VIA-Sync
Synchronized vehicle motion recording and playback

Dr. ir. Joost Venrooij
VIA-Sync

An environment for synchronized vehicle motion recording and playback

VIA-Sync

VIA-Rec
Synchronized motion recording
Visual  Inertial  Auditory

VIA-Play
Synchronized motion playback
Visual  Inertial  Auditory
Why VIA-Sync?

• **Goal:** improve quality of motion cueing algorithms
• **Approach:** replay realistic vehicle maneuvers on motion simulator
• **Problem:** available vehicle motion recording products did not meet our requirements
• **Solution:** VIA-Sync

• Useful in other applications:
  – driver assessment, road inspection, vehicle dynamics testing, autonomous driving,…
VIA-Sync

VIA-Rec

Synchronized motion recording

Visual  Inertial  Auditory

VIA-Play

Synchronized motion playback

Visual  Inertial  Auditory
What is VIA-Rec?

- GPS receiver
- Stereo cameras
- IMU
- Microphone
VIA-Rec components

- GPS-Antenna
- INS
- FlexPak 6
- Touch-screen
- HD Camera
- Microphone
- RS232
- Power
- CAN
- Ethernet
- Trigger
VIA-Rec components
VIA-Rec: Cameras

• Cameras
  – AlliedVision Prosilica GX1910
  – 1920 x 1080 x 60 fps
  – Positioned close to eye-point

• Triggering
  – National Instruments PCI-6601

• Recording
  – NorPix StreamPix
  – Additional module for recording control and time-stamping
VIA-Rec: Inertial Navigation System

- NovAtel SPAN-CPT
  - Fuses GNSS and IMU

- GNSS receiver
  - Two GNSS antenna’s
  - Accuracy: 0.6 m
  - Data rate: 20Hz

- Inertial measurement unit
  - 3 Fiber optic gyros
    - Angular random walk: 0.0667 °/√hr @ 1σ
  - 3 Accelerometers
    - Noise level: 55 μg/√Hz @ 1σ
VIA-Rec: Battery and hard disk

- **Large battery:**
  - Longex 12LC-150
  - 12V – 160Ah
  - ~4-5 hours operation

- **Small battery:**
  - VARTA LAD85
  - 12V – 85Ah
  - ~2-3 hours operation

- **Hard disks:**
  - 2x Intel SSD 600 GB
  - ~1.5 hours recording
VIA-Rec: Data flow

**INS**

**Video**

**Audio**

**RAW DATA**

- RAW INS files
- RAW Video files
- RAW Audio files
- Video Timestamps

**RECORDING SETUP**

('PORTABLE')

- start/stop/reset
- warnings/errors

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VIA-Rec: Post-processing

RAW IMU files → filter → resample → IMU Data

RAW Video files → RAW video to AVI → Combine Videos → Compression codec → Video time → Sync → Video time

RAW Audio files → Compression codec

Video Timestamps

POSTPROCESSING SETUP ('OFFLINE')

Processed data

*.MP4
*.MAT
*.WAV
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<td>Synchronized motion playback</td>
<td>Visual</td>
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VIA-Play

- High timing accuracy:
  - Psychtoolbox: MATLAB/Octave toolbox for visual research
  - Linux implementation
- Provides control over individual video frames
- Other features:
  - Warping of video frames
  - Stereo video playback

GUI -> VIA-Play
Real-time PC

“start”, “stop”
“play”, “quit”
“show text”
VIA-SYNC IN ACTION
Our first prototype
Recording car maneuvers

[Video]

VIA-SYNC
CAR RECORDINGS

© MPI FOR BIOLOGICAL CYBERNETICS
Recording helicopter maneuvers

[Video]
MPI CyberMotion Simulator

[Video]

The CyberMotion Simulator
The motion cueing challenge

Making a simulator move

- **Motion Cueing Algorithm:** converts vehicle motion in simulator motion

- **Goal:** improve quality of MCAs

- **Approach:**
  replay realistic vehicle maneuvers on motion simulator with different MCAs
VIA-Sync in motion cueing study
Other applications

• VIA-Sync could be used for other applications:
  – driver training and assessment
  – comfort studies
  – road inspection
  – vehicle dynamics testing
  – autonomous driving
  – …

• and in other vehicles:
  – trains
  – ships
  – helicopters
  – aircraft
  – …
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THANK YOU