



# Biometrics and ABC at air, land and sea borders

4th Biometrics Institute Seminar

Identities at the Borders & the Movement of People

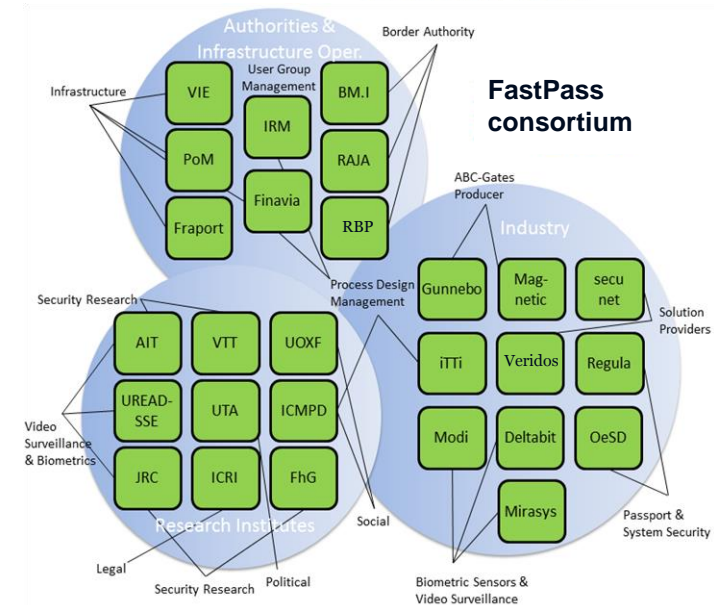
Presented by

Markus Clabian (Coordinator FastPass)

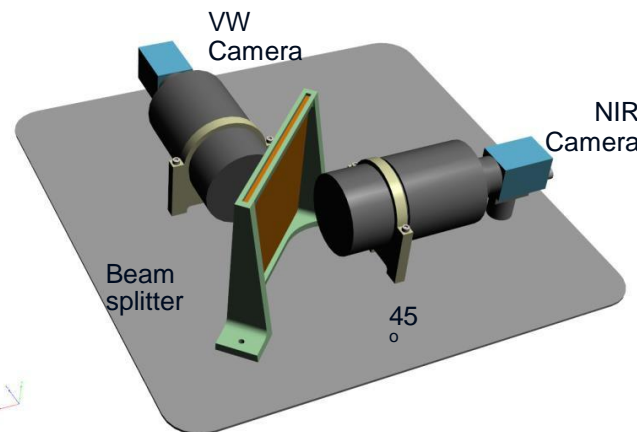
Senior Research Engineer, Safety & Security Department,  
AIT Austrian Institute of Technology, Austria

# Presentation Overview

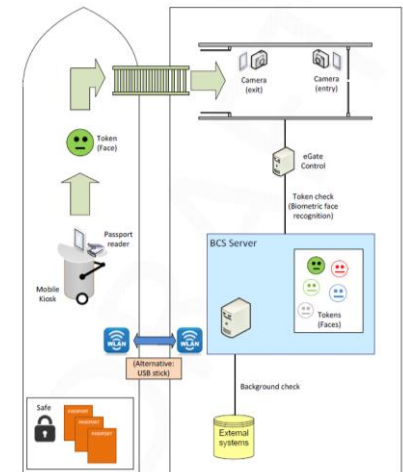
- **FastPass project, consortium, objectives, achievements and time line**
- **Biometrics and ABC**
  - **New algorithms**
  - **New technologies**
  - **New scenarios**



Camera-mirror system for kiosks (from Modi)



Multispectral iris sensor (from UREADSSE)



