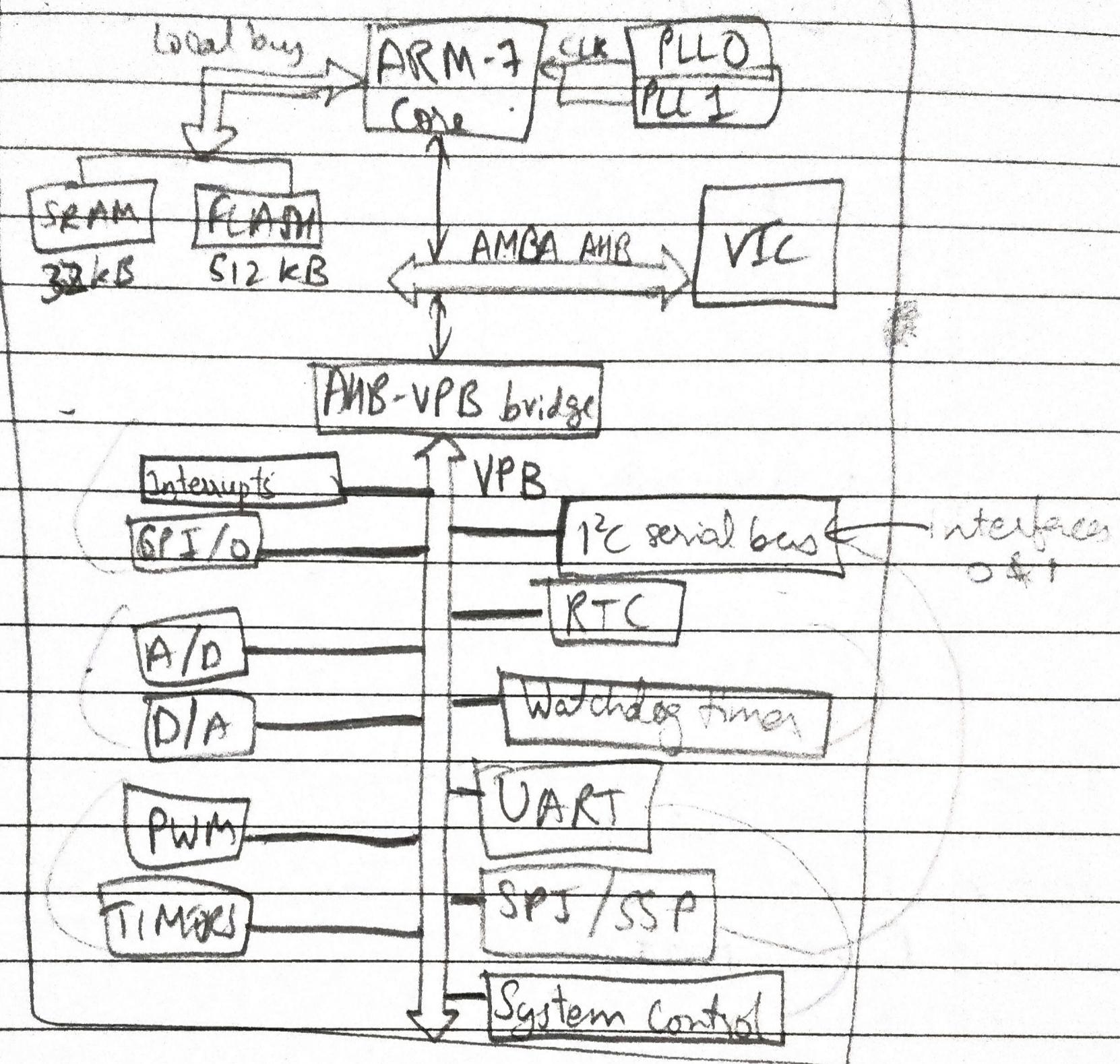


LPC-2148



## μProc

- CPU, RAM, ROM on chip. external
- Expensive
- General/Versatile
- High proc. pow.
- 32-64 bit
- Deep pipeline
- Not time-critical
- μCont
- Embedded on board
- 1-purpose / specific
- 8-16-bit
- low depth

