2030: The Future of Traveling

INTERACTION CONCEPT FOR FLYING CARS

Abstract

The advent of new automotive technology at a lightning fast pace has led the auto industry to push the limits and rethink what an automobile can do. The same advancement has led to the realization of flying cars - a dream weaved in the minds of people right when the first aircraft took of successfully. Companies like Aeromobil and Terrafugia have shown through their auto models that the future is finally here. This is equally magical and inevitable.

Extensive research has been going on for decades on the personal airborne mobility solutions. In the case of flying cars, the real challenge is posed not just in the technological limitations but mostly in the human limitations and its more challenging than ever to successfully and safely mold human to machines and vice versa. The proposed concept in this poster attempts to devise some new user-centered interaction methods for such a flying car of the future.

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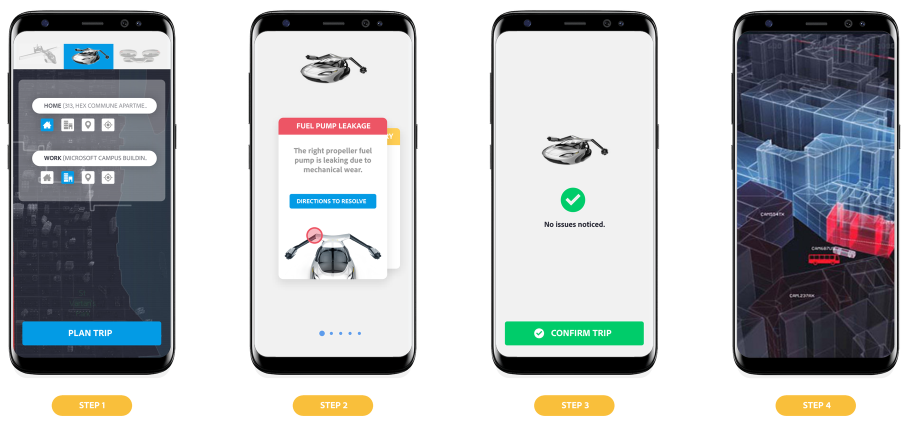
Commute from Home to Work

CAR-2030 runs on an operating system, seamlessly integrated with other devices (wearable and mobile phone) of the user. A pre-plan feature has been proposed in this concept where the user plans his journey even before entering the car so that all the necessary checks can be performed before hand over the network, saving the time and effort of the user. The user can use the *CAR MODE* while he is in the lift or having breakfast. This feature has been incorporated in the concept after an extensive research on the aviation industry where the current feature is analogous to the time consuming flight planning and maintenance activities after every flight. Since most of the activities are moving towards adapting IoT, it's safe to assume that most of these checks can be done via mobile phones/ personal devices over the network in the future.

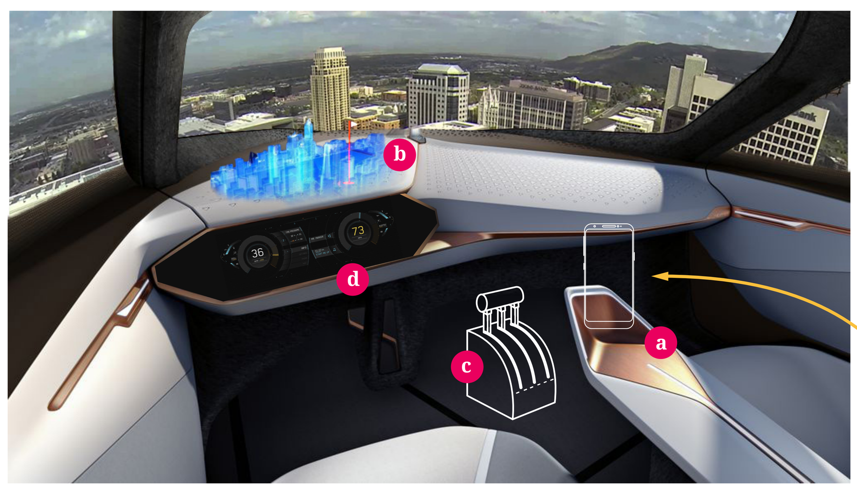


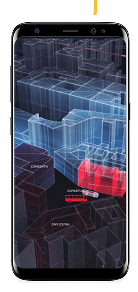
STEP 1 — Through *CAR MODE* on the mobile phone, the user starts by choosing the car he wishes to travel in, followed by choosing the source and destination to perform an overall route check comprising technical checks after each flight, the route weather conditions, fuel availability, etc. to gain an overall idea of the feasibility and safety of the flight. The user can easily choose the predefines 'home' and 'work' options (most used) for efficiency.

