



IP Video Surveillance

■ Presented by Mao Cai

Agenda

- 1 **Company & Project Description**
- 2 **Video Surveillance evolution**
- 3 **Features of Network Video recorder**
- 4 **Next semester's task**
- 5 **what I have gained**

Company

❖ Computers New Zealand

- CNZ is in the business of providing IT consulting advice, hardware platforms, software and support services to business customers.
- Starting November 2008, CNZ has researched into IP based video surveillance technology and has since successfully installed IPVS system in 3 projects



Project Description

❖ Video Surveillance

- CCTV & IPVS two technologies
- Research on differences between CCTV & IPVS in terms of technology and implementations
- Learn the implementation of surveillance system
- Test system
- Investigate & Development new functions

Video surveillance history

❖ CCTV: 40 years ago

- Cameras + coax cable + VCR (tape)

❖ CCTV: 12 years ago

- Cameras + coax cable + DVR (disk)

- Quality not bad
- Cost not high
- But people want more ...

Video surveillance history

❖ Nowadays

- Internet Protocol Video Surveillance (IPVS)
- IP cameras + Category 5 cable + Network Video Recorder (NVR)
- Digital technology
- Cost is higher...

Why IPVS

- Higher resolutions
 - IP Camera: 1.3 MP
 - Analogue Camera: NTSC specifications restrict – 0.4 MP
- Quality transmission
 - IPVS: Network cable, packets based (binary data stream)
 - CCTV: Coax cable, electronic waves inside, **interference**
- Flexible recorder
 - IPVS: Usually a software, sometimes vendor sell it as a complete, pre-configured PC. Open platform.
 - CCTV: A closed-box. Open it = Lost warranty

More on IPVS – Camera

Camera is the most important element...

- Aim of VS is monitoring a certain place, we want to see everything if possible – so we need high quality videos.
- How to choose cameras?

○ Basic components:

- A lens / a few lenses
- A sensor
- Signal-processing chips

Light passes through the lens then project onto an image sensor.

Image sensor 'converts' light (photons) to voltages and then produces signals.

Quality of images/videos

○ Key aspects:

- Focal length

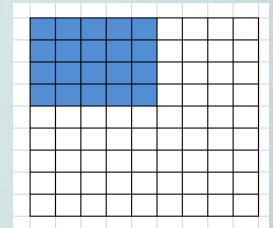
- how far the object can be captured. A short lens with less mm (12 for example) provides a very wide angle of view.

- Sensors

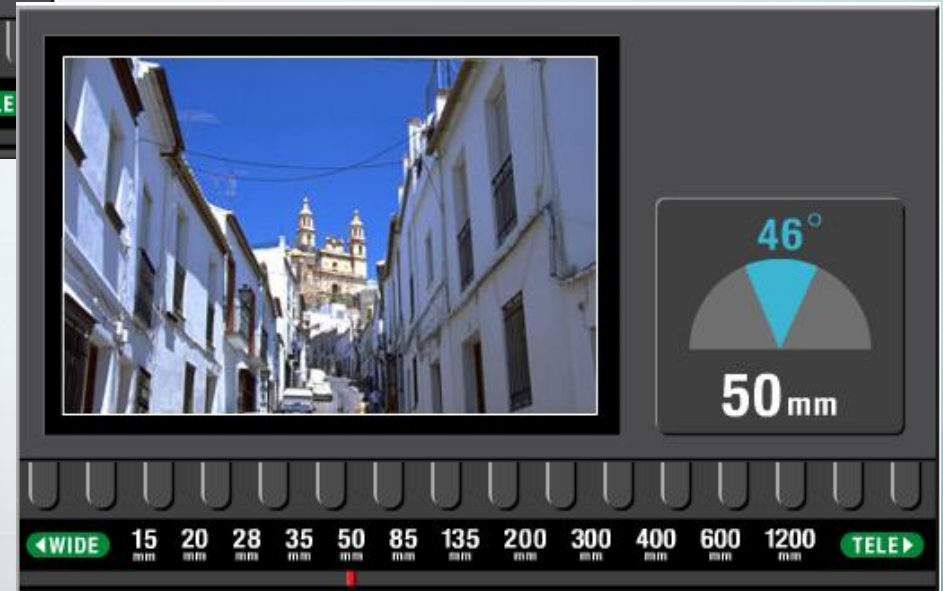
- CCD – Charge-coupled device. Every pixel's charge is transferred through one output node to be converted to voltage.
 - CMOS – Conversion is performed individually for each pixel at same time. Often includes a ADC.

