Design Project 4: Das Auto

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1. Motivation and Rational

1.1. Introduction

Autonomous cars may be an important part of our future. We explored the different concepts, scenarios, and functionality a self-driving vehicle can have. A person who is in a fully autonomous vehicle is free to do whatever they please, if the car is safe and sound. We worried about the safety of an autonomous vehicle, but it wasn't our focus for this design. Our focus was on what they could do during their commutes to and from work.

People may drive upwards to two hours a day on their way to work. The amount of time driving in their car could be better used for accomplishing work related tasks so they do not have to "waste" their time during the commute. People would like to get ahead of their work during the car ride if they could. What we want to achieve in this design, is to allow people to make the most of their travel on the way to work, and long commutes they may have to make during the work day.

1.2. Problem Statement

How do we help people complete work on their travel to work?

1.3. Solution

In fifteen years, we want to simulate the work station in the car. We aim to help people complete work related tasks by creating an office space in their vehicle. The car will have be fully autonomous on the highway. This design will provide Volkswagen a solution they can realistically implement in upcoming future.

1.4. Rationale

Our main focus of our design is to help people get work done on their commutes to work. This is through the use of our "workstation." Our workstation allows people to virtually connect to their systems at work. Since they can connect to their workstation, they will be able to check emails, attend conference calls, read reports, and browse the internet while being safe on their drive.

Based on our research, we were able to make assumptions about the future to aid our design. These assumptions are made for fifteen years into the future. These are the assumptions we needed to clarify how our workstation will fit into the existing systems of the future:

- The car is not fully autonomous
- Users can access their workstation through a virtual machine
- The car will have safety features that help users regain control when needed
- All of our decisions are based on research and insights.

Assumptions Clarified

A fully autonomous vehicle that works everywhere will be hard to imagine in the next 15 years. Our research points out the many contingencies to consider in the safety and predictive technologies realm. [2]

Users being able to access their workstation through a virtual machine is reasonable in the future. The current issue for virtual machines are the latency due to internet connection and hardware problems. However, our research indicates that this will no longer be an issue in the future.

Many people might ask, if we have an autonomous vehicle, why don't we just bring our laptop into our car. There are a few reasons why: safety, convenience, and technology issues. Having a laptop in your lap while driving will be dangerous if you need to take control of your vehicle. Our workstation is convenient because you will not need to bring the laptop. Additionally, people may only have a work desktop. The technology issues of the future are hard to predict, but in order to actually produce meaningful work from a laptop in a moving car, you would need quite a bit of hardware: laptop, proper software installed, wireless hotspot, etc. This also ties into the convenience issues.

The safety issues of autonomous vehicles are apparent in present day. However, in the future this will be different. From our research, we uncovered the many different technologies that will help increase safety. These include everything from, car communication systems, sensors, haptic feedback, warning systems, and many others.

Workstation

We choose autonomous on the highway compared to city/street traffic because of many reasons. traffic lights, stop signs, map dependent changes, and future endeavours of entrepreneurs. On the highway, there are no traffic lights, stop signs, and changes often don't impact traffic. Our research findings indicate that these reasons are the current issues that Google is struggling to solve. Additionally, Elon Musk even states he believes he can produce 90% autonomous cars that can drive autopilot on the highway. [3]

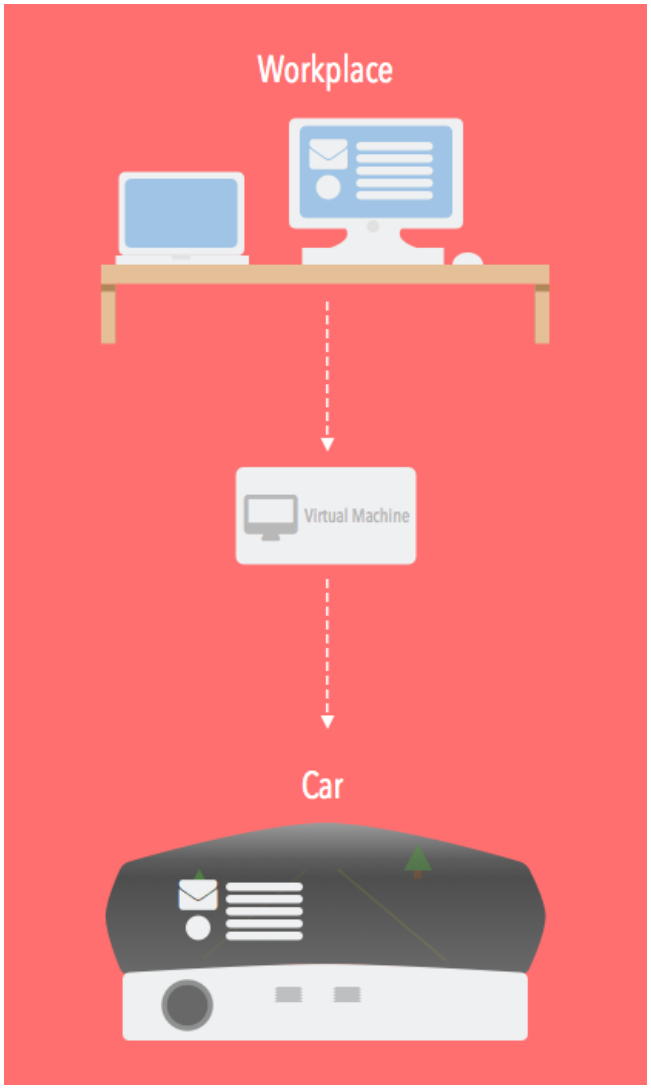
The workstation will consist primarily of a display on the windshield. The windshield is used because users in the future will still be sitting in the front seat with a steering wheel. It is in their immediate field of view.

They will allow users to check emails, attend conference calls, browse the internet, and read their files. These are the tasks that many people do to start their workday. The user will simply interact the with workstation by using voice and gestures.

The physical workstations of the future will probably no longer include the mouse and keyboard. The interfaces will be even simpler to use and more intuitive. Dell believes this is the case and that voice and gesture will take over in the market place. This is the reason why we are implemented voice and gesture for controlling the workstation. The workstation will be context-aware so there will be no issues when you are giving commands in the middle of calls or browsing the internet.

The workstation will let the user know in advance that it will save their work and close when traffic becomes congested or they arrive in the city/streets. The workstation warns them when they are needed to take control of the wheel. If the user does not start to take control, the car will automatically merge into a side lane and pull over on the side.

1.5. System Design



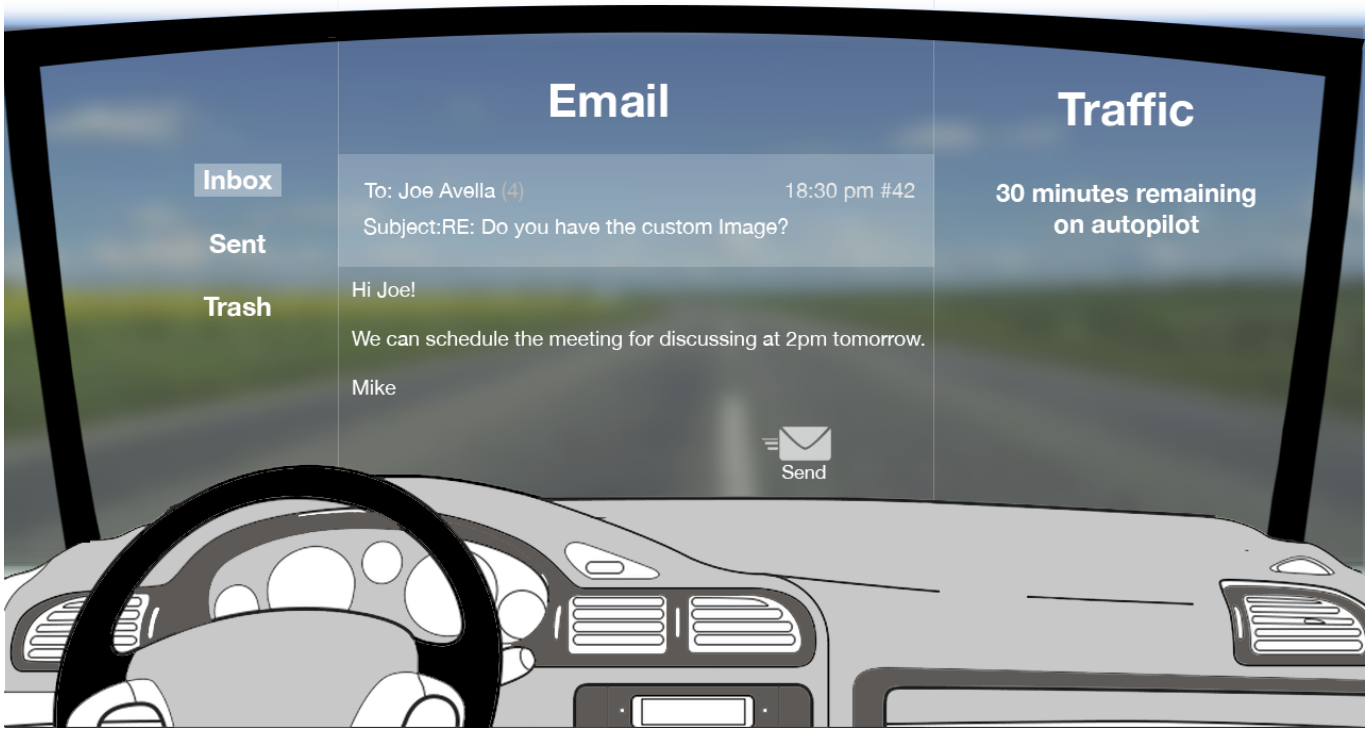
The computers at workplace are connected internally to a hypervisor (A hypervisor or virtual machine monitor(VMM) is a piece of computer software, firmware or hardware that creates and runs virtual machines. [wikipedia]), that enables the systems to act as a Virtual Machine there by sharing their data to any connected system. The car is connected to the virtual machine (through self-service provisioning) that mirrors the system data and makes it easy to access one's content on the go.

