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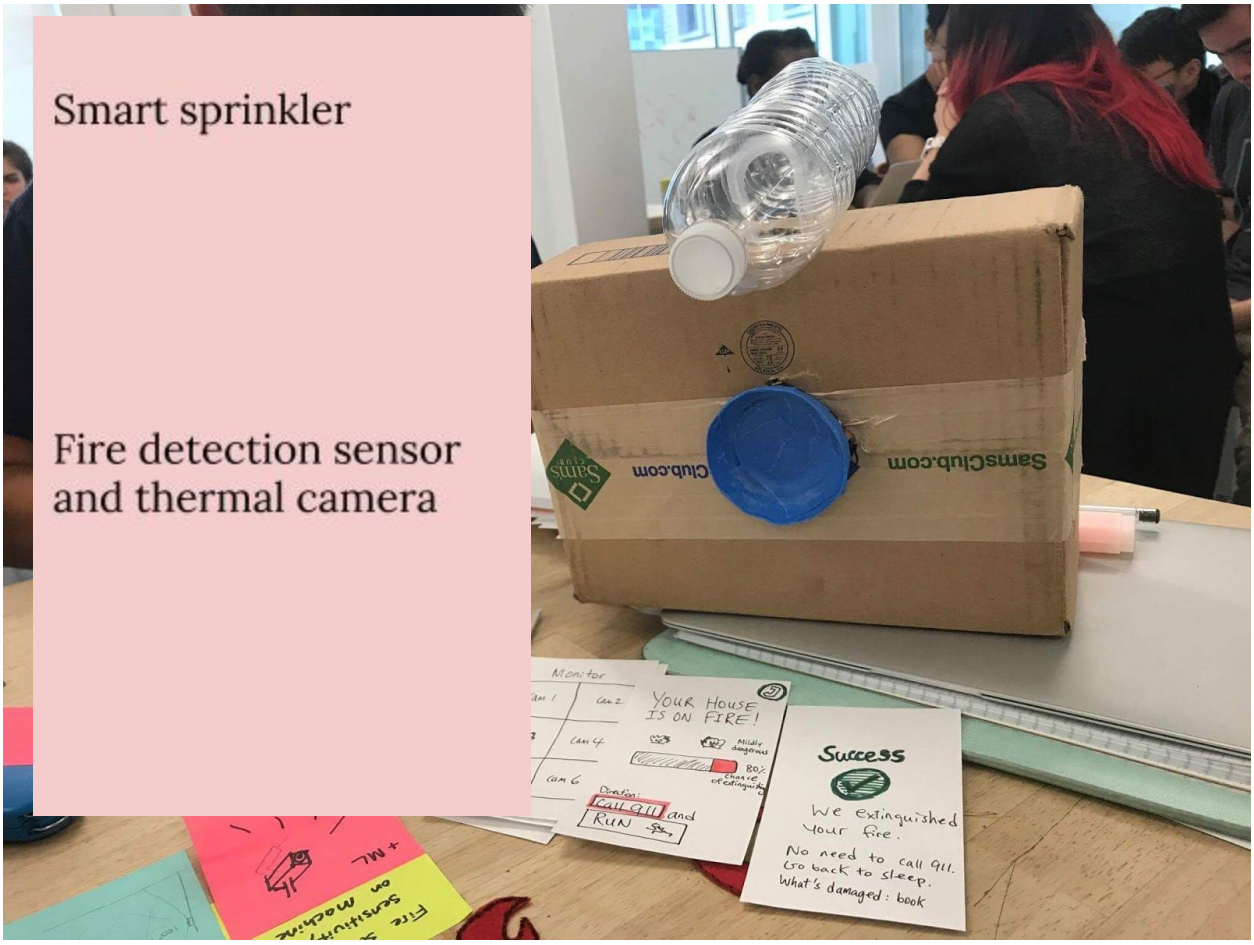
Prototyping, wireframing, and additive manufacturing

Summary: This week, we used prototyping, wireframing, and additive manufacturing as our three main prototyping methods. We started out with rough sketches on papers, moved to a mobile app made of index cards and a fire detection camera and smart sprinkler made of cardboards, plastics, and discard items, and have reached to medium fidelity prototypes, including a clickable user interface for our mobile app and a 3D printed fire detection and extinguishant model. We learnt that prototyping can be extremely helpful to visualize, experiment, validate, present, and persuade our ideas. Prototyping allowed us to iteratively improve the user experience and to collect valuable user feedback with something visual or tangible to show to our users.

