

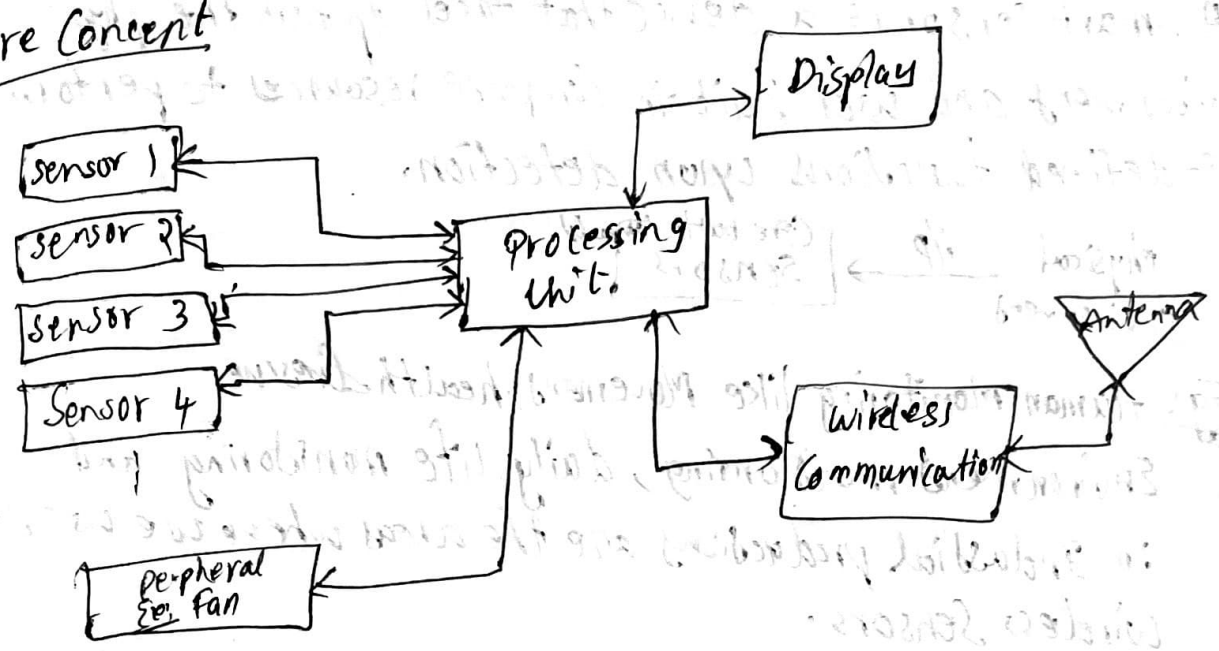
06th August, 2025.

Internet of Things:

