

DVN Lidar Workshop December 2019

Chances and Risks for the integration of sensors into lamps

Audi e-tron GT



With a „Piece of Art“ Headlamp



Sensor Integration is not only functional

- › Car Design is still the Number one reason for car purchase
- › Today Lighting is a piece of art with high influence of car design
- › Visible components have to be aesthetical perfect

Solutions for Lidar integration

1. Lidar sensors have to be totally hidden
2. Lidar sensors are a piece of art too



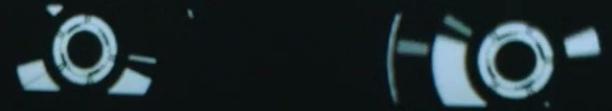




Lighting Functions start to use Lidar Information

- › Audi e-tron Sportback comes with DMD Road Projection
- › Animation for Road and Wall projections have to be different because of image deformation
- › Lidar Information is used to detect Walls (or any obstacles)
- › Projection type – road or wall - is chosen

Audi MediaTV
World Premiere
Audi e-tron Sportback

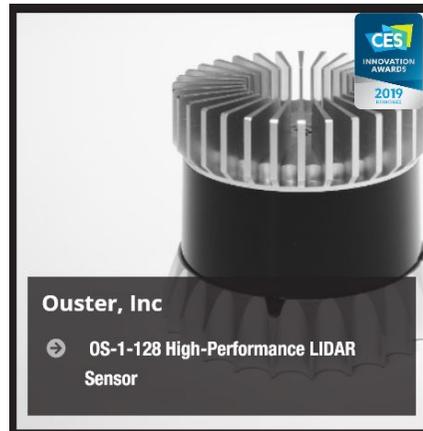


Sensor Integration is not only functional

- › Target Conflict for integration: Headlamps still decrease in size.
- › There is not one cm² free space today
- › Headlamps total Volumens are roughly between 3 and 6 liters
- › Lidar Sensors have decreased for 5 l to 1.5 l, still shrinking
- › Some Lidar companies show here volumens of 0.25 l or lower.
This is necessary for headlamp integration

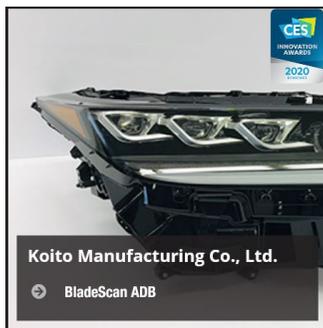
To compare: CES 2019 Innovation Award Winners

Three LIDAR Systems out of 22 Awards in this segment.



CES 2020 Innovation Award Winners „Vehicle Intelligence and Transportation“

Four LIDAR Systems out of 25 Awards in this segment.



Koito won with a scanning ADB System despite it is not legal in the US

Trends in the Legal environment

- › The first test specifications for AVs are on the way.
- › Of course different specs is different countrys
- › US NCAP test spec approach favour camera solutions (2000 lx or more)
- › Different SAE specs describe test scenarios (J3018, J3114, J3116, ...)
- › Legal requirements will influence the necessary typs of sensors
- › Camera only solutions will have difficulties
- › C2X is pushed in China (Wuxi smart city approach) and Korea

- › Generally one can say that standardised test specs are missing.

AV safety assesment will support Lidar introduction

By building out their K-City test circuit, it provides a realistic testing environment. The Korean Transportation Safety Authority (TS) develops safety assessment technology for automated vehicles Automated Driving Safety Assessment: Assessing the safety driving



Which scenario requires Lidar? Where is distance information necessary?

Warning for safety driving: Obstacle on the road warning④, Hazardous condition road warning⑤, Road works warning⑥

–Safety at intersections: Red light warning⑦, Warning on the vehicle right turning vehicle⑧

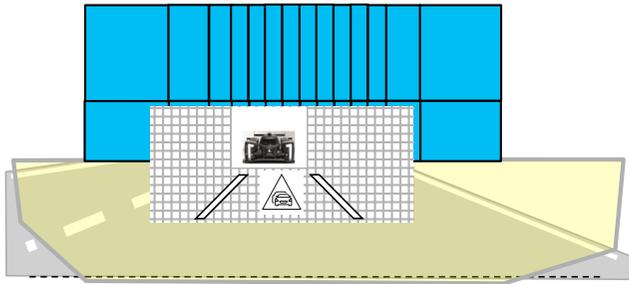
–Transportation safety: Public transportation management⑨, School bus approaching notification⑩

