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Portable Omni-directional Video Capture System

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Androme

Objectives

- Omni-directional imaging as an alternative to 3D modeling
  - Visual realism
  - Cost-effective acquisition
- Improve on current state of omni-directional imaging
  - Capturing more than the typical “street scene”
  - Pedestrian zones, indoor locations, off-road, rugged terrain, …
  - Key objective: **mobility**
  - Other: improve **image quality** and **processing speed**

Mobile Capture System



Late 2008 prototype

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ODV wheelchair





3x point grey dragonfly (ieee1394a) with fish eye lens
3x 1.3MPixels @ 20Hz capture = 78Mpixels per second



car battery + invertor, GPS,
server computer with RAID
mounted in modified wheel chair

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ODV wheelchair – Issues

- Cameras were not synchronized
- Images not as sharp as could be
- Images are rather noisy
- Images exhibit parallax artifacts
- Calibration is tedious manual procedure
- Wheelchair setup still is heavy (ca 70kg) and bulky
- GPS and compass do not work in in-door areas

Mobile Capture System



Late 2008 prototype

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Mobile Capture System



Late 2008 prototype



Current prototype

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ODV wheelchair – Lessons learned (1)

- Cameras were not synchronized
  - Point grey MultiSync driver, or hardware external triggering
- Images not as sharp as could be
  - Use better fish eye lenses
  - Use better Bayer demosaicking
  - Stabilize cameras (motion blur, lenses go out of focus)
- Images are rather noisy
  - Use better cameras

ODV wheelchair – Lessons learned (2)

- Images exhibit parallax artifacts
  - Develop better stitching algorithms
- Calibration is tedious manual procedure
  - Develop automatic calibration procedures
- Wheelchair setup still is heavy (ca 70kg) and bulky
  - Develop laptop based capture system
- GPS and compass do not work in in-door areas
  - Develop other means of position and orientation tracking

Portable System - Main Components



Steadicam



Custom camera



Laptop

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ODV backpack V1



Fujinon hi-res CCTV fish eye lens



PointGrey flea2
0.8Mpixels, ieee1394b
3 cams on one bus @20Hz



Apple macbook pro
+Fast internal hard drive (55MB/sec)
+powerful GPU (nvidia 8600)
+powered ieee1394b bus
(no need for external batteries)



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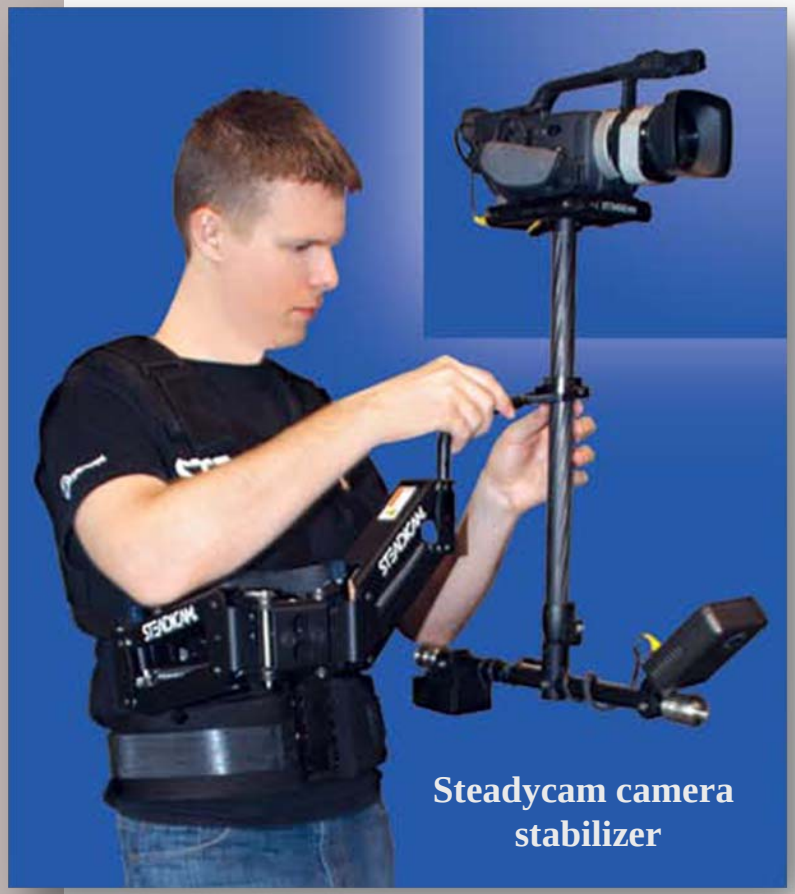
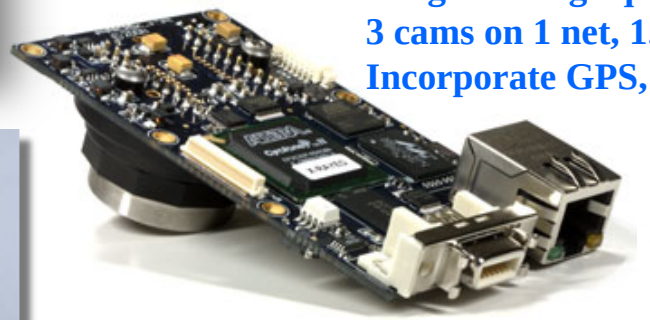
ODV backpack V2





