Environmental monitoring

- Sensing (in a distributed and self-managing fashion) of natural phenomena and processes allows to access environmental data in real-time over large-scale area
  - temperature, humidity, light
  - wind, rainfall,
  - river height
  - Vibrations
- Monitoring of critical areas

(volcanic areas, remote areas)

- Fire detection alarms
- Agriculture monitoring

Structural health monitoring (SHM)

- SHM allows to detect deteriorations and potential damages of a structural system by observing the changes of its material and geometric properties over long periods of time.
- Usually there are 3 main risks in a lifetime of a structure:

1. During or directly after the construction or reconstruction (design failures, quality problems, uncertain or unknown outer parameters, e.g. geology)
2. Due to or after an outer impact (possibly repeated)
3. When the structure gets old and maintenance is inadequate

Structural health monitoring

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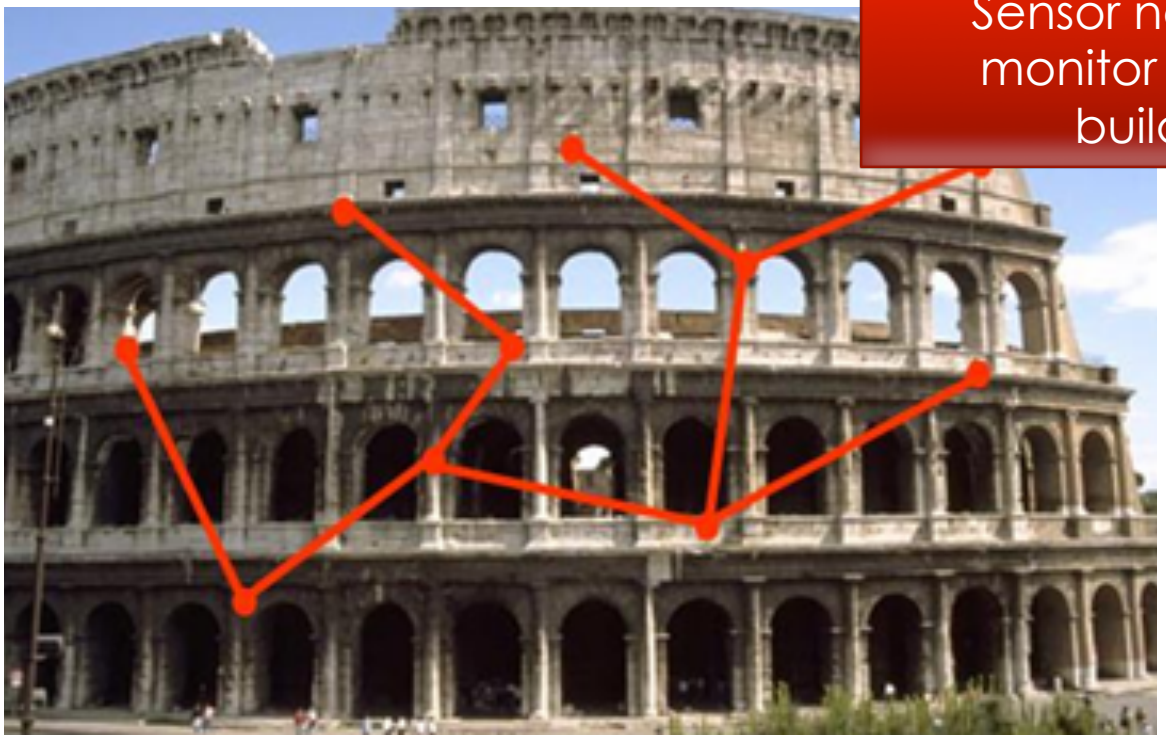

