Smart Embedded Cameras

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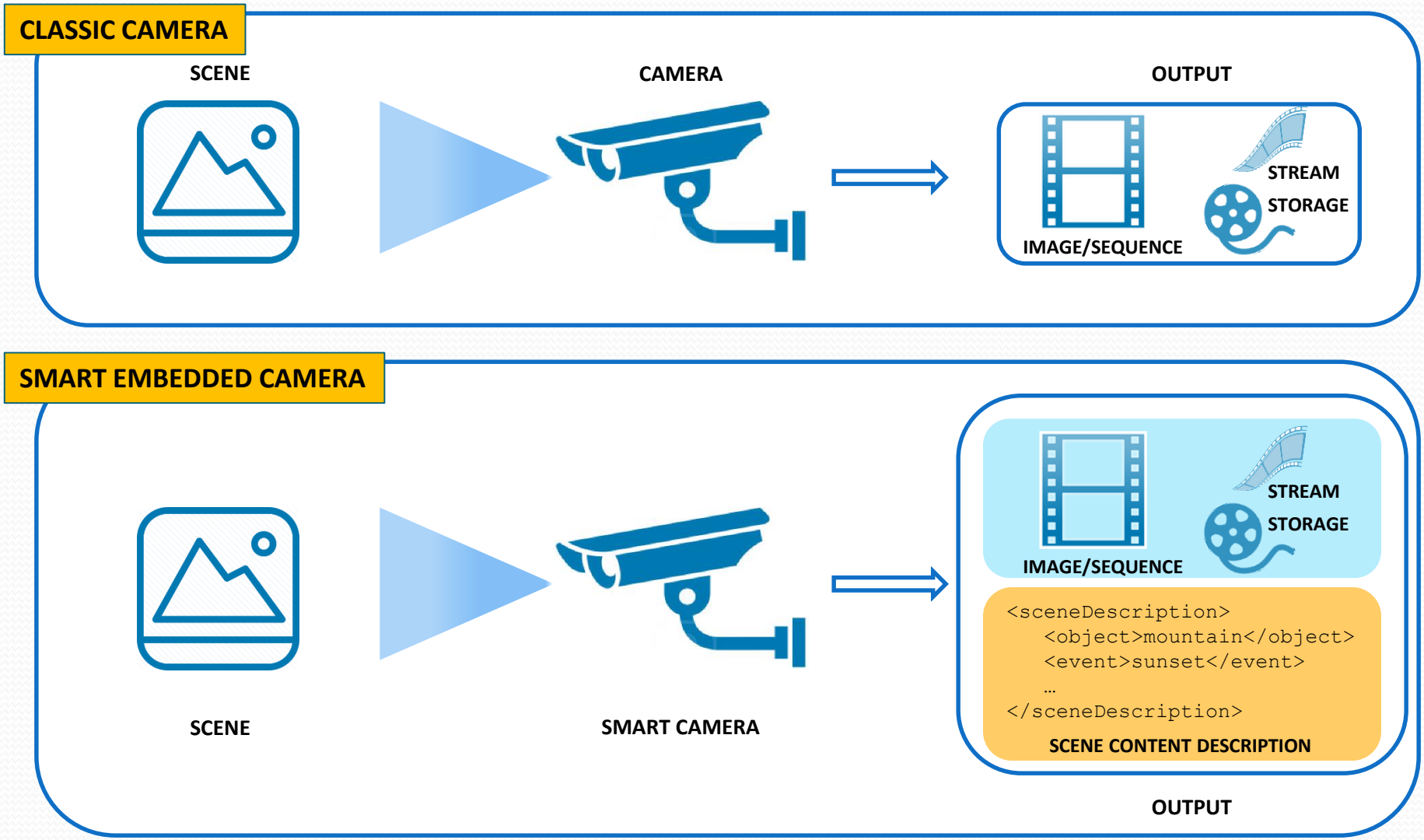
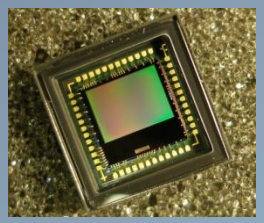
Agenda

