



Petrozavodsk State University
Department of Computer Science



Nikita Bazhenov, Dmitry Korzun, Sergey Balandin

Smartphone-Oriented Development of Video Data Based Services

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Application Domains of Video Data Based Services

- Smart safety and security: geo-spatial territory monitoring for protection
- Ambient Assisted Living: smart assistance to patients in their everyday life
- Event detection: monitoring of production equipment and service personnel during the operation
- Video surveillance: other services that use video captured from video cameras



Ambient Assisted Living



Smart Safety & Security



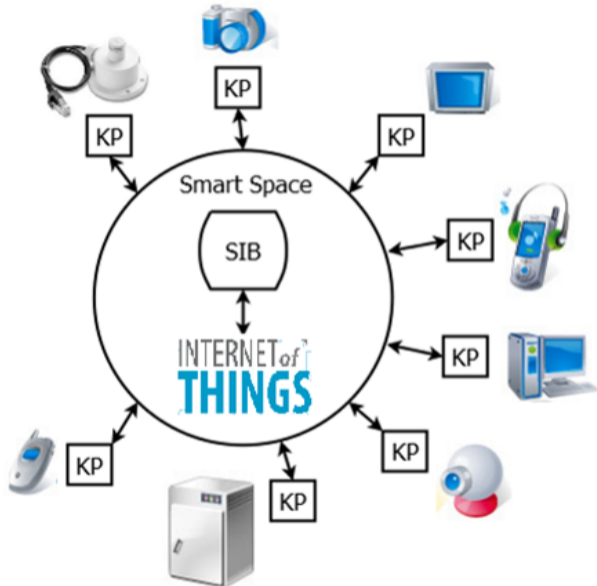
Event detection facilities



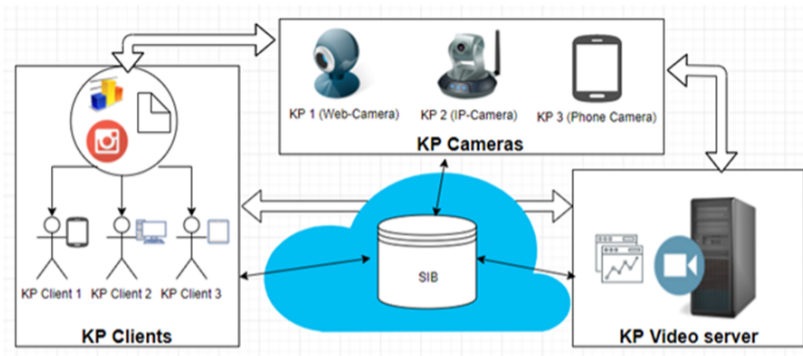
Video surveillance

IoT Environment for Constructing Video Data Based Services

- Many video-capture devices and data processing devices
- Local devices for data processing
 - ▶ Video server hosting known video analytics algorithms
 - ▶ Agents acting as Knowledge Processor (KP)
- Semantic Information Broker (SIB)
 - ▶ Shared view on available resources (captured video, data processing, results)
 - ▶ smart space of information services (for mobile users)

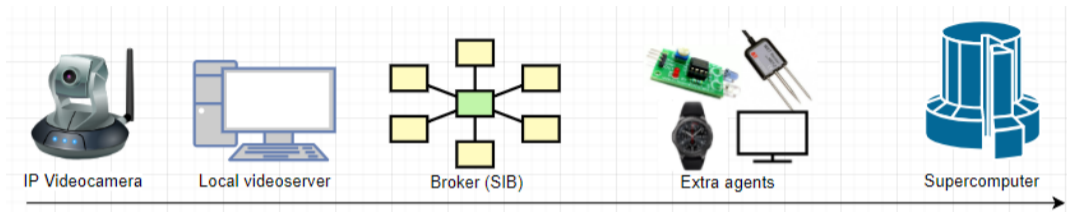


Proposed Architecture



- Based on the Smart-M3 platform: sourceforge.net/projects/smart-m3/
- KP — Knowledge Processor: an access point to video capture and data processing
- Video server: a “traditional” system for data processing and storage
- SIB — Semantic Information Broker: a shared view on video data for all participants

Extendable Use of IoT environment



- **Local video server**: video data processing and storage are performed locally
- **SIB** integrates available processing resources and video analytics results
- **Extra KP agents** implements some data processing (in addition to the video server)
- **Supercomputer** remotely implements resource-intensive data processing if needed

Examples of Video Data Based Services

- *At-Home Lab for healthcare*: Personalized healthcare services provided at home settings, where everyday cameras are used for video capture.
 - ▶ Services analyze the human motor activity in everyday life conditions
 - ▶ Reduced analysis precision compared with medical and healthcare laboratories having professional equipment
- *Face recognition*: Person identification and verification using images in video data
 - ▶ Video data are coming from multiple cameras installed in a spatial area (building, out-door, public space)
 - ▶ Cameras are typically of low capacity and of heterogeneous characteristics
- *Equipment monitoring*: Detection of deviations in equipment operation
 - ▶ In addition to cameras installed near the equipments
 - ▶ Personnel use smartphone camera to observe the current operation situation

