FLEXIBLE INTELLIGENT VISUAL SURVEILLANCE SYSTEM

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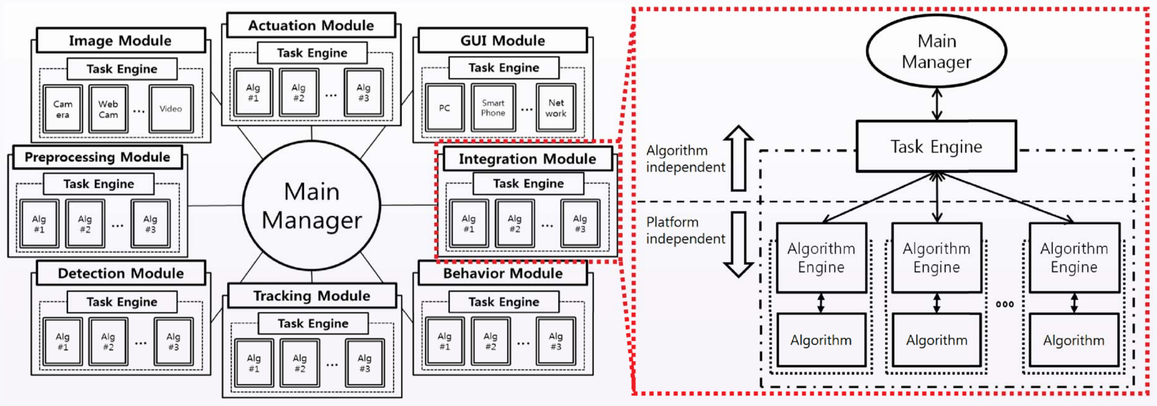
Abstract

We develop a real-time intelligent visual surveillance system named as ***perception and intelligence lab - enhance your eye (PIL-EYE)*** by applying flexible modular system architecture. Any functional module and algorithm can be added or removed independently. Also, functional flow can be designed by simply placing the order of modules. Algorithm optimization becomes easy by checking computational load in real time and commercialization can be easily achieved by packaging of modules.

The PIL-EYE Architecture



- ***Main manager*** manages the whole system flow and resources.
- ***Task engine*** is connected to the main manager and instantiates task modules.
- ***Algorithm engine*** exists for each algorithm which is actually run to achieve tasks.

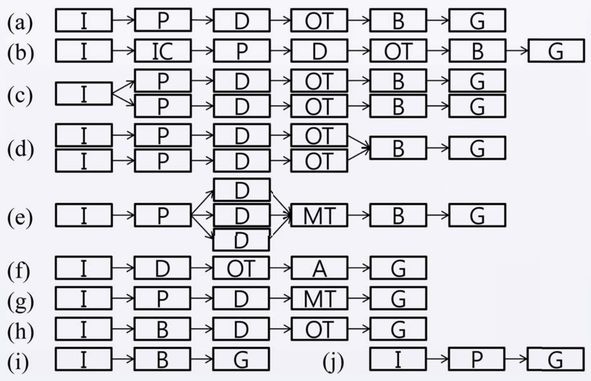
Since the main manager communicates only with task engines, it is algorithm independent. Also, algorithm engine acts as a wrapper for each individual algorithm, making the task engine algorithm independent as well. Also the algorithm engine wraps the algorithm to fit the platform or OS.

Principles of Architecture

1. *The system consists of instances of each module.*
2. *All communications are hold within child-parent relationship.*
3. *No communication between children nor between parents.*