1.6. Final Design

The initial screen that is activated once the car is on a highway. This can either be activated through voice control or by using a tactile button that is present on the steering wheel.

On saying "Email", the system recognises the voice and opens the email application.

The user on wanting to read the first unread email, just by talking out loud the desired action, the interface opens the email and displays it on the screen.



The user then talks out "Reply", and the interface takes him to an edit mode where there is a functionality that converts what the user talks to text on the interface.

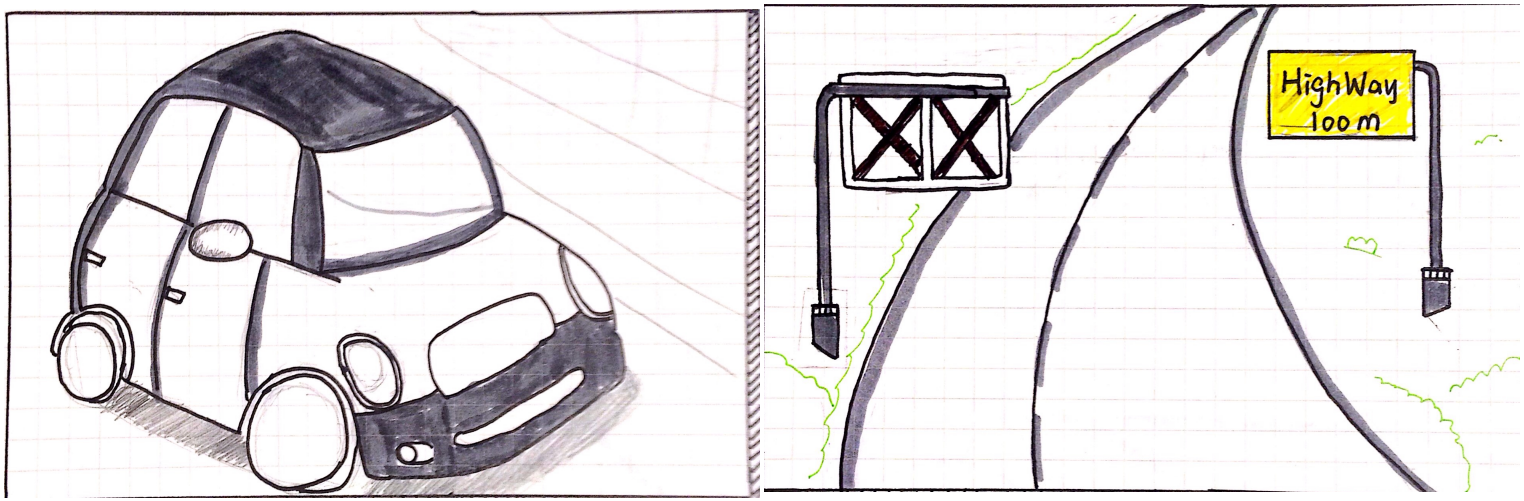
The browser can be opened in a similar fashion - by talking it out loud. The user is then given the option to browse using gestures to scroll and navigate through links.

The system supports multi-threading, i.e - many applications can run simultaneously. In this case, the system receives a Skype call while browsing. The user can answer the call by talking out loud the option that is preferred.

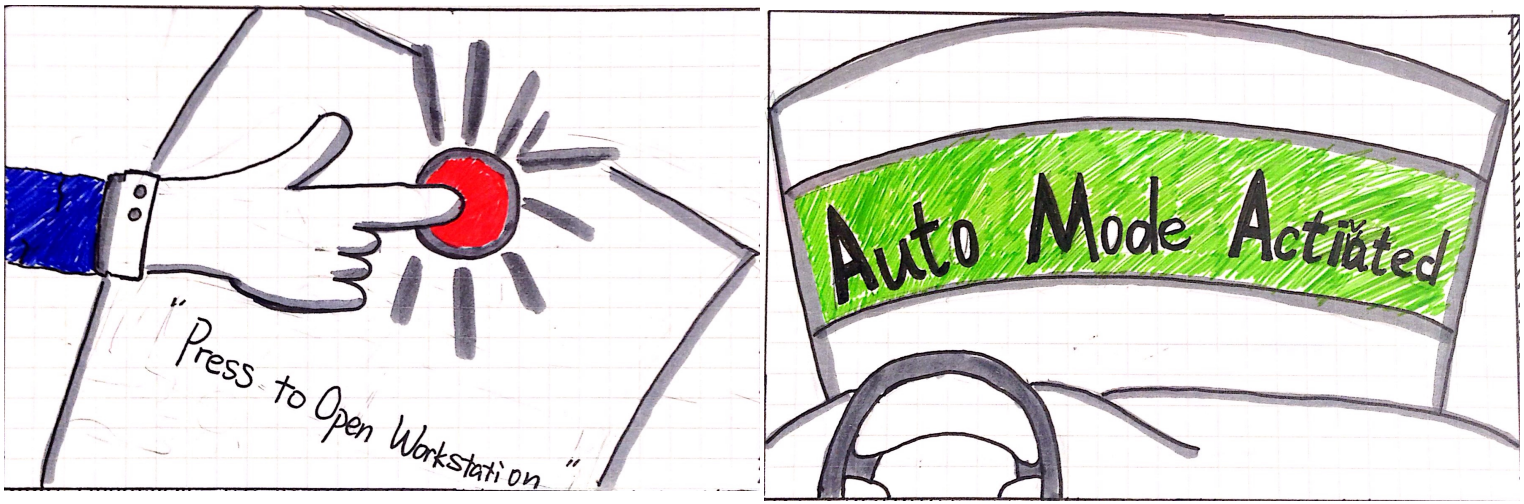
The user can end the Skype call by just talking out the words "End Call". A completely context-aware system will understand that the command is not a part of the Skype call input and will end the call appropriately.

The system alerts the user to take back control of the vehicle five minutes before the end of autopilot. It automatically saves the work done on the workstation before shutting down.

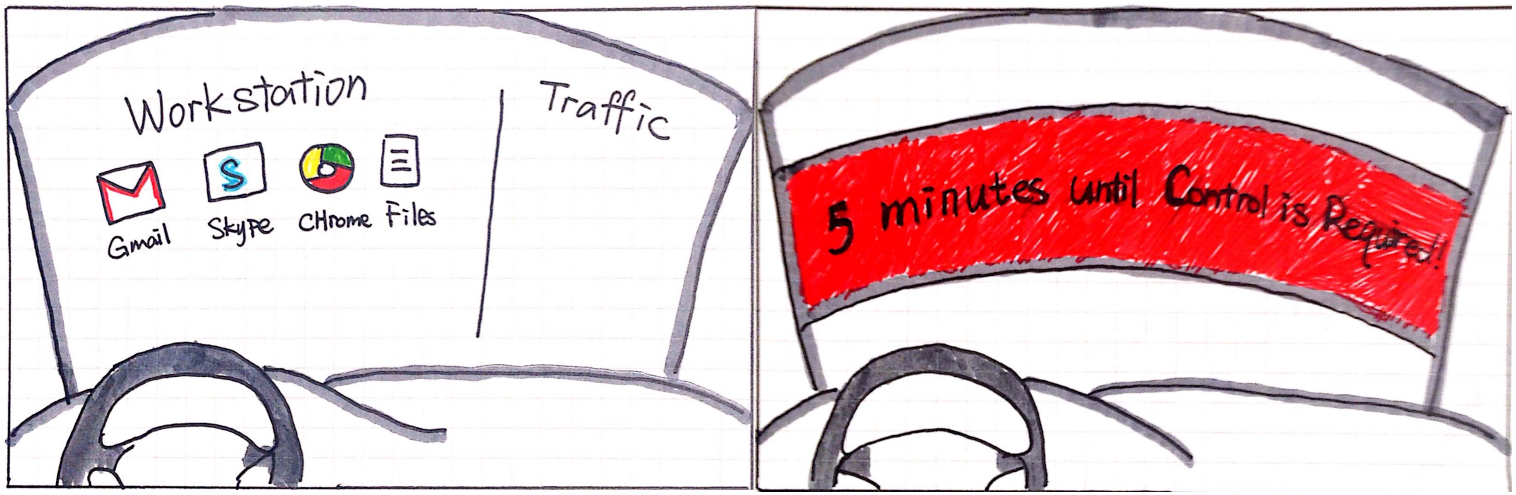
1.7. Storyboard



The user gets into the vehicle and has to manually drive the vehicle till it reaches the highway.

