MINING INTERNET OF THINGS DATA

BEIYU LIN

INTRODUCTION TO SMART ENVIRONMENT

What is a **Smart Environment**?

- "a small world where different kinds of smart device are continuously working to make inhabitants' lives more comfortable" by Cook and Das. (link 10'-)

Related to **Ubiquitous Computing**

- "… a **physical world** that is richly and invisibly interwoven with **sensors**, actuators, displays, and computational elements, embedded seamlessly in the everyday objects of our lives, and connected through a continuous network." by Mark Weiser et. al (link , - 1:23')

SMART ENVIRONMENT AND SMART DEVICES

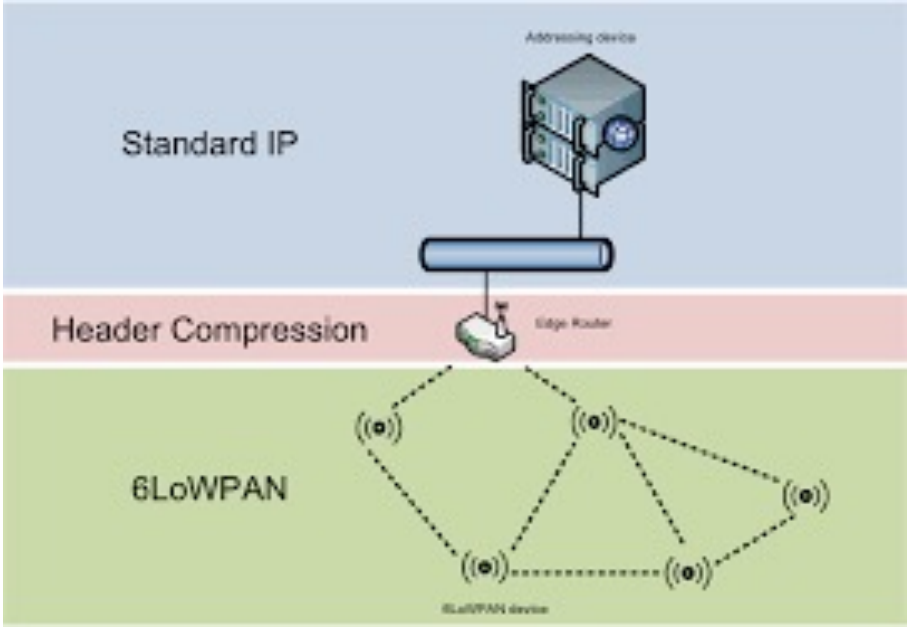
- Smart devices that
  - Connected to other devices via network protocols
  - Operate autonomously
  - Interact with
    - physical world (e.g., via sensors)
    - humans
    - each other

IOT BASED ENVIRONMENTAL MONITORING

- Monitoring Devices
  - monitoring systems consists a various device that generate signals which can be used for many monitoring aspects.
  - Using sensors supported by Bluetooth or Wi-Fi
- Sensor Models
  - AirBot (link -- 3'00)
  - WaterBot
  - Sensordrone
  - Air Quality Egg (link
  - Lapka (link 20'- 3'25)
  - Wearable sensor (link 27'- 40)