- Smart cameras
  - Camera networks for cooperative sensing
- Our prototype
- Smart cameras for the campus
  - Traffic and parking lot monitoring

Smart Embedded Cameras



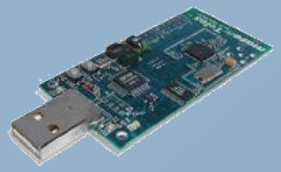
Smart Embedded Cameras


CAMERA SENSOR

+


EMBEDDED PROCESSOR

+

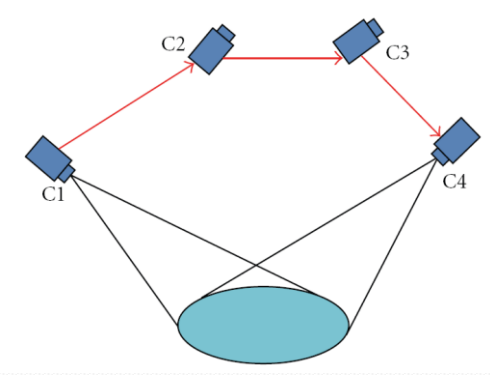

RF TRANSCEIVER (NETWORK)

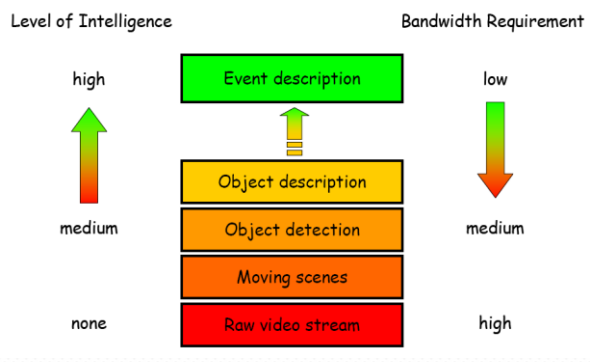
= Smart Camera

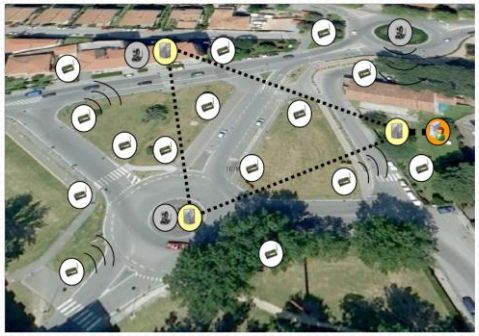
- Embedded processor equipped with application-specific computer vision logics
  - for on board image analysis and understanding:
    - Object detection
    - Event Detection
- Network interface for propagation of camera belief:
  - IoT perspective

