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Sub: IOT

ASSIGNMENT No. 2.

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Q1] Draw a generic Block diagram of IOT & discuss the working of each block.

→

Connectivity	Processor	Audio/Video Interfac	I/O Interfaces
USB Host	CPU	HDMI	(for sensors,
RJ45/Ethernet		3.5mm audio	actuators, etc)
		RCA video	
			UART
			SPI
			I2C
			CAN

Memory Interfaces	Graphics	Storage Interfaces
NAND/NOR	GPU	SD
DDR1/DDR2/DDR3		MMC
		SDIO

- An IOT device may consist of several interfaces for connections to other devices, both wired and wireless.
- I/O interfaces for sensors
- Interfaces for internet connectivity
- Memory and storage interfaces
- Audio/Video interfaces

• Working of IOT Devices (Generic)

1. Connectivity:
   - Enables communication with other devices or cloud using wifi, Bluethooth, etc.

2. Processor :
- Controls the device, processes data from sensors, runs logic and encryption

3. Audio/Video Interface :
- Handles input/output of multimedia data

4. Memory Interface :
- Connects to RAM for temporary storage during processing

5. Graphics :
- Renders visuals for display

6. Storage Interface :
- Connects to permanent memory (Sdcard, flash) to store data or logs.

7. I/O Interface :
- Connects sensors and actuators to interact with the physical world.

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Q2.] Enlist & explain protocols used in IOT

→ • LINK LAYER (Handles data transfer over physical media)

1. 802.3 - Ethernet
   - Wired network protocol for high-speed data transfer (used in LANs)

2. 802.11 - Wifi
   - Wireless protocol for local area Internet access.

3. 802.16 - WiMax
   - Wireless broadband access for long-range communication (city-wide)

4. 802.15.4 - LR-WPAN:
   - Low-power, low-speed protocol for IOT (used in Zigbee, 6LOWPAN)

5. 2G | 3G | 4G
   - Cellular network protocols for long-range, mobile communication.

• Network / Internet Layer (Handles addressing & routing)

1. IPv4:
   - Internet protocol with 32-bit address (limited address space)

2. IPv6:
   - 128-bit upgraded version of IPv4 with vast address space.

3. 6LOWPAN:
   - IPv6 over Low-power wireless network like 802.15.4 (for IOT)

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- Transport Layer (manages data delivery between devices)

1. TCP (Transmission Control Protocol):
   - Reliable, connection-based protocol with error checking

2. UDP (User Datagram Protocol):
   - Fast, connectionless protocol, no guaranteed delivery (used in real-time apps).

- Application Layer (used by IoT apps to exchange data)

1. HTTP:
   - Web-based protocol (used in websites and REST APIs).

2. CoAP:
   - Lightweight HTTP-like protocol for low-power IoT devices

3. WebSocket:
   - Enables two-way, real time communication (used in live apps, chats)

4. MQTT (Message Queuing Telemetry Transport):
   - Lightweight publish-subscribe protocol for remote sensors

5. XMPP (Extensible Messaging and Presence Protocol):
   - XML-based protocol used for messaging (originally for chat, now in IoT too).

6. DDS (Data Distribution Service):
   - Real-time data exchange protocol for high-performance systems

7. AMQP (Advanced Message Queuing Protocol): - Reliable message-oriented protocol used in cloud based systems.

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Q3] Explain IoT Levels with suitable application & diagram.

→ These levels show how data flows from sensors to meaningful services for users.

1. PERCEPTION LEVEL Level 1

- Detects and collects real-world physical data
- Devices: Sensors, RFID tags, Cameras, GPS
- Example: Temperature sensor sensing 28°C

2. Network level Level 2

- Transfers the collected data to other IoT layers
- Technology: Wifi, 4G/5G, Bluethooth, ZigBee.
- Example: Sending temperature data to the Cloud.

3. Data Processing Level Level 3

- filters, preprocesses, and analyzes raw data
- Involves: Edge computing, fog computing
- Example: filtering noise from sensor data before cloud upload

4. Application Level Level 5

- offers services to end-users through apps or dashboards
- Users: Consumers, businesses, government
- Example: AC app showing live temperature and turning it ON/OFF

5. Service Level — Level 4

Role - Provides specific services based on processed data.
Task: Manages services like alerts, automation, notifications.
Example: Sending alerts when room temperature exceed 30°C

6. Business Level — level 6

- Handles overall business goals, decisions, profits, and strategy using IOT data.
- Function: Visual analytics, decision-making dashboards, Policy control.
- Example: A smart farming company for analyzing seasonal patterns to increase crop yield.

Diagram:

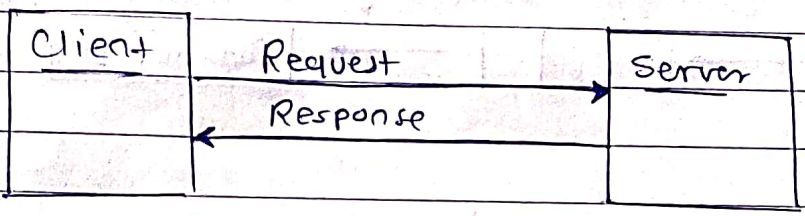
Business Level	→ Strategy, decision making
Application Level	→ Interface for end users
Service Level	→ Manages services based on data
Data Processing level	→ filtering & pre-processing data
Network level	→ Data transmission
Perception level	→ sensors Collecting real-world data

Q4] Explain the IOT communication models with the diagram?

