

# LITERATURE ANALYSIS & INSIGHT PROJECT



## INTERACTION OF ENTERTAINMENT SYSTEMS INSIDE DIGITAL INSTRUMENT CLUSTERS IN CARS

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HCIN 5200

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# INTRODUCTION

With an insight of Creating Creativity (Shneiderman, 2000) I formed my creation by different sessions. After the readings and a research. I started to quickly sketch my own scenario and interface, I started to visualize the scenario and create a style, a palette and design each interface element. I looked into exploring new solutions via functionality, and critically reviewed results with the insight of papers we have read in the class. To preview use cases, compositing scenarios that create the performances and after reviewing and replaying session histories I am sharing the results and of my research.

There are two graphical elements I got inspired while doing this project, which stand different than other because of their multi discipline functionality. They are dynamic route audiocrumb guidance system for drivers and intelligent speedometer with tolerance limit.

I am inspired to research digital interfaces for cars by exploring with visual techniques and present development ready graphics. While looking for innovative solutions, I must look into strengths and weaknesses, compare it with existing solutions, and blend virtuality with reality. Any design pattern, visual perception and design is an ability to have a structure for our designs to create relationships while perceiving solutions.

I am also looking for best way of reporting creative innovations, using literature and typographical design and adapt the reader to learn more about the content.



*Every human occupation maybe broken down into three processes, receiving information, processing and decision making, appropriate action. (Freeman, 1969)*

# DRIVER'S SEAT

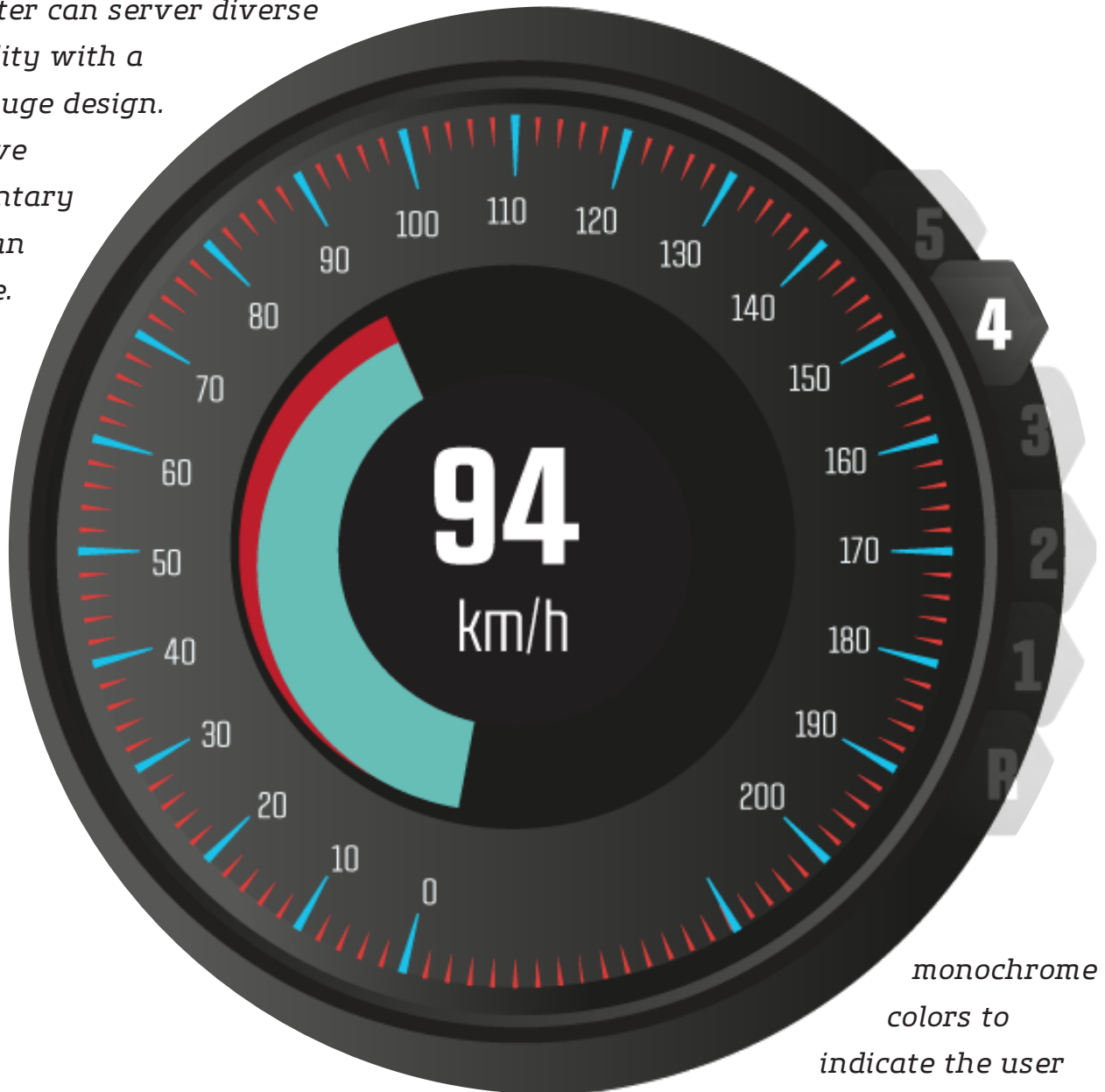
Designing an auto is similar to software design, however since digital car systems are new and industrial designers are only using this technology to promote high-class cars. Consumers as well as car manufacturers are pleased with artistic taste rather than combining aesthetics with functionality. If we need to look for further usability we might have to modify the instrument for the driver's use. The driver uses his five senses while controlling a car. Vision becomes priority at human attention while we are not using often our hearing and tactile senses. Driver skills and his confidence and memory build up by experience; this means the software can acquire each drivers level. This is where walkthroughs and user guidance can help the transition because of the learnability and memorability levels. It takes about two seconds of time to take a quick look at the digital instrument cluster and looking back. For that amount of time, it can take away the driver's concentration. Because head-up displays is observed by the careful driver frequently while this information can be significant it can also be attracting too much attention as a contrast.

