WSN applications

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AgroSense

Current status

- **Scientific experiments** – Developed and deployed by experienced computer scientists–Small scale, short term–Supervised operation
- **(Almost) no „real-world" applications** – Developed and deployed by application domain experts–Large scale, long term–Unattended operation

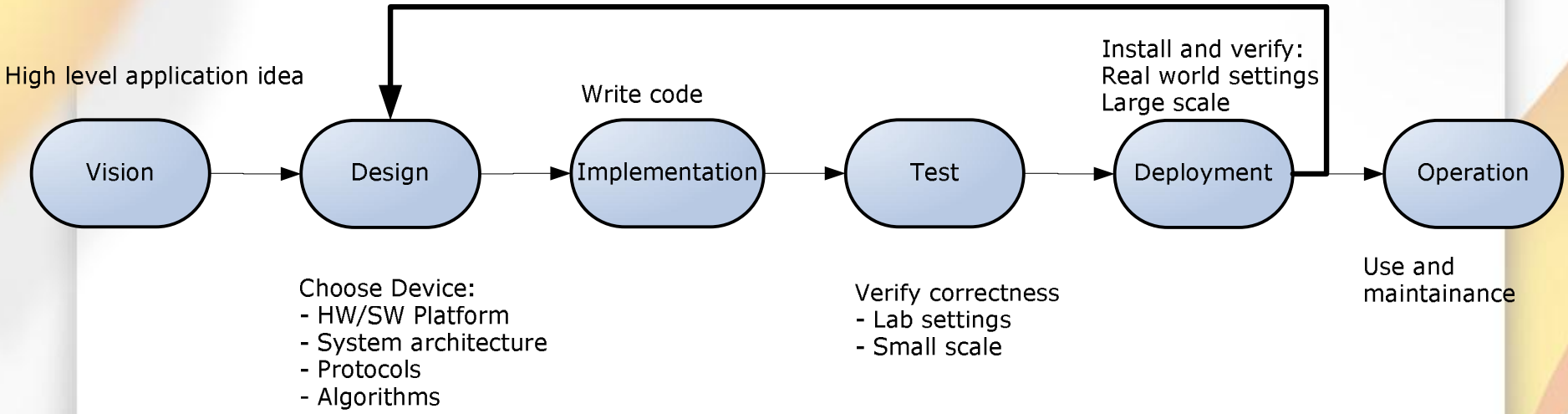
Current status - causes

- Lack of installation ease/ease of use
- Lack of reliability or robustness
- Concerns about interference
- Lack of standards and interoperability
- Power consumption too high / battery life too short
- Overall costs too high
- Lacking encryption and other means of security
- Bit rate too low
- Applications not clearly defined
- Size of nodes

Current status – causes 2

- *Depends on individual skill of developers*
- *Many iterations of system design / implementation required*
- *Involves significant manpower*
- *Involves a certain amount of luck*
- *Everything that could go wrong did go wrong*

Application lifecycle



Current status

- Pilots are still under the spotlight
- Size of pilots is rapidly increasing
- Big systems are planned out where commercial aspects of applications are clearly defined
- Nodes for end user commercial applications are available.
- The business opportunities arise from collecting the generated data from a network into a central database and exploiting it in consumer profiling

We have developed Sensor Nodes running appropriate software and algorithms, though for majority of the applications it is still not clear what, where and how to measure.

"Application specific requirements define almost every other topic in WSNs."

Application Types

- Detection
- Tracking
- Monitoring

- Terrestrial WSN
- Underground WSN
- Underwater WSN
- Multi-media WSN
- Mobile WSN

- Information and analysis
- Automation and control

Road infrastructure

- Variety of end-user applications
  - Increasing safety for traffic participants
  - Saving energy
  - Increasing traffic throughput
  - Maintaining roads
  - Increasing end-user comfort…

Google's self-driving car

- No road infrastructure needed
- video cameras, radar sensors and a laser range finder to “see” other traffic
- detailed maps collected using manually driven vehicles
- Google’s data centers, which can process the enormous amounts of information gathered by our cars when mapping their terrain.