Prosilica 1380GB cameras
+ GigE (50% more bandwidth than 1394b)
+ cheap hubs (standard Gigabit Ethernet)
+ higher image quality
3 cams on 1 net, 1.4Mpix @ 27,6Hz each
Incorporate GPS, compass, mic in one head







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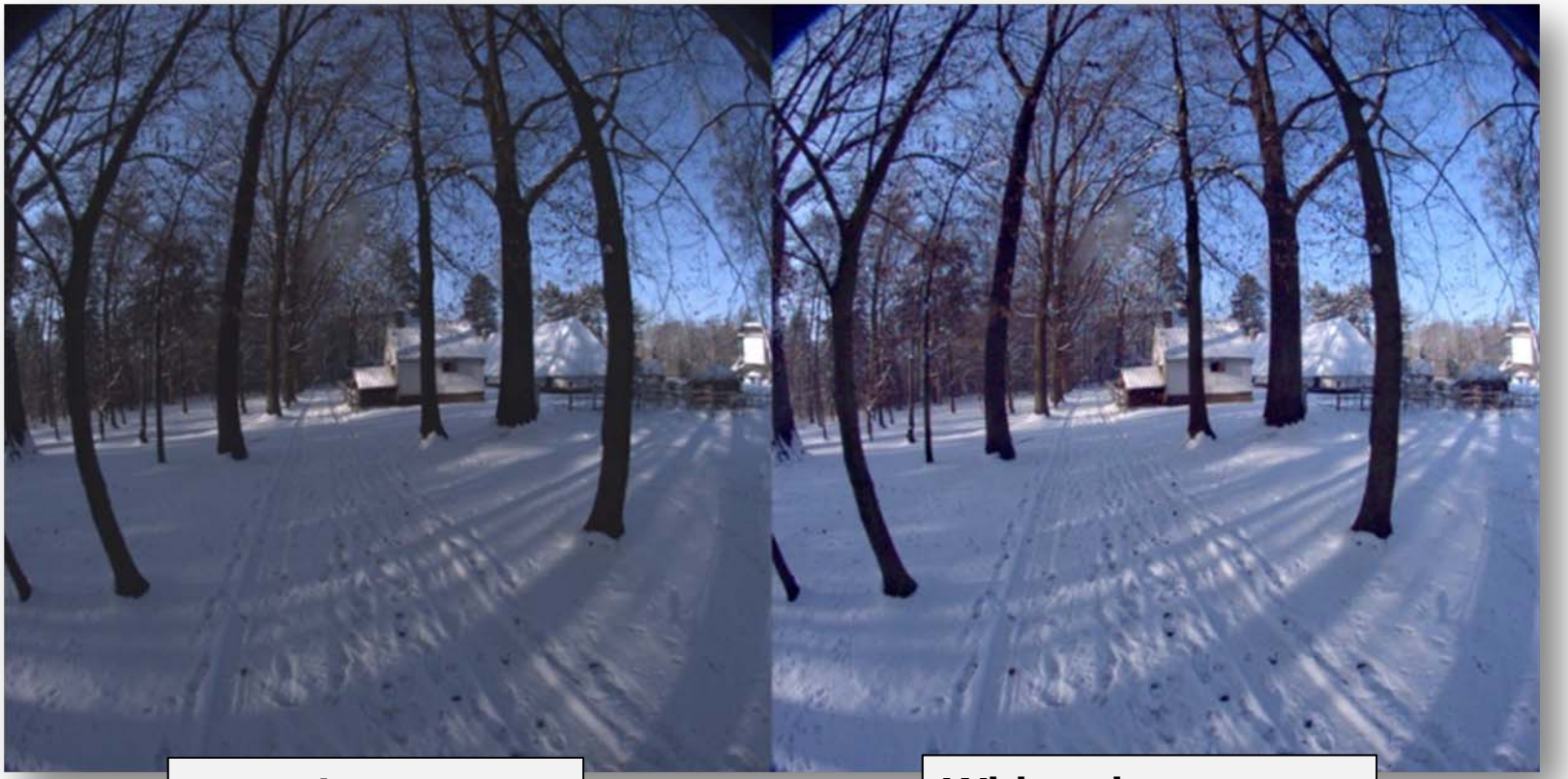
Technical Goals and Achievements (1)