## SPEEDOMETER

*Speedometer can server diverse functionality with a colored gauge design.*

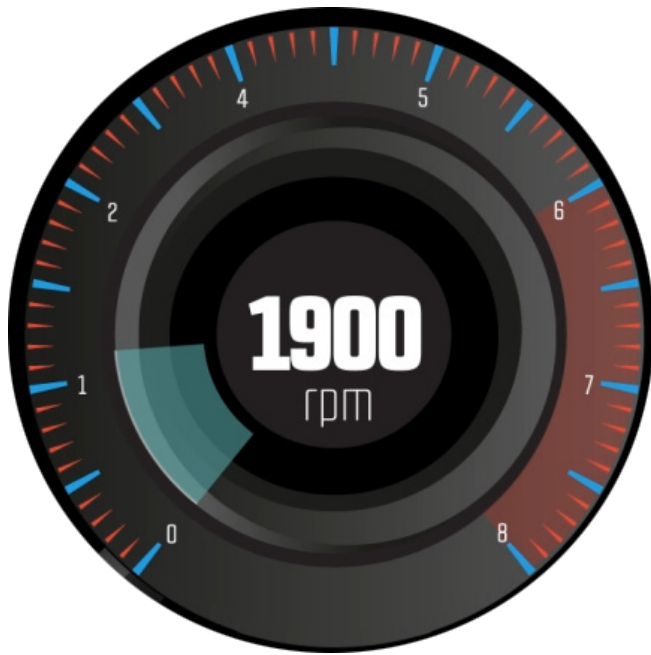
*An intuitive complementary colors as an advantage.*

*The circle bar can use*

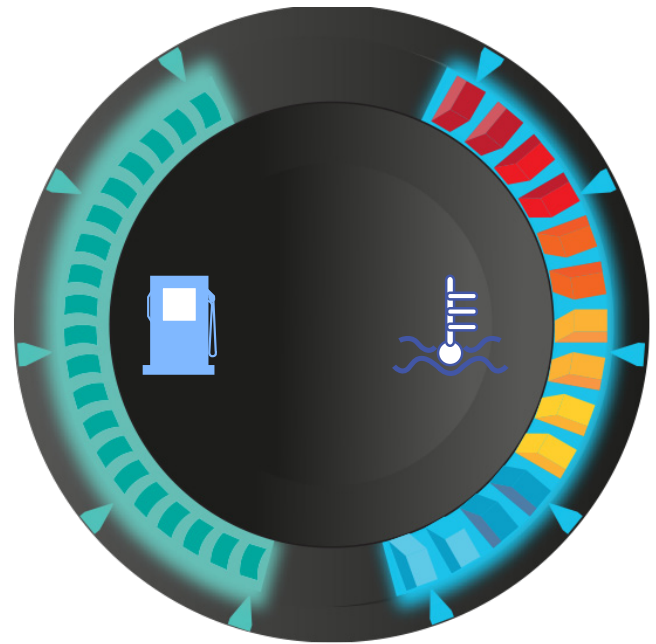


*monochrome colors to indicate the user for any significant speed limit. The gear shift is joined with the speedometer.*

Occasionally, some use-cases when the road has no clear vision or while parking without rear sight can be the only solution. Navigational and traffic warning signs that alerts to driver can be used as guidance for convenient way finding. Usually the next turn, and the time left for destination is the most visited information. Text and icons have to be just legible not to glossy but the level of vibrancy can be adjusted for instant alerts. Distances in meters with the car behind or front, next turn ahead. Any other unnecessary information could be cluttering the screen, and blocking the driver's mind and view, and it might increase the risk of crashes.



*In the danger zone (6000-8000 rpm) is showed to driver by a red circular animation and a circle bar. This is the danger zone, it is recommended to change speed after 2000 rpm.*



*A multi gadget that show the level the fuel tank with the motor heat since it is they both take equal amount of space on a vertically mirrored path.*

Without instruments or gauges automobile drivers will not be aware about the limitations of the car or the guidelines. User guidance assistance for drivers is inevitable in regards for the traffic and everybody's safety. In the digital century, majority of the car owners have access to digital displays and software based car control systems. As designers, I think now it is time for the opportunity of developing better and customized digital gadgets. These must be user-friendly gauges and meters can increase the usability of the car while improving the performance and safety for the driver. Using graphical symbols and information can increase efficiency of driving while getting the attention of users on traffic rules or surrounding dangers. According to the research about head-up displays for planes (Freeman, 1969), vision is the foremost sense of driver's attention.

There are three types of visual elements in the car. Heads up displays, digital instrument cluster, digital displays. Cars have too many sensors but not a lot of space. Digital gauge clusters are the driver's cockpit. It's the link of which the important information that guides the user for controlling the car, more like a dashboard of an operating system. Pilots use head-up displays for landing the airplane. The method of landing the plane is a basic alignment of the symbols

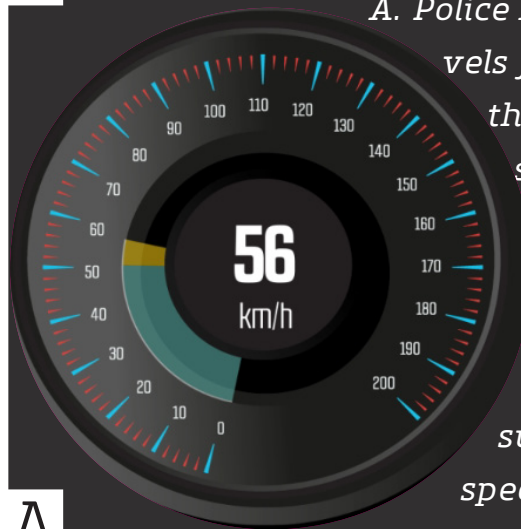


seen in the display with the runway and it is sufficient to accommodate the drift angle of the aircraft.

