Augmented Reality Head-up Displays for Cars

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Outline

1. Why Augmented Reality for the car?
2. What are the design issues?
3. How to design, prototype and test AR applications for cars?
Human-Machine Interfaces (HMI) Mission Statement:

Explore enriching the driver’s experience while respecting the primary task of driving.

Methods:

User-centered design methodologies.

Start observing, than design solutions with technology components.
Challenges

Technology

People
Solutions

Autonomous Cars

Google

Enhanced Driver

Mercedes
Augmented Reality for Cars

From Wikipedia:

Augmented reality (AR) is a live, direct or indirect, view of a physical, real-world environment whose elements are augmented by computer-generated sensory input such as sound, video, graphics or GPS data.

HI-CAR:

Honda Interactive Contextual Augmented Reality
Mobile Devices for AR

Smartphone: Portable, connected

Tablet: Portable, connected, bigger interaction surface

Car: Portable, connected, huge interaction surface
   + More sensor options
   + Larger field of view
   + Direct see-thru view
   + Transports user
AR seems like a cool thing, but what is the content?

And how do we display it?
Cognitive Dissonance Problem

27 Broadway
$206/night

32 Broadway
Danio’s Café

***
Create a consistent world view

27 Broadway
$206/night

32 Broadway

Danio’s Café

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Dual focus problem

http://webphysics.davidson.edu/physlet_resources/dav_optics/examples/eye_demo.html
Parallax problem

Experiment 3: Frontal plane vs. 3-D Ground plane
Cognitive Issues

Perception
- Situation
- Awareness
- Visual Stimuli

Driver Distraction

Behavior
- Defensive Driving
- Reflexes

Inattentional Blindness

Good AR

Bad AR
Design-Prototype Cycle

- **Design**
  - Low fidelity prototypes
  - Research and development
  - High fidelity prototypes
  - User evaluation
User-centered Design

User research  Brainstorming observations  Idea generation
Life Cycle of a Driving Application

- Safety Grid
- Iteration
- Higher fidelity
Prototyping

120 deg driving view

Adjustable size powered chair

Customizable driving simulator

In-lab HUD Prototype

Prototype
Driving aids
Use Cases for UI Composer + AR

1. How to integrate with existing legacy systems (including driving simulator)
Integrating UI Composer with Legacy Code

Data streams
- Cameras
- GPS receiver (Bluetooth)
- Location Services

Sensory data
- Time
- Long/lat
- Location info

perception

roadmodel

application

Extracted scene information

3-D labels

OpenGL ES application as texture

HUD display

Driving Simulator

UI Composer

See: Runtime/Plugins/Render/gears
Communication with UIComposer

- **NADS Driving Simulator**
  - udp socket connection

- **Legacy Framework**
  - Gear changes, Speed, RPMs, State changes

- **UI Composer**
  - QSharedMemory
  - Shared Memory Cells
  - Shared memory I/O dll

- **Shared Memory**

**Extracted Text:**

- Communication with UIComposer
- NADS Driving Simulator
- Legacy Framework
- UI Composer
- QSharedMemory
- Shared Memory Cells
- Shared memory I/O dll
- udp socket connection
- Gear changes, Speed, RPMs, State changes
No need to restart entire system

- NADS Driving Simulator
  - Gear changes, Speed, RPMs, State changes
- UI Composer
  - Shared memory I/O dll
  - Shared Memory Cells
- Legacy Framework
  - udp socket connection
- Shared memory
  - QSharedMemory
  - dll

Diagram showing connections between NADS, UI Composer, and Legacy Framework.
Feedback for driving

Maya modeling

UI Composer animation
+ scripting
Augmented reality for cars has potential to aid and engage drivers.

Must design carefully for driver. Design, prototype, test and iterate.

UI Composer can help in this process and can be integrated with custom driving assistance systems.
Thanks

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