- Chips efficiency

- High-end cameras have powerful chips. More functions.



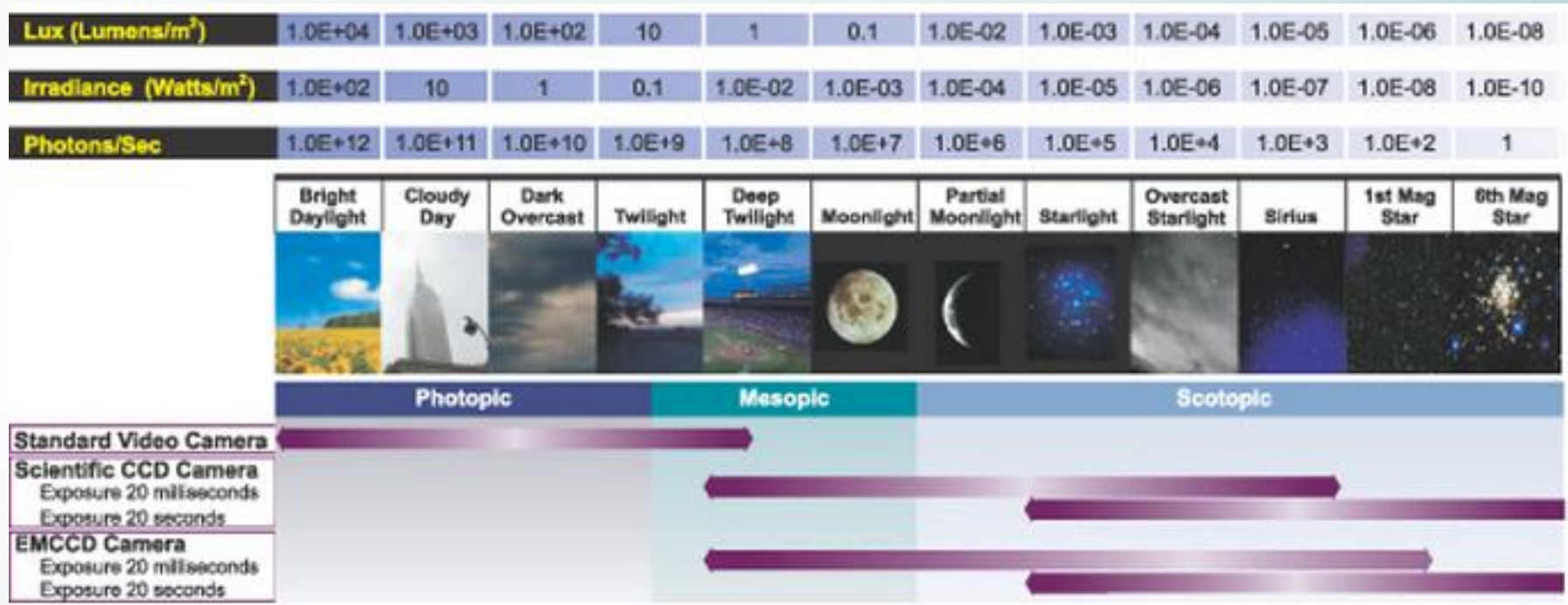
Quality of images/videos



Analysis of IP Camera

- Sensor – CMOS (Complementary metal–oxide–semiconductor)
 - “parallelized” light to electrical signal conversion, so sensor is fast
 - Amplified and noise-correction for each pixel. Image quality is lower, because of physical implementation.
- Sensitivity
 - some products could have 0.05 lux, some are ~1.0
 - No problems on day time, not as useful low light source background.
- wide dynamic range technology
 - Scans the same frame twice – slow scan, then fast scan. Processing two frames together and result in single frame.
 - Clear and low noise image. Not too bright, not too dark.