Any innovation that helps the driver's safety and comfort can gain the auto's functionality. An intuitive approach for the speedometer can be indicating with a simple speed limit. The simpler the innovation is, the more powerful effect it has on creativity and therefore intuitive design, keeping the original of the design and adding natural functionality, by adding another principle to form a pluralist condition.

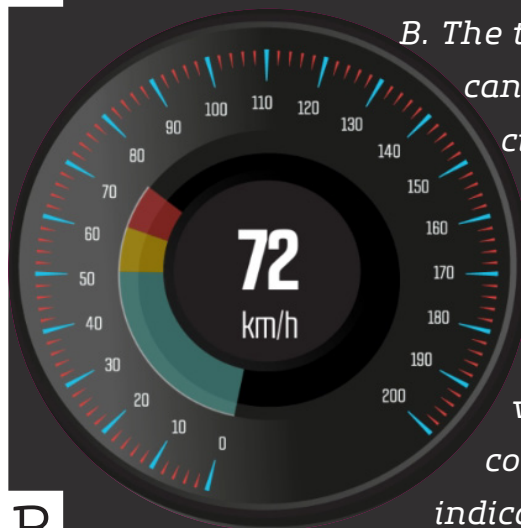
The problem with head-up displays, it reflects light into the user's eyes, but this method produces ghost images as the result of multiple reflections. To increase safety and accuracy of the transparent screens researchers in Taiwan have produced a design for a head-up display that instead uses scatter consists of  $Al_2O_3$  to display the image and it offers a large viewing angle. Like conventional head-up displays, this display still requires drivers to adjust the focal distance of their eyes to read the information. (Pleasants, 2014)

## UNIVERSAL SPEED LIMIT CONTROL



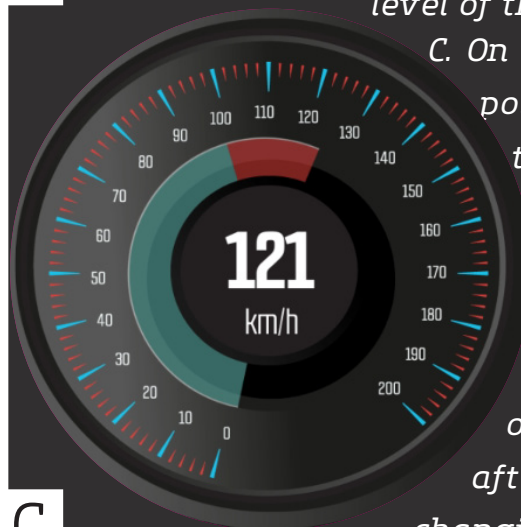
*A. Police has tolerance levels for an amount less than 10 kms over the speed limit. Driver is informed by a simple change of color on the circle bar instantly measuring speed on the speedometer.*

A



*B. The tolerance method can be useful in the city, but police have different tolerance levels in different cities, data is collected on the server to give orange color of feedback to indicate the tolerance level of the speed limit.*