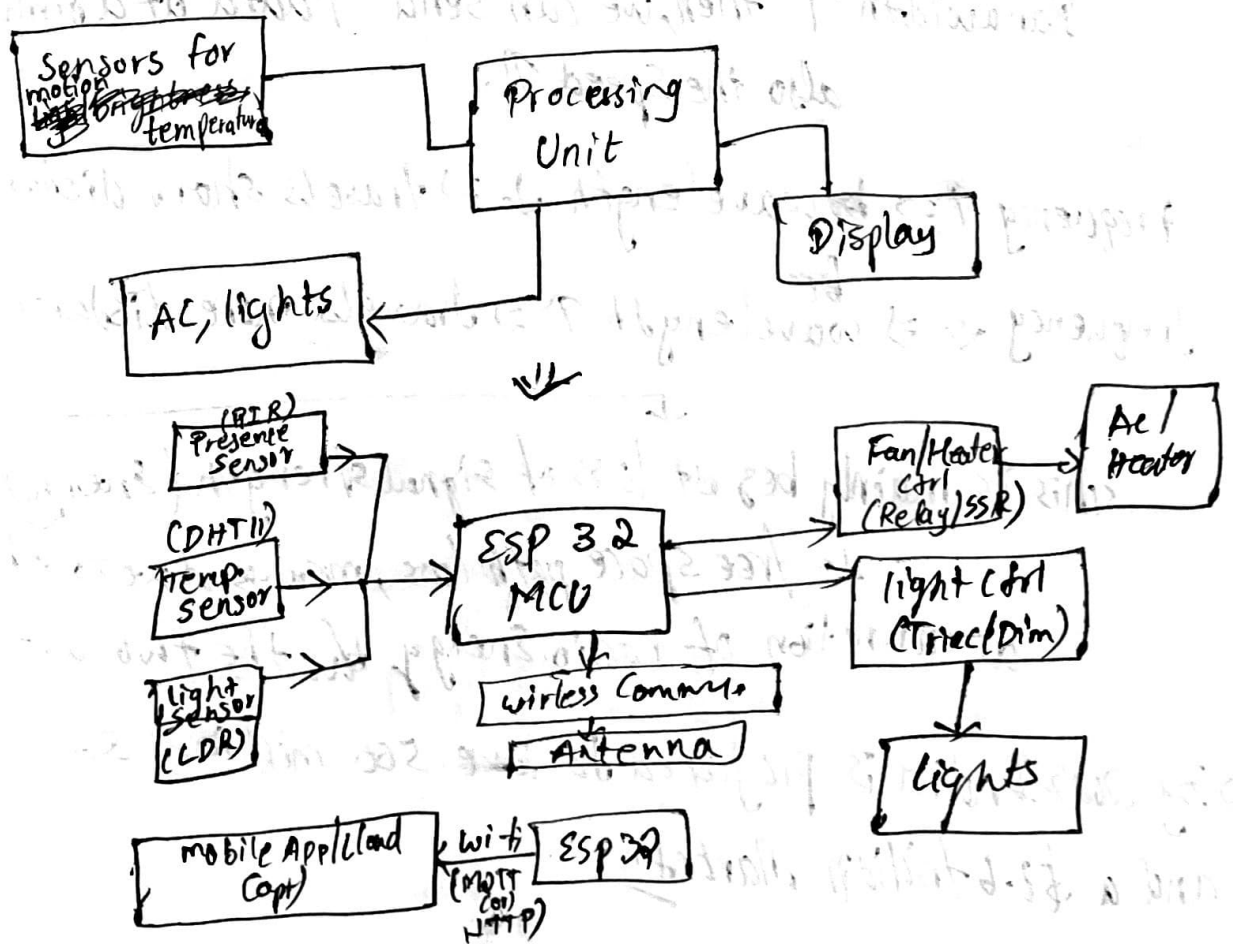
10, 7, 5, 1, 2) Normalize it.

Average $\rightarrow \frac{10+7+5+1+2}{5} \rightarrow 5$

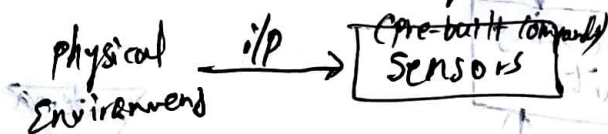
Core Concept



Block Diagram of Room/lab



- Sensors capture data from the Environment.
- Vision of India in IOT is to develop a connected and smart IOT based system for our country's Economy, Society, Environment, and the Global needs.
- A smart sensor is a device that takes i/p from the physical Environment and uses built-in Compute resources to perform pre-defined functions upon detection.



Eg: Human Monitoring like Movement, health rescue, Environment monitoring, daily life monitoring and in industrial productions are the areas where we use these wireless sensors.

- IOT uses standard & interoperable communication protocols to connect & exchange data with the other devices.

Bandwidth ↑ then, we can send ↑ data at a time & also the Speed ↑.

Frequency ↑ ⇒ wavelength ↓ ⇒ travels short distance

frequency ↓ ⇒ wavelength ↑ ⇒ travels more distance

↓
This is mainly because of loss of signal strength (Energy) due to free space path loss, means due to the attenuation of radio Energy b/w the two antennas.

- By 2025 India is projected to have 500 million IoT devices and a \$1.6 trillion Market.