Sensor network to monitor historical buildings

Structural health monitoring

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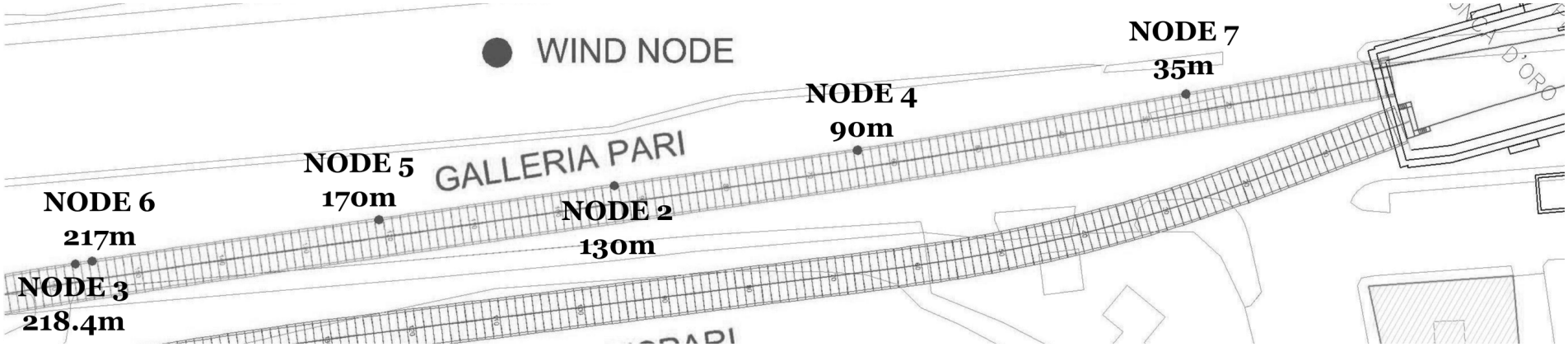
- SHM is a vital tool to help engineers improving the safety of critical structures, avoiding the risks of catastrophic failures.
- Wireless sensor networks can provide a quality of monitoring similar to conventional (wired) SHM systems with lower cost.
- WSNs are both non-intrusive and non-disruptive and can be employed from the very early stages of construction.

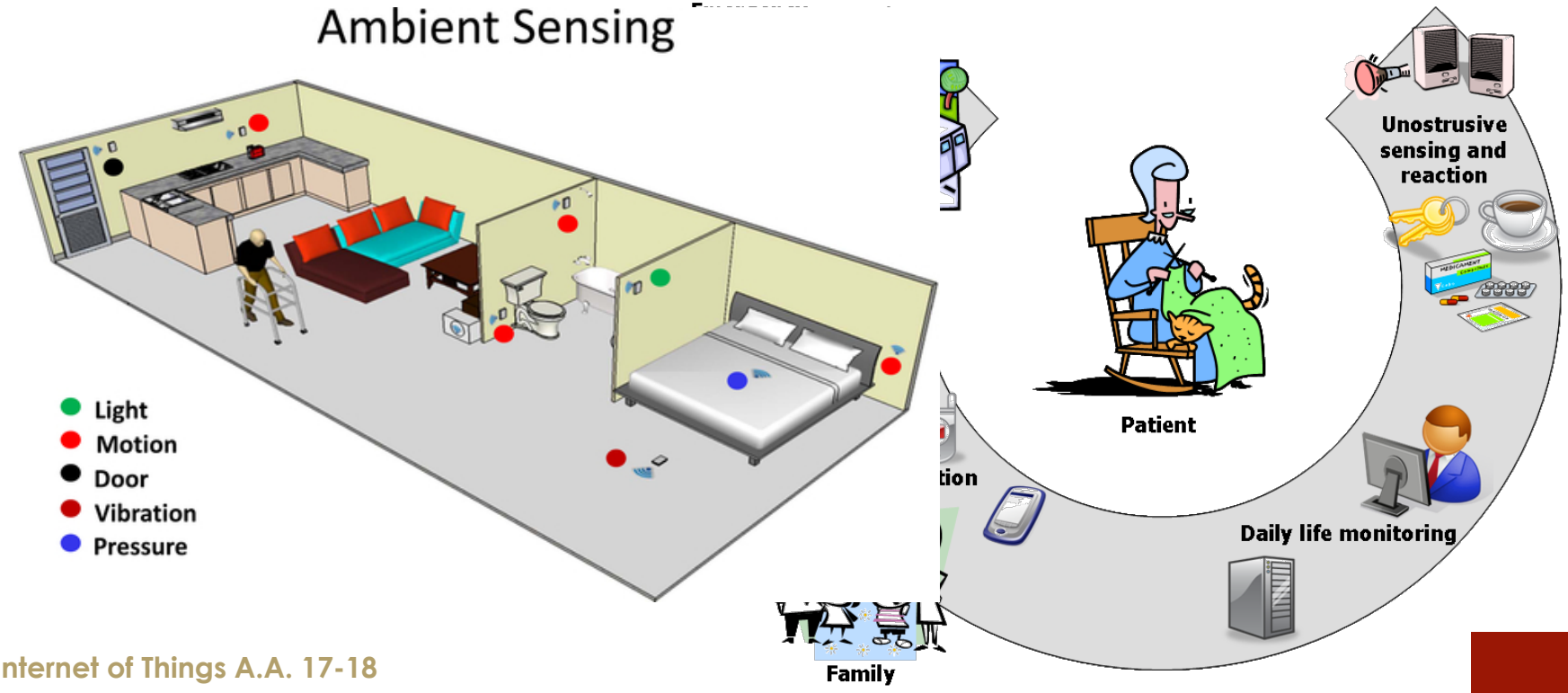


Health-care

- In hospital – patients carry **medical sensors** to monitor parameters such as **body temperature, blood pressure, breathing activity** but also **location** and **activity** sensors to monitor patient activities