Possible Desktop Platforms for Service Client Development

	Windows 7	Windows 10	Windows 8.1	MAC OS	Linux
Market %	42.39%	34.29%	5.56%	4.46%	1.31%
Release year	2009	2015	2013	2001	1991
Accessibility	Very high	High	High	Low	Medium
Access to low-level functions	Medium	Medium	Medium	Low	High
Complexity of programming	Medium	Medium	Medium	Medium	Easy
Processing speed + complexity	High	Low	Medium	Low	High
Support for various libraries	High	High	High	Low	Medium
Prevalence	Medium	Very high	High	Medium	Low

Market Share Statistics for Internet Technologies, netmarketshare.com

Possible Mobile Platforms for Service Client Development

	Android (4.0-6.0)	Android (7.0+)	iOS	Windows Phone	Sailfish OS
Market %	51.54%	34.36%	14%	0.1%	0.1%
Release year	2011	2016	2007	2012	2013
Accessibility	Very high	High	High	Low	High
Access to low-level functions	High	High	Low	Medium	High
Complexity of programming	Medium	Medium	Low	Medium	Low
Processing speed + complexity	Medium	High	High	Low	Very High
Support for various libraries	High	High	Medium	Low	High
Prevalence	High	Very high	High	Very low	Very high

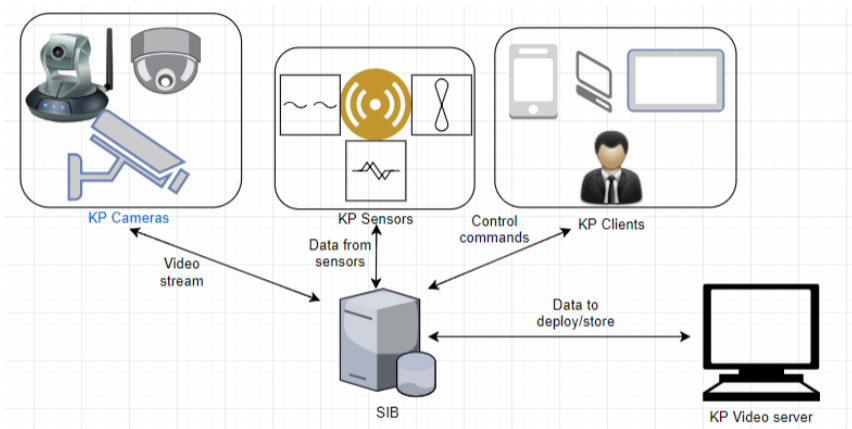
Market Share Statistics for Internet Technologies, netmarketshare.com

Video Data Processing

“Traditional” data processing using known algorithms

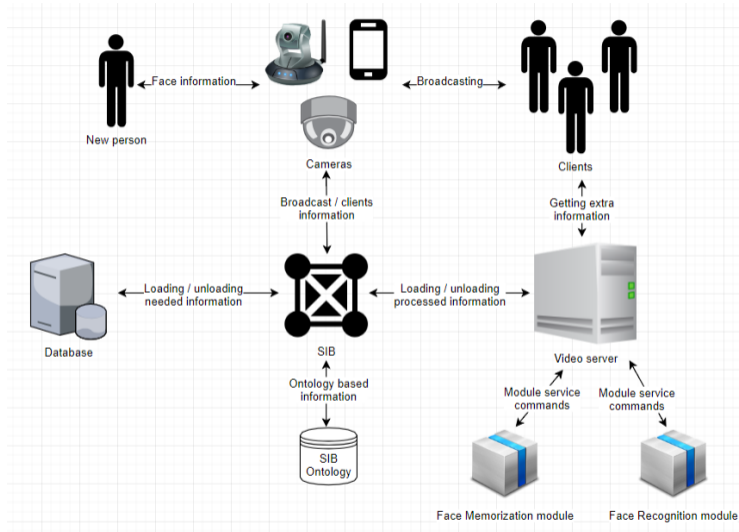
- An algorithm processes one or more video data streams
 - ▶ directly on the video capture device (e.g., smartphone)
 - ▶ the video server receives the data streams
 - ▶ additional KP on some appropriate device nearby (e.g., smartphone)
- Direct service provision to clients
 - ▶ visualize/play the stream to the user (e.g., smartphone)
 - ▶ observable reaction on events detected in the processed flow
 - ▶ augment the video stream with non-video information (e.g., context from sensors)
- Collection of data processing results
 - ▶ store discovered video analytics for later use
 - ▶ offline video and statistics
 - ▶ video server is a primary storage

Semantics for Data Mining



- SIB virtualizes the resources: camera discovery, data discovery, service discovery
- Service clients are connected with services
- Services are constructed based on discovered data and using appropriate resources

Implemented Prototype



See our demo *A Mobile Application for Presence Detection based on Face Recognition*

Conclusion

- Distributed architecture for constructing video data based services
- Extendable IoT Environment configurations
- Analysis of platforms for service client development
- Models of video data processing based on known algorithms and semantic methods of data mining
- Demo of mobile application presence detection based on face recognition

Thank you!

`github.com/nikitawow1337`

bazhenov@cs.karelia.ru