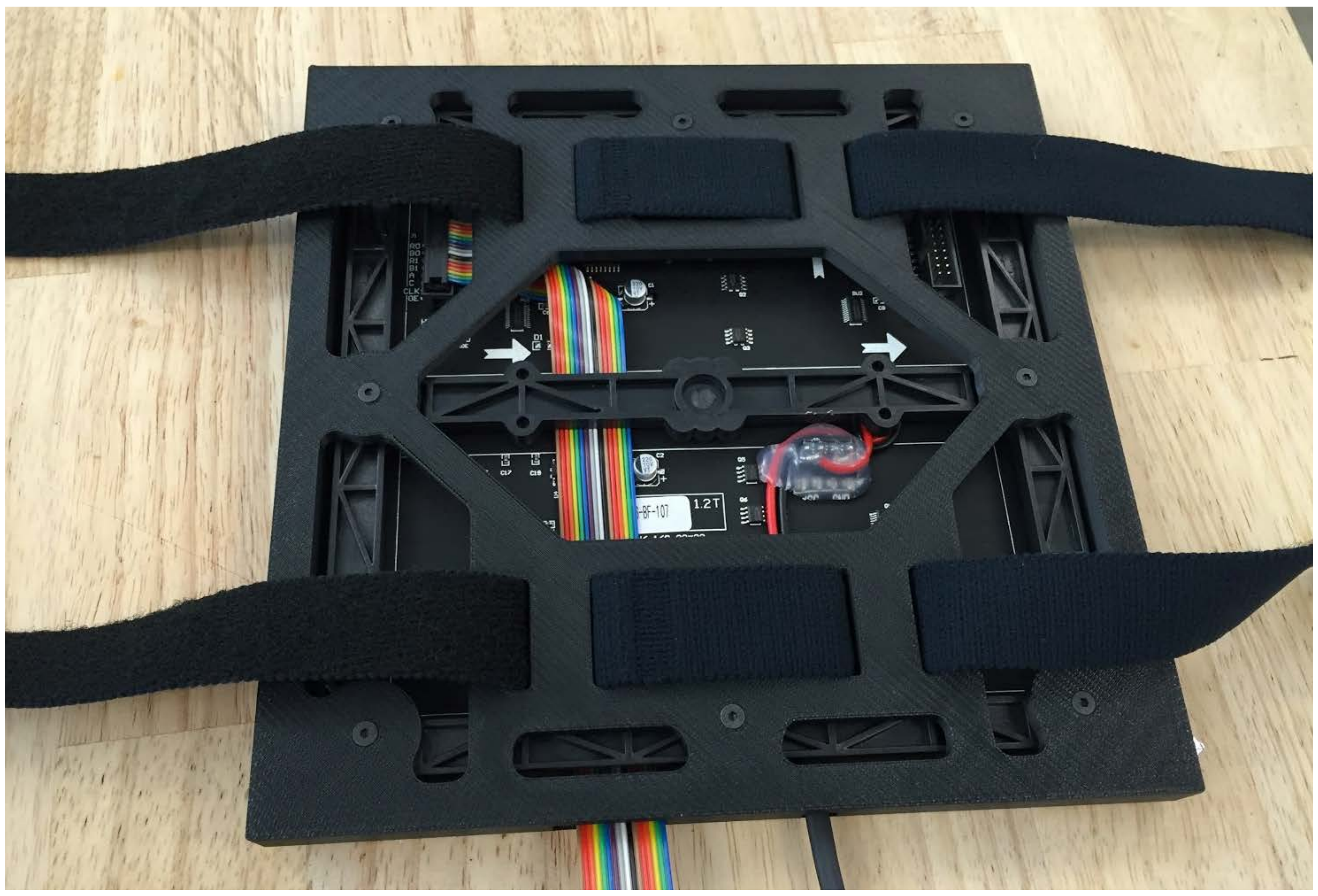




Design Process

Hardware

We then 3D printed the LED Matrix cover, and attached the velcro strips to it.