Smart Camera Networks

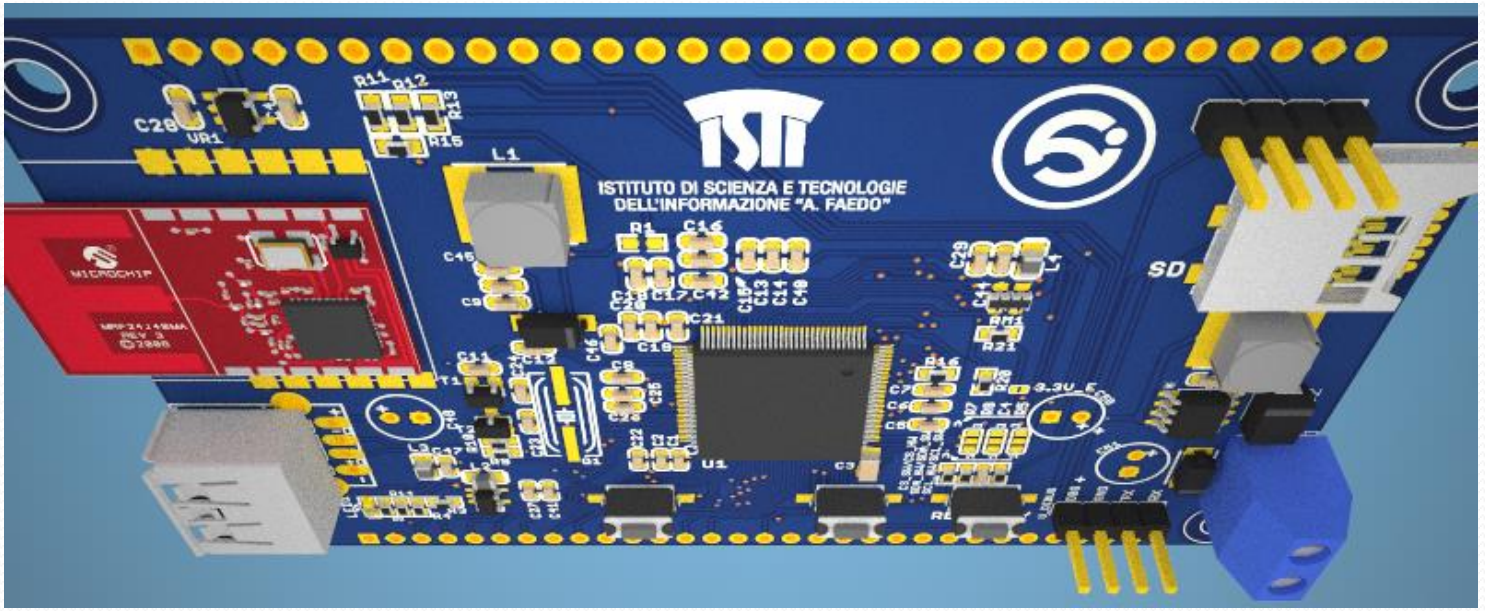
- Co-operative approach to scene understanding
  - *Nodes* collaborate to extract the semantics of the scene
- <u>Advantages:</u>
  - Distributed visual intelligence
  - Pervasive approach
  - Robustness & fault tolerance
  - Autonomy
  - Coverage of very large areas
  - Scalability





