



GPU-accelerated H.264 Decoding for Video Surveillance

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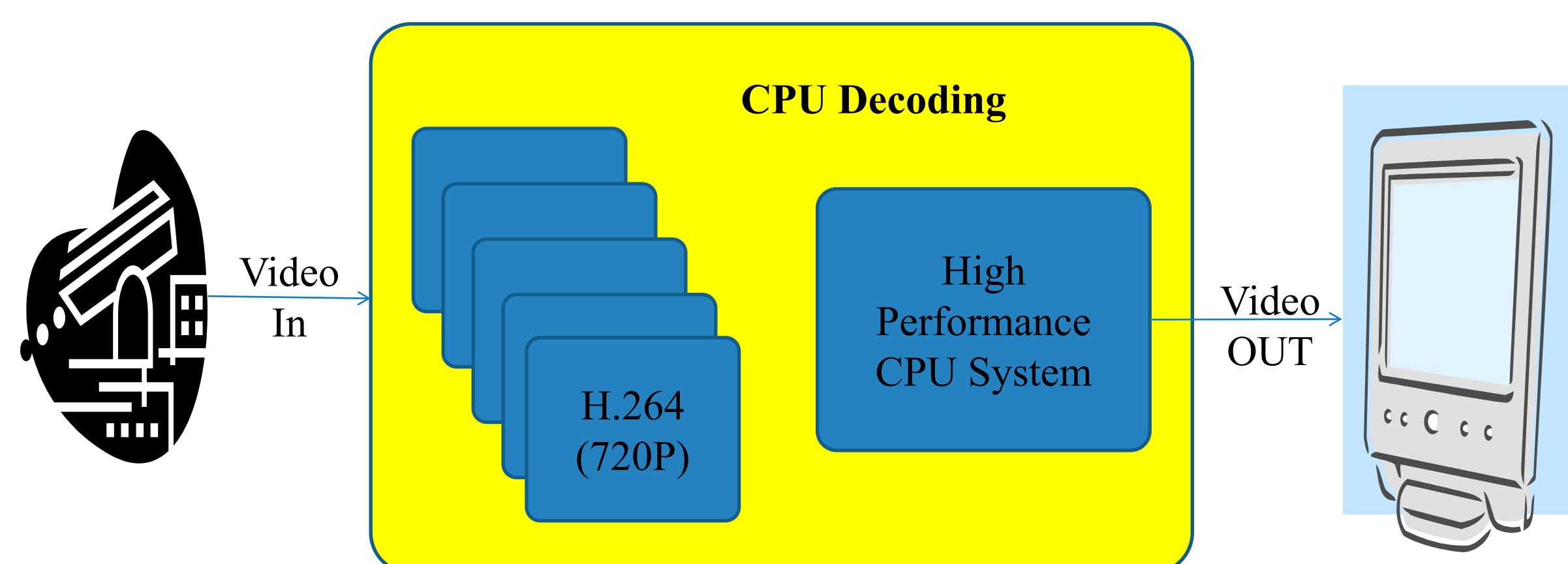


1. Introduction

Along with its fast-paced advancement, the quality improvement, analysis, tracking and surveillance of video has been widely used for video security. VMS(Video Management System) is a software package that keeps under surveillance, record and control visual targets (e.g., motions of automobiles and people) by integrating network products such as networked cameras, video servers, etc. To display the transmitted video via networks, the process of decoding is needed. However, the high-performance CPU resources are required to secure multiple HD videos. We have implemented a HW/SW-combined video control system that utilizes nVIDIA's GPUs.