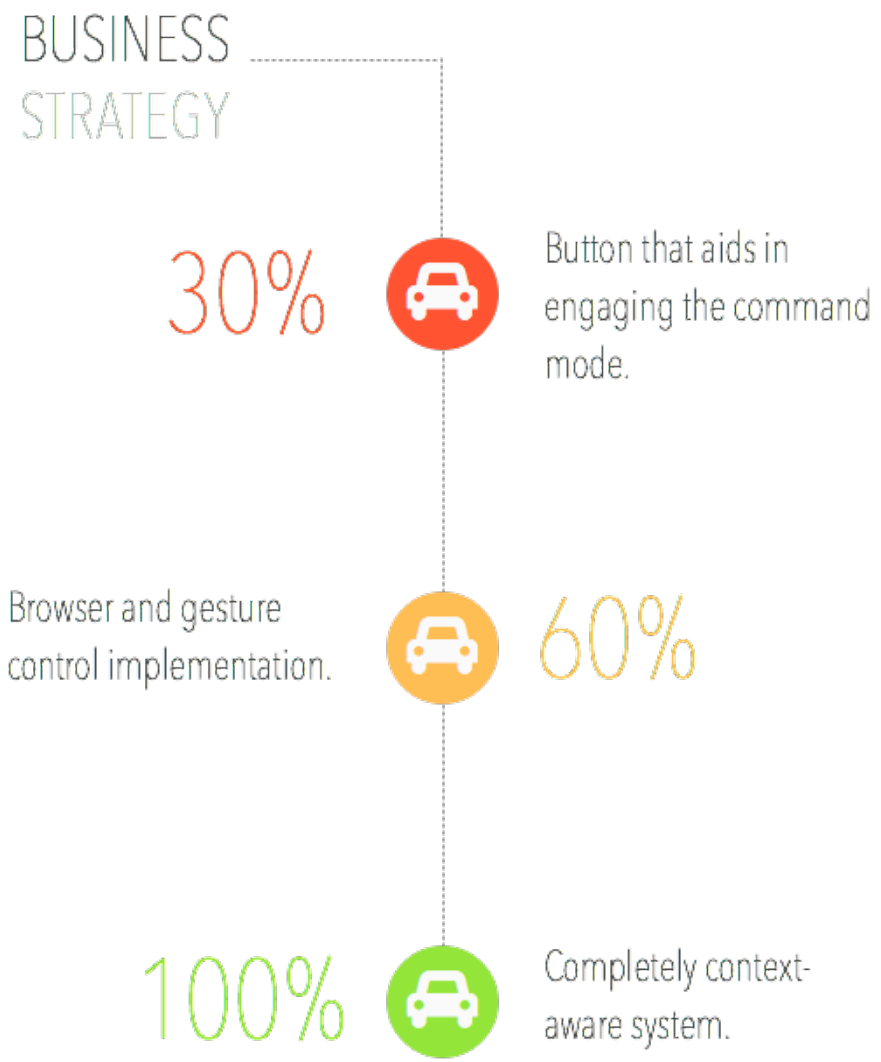


The workstation can be activated by pressing a tactile button. This activates the windshield and it is displayed on the interface.



The interface then displays the different applications. The windshield is operable till the system decides the traffic needs attention and that the user has to take back control of the car.

1.8. Design Strategy



Our design incorporates elements such as voice recognition, gesture controls and self-monitoring of traffic. An incremental release of features will help in expanding the framework gradually by releasing a minimum-viable-product (MVP) to production.

Minimum Viable Product (MVP - 30% release)

This product includes features such as an app for aiding conference calls, emails and access folders of the workplace system from the car. Initially, the design will incorporate a tactile button that helps the system to understand when the user switches to a command mode.

Near future (60% release)

This version of the system will include the browser along with gesture controls that helps in controlling the browser. The gestures will enhance the usability of the system by providing an intuitive way to interact with the windshield interface.

Distant future (100% release)

This is the final design that incorporates intelligent context-aware voice recognition that understands what command is being called out by the user. This requires a lot of work in the field of Natural Language Processing (NLP) to come up with algorithms that can differentiate between a command and other voice input.

2. Design Process

2.1. Problem Exploration

Our team started by analyzing autonomous cars and conducting secondary research on anything we could find on the topic. After exploring research, we conducted some brain storming sessions to help explore the potential problem space in this area. At this point, we didn't believe we had enough ideas, or strong enough ideas to explore. We then realized we should focus on a target audience and then narrow down to personas. After doing this, we conducted interviews and surveys on our target audience to help us explore their problem spaces. This led us to uncovering the problem we wanted to tackle, the commute to work.

Our team conducted primary and secondary research to understand the different concepts we needed to understand for our workstation. These findings helped us understand the present day and the possibilities available in the future.

Primary Research

- Surveys (refer to Appendix 4.4 for Survey Results)
- Interviews (refer to Appendix 4.4 for Interviews)
  Through primary research, we were able to ask questions and interview about autonomous vehicles. We uncovered a problem space, people's frustrations, wants, needs, and opinions.

Secondary Research

- Research on Autonomous Vehicles [8]
- Research on Car Safety [4]
- Research on Traffic [6]
- Research on future of virtual machines [10]
- Research on Heads Up Displays (HUD) [12]
- Research on Voice/Gesture [13]
- Research on Workstations [11]

The articles can be found in our Appendix (4.4)

This secondary research allowed us to use data to provide rationale for the implementation of our workstation. We were able to uncover the future of autonomous vehicles and the concerns that go along with autonomy, such as: trust, security, cost, and ethics. The safety of cars is was a concern, the research helped us make the assumption that cars will be much safer in the future. The issue of traffic can be solved with autonomous cars that have a communication system.

We also uncovered current trends in HUDs in the car. The current HUDs already look futuristic and they will only improve in the future. Jaguar has a neat concept [13] for it's HUD in the car. The future of workstations will change with the advent of newer technologies. These technologies will allow us to work in a setting of voice, gesture, and without keyboards and mice.

2.3. Personas

Our personas were created in order to keep our focus on the real user, think outside of our headspace and determine the best and most user-oriented approach to solving our primary problem – helping people complete work while driving.

Image retrieved on November 4th, 2014 from:
http://cache3.asset-cache.net/gc/465911239-year-old-professional-male-gettyimages.jpg?

Ricardo Dominguez

About

- Health Consultant
- 44 years old
- Boston, Massachusett
- 60 - 90 min work commute
- Has never been in an accident
- Enjoys driving

Needs

- Spend more time with family
- Complete work on the drive to work
- Check emails and reports on the way to work
- Buy a car that will save him time while driving to work

Ricardo lives in a suburb of Boston, Massachusetts in a house with his wife and 5 kids (2 boys, 3 girls) ranging from ages 4 -17 years old. He leads a routine lifestyle because he works as a Health Consultant. His job often entails him working from 9 - 5 pm Monday through Friday. Often times his commute can be an hour and a half, with 1 hour of it being on the highway. Ricardo wants to get more of his work done, so he can get home and spend more time with his family.

Ricardo used to check his emails when driving, but stopped when he almost got in an accident a few months ago. When he gets to the office, he often spends his first hour or so catching up on the influx of emails and reports he needs to read for the day. Ricardo needs a way to get up to speed with work much faster. He doesn't like to stay at work late, or do work at home because he'd rather be spending that time with his family.

Image retrieved on November 4th, 2014 from: http://cache1.asset-cache.net/gc/83455021-portrait-of-35-year-old-woman-gettyimages.jpg?v=1&c=IWSAsset&k=2&d=25Nq1FacJi9oWL42WHTvi4NJoEa5l1pf%2Fp%2B0rVzBI30%3D

Laurene Day

About

- Insurance Saleswoman
- 34 Years old
- San Diego, California
- 45 - 60 min work commute
- Has been in two accidents, one was her fault
- Does not enjoy driving

Needs

- Spend more time with her friends and dog
- Prepare for her meeting on the drive to clients
- Check emails and reports on the way to work
- Buy a car that will save her time and drive for her

Laurene lives in the suburb of San Diego, California in a studio apartment with her Fox Terrier named Lilly. She leads a routine work schedule, usually working from 8 - 5 pm as an Insurance Saleswoman. Laurene often has to drive far to meet with clients, taking the highway to save time. Some days she is driving on the highway for 2 - 3 hours a day. Laurene wants to prepare for her meeting with clients on her drive. She also wants to check emails and reports on her way to work.

Laurene currently prepares for her client meetings by sitting at her desk and reading reports and documentation. When driving, she tries to memorize what she has read so she can make her meetings quick and effective. If she isn't fully prepared, her meetings often last too long, which causes her to come home late from work. Coming home late from work can be an issue because she needs to take her dog for a walk and feed her.

2.4. Ideation

After our personas were created, we decided to focus in on and understand what these types of users would want to do on their way to work. We interviewed a few people who had a long commute to work and found out that they would like to start working when they get into the car, not wait until they get to their desk. From this insight, we decided we wanted to create some type of environment that allowed them to work in the car.

There were some core concepts in this system we had to consider:

- Safety
- Autonomous Vehicle
- Accessing the workstation
- Workstation

From these core concepts, we decided to narrow our focus onto the actual workstation. The safety, autonomy, and accessing the workstation are other areas to explore, but we decided to focus our attention elsewhere. Based on our research and understanding of the current technologies, we believe the all of these will be taken care of in the future.

We started thinking about how exactly will users interact with this workstation. Using some of the golden questions allowed us to explore the current technologies and research into what is currently being developed for the future.

Here are some of the core concepts we explored for the workstation:

- How to communicate with the system (touch, voice, gesture)
- How to display the information (HUD, Windshield)
- What to allow people to work on (emails, read documents, conference calls, internet)
- What else to allow people to see (traffic, weather, news)
- How to warn users that they need to control the car (warnings, timers, displaying info)

2.5. Sketches

Our team completed sketches to explore these core concepts and understand how they would interconnect within the workstation. Please see appendix (section 4.3 - 13 concepts) to see our flow of sketches and understand where we started and where we ended up.

2.6. Usability Testing

The usability testing was fruitful to see the usability of our windshield design. (For the usability test,script and procedures refer to Appendix 4.1 and 4.2)

Changes made to our initial design after the usability test:

- Our first usability test indicated that the users were confused about the mode of commanding the interface when they are already in an input mode (i.e, already typing out an email or on a Skype call.)
- We introduced a *tactile button* to solve this problem on the arm-rest. Once the user presses this it will act as an override and shift to a "*command-only*" mode.

3. Conclusion

3.1 Overview

This system helps in establishing an environment that is conducive to working remotely by setting up a workstation that mirrors the systems from the workplace. This would help people who commute long hours to work by aiding them to work on tasks while traveling.

3.2 Future Strategy & Opportunities

- This system can be incorporated to completely autonomous vehicles which can guide through traffic as well.
- The workstation can eventually accommodate full-fledged applications that can be built for the car's operating system (OS)
- This will expand the market by bringing developers to develop new and interesting applications for the framework thereby making the possibilities limitless.

4. Appendix to the design document

4.1 Usability Test Documents

Participant Consent Form

The purpose of this usability study is to evaluate the design of the car workstation. We are interested in determining if people can accomplish common tasks and easily find information using this workstation. The session will not 'test' you or your ability, rather the session will test the system to provide information on areas that might be improved. Please be advised that there are no risks associated with participation in this session.