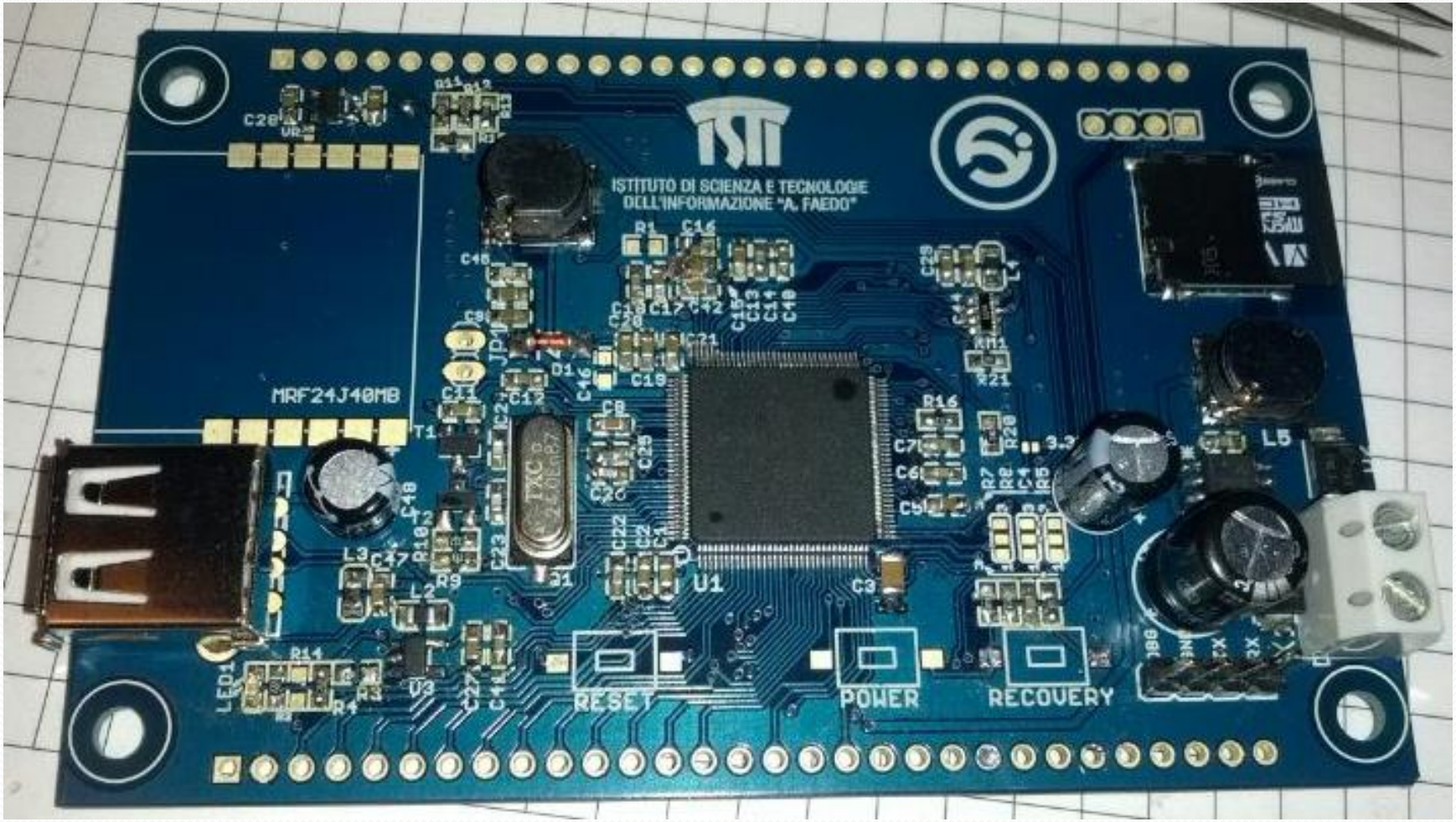


Prototype design



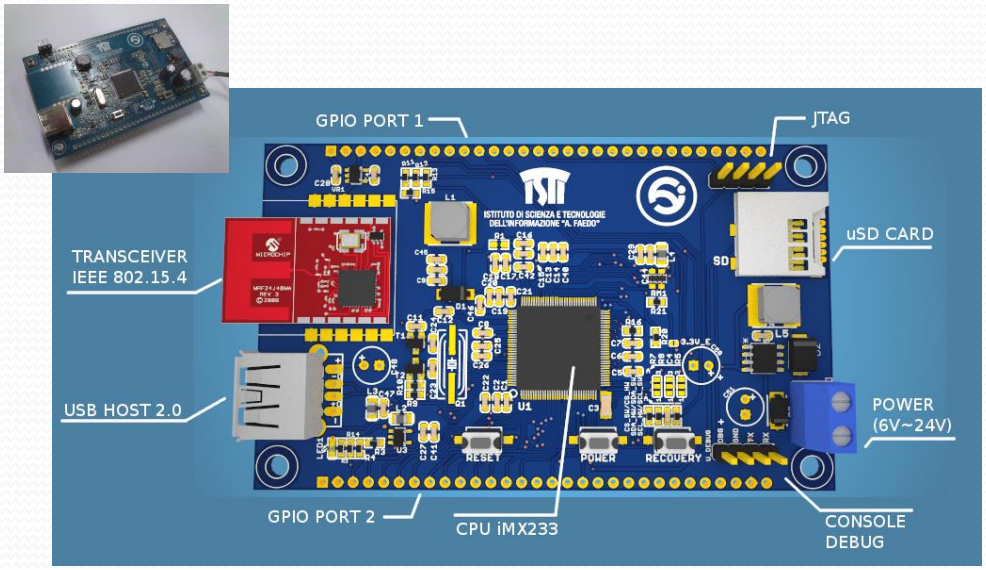
- Low cost
- Low power
- Enough flexible to support multiple vision tasks
- Integration of custom sensors
- M2M Networking