STEP 2 — If there are any issues in the overall route planning, it shows up as swipe-able critical (red, unskippable) and warning (yellow, skippable) cards having direction to rectify that issue. Full screen cards are used instead of lists for prominence and to avoid the missing of a critical issue. After all the issues are resolved (or if there are no issues in the first place) the user confirms the trip planning in Step 3.

STEP 3 — Once there are no issues, the user confirms the trip and information of the same is sent to the car over the network so that a customized experience (trip route visualization, weather updates and further directions, etc.) for that particular route is created when the user starts his trip.

STEP 4 — After the confirmation, the user can see a full 3D visualization of the route including the surroundings and the airway for effective visualization.
User and desk research indicated that correct and effective visualization in aviation is one of the most important factors to be considered for safe flight.





a. Once the user enters the car, he already has a full assistive system ready for the trip he/she is about to take. Although the car already has the information of the trip received via network, in case of any network issues, the user can easily dock the phone in position 'a' (as shown in the image) to transfer the information via the seamless OS in the car and the phone.

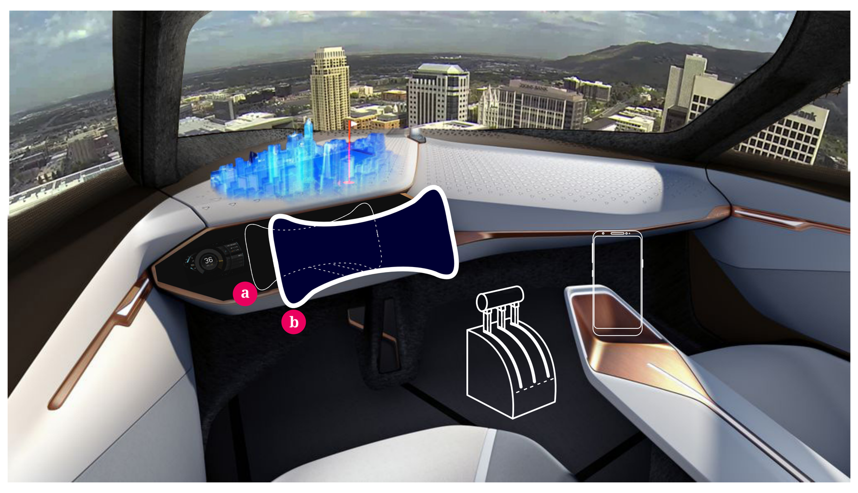
b. The map shown on the mobile during the trip can be viewed as a full 3D hologram (position 'b' in the image) over the surface of the dashboard which changes realtime as the trip progresses for an exceptional situational awareness.

c. One addition to the overall car interior is the throttle lever (position 'c' in the image) similar to a passenger aircraft to control the engine speed. The foot controls of accelerator and brake are not used during flying mode to reduce complexity in the overall car control. On ground, accelerator and brake are used very frequently which is not the case when the car is airborne. The throttle is included in the system for its rich affordance and intuitiveness.

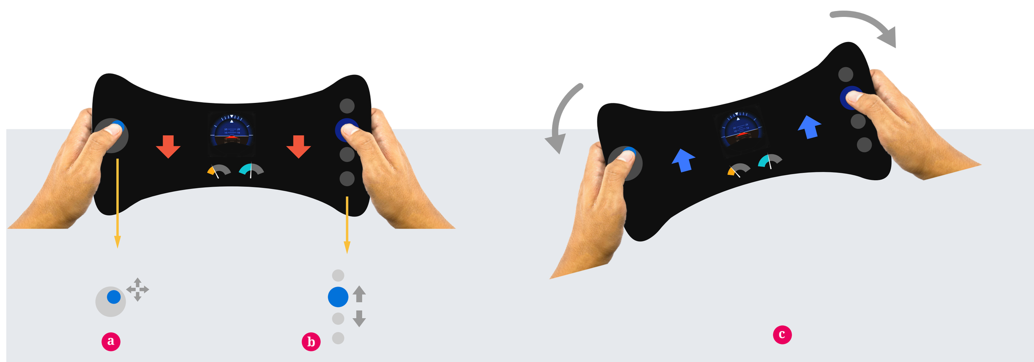
d. Instead of using too much information on the HUD, the not-so crucial information is shown in the infotainment screen in front of the driver. The panel acts as a screen in the autonomous mode and retracts forward in manual mode to act as a steering wheel.

