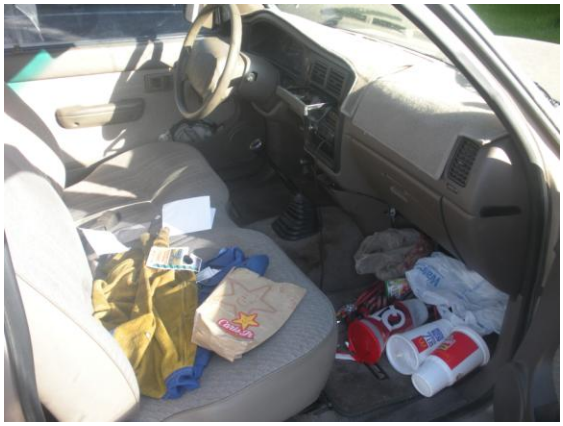
Building a Digital Physical System

Learning how to create a digital physical system was an adventure of learning. Coming into this class, I already had a firm grasp on fabrication, but I was looking forward to learning about programming and user requirements of a digital physical system. Coming from a design background I understood that the user was important, but this class has helped me cement how important the user is in the design process.

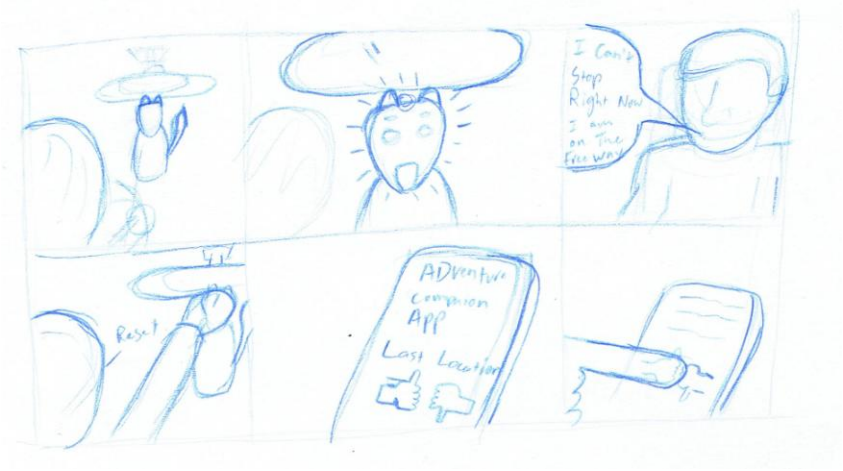
The jumping off point of creating a digital physical system is learning about the user. You can't learn about the user unless you define who they will be; that part comes down to you. Who would you like to help? Once you do a little brainstorming and figure out what demographic you want to appeal to, whether it may be people who drive cars, the elderly, college students, or as specific as bike messengers. Once one has their demographic or user group chosen, then is the time to learn more about them. One can learn about their chosen user group by conducting surveys, interviews, or cultural probes, but what I think brings the most relevant information is when one conducts an ethnographic study of some of their defined users. An ethnographic study is when one observes individuals in their daily comings and goings and the environment in which they live their lives. In class, we used ourselves as the guinea pigs for our own ethnographic study of how we use, or live in, our cars. We conducted an ethnographic observation of our own vehicles by studying the contents, placement of said objects, overall environment of the interior of our vehicle, and what these things might tell us about the owner (i.e. me). It was quite interesting taking an objective view of my own habits through the study of what is in my car. A few things I learned about myself: I am messy, busy, most likely work with my hands, and most likely a student. All these statements are true and it is quite interesting how much our cars are projections of ourselves; but that also can be said about any space we spend a good amount of time in and have personal control of. We as a class were able to collect a lot of data, but what good is a lot of data about human-vehicle relations if there is no meaning applied to it. That is where we used an affinity diagram to help us group the information we had gathered



into meaningful categories of consideration. Some of those categories included were Ownership and Pride; Adventure, Freedom, and Discovery; Entertainment; and Safety. Having these categories gave us places to start from in the actual creation of the concepts we would like to develop.