Cruise ship scenario

# Motivation

## Challenges :

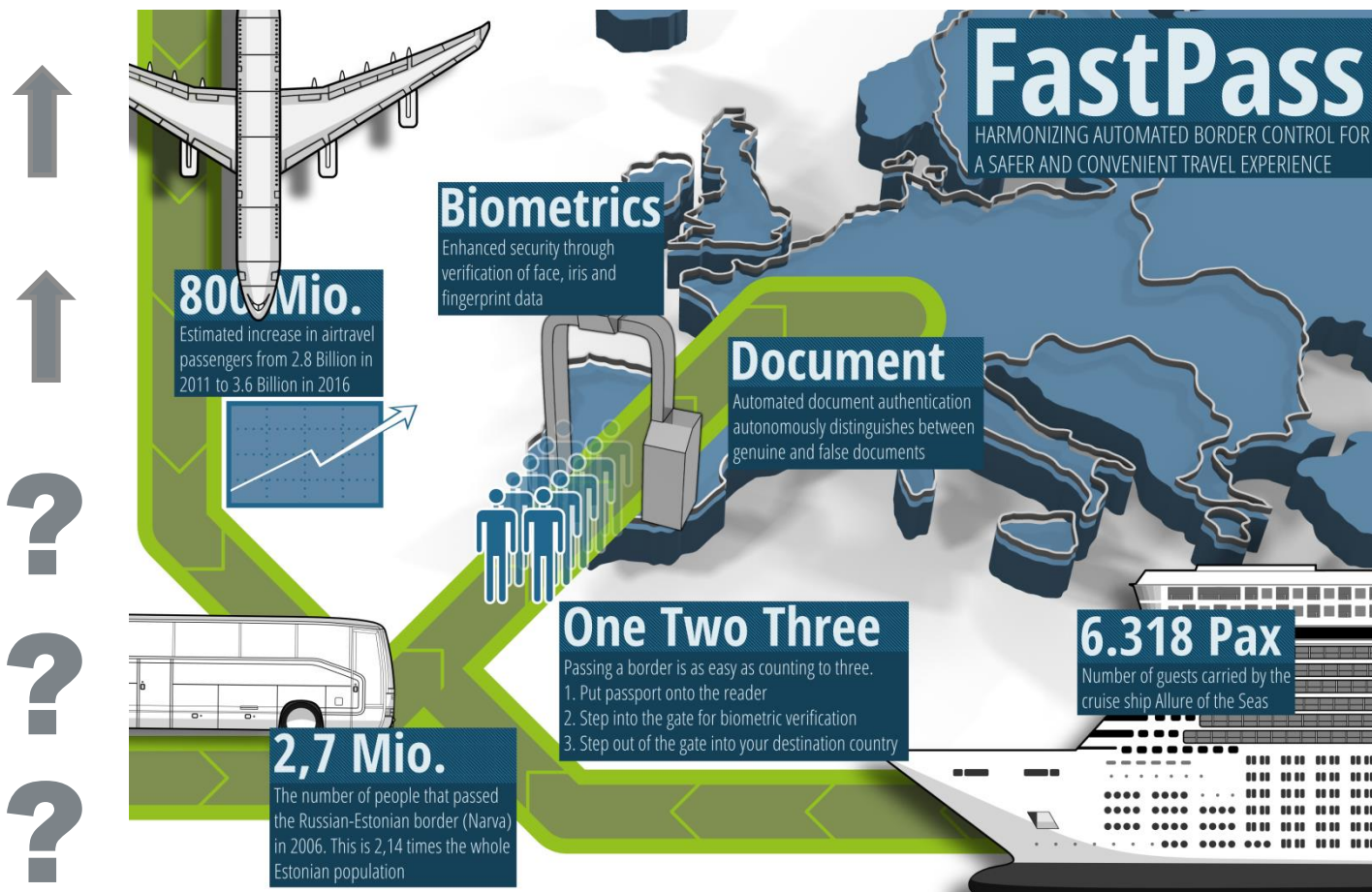
Passenger flow

Requirements on  
the border control  
process

System risk  
assessment

Harmonization

Variety in usage



21.04.2016

## FastPass Objectives

### Supporting Innovative Border Crossing Concepts

**Airborder:**  
Comparison of classical method with kiosk biometric token

**Landborder:**  
Process with/without registration

**Cruise ship:**  
Enhance nominal list with biometric information

### Architecture Based on Innovative Technologies

**Reference Architecture with open interfaces**

**Advanced Technology Modules**  
(Passport, Identification, Video Surveillance)

**Security evaluation**

### Integration with EES and RTP

**Extend usability to TCN**

**Evaluate the value of RTP for EU citizens**

### Harmonized ABC Systems

**Usage of passport scanners**

**Usage of kiosks**

**Instantaneous „Go Through“**

**Process harmonization**

### European cooperation

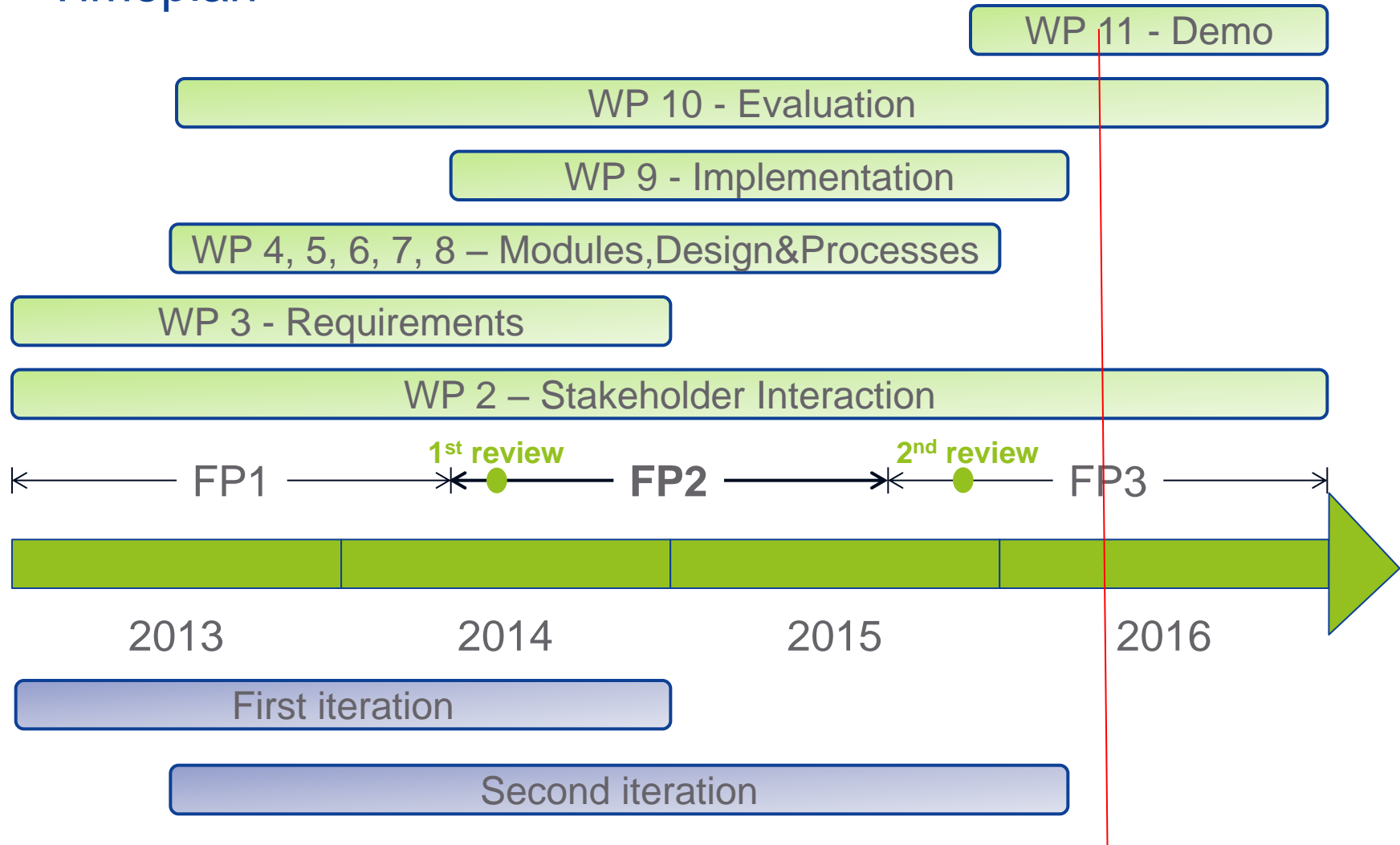
**Liason with commission, EP, Frontex, eu-LISA, FRA**

