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Basic of Industrial IOT

IIOT ↳ subset IOT

I IoT → Integration of Sensors in the field.

I IOT → Industrial Internet of thing.

ICT → customer based service.

IIOT → complex & Expensive.

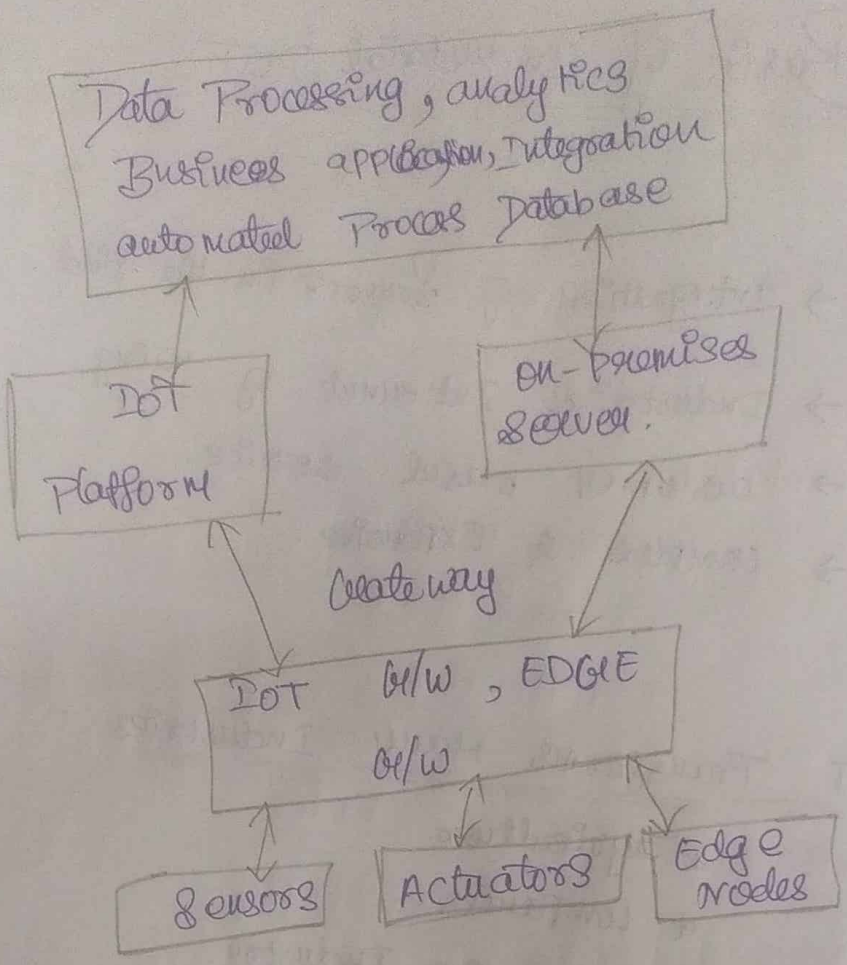
→ I IoT Transforms many Industries :-

* agriculture
* companies
* automative Industry.