- Image Stabilization
  - Steadicam
  - Orientation tracking
- Real-time Compression
  - PNG-like lossless, ~1:2 compression ratio
  - Wavelet-based near-lossless, ~1:5 compression ratio
- Calibration
  - Footage-based method (refinement)
  - Structured light-based method
    - Sub-pixel accuracy

Technical Goals and Achievements (2)

- Real-time, automatic image processing techniques (30Hz)
  - Bayer demosaicking
  - Contrast enhancement
  - In-painting (for CCD smear removal)
- Near real-time, automatic image processing techniques (5Hz)
  - Parallax correction

Contrast enhancement



No enhancement

With enhancement

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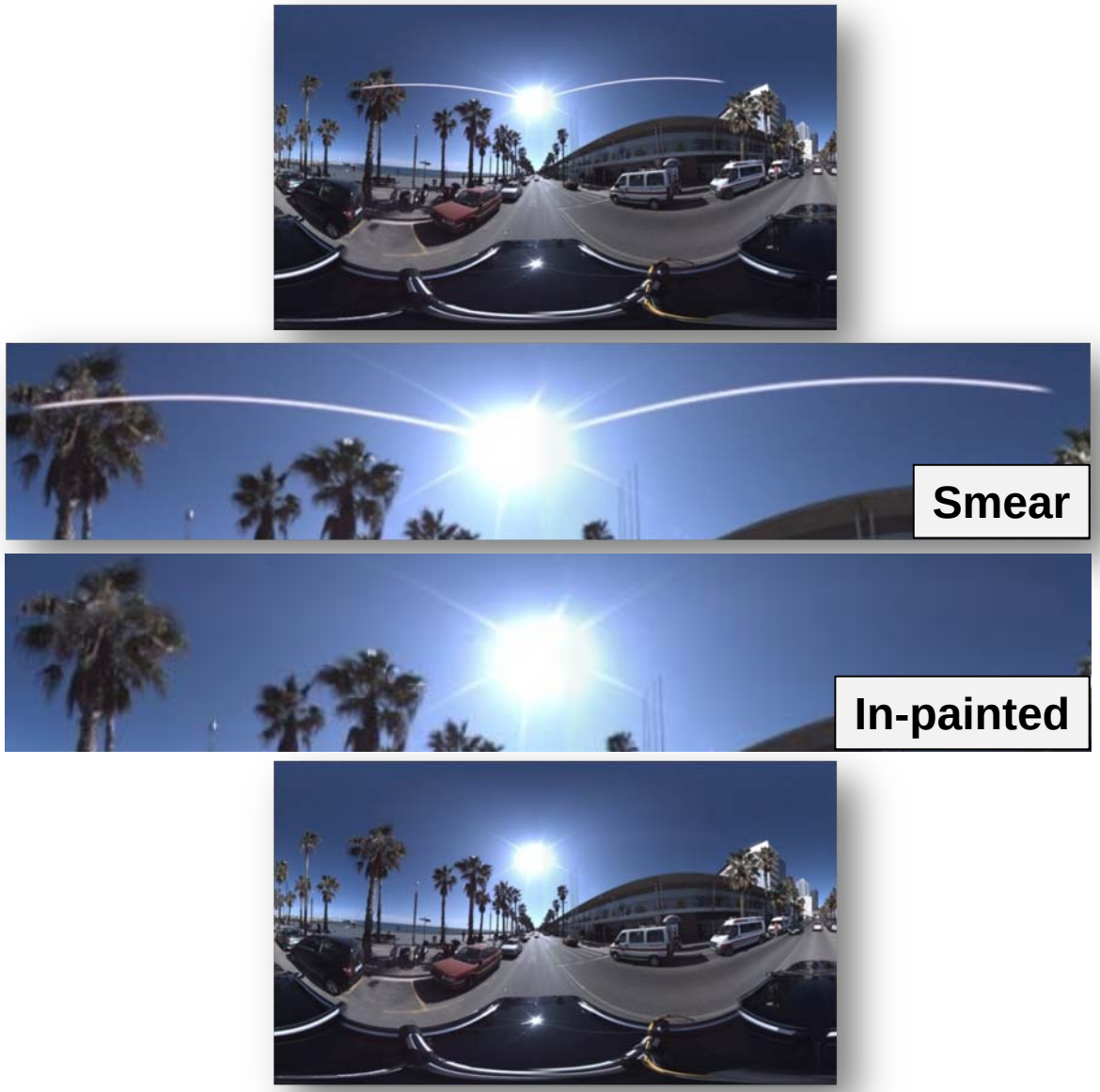
In-painting for “CCD smear” removal