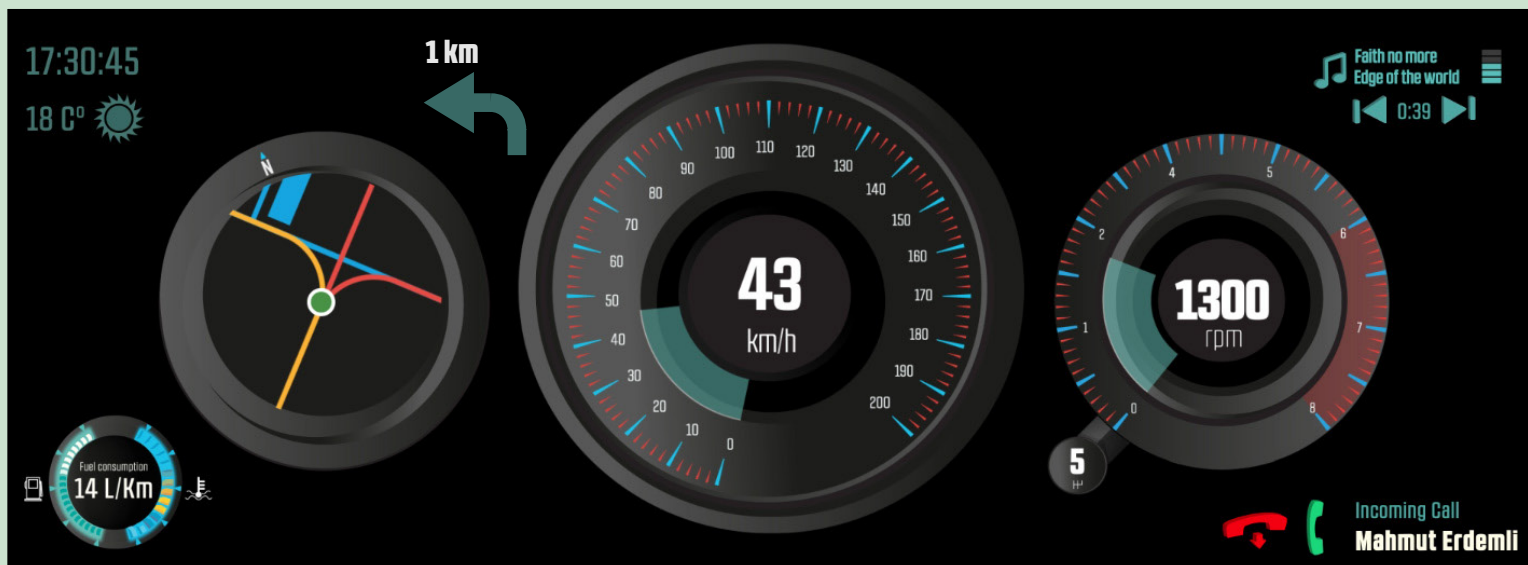
B



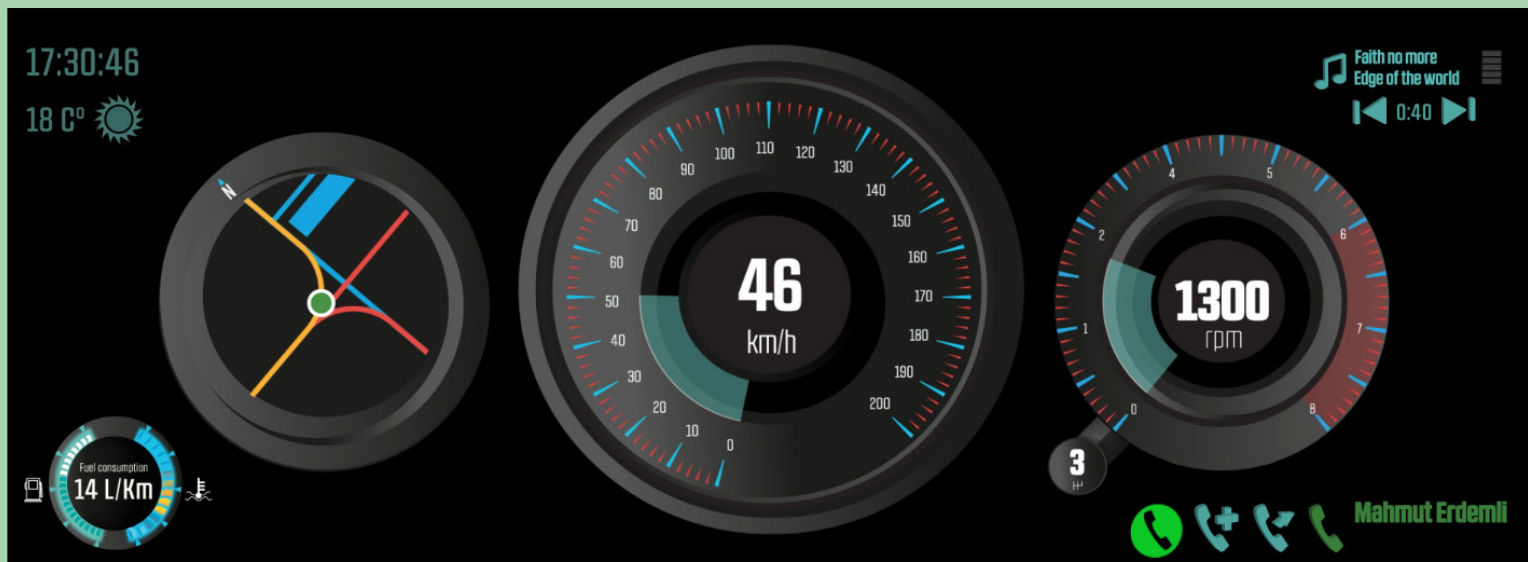
*C. On the highway police has higher tolerance level, the inbetween colors are unnecessary, user is alerted by the indicating only the part after the speed limit changing color to red.*

C

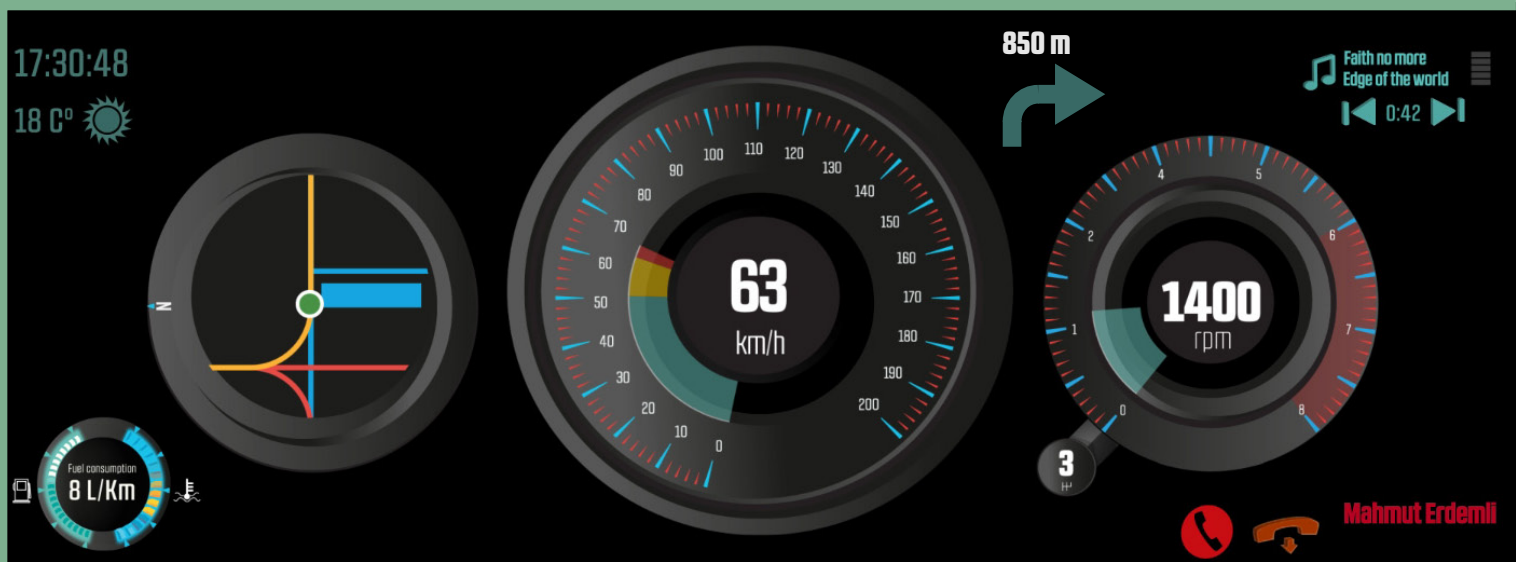
## DIGITAL INSTRUMENT CLUSTER



Receiving a phone call from me.