During this session, you will be asked to complete some tasks using the workstation's interace and answer some questions about it. As you complete the tasks, members of the User Experience Group will observe and take notes. In addition, the session will be captured on video for future review. The session will last no longer than one hour and fifteen minutes.

If for any reason you are uncomfortable during the session and do not want to complete a task, you may say so and we will move on to the next task. In addition, if you do not want to continue, you may end the session and leave at any time.

Approximately 2 people will participate in this study. Results from all sessions will be included in a usability report to be presented to {our class}. Your name will not be included in the report nor will your name be associated with any session data collected.

If you wish to speak with someone about your participation in this study, or if you feel you were not treated as described above, please contact the User Experience Group manager at 812-391-9330.

I, _____ _____, have read and fully understand the extent of the study and any risks involved. All of my questions, if any, have been answered to my satisfaction. My signature below acknowledges my understanding of the information provided in this form and indicates my willingness to participate in this user testing session. I have been given a blank copy of this consent form for my records.

Signature:_____ Date:_____

Usability Test Script

Hello,

You probably already know, but let me explain why we've asked you to come here today: We're testing a concept car design that we're working on to see what it's like for actual people to use it.

I want to make it clear right away that we're testing the design of our concept, not you. You can't do anything wrong here. In fact, this is probably the one place today where you don't have to worry about making mistakes.

We want to hear exactly what you think, so please don't worry that you're going to hurt our feelings. We want to improve it, so we need to know honestly what you think.

As we go along, I'm going to ask you to think out loud, to tell me what's going through your mind. This will help us.

If you have questions, just ask. I may not be able to answer them right away, since we're interested in how people do when they don't have someone sitting next to them, but I will try to answer any questions you still have when we're done. We have a lot to do, and I'm going to try to keep us moving, but we'll try to make sure that it's fun, too.

And again, as much as possible, it will help us if you can try to think out loud so we know what you're thinking about.

4.2. Testing Results

Usability Test 1

Before we begin, I have a few general questions I would like to ask you

Questions to ask before the usability test begins:

- First we'd like to know what car do you currently own. Also how long do you drive to work?

I own a Prius now. Since I stay at Indianapolis, I drive to classes here at IU. I come here about 2 days a week. I am a part-time student and I don't drive to work because it's just a couple of blocks away back at Indy.

- What are your thoughts about an auto-driving car? Would you buy one?

I think the idea is pretty futuristic. I have seen the video of the Google autonomous vehicles. It seems a little unnerving when I think about the car driving itself. I am not sure how safe the cars are and who is accountable for if something goes wrong. If the car is a 100% safe, I will buy one if it is affordable.

- Let us assume you own an auto-driving car that is a 100% safe on the highways and freeways. On your commute to classes, what activities would you like to do on your way to school in the car?

So that means I will still have to drive in the city and that the car is autonomous in the highways. That case, I would like to catch up some readings for the class I am traveling to. That way I will be able to keep myself updated.

Questions during the usability test:

Before we started with the testing of our design, we would like to explain some basic assumptions of our design so that you have a clear understanding of the system.

Our system mirrors your workplace, be it your home computer, your work computer or your laptop etc. That is, your computers act as a virtual system and all that data is available in your car for use. The car has it's own interface on the windshield can be completely controlled through voice.

- You are just exiting the city limits and have entered the highway. Your car is now on autonomous mode and you are presented with this screen. What do you see?

I see an interface that shows that I can read the email, use the browser or make a conference call. This portion of the screen shows that the car will not auto-drive itself after 20 minutes. So does that mean that I will have to take control of the vehicle after that?

- You decide to check your email. How would you do that?

Since you told me this is voice controlled, I would probably say "Open Email".
You decide to check the inbox. You want to read your first unread email. How would you do that?
I will continue talking to the system. I will say "Open the email from" and say the name it is from.

- This is what you are presented with. What do you see?

So I assume this is the email screen. The email has opened. I can read the email and have an option of replying or forwarding this to someone.

- You read the email. You want to respond to the email. You want to schedule a meeting with the person. How would you do that?

So I guess I need to say "Reply to this email". Ok so I have a text editor in front of me now. I will go ahead and talk my email out. I am not sure how I can send the email though. If I continue talking, will the text editor type it or respond to my command?

- You are done replying to the email. You want to browse the internet. How would you do that?

I am in the email screen. So I want to get back to the screen where I can see the app icons. Probably I would say "Go back to homescreen". Now I see the browser icon. I will say "Open the browser ".

- You are browsing the internet and after a while you see this screen. How do you react?

So I see that I am receiving a call on Skype. So I can answer it by either saying "Answer call" or just skip the call if I want to. I think I will answer it.

- So you take the call and after a while you want to end the call. How would you do it?

Again, I am not sure if the car will understand if I am talking to the person or the car. I might go ahead and say "End this call". Will that work?

Questions to ask once the usability test is over:

- What do you think about this system? How do you think this will be useful to you?

I think it is a pretty cool system. If I am person who travels a lot to work, I guess I can get done a lot of my work done in the car. I did have trouble understanding a few things though. I am not sure how the voice control can understand me. I am also unsure about how the system will transfer control back to me for driving the vehicle once I hit the city.

- Is there anything else about the system that concerns you?

I find it hard to imagine a system that can drive itself. I think it is possible in the distant future, but the safety aspects still bother me. I also wonder if the car can drive itself in the highways, why can it not drive itself in the city? I will like a system that can own up the entire driving process which will enable me to concentrate on my work.

Usability Test 2

Before we begin, I have a few general questions I would like to ask you

Questions to ask before the usability test begins:

- First we'd like to know what car do you currently own. Also how long do you drive to work?

I own a Toyota Corolla. I drive about 20 minutes to work.

- What are your thoughts about an auto-driving car? Would you buy one?

Sure. A car that can drive itself. Who wouldn't want one?

- Let us assume you own an auto-driving car that is a 100% safe on the highways and freeways. On your commute to classes, what activities would you like to do on your way to school in the car?

So assuming that I also use the highway for getting to work, which I need not as of now, I will probably check my email, read reports or do things which I will probably spend time doing as soon as I reach work.

Questions during the usability test:

Before we started with the testing of our design, we would like to explain some basic assumptions of our design so that you have a clear understanding of the system.

Our system mirrors your workplace, be it your home computer, your work computer or your laptop etc. That is, your computers act as a virtual system and all that data is available in your car for use. The car has it's own interface on the windshield can be completely controlled through voice.

- You are just exiting the city limits and have entered the highway. Your car is now on autonomous mode and you are presented with this screen. What do you see?

I can check my email, or browse the internet. I am not sure what conference means? Does it mean I can start a conference call with someone?

- You decide to check your email. How would you do that?

I will say "Open first unread email".

- This is what you are presented with. What do you see?

I see the email has opened. I will read it. Probably reply to it if necessary?

- You read the email. You want to respond to the email. You want to schedule a meeting with the person. How would you do that?

I will say "Reply". I will continue talking the text that I will like to reply with. As I see it getting typed, I will frame my sentences. What if I make a mistake with what I just said? Do I say erase this text? Probably yes. What if "erase text" gets typed?

- You are done replying to the email. You want to browse the internet. How would you do that?

I remember seeing a browser icon in the first app screen. So I need to get there first. Or maybe I will just say "Open Browser" and assume the computer is smart enough to open the browser for me from this point.

- You are browsing the internet and after a while you see this screen. How do you react?

Someone is calling me on Skype. I will answer this call by telling the system the same.

- So you take the call and after a while you want to end the call. How would you do it?

I am talking right now. With what I can understand about the system now, it is intelligent enough to understand what action is to be performed. So if I say "End this call", it is going to end this call for me.

Questions to ask once the usability test is over:

- What do you think about this system? How do you think this will be useful to you?

This will be extremely useful for me if I commute long distances to work. I travel in the city. So this car is never going to be self-driving for me.

- Is there anything else about the system that concerns you?

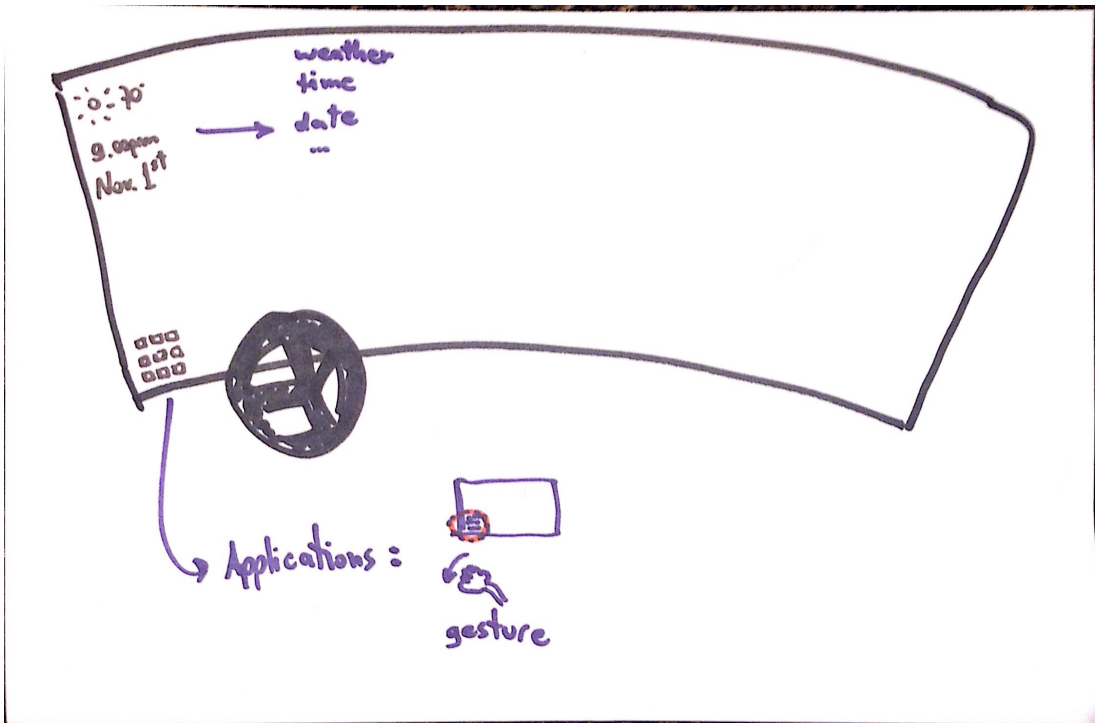
I do not understand how the system can intelligently understand what I am trying to say. I assume it might get confused at times and could be frustrating. Siri is pretty annoying at times. I stopped using Siri because it does not do what I want it to. This is like a Siri in a car to do more important and serious tasks. I will surely like a reliable system for tasks related to work.