Manual Flying Mode & Speeding Up

Following the design principles closely, the interactions have been proposed to assist the user in every case.
For example, only the required information is shown at a given moment of time like the retraction and steering control and information display on it is applicable only when manual flying mode is activated and the digital information shown on it is the sufficient amount for successful control and least cognitive load. Human factors and ergonomics also play a critical role in the interaction design process like in this case the form and size of the steering control. Usage of gestures in this context is derived from the day to day familiar gestures and intuitiveness of the same efficient control.

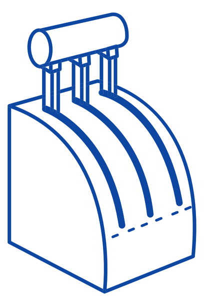


If the car is airborne and due to a malfunction the autonomous flying systems stops (as given in problem statement), a steering retracts forward from the dashboard screen given in front of the driver's seat. In autonomous mode, the steering is seamlessly integrated in the screen working as a display and comes out only when required (like in this case of malfunction). The steering also works as a multi gestured digital display which is used to display some information and also works as an ambient media. The image shows the initial position of the steering (a) and the position after forward retraction (b).



The steering concept is formed keeping in mind the ergonomics of hand-held game controllers and a traditional steering wheel. On the backside the steering has a grip for the four fingers and the front side is a full display panel with extreme left and right vertical columns for control via thumbs. The center panel acts as a information display having altitude meter, fuel and engine health status among the most important ones.

a. The left thumb is used as a multi directional control for the hologram above the dashboard which can be used to view the hologram in any direction and zoom.
b. The right vertical column is used to vertically swipe different car controls such as music, air conditioner, calls, etc.
c. The blue arrows (pointing up) and red arrows (pointing down) are utilized as ambient media where the user doesn't have to look at the steering control while driving but the blinking of these colored arrows gives the user an indication to increase (blue) or decrease (red) the altitude while focusing on the surroundings.



Controlling the speed of the airborne car is done through the engine rotor speed both in vertical thrust cars (similar to drones) and winged cars (similar to aircrafts). Since the speed of the car and skill of the driver comes into play mostly in the take off and landing use cases, it is of utmost importance to keep the control intuitive and straight forward.

Speeding Up

To speed up **winged cars**, the thrust lever should be pushed upwards which will eventually start raising the altitude of the car. It should be then compensated with forward tilt of the car with the help of the steering control which tilts the back part of the wing resulting in desired forward tilt.
Similarly for **propeller (drone-type) cars**, the angle of the propeller is changed with the steering control pushing the car forward which can then be sped up more by increasing the rotor speed using thrust lever. Drone type cars can also hover at one point by balancing the weight of the car with the vertical thrust, keeping the propeller angle parallel to the ground.

Neutral Position

Flight tilt is another important feature in aviation.
The above image shows the steering control in the neutral position keeping the car horizontal while flying.

Tilt Backwards

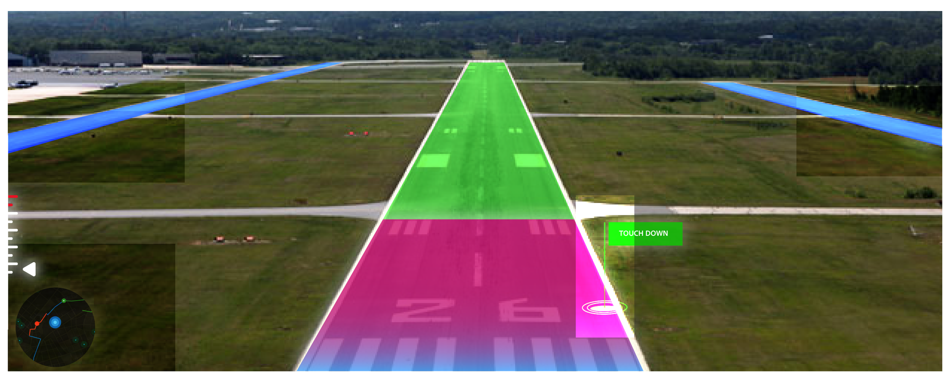
To raise altitude, the steering control is tilted backwards simultaneously increasing the engine speed with the throttle lever. Tilting the steering control backwards changes the wing orientation (in a winged car similar to a passenger aircraft) and the propeller angle (in a drone-type car similar to a chopper).