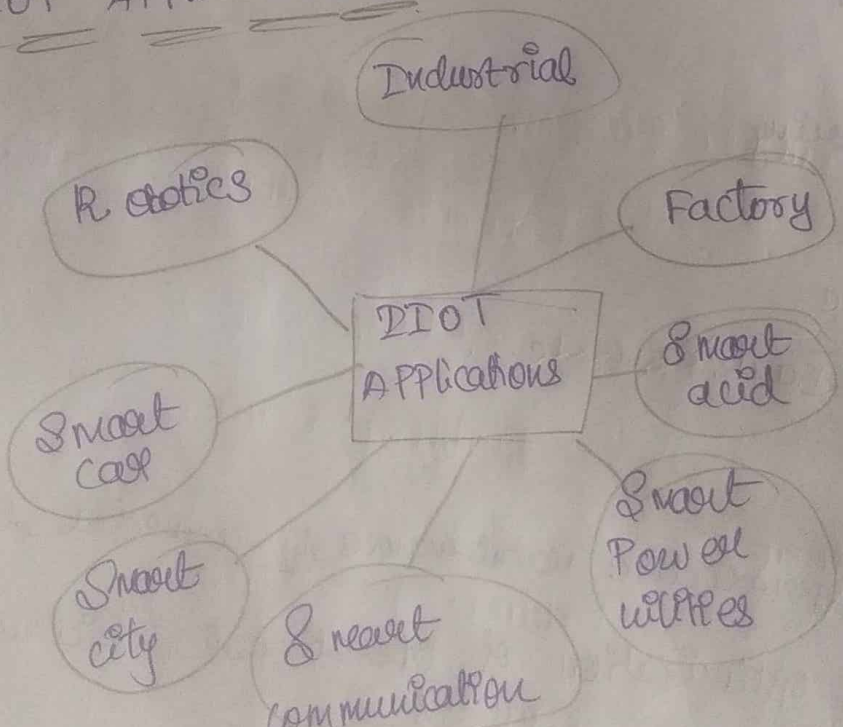
1) Engineering Industry
2) Mining
3) Manufacturing
4) Logistics.
5) Healthcare
6) Others - Bank ATM etc...

→ Benefits :-

1) Predictive maintenance of connected devices.
2) optimization of operational Efficiency.
3) Optimization of Process.



→ IIOT Applications :-



↳

*IIoT ⇒ connect Physical as well as virtual Interoperable Industry common.

*IoT ⇒ conceptual model, use of new technology which enable device to communicate each other using internet.

→ A take Intelligent Decisions on available Data:-

* IIOT → subset of IOT.

* IIoT → adjust environment & maintain Health.

→ Diagnose mic & schedule their maintenance.

→ If a Part of mic start giving trouble through software Pass software information to other Mic.