**Liason with other European Research Projects**

**Liason with industry**

**Liason with BG authorities**

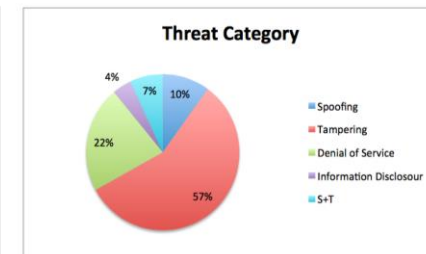
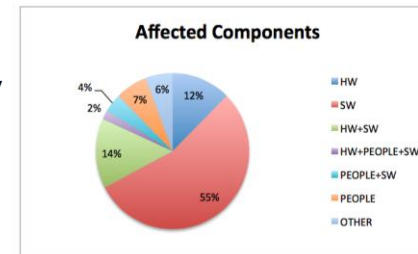
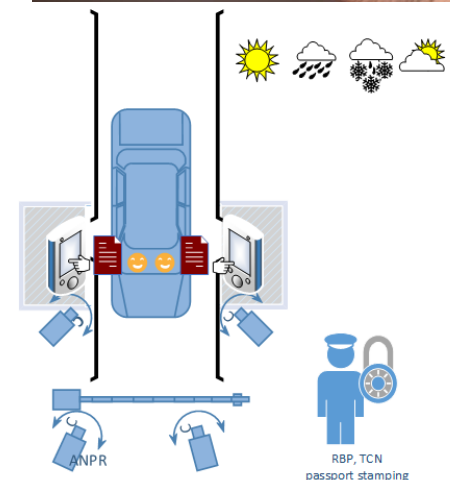
# Timeplan





## Main achievements

- **Next-generation sensor development and novel frameworks, software and algorithms**
  - On-the-move biometric identification, speed, quality, reduced intrusiveness, counter spoofing and costs
- **Innovative scenarios based on harmonized architectures**
  - Several air border scenarios, cruise-ship scenario, land border scenario with travellers remaining in the cars
- **Methodology for a holistic risk and security assessment**
  - List of threats, with type, impact, exploitability and mitigation strategy

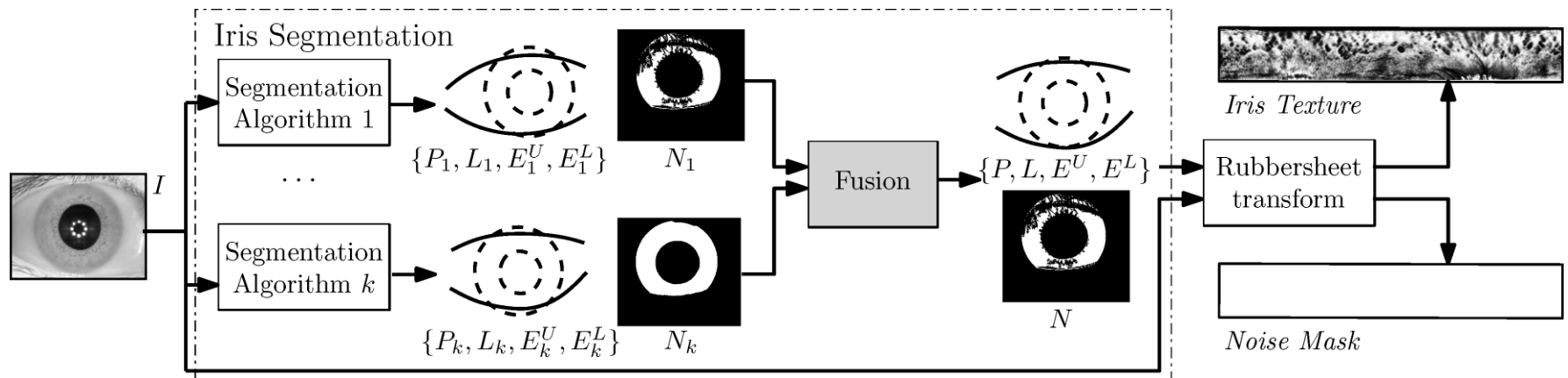


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# Segmentation-level Fusion for Iris Recognition

(by Wild, Hofbauer, Ferryman, Uhl; presented at IEEE BIOSIG, 9-11 Sep 2015, Darmstadt, DE)

- **Topic:** Novel fusion method at segmentation-level for iris recognition at-a-distance
- **Motivation:**
  - Better accuracy for less invasive recording conditions?
  - Potentially faster than multi-algorithm fusion?
  - Towards better understanding of algorithms' segmentation errors.
- **Contributions:**
  - Analysis of reference methods for iris segmentation-level fusion;
  - Considering ground-truth vs. recognition-based assessment.



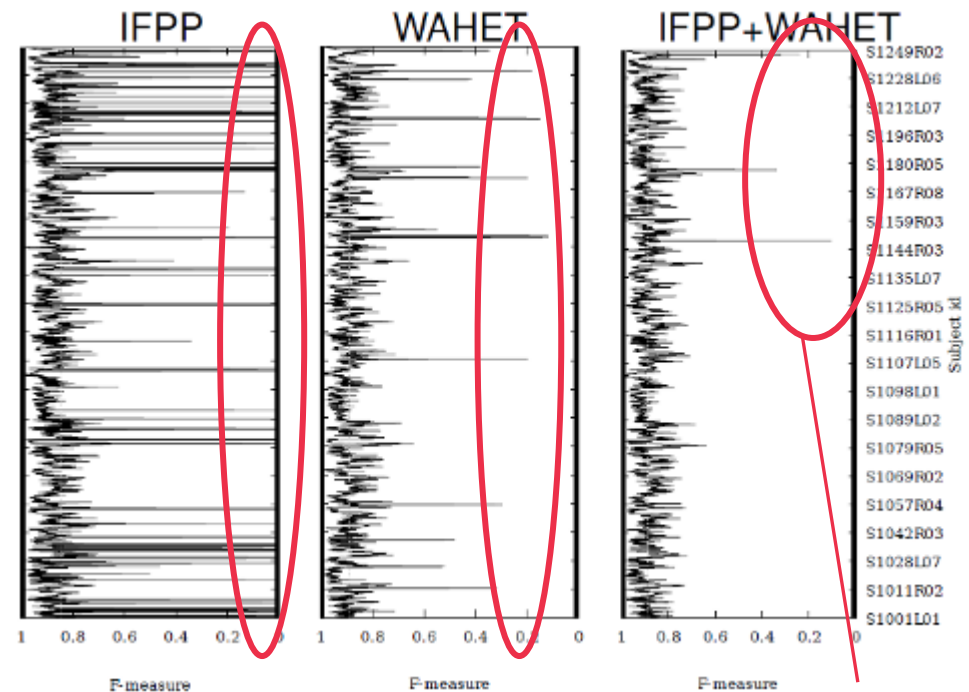
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# Segmentation-level Fusion for Iris Recognition (cont.)

