

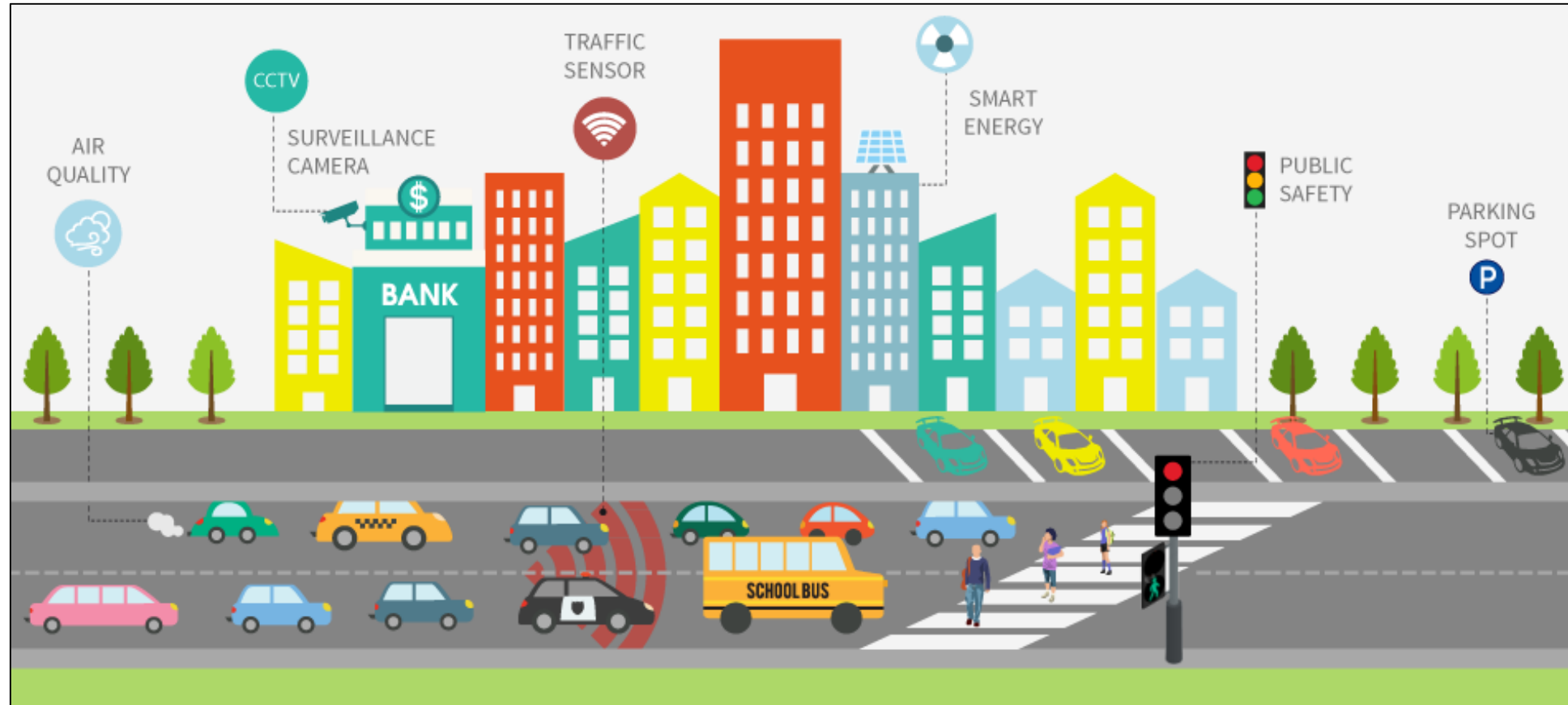


Digital Environmental Monitoring at Town Centers and High Streets

ADEPT Lunch & Learn

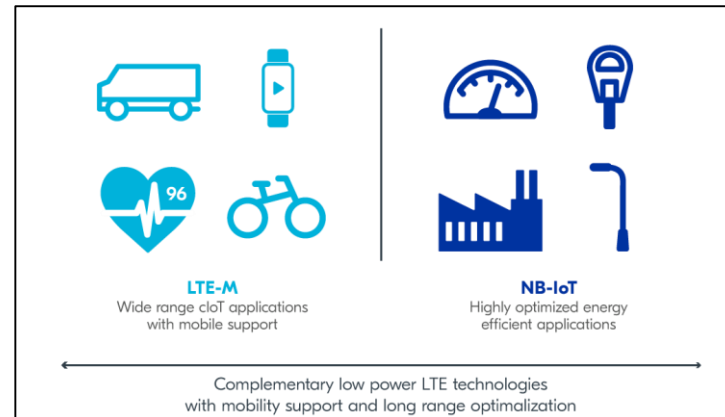
24th June, 2021

Digital Environmental Monitoring



- Source: Daniel Christopher, "How IoT Could Solve Traffic Congestion In Cities", Hackernoon, March 2019.

Main Features of Digital Environmental Sensing



- **IoT sensors** - to measure parameters ¹ such as
 - (a) air and water quality,
 - (b) weather,
 - (c) noise
 - (d) smoke
 - (e) seismic activity
- **Artificial Intelligence algorithms** ² -to detect objects of interest from collected sensory data such as
 - ✓ Classification
 - ✓ Object detection
 - ✓ Image segmentation
- **Mobile IoT technology** - to enable IoT sensors to be deployed efficiently and effectively across the city. E.g., LoRaWAN, NB-IoT, LTE-M ⁴

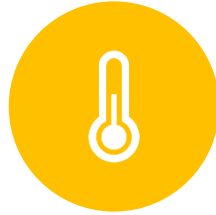