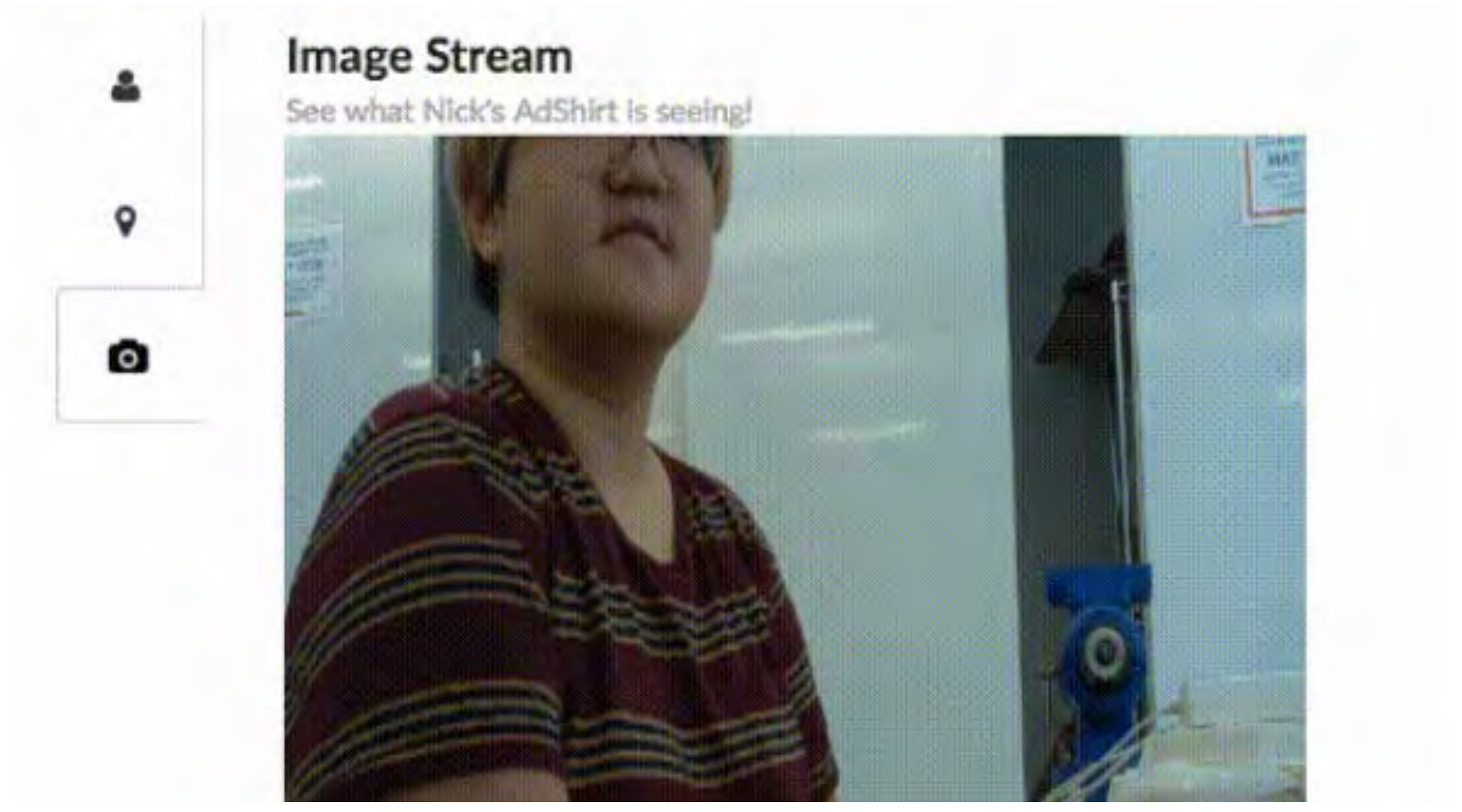
Design Process
Software

After finalizing our idea, it became clear that the software would be composed of two main components. The Raspberry Pi would need to display the ads and communicate to the server, transmitting information regarding the billboard's location and receiving data about the winning bid. The second component, the website, would allow users to create and place bids.

Raspberry Pi

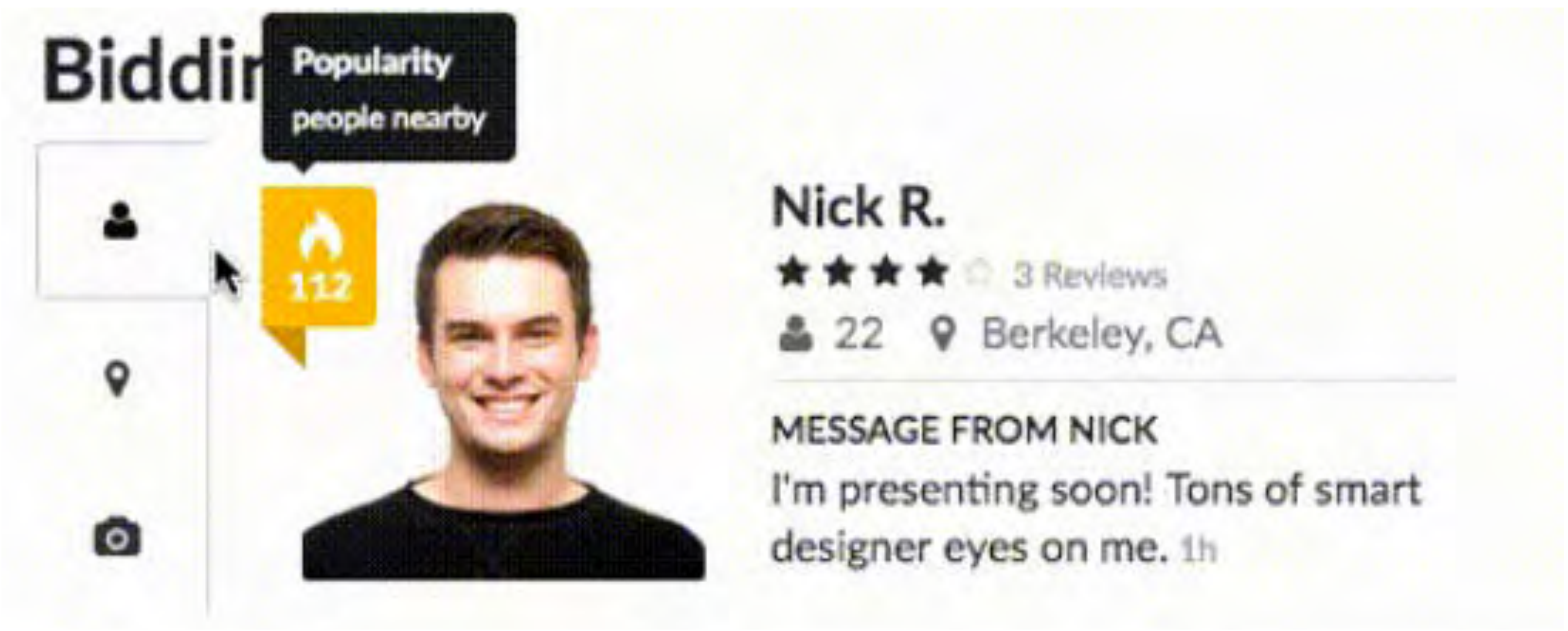
Camera

To allow users to make an informed bid, we wanted a way for them to gauge the number of people viewing the ad. To do so, we decided to use the Raspberry Pi's camera module and openCV to detect the number of faces currently visible. Unfortunately, the face detection algorithm took up to five minutes! With a bidding round of only one minute, this was far too slow. However, as with most computer vision algorithms, the human eye is much faster and more accurate. We realized we could still use the camera module to take screenshots of the billboard's environment, and provide the user with a live stream. This is done by simply taking a picture using the PiCamera library on Python, and saving it on the Pi. We encode the image as a base 64 string, and push it to our server's API endpoint.



Design Process
Software

Popularity
We also wanted to provide another way for users to gauge their ad traffic, since the live stream's view can be quite limited. With hopes of avoiding bluetooth and requiring a connection to the billboard's mobile phone, we realized we could determine a billboard's general location through the Pi's IP address. In Python, we continually query http://ipinfodb.com/. We then parse the response to find the user's approximate zipcode, which we send to the U.S. Census API to get a rough population estimate.



MESSAGE FROM NICK
I'm presenting soon! Tons of smart designer eyes on me. 1h

Communication
Now that we had the livestream and population data, we needed a way to communicate this information to the server. Using the Requests library in Python, we were easily able to send POST requests to our website containing the population number. Our livestream screenshot was encoded and sent as a base64 string. To get information regarding the current winning ad, we send a GET request to the server. This server's response includes whether the ad is text or an image, and contains the text or base64 image string. If the ad is text, the Pi generates a PPM (a file format easily read by the LED matrix) using Python's Image Library (PIL). Otherwise, the Pi decodes the base64 image string and saves it as an image. This process of transmitting and receiving data runs in a perpetual loop.