OS

Modifiable

WT

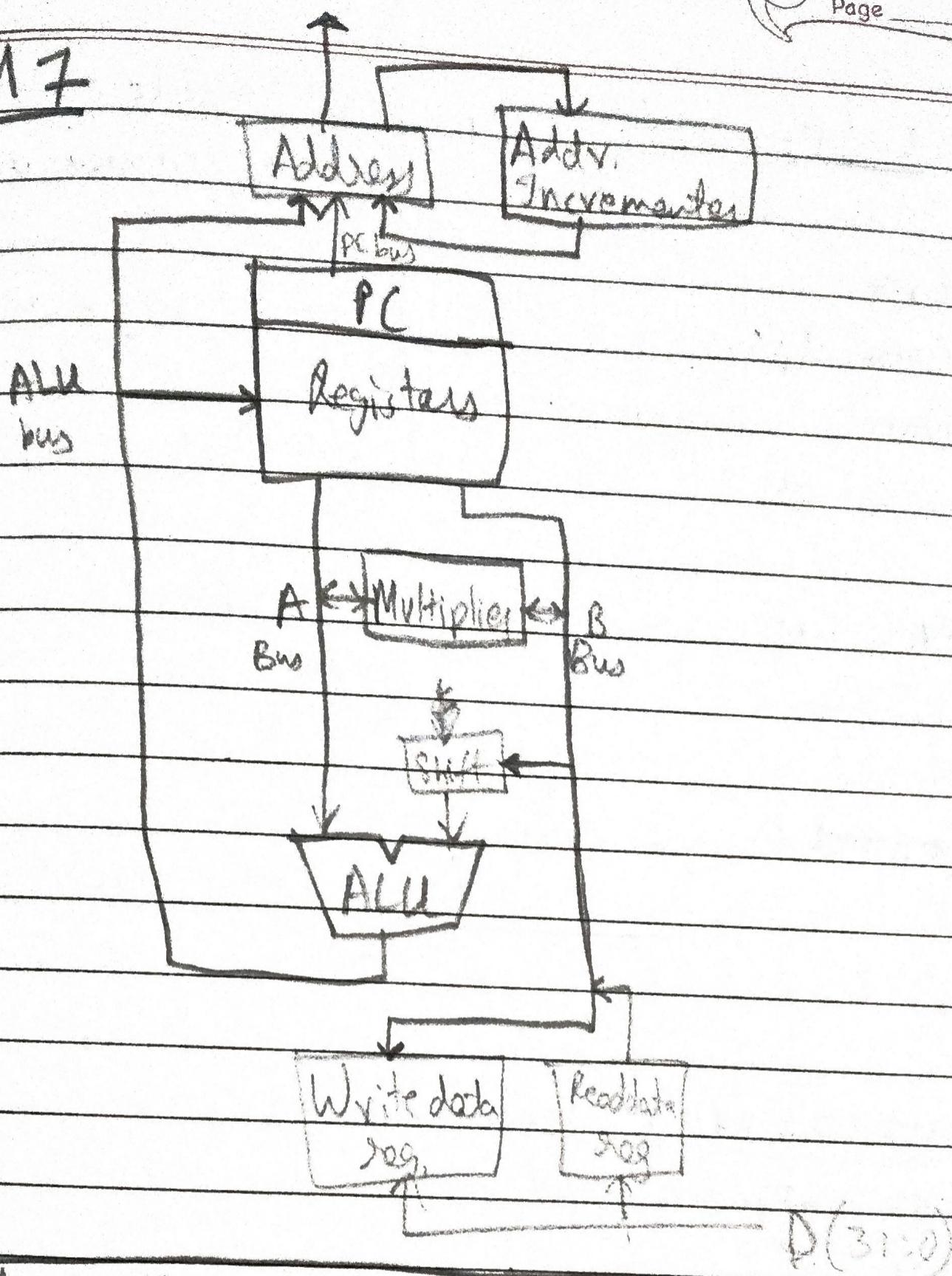
## CISC

- Few instr's per task
- less registers (efficient)
- large instruction set
- High PWD.
- Complex hardware
- Variable instr. len.
- exec. time
- Emphasis on hardware

## RISC

- ES :
- functionality (real time, networked, mobile, ~~standalone~~, standalone)
  - performance (Small, Medium & High scale)

ARM 7



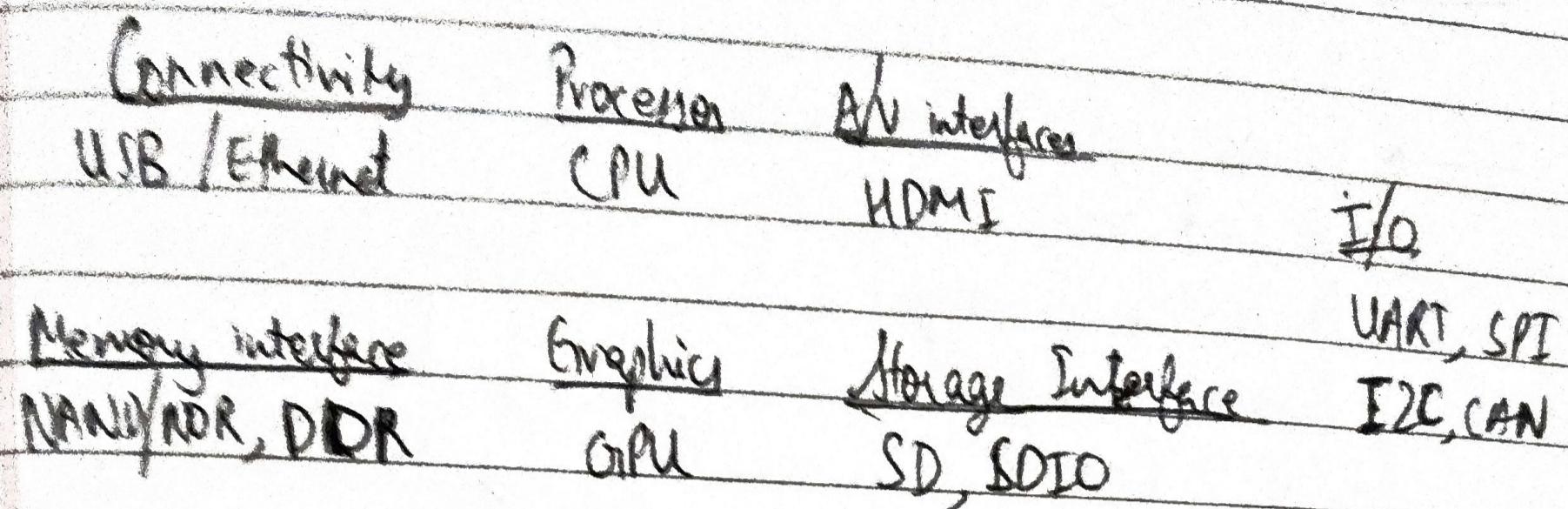
### ARM features:

- RISC
- Eng-effic.
- Scalable
- 1 CLK instr's
- Thumb-2 tech
- large no. registers
- Memory Management Unit
- Pipeline