2. Problems

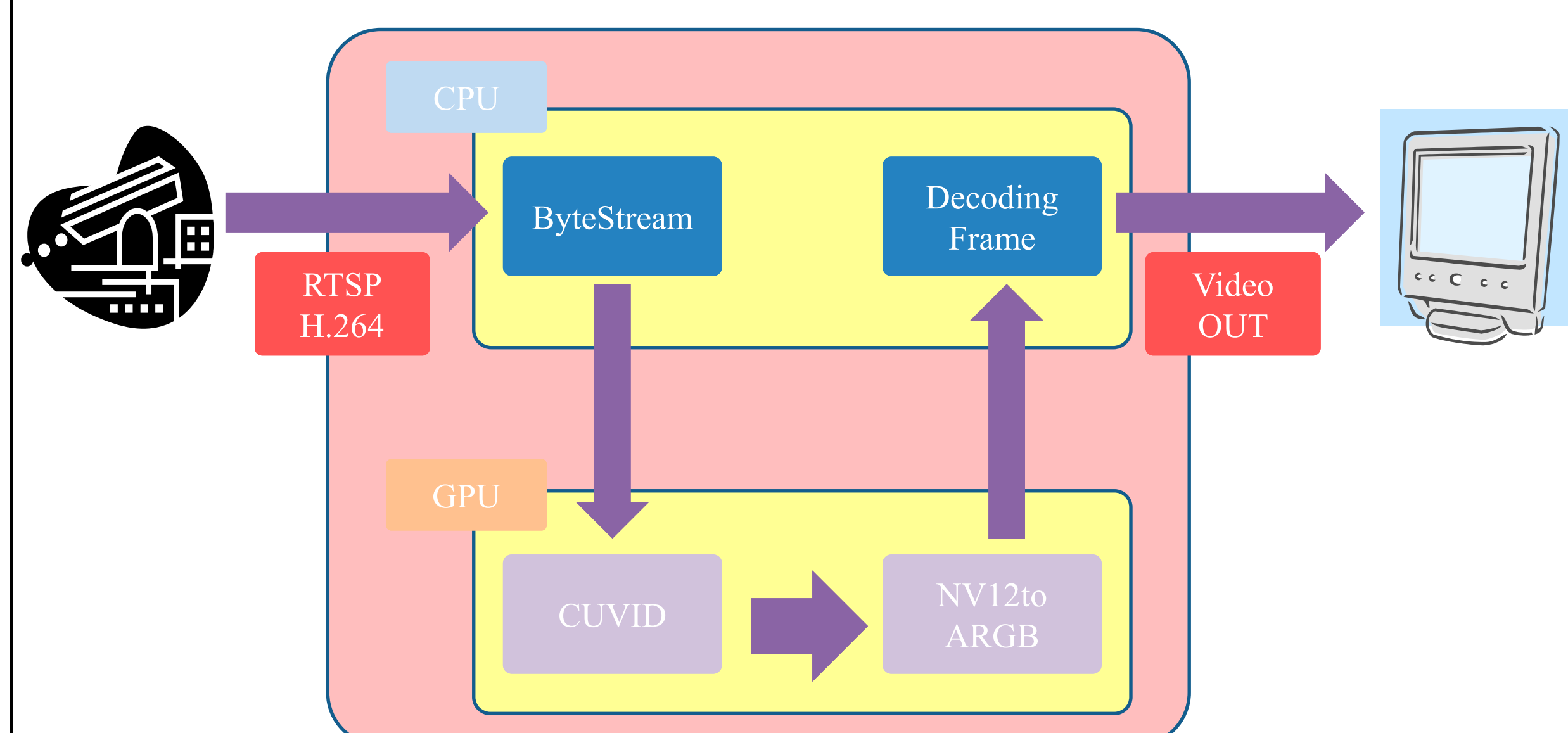
- Decoding of multiple HD videos
- High-performance PC Systems required
- Low costs and high performance demanded by the market



