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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 form video cameras
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

<table>
<thead>
<tr>
<th>Feature</th>
<th>Windows 7 (%)</th>
<th>Windows 10 (%)</th>
<th>Windows 8.1 (%)</th>
<th>MAC OS (%)</th>
<th>Linux (%)</th>
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<tbody>
<tr>
<td>Market %</td>
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<td>34.29%</td>
<td>5.56%</td>
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<tr>
<td>Access to low-level functions</td>
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<td>High</td>
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<tr>
<td>Complexity of programming</td>
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<td>Medium</td>
<td>Medium</td>
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<td>Easy</td>
</tr>
<tr>
<td>Processing speed + complexity</td>
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<td>High</td>
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<tr>
<td>Support for various libraries</td>
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<td>High</td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>Prevalence</td>
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<td>Very high</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
</tr>
</tbody>
</table>

Market Share Statistics for Internet Technologies, [netmarketshare.com](http://netmarketshare.com)
## Possible Mobile Platforms for Service Client Development

<table>
<thead>
<tr>
<th></th>
<th>Android (4.0-6.0)</th>
<th>Android (7.0+)</th>
<th>iOS</th>
<th>Windows Phone</th>
<th>Sailfish OS</th>
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<td>Access to low-level</td>
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<tr>
<td>programming</td>
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<td>High</td>
<td>High</td>
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<tr>
<td>Support for various</td>
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<td>Medium</td>
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<td>libraries</td>
<td>Prevalence</td>
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<td>Very low</td>
<td>Very high</td>
</tr>
</tbody>
</table>

Market Share Statistics for Internet Technologies, [netmarketshare.com](http://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
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!

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