Prototyping

Prototyping is a great method for quickly iterating through low fidelity prototypes and gaining insight from each one. We did this by using a cardboard box and soda can as a camera with a water bottle as a sprinkler system. From this, we learned that a boxy exterior would not be the greatest choice as it wasn't the most functional and was not very aesthetically pleasing. This low fidelity model can be seen below as our starting point. In order to design the final exterior prototype, we used the 3D modeling software SolidWorks to create a hemispherical camera that has a 360 degree view with an integrated extinguishing system inside and alarm lights on the bottom. The latest rendering of our prototype can be seen below as well.

In addition to our prototype of the physical camera, we prototyped the app with cardboard in place of the phone and paper in place of the various screens. Through this we were able to conduct user testings and demonstrate our concepts. We learned which screens were needed and which ones were not. We were able to incorporate these into a medium-fidelity prototype as a click-through app through Adobe Experience Design.

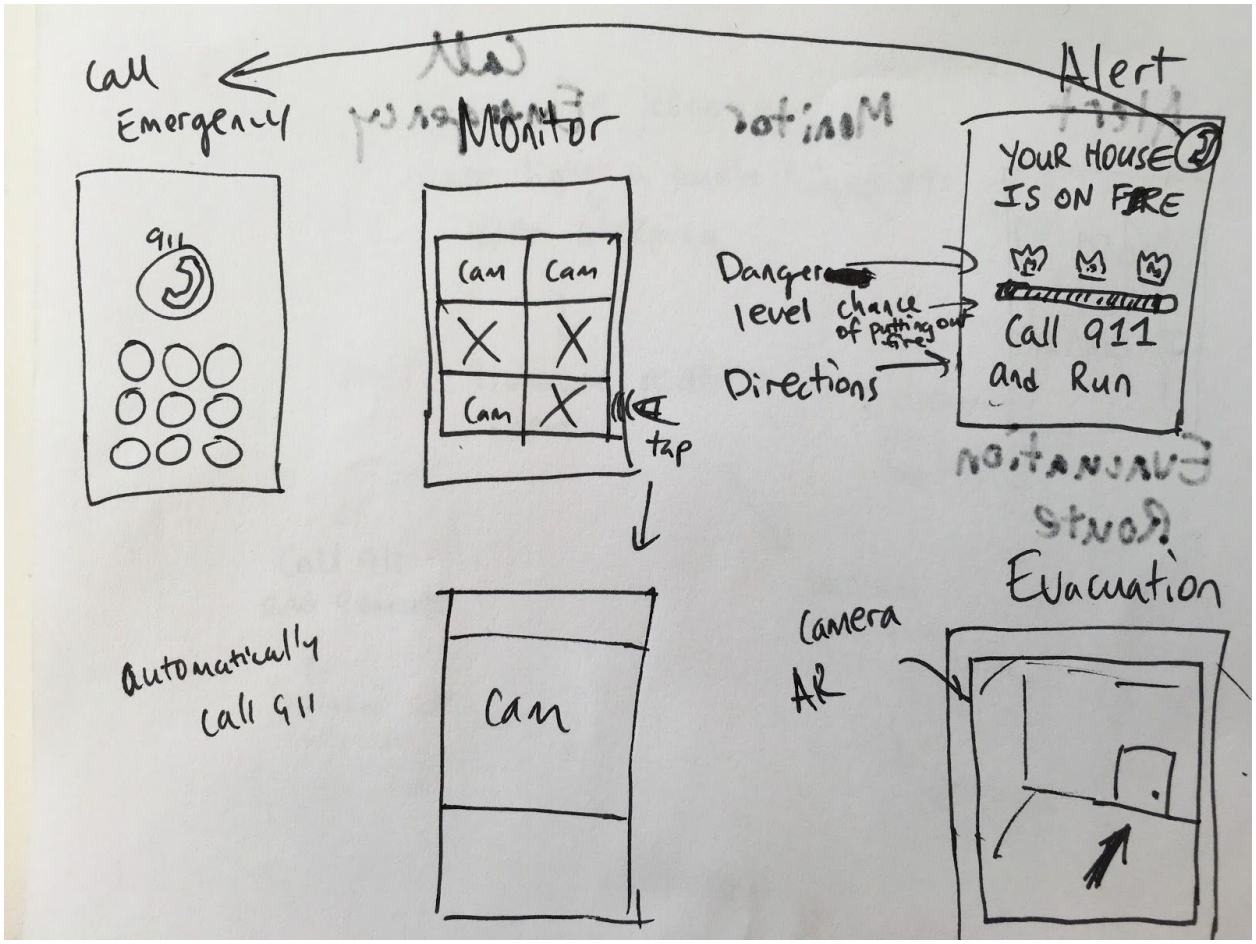


Our low-fidelity prototype of the hardware, using a cardboard, a water bottle, and a soda can

Our medium fidelity rendering of the hardware designed in SolidWorks

Wireframing

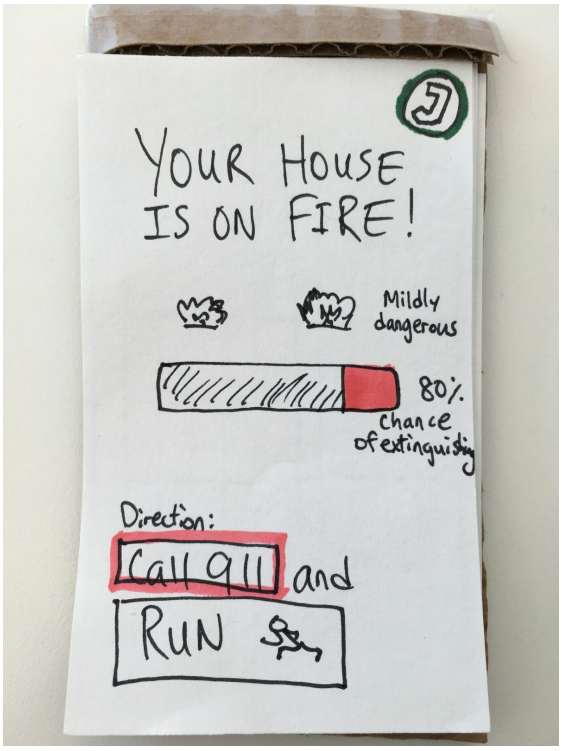
Wireframe is a great tool, or even an essential tool, to create low to medium fidelity prototypes of user interfaces without needing to write any chunk of codes. It serves us well because it can quickly surface the key features and values our app should bring to our users, since we are highly conscious of achieving great usability by incorporating minimalism into our design. Before we began wireframing, we discussed the essential features that our mobile app should have. Those features or screens first of all should include a homepage that shows both alerts in case of a fire and some general information when there is no fire. From the homepage, user should be able to go to other screens to do specific tasks, such as monitoring the house using FireAway thermal cameras, making phone calls (especially the emergency), and evacuating from home using the safest route.



