Application examples

- The claim of wireless sensor network proponents is that this technological vision will facilitate many existing application areas and bring into existence entirely new ones.
- This claim depends on many factors, but a couple of the envisioned application scenarios shall be highlighted.
- Apart from the need to build cheap, simple to program and network, potentially long-lasting sensor nodes, a crucial and primary ingredient for developing actual applications is the actual sensing and actuating faculties with which a sensor node can be endowed.
- For many physical parameters, appropriate sensor technology exists that can be integrated in a node of a WSN.
- Some of the few popular ones are temperature, humidity, visual and infrared light (from simple luminance to cameras), acousticvibration (e.g. for detecting seismic disturbances), pressure, chemical sensors (for gases of different types or to judge soil composition), mechanical stress, magnetic sensors (to detect passing vehicles), potentially even radar
- But even more sophisticated sensing capabilities are conceivable, for example, toys in a kindergarten might have tactile or motion sensors or be able to determine their own speed or location
- **Actuators** controlled by a node of a wireless sensor network are perhaps not quite as multifaceted.
- Typically, they control a mechanical device like a servo drive, or they might switch some electrical appliance by means of an electrical relay, like a lamp, a bullhorn, or a similar device.

  Firefighters equipped with personal digital assistants (pdas). Similar scenarios are possible for the control of accidents in chemical factories, for example.

Environment control and biodiversity mapping

wsns can be used to control the environment, for example, with respect to chemical pollutants – a possible application is garbage dump sites. Another example is the surveillance of the marine ground floor; an understanding of its erosion processes is important for the construction of offshore wind farms. Closely related to environmental control is the use of wsns to gain an understanding of the number of plant and animal species that live in a given habitat (biodiversity mapping).

The main advantages of wsns here are the long-term, unattended, wirefree operation of sensors close to the objects that have to be observed; since sensors can be made small enough to be unobtrusive, they only negligibly disturb the observed animals and plants. Often, a large number of sensors is required with rather high requirements regarding lifetime.

Intelligent buildings

- Buildings waste vast amounts of energy by inefficient Humidity, Ventilation, Air Conditioning (HVAC) usage. A better, real-time, high-resolution monitoring of temper-ature, airflow, humidity, and other physical parameters in a building by means of a WSN can considerably increase the comfort level of inhabitants and reduce the energy consump-tion (potential savings of two quadrillion British Thermal Units in the US alone have been speculated .
- Improved energy efficiency as well as improved convenience are some goals of “intelligent buildings”, for which currently wired systems like BACnet, LonWorks, or KNX are under development or are already

deployed; these standards also include the development of wireless components or have already incorporated them in the standard.

- In addition, such sensor nodes can be used to monitor mechanical stress levels of buildings in seismically active zones.
- By measuring mechanical parameters like the bending load of girders, it is possible to quickly ascertain via a WSN whether it is still safe to enter a given building after an earthquake or whether the building is on the brink of collapse – a considerable advantage for rescue personnel.
- Similar systems can be applied to bridges. Other types of sensors might be geared toward detecting people enclosed in a collapsed building and communicating such information to a rescue team.

Facility management

- In the management of facilities larger than a single building, WSNs also have a wide range of possible applications. Simple examples include keyless entry appli-cations where people wear badges that allow a WSN to check which person is allowed to enter which areas of a larger company site.
- This example can be extended to the detection of intruders, for example of vehicles that pass a street outside of normal business hours.
- A wide-area WSN could track such a vehicle's position and alert security personnel – this application shares many commonalities with corresponding military applications. Along another line, a WSN could be used in a chemical plant to scan for leaking chemicals.
- These applications combine challenging requirements as the required number of sensors can be large, they have to collaborate (e.g. in the tracking example), and they should be able to operate a long time on batteries.