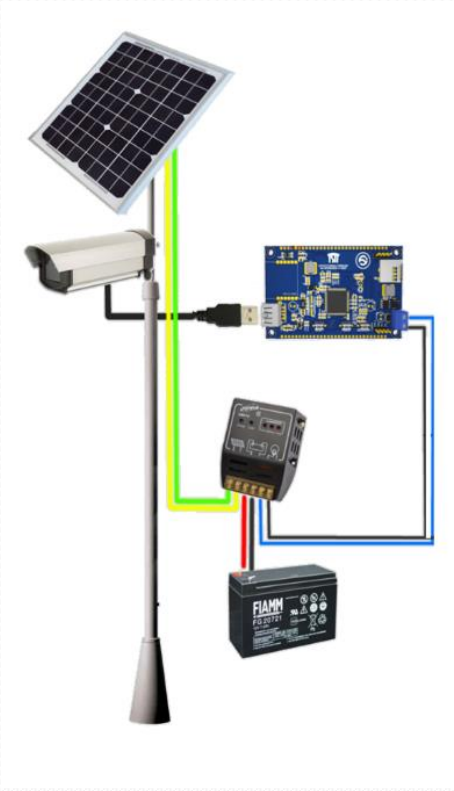
Current proprietary prototype



Current proprietary prototype

- < 100 mA power consumption (with no devices connected)
- Networking:
  - Support for Ethernet
  - Support for WiFi
  - Integrated IEEE 802.15.4 transceiver
    - For 6LOWPAN communication
- Power supply:
  - PV harvesting
  - Li or Pb batteries
- Suitable for installation on existing poles





Smart cameras for the campus

Application for the Smart City

- Security, surveillance and environmental monitoring
  - Shopping malls, airports, stadiums
  - Threat and anomalous event detection
- Logistics
  - Freight control and management of goods towards the city
  - Hub monitoring and last mile
- Intelligent systems for urban mobility
  - Vehicular flow monitoring
  - Accident detection
  - Charging station and parking availability