Tilt Forward

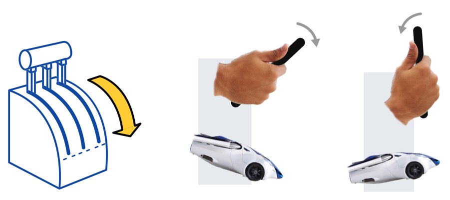
Similar to the backward tilting, the front tilting also works according to the same principle. To decrease the altitude, the engine speed shall be reduced from the thruster lever along with continuous front tilt of the car.

Landing Interaction & Scenario

This section proposes an effective landing interaction, HUD display of information and an airstrip system built to make the landing more efficient (in terms of space and affordability) and safe.
The real world aviation has been the inspiration in this case where the landing interaction in the car has been kept somewhat similar to the current scenario because of the intuitive factor, easy learnability and landing process criticality.

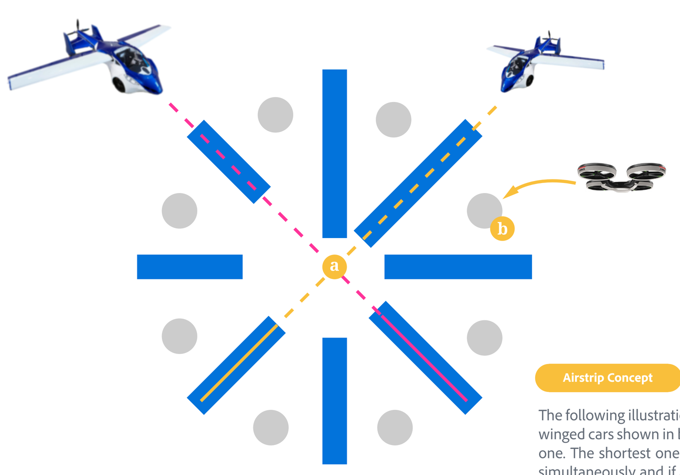


One of the most effective ways of visualization in CAR-2030 is using the Head Up Display (HUD) to show crucial information on the windscreen. Only the relevant information shall be given in the HUD such as relevant location based tags, surrounding vehicles, the route direction with altitude variation gradient, overall route map and altitude indicator. In the given image, the pathway has a gradient to show that the altitude needs to be slightly lowered in the coming direction (towards magenta color) and this is where the blinking arrows on the steering control come into play to guide the user of the altitude variation.