- **Experimental setup:**
  - Multisegmentation fusion using pairwise combinations of CAHT, WAHET, IFPP and OSIRIS iris segmentation algorithms on public CASIA and IITD databases.

- **Result:**

- 10/24 Cases with autocorrective behaviour (augmented model fusion);
  - 0.64% Equal Error Rate (EER) for WAHET+CAHT vs
  - 0.99% EER for CAHT only



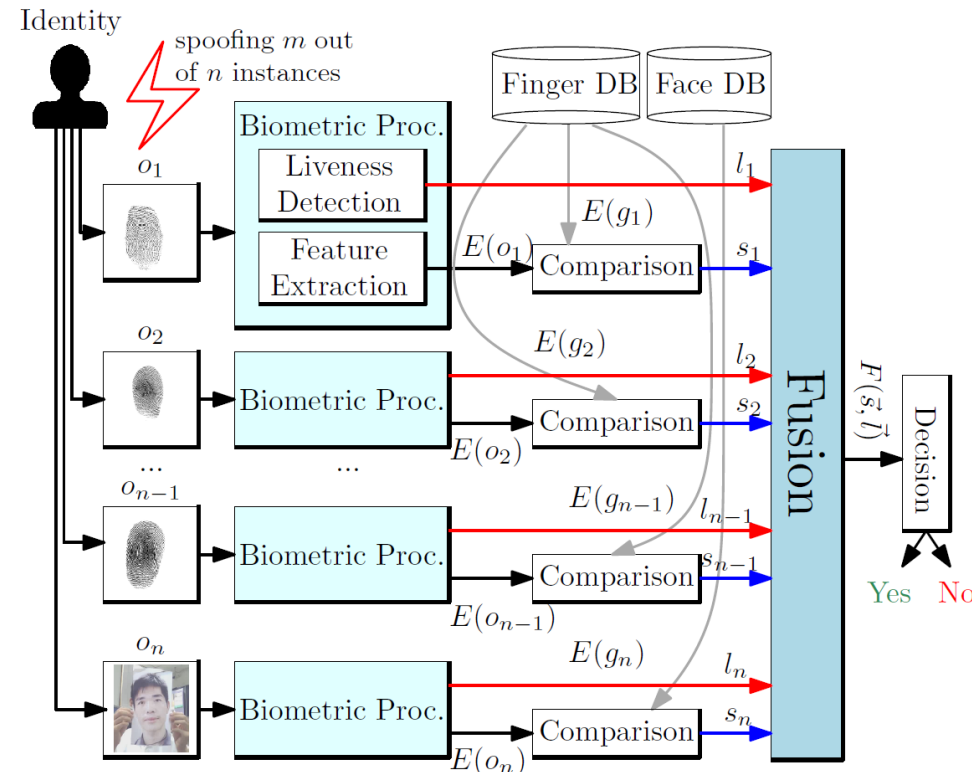
fewer outliers



# Spoofing-Resistant Multimodal Face & Fingerprint Fusion

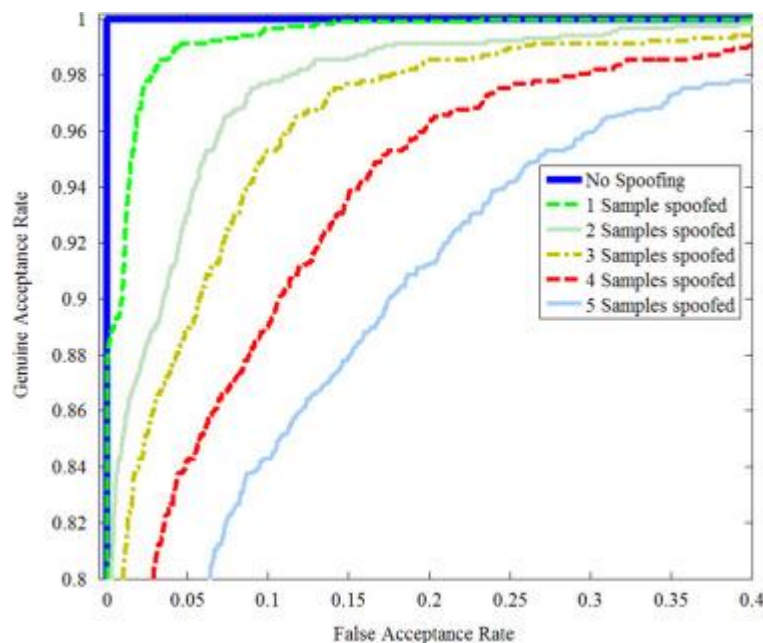
(by Wild, Radu, Chen, Ferryman; article in Pattern Recognition Journal – Impact factor 3.5)

- **Topic:** Problem of partial multibiometric spoofing (e.g., in border control) where  $m$  out of  $n$  biometric sources to be combined are attacked
- **Motivation:**
  - How to incorporate liveness scores into the biometric fusion process?
  - Can score anomalies be detected?
  - Towards better trade-off between cost (time, sensors) and security.
- **Contributions:**
  - 1-Median filtering as a spoofing-resistant generalised alternative to the sum-rule;
  - Novel fingerprint counter-spoofing algorithm with better performance on LivDet CrossMatch.