–Caution areas: School zone warning⑪, Warning for pedestrians and bicycles⑫

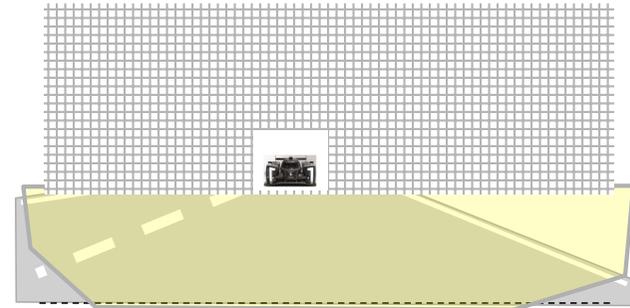
–Accident prevention by V2V: Stopped or slow vehicle in front warning⑬, Emergency vehicle approaching⑭, Longitudinal collision risk warning⑮



And here are the next next steps



30 Matrix Segments + 1.3 Million DMD Pixels + Low beam



15.000 LED Pixels + Low beam

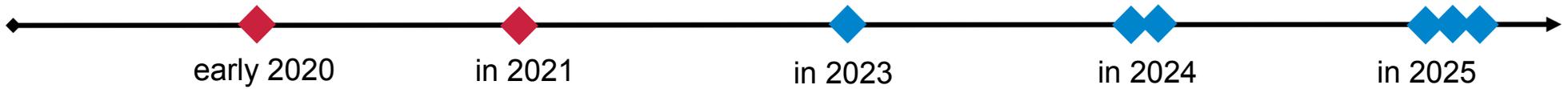


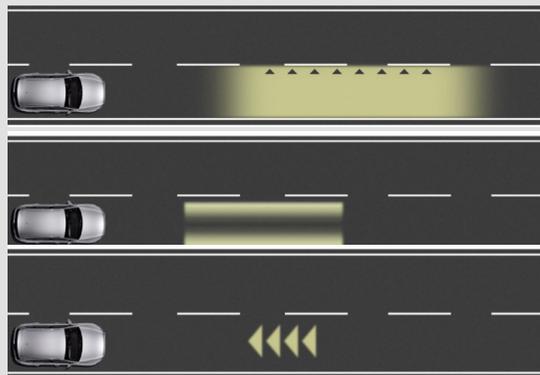
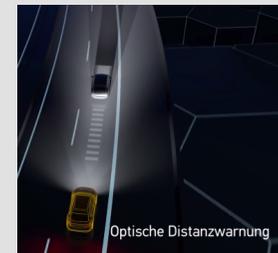
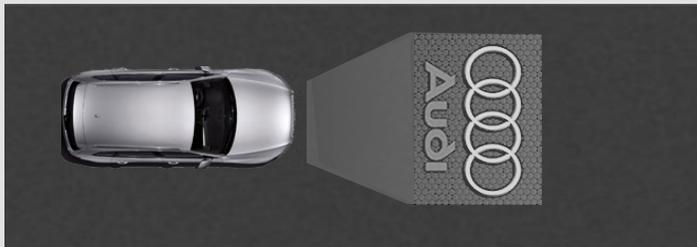
TI DMD Chip



LED Matrix Array

No Road Projection?





Construction Zone Guidance (Narrow Passage Guidance)

Daynamic test drive with 80 subjects



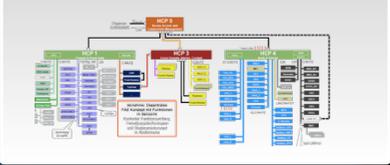
Construction zone:
guiding lines

Light for Autonomous Driving
Communication

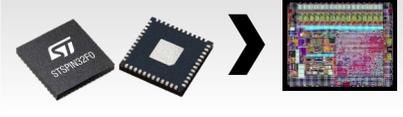


And what about rear lamps?

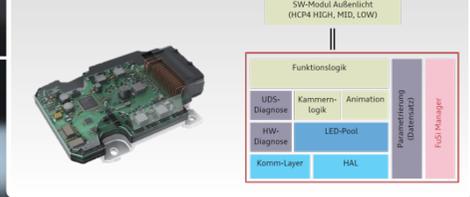
Car Architecture



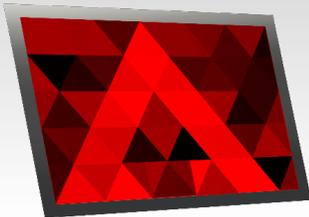
Multi-Channel OLED-Driver



Software Modul



Multi-Segment OLED



Multi Segment OLED is coming.
Flexible Micro LED solutions are highly welcome!

