Designing Intelligent Surveillance Camera System

Koichi Sato

EE382C: Embedded Software Systems
Class Project: Final Presentation
Problem Statement

- Design an intelligent surveillance system
  - Preprocess for human tracking and human interaction recognition
    - Velocity extraction
    - Human segmentation

- Camera Features
  - Lateral view static monochrome camera

- Hybrid system
  - PC yields final results for whole system
- Binarization process
  - \( r \): execution cycle per one frame cycle
**TSV Transform**

- Extracts velocity from a sequence of one-dimensional binary images
  - Parallelogram shift (horizontal shift)
  - Multiplication / Addition
Design on Ptolemy
Simulation on Ptolemy

- Domain:
  - SDF

- Implementation
  - Stars in C++ / galaxy in dataflow programming

- Inputs
  - Sequence of PGM files (320x240 pixels)
  - 100 images in the sequence

- Output
  - Velocity extracted sequence of image (TSV image): PGM format (320x40 pixels)
  - 100 images in the sequence
Results

Original Image

TSV Image

velocity

20th frame

40th frame

60th frame

80th frame

100th frame

velocity
Simulation on microprocessor

- **Hardware Implementation**
  - 16bit CISC Microprocessor (Hitachi H8/3048F)
  - Multi-port DRAM specialized for Image processing / Graphics (Mitsubishi M5M442256) (1Mbit x 4)

- **Software Implementation**
  - C / Assembler
Result

- Computation time
  89msec / cycle
  < 100msec = 3 frame cycles
- Data rate to PC : 128kbps
- Code size : 5732 bytes
- Internal RAM usage (static) : 854 bytes
Conclusion

- Ptolemy Simulation
  - SDF: C / Data flow programming
- Hardware Simulation
  - 16 bit CISC Microprocessor / Multi-port DRAM
  - Fast computation (3 image frame cycles) with low power processor
  - Small code size
  - Small internal RAM size
- Future Work
  - DSP Simulation on Ptolemy
  - DSP Implementation on hardware