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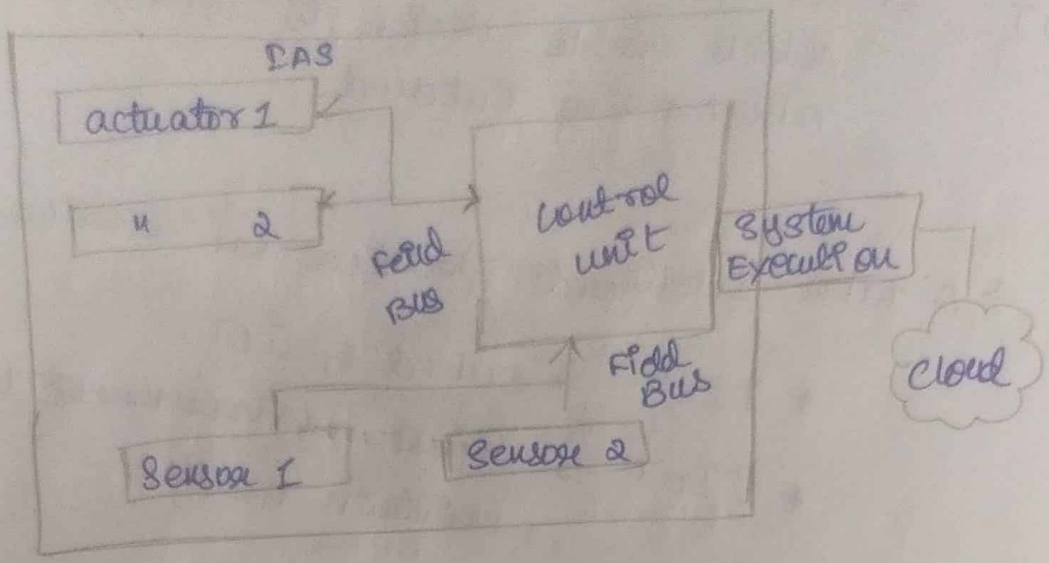
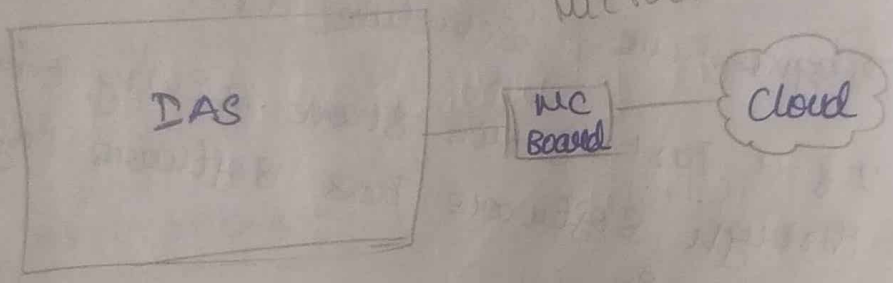
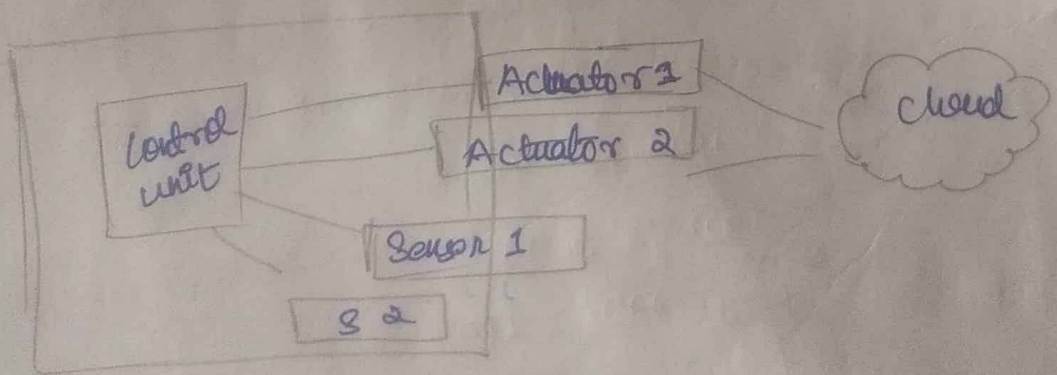
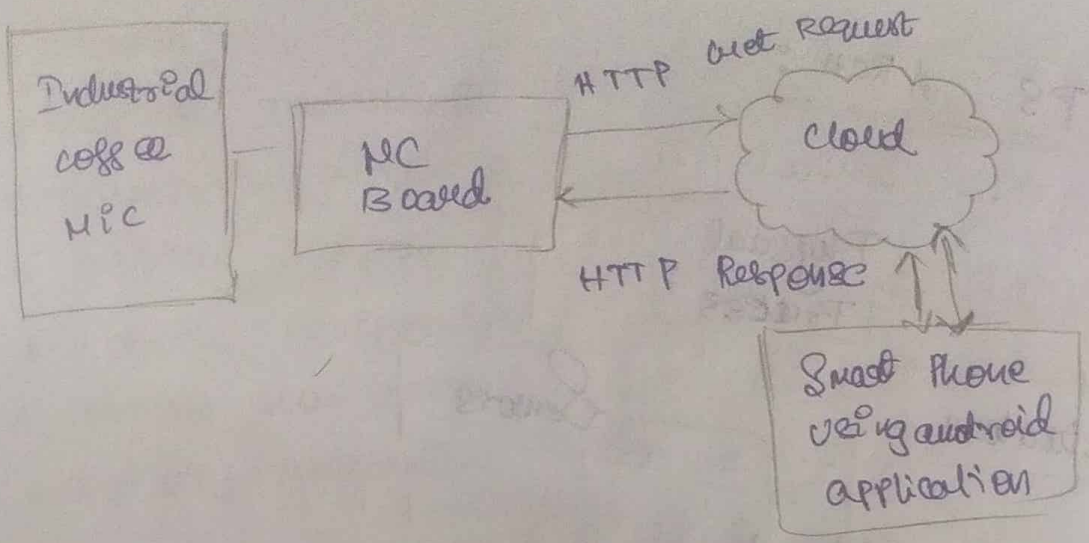
→ Industrial Automation System (IAS) :-





