

## AN INTUITIVE STEERING WHEEL



### Reducing driver distraction

In today's vehicles, visual GUIs and auditory cues (including voice interfaces) are the main way of giving a driver feedback. But our senses of seeing and hearing may get overloaded, which can cause severe driver distraction. To better protect the driver, the HARMAN FX (Future Experience) team has developed a solution to this problem: the Shape-Shifting Steering Wheel offers a new way of interfacing. It changes its thickness dynamically to subtly convey information to the driver.

### Why change of thickness to convey information?

The steering wheel's robotic actuators can slightly lift each finger, separately or all at the same time, and at various speeds. This thickness change is perceived by humans via their sense of proprioception which is under-utilized in today's HMIs: this is the sense that allows us to feel the size and shape of objects we touch without looking and, e.g., distinguish an orange from a banana, blindfolded.

HARMAN has developed a whole new language that allows the car to communicate with the driver in a completely different way, not adding to driver information overload. In fact, the information from a shape-shifting steering wheel is perceived almost subconsciously. At the same time, the learning curve is very flat, and most drivers do not even need any instruction to immediately understand what the car is telling them.

There are a large number of use cases that can take advantage of this way of conveying information to the driver. They include navigation and safety. For example, the steering wheel can indicate the steepness of upcoming turns, provide merger and blind spot alerts, countdown to turns, frontal collision alerts, pedestrian alerts, hidden object alerts, and many more.

### Key highlights

- Steering wheel conveys information to the driver by changing its thickness
- Allows car to communicate with driver in an almost subconscious way
- May reduce driver sensory overload as senses are largely processed in parallel
- This is an industry first, and a radically novel user experience (UX), protected by multiple patents (granted and pending)

### HARMAN LIVS

HARMAN's Life-Enhancing Intelligent Vehicle Solutions (LIVS) use an end-to-end approach by integrating the in-car computing platform with the cloud platform for a new level of user experience.

#### SCALABLE | Compute Platforms

Tailor-made for the needs of automakers and vehicle segments

#### CONNECTED | Modular Connectivity

Ready for delivering connected services – enhancing efficiency, productivity, and entertainment

#### SAFE | ADAS & E-Horizon

Monitoring and assessing the surroundings of the entire vehicle and beyond line of sight

#### SECURE | 5+1 Security Architecture

Full protection for the driver and the vehicle, OTA (over-the-air) updateable

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## Features and benefits

New communication channel	<ul style="list-style-type: none"><li>• The system creates a new communication channel between car and driver which relies on a human sense which is under-utilized in cars today</li><li>• With the system, the driver can be alerted in a subtle way to indicate information such as when to turn, and how steep the upcoming turn will be</li></ul>
Not adding to information overload	<ul style="list-style-type: none"><li>• The system does not add to information overload because people can process certain sensory information in parallel. The changing thickness of the steering wheel is clearly perceived simultaneously while the driver is looking at the road and talking to people</li></ul>
Flat learning curve	<ul style="list-style-type: none"><li>• Drivers need little to no instructions to understand what the car would like to tell them</li></ul>
New language	<ul style="list-style-type: none"><li>• HARMAN has developed a new proprioceptive language which uses the actuators under each finger in many different ways – separately or together, statically or dynamically – as a sequence of motions to create a highly expressive back channel between car and driver</li></ul>
Mechanical features and actuators	<ul style="list-style-type: none"><li>• Mechanical actuators can lift each of the driver's fingers on the steering wheel, separately or in sync, at various speeds</li><li>• The current prototype uses servos which rotate a lead nut on a short, rigidly mounted segment of a lead screw. The lead nut pushes on a flexible brass finer to translate the movement to the entire finger</li></ul>
Alternative actuators	<ul style="list-style-type: none"><li>• For an MVP, the suggested technology may be a steering wheel overlay with built-in pneumatic actuators and wireless connectivity to the vehicle</li></ul>

## An industry expert as partner

HARMAN is the market leader in connected car solutions for the world's automakers. HARMAN's innovative and highly integrated infotainment technologies offer automakers the most extensive solutions for advanced navigation, intuitive user interfaces, integrated audio, device connectivity, cyber security, and connected safety, just to name a few. From Boston to Berlin to Bangalore, HARMAN is delivering a dynamic in-car experience for an increasingly connected world. HARMAN is a wholly-owned subsidiary of Samsung Electronics Co., Ltd.

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