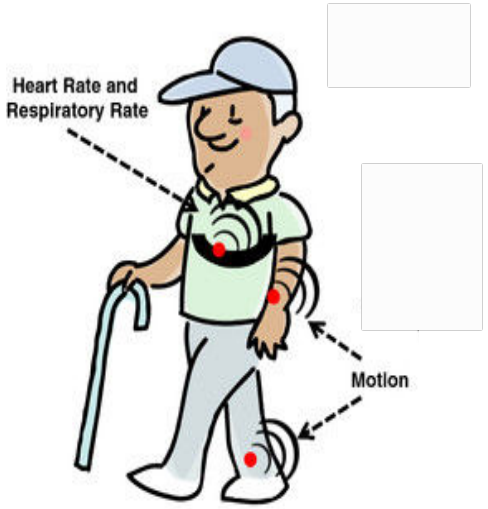
Health-care

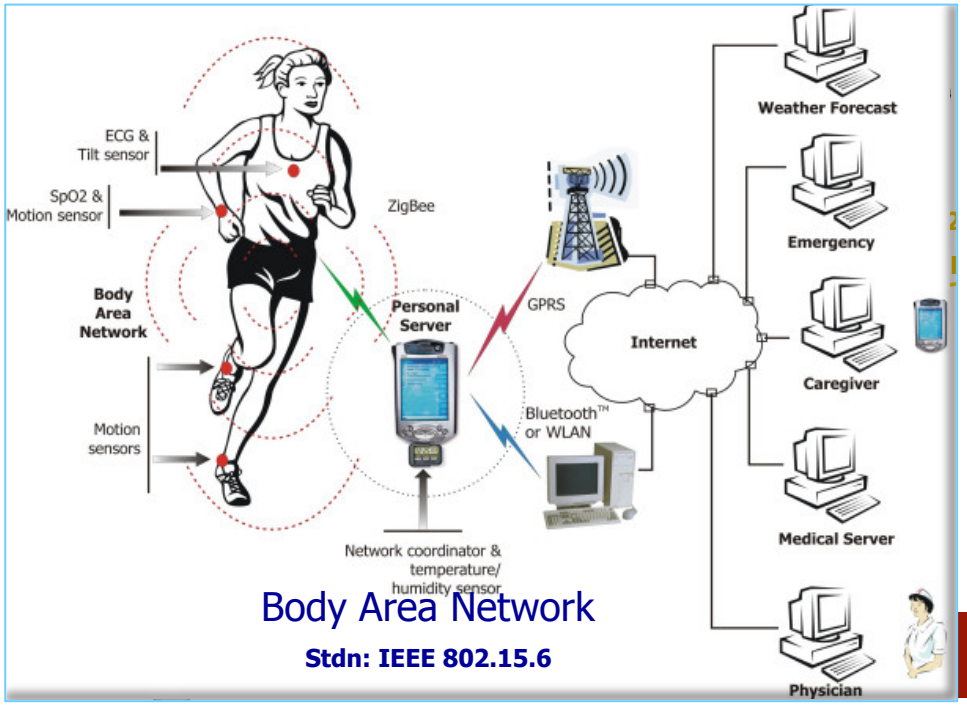
- At home – besides body sensors, wearable (accelerometers, gyroscopes) or fixed (proximity) **sensors can be used to infer user's activities and state in his/her living environment**. This is particularly useful for the elderly who live alone (detection of falls or illness)



Health-care: well being

- Personalized health-care and well-being solutions
- The use of wearable sensors, together with suitable applications running on personal computing devices enables people to track their daily activities (step walked, calories burned, exercises performed, etc.) providing suggestions for enhancing their lifestyle and prevent the onset of health problems