→ Usage of Intelligent actuator + sensors





→ Sensors to New Service + Business models. I4.0

Industrial transformation sensor
Platform + Application, exchanges
& eco systems, vision, innovation
Leadership

④ Monetization
Innovation
Revenue

③ New capabilities
advanced service
& applications.

② Value chain organisation
& managing & Maintenance
Data Driven services

① Building Digital &
Physical assets Carrier
Connectivity unconnected

New service
Connectivity
System
Internal Service
Sensors & Actuators

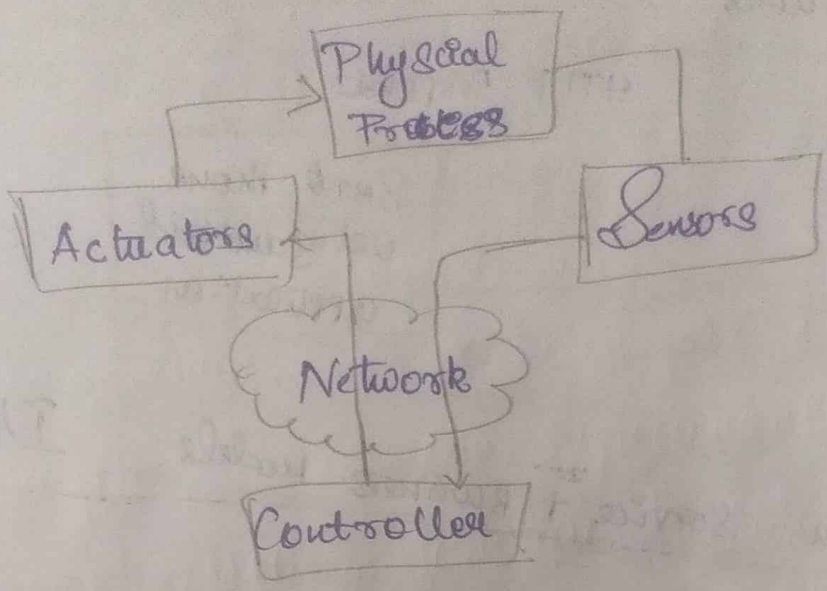
Collaborative
Business Models
New customer
Partners

Lead Usance asset
Tracking
Tracking Produ-
tivity

Energy Management
asset Monitoring
control Insights

Add scalable
Identable &
sending.

→ CPS ARCH :-



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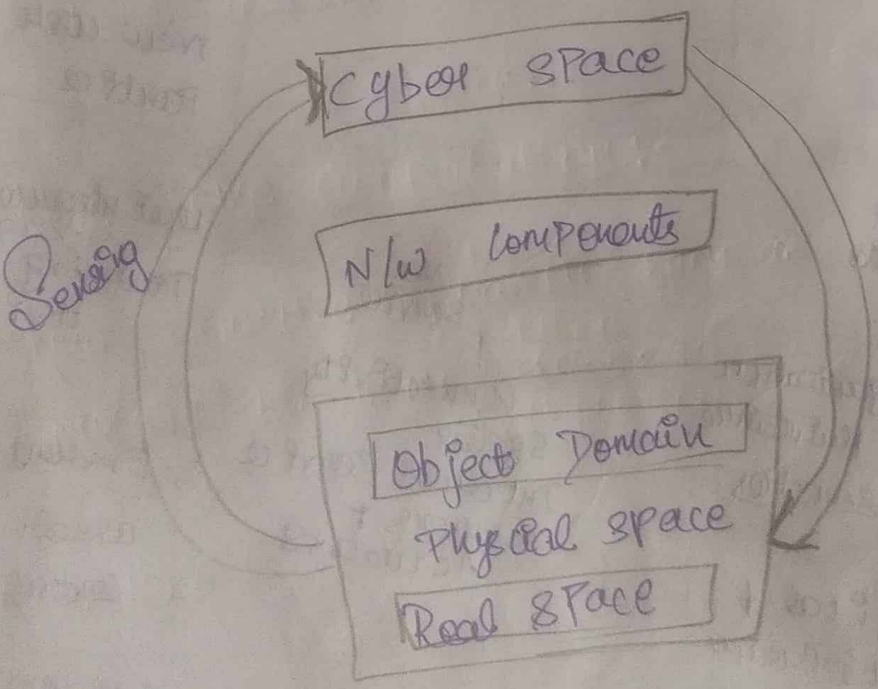
CPS - Generalization & Embedded System