While a phone call is active, music is on pause.



Music continue to play after a phone call.



The GPS maps are loaded into the digital instrument in a fixed position, and it is aligned next to the other gauges. According to (Van Welie Van der Veer, Elliends 1999), drivers knowing their possibilities at any time will increase satisfaction and memorability. But driver turning his head down and up on a permanent position will decrease performance speed. Visual navigation systems displays left and right icons by turn-by-turn directions. GPS navigation devices that does not use internet, occasionally gets updated , because there are not many user-friendly GPS software on the market today needs to get updated by a connection with cable to a personal computer.

Data plans allow devices access to Internet with 3G services. A server structure as your on cloud, can at least beat the manual updating solution. But more importantly, we can get a frequent information of traffic, as well as synchronization possibility with our online contacts and their locations. This will bring a all new dynamic and active map system.

Essentially, Internet data can be more efficient for traffic. Google maps' response time to get the live traffic data to and from the server is three seconds. Next, this information can help operating the traffic as well as making arrangements between two drivers who are actually adjacent while they are driving. The streaming information between drivers can be practical, for instance to communicate between two drivers that are sharing a lane or physically overtaking the left lane.

Drivers can ask each other to get authorization for directional priority, instead of using car headlights. This can increase safety and satisfaction.

Natural language can gain time, if we can complete our work like making phone calls or building schedules when we drive our cars. Reading emails can be done when driving with checking the social media news while making phone calls and listening to music without evading traffic regulations. The voice recognition mode could also be deactivated with a simple button or a voice command.

Through voice recognition, you could also make voice activated calls, get weather forecast, and write text messages. For driver safety, further research should be done to find out which keywords to use that could remind the system to help controlling the car, For example, "stop the car". What I could think of safety measurements is using tangible controlling interfaces, perhaps magnets on the steering wheel can be applied to give the user the sense of speed.

Voice guided navigation uses voice commands to get directions. It is recorded audio of a person, speaking turn-by-turn directions to the driver. Driver can only add a practice tying a voice command, this is a multi principle approach while the driver always have the visual indicator fixed on the GPS display. On my opinion because of the timing of the audio speech, and it can be distracting because it's a stranger, even my own voice could be very distracting.

My inspiration was to use sound effects instead of voice commands as called as soundcrumbs (Magnusson, Rassmus-Gröhn, & Szymczak, 2012). They are very close toas breadcrumbs in websites, and coins in games specifically game play and the level design for Pacman. Differentially I thought about applying a library of a variety of sound effects as the coefficient for distance instead of adjusting volume level in soundcrumb.

When you are driving on the direction of your destination then driver will hear a short audio effects with an set of audio recordings, depending on whether the user points directly at the target or beside it. The deviation of the sound will depend on the distance to the destination point and it will get choose a similar audio recording exclusively, and this will keep changing as you drive further away. Virtually the recordings can be supported by spheres that are displayed on the windscreen. This can also be used for designation and letting the user can know if he is near by a crumb location. Now, almost all of the cars have stereo audio systems, this can also help determine the direction of the source, and driver will hear the directional sound to realize where he is on the route to get his orientation. To increase efficient, driver will also see icons for services and facilities such or close by fuel stations. This could be a new market for beneficial commercial ads. Driver can customize his own car settings to remind him more often, if the fuel is about to finish. Audio has multiple tracks, one of them could be ambient sound, for example a background sound recorded in the city can guide to keep track of their location, hearing distance to major locations. Hearing an ambient sound with an adjusted level might give an idea of distance, and increase memorability in way finding.

Breadcrumbs pattern can also can increase learnability guiding a certain route. By way of illustration, before making a turn, it can display the approval of the driver on the windscreen, or give a pre signal to the other driver that he should be aware of your next move.