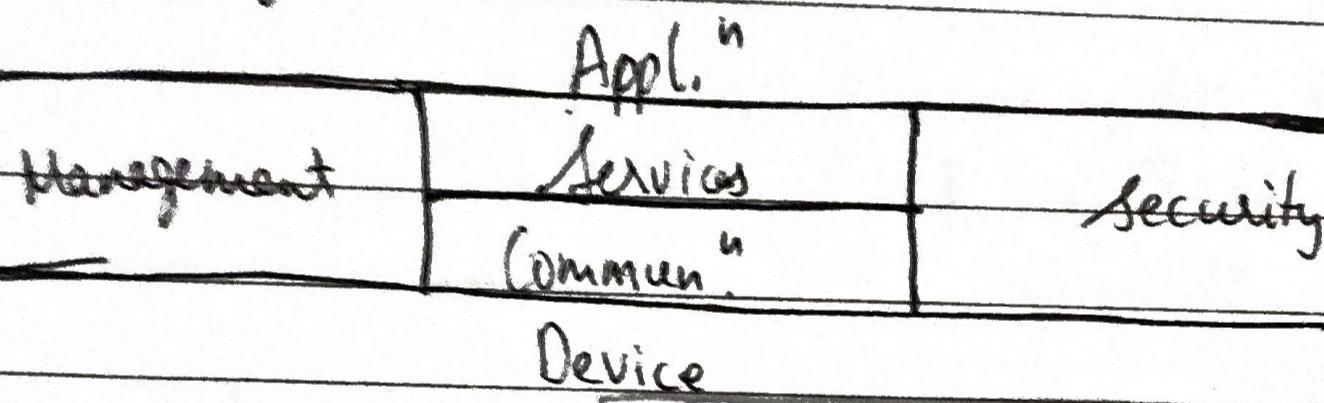
### Open<sup>n</sup> modes

- User
- OS System
- Supervision
- F10
- F20
- Abort
- Undef

## Block diagram (Physical design)



## Logical design:



## → IoT steps:

- Project spec<sup>fn</sup>
- Project model ..

IoT Domain ..

IoT - Info ..

IoT - Service ..

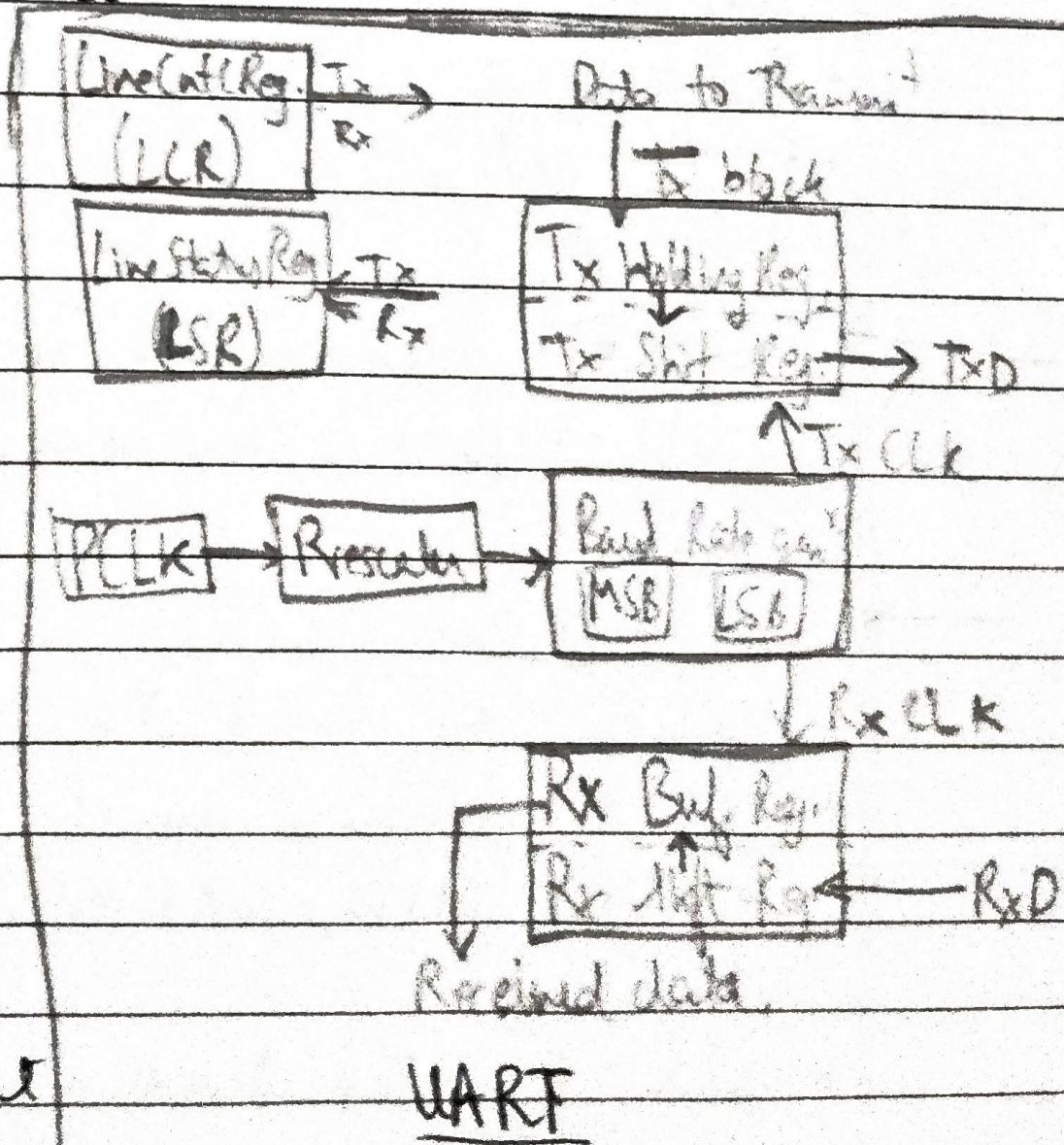
- IoT level .. ✓

- Func. view .. ✓

- Operational .. ✓

- Component integ.<sup>fn</sup>.