Design Process
Software

RGBMatrix

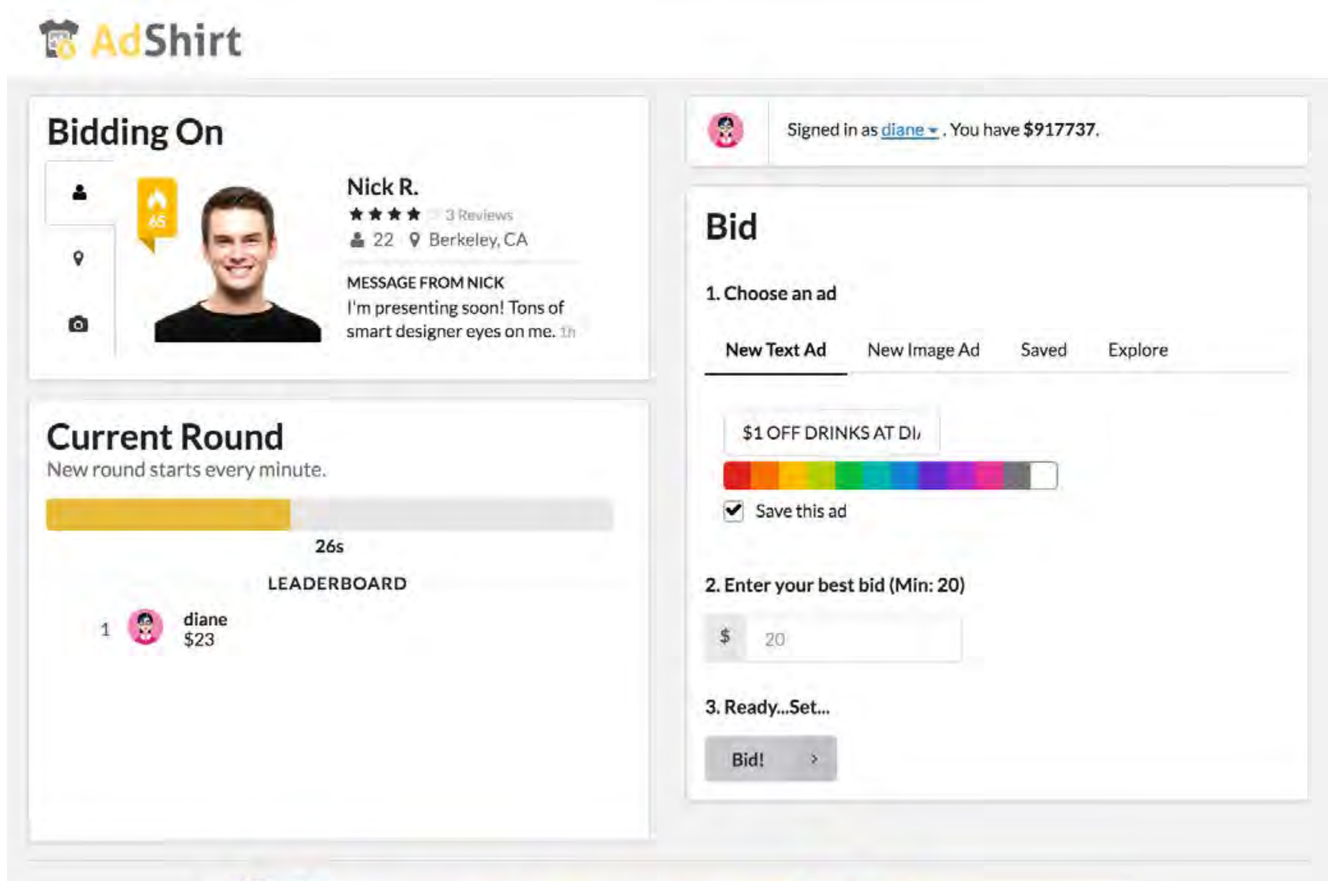
We found that one of the most challenging parts was interfacing with the LED matrix, especially since its image display had to change every minute. We decided to alter C++ sample code, which could display both still images and gifs. However, this didn't allow for image scrolling, which was necessary for text ads. We were able to piece together more code from another demo. The altered code runs in a continual loop, reloading the current image ad file, processing it, and displaying it. It first reads in a PNG image, and does a check on its size. If it's exactly 32x32, we infer the user submitted an image ad, and display it statically. Otherwise, if it is larger, we read in the .ppm text ad and scroll it. A challenge for text ads was getting the refresh rate correctly: we wanted to check for updated images continuously, but not 'jerk' the current ad, which required a bit of tricky math to get checking at the end of the text scrolling. If the image is smaller than 32x32, then a GIF should be loaded. The size of the image indicates which GIF should be loaded. For instance, an image size of 1x1 is linked to the flashy "BuyAdsOn.Me" GIF.

Default Ad on Display

Design Process
Software

Web Application

Setup
The first step to starting the website was to decide which frameworks we were going to use. We realized that the website would have to be dynamic and responsive, automatically updating each client as bids are made and won. We found that one of the best frameworks for this was Meteor, which was new technology for all of the group members. For the UI, we chose SemanticUI for its clean look. Finally, we chose to host our server on Heroku, because we are poor college students. Luckily, our status allowed us to take advantage of the nc.me free .me domain name offer, where we got BuyAdsOn.me.


AdShirt

Bidding On

Nick R.
3 Reviews
22 Berkeley, CA
MESSAGE FROM NICK
I'm presenting soon! Tons of smart designer eyes on me. 1h

Current Round
New round starts every minute.
26s
LEADERBOARD
1 diane $23

Signed in as diane. You have $917737.