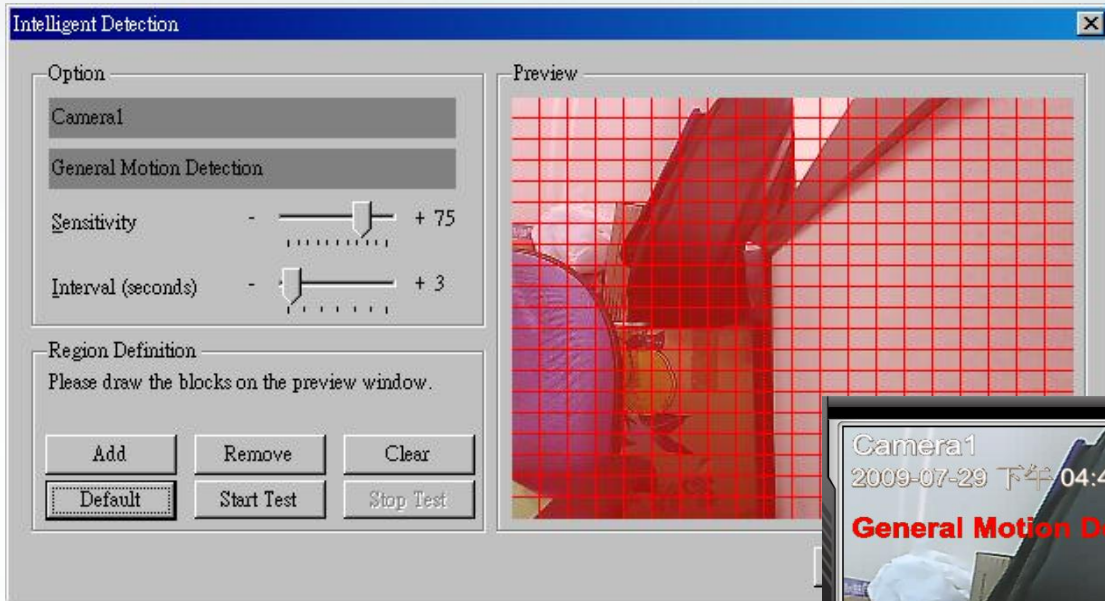
Analysis of IP Camera



Network Video Recorder

- **Monitoring & Recording**
 - Live videos – up to 64 IP cameras
 - Real time PTZ controls (pan, tilt, and zoom)
 - H.264/MPEG4 30 fps, mega pixel compressed video – high quality
- **Event detections**
 - Motion detections – set up a detection zone and monitoring the pixel changing.
 - Events such as focal loss, signal loss. – 10 seconds pre-record and unlimited post-record
- **Searching**
 - Smart search: helps user to investigate changes or actions in recorded videos automatically

Network Video Recorder



Network Video Recorder

- Storage Issue
 - Video recording require huge disk spaces
 - People also do not like sit at front of computer 5 hours to search when the door has been opened.
- NVR solution
 - Motion detection – record if something has been changed.
 - Always keep 10 seconds video in memory, if event happened, the video in memory will be saved to disk, this is called prerecord.
 - NVR must have a good algorithm design.

Motion Detection Algorithms

- Concept
 - Compare current frame and previous one.
 - Set a value called sensitive level, if the difference is bigger than the sensitive level, then there is a change.
- How to (based on C# image processing library(1))
 - Filter to clear the random noisy pixels
 - Capture the first frame of the stream as 'background'
 - Capture the previous frame, compare both with current frame.
 - If there are some changes, set background to the i frame where $i = (\text{background frame} + \text{previous frame}) / 2$

(1) available: http://www.codeproject.com/KB/audio-video/Motion_Detection.aspx

Motion Detection Algorithms

- This is only a concept
 - Two comparisons make sure that it can either detects slow moving objects or fast moving objects.
 - It can be optimized for different cases.
- Someone's work



Compare with previous frame only

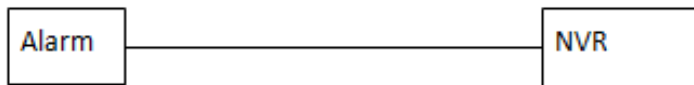


Compare with both frames

source: http://www.codeproject.com/KB/audio-video/Motion_Detection.aspx

Next semester's task & goals

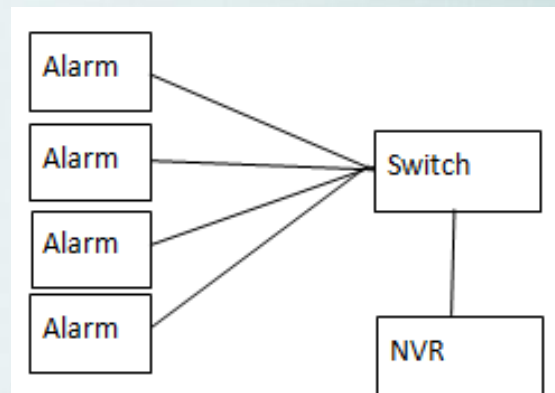
- A new function to the system
 - Digital input/output for NVR – for example, connect windows/door alarms to NVR
 - Detects alarm's signal



Send binary 1 every t seconds for communication check.

