Displays, HUD and Augmented Reality

WardsAuto UX, Oct. 4, 2016
Our Vision:
A global leader in automotive cockpit electronics delivering a rich, connected cockpit experience for all cars from luxury to entry segment.

Our Mission:
To be the foremost leader in driver information and connected infotainment solutions that enables a rich driving experience in a safe and convenient manner. We will achieve this through relentless pursuit of excellence in electronics and software technology as well as global execution.
Broadest cockpit electronics portfolio in the industry

Complete cockpit electronics portfolio positions Visteon well for continued growth
Topics for Today

• Displays proliferation and user interaction

• Driver information display trends

• HUDs and augmented reality
Trends in display integration in instrument panel: wider displays

Extra-wide information display, shared between driver and passenger

BMW Concept Interactive Vision (CES 2016)
PSA Citroen CXperience (Paris 2016)
Mercedes F015 (IAA 2015)
Avoiding driver distraction

• Wider information display, or dedicated passenger display, allows for additional content (entertainment, services) for passenger

• To avoid driver distraction, a privacy mode feature is then required (static or switchable)

Multiplication of displays requires increased focus on driver distraction avoidance
Trends in display integration in instrument panel: seamless

- Designers wish to seamlessly integrate displays in instrument panel
- Freeform shapes, no visible display active areas
- Will touch still be the most adapted solution for user interaction?
Future spatial gesture recognition solutions

- Visteon InfraRed technology unit
- Hand approach and tracking
- Swipe left / right
- CW / CCW rotation

- Low-cost CMOS camera
- Static gesture
- increased spatial recognition envelop
- Multiple axis detection

- Time of Flight camera technology
- High-quality proximity detection
- 3-D hand gesture detection
- Virtual touch panel
- Driver / passenger identification

From simple gesture recognition to more elaborate body language
Driver information display trends
Reconfigurable clusters becoming standard; designers looking for ways to enhance driver experience

Growing interest in technologies increasing depth of the image – enabling 3-D effects – for a more immersive experience
Increased depth for driver information

Multi-layer display
• Delivers depth with use of transparent display over traditional display

Prism display
• Delivers depth with use of two displays and a semi-reflective “blade” in between

Auto-stereoscopic display
• Uses switchable parallax barriers to generate 3-D effect
• Requires eye-tracking information for smoother experience
Prism display

- Scalable concept using standard LCD-TFTs display sizes

- Importance of GUI definition to maximize benefits of 3-D effects and transitions

- Prototype sample (mass production in 2019)
HUD and augmented reality
HUD – Visteon’s history

The head up display creates an unleashed selling point on the 3008 and 5008 Peugeot vehicles.

Head of purchasing, PSA

After being first to market with combiner HUD, Visteon HUDs proliferate across regions and customers.

Visteon wins PSA Innovations Award

2009

2010

2012

Acura C-SUV
China

PSA Expert / Jumpy / Traveler / Space Tourer
Europe

SGM GL8
China

Late 2016
Japan OEM X

2017
Japan OEM Y

2018
N. America OEM

2019
Japan OEM Z
Europe OEM

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HUD roadmap – from standard HUDs to augmented reality

Field of View

- **2010**: 4.5° x 1.5°
- **2015**: 7° x 3°
- **2017**: 10° x 3°
- **~2020**: > 10° x 4° AR
What is augmented reality HUD?

Conventional HUD
Visual assistance system to increase driving safety and user experience

Transition from
- below line of sight -

into
- drivers direct vision -

overlaying
- reality and information -

Augmented Reality HUD
Further enhances driver’s experience and generates faster reliable decisions out of ADAS-system data in real time
Augmented reality HUD – basic features

Lane departure warning

Adaptive cruise control

Intuitive navigation

SENSE
Data acquisition

Cameras
External and internal

Car sensors
Speed/acceleration, steering angle

Navigation
GPS/positioning

ANALYZE
Data fusion

Data fusion
- Data processing
- Data fusion
- AR decision making
- Dynamic coordinates positioning
- Prediction function

INFORM
HMI generation

AR HUD
Image generation
- Real-time drawing
- Dynamic object creation
- Warping pre-correction

ADAS domain

HUD domain

Visteon
Augmented reality HUD – optical concepts

Single image AR HUD – fixed virtual image distance

- Vertical virtual image (10°x4.5° at 15m)
- Not parallax-free, eye tracking system required
- Lower optical design complexity

Dual image AR HUD – variable virtual image distance

- Parallax-free, no eye-tracking system required
- Dual optical system to add conventional HUD information
  (10°x5° lying on the road at 10 to 20m / 5°x1° classic HUD @ 2m)
- More complex optical design and increased packaging challenge
Augmented reality HUD – ergonomic studies

- Increased image size and projection distance generates packaging challenges
- Ergonomic studies allow confirmation of minimum image size by feature

Blind spot detection

Adaptive cruise control
Augmented reality – audio HMI

- Human ear is always active
- Ear is permanently listening in all directions
- Acoustic channel is hardly used for automotive HMI

Bikes
Forward collision warning
Pedestrians

Multimodal HMI vehicle
- Integrates driver into environment through acoustic cues to increase safety
- Immersive audio must be relevant – should be contextual
HUD and augmented reality – conclusions

• While packaging remains a challenge, existing HUD technologies (TFT, DLP, laser) are available to introduce basic augmented reality features in near future

• Enhancing driving experience by providing relevant and intuitive information about driving and ADAS

• Augmented reality experience will support the transition towards autonomous driving by reassuring driver in semi-autonomous mode

• New technologies (e.g., holographic optical elements) may allow for package size reduction in the future and enable wider adoption