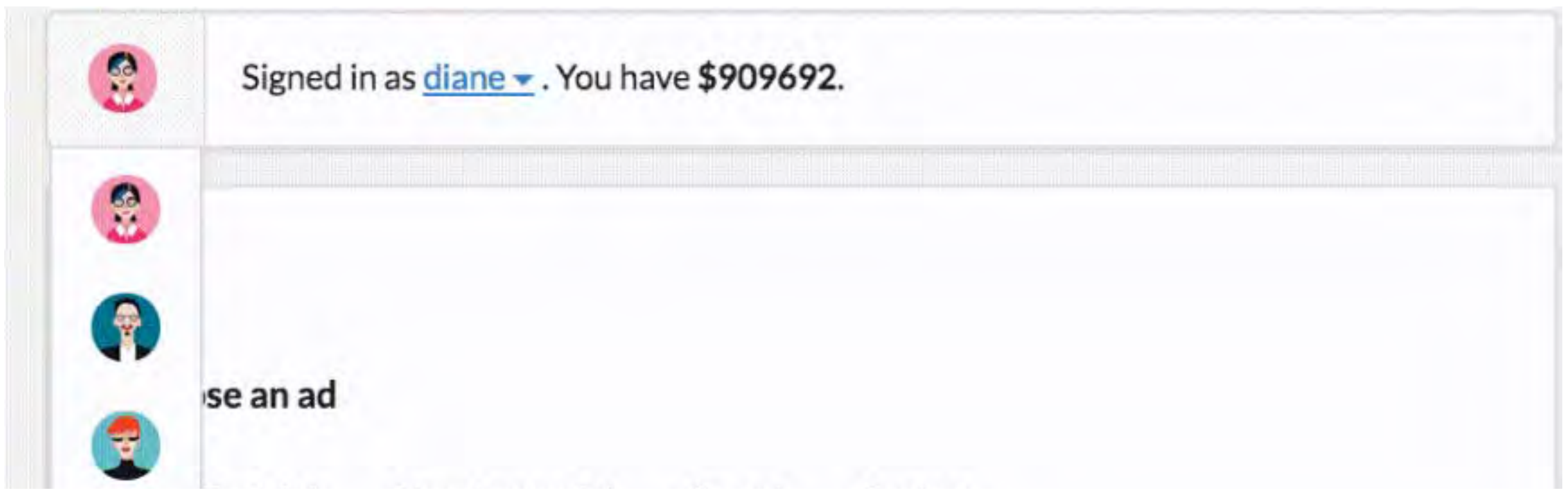
Bid
1. Choose an ad
New Text Ad | New Image Ad | Saved | Explore
$1 OFF DRINKS AT DI
Save this ad
2. Enter your best bid (Min: 20)
$ 20
3. Ready...Set...
Bid!

The Web Application

Server
Meteor server setup is quick and easy. All we needed to do was declare what kind of data would be in our database. We have a Bids table, which keeps track of all the bid information, including the bid price, the ad, the user, etc. We also have an Advertisers table. Each entry in the Advertisers table corresponds to a billboard, and maintains information about their current ad. The Pi also sends data to the Advertisers API endpoint to update the livestream and population data. Since we only have one Adshirt device, there is only one Advertiser in our database.

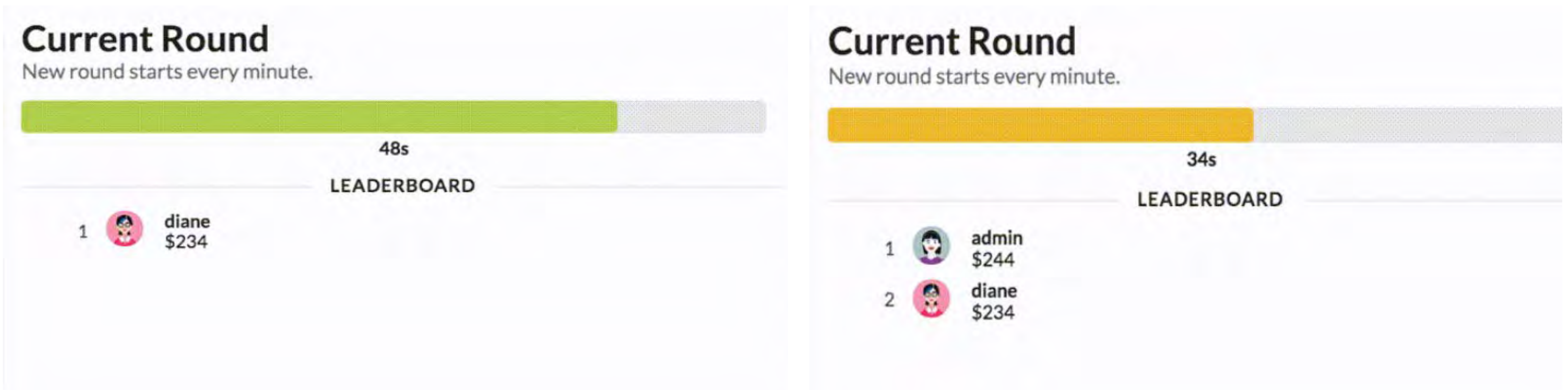
Design Process
Software

User Accounts
To allow different users and companies to bid, we needed to set up accounts. Fortunately, this is a Meteor feature that is quickly added without much reconfiguration on our end.


Signed in as diane. You have $909692.

Accounts make the platform interactive

Interactive Bidding
Timing
To enable interactive bidding, we realized it would be easiest to coordinate rounds using the server's internal clock. To make 1 minute (60 seconds) rounds, we simply modded the server's time by 60 to give the seconds remaining in the round. Once time%60 == 0, the server executes a simple SQL query to get the highest bid for the around, and updates the advertiser's current ad accordingly. On the client-side, a progress bar is updated based on time%60. If time%60 == 0, and the user is the round winner and a pop-up notification is generated.