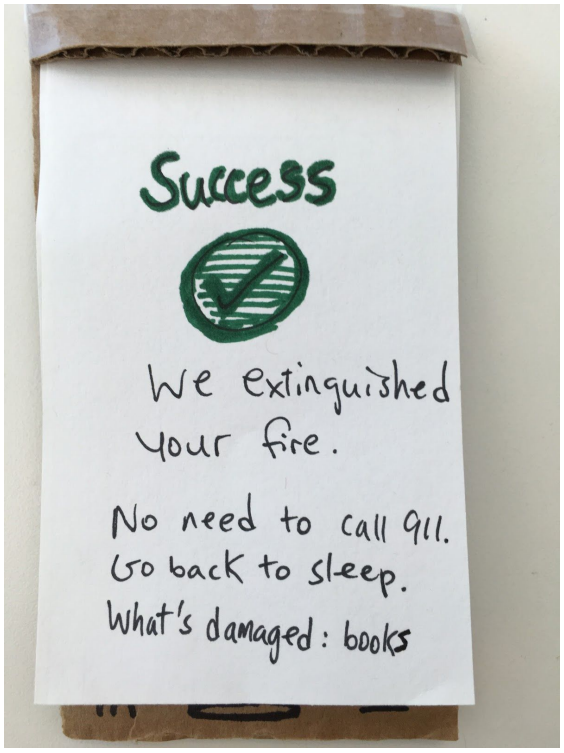
Our first (very rough) sketch

With the above sketch and understanding of the key features/screens, we created a low-fidelity app prototype using index cards and a piece of cardboard. We tested this prototype on two potential users, and we realized that it can be improved by having the app automatically dial 911 and provide all the necessary emergency info in case of a

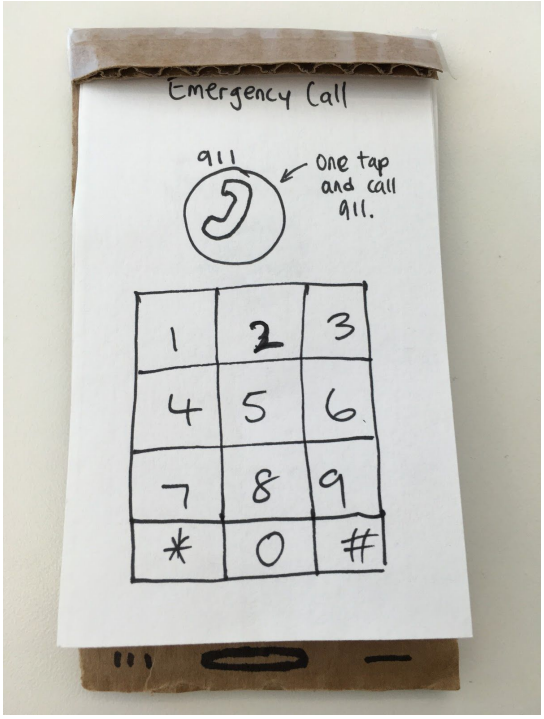
dangerous fire. We also realized that the app needs to respond to other scenarios, such as when the fire can be easily put out by FireAway extinguishant. In this case, the alert page will need to show the remaining time for the fire to be extinguished and also recommended instructions for users to do, so that users can have a peace of mind. Lastly, corresponding to our research on user needs in week one, we realized that it would be better if the app can **reduce** users' **uncertainty**, which would **relieve** users' **stress** in an extremely stressful event like a house fire. Thus, we decided that the app needs to communicate to the user about what items were destroyed in the fire, and users need to be reassured that FireAway is preserving users' belongings and properties as much as it can. For the convenience of users after the fire is extinguished, the app will show users their insurance companies' number so they can call their insurance company right away.