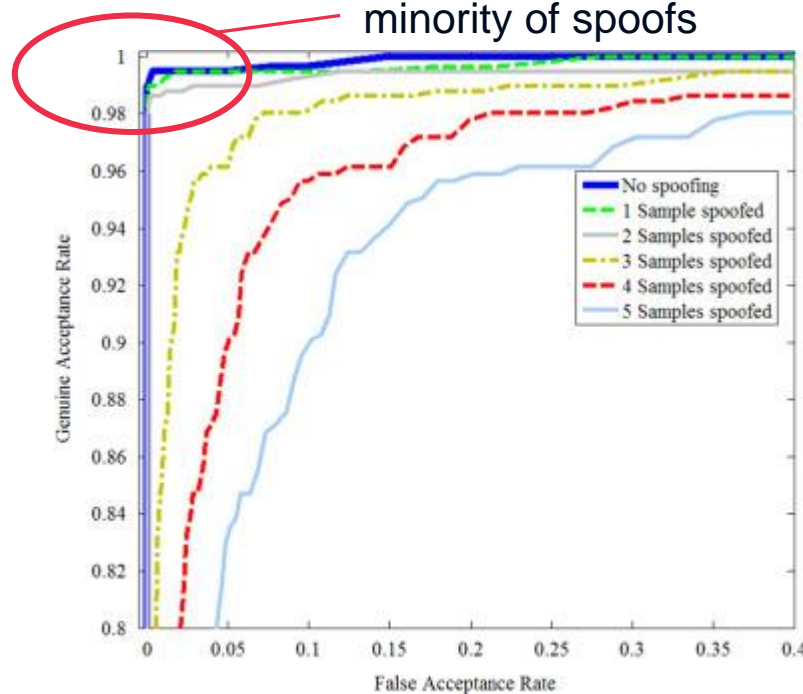


# Spoofing-Resistant Multimodal Face & Fingerprint Fusion (continued)

## Results:



Median Rule can better detect minority of spoofs

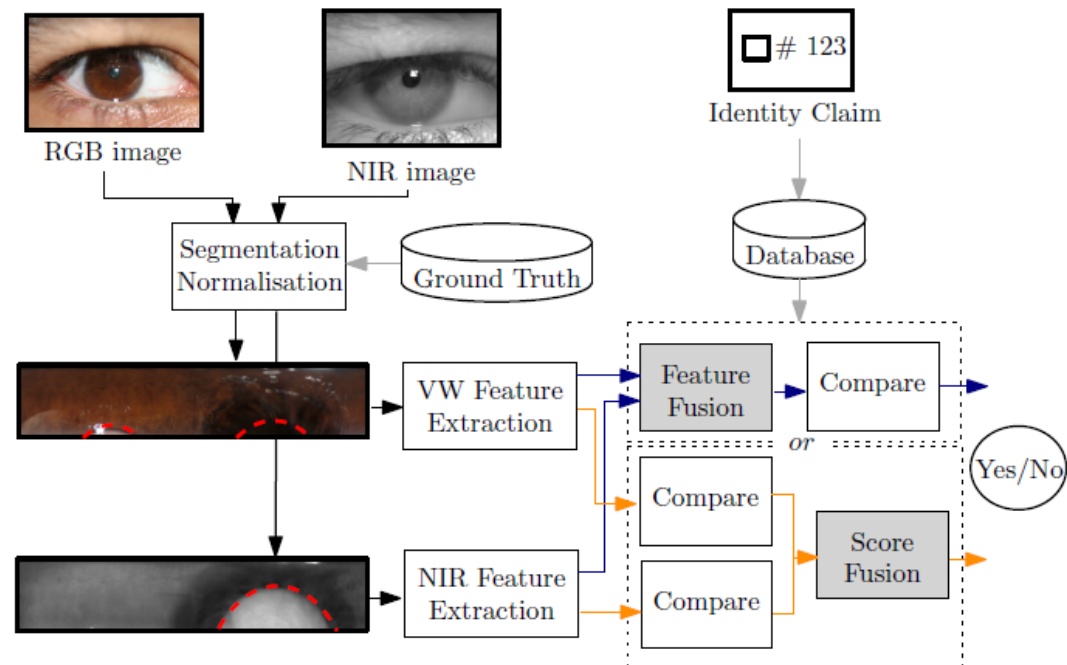


- Stabler results, where  $m$  out of  $n$  samples of an identity are spoofed (EERs 0.47–1.81% vs. 0–12.24% for the sum rule).

# Multispectral Iris Recognition

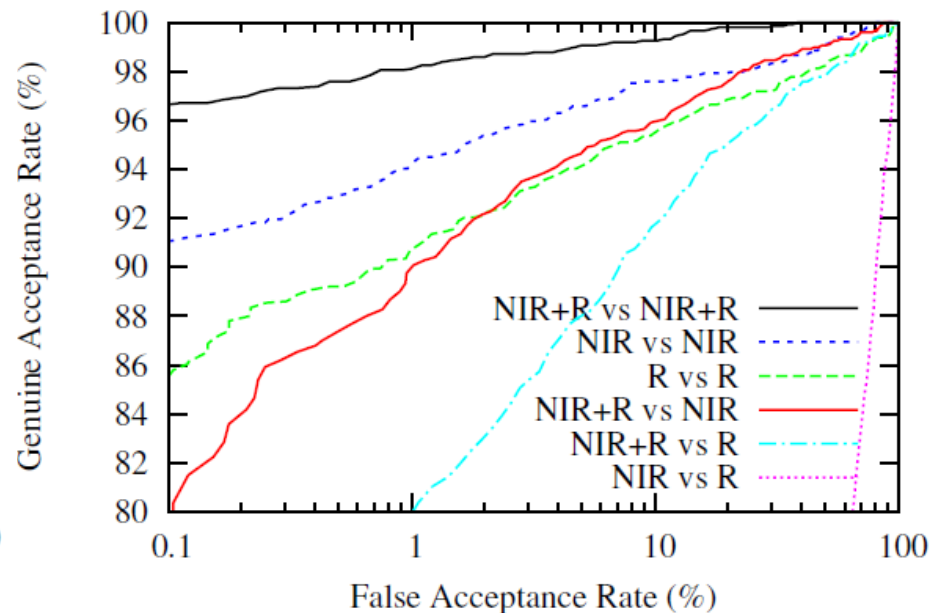
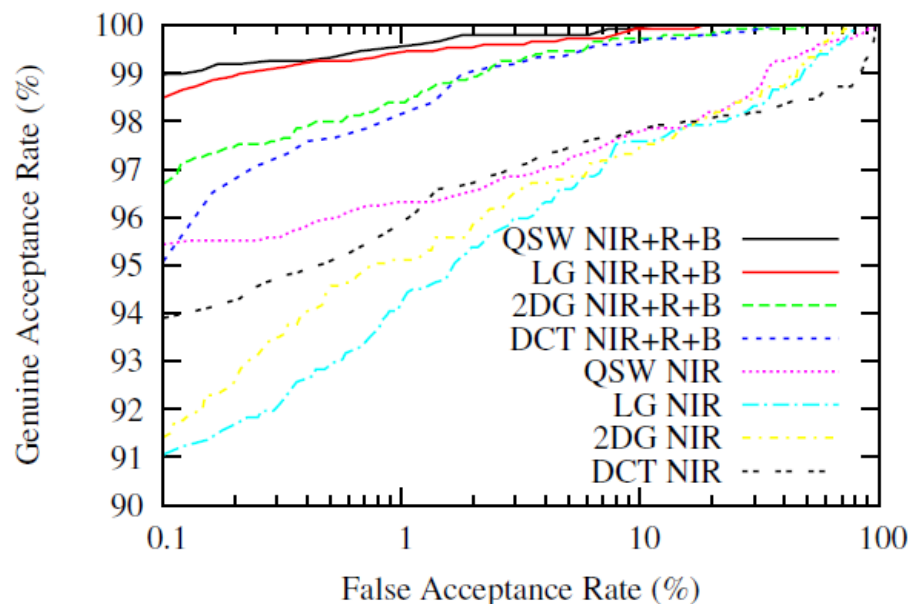
(by Wild, Radu, Ferryman; presented at IEEE ICB'15, 19-22 May 2015, Phuket, TH)