COMMUNICATION TECHNOLOGIES

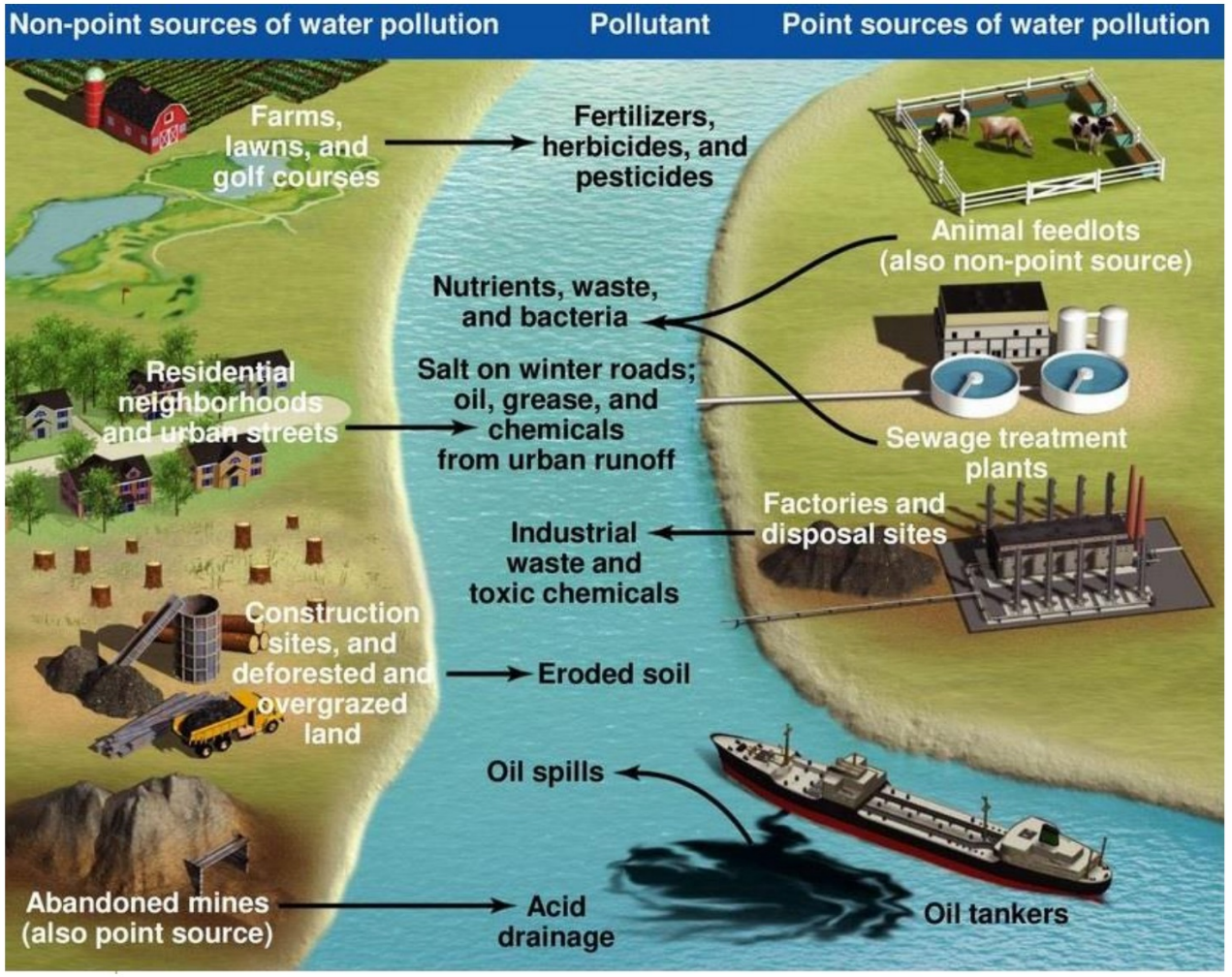
- Bluetooth (less distance)
- Bluetooth 4.0 LE (low energy)
- ZigBee (extra distance; fast; reliable)
- Wi-Fi (less reliable)
- 6loWPAN (IP-based network)
- Z wave (fewer congestion problems)