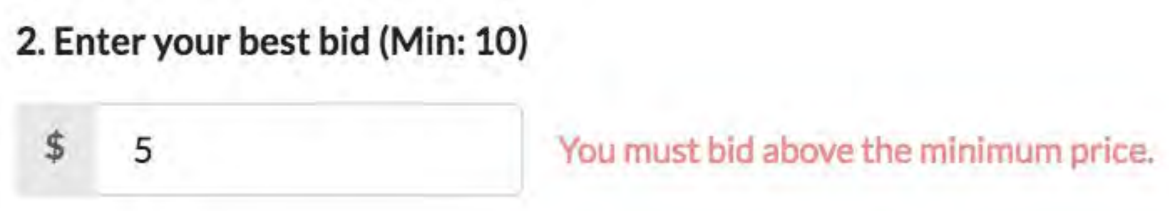

Current Round
New round starts every minute.
48s
LEADERBOARD
1 diane $234

Current Round
New round starts every minute.
34s
LEADERBOARD
1 admin $244
2 diane $234

Global leaderboards update with bids

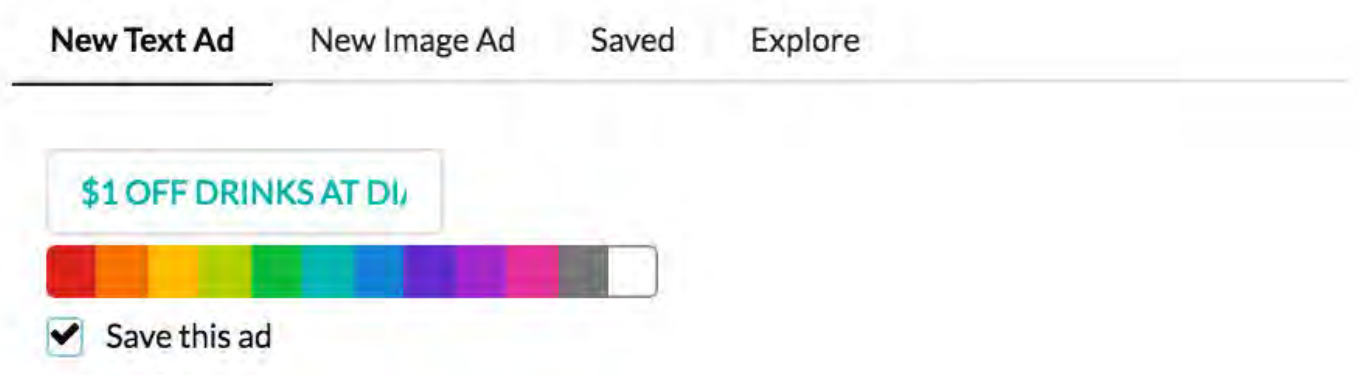
Design Process
Software

Minimum Bid
The minimum bid is determined based on the billboard's population. Their population, scaled by a fraction, is mapped to a dictionary of minimum bids: $0 for zip code populations under 100, $5 under 1000, $10 under 5000, and $20 otherwise. This minimum bid is enforced using jQuery's form validation.


2. Enter your best bid (Min: 10)
$ 5
You must bid above the minimum price.

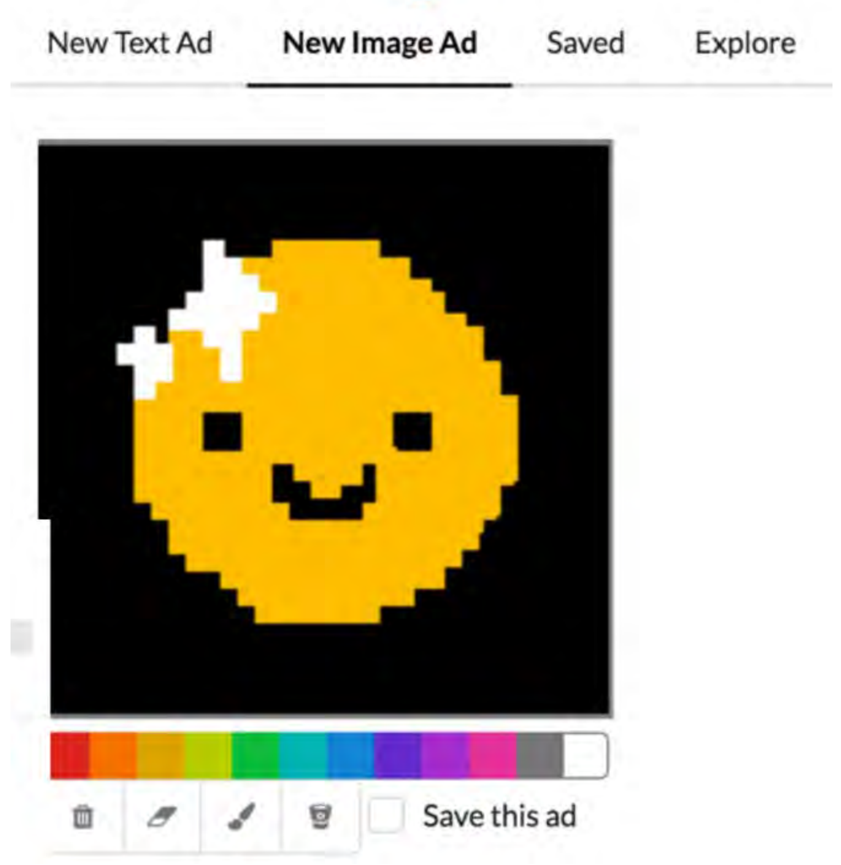
Form Validation

Ads
Text Ads
When a user submits a text ad, the RGB value of the color they chose is saved in the bid, along with the ad's text itself.