- **Topic:** Problem of comparison of single versus cross-spectral recognition performance and score-level fusion accuracy for different feature types
- **Motivation:**
  - Feature stability?
  - Ground truth based evaluation avoiding bias by segmentation impact
- **Contributions:**
  - Cross-spectral performance turned out to be highly challenging (EERs > 33%)
  - New multispectral random selective bits fusion technique



## Multispectral Iris Recognition (continued)

- **Results:** Executing tests on public UTIRIS multispectral iris database



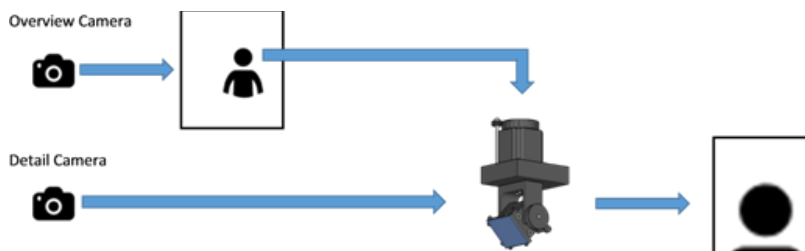
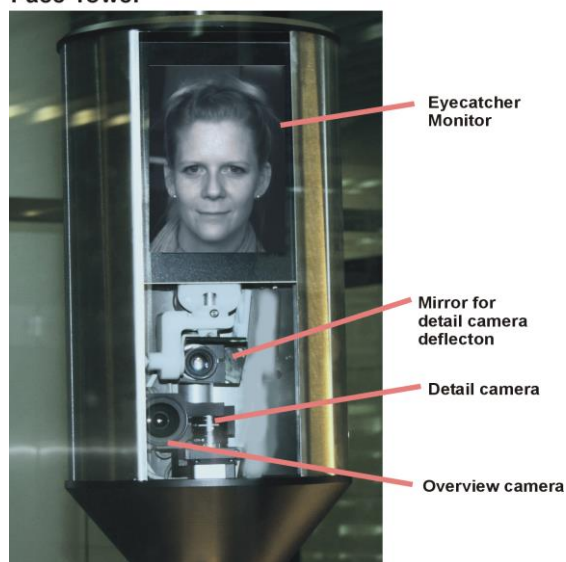
- Score-level fusion delivered best results for NIR+R+B for 3-channel
- Features can be rather susceptible to spectral channels
- Multispectral random selective bits fusion was able to improve accuracy (97% vs. 91% GAR at 0.1% FAR)

## On-the-move face identification

### New type of Face ID unit:

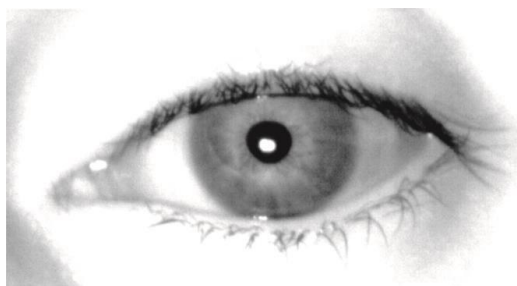
- Camera field of view deflected by fast moving mirror.
- ID unit in walking direction above the gate
- Adomo® cameras for face / iris capturing at height of 1,2 – 2,2 m at different positions.
- **Challenge:** for capturing face, users look around without looking at the camera properly and standing still close to the sensor
- **Solution:** face template generation from a series of face images (10+ images)
- Can be installed for land border and sea border scenarios
- **Results in >700 travellers throughput per hour instead of 150 per hour**

Face Tower





## Iris recognition prototype



### Current challenge on the market:

- Two groups of iris cameras
  - 1) Distance up to 0.5m, price range €1-5K, require user cooperation
  - 2) Distance up to 2m, price range €15-40K, require less user cooperation

### Objective:

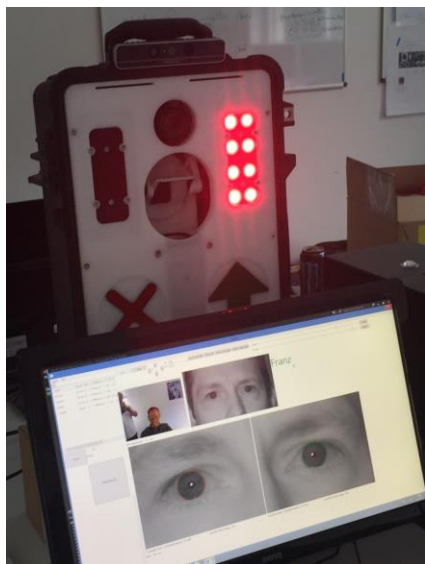
- Longer distance
- Less intrusive, more user friendly
- Much lower price