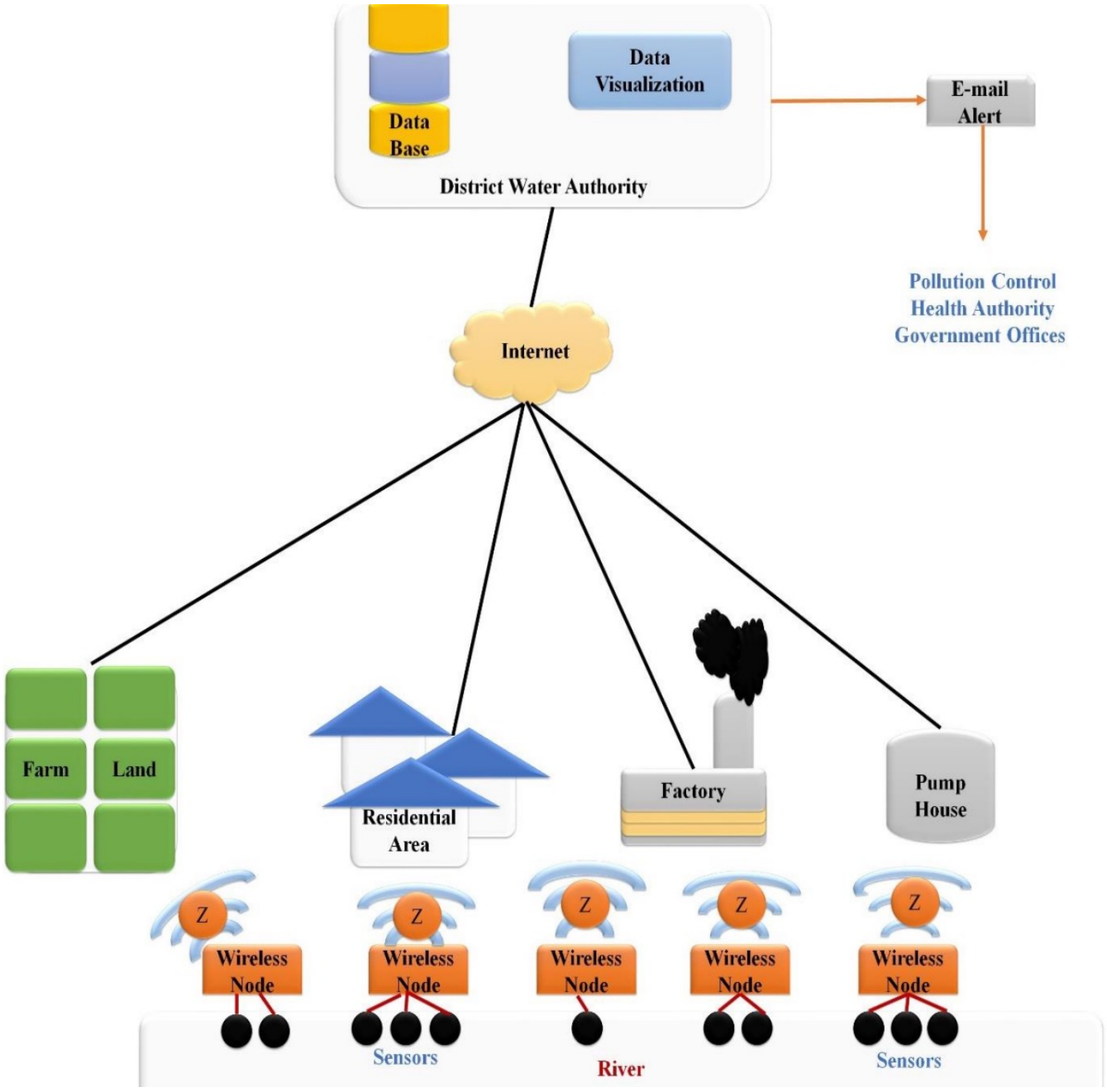
COMMUNICATION TECHNOLOGIES

Standard	Bluetooth	Bluetooth 4.0 LE	ZigBee	Wi-Fi	6loWPAN	RF-Link	Z wave
IEEE Spec.	IEEE 502.15.1	IEEE 502.15.4	IEEE 502.15.4	IEEE 502.11 a/b/g/n	IEEE 502.15.4 2006	C 95.1 2005	Z wave alliance
Topology	Star	Star	Mesh, Star, Tree	Star	Mesh, Star	-	Mesh
Bandwidth	1 Mbps	1 Mbps	250 Kbps	Up to 54Mbps	250 Kbps	18 MHz	900 MHz
Power Consumption	Very low	Very low	Very low	Low	Very low	Very low	Very low
Max Data rate (Mbit/s)	0.72	5 to 10 m	0.25	54	800 m sub GHz	1	9600 bits or 40 Kbits
Range	< 30 m	5 to 10 m	10 to 300 m	4 to 20 m	800 m sub GHz	< 3 m	30 m
Spectrum	2.4 GHz	2.4 GHz	2.4 GHz	2.4 - 5 GHz	2.4 GHz	2.4 GHz	2.4 GHz
Channel Bandwidth	1 MHz	2400 to 2480 MHz	2 MHz	22 MHz	868, 902, 2400 MHz	-	868 MHz