Send n binary 1's within t seconds for indication A
and send n binary 0's within t seconds to indicate end of A

If NVR get A, then start recording until get end instruction.



Each alarm is pre-programmed,
once alarm is on, it will send a packet
includes following data:

1. NVR's address
2. Alarm's address

Project summary

1

Have learnt the difference between IPVS and CCTV, possible to give a suitable suggestion to different users.

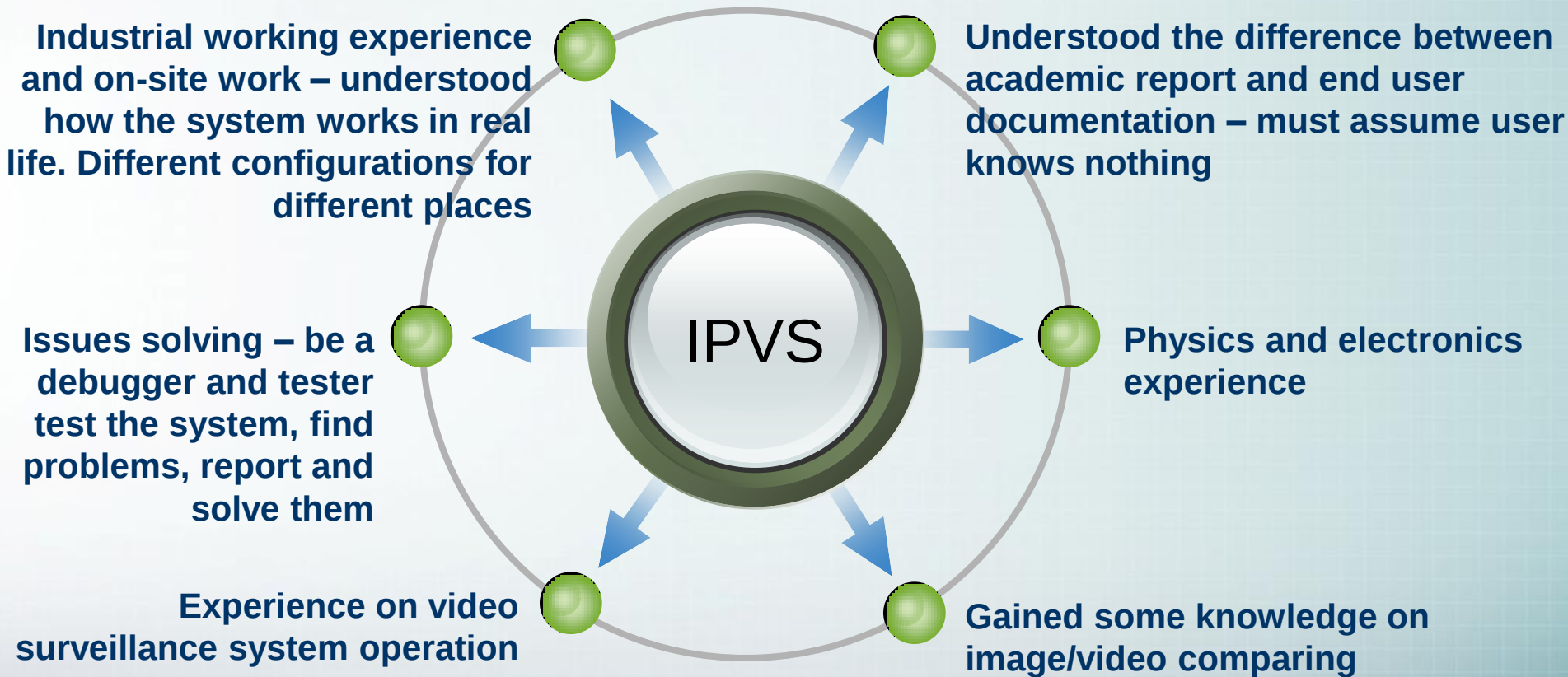
2

Investigated the implementation of video surveillance system. The operation of based elements.

3

Gave the possible suggestions to company to solve some issues. For example camera's IP has changed after router rebooting – turn off DHCP.

What I have gained





Thank You !