Thank you very much, your input and thoughts will help us improve our product. We will now be able to redesign it to the best of our ability.

4.3. Sketches

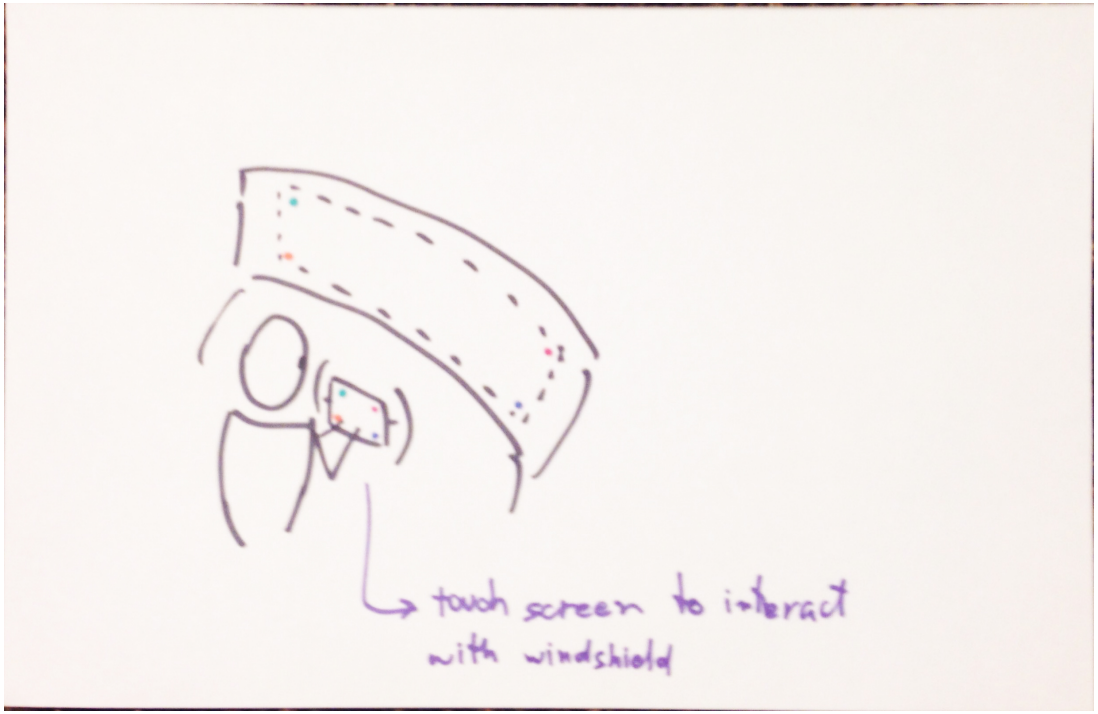
In the process of ideation we produced a number of different design concepts. The different sketches for all our design concepts are as follows:

Concept 1:



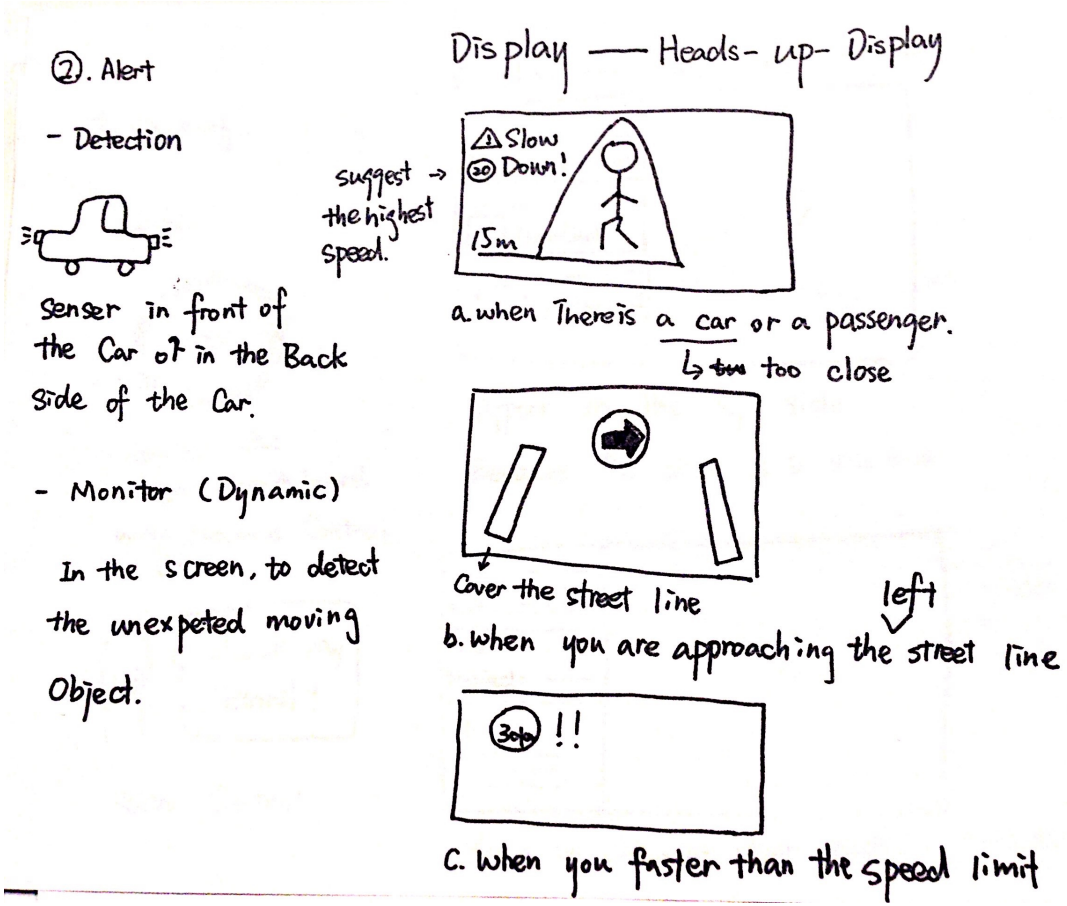
A gesture controlled system that displays information on the windshield. This system assumes that the car is autonomous and that the windshield can be used as an interactive hub for work and play.

Concept 2:



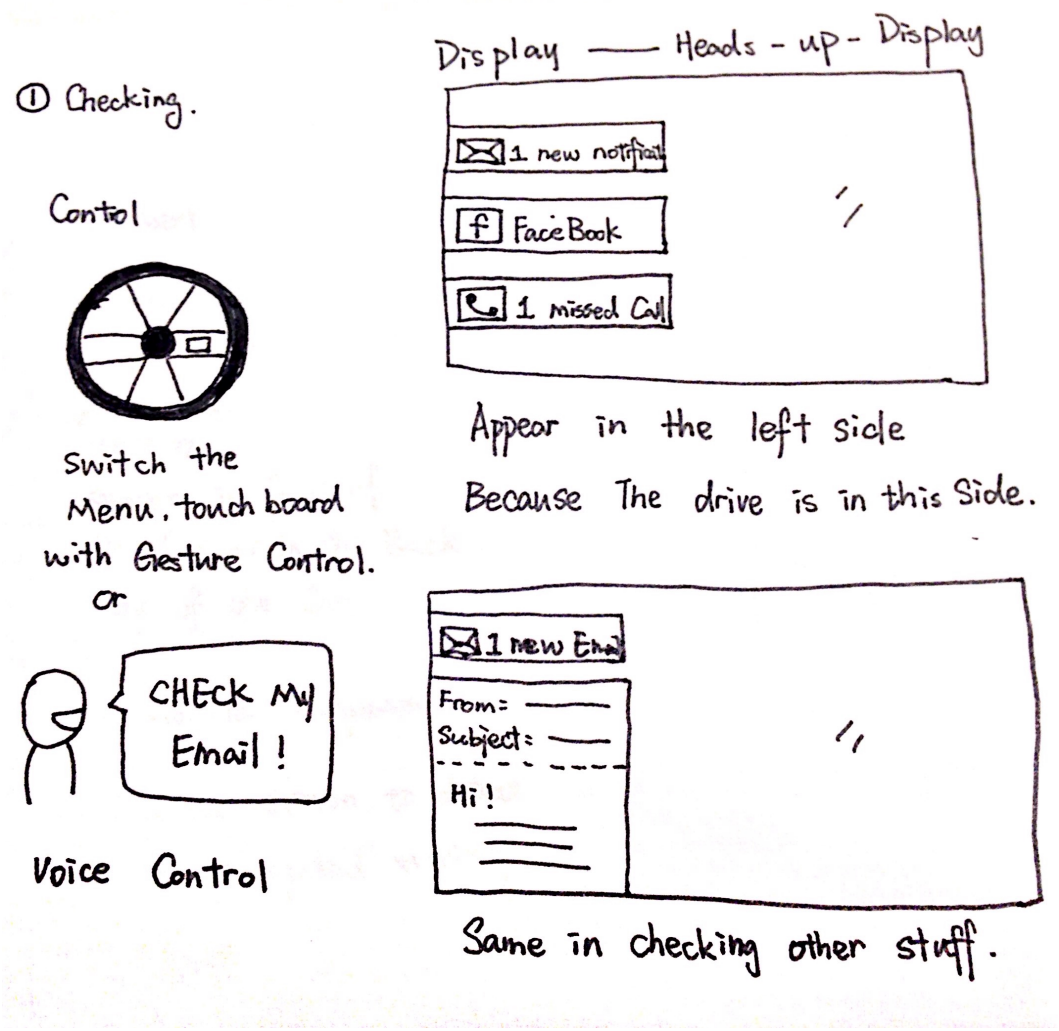
A touchscreen controlled system that interacts with the windshield that maps the controls on the touch interface to that on the windshield.

