EH01 Applications – Energy Harvesting

Remote Sensors
These are used for many kinds of tasks including:

- Temperature
- Humidity
- Barometric Pressure
- CO Gasses
- Soil Moisture and PH
- Monitoring animals in a farm
- Traffic Flow
- Rain
- Surveillance motion sensors

They send data to the base and take commands back, so they need bidirectional communication.

Remote Sensors – Short Range
Most are *short range*: 100m for WIFI or 1km for ZigBee. There are also many proprietary protocols used.
This seems to be the most talked about possibly the most common.
Advantages:
Usually arranged as a mesh, can be *ad hoc* (spontaneous, no need to Preconfigure each element). *Note that not all protocols allow the mesh style, some need a tree!*
Very reliable to failure
Simple unidirectional antennas and therefore cheaper.
Disadvantages

- You need the network, so if you have a large area you need many sensors
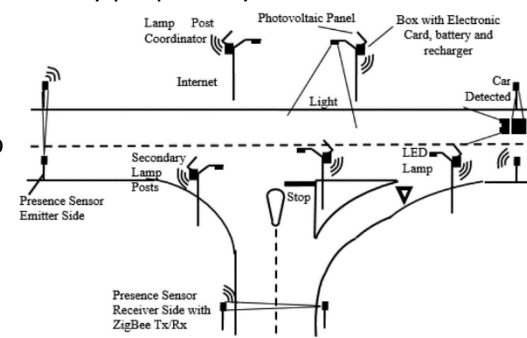
Remote Sensors – Long Range
These use directional antennas making a point-to-point communication.
These can have ranges above 10km, what is much better for large farms.
WIFI and ZigBee are also used here, all though these protocols were not really intended for use with point-to-point networks.
Then each one has to collect the data and send it directly to a base station.
The main advantage is this applications requires fewer devices due to the extended ranges.
The main disadvantage is the cost of the antennas
 Also requires line of sight between antennas

Design application:

- We can design a PCB. We would need some kind of communication: I2C, SPI, perhaps UART or RS232.
- Anything received would be sent to the WIFI.
- We would need to provide an API so the customer can add custom firmware.

Components:

- 1 or 2 EH01s, depending on desired power
- 8bit or 16 bit CPU (MSP430 or 8051 or AVR)
- WIFI/Zigbee transceiver (like AT860RF230)
- Antenna connector, long-range or short-range.

Other notes:

- Typically 2.4GHz and 5GHz are used as these are unregulated worldwide. Others depend on the country. There is also another free range at 40MHz.
- ZigBee requires a yearly fee to sell devices that support it.

Highway Emergency Phone

Can be simply a fixed cellphone with a solar panel:

Must be in a place with cellphone coverage, so can't be too far out.
Solar panel and 1 or 2 EH01, so we could have 5-10W.
There is no display, applications, just the conversation time.
Typically need 250-300mW to transmit, but in places with poor coverage can require up to 1.3W.

Alternatively they could use a dish antenna like the remote farm sensor. Then all you need is a base like a highway police center 10-50km away.
Bandwidth will be higher than the remote sensor, but data transmission is rare.
Could also have a built-in self-test where all phones check the microphone and receiver side and transmit a PASS/FAIL status.

Camping Solar

Flexible Solar panels can be added to tents like the military one on the photo.
The blanket panels can be extended, used as shade, placed over the tent, and rolled up when done.

Smart Cities

Automated Trash Bin

Smart, Self-Powered Waste Management & Recycling Solution
Capture & Analyze Real Time Data from Smart, Connected Stations
Arrived in Brazil in 2015
Polycrystalline silicon cells

Smart Water

Chemical leakage detection
Pollution in the sea
Water leakages (pressure variations)
Collects data and sends
Monitoring Sea, Water Leakages, Quality of tap water

Smart Lighting

Smart Lighting, intelligent and weather adaptive lighting in street lights
Smart roads, warning messages according to climate conditions

Smart Environment – eHealth

Air pollution
Waste management

Security & Emergencies

Radiation levels
Explosive and Hazardous gases
Liquid Presence, detection in data centers, warehouses
Safecast - a global sensor network for collecting and sharing
radiation measurement founded by a small group of people in
the U.S. and Japan a couple of days after the Fukushima disaster
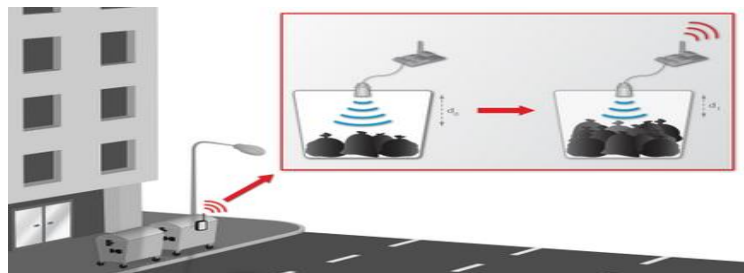
Smart Agriculture

Meteorological Stations Network
Animal tracking, wireless cattle collar that gathers information
about an individual animal's location and behavior
Ultraviolet radiation, measurement of UV sun rays to warn people,
also can be used in Smart Cities and Health systems.
Smart Farming

Military

According to recent studies undertaken on battery usage, up to twenty kilograms of spent
lithium batteries are discarded by a single soldier during a five-week deployment and up to 88
'AA' batteries may be consumed on a five-day mission.

Portable Solar Lights

High-quality solar-powered LED lamp
A market focused on getting clean, reliable, affordable light to the 1.1 billion people worldwide
without access to electricity

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