→ Examples :-

* Medical Instruments
* Transportation vehicle
* Defense systems.
* Robotic Equipment
* Process Monitoring
* Factory Automation system.

→ Diff b/w ES & CPS

ES	CPS
* Device has Induction Processing system Embedded into them.	Complete system has physical component & S/w
* Typically, confined to single device	Networked set of Embedded system
* Limited Resources, Limited No. of task	Not Resource constrained.
* Main issue - Real time Response + Reliability	Timing + Concurrency

→ Features of CPS :-

* Reactive computation.
* Interact with the Environment
* Sequence of observed I/O.

→ Concurrency :-

* Multiple Process run concurrently.
* Process exchange Information to get desired Result.
* Synchronization async nation.
* SYNC or ASYNC Modes of operation.
* Feedback control of Physical world.
  * Sensors - sense Environment.
  * actuators - Influence pt.
* Hybrid control system for complex task.

→ Real Time Computation :-

* Time sensitive operation such as co-ordination Resource allocation etc..

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→ Applications of CPS :-

① Health Care :-

* Highly accurate Medical Devices System.
* Image guided Surgery & therapy.
* control of fluid flow for Medical Purpose.
* Biological Analysis of Intelligent operation theatres & hospitals.
* Engineering systems based on cognition & Neuroscience

② Transportation & Infrastructure (IS) Based transportation CTS :-

* Real time monitoring of traffic IS & traffic control (traffic signal, camera etc)

③ Vehicle IS coordinated Transportation CPS :-

* proximity detection for safety.
* vehicle health monitoring.

④ Smart grid :-

* smart meters
* Demand management with Distributed generation
* Automated Distributed with Intelligent substation
* wide area control & smart grid.
* Phasor measurement unit (PMU)
* Data aggregation unit.

⑤ Industry :-

* Manufacturing systems with Logistics.
* Integrated with communication abilities, sensors + actuators.
  → Smart control.
  → optimal Resource utilization
  → smart Diagnostics & Maintenance.

* Flexibility of development system.
* End Products customized specific to needs of customer.

→ CPS needs for IH4.0 :- ④ question

↳ 5C architecture ⇒ 5 levels.

① connection
② conversion
③ cyber
④ cognition
⑤ configuration.

① Connection :-

* Smart connection to ensure accurate data obtained from IIoT.
  ↔ seamless data
  → selection of sensors.

② Conversion :-

* Convert machine data to meaningful info.

Information Machine → self aware.

③ Cyber :-

* Central Information hub
* Gather Information
* Obtain status of Individual machine
* Rate → Performance of machine.
* Predict future behaviour.
* Cluster for data mining.
* Machine → self comprehension ability.

④ Cognition :-

* Proper presentation of info to the user for generation through to knowledge of the system.
* Collaborative Diagnosis
* Design making
  ↓ ↓
  prioritization optimization.

⑤ Configuration :-

A supervisory control to determine actions to be taken by machine.

* self configuration & response.
* " adjustment for variation
* " optimization for Disturbance.