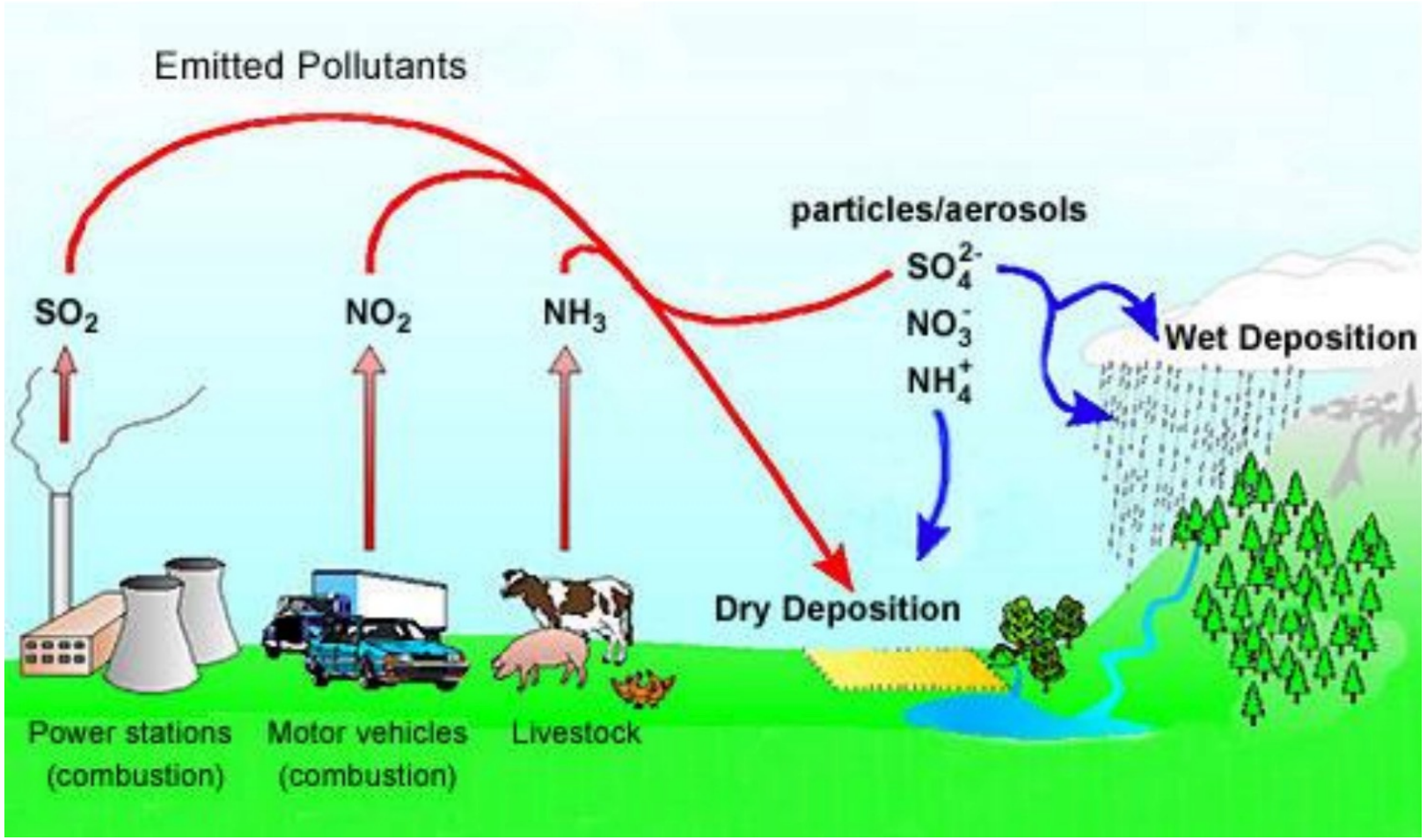
SMART CITY - WATER



SMART CITY - WATER

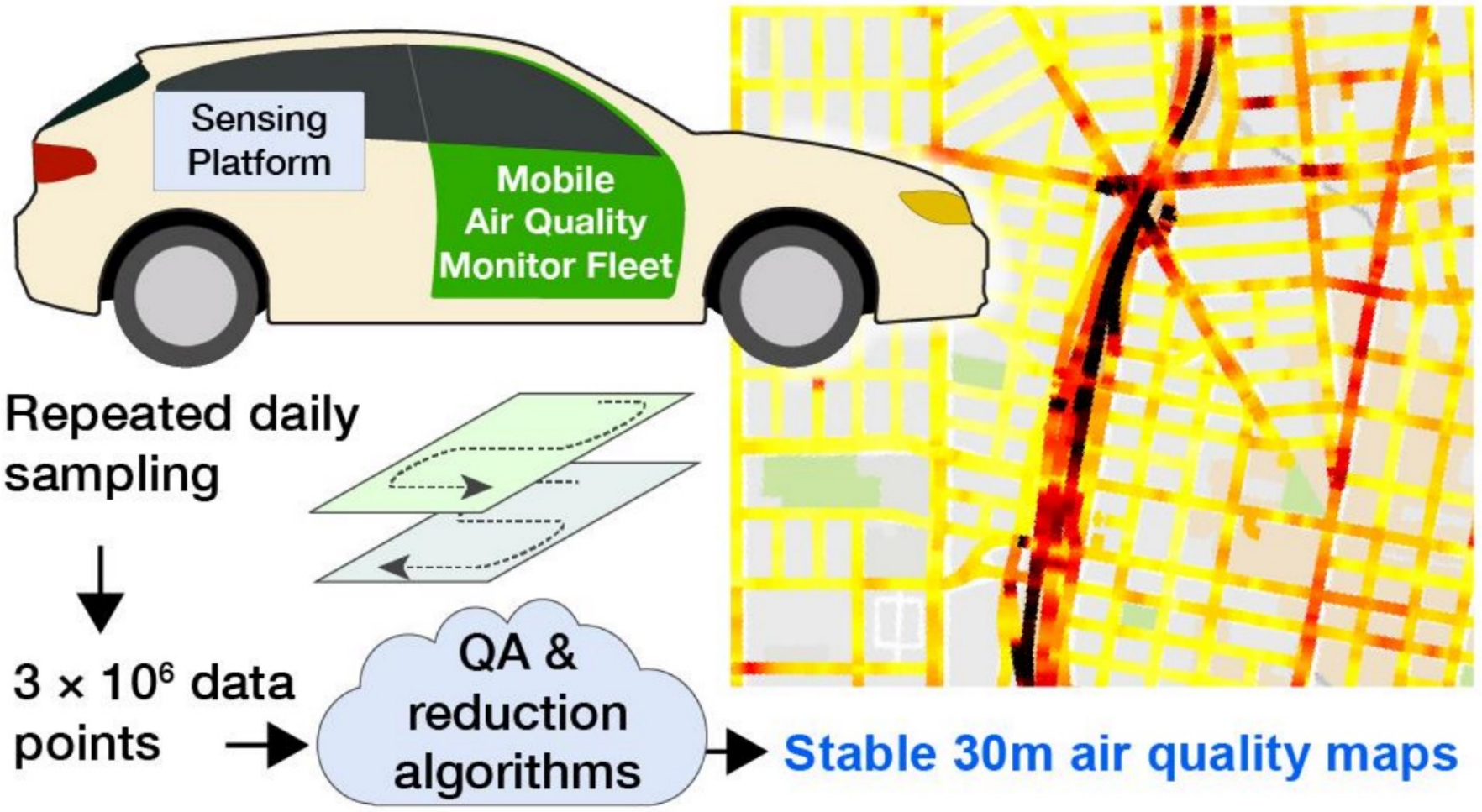


SMART CITY - AIR



1. Burning of Fossil Fuels
2. Agricultural Activities
   Animal breeding /Grow crops
3. Factories and Industries
4. Mining operations
5. Indoor air quality
   80% of all cancers are attributed to environmental