System Aspects

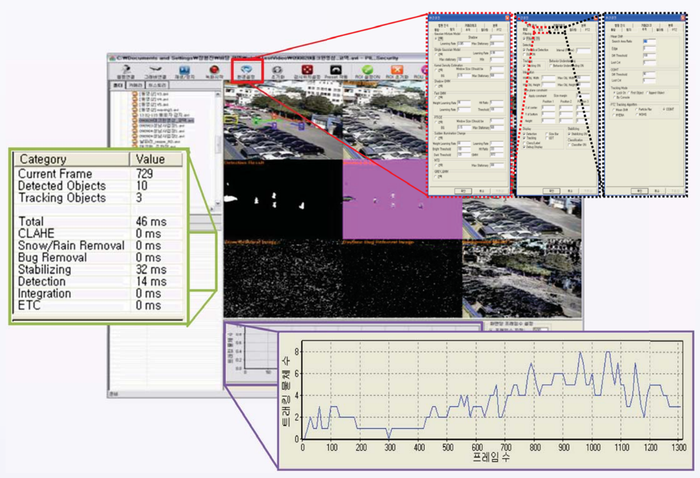
Openness: New algorithms can be freely plugged-in regardless of programming language and platform.
Extensibility: The functionality of system, such as a new task module or sensory device, can be extended freely.
Flexibility: The system flow can be flexibly designed, because all the I/O interfaces of the task engine and algorithm engine are standardized and independent to each other.
Transparency: The computation time and memory of individual algorithms can be easily measured by checking independent modules.



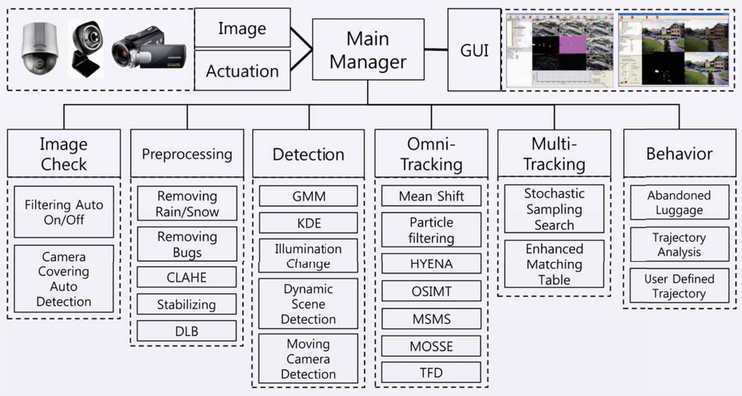
- Flexibility in designing system flow. Block I, IC, P, D, OT, MT, B, A and G are image, image check, pre processing, detection, omni-tracking, multi-tracking, behavior, actuation and GUI module respectively.

System Implementation

The system is composed of a single main manager and 9 task engines, and implemented in C++ and uses VXL image plane format. The system operates on a windows PC, but only the task engines related to image acquisition, actuation, and GUI are related with the OS, and therefore can be easily ported to many platforms.



- GUI of PIL-EYE system. Configuration window and running algorithm information.



- Implemented algorithms in the PIL-EYE system.

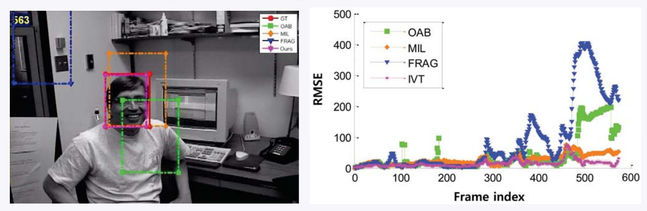
Performance

1. Synergy by Combining Algorithm
The preprocessing module reduces false alarms by filtering out noises and enhancing quality of input video.

Synergy by Snow Removal Filter

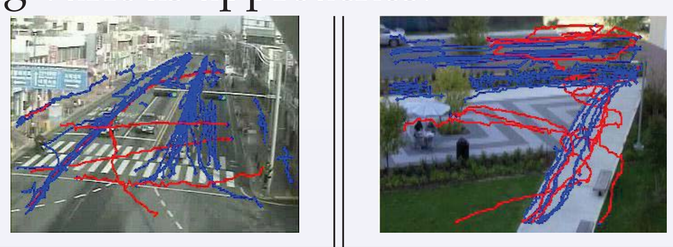
Filter OFF **Filter ON**

Robust tracking performance has been achieved by using detection results.



- IVT tracker (pink) is our tracker.

2. Abnormal Behavior Detection
The flexibility is suitable for developing various approaches.



TP	TN	TP	TN
83.3%	98.2%	80.0%	92.9%

- Results for abnormal trajectory detection. (TP: true positive, TN: true negative)

Acknowledgements

The research was sponsored by Samsung Techwin Co.,Ltd. and SNU Brain Korea 21 Information Technology program.