→ Challenges - CPS :-

* Safety, Security, Robustness.
* Hybrid control systems.
* Computation & Real time Embedded system.
* Sensor & Mobile network.
* Architecture & Modelling
* Verification, validation & certification.
* Education & training.

→ Next Generation Sensors :-

↳ Smart Sensors :-

* Integration of sensors + actuation with processing & communication module.
* Defined in IEEE 1451 standard as sensor has small memory & standard connection to enable communication with processor & Data network.

→ Functionality :-

* self calibration, communication, Multisensing cost improvement.

→ Limitation of Smart Sensors:-

* Predefined Embedded function, customization not possible.
* Narrow application
* Sensors Data aggregation not possible.
* External processor → sensor calibration
* Basic communication protocols.

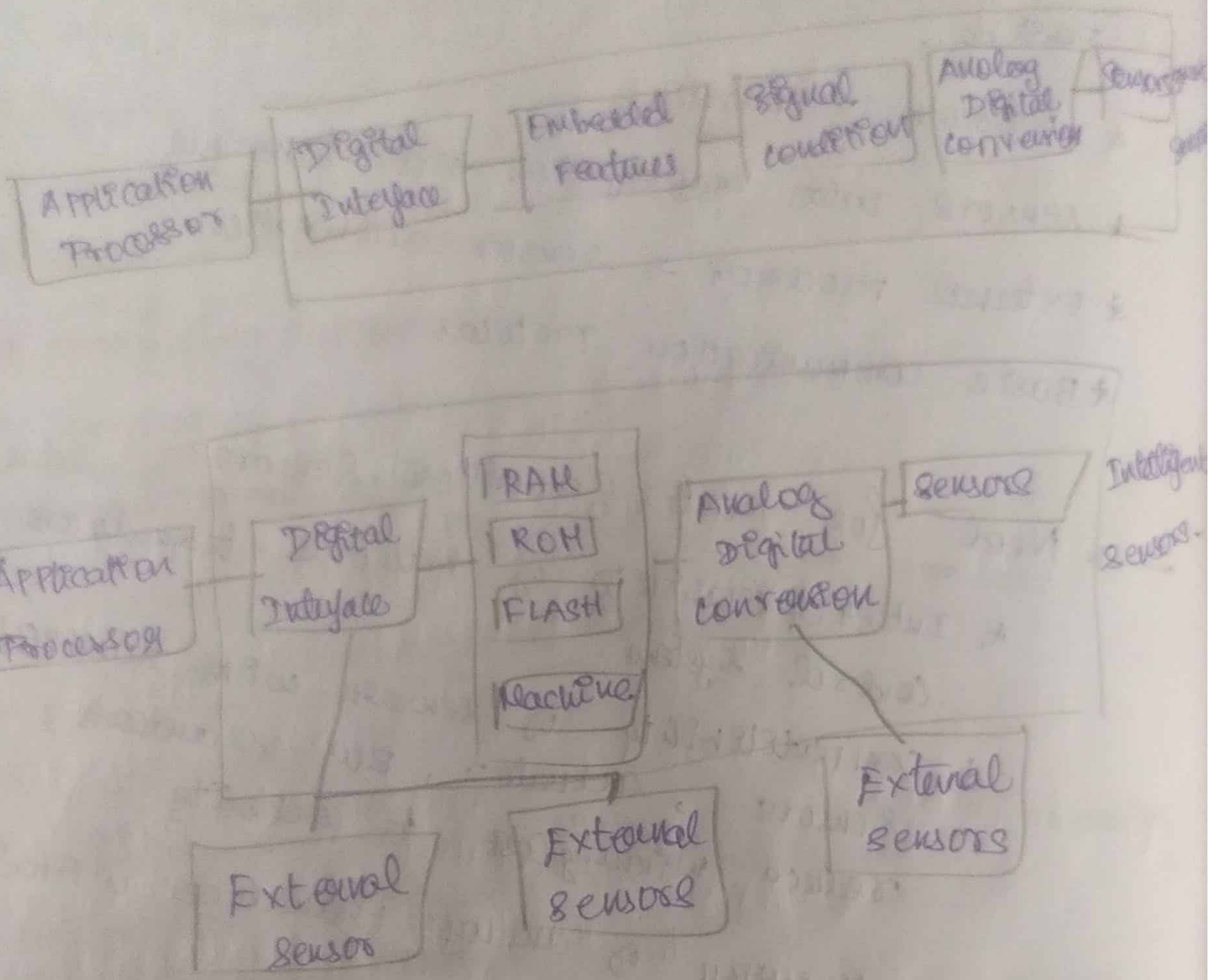
→ Need for Next generation Sensors: Transducer.