Concept 3:



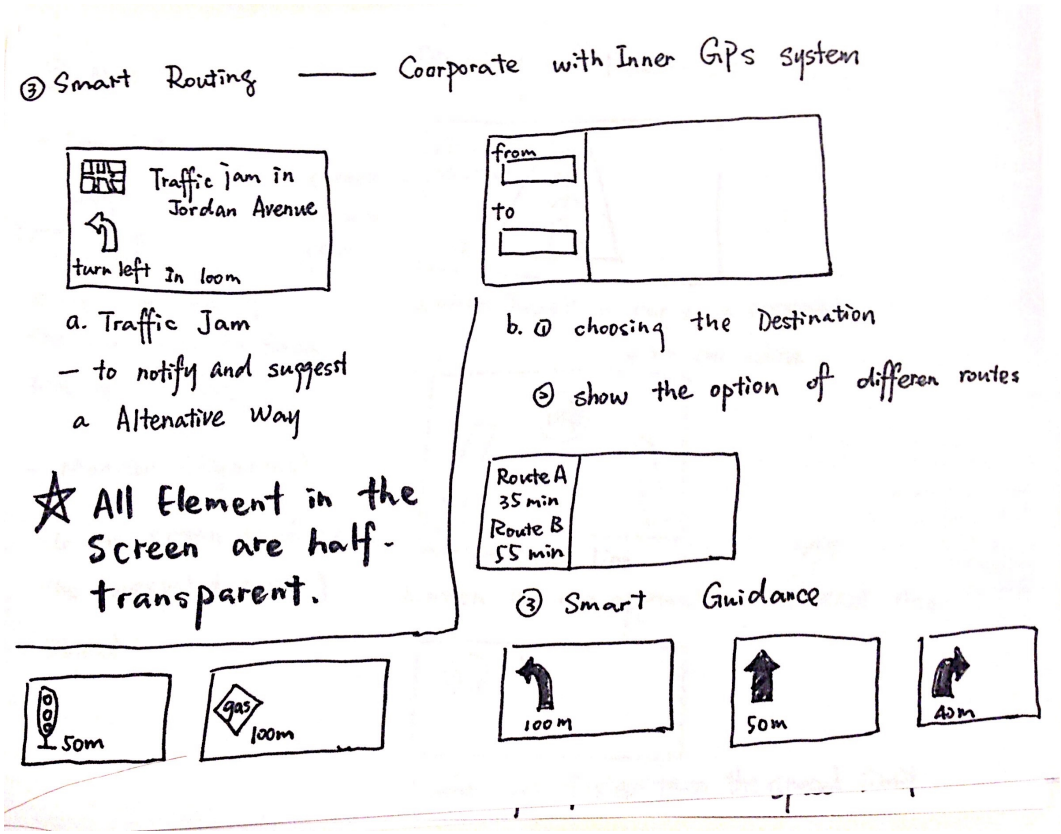
A notification system built in the vehicle that alerts the user when there is passenger close by, or when the vehicle drives towards the sidelines, or when the vehicle exceeds a particular speed limit. A dynamic monitoring system that functions with the help of sensors installed on the periphery of the vehicle.

Concept 4:



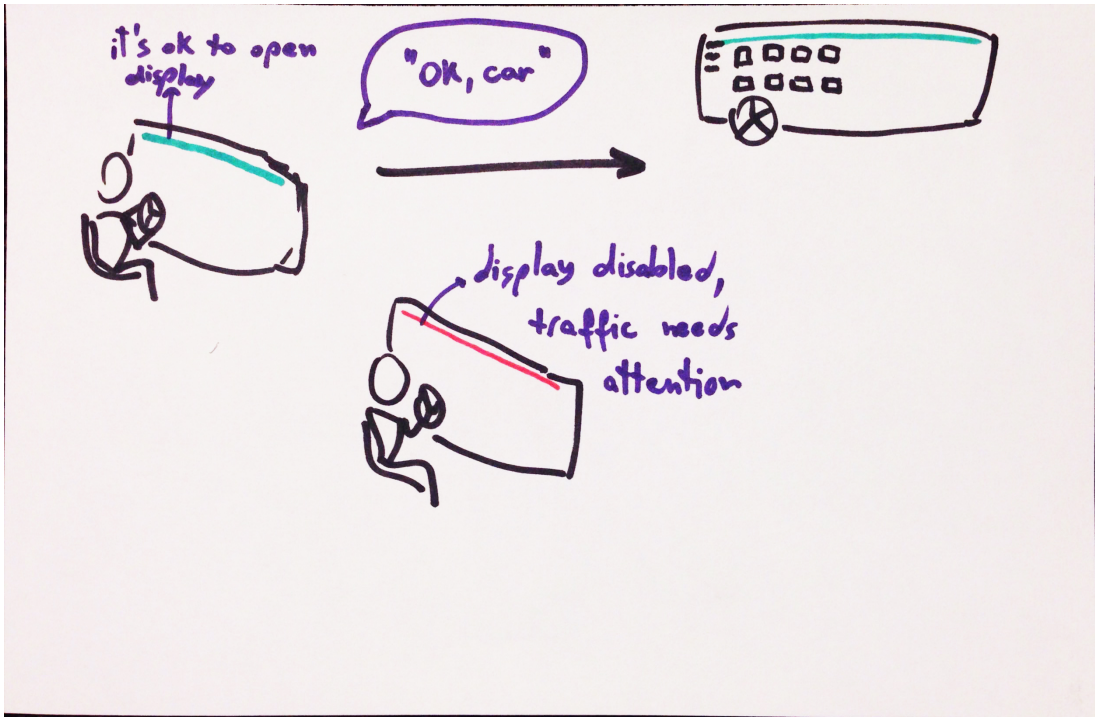
A heads-up-display (HUD) system that appears on the left side of the windshield. It is controlled by the the switch present on the steering wheel. Also, supports voice control which aids in checking email etc.

Concept 5:



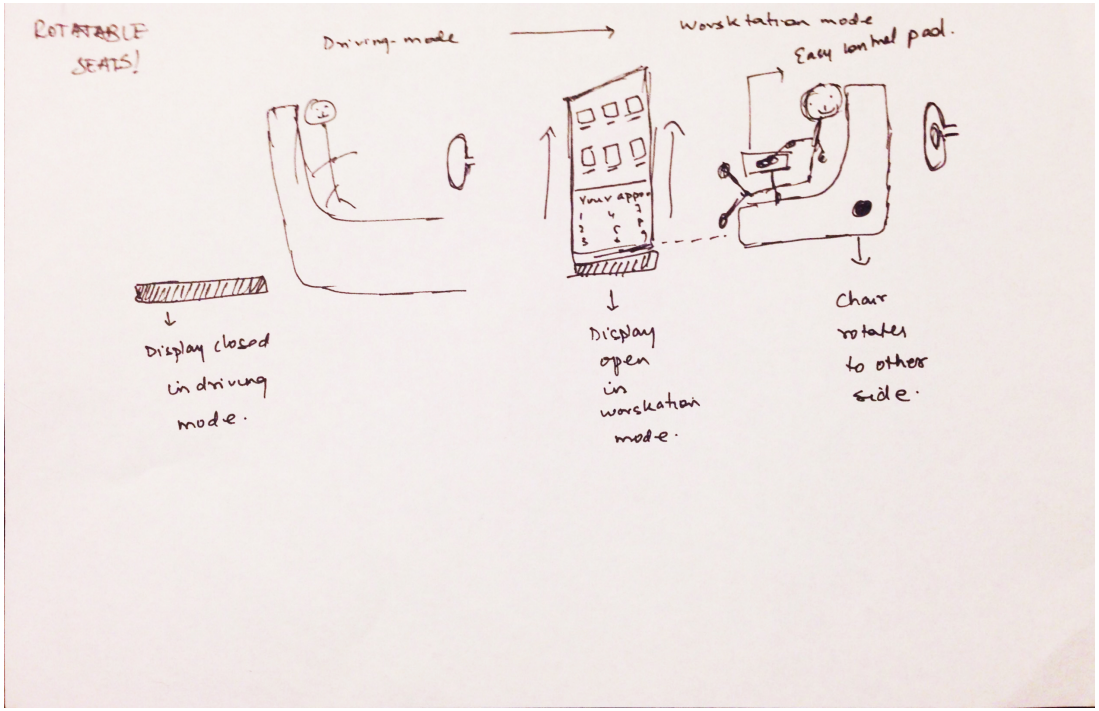
A smart guidance system that shows different routing options. It is displayed on a transparent screen on the windshield. This way the user is still aware about what is on the road. Also, this system displays the different routes and how long they would take to reach the destination.