Smart business/inventory and product management

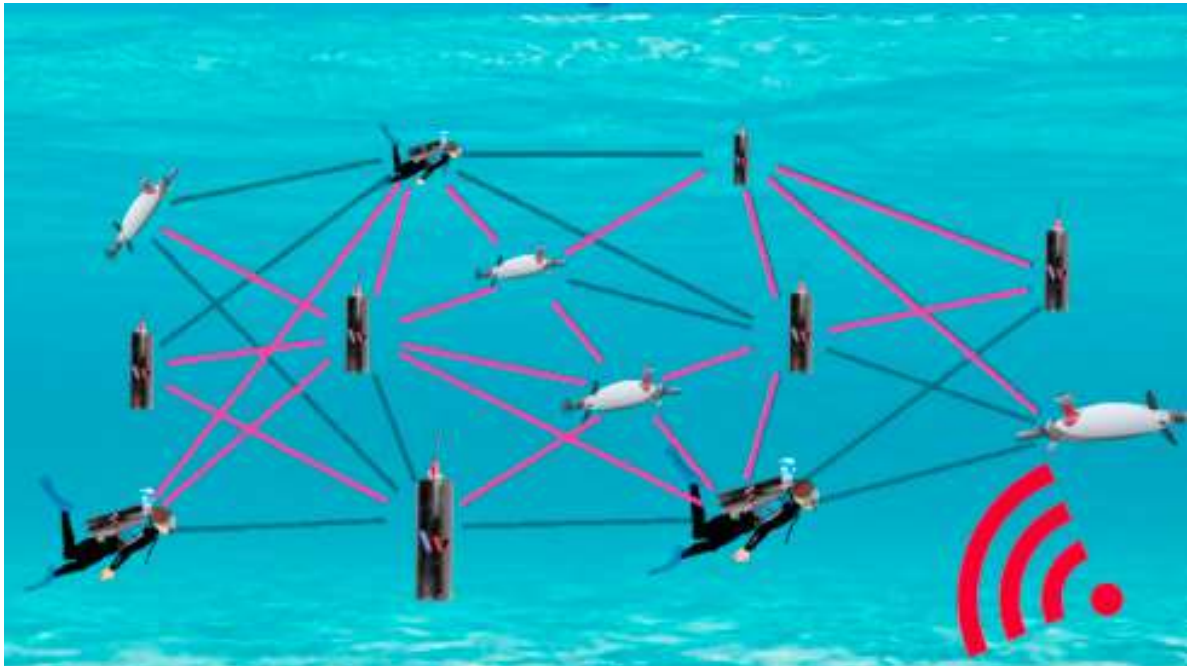
- RFID technologies support applications for tracking goods.
- RFID applications are built in a rather ad hoc fashion and are only partially integrated into supply management systems
- IoT can be used to monitor in ***real-time product availability*** and maintain ***accurate stock inventory***
- After market support: users can automatically retrieve all data about the products they bought
- Bio sensors (temperature and bacteria composition) in combination with RFID technology may allow ***control production processes***, ***final product quality*** and ***possible shelf life deterioration of the product***

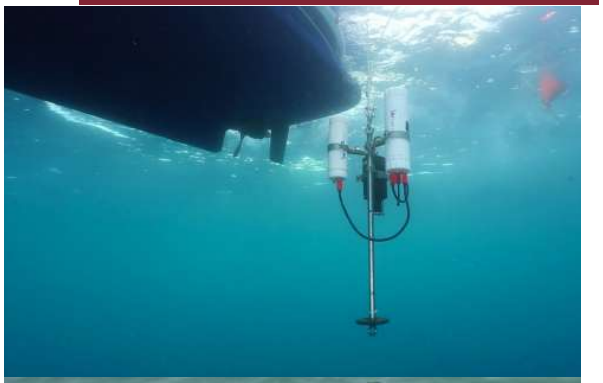
Security and surveillance

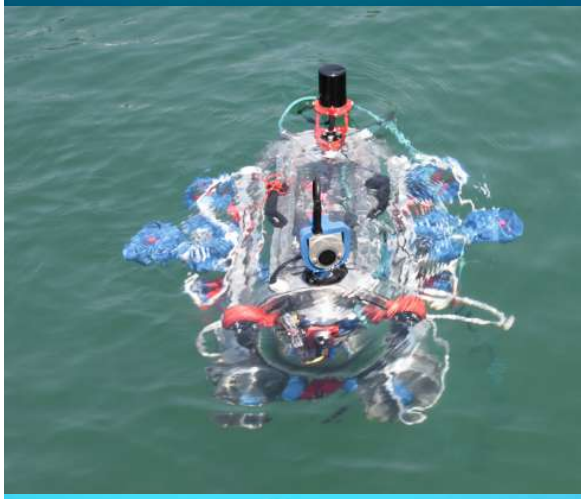
- IoT technologies can improve surveillance in enterprise buildings, shopping malls, factory floors, car parks and many other public places.
- ***Ambient sensors*** can be used to monitor the ***presence of dangerous chemicals***
- Sensors monitoring the ***behavior of people*** may be used to assess the presence of people acting in a suspicious way
- Efficient early warning systems can therefore be built
- Personal identification by means of RFID or similar technologies is also possible