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Parallax correction





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Parallax correction



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Viewers

- Desktop standalone application
- Browser version implemented in Flash
  - Uses cubemap export
- Mobile version on iPhone
  - Runs on 3G connections



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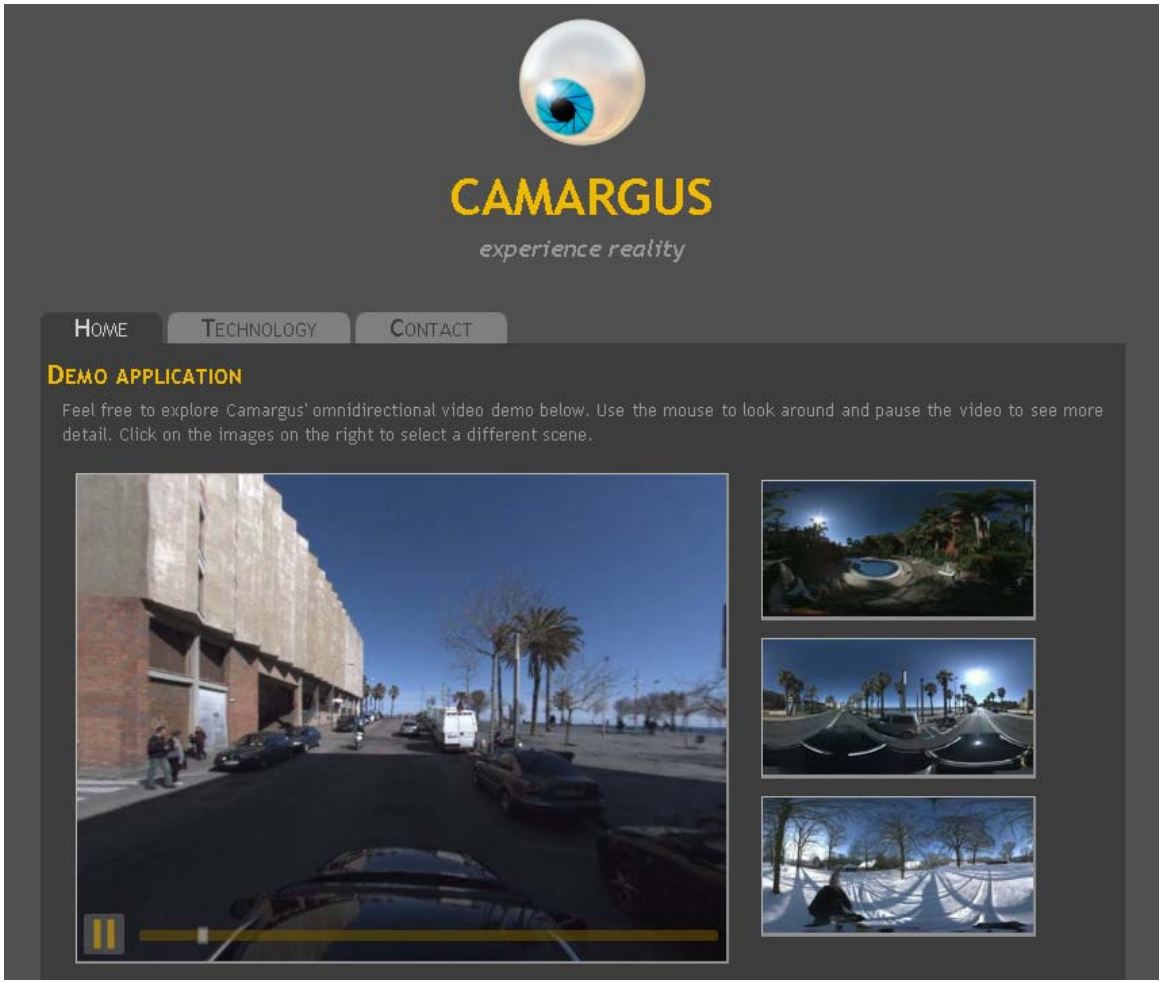
Demo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Feel free to explore Camargus' omnidirectional video demo below. Use the mouse to look around and pause the video to see more detail. Click on the images on the right to select a different scene.

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