Landing Interaction

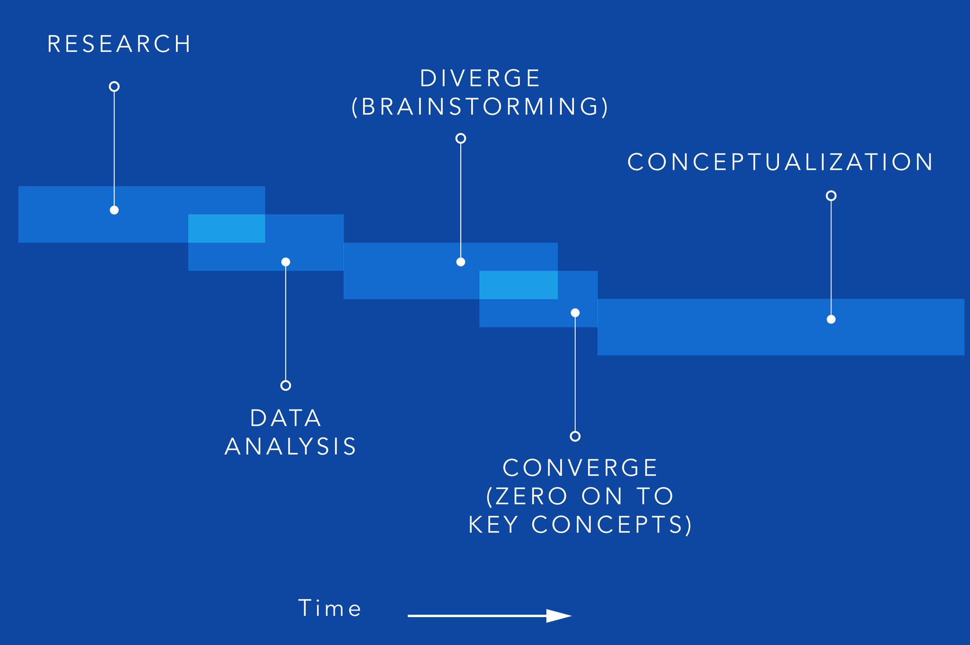
As discussed in the previous section of Manual Flying Control, landing will be done using the throttle lever and steering control simultaneously. The driver/pilot slowly starts to pull down the throttle lever from its current position and at the same time starts tilting the car forward. This will ensure descend and to maintain it smoothly a small backward tilt to maintain balance (as done in ideal aircraft scenarios). So the interaction can be summed as **Lever Down -- forward tilt -- little backward tilt -- repeat**. The HUD assists the driver at all times and here it shows a touch down area (range) in the airstrip which is the safe area to make first contact while landing.



Airstrip Concept

The following illustrations shows a landing system for the given scenario for maximum space utilization while ensuring safety. The airstrips (for winged cars shown in blue color) are in a spiral arrangement with each clockwise consecutive strip a certain length 'x' shorter than the previous one. The shortest one is the safe length of an ideal runway. This is done because, in an edge case, cars from all the 8 directions will come simultaneously and if all the runways were of same length, they'd have collided at the center of the circle. Therefore the length 'x' is the safe area for touchdown of an airstrip making the system collision proof where at point (a) the altitudes of each of the car will be different.
Propeller cars will land on the grey circles (b) using vertical landing. Therefore an effective landing of (minimum) 16 cars can be done safely and simultaneously using the proposed system.

DESIGN PROCESS



The current design brief deals with the interaction design concept of the future. To propose a concept of such sort, the design process shall be tailored to achieve the results in the same line. In such scenarios, diverging is an important phenomenon and the same has been adapted for the current design process. Future scenario and solution conceptualization requires a little more focus on brainstorming and prototyping than research. Every problem statement requires a different approach and the design process shown above seems fit for the current design brief.

RESEARCH FINDINGS

- **Landing** and **Take-Off** are the most **critical** processes in a flight due to a perfect requirement of precision and control. Most of the driver/pilot effort is needed here.
- Pilots and drivers alike have stressed on the sheer **importance** of effective **visualization** in a successful journey.
- Most of the interviewed users were concerned about the **safety** during flight and wanted to be **reassured** of the same.
- From desk research, it was found out that there can be two types of flying cars which can come into existence -
  (i) Winged Cars (similar to aircrafts, less likely to become commercial due to their space and usage requirements)

  (ii) Propeller Cars (similar to drones and more likely to become commercial)

DESIGN PRINCIPLES

- **Prevent Information Overload** to avoid panic and reduce the cognitive load on the driver by showing only the needed information.
- **Reduce the learning time** by establishing proper and intuitive controls throughout the system.
- **System** (including User Interface) should be **forgiving**. Since human errors are extremely dangerous in this case, the system should accommodate such errors to save lives.
- Focus on **Effective Visualization**. Visualization and visual aid help in reducing errors and reassure safety by giving a good idea of the situational awareness to the driver.
- Establish **consistency** in control and interactions throughout the system. This will help in both reducing the learning time as well as in reducing the excessive cognitive load on the driver.

ASSUMPTIONS

- There is enough oxygen at the maximum altitude the car is flying and therefore no special oxygen equipment is needed.
- All the cars in a certain pre defined proximity will be connected with each other to ensure a safer commute and to minimize air congestion.
- The user knows the basics know-hows of the flying car (It may or may not be the first time).
- There is sufficient space in all the locations (home, work, shops, etc.) for the car to land and take off.
- There are more than one levels of flying altitudes for a better air traffic management and effective allotment of routes (while planning through mobile) according to the source and destination information.
- The car is connected to the network at all times.

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