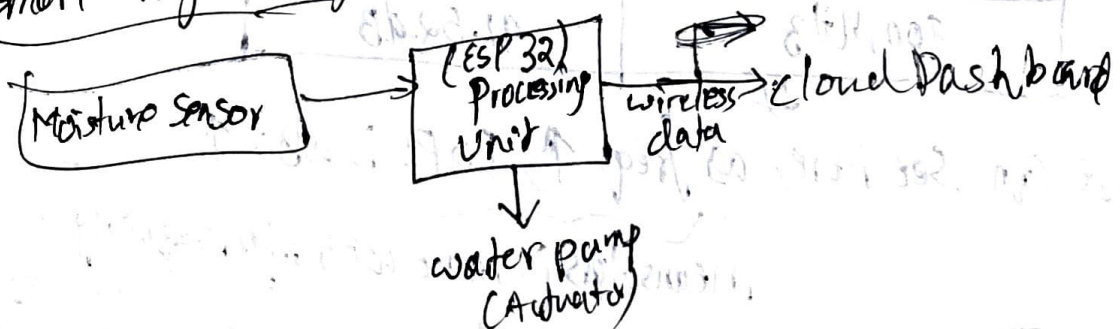
Tech	Freq. Band	Range	Power Use	Use Case
Wifi	2.4/5 GHz	100m	High	Smart Homes & Offices
Bluetooth	2.4 GHz	10-100m	Low	Wearables, Health IoT
ZigBee	2.4 GHz	10-100m	Very Low	Smart Lighting, Mesh
LoRa	433/868/915 MHz	>10km & <20km	Very Low	Smart Agriculture & the Smart City
NB-IoT	LTE Bands	Wide Area	Low	Industrial IoT, Smart Grids
5G IoT	Sub-1 GHz & mmWave	High Speed	Moderate	Autonomous Vehicles, Smart Cities.

IoT Challenges

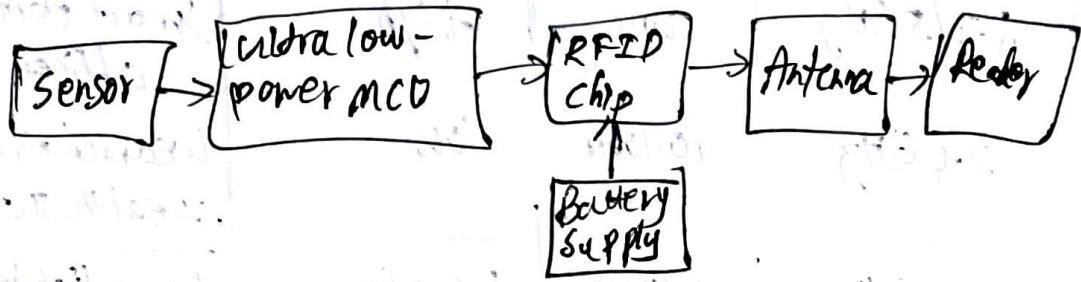
- ① ⇒ Protocol Selection
(Range, Data Rate, Power)
- ↓
- ② ⇒ Deployment
(Scalability, Reliability, Cost)
- ↓
- ③ ⇒ Maintenance
(Security, Latency & Compliance)
- ↓
- ④ ⇒ User Level
(Experience, Environmental factors):

A Successful IoT Solⁿ must balance these performance, security, scalability & the cost.

Smart Irrigation System Block Diagram



RFID IOT Tech Block Diagram:



Free Space Path loss

FSPL is the natural weakening of a wireless signal as it spreads out in space. (Double the distance \rightarrow signal loss by 6dB)

As farther it goes the higher its frequency, the more it loses its strength.
for Eg:

for 2.4 GHz signal with 0dB, 0dB of transmitter gain, Receiver gain over 1km range, FSPL is ≈ 100 dB.

