



EDV Technologies

Technical Plan

Your technical plan will require that you answer five questions within the allotted word count. Keep in mind, you are explaining to the judges the "why" and the "how" for your design, so try to use as much detail and evidence as possible. Don't forget to check out the Judging page to view the scoring guide.

What is the concept for your dashboard of the future?

We propose a dashboard with futuristic information components, embedded within a largely traditional graphic presentation. Postwar baby-boomers are a growing demographic cohort; a radical redesign of the driving interface would confuse and distract the majority of drivers, while scuttling 60 years of ergonomic engineering.

El Diseño Verde (EDV) is envisioned for initial implementation in high-end 2015-2020 model year vehicles. It assumes widespread implementation of Intelligent Transportation Systems (ITS) and availability of telematics-related information services. Vehicles exchange peer-to-peer messages for functions such as intersection collision avoidance and road condition advisories; and traffic management centers monitor movements of vehicles (subject to privacy safeguards), providing information on traffic incidents, weather, transit schedules and status. Most of this is transparent to the driver.

EDV is a broad set of functionality rather than merely a display. It is a partnership with the driver, to achieve economy, safety and consistency. Display layout and the driver's record may be ported among multiple vehicles, including rentals (analogous to SIM cards carrying user details among phones).

A centerpiece of our vision is the EDV GreenPoints program that encourages efficient driving. EDV continuously calculates maximum instantaneous potential fuel economy, based on the performance of other vehicles on a given stretch of road under similar conditions. It compares it to current performance, and awards GreenPoints on that basis, which can be used to earn discounts on car parts or even a new car. Users can view their friends' green driving stats and are motivated to surpass them.

EDV's navigation system evaluates routes based on gradients and economy, as well as drive time, ease of maneuvers and scenic value. Furthermore, it constantly profiles the route ahead, makes gear shifts in anticipation of a hill to reduce engine strain, and optionally notifies the driver if speed adjustments could improve efficiency (in cooperation with the forward collision avoidance system).

Beyond controlling the vehicle, EDV interacts with friends needing a ride, and evaluates transit alternatives in real time, enabling enormous improvements in driving efficiency.

Information and notifications appear in two display areas, both Organic LED (OLED): the instrument cluster and center waterfall navigation/media/green console. The displays are user-configurable in terms of layout, colors, digital vs analog, measurement units, etc., subject to local laws.

Upon turning the car on, a welcome screen shows green driving statistics, diagnostics such as sparkplug condition, and tips on efficient driving. When the car is in drive, the instrument cluster displays a tachometer, speedometer, odometer, fuel range and distance to the nearest fuel station, cabin and engine temperature, simplified navigation instructions, and an overview of the car's systems that affect fuel economy. The outlines for these glow green if the driver is driving efficiently, blue if average, and red if inefficient. The eco-status in the center waterfall display graphically reports the history of driving efficiency. This console also serves as a complete command center for all of the car's functions. This provides a clean, informative interface.

How will your dashboard design and related feedback mechanisms support behavior change to help drivers maximize fuel efficiency and reduce environmental impact?

Most drivers would like to drive efficiently, but they lack information: (a) engineering impacts of behaviors—e.g. on a hot day, is it better to roll down windows and suffer drag, or is airconditioning more economical? (b) traffic conditions and optimal routes; (c) other players in the transportation system: travelers in need of a ride, other available modes of transportation. EDV automatically gathers extensive information and performs complex analyses, while presenting a simple and intuitive interface to drivers. GreenPoints reward behaviors that achieve the greatest environmental savings.

- * A Friends List offers opportunities for ride sharing. Drivers see ride requests from friends, detailing the friend's location and destination. If a ride is arranged, it can reduce fuel consumption by almost 50%.
- * Drivers are presented with alternative transport options. EDV checks transit on-time status, factors in time and parking cost at the station or destination, and calculates ETAs and the time, costs and green benefits of pulling over and switching to rail or bus. The driver decides based on subjective factors such as time criticality, neighborhood quality, etc.
- * Drive mode autosets are displayed in the zone between the instrument cluster and center console. Tips encourage a driver (a) to use the eco option to make gearing and acceleration more gentle, (b) to turn off unneeded cylinders when cruising, (c) to turn off AWD and (d) to turn off air conditioning.
- * Graphics and audio advisories encourage acceleration before a hill to reduce engine strain.