"New Text Ad" Tab

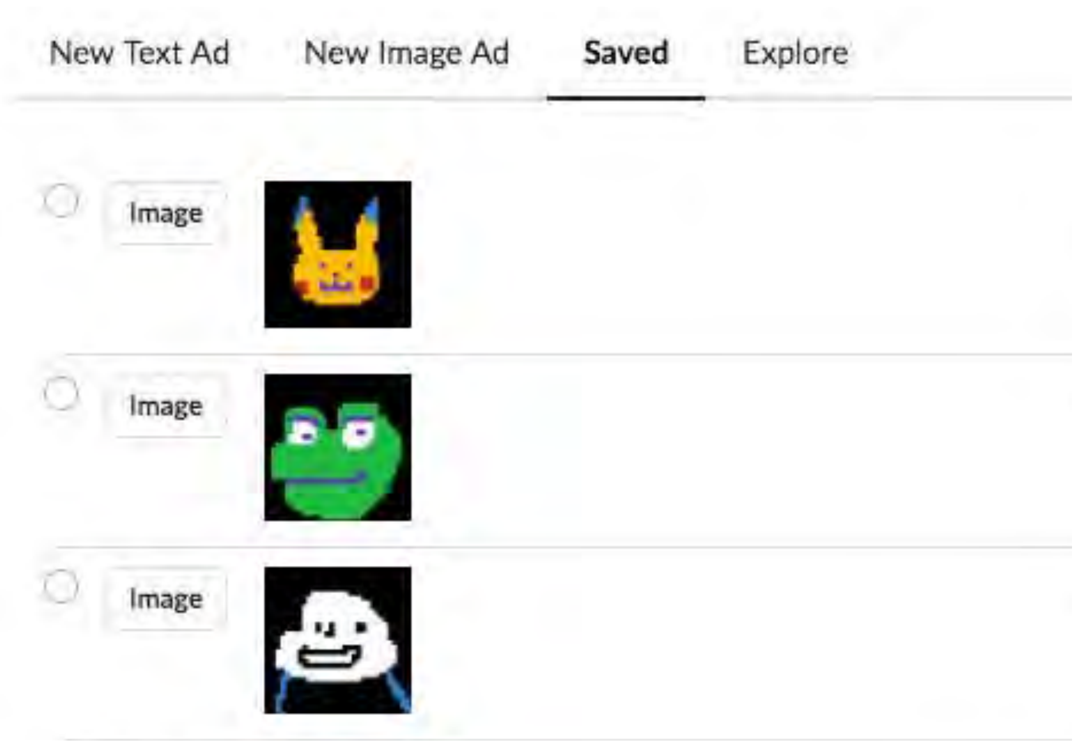
Image Ads
Users can draw their ad using a modification of an InteractJS project, which allows users to draw on a HTML5 canvas object through mouse dragging. A user may select from a palette of colors, which change the canvas's fill color through an onClick and onDrag method. The user may also select the paint bucket tool which implements the flood fill algorithm to recursively color the image. When the user submits the ad, it is encoded as a base64 string and saved. Using this method, we are able to avoid image hosting through AWS, especially since our ad images are relatively small.



"New Image Ad" Tab

Saved Ads

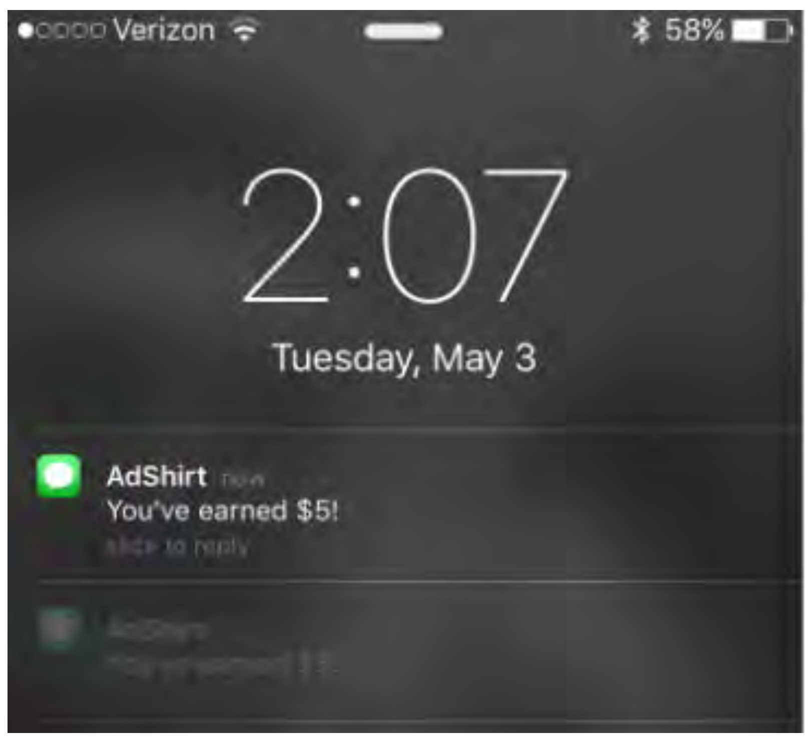
A user may chose to save an ad before submitting their bid. This simply pushes the ad information to an array in the Users table. Then, users can access their saved ads in the "Saved" tab.



"Saved" Tab

Text Updates

We also wanted billboards to receive notifications for the amount of money they made each round. We created a Twilio trial account, which allows us to use their API to send texts to the billboard with the winning bid's value at the end of every round.