Smart solutions



TRAFFIC
MANAGEMENT



SMART
PARKING



AIR QUALITY
CONTROL



PUBLIC SAFETY
SOLUTIONS



SMART STREET
LIGHTING



SMART WASTE
COLLECTION

Traffic management

- Smart traffic lights respond to traffic congestion in real time.
- The traffic management group make decisions based on traffic data on how to divert the traffic.
- Big data analytics to analyse alternate routes



Source: <https://www.digi.com/blog/tag/traffic-management>

Smart Parking

- Sensors on street curbs use lighting and metal detectors to know if a parking spot/loading area is occupied or not.
- Sensed data are sent to Cloud database for analysis, and the output is sent to the app.
- Drivers can get real-time information on an app locating free parking spots.
- Integration of an online payment system

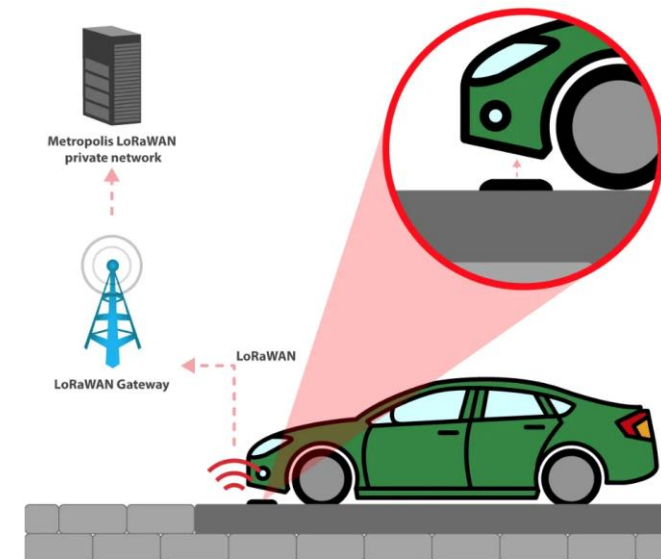
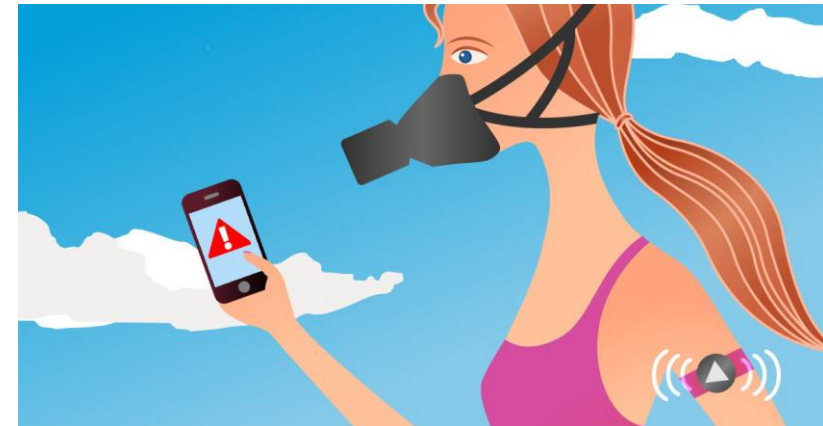