* Interoperability of Network, transducer control systems.
* compatibility of sensors with multiple sensors actuators, Bus standards, reduce wiring cost & complexity
* Integration of analog transducer with Digital Network.
* Increase usage of existing Network → Instead of Developing new state.

→ Intelligent Sensors:-

* capable of processing
* capable of customize
* capable of managing controlling external sensors.
* sensor, machine memory
  → RAM, ROM, FLASH

→ Block Diagram of Smart Sensors :-



→ Advantages :-

* Reduce Data communication
* Reduce Power communication
* Application specific customization of sensors nodes
* Continuous calibration & monitoring of sensors
* Adaptive Samples rate & Sleep wake cycles
* shorter software development time
Network
Improved compatibility of sensors

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Augment Reality & Virtual Reality :-

* A R & VR in I4.0.
* AR & VR used in manufacturing industry.
* Data warehouse efficiency Improved.
* Safety training - Safety hazards.

→ AR & VR in IIoT :-

* Marketing & Production.
* Education & Collaboration.
* Assembly.
* Safety & Security.
* Digital Prototyping.
* Factory Planning.
* Maintenance & Inspection.

→ Augment Reality :-

* Enhanced version of reality.
* Direct / Indirect views of Physical world are augmented with computer generated super Imposed Images.
* Adds digital Element to actual.
* Amplifies present perception of Reality.

→ Key Features of AR:-

* Lies in middle of the reality spectrum.
* Multiple sensor
  Module → audio, video, haptic (touch)
* Use existing Environment & overlays new information on top of it.