Homepage/alert page, which leads to other pages

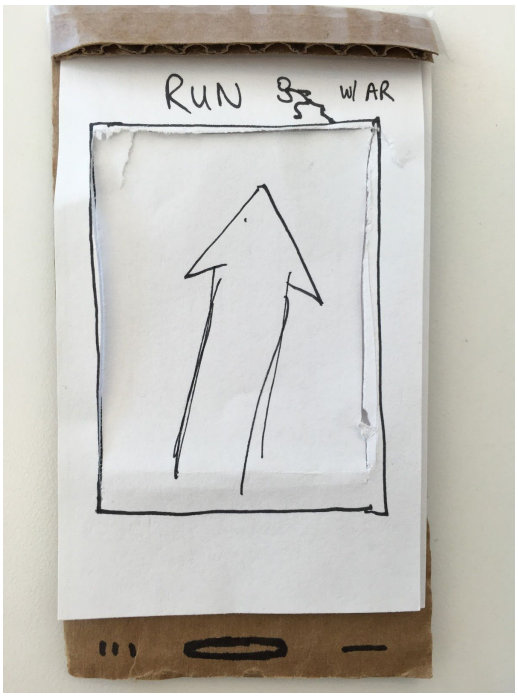


After the fire page

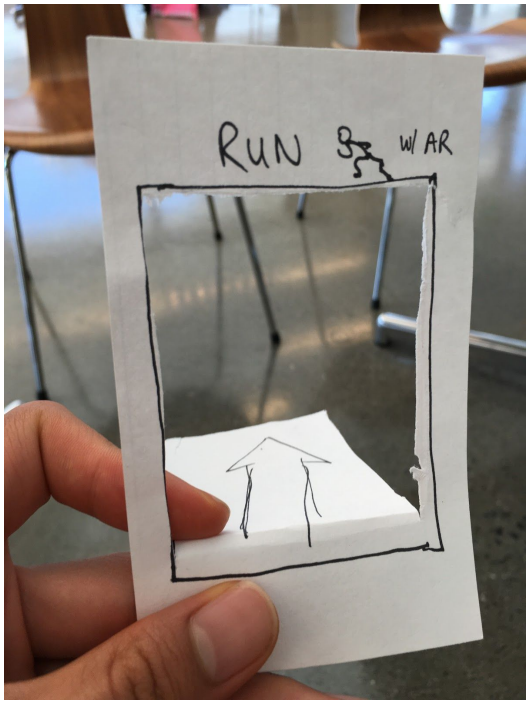


Emergency call

Monitors that can monitor the whole house and detect fires



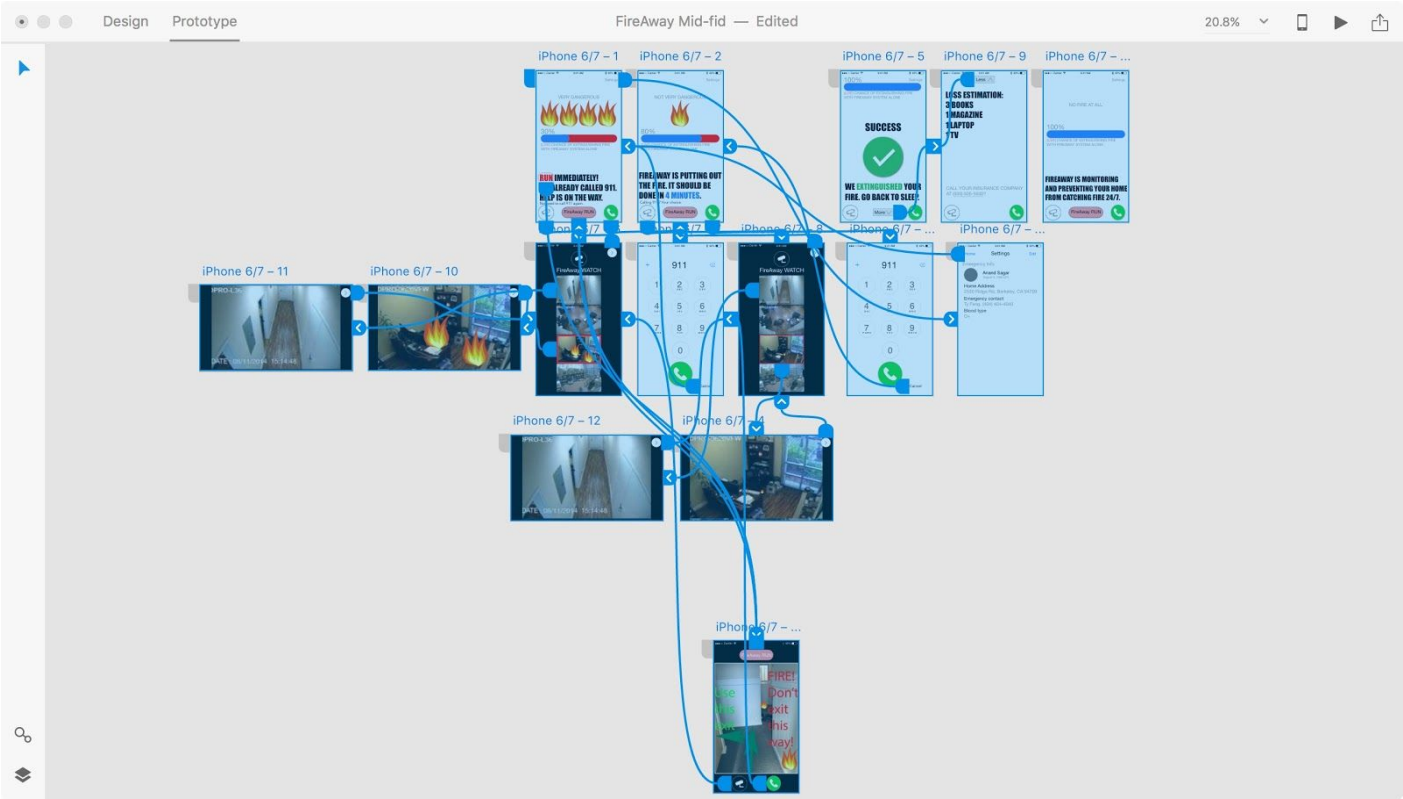
FireAway Run



Uses Augmented Reality to show the best and safest route

These are screens of our low-fidelity mobile app prototype

After we learned a lot from using our low-fidelity prototype to do user testings, we moved onto creating a medium fidelity prototype using Adobe Experience Design, a professional wireframing and prototyping tool. We incorporated all of the above insights and learnings into the design, and the following is the current version of the medium fidelity prototype that can be clicked through and tested on a mobile phone.



Workflow of our mid-fidelity prototype, in Adobe Experience Design

Video demos can be found here:
Scenario 1 (when the fire is big and dangerous)
https://drive.google.com/file/d/0B7RtV6fi_ivwSGpNUWZEck53MTg/view?usp=sharing

Scenario 2 (when the fire can be easily extinguished by FireAway system)
https://drive.google.com/file/d/0B7RtV6fi_ivwZXlGNFZVN0kwaEk/view?usp=sharing

An online, clickable version of the prototype can be found here:
https://xd.adobe.com/view/de6009e7-ed35-479d-a9c1-ae2cf80ed393/.

Overall, we learned a lot from using this simple yet effective prototyping method. The end result is a medium fidelity prototype for our user interface that can be easily used for

demonstration of our concept and project, persuading stakeholders to use our product, and most importantly gathering useful data and observations from user testing. With the outcome of this method, our next step would be to conduct more user testings with our medium fidelity prototype, which can be presented and "used" on an actual mobile phone. As we conduct user testings, we can experiment with different scenarios and user contexts, further validate our ideas, and develop better ideas and prototypes with further iterations.