Concept 6:



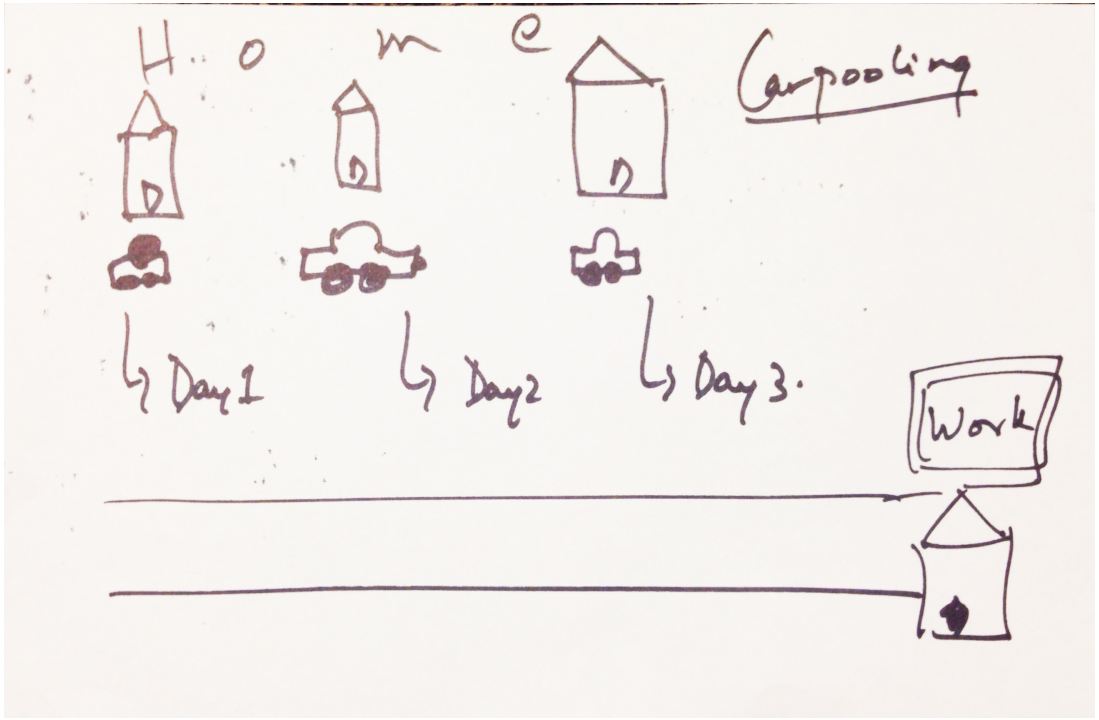
A display mechanism that displays content on the screen only when the system predicts that there is absolute no necessity of attention from the user. It automatically turns off when the traffic needs attention of the user.

Concept 7:



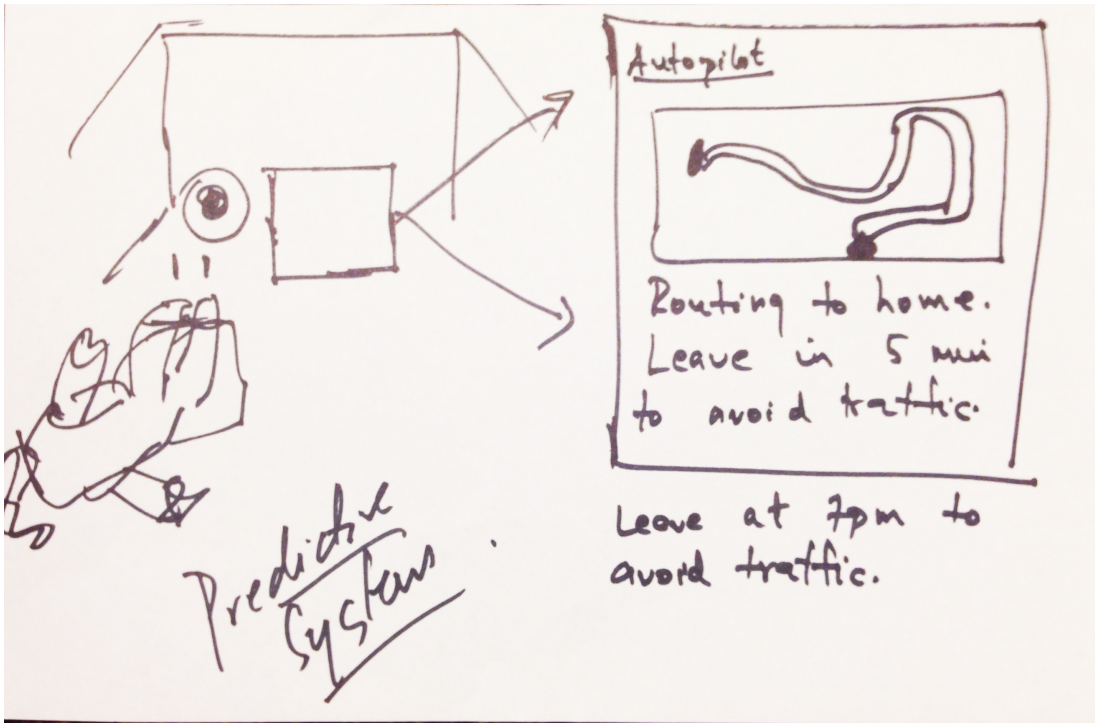
A concept that includes rotatable seats. The seat is rotated to the other side when the user wants to work on something when the car drives automatically. This allows for more room to work on a computer. This system also includes an inbuilt workstation in the vehicle. This is enabled only when the chair rotates to the other side.

Concept 8:



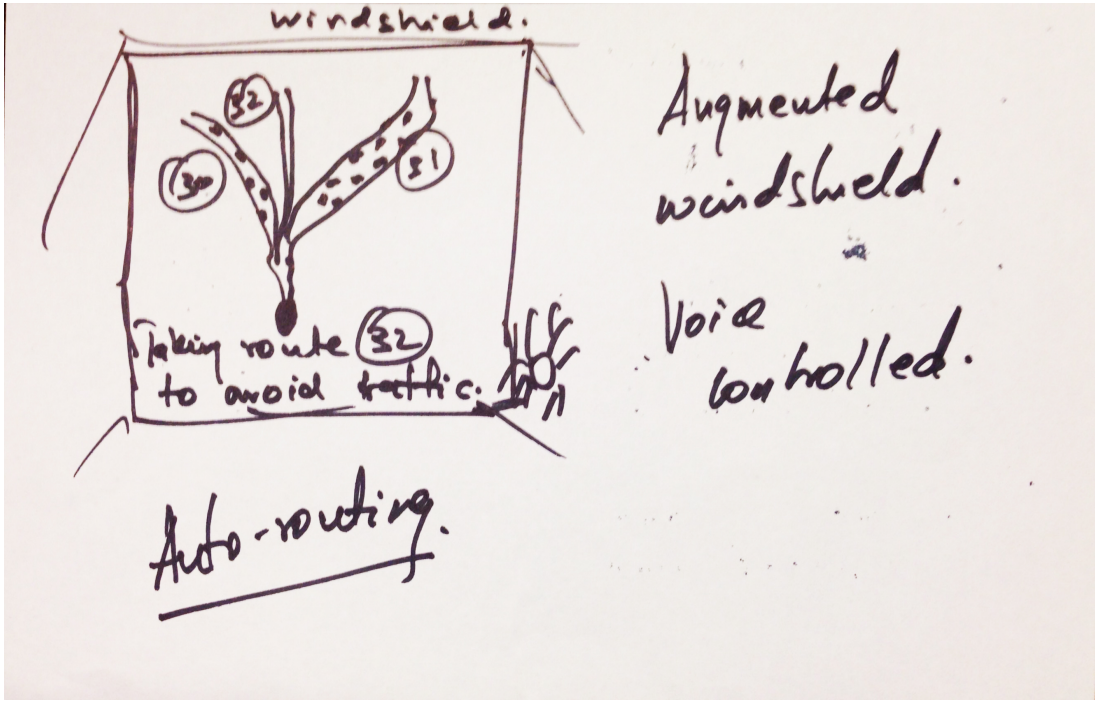
A system that consists of autonomous cars in an area that can coordinate with each other and assist in carpooling. Cars traveling the same route can alternate their ride to work or destination thereby saving on gas.

Concept 9:



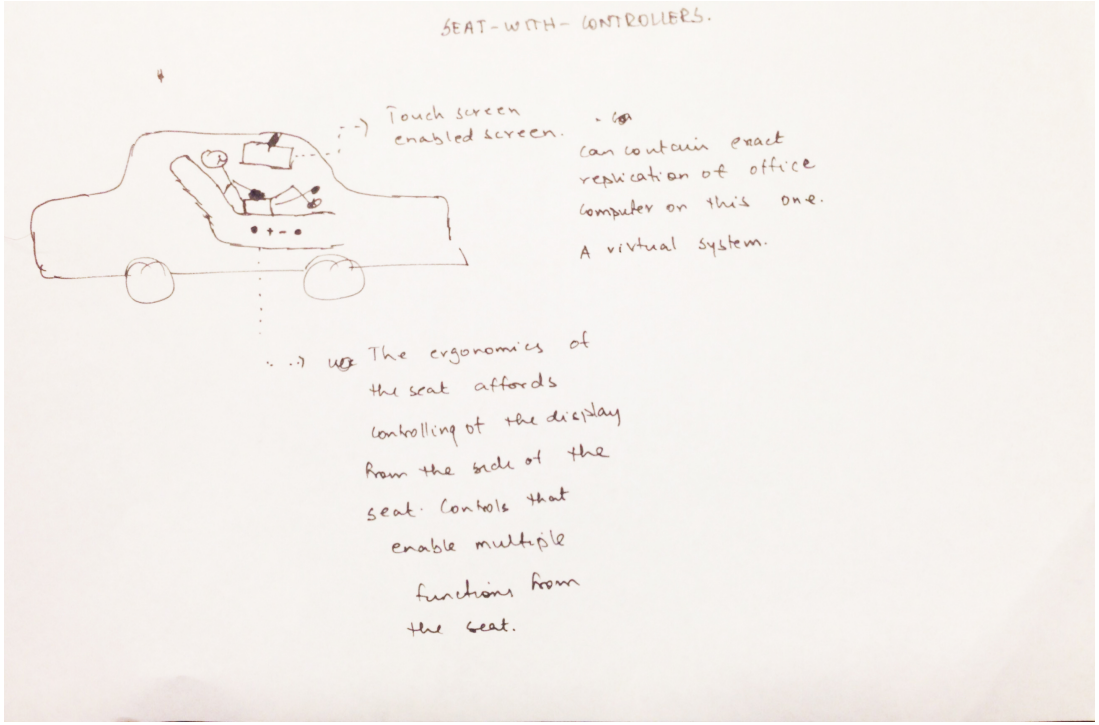
A predictive system that suggests to the user about their travel schedule. It smartly calculates the best time to travel thereby avoiding traffic. Also, can route to take the fastest path to the destination.