The pothole patrol

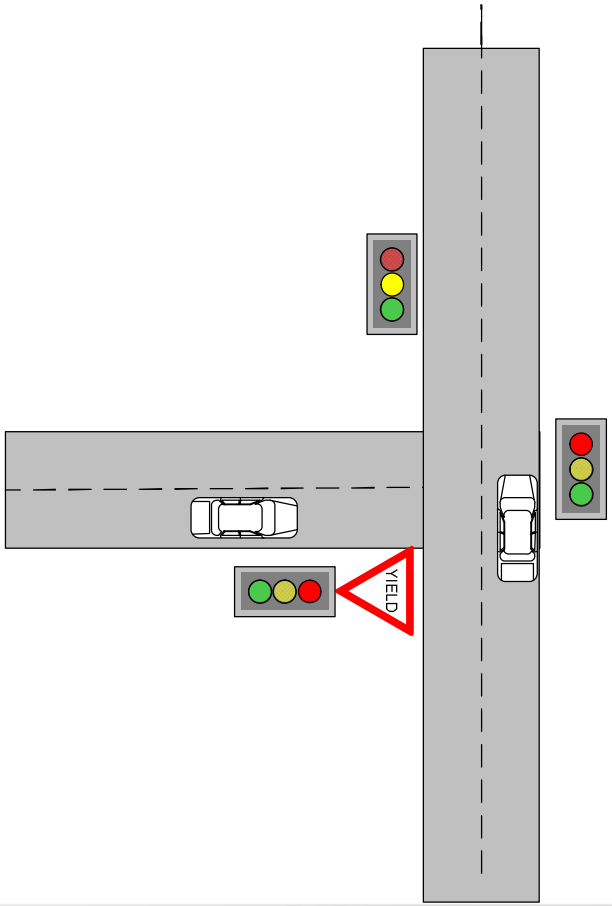
- detecting and reporting the surface conditions of roads
- a collection of sensor-equipped vehicles.
- opportunistically gathering data from vibration and GPS sensors
- With the help of simple machine-learning approach potholes and other severe road surface anomalies are identified
- manual inspection of reported potholes shows that over 90 % contain road anomalies in need of repair

Smart Crossroads / and Roads

Aware of

- Cars waiting in the crossroad
- Cars in the crossroad

Consider managing the whole city.



Smart Crossroads

- Current solutions are based on inductive loops that are expensive and difficult to place down
- Optic sensors are not appropriate due to large amounts of dirt

TRITON Project

- dynamically maintaining the legislated light levels
  - enables energy savings at the tunnel entrances
  - Sensor readings allow for maintenance of the light levels required by law even when lamps burn out or are obscured by dirt
- Exploring the use of techniques to harvest energy from the environment, e.g., relying on solar light at the tunnel extremities or vibrations caused by vehicles in transit
- four existing tunnels (400 to 1,400 m) with average traffic of 14,000 vehicles per day
- Road Safety through Automatic Video surveillance
- Adaptive Control of Ventilation and Pollution
- **Future Solutions** advanced solutions will be considered for which integrated solution cannot be foreseen.

- http://triton.disi.unitn.it/

Ideal Vineyard 10 000 m²

Soil Humidity	
Position	Nr. Of locations
-0.1 m	9
-0.3 m	9
-0.6 m	9
-0.9 m	9
-1.2 m	9
	45

Leaf wetness	
Position	Nr. Of locations
0.8 - 2.3 m	10
0.8 - 2.3 m	10
0.8 - 2.3 m	10
	30

Stem extent	
Position	Nr. Of locations
0.5 m	20
	20

Sun radiation	
Position	Nr. Of locations
2.3 m	9
1.8 m	9
	18

Temperature	
Position	Nr. Of locations
2.3 m	9
1.8 m	9
1.8 m	9
0	9
-0.1 m	9
-0.3 m	9
-0.6 m	9
	72

Sensor count: 176

- Above ground: 126
- Bellow ground: 50

AgroSense

www.agrosense.org

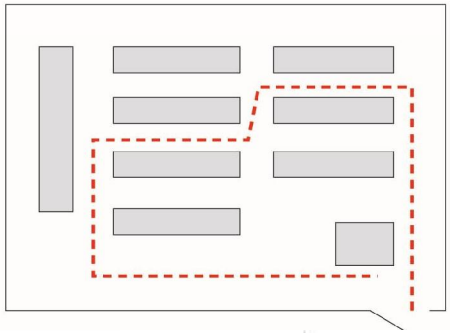
RFID advances

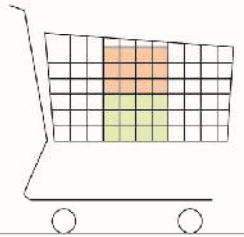
Dutch Umbrella

- A system for the shared public use of umbrellas comprised of pick-up and drop-off locations within a defined urban area.
- A community supported effort to encourage citywide sharing, enabling the convenience of any-time umbrellas.

Smart supermarkets

- With introduction of RFID tags the customer and his shopping process will be traceable





Large scale projects

SwissEx - The Swiss Experiment aims to provide a platform for large sensor network deployments and information retrieval

Å APUNCH, COGEAR, MOUNTLAND, BigLink, TRAMM, RECORD, EXTREMES, HYDROSYS, SensorScope, GSN, SensorMap, PermaSense

Pachube - Stores, shares & discovers realtime sensor, energy and environment data from objects, devices & buildings around the world.

Sensorpedia is a program that is to utilize Web 2.0 social networking principles to organize and provide access to online sensor network data and related data sets.

“The best way to predict the future is to invent it”

Alan Kay

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Well known Project examples

- Great Duck Island [1], ZEBRANET [2], Glacier Monitoring [3], Cattle Herding [4], Bathymetry [5], Ocean Water Monitoring [6], Grape Monitoring [7], Cold Chain Management [8], Rescue of Avalanche Victims [9], Vital Sign Monitoring [10], Power Monitoring [11], Parts Assembly [12], Tracking Military Vehicles [13], Self-Healing Mine Field [14], Sniper Localization [15], Early Warning Fire Detection [16].

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