### Solution:

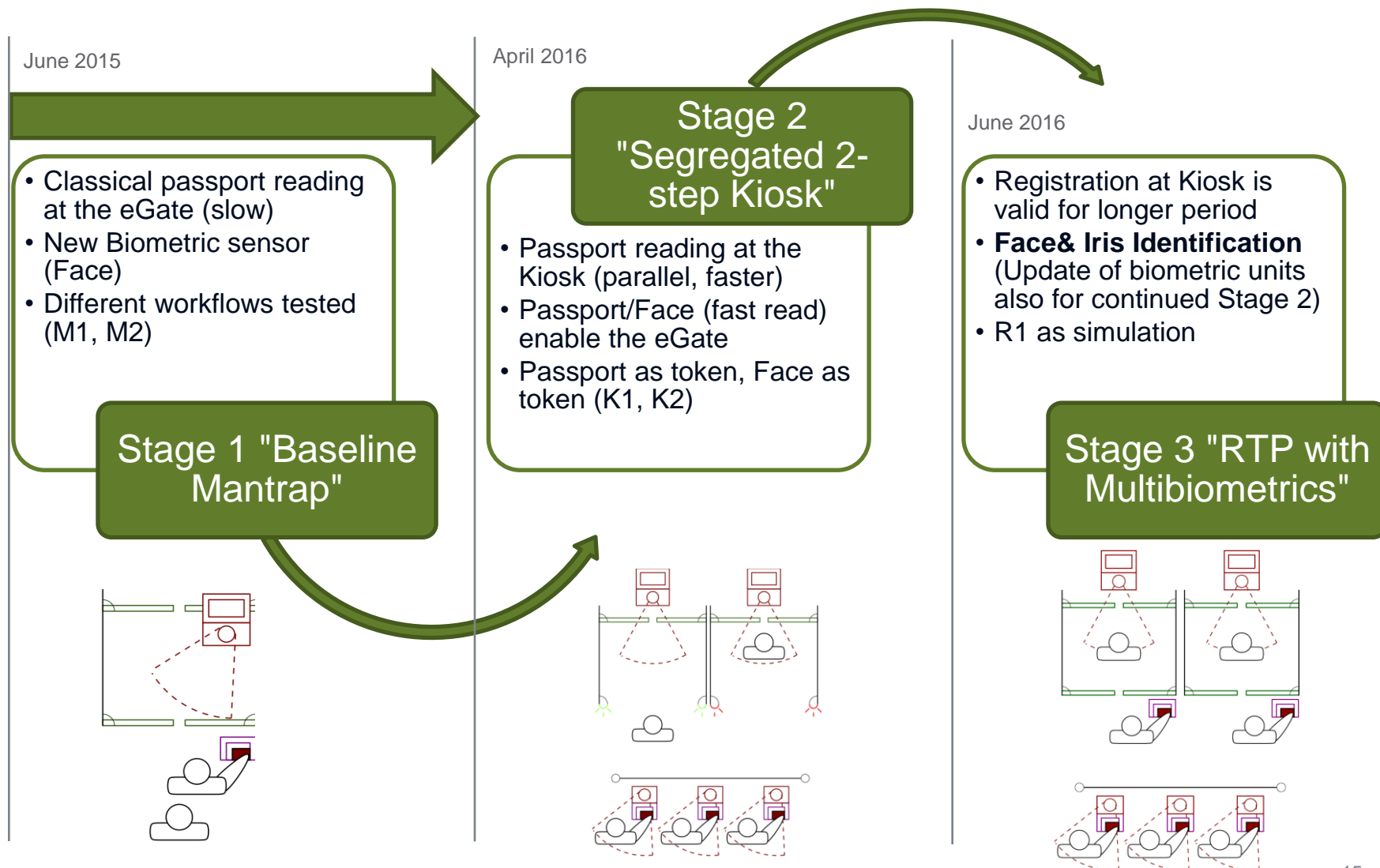
- Distance & region: 1.5m x 2m, with Adomo® mirror
- Novel iris capture camera
- Usable as token
- Minimum user cooperation
- Kiosk iris enrolment
- Price: around €5K

### Future focus:

- Development to reduce the size of the mirror
- To make integration into different housing easier

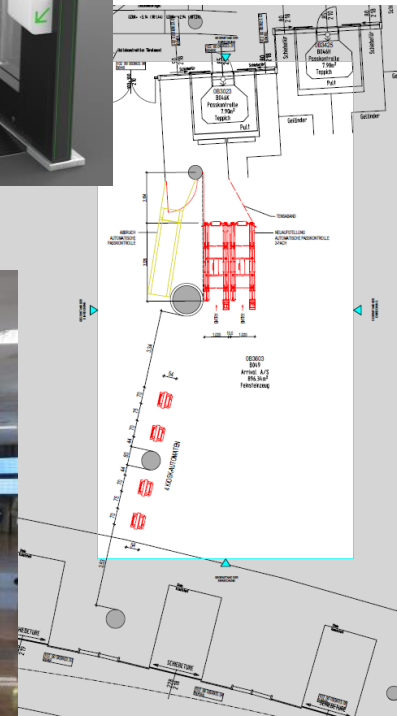


# Air border



## Air border

- Operational Test at Vienna International Airport
- Comparison of several installation types
- Documents: ePassports
- Travellers:
  - Stage 1: EU/EEA/CH
  - Stage 2 +3: + TCNVH, + TCNVE
- Biometrics:
  - Face (all Stages)
  - +Finger (Stage 2), +Iris (Stage 3)
- RTP (Stage 3) will be simulated



## Air border



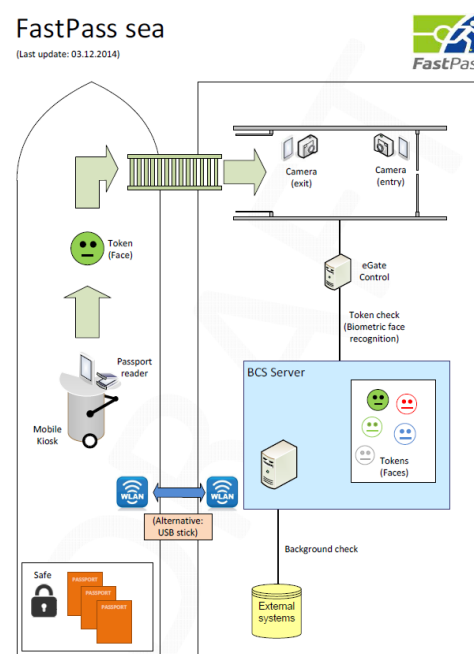


## Cruise ship

- Demonstration Test at Port of Piraeus
- Document Authentication
- Passenger Authentication and Identification (1 :n)
- Documents: ePassports
- Travellers: EU/EEA/CH, TCNVH, TCNVE
- Biometrics:
  - Face (+ Iris as test)
- RTP will be simulated



FastPass sea  
(Last update: 03.12.2014)