Now that an understanding of the user has been established one can now define what type of digital physical system they want to create. The type of system depends on what your goal is and what scale you have to work with. The main types of systems are: wearables, ambient systems, artistic pieces and public displays. The scale varies with each of these types from personal, to social and finally public. Since the scope of our project was in the car, we kept our concept to the personal and social range, which gave us two types to work from: the wearable and the ambient systems. We found the ambient system the most attractive choice for use. Objects like the ambient orb and the clock that had an advanced understanding of your calendar and other information to give you advance notice of when to leave gave us inspiration, because they gave pertinent information to the user in a glanceable, unobtrusive way to make one's day run more smoothly and on their own terms. Knowing what type and what scope you are designing for helps put defining parameters for ideation and continued design process.

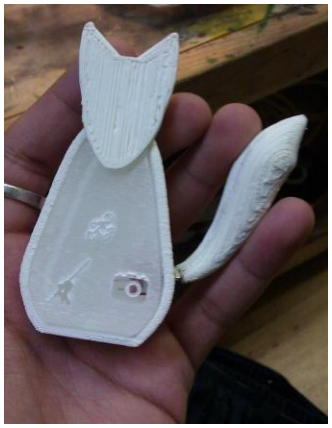
After all the information has been gathered and parameters set for what kind of system one would like to create, it is time for ideation. Ideation is the brainstorming and creation of ideas for systems in which one can create. One useful way of conducting an ideation session is using sketches to convey your ideas. In class, we were to create a number of sketches of ideas that we could do to fulfill the category of our choice from the affinity diagram. We were to draw as many ideas as we could in a five minute time period. The time limit makes it so you don't consider if the idea is good or bad, but to get as many ideas out as possible. The more ideas generated, whether they be good or bad, gives you a greater possibility of creating something great. Also, using sketches sometimes conveys



more than what you can say in words and gives you a starting point for the form design as well. Once you have made some sketches it is important to show them to others and explain it because in the process of explaining you can develop a better understanding of your ideas and also get feedback from others on how to improve the idea. Once you have some feedback, it is time to choose an idea you like most and do a more in-depth sketch with a more in-depth understanding of the idea- possibly even use storyboards to give context and show how the idea is to be used. If at the end of this process you still don't find an idea you like, then go back to step one of the ideation session and start over again. This is one of many ways to conduct an ideation session; the thing that is most important is what works for you and what inspires you.

Once you have selected a concept to pursue, now is the time to create some higher fidelity sketches or computer-aided images, think about the form with the consideration of affordances your concept should have, and really think about how this could aid the user in the category you have chosen. Higher fidelity sketches will help you figure out what form the system should take. The form may define a lot of things about the system; for example- whether it is personal or public, if it needs character, and if it tells you by just looking at it how it is used. For my group's project our device took on the form of a simple fox character. The form was meant to be displayable, but personal as well, and allow users to create an emotional attachment so that they would want to use it often. Your sketches help you create a final prototype.

Once all the conceptual thinking is done, now is the time to combine the design with the technology and create a working prototype. The parts to consider in the prototype process are: the enclosure, the electronics, and the programming. The enclosure is what will take on the form that you have developed from the sketches. The shape the form takes will define the best way to fabricate it. Good ways to fabricate enclosures quickly is through laser cut pieces, rapid prototyping, CNC milling, and all with some by-hand refining. In addition to the enclosure taking on the form of what you desire, it also needs to protect and have enough room for the electronics. For my group's project we used a Makerbot CNC to rapid prototype and fabricate the majority of the body, and a laser cutter to create other pieces. The electronics required are defined by the function you have created and the programming you develop. A powerful tool in digital physical systems is a programmable micro



controller, like an arduino. The programming side of things may be daunting, but if you take it step by step and think about the logic in the process of how your system will work, it will make things easier. There are many resources on the internet to help you program your system. Once you have the enclosure finished, all the electronics assembled, and programming finished, it is time to test you system. Testing the system will see if your hypothesis was correct on how it would aid the user. If not proven correct, then is the time to take that feedback and go to the beginning of the process and use the information you now have and improve the system. If you are proven correct, it is still time to take the feedback you have gotten and improve the system even more. The creation process is a cycle, and something can always be improved. In the end, the most important thing is if you have aided the user in some way and that they have a positive experience using the system.