UNIT-1

Assignment-1

Computer Networks

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INDUSTRIAL * CONTROL * SYSTEM * NETWORKS

Scenario:- A manufacturing plant uses automation and robotics over LAN

Questions:

a) Identify suitable transmission media resistance to interference.

Ans) 1. Fibre optic cable:-

=> Immune of electromagnetic interference (EMI)
=> Ideal for noisy industrial environments
=> offers high-speed data transmisson and long-distance communication.

2. Shielded Twisted pair (STP):-

=> It has shielding to reduce interference
=> Better performance in areas with moderate EMI

3. Co-axial cable:-

=> offers good resistance to EMI due to its sheilding
=> suitable for short to medium distances in industrial setups.

4. Industrial-Grade ethernet cables:-

=> Designed to handle harsh environments
=> provides better protection from interference and physical damage.

5. Wireless communication with Frequency Hopping.

=> Avoids static frequencies to minimize interference
=> useful where cabling is not fessible, but less reliable than wired media.

Question:

b) Describe the role of the physical layer in PLC communication.

Ans) 1. Signal Transmission:-

⇒ converts data into electrical signals for transmission over physical media

2. Defines Transmission Medium:

⇒ specifies the type of cable used in PLC.
eg:. twisted pair, CO-axial or power lines

3. Modulation and Demodulation:

⇒ Handles the modulation of data signals onto carrier frequencies for transmisson over power.

4. Bit-level communication:

⇒ Transmits raw bitstreams (0s and 1s) without interpreting their meaning.

5. Synchronization:

⇒ Ensures sender and receiver are synchronized to accurately transmit and receive data bits

6) Data rate control:

⇒ Manages the speed at which data is transmitted

7) physical connector standards:

⇒ It Defines connector types and pin configuration of interfacing devices.

Question:
c) Recommend error control methods for real-time data.

Ans) 1. Forward * Error * correction (FEC):-

=> Adds redundant data so the reciever can detect and correct errors without retransmission.

=> Suitable for real-time system delay must minized

2. Cyclic * Redudancy * check:-

=> Detects error using a checksum technique.

=> Often used alongside FEC in industrial commucation

3. Hamming * code:-

=> Corrects single-bit errors and detects two-bit errors

=> useful in system requring light weight error connet

4. Interleaving:

=> Re-arranges data before transmission to reduce impact burst errors.

=> Helps improve realiability in noisy environments

5. Low-latency * protocol:-

=> Use light weight protocals with optional error correction to maintain speed

6. Time-sensitive Networking:-

=> Ensures realible and timely delivery in ethernet - based real-time networks.

Question:
d) Compare Modbus and ethernet IP protocols for automation.

Ans) 1. communication TYPE:

=> Modbus:- Master slave protocol.

=> Ethernet IP:- producer-consumer model allows simultaneous communication.

2. Speed:-

=> Modbus:- slower, especially in Modbus RTU.

=> Ethernet IP:- Fasted due to use of ethernet - real-time communication.

3. Network TYPE:-

=> Modbus:- works over serial and TCP/IP (RS-232/482)

=> Ethernet IP:- uses standard Ethernet and TCP/UDP.

4. Scalibility:-

=> Modbus:- limited device support per Network segment

=> Ethernet IP:- Highly scalable supports many devices and large Networks.

5. Data Handling:-

=> Modbus:- Handles simple numeric data types

=> Ethernet IP:- supports complex data types and large data sets

6. Interoperability:-

=> Modbus:- widely supported simple and open protocol

=> Ethernet IP:- Better suited for integration with Modern industrial system.