- * Comprehensive map overlays display fuel stations and price as the car starts to run out of fuel.
- * Cruise control is strongly encouraged when the car is on the freeway at a steady speed. This option is promoted by gently pulsing the brightness of the steering wheel's cruise buttons.
- * The driver can exchange warnings with other drivers (using the 4G network through a press of a button in the center console) regarding weather, traffic, accidents, or contingencies like fallen trees. Bypassing these potential hazards can save drivers precious time and fuel.
- * At the end of a drive, the instrument cluster displays how much energy the driver saved and how it compares to previous instances of driving on the same route. It offers the option to upload driving results to social networking websites to brag to friends. The driving record and preferences can be transferred from car to car via wireless or physical media, verified by face recognition or biometrics. This makes drivers' statistics readily available and they can try to better them on different cars.

Probably the most compelling reason to drive efficiently is the GreenPoints program that awards discounts for car parts and other items (not gasoline—that would encourage driving). The GreenPoints balance is constantly displayed in the instrument cluster, and the tips section offers ways to increase one's score. These displays and opportunities for discounts motivate drivers to use less energy and drive better.

How does your dashboard design and related feedback mechanisms comply and defy Federal Motor Vehicle Safety Standards?

Our design is guided by NHTSA Safety Assurance standards and regulations, Part 571, available at <http://www.nhtsa.dot.gov/cars/rules/import/fmvss/index.html>, in particular Standards 101-105, 201-205. No aspect of the design explicitly violates NHTSA policy.

The EDV incorporates or provides an interface for the following safety features:

§ While the instrument cluster is configurable by the driver, certain key gauges are in fixed positions with minimum size specifications.

§ Rear-view mirrors are supplemented (not replaced) by an array of visible-spectrum and infrared cameras along the sides and rear of the vehicle, with images stitched into a 180° panorama. The display is in the instrument panel or center console, configurable by the driver. The passenger-side and rear views in the camera array are useful while parking. With camera technology decreasing in price, this can be implemented even on lower-end cars. The infrared feature is useful in poor weather; however the system is vulnerable to dirt on exterior cameras.

§ Lateral collision avoidance warning at speeds above 10 mph. This is implemented using two or more cameras and image analysis to determine the distance to objects in the 180° rear-facing zone. The system does not operate at low speeds to avoid alerts while parking.

§ Adaptive cruise control and forward collision avoidance. This is essential as EDV promotes cruise control for maximum fuel economy. The sonar-based control regulates speed based on separation to vehicles ahead, and warns if separation is falling too rapidly for manual control. The impending-collision system triggers the brakes if the speed difference is too great, whether or not cruise control is enabled. This feature too is disabled at low speeds.

§ Lane change alert, based on optical lane striping sensors, local positioning beacons and/or GPS, to sense involuntary lane changes. Unlike lateral collision avoidance, this operates with or without the presence of other vehicles.

§ The dashboard provides for pedestrian detection. A forward infrared camera senses pedestrians and animals, and provides an audio warning and pre-charges brakes.

§ The center console receives and displays warnings from other vehicles on hazardous situations; e.g. black ice, freeway pileups in poor visibility. Depending on the nature of the condition, the warnings trigger automatic actions in the drive system, or visible/audible warnings to the driver. Some aspects of the warnings can be driver-controlled and stored in the driver's preferences profile.

§ Minimally distracting: brightness, voice inputs and feedback, minimal tiered menus

§ Park assist (as seen in many modern cars)

§ Emission sensors detect harmful chemicals such as dioxins entering the cabin.

§ Particulate matter sensors in the exhaust system and tailpipe measure environmentally harmful chemicals and unburnt fuel.

§ The steering wheel provides room for an airbag, and is covered in soft leather. Materials in the EDV have a soft, forgiving feel that would not cause personal injury in the event of an accident. These include soft rubber in the trim pieces, and a foam/polyurethane composite for the main dash. Flexible OLED screens do not shatter in an accident.

How does your design measure and visually display data reflecting fuel economy, environmental impact, and vehicle position?

Communication Overview

There are two media of communication to the driver: (a) touch-activated OLED displays; (b) voice notifications, configurable through the settings in the center console.