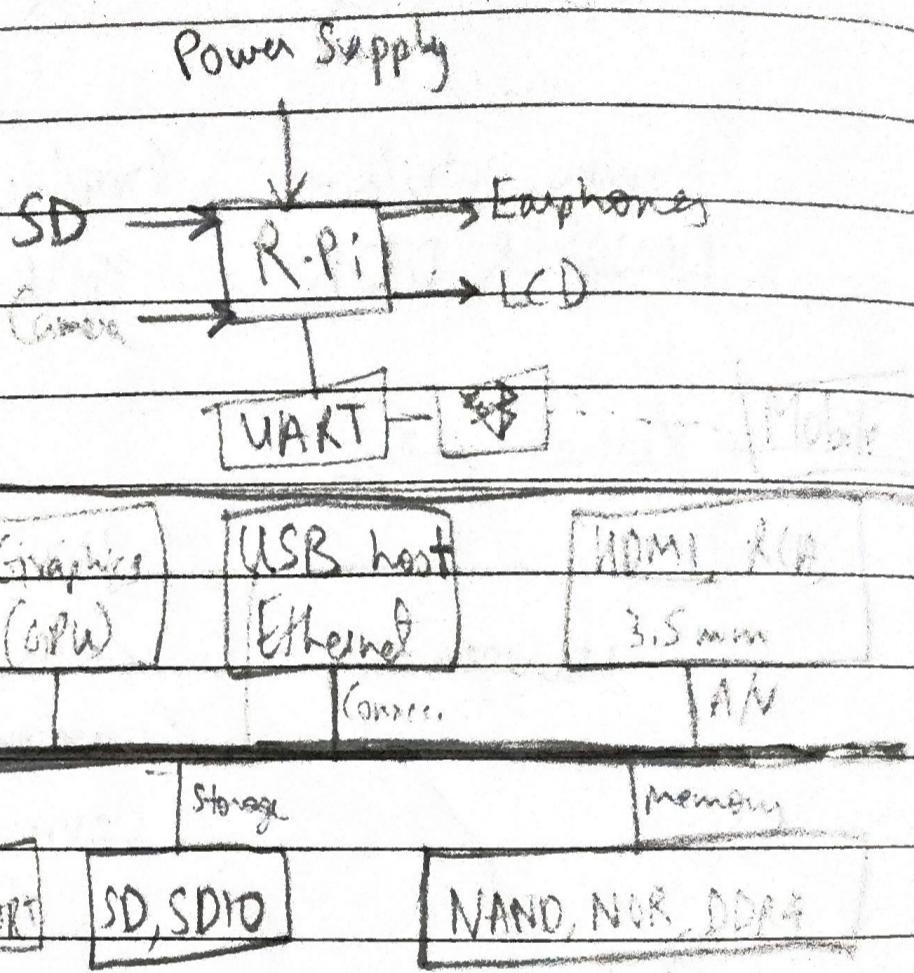
- Application development



→ Building blocks of IoT device: sensing, actuating, connecting & Processing

→ Raspberry Pi components:

- SD card reader
- Micro USB for booting
- Camera input (interface)
- GPIO pins
- 4 status LED's
- HDMI o/p
- RCA o/p
- LCD o/p (DSI)
- Audio o/p
- USB port
- Processor
- Ethernet port



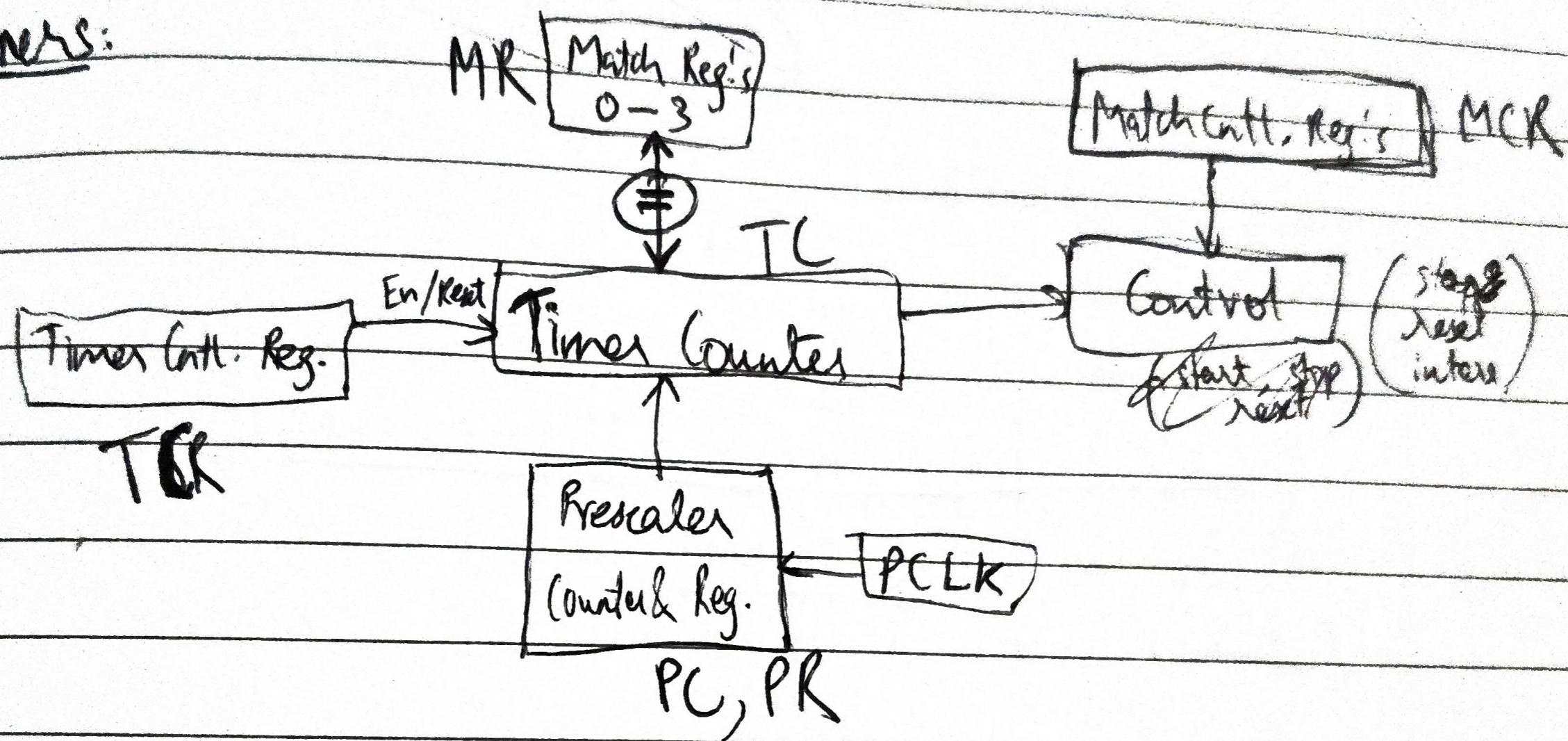
→ RPi (+): low cost, compact, versatile, erg. efficient, Linux support

(-) : No storage, processing power, Ltd. memory, Ltd. real-time perf.