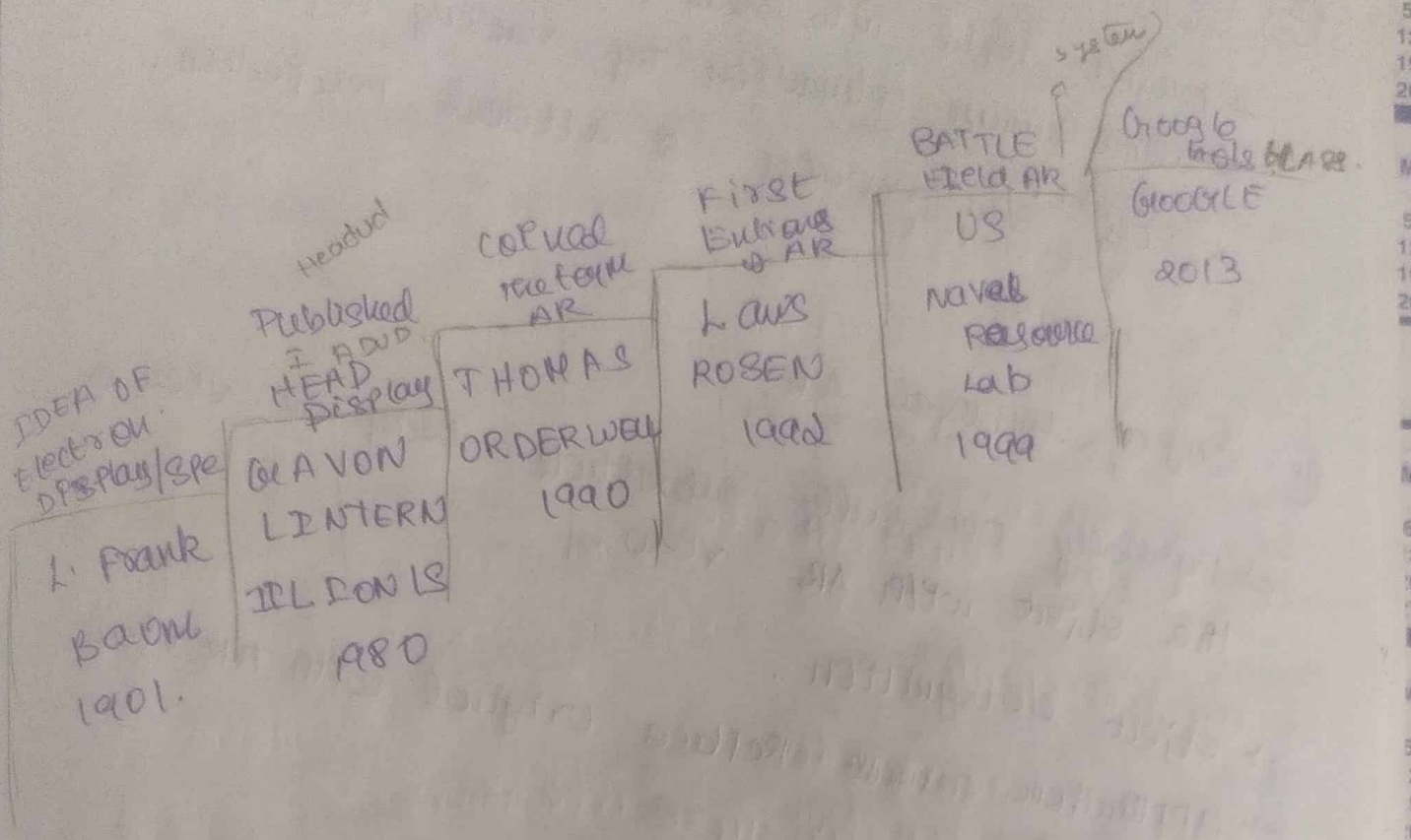
→ Application of AR:-

* Retail & Industrial Design.
* Medical.
* Education.
* Flight training.
* Military
* Tourism
* Entertainment.

→ Key components of Devices:-

* Sensors
* Projection screen.
* Camera
* Processing unit
* Reflection

→ CHRONOLOGICAL Order of AR :-



→ Types of AR :-

① MARKER BASED AR :-

→ O/P :- When Reader Sense by Camera & visual visual Maker.

Camera :- difference b/w Marker at Real objects.

Marker :- Distinct Patent can be easily Processed.

② MARKER LESS AR :-

→ Mapping Directions.
→ Location Based on GPS, digital Compass, or accelerometer.
→ attached to the Device

③ Projection screen AR:-

→ project light into real world surfaces.
→ allow human interaction by sending lights.
→ Diff b/w expected & altered projection.

④ Super Imposed AR:-

→ Partially or fully substitute original view of the object with AR view.
→ Object recognition.
→ application cannot Replace original with AR view.

VR

* Mixture of Hardware & Software Based artificial Environment.
* Realistic 3D Image created.
* Presented to the user → Interact with real or Physical world.

→ Key Features :-

* Create & enhance Imaginary reality.
* Physically present in non-physical.
* Incorporate auditory & sensory feedback.
* Allow user to get naturally absorbed to virtual.

→ CHRONOLOGICAL ORDER OF VR :-

Experience theatre	Sword of Demo clock	Coupled VR	Produced & NW	Large experience Expo	Google I/O Expo
Film maker Morton 1962	IVAN Sutherland MIT, comp Scientist 1968	JARON LANIER 1984 Scientist	DAVID 1977- 1984	ERIC HOLCAT 1979	Mechan 2015