Multi-camera Systems And Embedded Vision Applications

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Multi-camera Applications and Systems Architecture

Agenda

• Definition
• Applications
• Configurations
• Considerations
• Possible approach with PCIe and xSwitch
Definition

• Multi Camera Systems are systems having more than one camera

  ... but

• Can include any mix of camera resolutions, fps, spectral sensitivity, triggering, etc.

  ... and each camera can be addressed and configured individually
Multi-camera Applications and Systems Architecture

Applications

- Medical Imaging
- Mapping/Surveying
- Motion Tracking Systems
- Immersive Technologies
- Cinematography
- Machine Vision
- 3D Scanning, Photogrammetry
Multi-camera Applications and Systems Architecture

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Configurations

- Inside Out
- Outside In
- Array
- Clustered
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3D Dome (with 51 Cameras)
– Analog system, circa 1995

51 analog cameras:
Synchronized and time-stamped
Recorded on VHS video tapes
Digitized later one by one

Carnegie Mellon

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Multi-camera Applications and Systems Architecture

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Considerations

FRONT END

* n cameras

CONNECTIONS

BACK END
Multi-camera Applications and Systems Architecture

Considerations

**FRONT END**
- *n* cameras

**CONNECTIONS**
- Jitter
- PTP
- Master
- Master - Slave
- Trigger
- Illumination
- Optical Components

**BACK END**
- Heat
- Weight
- Size
- RGB; Mono, HSI, NIR etc.
- GPS, Lidar, etc.
- Control
- Mount
- Quality
- Focal lengths
- Size
- Weight
- Filters...

**FRONT END CONNECTIONS**
- Control
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Multi-camera Applications and Systems Architecture

Considerations

**FRONT END**

- n cameras

**Data**

- Storing:
  - Hard disk
  - Memory

- Processing:
  - Online
  - Offline
  - Sub Processing

- Bandwidth:
  - For storage
  - For streaming
  - For processing

**Computer**

- Form factor:
  - NUC
  - Jetson
  - COMexpress
  - ATX

- Processors:
  - Intel/AMD
  - ARM
  - FPGA
  - GPU

- Hosting:
  - N:M cameras per computer

- Operating System:
  - Windows
  - Linux
  - Mac OS
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Embedded Platform Examples

xiCX - COM Express Embedded PC

XIMEA Custom COM Express box

- 16 PCIe G3 lanes
- 2 x PCIe X8G3
- 4 x USB 3.1 Gen1
- 4 x USB 2.0
- GigE
- HDMI
- 4 M.2 SSD PCIe4G3 slots
- up to 8TB storage
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Embedded Platform Examples

xEC2 - NVidia Jetson TX2

XIMEA custom carrier boards
- 4 x X2G2 downstream
- 1 x X4G2 downstream
- 2 USB 3.1 flex
- 1 USB3.0 type A
- 1 USB 2.0 micro B
- M.2 x4G3
- GigE
- HDMI
- Battery Management IC
  Hot swappable with charging
- SD memory
- mSATA
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Considerations

**FRONT END**
- n cameras

**CONNECTIONS**
- Replication
- Distance
- Battery
- Common rail
- Multi supply
- Optical
- Copper
- Size
- Robustness
- USB
- PCIe
- GigE, Coax others
- Upstream PCI x8G3
- Downstream PCI or USB
- Trigger & Power
- Flat ribbon
- iPass
- FireFly
- MTP
- Aggregation - xSwitch
- Power
- Data
- Interface
- Connectors & Cables
Multi-camera Applications and Systems Architecture

xiFLY — a platform for rapid development of multicamera systems from XIMEA

- Has the versatility to support all different configurations thanks to multiple interconnect options for dense and displaced architectures, superb bandwidth and excellent scalability

- E.g. a performance of:
  - 12 cameras each 12 Mpix resolution running @ 60 fps
  - totaling 8.6 GB/s sustained data rate to disk on a single PC
Multi-camera Applications and Systems Architecture

xiFLY Platform Examples

PCIe + USB aggregation / multiplexing

- Up to 27 PCIe camera ports
- Up to 8 USB3 connectors
- Synchronization
- Power replication
- Bandwidth up to 64 Gbit/s
List of Sources


5. LYTRON


7. IR Unlimited: http://ir-ltd.net/


9. LYTRON

10. LYTRON

Thank you for your attention

Questions?