Additive Manufacturing

Additive manufacturing uses methods such as 3D printing in order to create a physical medium fidelity prototype to hold and gain insights from. For this method, we will be 3D printing a full-size model of our camera/extinguisher assembly. However, since this is still only a medium fidelity prototype, it will only be a single piece and so will not move as it would in reality. It will also be a single color made from plastic instead of the various materials we planned in the rendering. What should be a light at the bottom will also be nonfunctional. These are not important right now however since we are only trying to get an idea of the design and what can be improved. With this medium fidelity prototype, we are able to show it to our stakeholders and/or users and gather valuable user feedback.

Conclusion and Next Steps

Prototyping:
Following our quick, low fidelity prototypes, we gained valuable insights for our medium fidelity prototype. Next we will be iterating on the medium fidelity prototype using 3D modeling software.

Wireframe:
With our mid-fidelity prototype for the UI, we will be able to do user testings by letting users "use" the app on a smartphone. We can then discover if there are any usability issues of the app itself or flaws in our product ideas. We will also be testing out our prototype with different user segments, especially people with disabilities, and also with different use scenarios, especially at night when fires can be the most deadly. With new insights that would be gathered from user testings, we can incorporate them in further iterations of the app.

Additive Manufacturing:
We have our first design ready for printing and we will try to gain as many insights as possible from it. Although we cannot make a functional prototype of our product with this method, we can get user feedback on the design and any suggestions they may have. In the future, we could make a more functional prototype by including electronics and out of several parts so that the prototype can move as it should.