→ RPi interfaces:

- UART - has Rx & Tx pins w/ exist peripherals
- SPI - synchronous connect  $\geq$  peripheral device. 1 master, 1 slave
  - MOSI, MISO, SCK (serial clock by master), CE0 & CE1 (chip enable)
- I2C - connect hardware modules, data transfer b/w SDA (data line) & SCL (clock line)

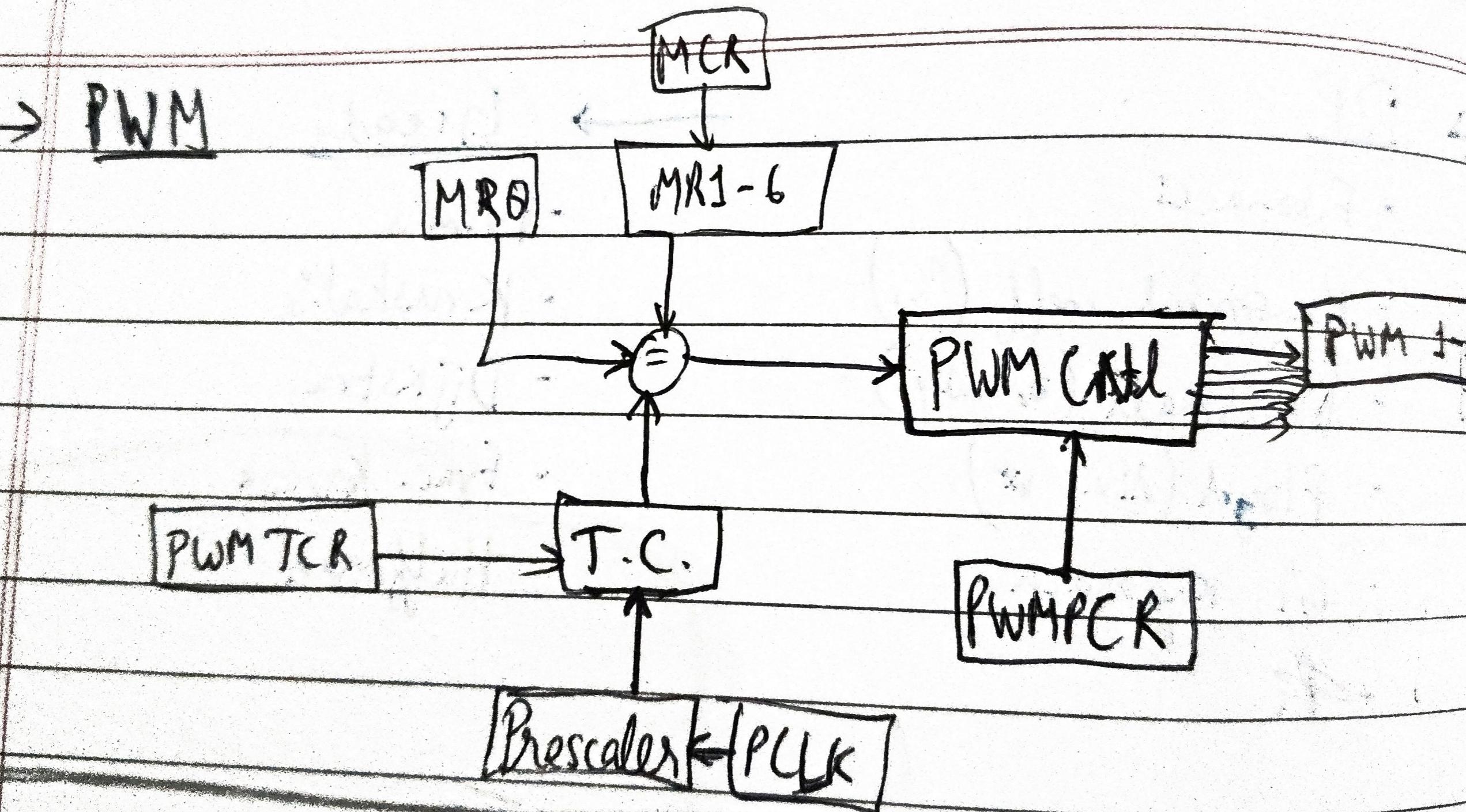
## Timers:



$$T_{OTCR} = \frac{1}{f_s} b \rightarrow 10_b \quad // \text{delay}$$

$$T_{OMR0} = (\text{speed})$$

$$T_{DMCR} = 100_b \quad // \text{stop timer on match}$$



DOI

SOT levels:1:

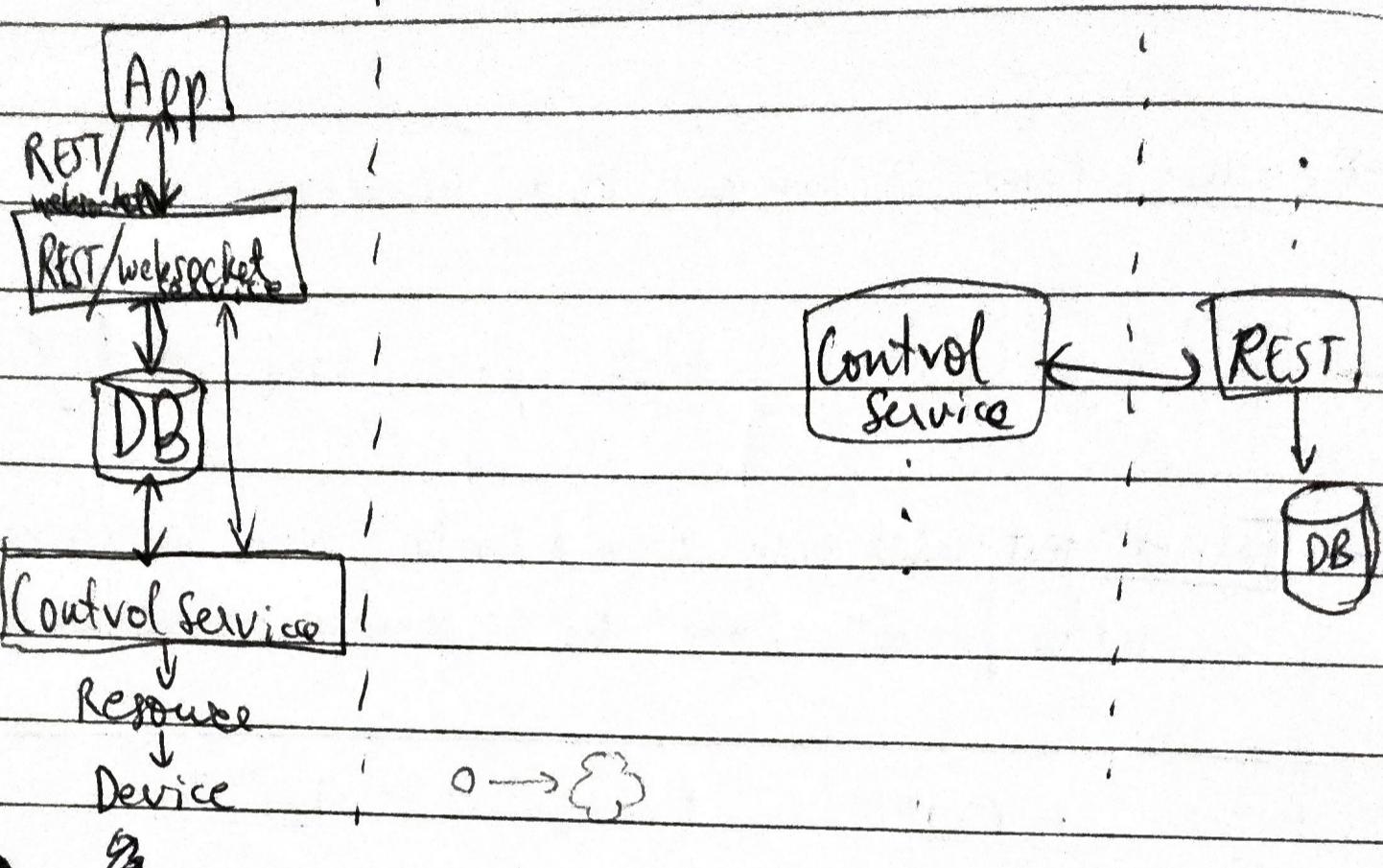
local

; cloud

2:

local

; cloud

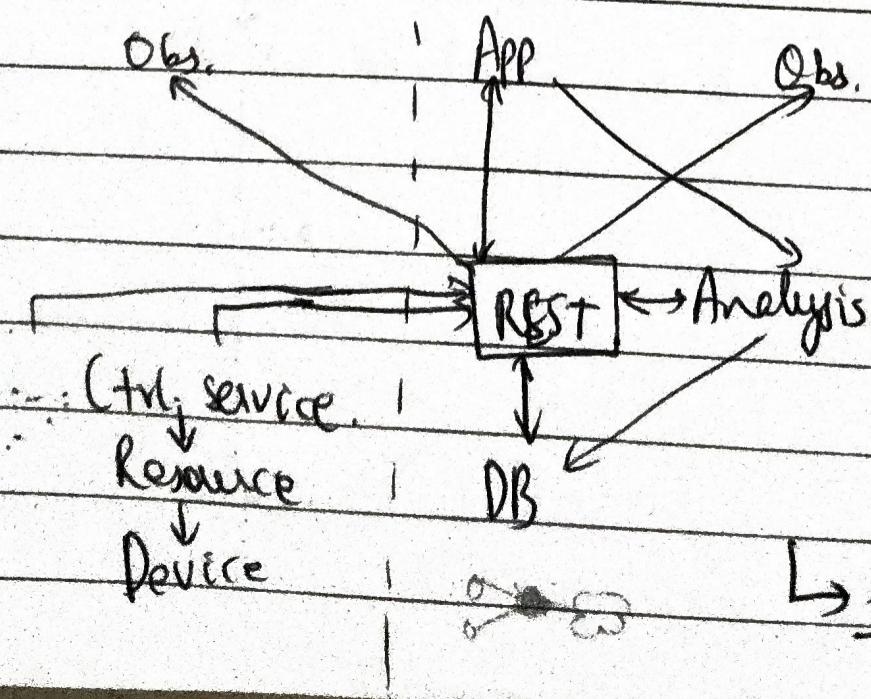
3:

= 2 + netw. services ..