*The icon on the gps also appears on the windshield using augmented reality.*

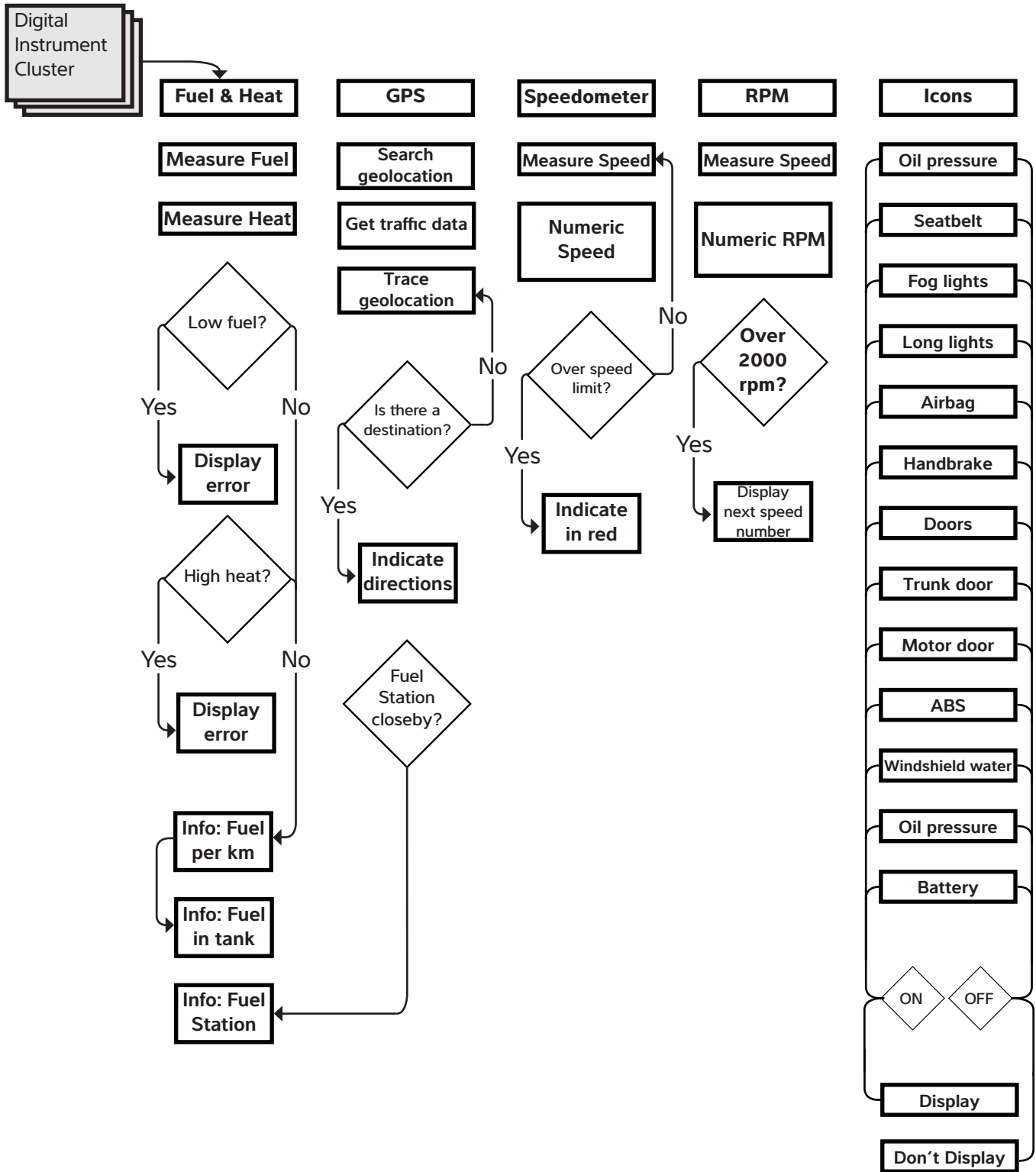


*Audiocrumbs are also assisted by visual appearance of spheres and speed indicators of other drivers.*

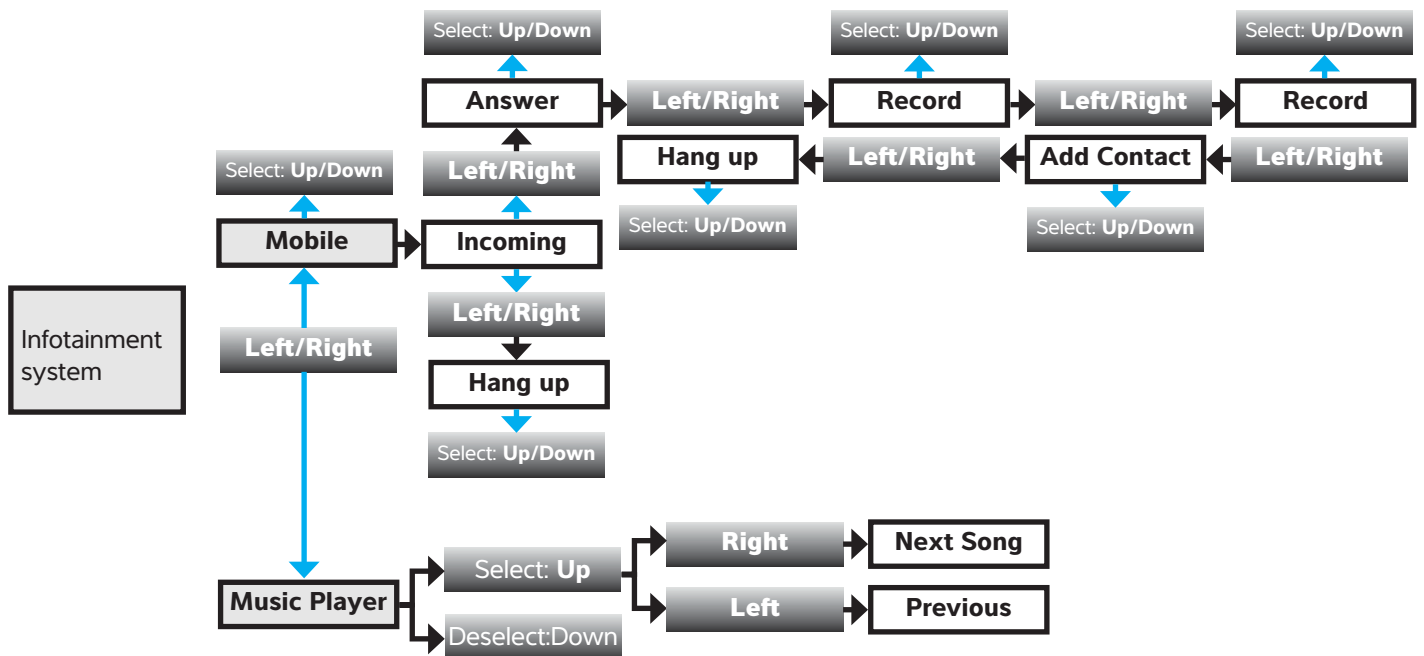


*Parking availability is shared with the driver, by augmented reality an icon will appear and route is given on the digital map.*