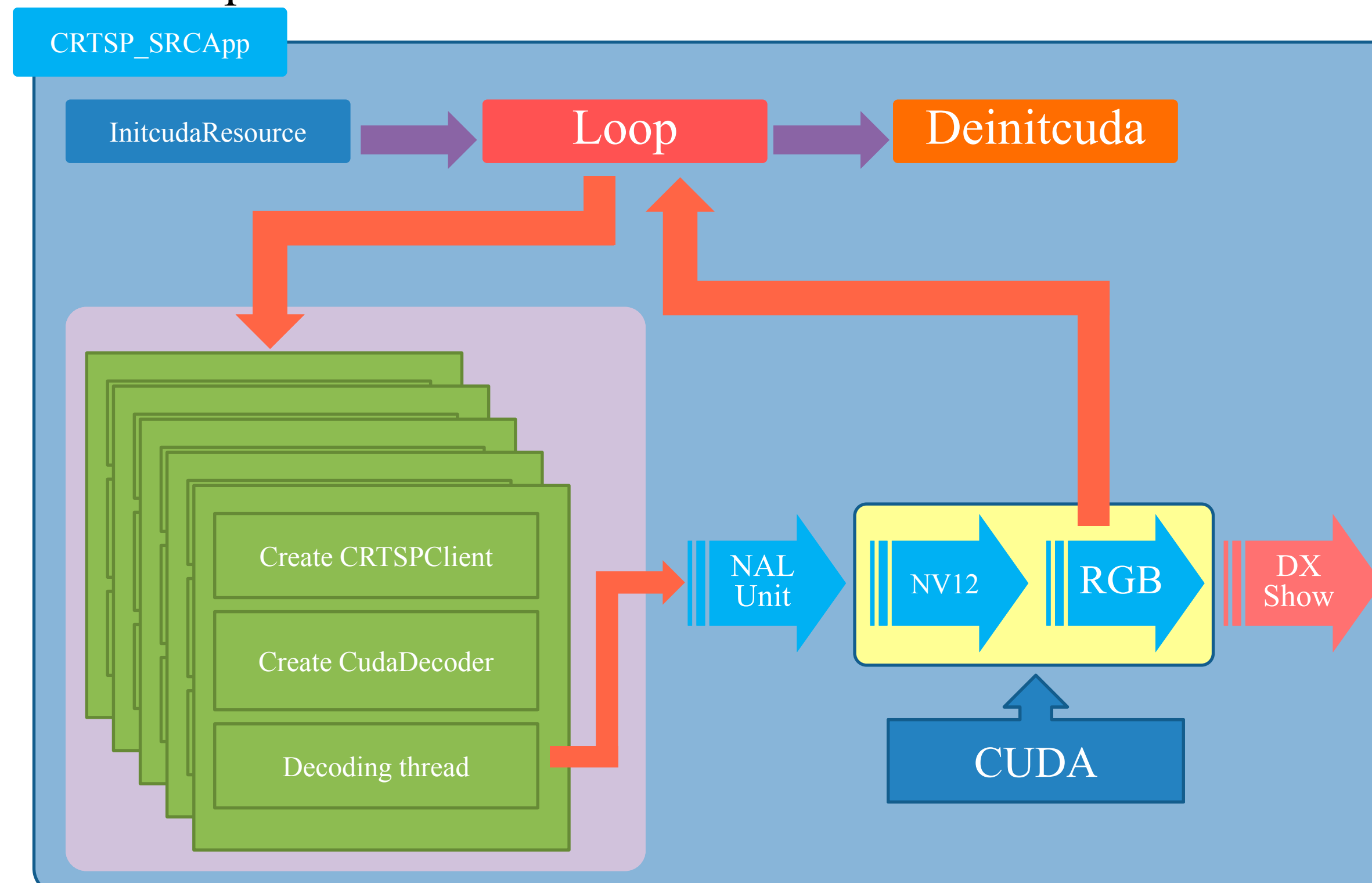
4. Multi Channel Video Algorithm

Main Processing Steps

- ByteStream reads data from multiple cameras with the RTSP
- Decoder pushes data to NVCUVID
- CUvideoparser performs the parser of CUDA
- CUvideodecoder decodes video bytestream



5. GPU Implementation



1) Beginning of CUDA Decoder

- Initializing of CUDA Resources (cuInit, cuCtxCreate, cuvidCtxLockCreate, cuStreamCreate, kernelNV12toARGB init)

2) Connecting IP Camera

- Create a RTSPClient
- Create a CudaDecoder (cuvidCreateVideoParser)

3) Receiving ByteStream data (Loop)

- ByteStream CUVID push (cuvidParseVideoData)
- HandleVideoSequence, cuvidCreateDecoder, cuMemAlloc (rgb buffer)
- HandlePictureDecode (ByteStream decoding)
- HandlePictureDisplay (DisplayPicture call)
- DisplayPicture (NV12toARGB)
- Delivery DirectShow

4) Ending of Streaming

- cuvidDestroyVideoParser
- cuvidDestroyDecoder
- cuMemFree(rgb buffer)

5) Ending of CUDA Decoder

- Release kernelNV12toARGB
- cuStreamDestroy
- cuvidCtxLockDestroy
- cuCtxDestroy