4:

local

; cloud

5: = 4 + inter connect. endpts  
 (+ coordinator node)

6 = 5 + central coordinate controller

## → IoT domains :

Home (light, appliance, intrusion, smoke)

Cities (light, park, road, structure monitor, surveillance, energy)

Envirn. (weather, air poll<sup>u</sup>, noise poll<sup>u</sup>, forest fire, floods)

Erg. (grid, renewable, prognosis)

Retail (inventory, payments, vending)

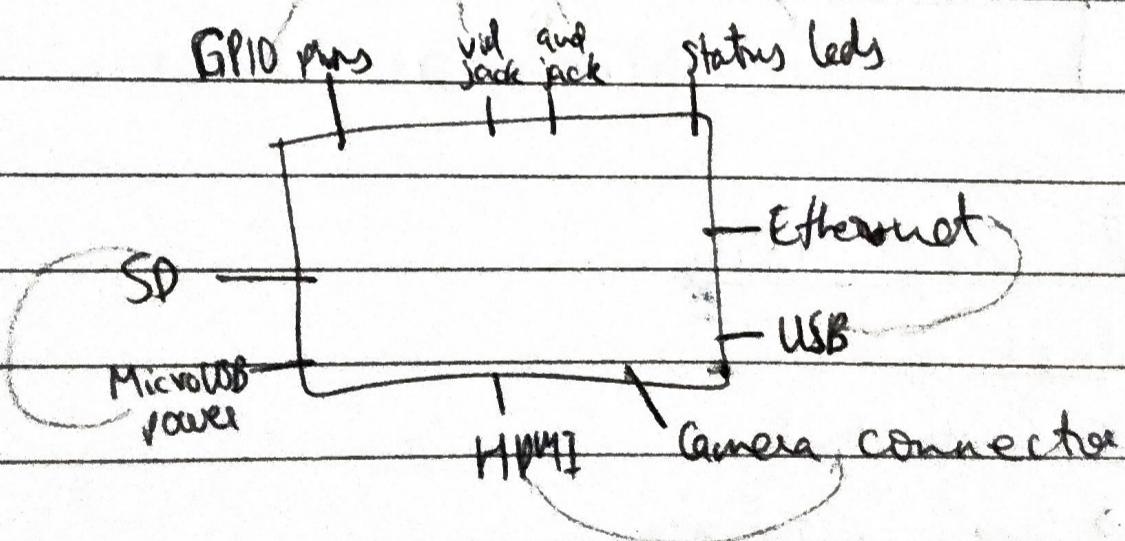
Logistics (route gen<sup>n</sup>, fleets, shipment)

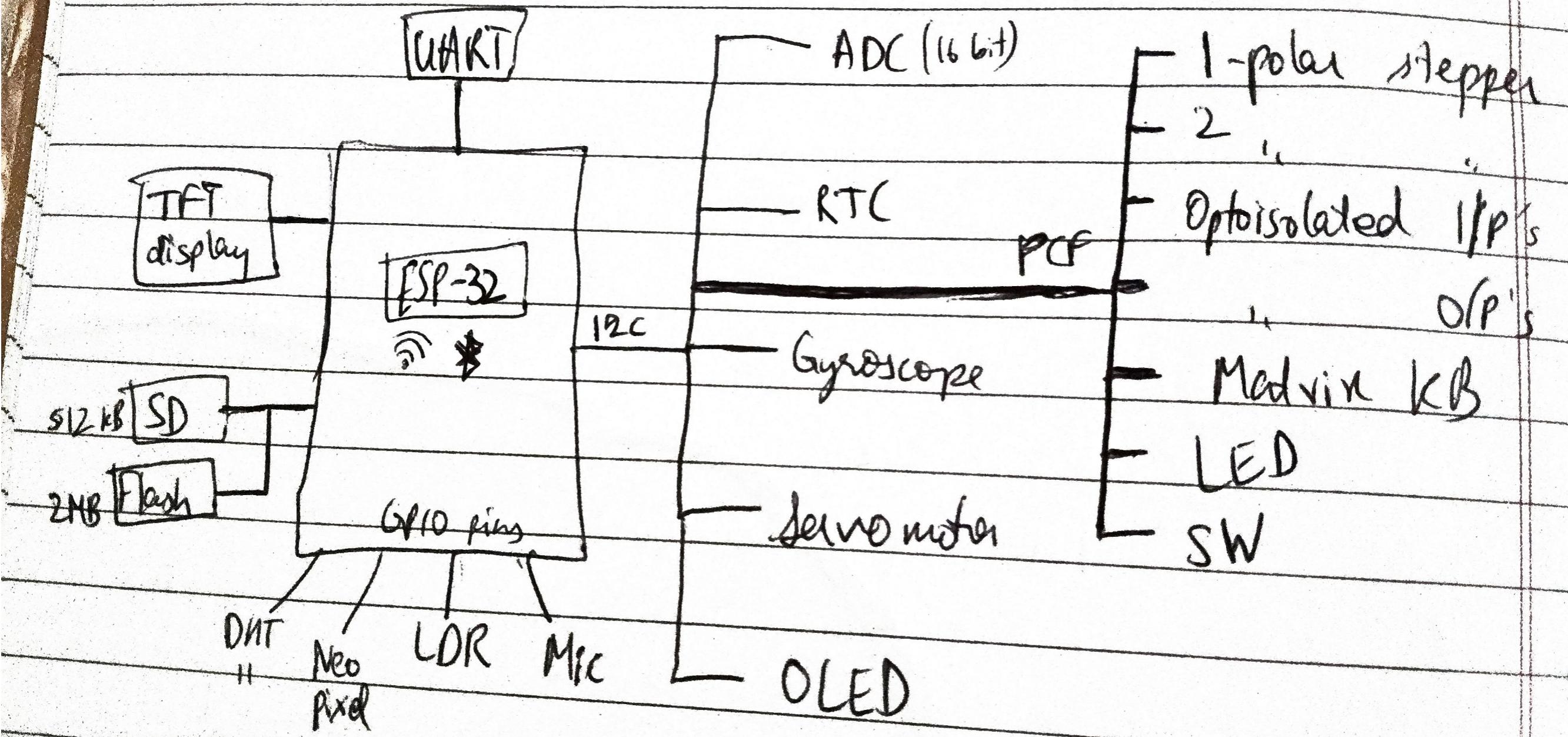
Agri (irrig<sup>u</sup>, greenhouse)

Industry (diagnosis(machine), air quality)