# LOGICAL FLOW : DIGITAL INSTRUMENT CLUSTER



## LOGICAL FLOW : INFOTAINMENT CONTROLS ON THE DRIVING WHEEL







# REAR MIRROR

*Rear-view mirror displays are small, these are exterior use and are always projected to sun.*

For the driver, on the side mirror, colour bars are visual references that show closure and perform a break before a possible collision. Cars can use video cameras and sensor radars to acquire the necessary information. Surrounding information and vehicles measurements can be assessed by sensors that can see around the vehicle, Today's technology is a more advanced version of today's blind-spot warning technology. It improves on current products by detecting fast-moving vehicles approaching in the adjoining lane, not just vehicles currently in the car's blind spot. (Fleming, 2013). The problem with rear mirrors is that the rear-view mirror displays are small, these are exterior use and are always projected to sun.

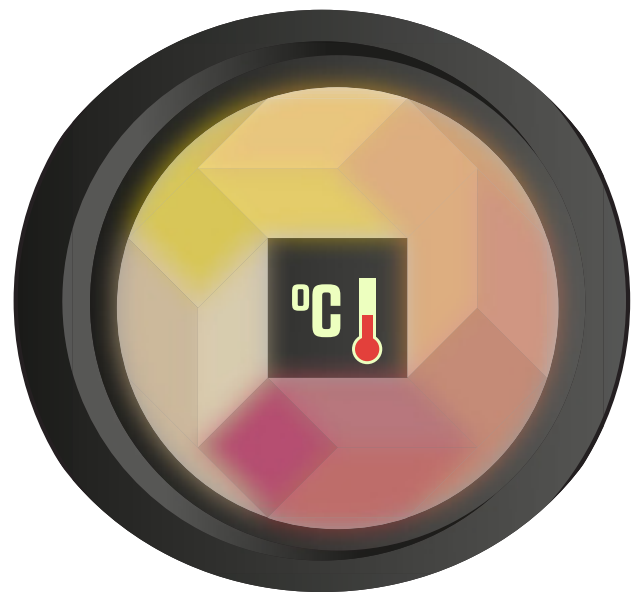
Researchers are following the plane technology (Freeman, 1969) . The set goal is to make the driving experience as close to the planes, with an automatic drive. The first steps to semi-autonomous drive are combining adaptive cruise control with automatic braking and surround view cameras and sensors, plus lane-keeping strategies, to permit a “set it and relax” (but pay attention) highway cruise. (“No simple roadmap to autonomous cars - SAE International,” n.d.)

Minimizing actions and flexibility of passengers and giving more to the driver can increase satisfaction of the driver, and reduce the error rate for the cruise. By only allowing the driver to certain controls, means multi-tasking and interaction between the software and other users.

A circular knob can increase affordance and the level of intuitiveness by giving controls like in the real world. However with the digital implementation, multi-touch controls this can be an anti-pattern while twisting fingertips will be harder then holding the actual knob. A solution can be the number of fingers will increase performance

and memorability. According to the user defined gesture set research (Wobbrock, Morris, & Wilson, 2009) twenty participants decided that fewer touch and a shorter time was rated difficult and it can decrease performance speed.

Although there might be problems with usability, there are advantages of the shape. By giving immediate feedback and provide the heat color is possible to improve satisfaction of the driver.

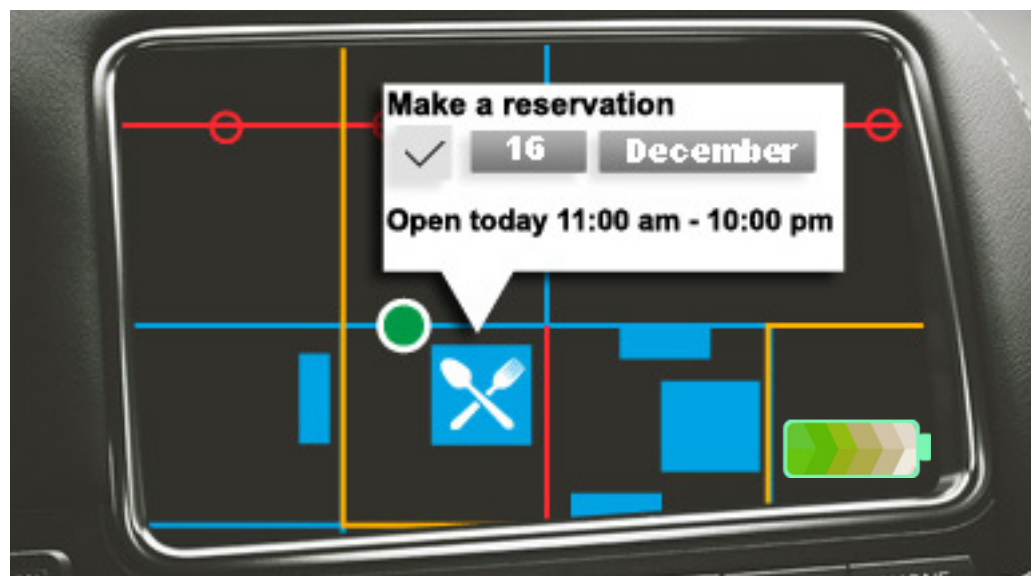
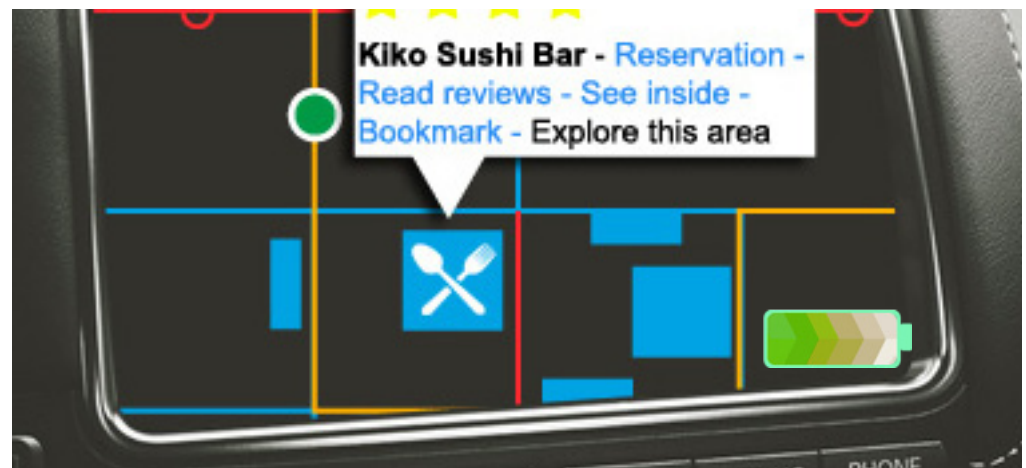