Diagram of Connected Parking project

Air quality control

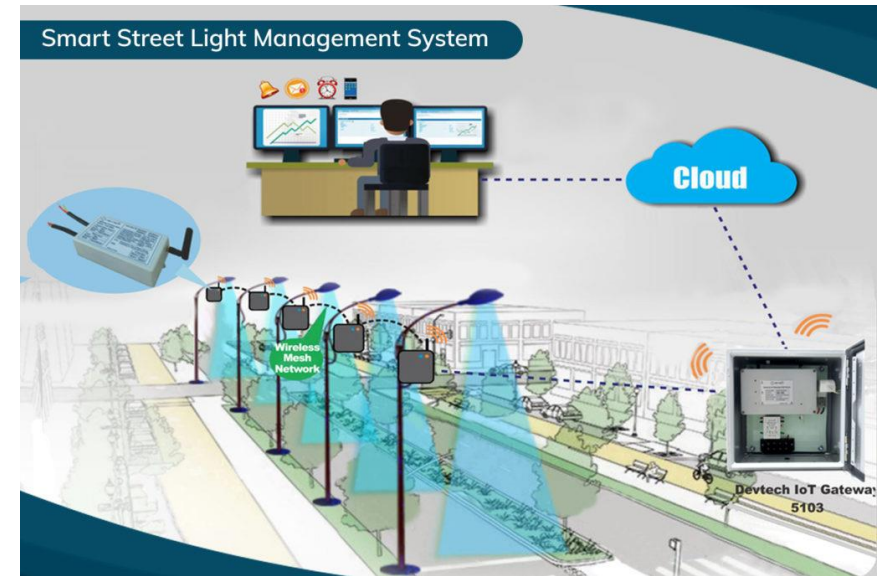
- Low cost and readily available sensors to provide real-time measures for pollutants like NO_2 , CO, CO_2 etc.
- This information is transmitted to a cloud database
- The data are analysed to provide information on the air quality and shared through a smartphone app



Source: <https://newsroom.cisco.com/feature-content?type=webcontent&articleId=1757249>

Smart street lighting

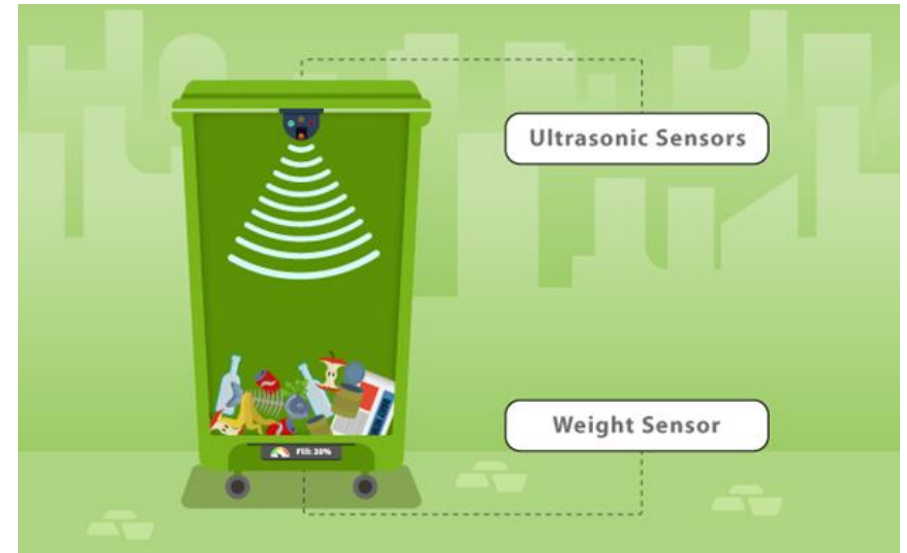
- Control the output of each and every light in response to time periods, weather, pedestrian or vehicle activity or areas of high crime.
- Various sensors e.g., light sensors, motion sensors