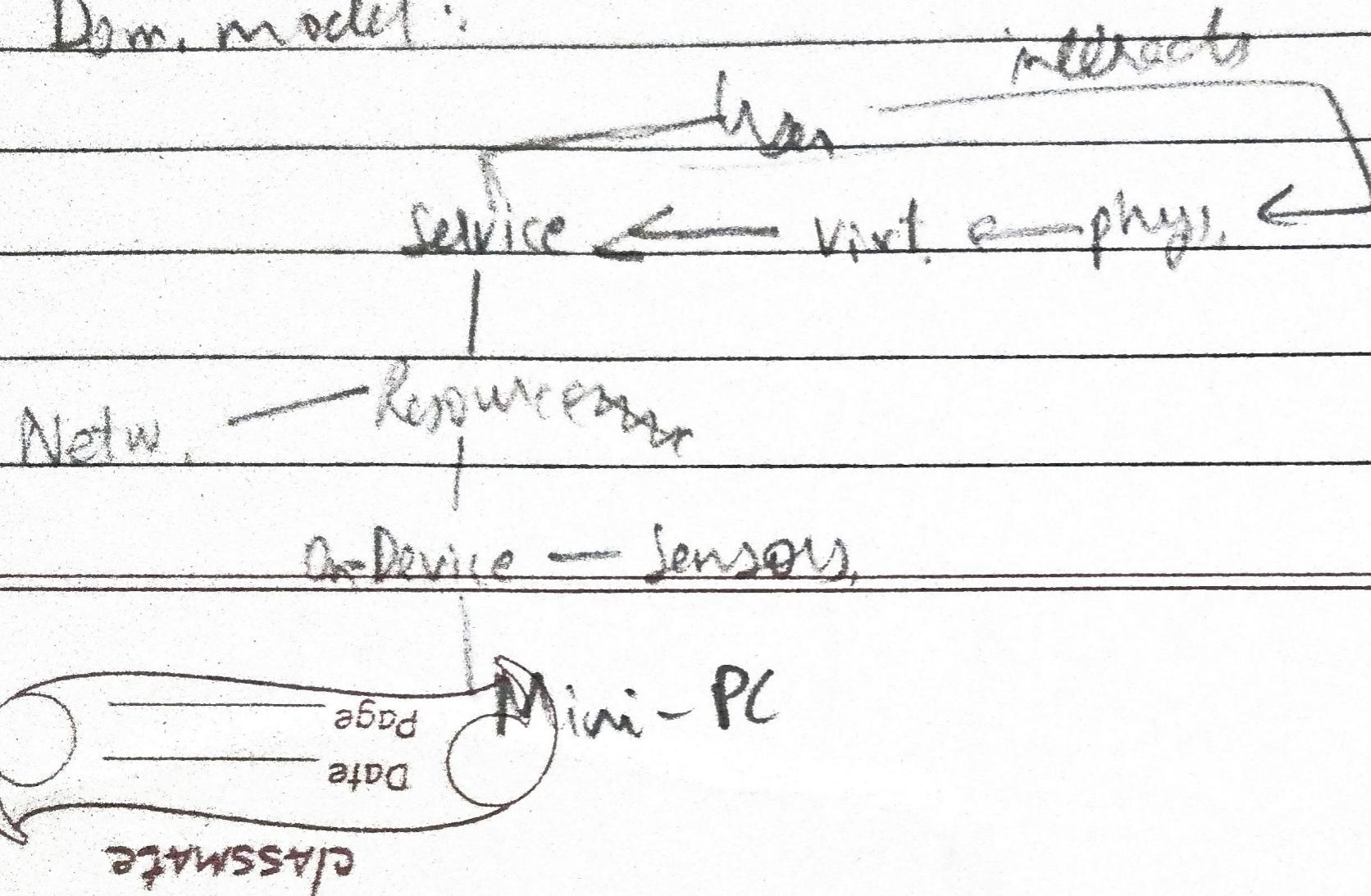
Health (fitness, wearable)

## → RPi :

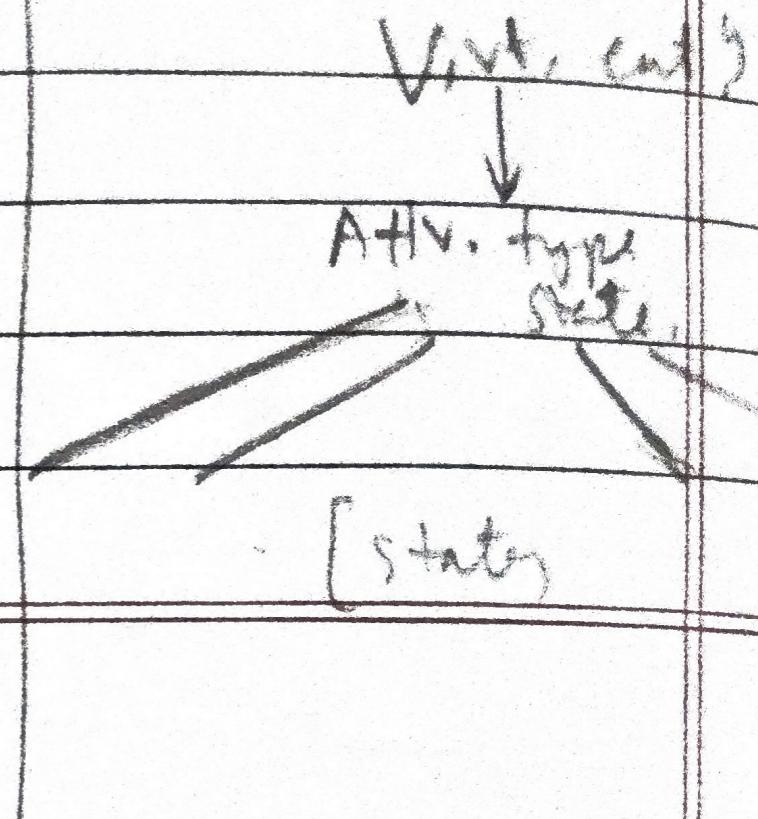




Dom. model:



Info model:



middle:

S/P

D/P

Service — endpt.

~~seq = 2, ack = 0, seq = 1, ack = 1~~

~~seq = 2, ack = 1~~

seq = 2

~~seq = 2, ack = 1~~

Device

Cloud

ESP

Session

data