*Touch screen knob control of the central heating system of the car.*

## BACK SEAT

Another interest point for passengers and the driver is the capability of charging mobile phones. While charging their phones, a digital touch screen display can be viewed on the couch display. The problem with wireless charging is not compatible with different products and how much charge they need. But intelligent car systems contain much more than a navigation system and a phone charger. Interaction between passengers as building a decision upon another's decision will can be helpful on changing plans instantly. An accurate

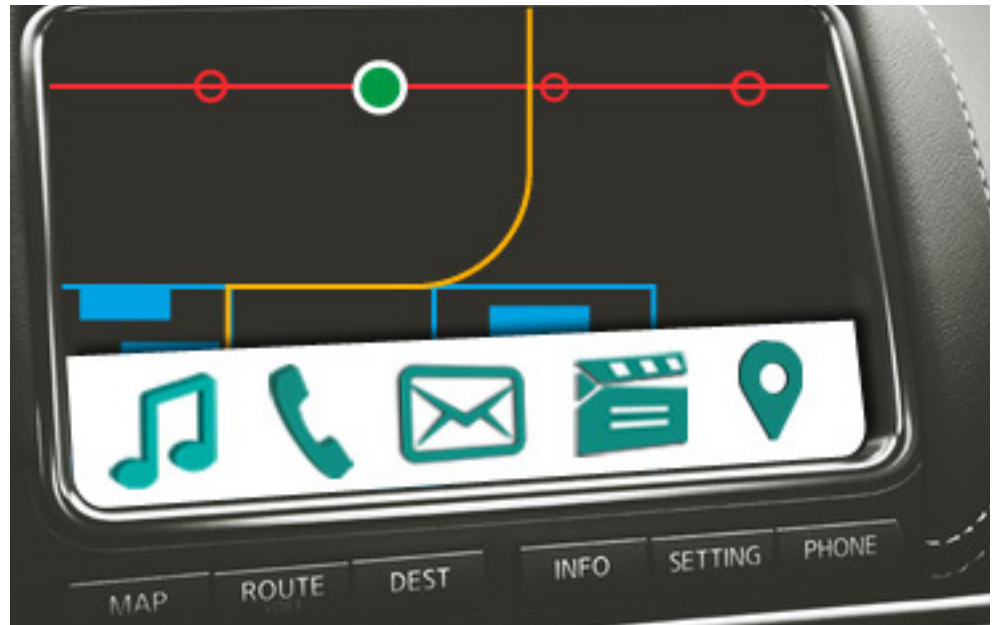
Passengers and driver side by side are negotiating to make a reservation at a nearby facility, on digital maps.



*The facing direction of the location will change when the car is turning in the real world. Therefore the icons identifying the restaurants should be pinned at the their parent object.*

augmented reality display on the car's screens is promising an engaging information system. Looking and scanning around the area seeing another layer on top with 3D depth, can increase the numbers of interaction can be thought creatively. If the voice recognition is paired with passenger's phone, you could naturally command to get navigation information, use infotainment system to get updates and entertainment, like watching a movie. Depending on their points of interest using search via natural language while they are driving, This can lead to see other driver's appearance on the map.

TOUCHSCREEN AT THE BACK SEAT



*Menu and buttons are layed out and aligned as groups to increase memorability and to increase the performance speed.*

# DISCUSSION

I liked the idea to get receive audio interactively with others as individual shops or businesses, maybe with the insight of sound designers this can turn into a rhythm and musical information. If it is done wrong then this must not be present concurrently, the overall effect can be cacophonous. (Mcgookin, Brewster, & Priego, 2009).

Augmented reality can be a solution to project traffic and navigation warnings, and it might optimize traffic accidents. But it should also not be amplified too often. Driver can loose attention with too much information. The transition shall be slow since, the virtual world data can make the user dizzy depending of the level of training. Natural language can be effectively used while driving and increase performance. Drivers are commonly speaking while driving, A strong proof we are changing our habits on interaction with technology, is Siri, that iis becoming popular on mobiles, Talking can be vice versa, it would feel warm and like you have your co-pilot in your car.

Cars are spatial, because it is isolated, there is a social circle inside the car that is distriicted from outside. With close friends or alone it is more convenient to use natural language.

A digital instrument cluster can be customizable and include customized apps, which might have to be approved by the local traffic safety administrations.

With the help of open-source community, drivers are able to send feedback and volunteer to take part of the developing process of user interfaces in their car's systems. In addition, getting personal information about the driver, will let the car know more about its owners interest points. Depending on this, the system can tell the level of danger of the next move or if there were incidents occurred around this area.



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