Source: <https://smart tampere.fi/en/develop/street-lights-as-an-iot-platform/>

Smart waste management

- A combined reading from ultrasonic sensors placed on the lid of the trash bin and a weight sensor under the bottom panel is used to get an accurate measurement of the weight of the trash stored.
- Get live notifications of filled bins and their locations



Source: <https://www.faststreamtech.com/solutions/smart-waste-management/>

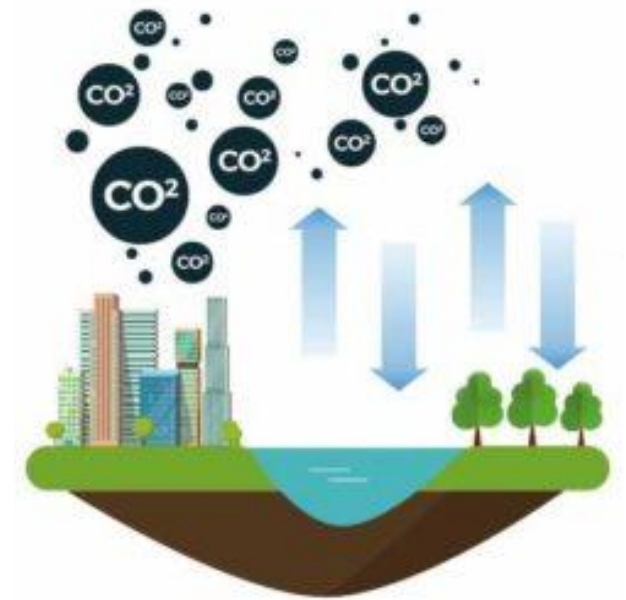
Sustainable solutions for environment

Reduce Carbon footprint

- It is difficult to store energy from renewable sources
- IoT has the potential to transition energy grids to be powered by renewable sources like wind and solar power through smart metering and forecasting.

Carbon capture

- Carbon capture ⁵ is a way to get rid of carbon dioxide that already exists within the atmosphere.
- For e.g., CarbFix is a solution that aims to suck carbon out of the atmosphere and turn it back into minerals that can be reused for energy purposes.
- IoT monitoring and automation systems could help scale carbon capture programs to a point where they may feasibly undo the damage already caused by CO₂ emissions within the past century.



Factors to optimise IoT deployments

(1) Data accuracy⁶

- Extra sensitive sensors for more accuracy
- Higher cost of more accurate sensors

(2) Sensor location

- Sensors in correct positions
- Measuring right attributes

(3) Local environmental conditions

- Sensitivity of readings to temperature and humidity
- Need to be tested and variations in readings to be recognised by data analytics

References

- 1. Agustin Pelaez, "12 IoT Sensor Types To Keep An Eye On [With Examples]", Ubidots.com, April 2020.
- 2. Matveev, Ivan; Karpov, Kirill; Chmielewski, Ingo; Siemens, Eduard; Yurchenko, Aleksey. 2020. "Fast Object Detection Using Dimensional Based Features for Public Street Environments" *Smart Cities* 3, no. 1: 93-111.
- 3. "How LoRaWAN Forms the Building Blocks of a Smart City", The Things Network, March 2021.
- 4. Low power cellular IoT, Nordic semiconductors, "Enabling a world of everything connected", May 2021.
- 5. Aeris, "How IoT is Being Used to Reduce Our Carbon Footprint", Aeris Blog, April 2020
- 6. GSMA, "Environmental Monitoring-A Guide to Ensuring a Successful Mobile IoT Deployment ", 2018.

THANK YOU