→ 1. Request - Response Communication Model

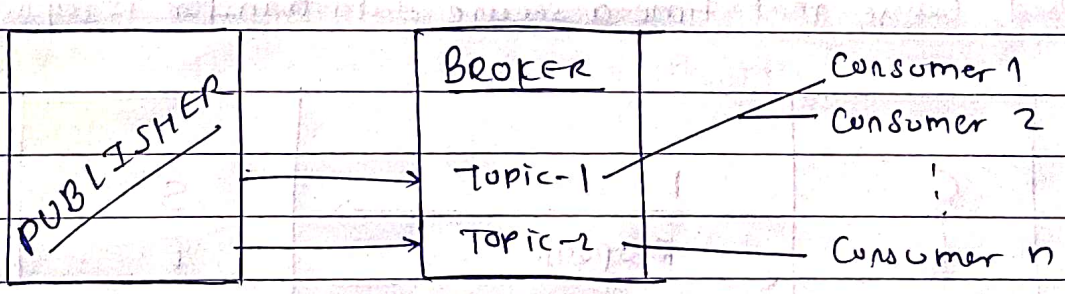
- Client sends a request, and Server sends a response
- Synchronous Communication (wait for reply)
- Used when data is needed on-demand

eg. ~~Your~~ Mobile app requests temperature → sensor/cloud responds



2. Publish - Subscribe Communication Model

- Device publish message to a broker
- other devices subscribe to topics of interest
- Decouples sender & receiver

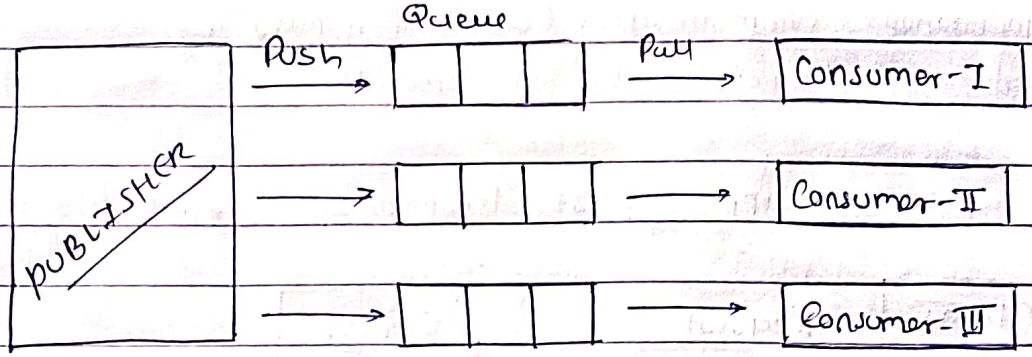


eg: Weather station publishes temperature updates → subscribed Apps/dev receive it

Protocols : MQTT, AMQP

3. Push-Pull Communication Model

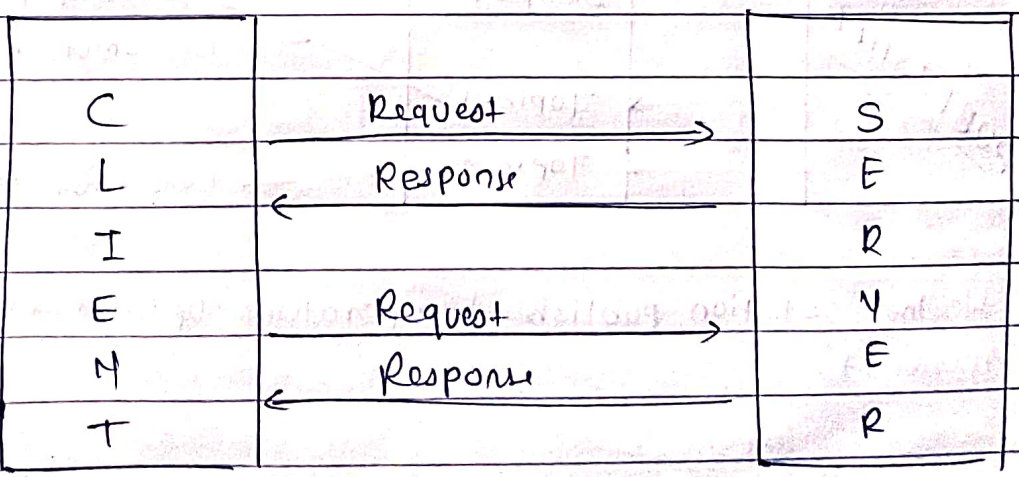
→ - Pushers send data to a queue
- Pullers retrieve data from the queue
- Useful in distributed systems with data buffering



eg: Sensor pushes data to a central queue → Cloud service pulls it when needed

4. Exclusive Pair Communication Model

- A Dedicated one-to-one full-duplex connection
- Used where real-time a secure data transfer is required



eg: A camera streaming live footage to a monitoring system.

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05.] Explain the following IoT enabling technology

(i) WSN (Wireless Sensor Network)
- Group of sensor connected wirelessly
- Used to collect environmental data
- Eg: Forest fire detection, smart parking

(ii) Cloud Computing
- Provides storage, processing, analytics remotely
- Scalable, flexible resource usage
- Eg: AWS, Azure used in smart homes

(iii) Embedded Systems:
- Specialized systems within IoT devices
- Control device behavior
- Eg: Microcontrollers in smartwatches

(iv) Big Data Analysis:
- Analyzes huge volumes of IoT-generated data
- Helps in prediction, optimization, decision-making
- Eg: Predictive maintenance in industries