OLED screens have high black levels, minimal energy usage, generate no superfluous backlighting in night driving, and have a low environmental impact during manufacture.

Navigation instructions are voice-synthesized. Triggered by the Mode button on the steering wheel, the system reads drive-time vehicle diagnostics, tips for driving more efficiently, immediate feedback for driving decisions that could affect fuel economy, and messages from drivers' phones.

Drivers may also control car functions with their voice.

Diagnostics in English (or preferred language), rather than cryptic icons, advise drivers about mechanical problems, the presentation dependent on urgency or negative effect on driving efficiency.

Measurement

Fuel economy, load factor and particulate matter/noxious emissions are measured by the on-board diagnostics (OBD) computer. An accelerometer measures road gradient, comparing it to GPS coordinates and road data in the navigation system. From the internet, EDV accesses historic fuel economy statistics for the section of road, under comparable traffic and weather conditions, and computes the efficiency of the vehicle relative to the historic record of other vehicles.

Display

1. The Fuel-section on the left side of the instrument cluster (A) displays instantaneous fuel economy, distance until the car is out of fuel, and distance to the nearest fuel station.
 2. The Drive-Tips section is to the right of the cluster (B). It addresses the most prominent factors currently affecting efficiency: AWD, A/C, Cruise Control in eco-cruising mode, and cylinder usage. This panel also has an leaf image that is pieced together as the driver enables/disables the aforementioned systems to achieve better fuel efficiency. Also present are automatic presets, which include shaping of the bodywork for aerodynamics. This gives drivers a quick, direct, and traditional way to improve their driving economy.
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1. Both information panels have vari-hued bezels that go from green to blue to red, rating efficiency and environmental impact from best to worst. The bezel of the instrument cluster (C) also reflects the environmental impact with these colors. Colors encircling each panel glow in hues from green to blue to red, depending on current driving. Efficiency calculations are the same as those that award GreenPoints. The glow is adjusted depending on ambient lighting, to attract attention without distraction.
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1. On the Waterfall console (D), “Enviro-status” details driving habits—best/worst efficiencies, a graph spanning the vehicle life to the past hour, the amount of energy that a driver saved, and the car’s systems that are working together for optimal efficiency.
 2. Lastly, the synthesized voice reports environmental impacts for every unique action that saves or expends energy. When a voice tells a driver that it would cost \$10 to turn off eco-cruise over a 500 mile journey, drivers are better compelled to retain it, saving fuel and the environment. The purpose of these outputs is to provide a simple, clear message about the environmental ramifications of a common current function like cruise control.

How did the individual strengths and interests of your team members result in a collaborative effort?

The team is composed of three sophomore students at Dos Pueblos High School in Santa Barbara, California.

Jake Moghtader is very interested in emerging computer technologies. He is knowledgeable on Flash, which we used extensively in the design process to create our respective visions. Jake was a proponent of the OLED display, a crucial aspect of our green design. His animation skills proved to be helpful as we constructed our video pitch. As he was the only one of our trio old enough to drive, he had real-world advice. He also enlisted our mentor, Kevin Schantz, an invaluable asset to our design team.

Kelvin Noronha brought this competition to our attention, and invited Jake and Nikhil to form a team. He has been infatuated with cars since infancy, and this interest helped him envision the design and functionality of the EDV dashboard. He was the architect of GreenPoints. Another brain-child of his was the panoramic rear view “mirrors,” in which multiple cameras generate a seamless 180° rear view. Kelvin argued for a traditional dashboard layout to avoid alienating those accustomed to analog instruments.

Nikhil Shinday provided a strong technical and practical viewpoint for the dashboard idea. The idea of “having sensors and cameras everywhere” (in the tailpipe and engine to measure emissions, in the tires, in the engine, etc.) was his, as was the basic idea of the multi-function OLED display in the center console. Nikhil also worked on some of the software interfaces, using his design prowess to advantage. His interest in technology and his desire to become an engineer kept our ideas realistic.

Kevin Schantz, our mentor, is an automotive software engineer and his constructive advice and knowledge of the technology behind modern cars enabled our team to think more realistically about design issues and practical solutions.

Our goal was to create a design that was innovative, safe, affordable (in the future), and above all, green. As long-standing friends, the numerous team meetings were a strong bonding experience, and the project challenged our respective skills, our sense of environmental responsibility and our passion for cars.