6. Test Report

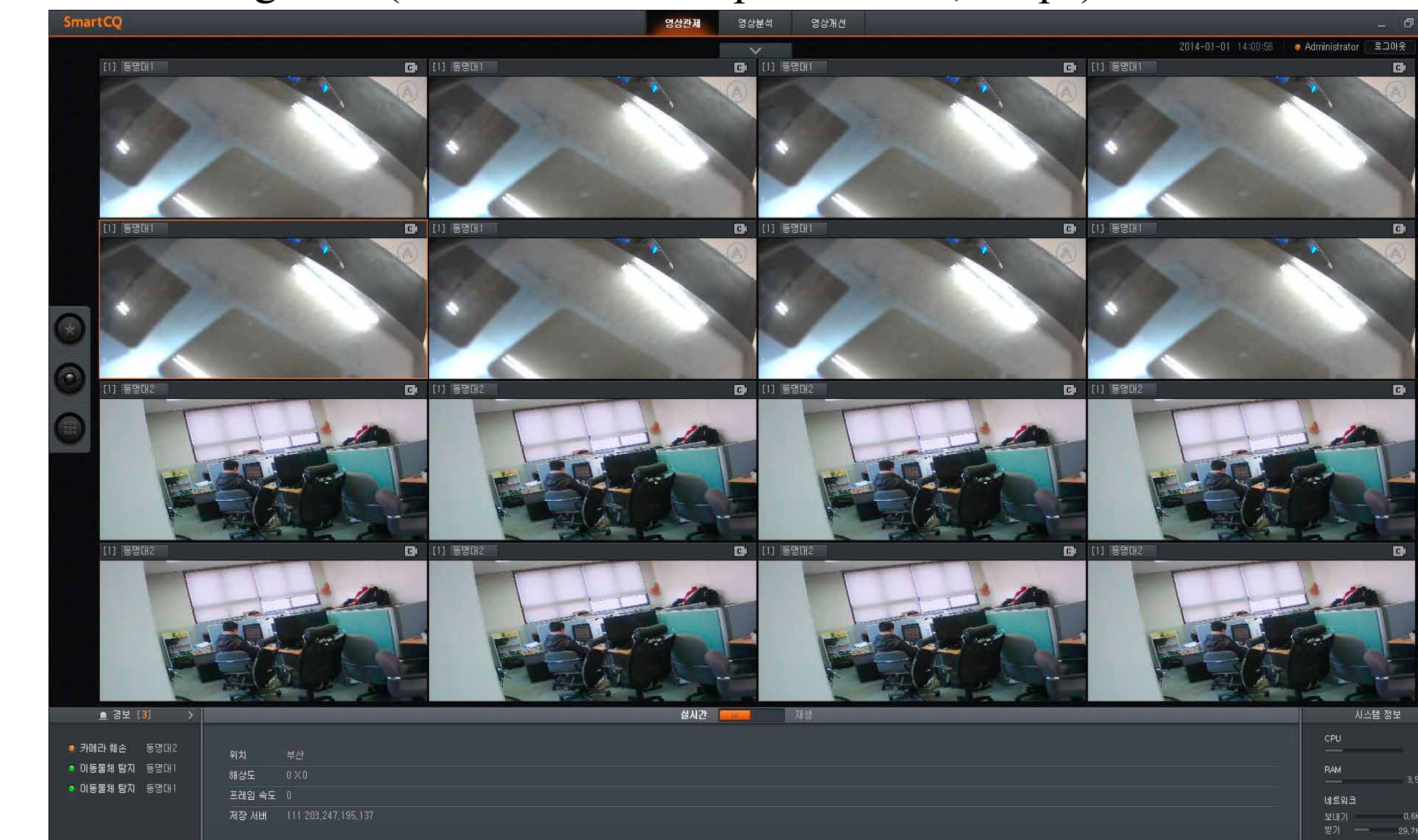
- Evaluation

ITEM	Specification
CPU	Intel Core i3-3240 @3.4GHz
RAM & OS	8 GB, Windows7 64bits
Test Video	720P HD CCTV (H.264, High Profile)
GPU	Quadro K4000 (3GB RAM, CUDA 768 Core)

- Performance (H.264,High Profile, 720P : 1280 x 720)

Video Channel	CPU Base		CUDA Base	
	CPU(%)	Total Frame	CPU(%)	Total Frame
1 CH	5	30	10	30
2 CH	11	60	10	60
4 CH	25	120	11	120
8 CH	65	240	11	240
10 CH	100	250	12	300
12 CH	-	-	12	360
14CH	-	-	13	420
16CH	-	-	13	430

- Monitoring S/W (Each channel 720p HD video, 30fps)



7. Conclusion

- Implemented with low-priced PC systems (GPU : nVIDIA Quadro K4000)
- Implemented a HW/SW-combined video control system that utilizes nVIDIA's GPUs
- Multi Channel HD Video Real-time decoding (720P)
- Supports the maximum of 16 HD cameras (High Profile, H.264, Each camera upper 27 fps)