Situation World Car Industry

BEV/PHEV and AV/Connect Cost explode

International Homologation and Specs become irrational

Turnover stable - Profit drops

R&D Budgets too high – decrease to be expected

Impact on Lighting

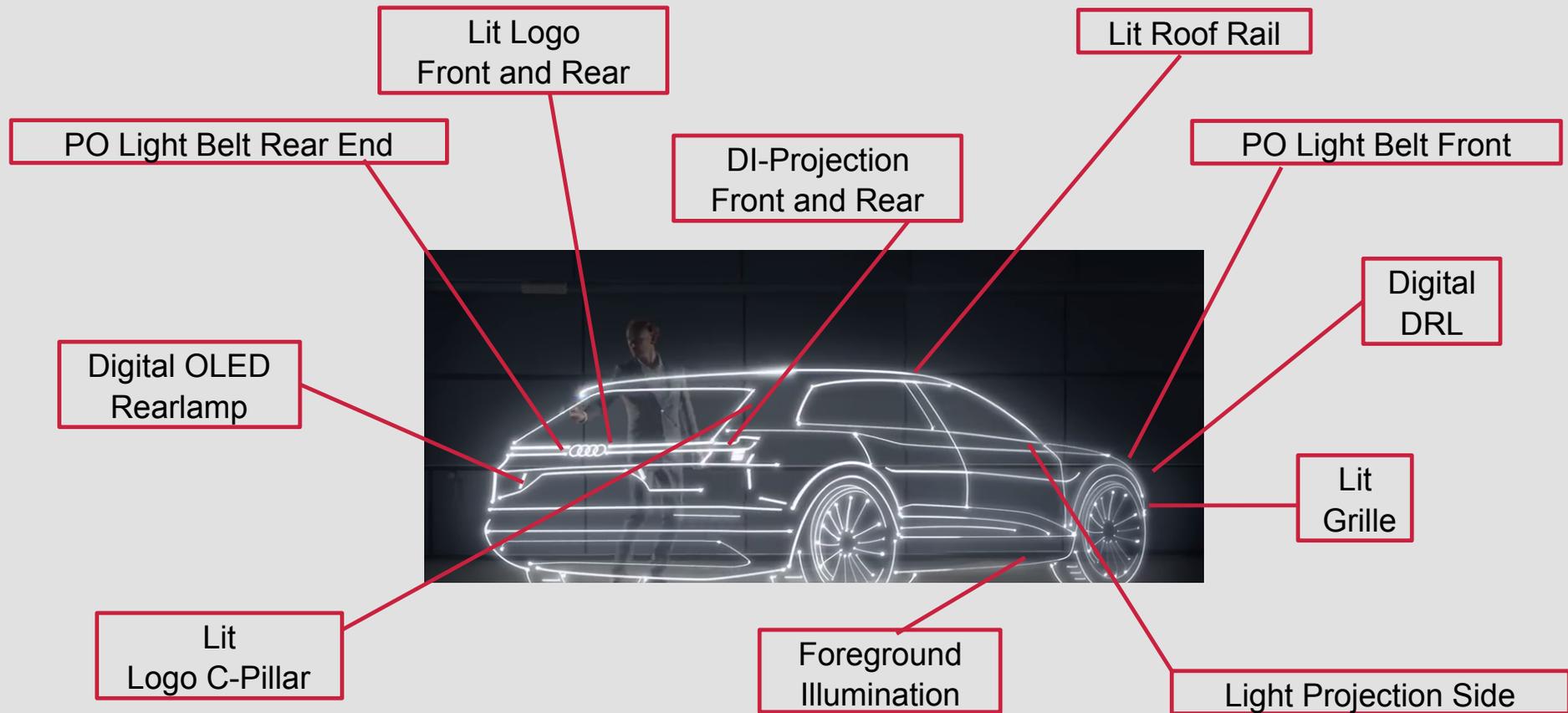
Reduced R&D Budgets

Lower Cost Targets

Less Engineering Capacity

New Exterior Lighting Elements within existing Budgets

Exterior Ambient Lighting (incomplete)



Thank You



The Game