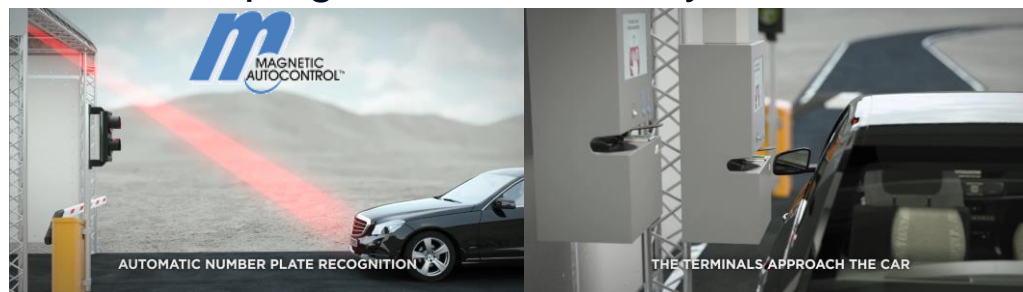
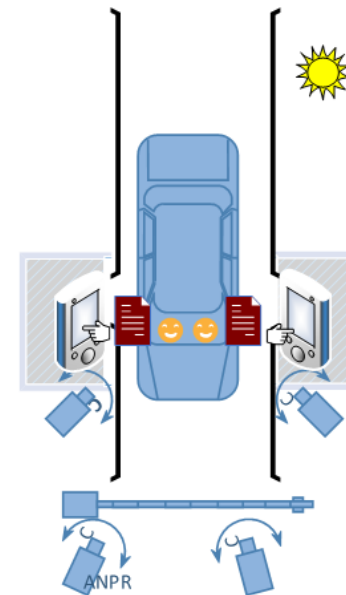
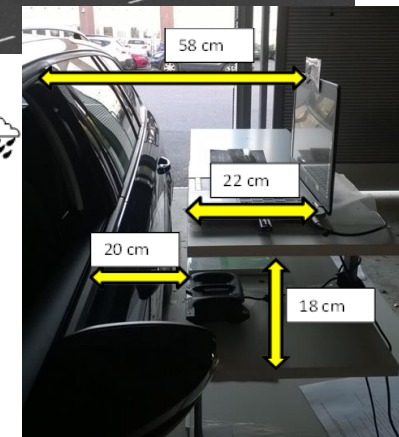
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## Land border

- Demonstration at Moravita
- Exit control for frequent traveller
- Enrolment of
  - ID documents
  - Vehicle documents
  - Driving license
- Moveable terminals
- ANPR to detect vehicle
- Driver and Co-driver check
- Customs check, occupancy check, stamping is done manually



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## FastPass – the system/technology, that

- **...is secure**
  - Resistent
    - to latest attacks on document scanner,
    - to biometric spoofing
  - Risk Assessment, Security Assessed by dedicated methodology
- **...you like**
  - UI developed with extensive feedback from different European border guards
  - Process and procedures developed with extensive evaluation from traveller groups
  - Respects privacy and data protection (Data protection impact assessment – DPIA)
- **...is harmonized – and shows new processes and scenarios**
  - ONE reference architecture serving many processes
  - First European solution for cars at land border with ABC
  - First solution for cruise ships
  - Real comparison of different approaches on an airborder crossing point

## Dissemination Activities

Type	
Papers in Journals or Conference proceedings	26
Presentations of the project (conferences)	58
Workshop (among them 6 organisation/chairing)	16
Press articles, specialised magazines	20
Academic work	2
Stand (among them 5 demo)	12
Video	3
Newsletter	10
Blog	5
<b>Total dissemination activities</b>	<b>152</b>

Research project conferences  
2014, 2015 and 2016



Presentations at Passenger  
Terminal Expo, Secure  
Document World and other  
conferences



eu-LISA conference:  
The future tested: Towards a Smart Borders reality



Organizing

1st +2nd International  
Workshop on  
Identification and  
Surveillance for Border  
Control (ISBC 2015,  
2016)

Best Voted Poster Award



Journal Paper in

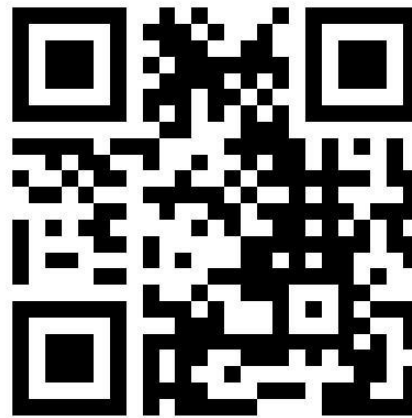


# Thank You !

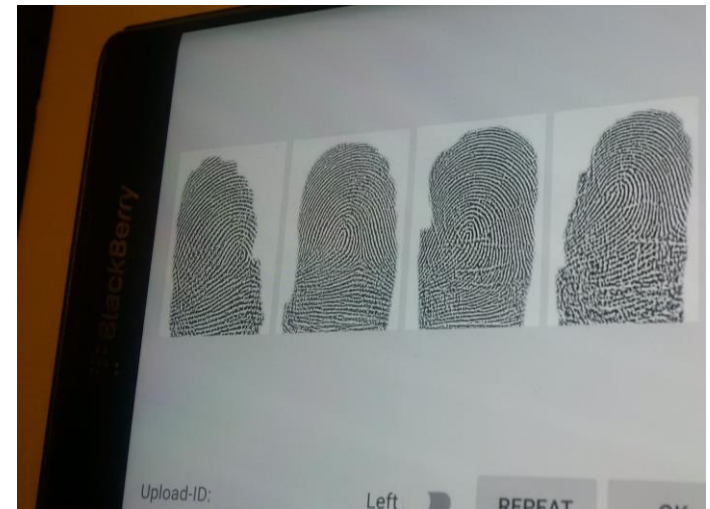
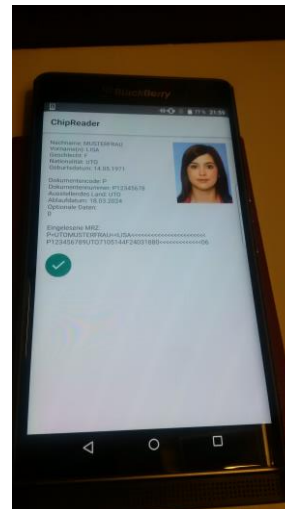
## Contact information

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Email: [FastPassCoordinator@ait.ac.at](mailto:FastPassCoordinator@ait.ac.at)



# From FastPass to MobilePass to Smartphone



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