FSPL Formula

$$FSPL(dB) = 20 \log_{10}(d) + 20 \log_{10}(f) + 32.44$$

1km range, 0dB - transmitter gain & 0dB - Receiver gain

frequency	FSPL (dB)
2.4 GHz	100 dB
24 GHz	120 dB
10 GHz	112.4 dB
900 MHz	91.52 dB

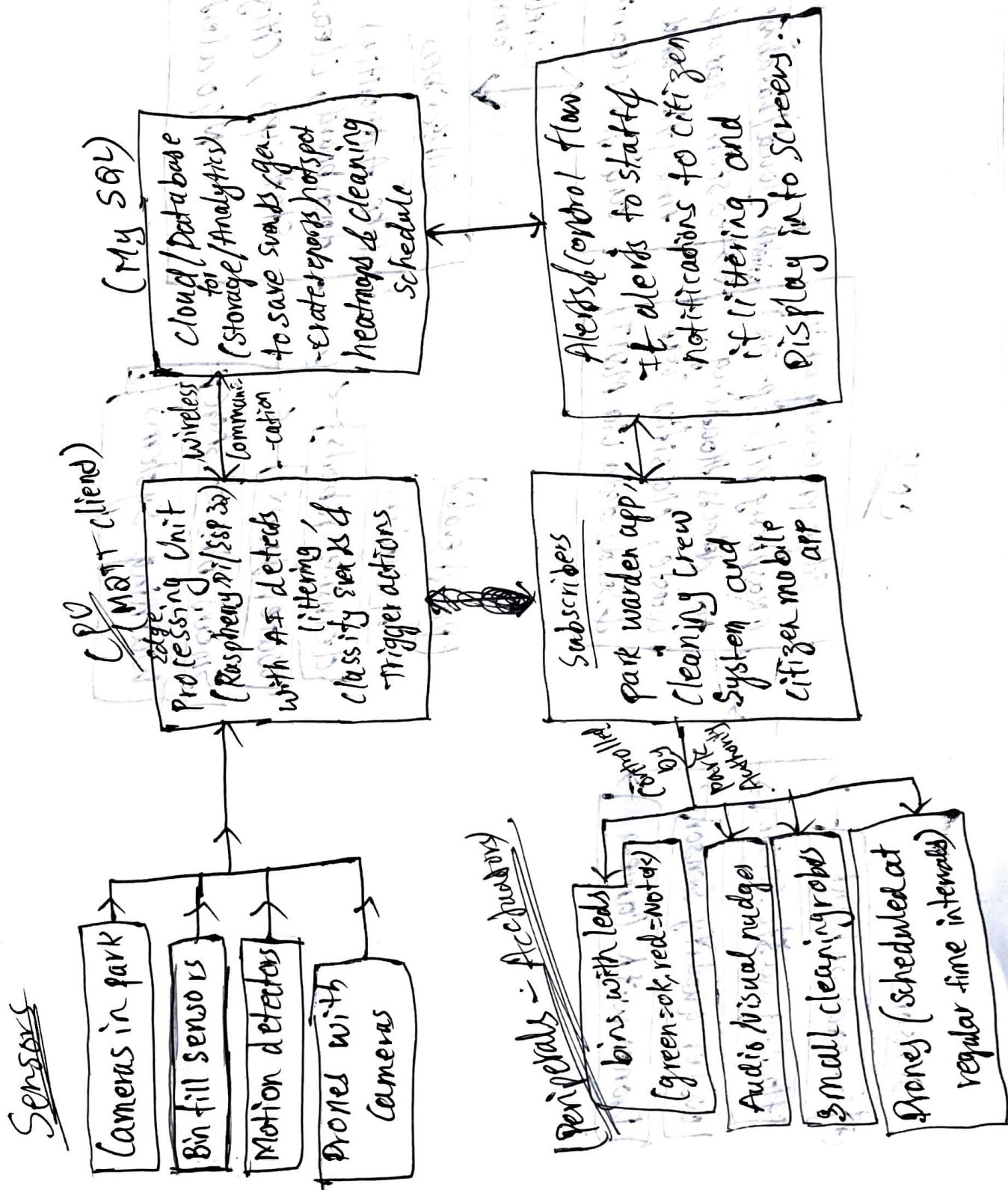
we can see here, as freq \uparrow , FSPL is also \uparrow
means, loss is more with high frequency wireless signals.

Problem Statement - 1

cleaning waste from parks & waste around dustbins (+)
stopping people while throwing the waste in the park.

In short,

Sensors → Edge → cloud → (Subscribers + Actuators)



Problem Statement-2

cleaning waste from the rivers/lakes by using an automatic IoT model.