SMART CITY - AIR



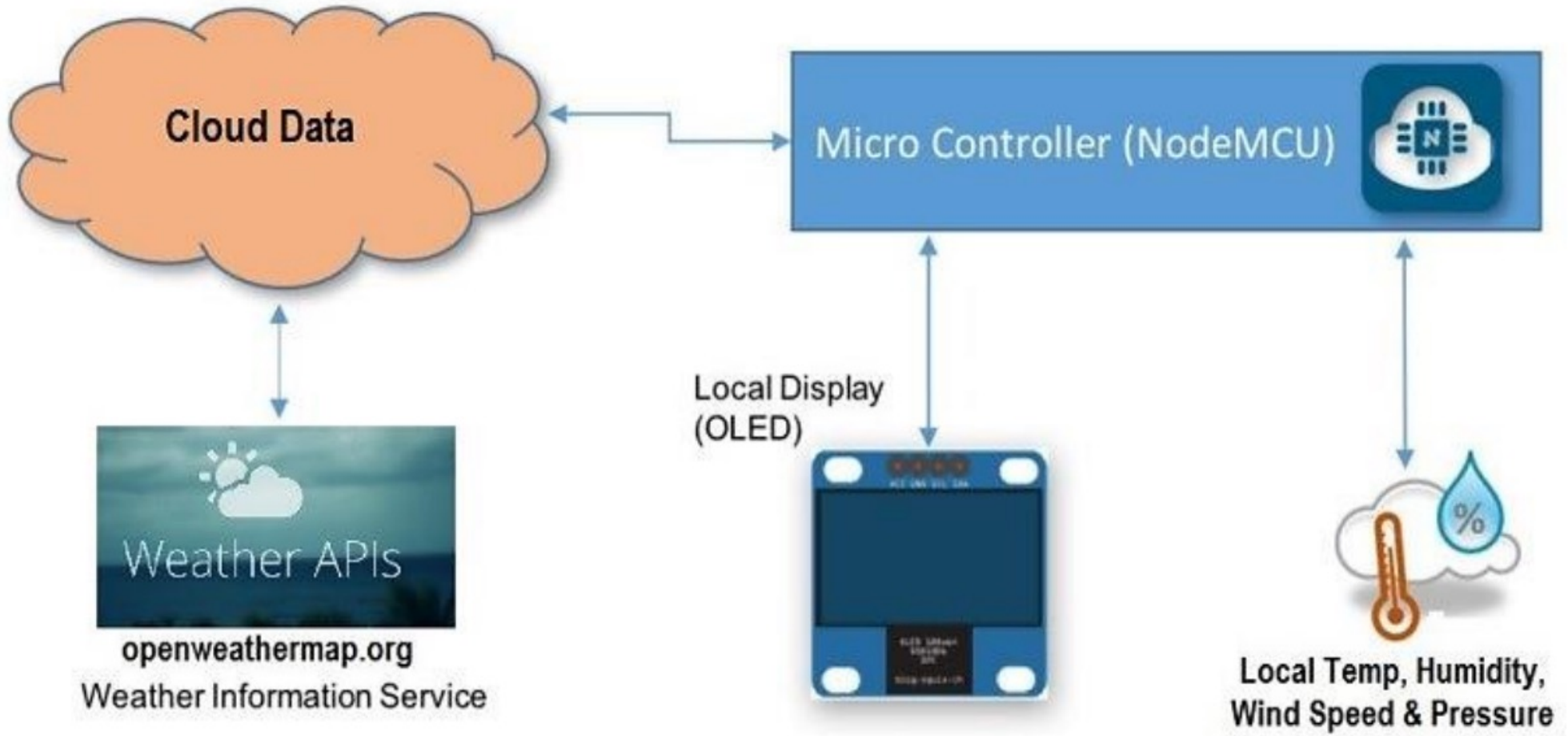
SMART CITY - WEATHER

Modern weather monitoring systems are based on wireless technology consist of many monitoring bases stations.

The base stations consist of different types of sensing units such as

- temperature measurement,
- humidity measurement,
- atmospheric pressure measurement,
- air quality measurement,
- rainfall measurement,
- wind speed
- wind direction measurement.

SMART CITY - WEATHER



SMART CITY – WASTE COLLECTION

The average Nevadan produces **nearly 8 pounds of garbage per person every day**.

That's nearly twice the national average