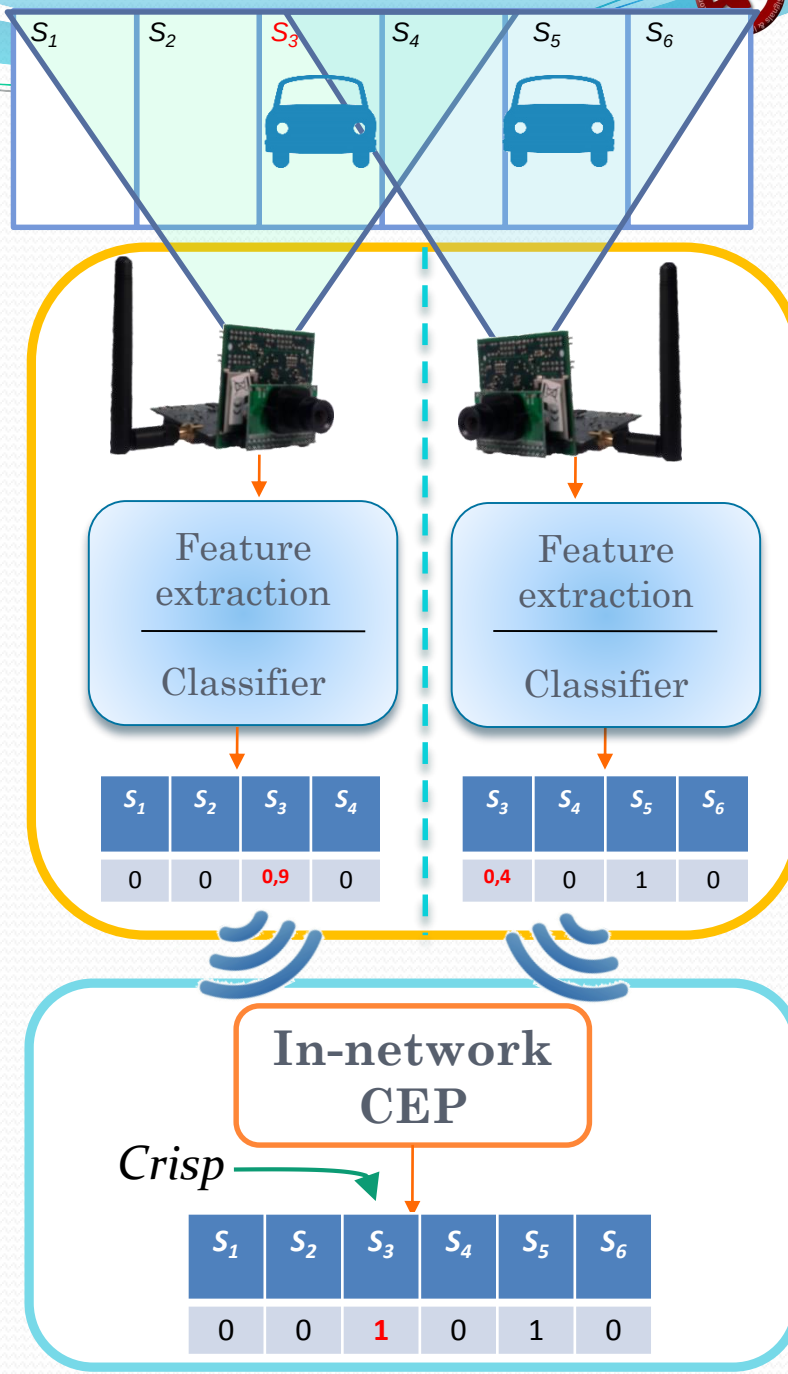
Avoid congestion, find parking

- Matter of chance
- Loss of time and money
- More pollution
- More stress

Thanks to M.Martinelli for this slide

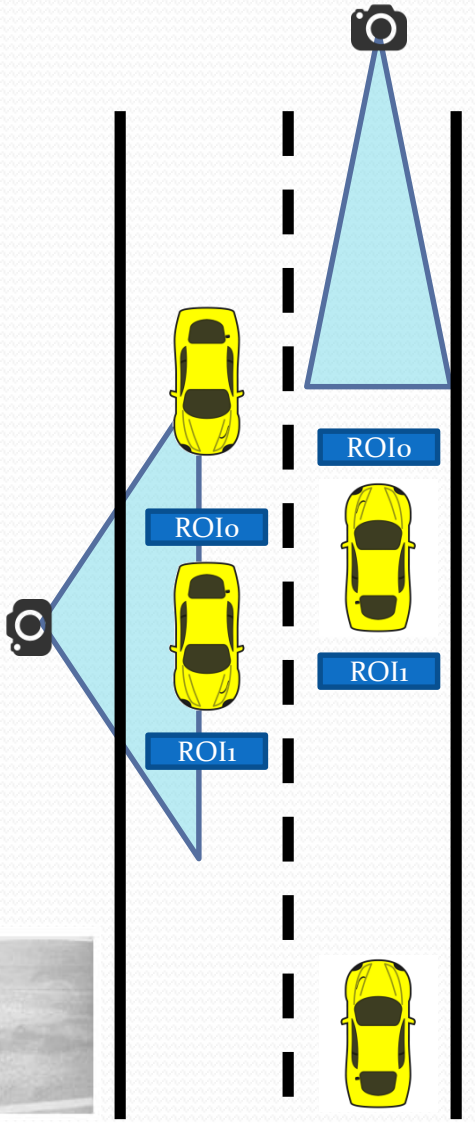
Parking monitoring

- Real-time free space detection on smart cameras
  - Each camera sends in real-time information about the spaces it monitors
- In-network Complex Event Process (CEP)
  - Beliefs of all the sensors monitoring a certain space are fused together to provide a final interpretation of the scene



Flow Monitoring

- Aim: vehicle count and classification (speed, size,…)
  - Congestion early detection
  - Intelligent real-time re-routing
- A dedicated lightweight pipeline has been designed and developed
  - based on transit detection on rectangular ROI or Strips



Our expertise in ITS

- Sensor prototypes and vision logics validated in testbeds (Pisa Int.l Airport and Montecatini railway area)
- Projects:
  - Regional
    - IPERMOB
    - SIMPLE
  - EU Funded
    - FP7 CIP MobiWallet
    - FP7 ICSI

IPERMOB

SIMPLE

MobiWallet

ICSI

Contact

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