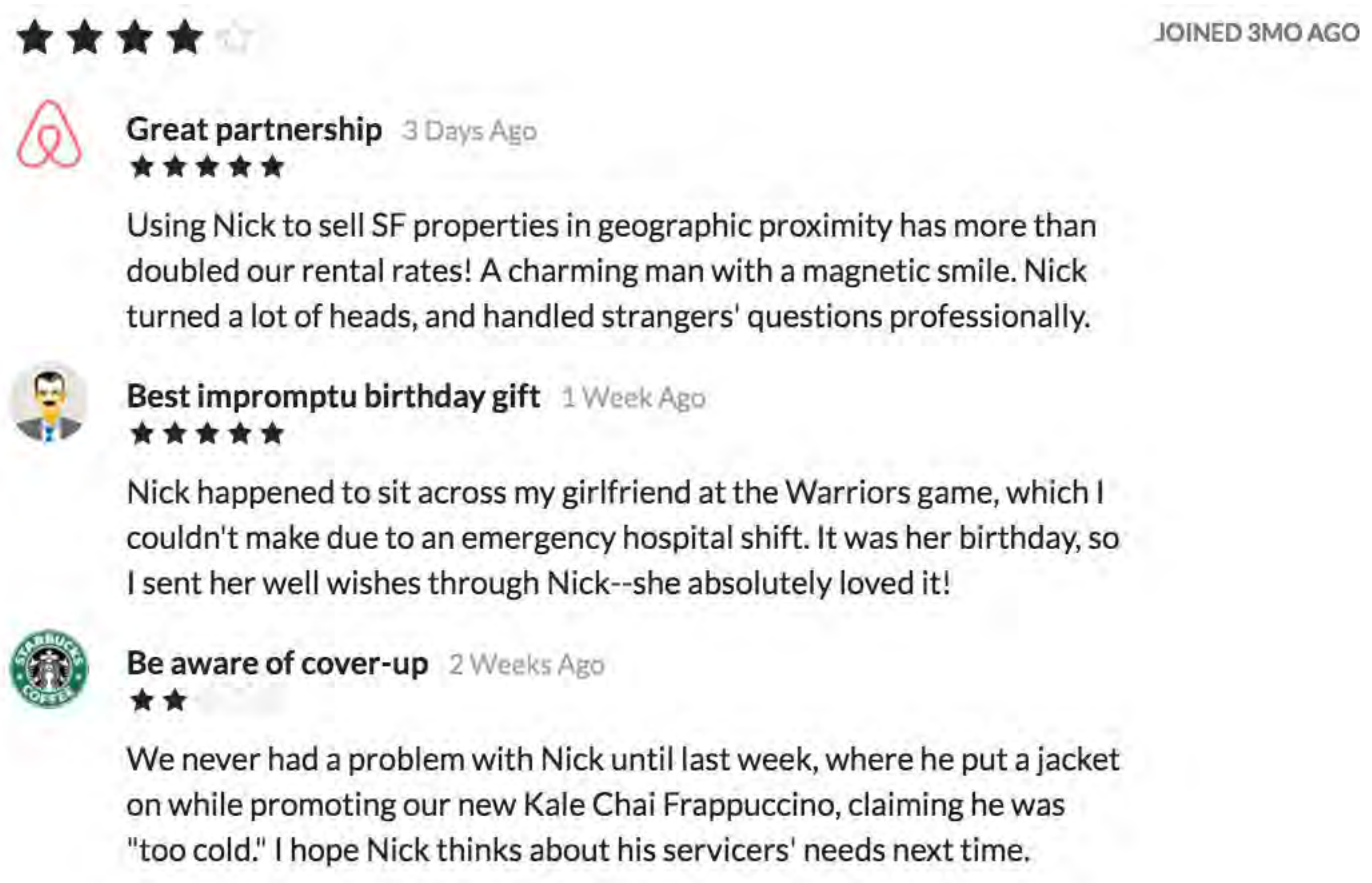


AdShirt
You've earned $5!

Text sent by AdShirt

Design Process
Software

Reviews
We also ‘hardcoded’ some humorous sample reviews for our user, Nick, accessible when you click on his image. Each describes a different use case of Adshirt: a bad review since Nick covered up the ad with a jacket, a good review of someone using his shirt to send his girlfriend happy birthday at a basketball game, and a review from a company whose sales increased due to Nick.



★★★★☆ JOINED 3MO AGO

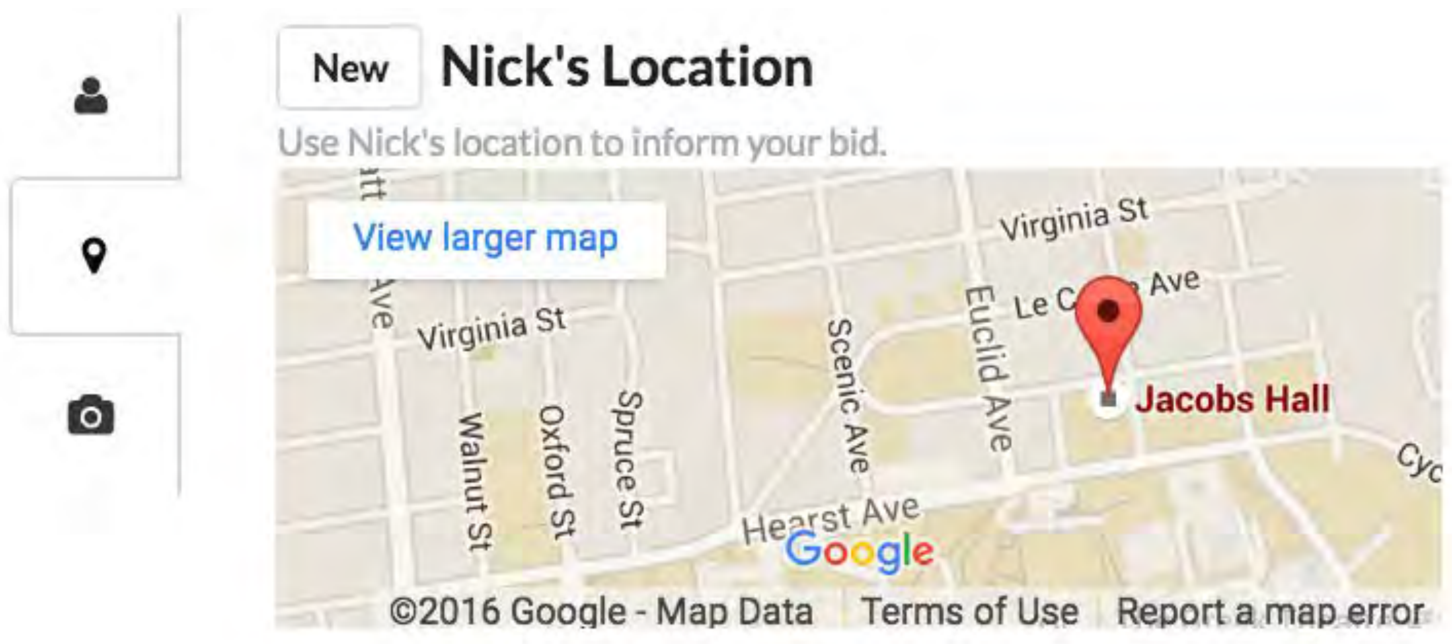
Great partnership 3 Days Ago
★★★★★
Using Nick to sell SF properties in geographic proximity has more than doubled our rental rates! A charming man with a magnetic smile. Nick turned a lot of heads, and handled strangers' questions professionally.

Best impromptu birthday gift 1 Week Ago
★★★★★
Nick happened to sit across my girlfriend at the Warriors game, which I couldn't make due to an emergency hospital shift. It was her birthday, so I sent her well wishes through Nick--she absolutely loved it!

Be aware of cover-up 2 Weeks Ago
★★
We never had a problem with Nick until last week, where he put a jacket on while promoting our new Kale Chai Frappuccino, claiming he was "too cold." I hope Nick thinks about his servicers' needs next time.

