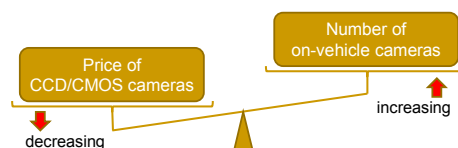


Multimodal Cruising Assist to Enhance the Drivers' Abilities to Perceive Surrounding Contexts Using Panoramic Presentation with Dynamic Multiple Windows

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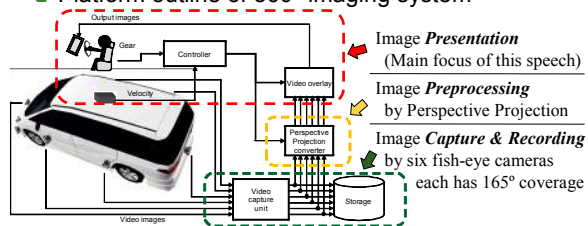
Background



- Increasing needs of a vision system
 - that presents multiple camera images
 - without drivers' confusion

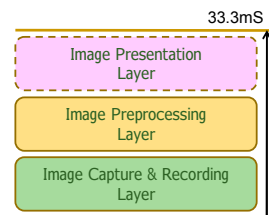
Research Interest

- Flexible development platform of a driver's vision system
 - Platform outline of 360° imaging system



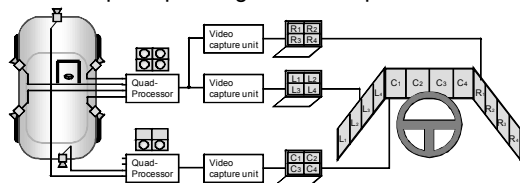
Real-time processing platform to develop a presentation layer

- PC-based platform
 - for rapid prototyping
- 3 Pen-M notebooks
 - for realtime processing
- Video inputs
 - 6 NTSC cameras
 - 2 quad-processors
 - 3 USB1.1 capt. units
- Video Outputs
 - 3 pairs of quad LCDs (12 LCDs)



Surround Vision System

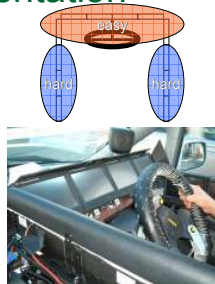
- First prototype to study
 - 360° image capturing by 6 fish-eye cameras (camera positioning and angles)
 - drivers' perception against widespread monitors



movie

First results from experimental implementation

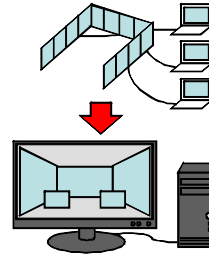
- Camera Positioning
 - Adjusted, working well
- Drivers' perception
 - Front monitors
 - have good visibility
 - Side monitors
 - have poor visibility in driving
 - except movement or blinking of large icons



➔ Development of integrated front-panel display

Remodeling of Surround Vision System

12 screens with 3 notebooks

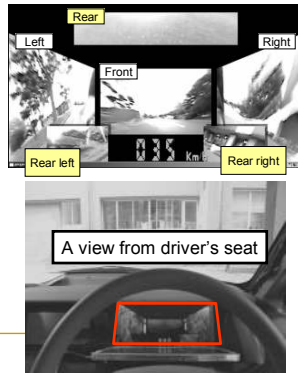


Single screen with ONE PC

- All useful information via single front screen
 - Powerful PC required
- Newly assembled PC
 - CPUs: Intel Xeon / HT 3.20GHz (Dual CPU)
 - Memory: 2GB
 - Video: NVIDIA GeForce 6600GT
 - Capture: Osprey-440

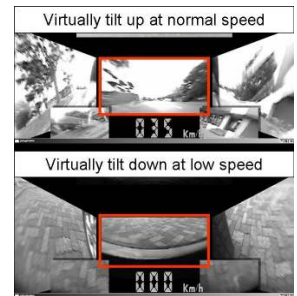
Presentation Layer (1/3) - Multi-windowed perspective view

- 12 displays into one
 - to minimize driver's eye movements
- Switching or patching?
 - Patchwork preferred
 - to avoid a driver's confusion
 - Perspective windows
 - to clearly distinguish side images
 - High-speed window manager developed



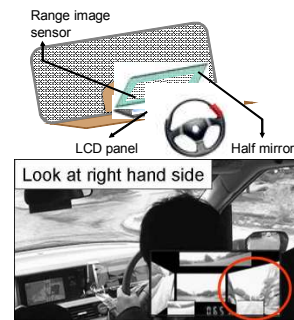
Presentation Layer (2/3) - Virtual pan/tilt of cameras

- Virtual pan/tilt control
 - done by selecting origin point in fish-eye image
- Supporting drivers' viewpoint
 - Cameras tilt up/down according to the speed
 - Capture around tires at low speed
 - They virtually tilt up, as speed gets higher
 - Improved fisheye pre-processor developed
 - More faster, incl. pan/tilt



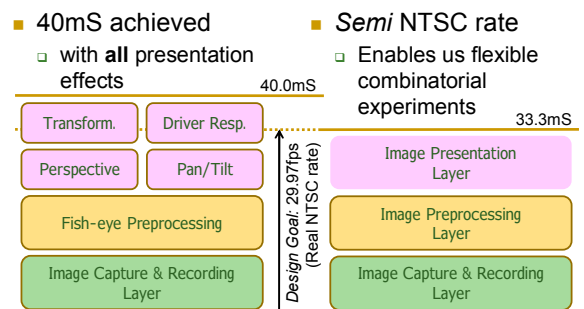
Presentation Layer (3/3) - Response to a driver's behavior

- "look in" response
 - magnifies left/right trapezoidal windows
 - according to the driver's head motion
- Driver's behavior
 - sensed by range-image sensor behind the mirror
- Magnification
 - keeps positional relation of windows



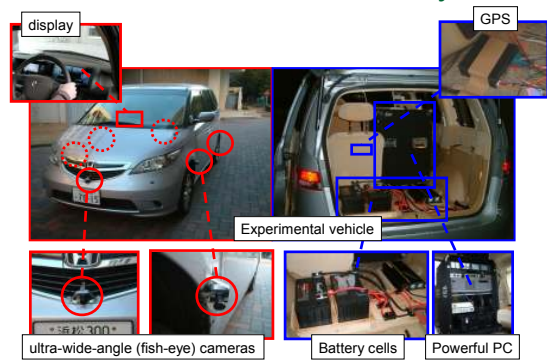
By changing the size of the both side images, representing the details.

Video throughput of remodeled Surround Vision System



movie

Current backyard of remodeled Surround Vision system



Conclusion

- Powerful prototyping environment developed
 - Powerful PC with multi-channel video capture
 - Faster fish-eye preprocessor with pan/tilt control
 - Fast & flexible perspective window manager
- Semi NTSC rate (25fps) achieved with
 - 6 perspective windows, with virtual pan/tilt control
 - Smooth transforming of perspective windows
 - Response to a driver's behavior
- Flexibly helps us to study presentation effects