Concept 10:



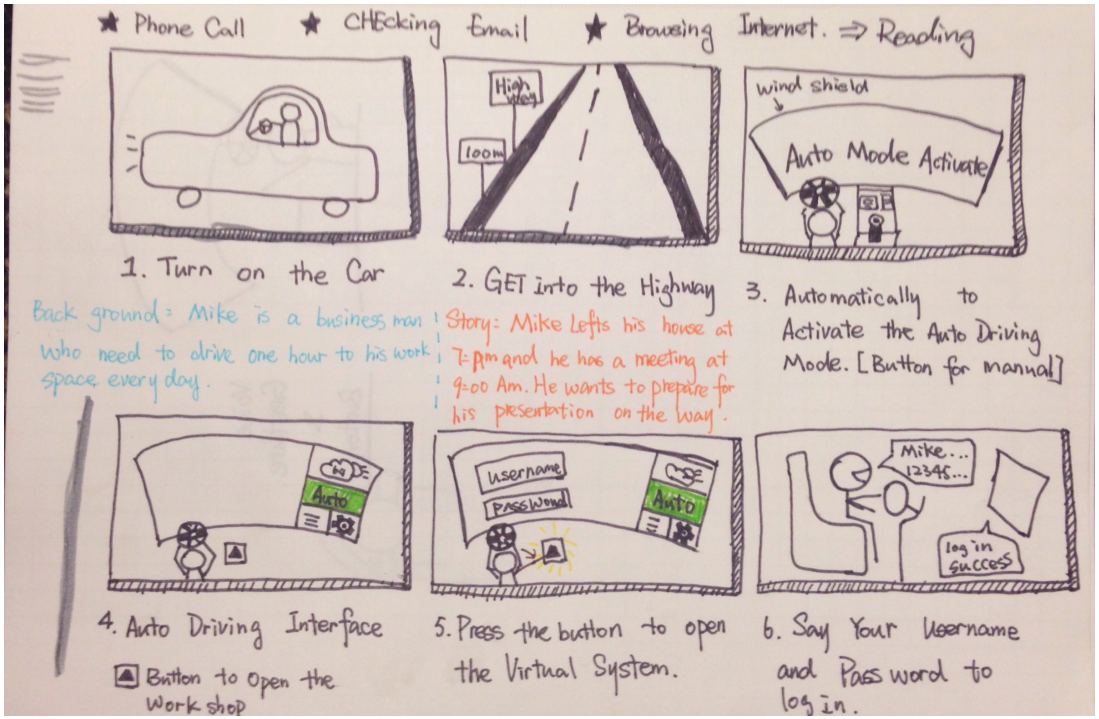
A windshield that is voice controlled. It displays the status of a completely autonomous vehicle. It reroutes to take an alternate route that avoids traffic thereby saving time.

Concept 11:



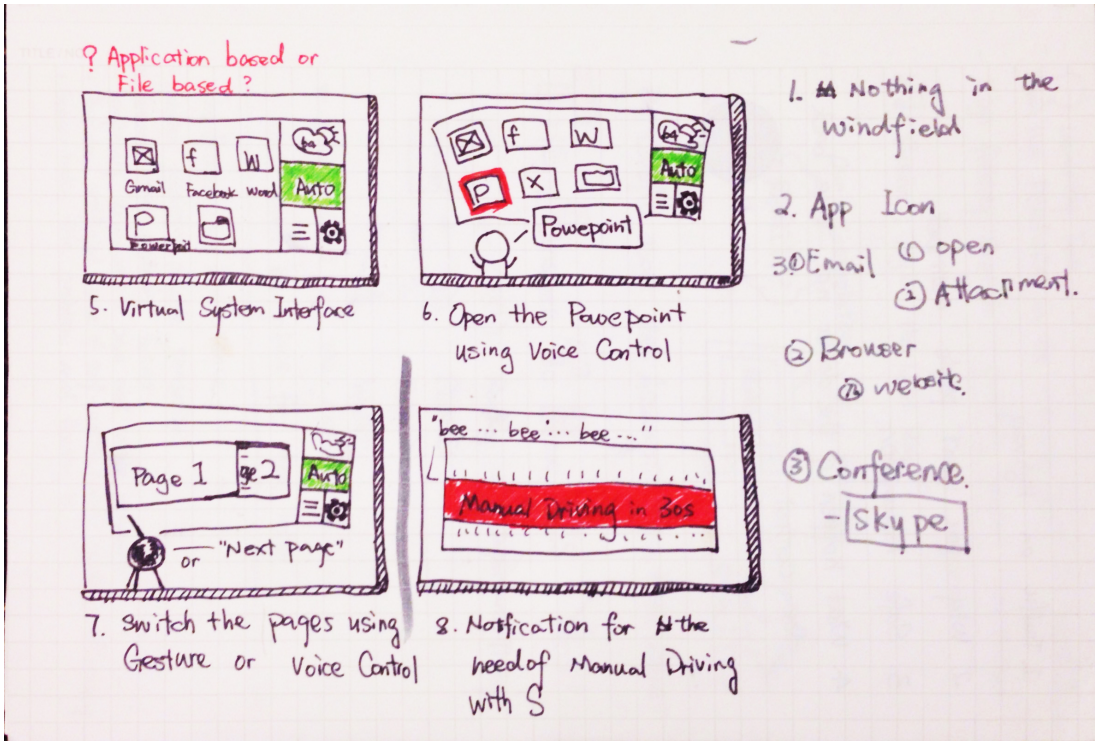
This concept is a redesign that focuses on the ergonomics of the seat that affords controlling of the display which is touchscreen enabled too. This system will mirror the user's office computer through a virtual machine software installed locally on the systems to be mirrored in the car.

Concept 12:



A storyboard illustrating a combination of different earlier concepts that shows how the car automatically shifts to an autopilot mode on reaching the highway.

Concept 13:



A virtual system interface that mirrors the systems from the workplace on the windshield. The switching between screens and application control is achieved through gestures. The system alerts the user to take back control of the system when the traffic needs attention.

4.4. Golden Questions

1. Why would anyone want a self driving car?
To save time, because they don't have to pay attention to the road anymore, so they can do other things in the car. It is practical. It is safer, there is no human error. To maximize productivity at work, because people can browse the internet and check emails at the car instead of at work.

2. How is the self driving car different from the traditional car?
It drives itself so you can use that time to do other things.

3. How automatic the self driving car have to be before people trust it and give their controls of the car to the intelligent system?

4. Will there be any accident or any traffic jam if all the cars in the world are smart car?

5. Who will be responsible for accidents?
The car will sensor if there is anything wrong or different in the road and will give control back to the driver, so he is still responsible. But, because the car is telling the driver to pay more attention, the accidents will be minimized.

6. Can the car fly in the future?
Not yet.

7. How do you define the level of smart?
According to NHTSA (National Highway Traffic Safety Administration), the levels of automation in the ar range from 0 to 4, from totally manual to totally self-driving. This car is a level 2.5, it is self driving in highways and freeways, but it still require a licensed driver for other situations and, even when it can drive itself, the user can take control whenever they want.

8. Why cars always have that kind of shapes? Doors, Wheels and etc. Can I have another appearance of my smart car?

9. Can the car talk to me when I drive alone to make me feel less lonely?

10. Why do I need a working station on my windshield?
The reason why we put the working station on the windshield is that the drivers always look at the windshield, they don't need to change their poses and adjust their seats to working on that. Further, since the windshield is half transparent, the driver can also monitor what it is happening outside briefly. And the working station is connected to other devices via the virtual machine. Therefore, the driver does not have to bring all their stuffs on the way to their work space. Besides, the windshield is big enough which can give the driver a great visual experience.

11. Can I afford the smart car?
In the future, the average revenue will be higher. At the same time the some technical problem of smart car will be solved maturely. Then the cost of smart car will be relatively lower than what it is nowaday. Therefore, people will be able to afford the smart car in the future.

12. If the virtual machine is connected via internet, how can you solve the security issue?

13. Since the car has an intelligent system, what if those who wants to murder me to hack my car system?

14. Why I will enjoy working on the way to my work place? I enjoy working on a stable environment, it is too bumpy for me.
Having the screen in the windshield stabilizes the feeling of bumpiness that you would have if using a laptop.

15. Is it really efficient to work on the way to my work place? Why not just finish my work at home?

16. What kind of energy does the smart car use?

17. Any trade-off between gas fee and efficient life within the smart car?

18. Can the smart car see if other cars are breaking the law?

19. What if I need to use the bathroom in the middle of the trip? Can I make the car stop?
Yes, you can. you can manually change the auto driving mode to manual driving mode.And every time there is a rest station, the car will notify you.

20. If I have to work in the car, will my company pay me extra hours?

21. What if I just want to read a book and not pay for all the extra stuff?

22. How does it improve my life?
First of all, self driving car will drive itself on the highway. So you can do whatever else you want to do on commuting. Second, self driving car will automatically detect the unsafe element and adjust for that which in some extent will be safe for those who drives when they are sleepy or drunk.

23. Why does this have to be embodied in the car? Why not use my laptop?

24. Can people outside the car see what I'm doing through the glass?
No, the glass is one side display. You can see what is in the windshield from inside but you can'ts see that from outside.

25. What happens to the car if the system crashes?

26. When will it work in the city?
No, it won't. It only works in highway or freeway.Therefore, It will automatically detect the exit of the highway or freeway and notify the drive to switch to the manually driving mode.

27. What if there is traffic in the highway or freeway?
the GPS system will detect the traffic no matter it is in freeway or the City. Therefore, once there is a traffic, the notification for manual driving will appear in the windshield to inform the drive to take back of the control.

28. So I just have to work more? Are you encouraging urgency addiction?

29. What if I fall asleep?
If it is on the highway, the car will automatically slow down and switch the lane and part itself in the emergency stop area. There is also an alarm inside the car to wake you up.

30. Why is it just work related? If I have internet, why can't I waste time on Buzzfeed the whole trip?

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