Underwater IoT

- Allows to interconnect underwater sensors, underwater robotics technologies, enabling **real-time data, reliable, secure information exchange**, providing an unprecedented opportunity to map, know, understand, sustainably exploit the marine environments



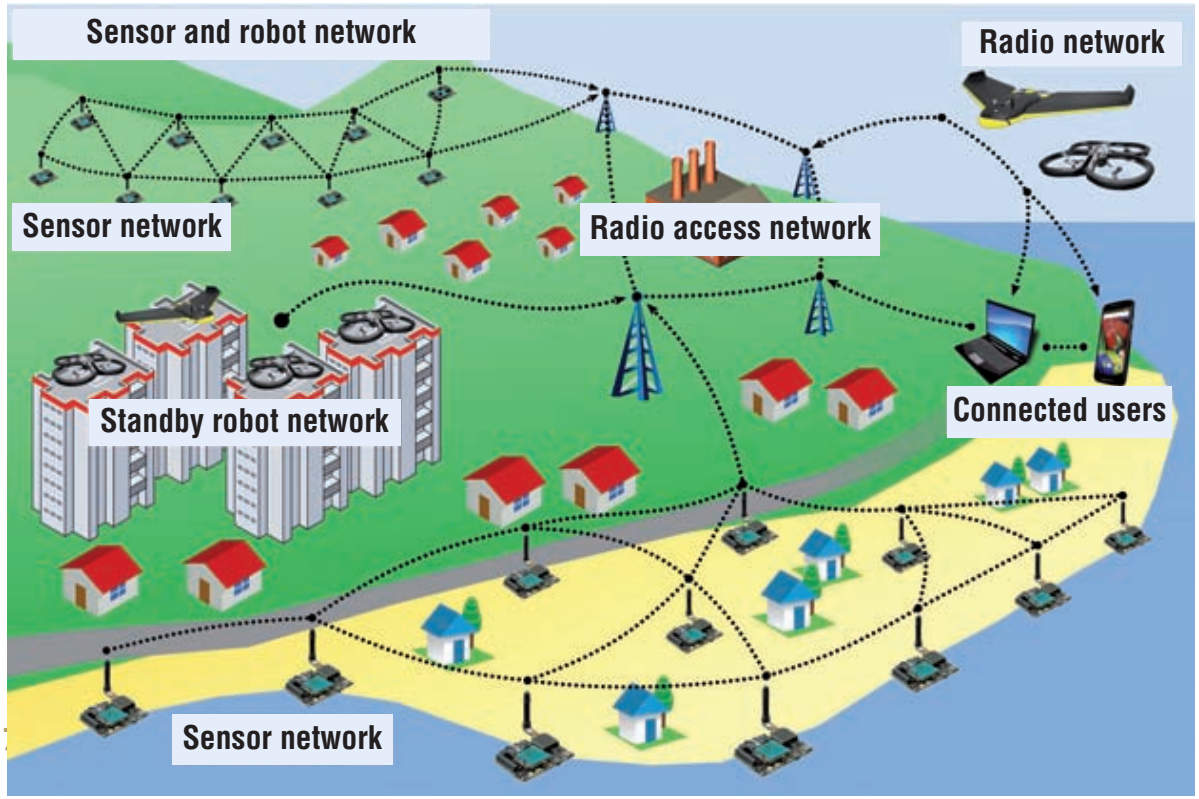




Drones

- A mixed WSN-UAV deployment scenario for disaster alertness for flood and landslide monitoring. Multiple sensors collect physical information—the water level at the monitored bank and vibration/displacement on the mountainside—and forward it to a centralized location.

- Stand-by UAVs can be called into active operational service to perform the function of so-called data mules.



Readings

- Paper available on Elsevier digital library:
- www.sciencedirect.com
- D. Miorandi, S. Sicari, F. De Pellegrini, I Chlamtac,"**Internet of things: Vision, applications and research challenges**", *Ad Hoc Networks*, volume 10, issue 7, sept. 2012, pp 1497-1516