Reviews of Nick

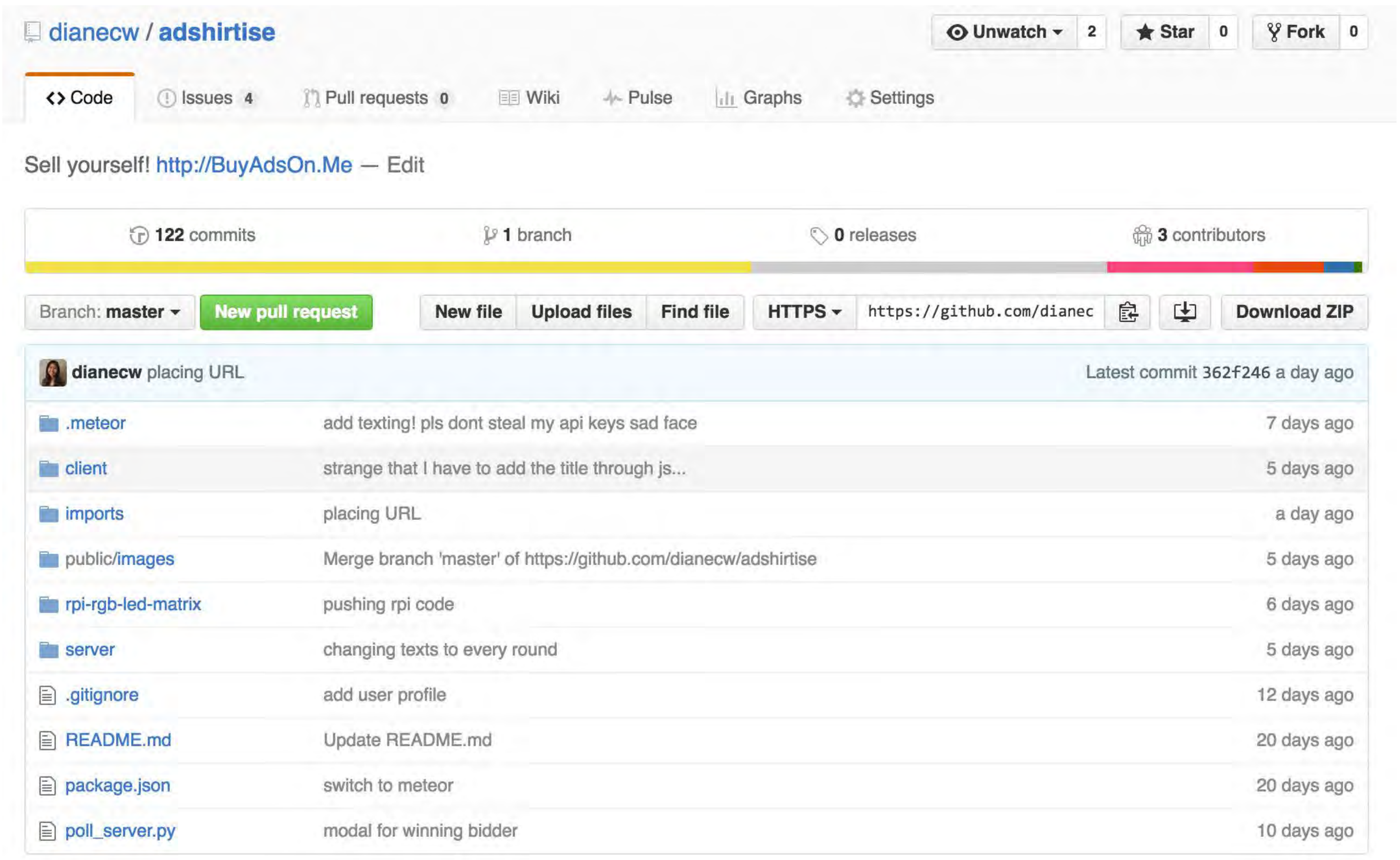
Location
We also embedded a Google map of Nick’s current location (set to Jacobs Hall).



Nick’s Location

The Code

All code can be found here. Code for the pi is contained in rpi-rgb-led-matrix (specifically poll_server.py and adshirtise.cc. All other files in the main directory contain code for the website's server and client.


dianecw / adshirtise

Sell yourself! http://BuyAdsOn.Me — Edit

122 commits | 1 branch | 0 releases | 3 contributors

dianecw placing URL — Latest commit 362f246 a day ago

.meteor	add texting! pls dont steal my api keys sad face	7 days ago
client	strange that I have to add the title through js...	5 days ago
imports	placing URL	a day ago
public/images	Merge branch 'master' of https://github.com/dianecw/adshirtise	5 days ago
rpi-rgb-led-matrix	pushing rpi code	6 days ago
server	changing texts to every round	5 days ago
.gitignore	add user profile	12 days ago
README.md	Update README.md	20 days ago
package.json	switch to meteor	20 days ago
poll_server.py	modal for winning bidder	10 days ago

Conclusion

Cultural preferences for selling one's body space for commercial purposes is an interesting topic that we were not able to fully explore in the current stage of the project. As we mentioned briefly in the presentation, it might be more culturally acceptable in Japan to sell one's body space as a location for ads. What are the ways that the Japanese and American culture differ that affect their views on the relationship between capitalism and personal body space?

Another opportunity that we would like to further explore is the precise design choices that make AdShirt impactful. From the informal user study that we performed with our friends (by describing the product and showing them early prototype), the responses were very polarized. Some thought it was an interesting idea, but some found it completely repulsive. The current prototype of AdShirt was designed to be as "dehumanizing" as possible - from the billboard-like LED panel to the public bidding and rating of the user. What are the design decisions one can fine tune to explore the nuanced relationship between aesthetics, capitalism, and private bodyspace? More interestingly, how would these preferences change as wearable electronics become more and more intimate and prevalent?

In our exploration of Adshirt's ethics, we raise and address these questions:

Does the user get control of the ads?
To an extent, but they suffer the consequences. Let's say the user is a huge labor rights activist and a Driscolli's (awful berry farm worker treatment) ad is displayed. They could turn off the display or cover it with a jacket, but future work would detect this, and the user would not be able to receive the money from that bid round. The ad is a surprise to the user until it appears on their back. We envision Adshirt being worn on the back, so the user doesn't even see what they're advertising—we want to play with the user, push them to accept their moral decay for the cash, as is inevitable in our increasingly neoliberal society.

How is the user treated?
Adshirt aims to make the user rich. That's it. Adshirt's goal is to service companies. This motivates our reviews page: treating users like Airbnb properties, companies can write how well their services was. We also have a camera stream, which raises interesting questions about privacy: again, the user must make this sacrifice for easy cash.

For future work, we are looking into more flexible displays, or embedded color changing textile displays. Were this product to become a reality, it would also be useful to track a click-through metric for companies to gauge the success of their ads.