NIK 400 Tentamen

Theme 1: Industrial IoT and Network Communications

- ### Industry 4.0

   a. **What is the difference between Internet of Things and Industrial Internet of Things?**
      - The Internet of Things (IoT) refers to the network of everyday objects, like smart home devices, that connect to the internet to send and receive data.
      - The **Industrial Internet of Things (IIoT)** is a specialized version of IoT used in industries like manufacturing, energy, or transportation. It connects machines, sensors, and equipment to improve processes, increase efficiency.
      - In short, IoT is for general consumer devices, while IIoT focuses on industrial applications.

   b. **Write down the difference between Industry 3.0 and Industry 4.0?**
      - Industry 3.0 focused on automation using computers and robots to improve production, making things faster and more efficient.
      - Industry 4.0 takes it further by connecting machines, sensors, and systems using the Internet and smart technologies like AI and IoT. This allows real-time decisions, smarter factories, and more flexible production.
      - In short, Industry 3.0 is about automating tasks, while Industry 4.0 is about using connected technologies to make factories smarter.

   c. **Write down two Industry 4.0 related technologies and explain their main role in Industry 4.0?**
      - Internet of Things (IoT): IoT connects machines, devices, and sensors to the internet, allowing them to share data in real-time.
      - Artificial Intelligence (AI): AI uses data to make decisions, predict problems, and optimize processes. In Industry 4.0, AI helps improve automation, increase productivity, and create smarter, self-managing systems.

a. **Industrial Internet of Things is defined as follows. (choose one)**
   - When IoT is deployed in an industry we call it industrial Internet of Things.
   - Industrial Internet of Things is a subfield of IoT, where Things belong to an industrial environment.
   - Industrial Internet of Things is defined same as IoT, where Things are connected to an Industrial Internet.
   - Industrial Internet of Things is a subfield of Industry 4.0.

b. **What is the difference between Industry 3.0 and Industry 4.0? (choose one)**
   - INDUSTRY 3.0: Mechanization, waterpower and steam power, INDUSTRY 4.0: Computer Automation.
   - INDUSTRY 3.0: Computer Automation, INDUSTRY 4.0: Cyber Physical systems.
   - INDUSTRY 3.0: Cyber Physical systems, INDUSTRY 4.0: Computer Automation.
   - INDUSTRY 3.0: Computer Automation and Cyber Physical systems, INDUSTRY 4.0: Artificial Intelligence and Virtual reality.

c. **Following are two technologies related to Industry 4.0. (choose one)**
   - Artificial Intelligence and Internet of Things
   - Augmented/Virtual Reality and Computer Computation
   - Artificial Intelligence and Augmented/Virtual Reality
   - Augmented/Virtual Reality and Smart Factories

Theme 1: Industrial IoT and Network Communications

- **IoT and Network Communications**

a. **Is chair a Thing? Write down at least two applications of a Smart Chair?**
   - Yes, a chair can be considered a Thing in the context of the Internet of Things (IoT) when it is connected to the internet or smart technology.
   - Two applications of a Smart Chair are: Posture Monitoring and Adjustable Settings

b. **Write down the names of two of the most widespread and commonly used IoT application protocols?**
   - MQTT (Message Queuing Telemetry Transport): A lightweight protocol used for sending data between devices in real-time.
   - CoAP (Constrained Application Protocol): A protocol designed for simple devices with limited resources, often used in low-power and low-bandwidth environments.

c. **Draw four layers of IoT and write the names of each layer?**
   - Perception Layer
   - Network Layer
   - Edge Layer
   - Application Layer

a. **A Thing is a physical or logical object that comes with the following key function. (Choose one)**
   - It is a Chair connected to internet.
   - It has an embedded system which makes it intelligent.
   - It can be uniquely identified within a network.
   - Anything which can be printed is known as a Thing in IoT.

b. **Following technology is used for tampering and protection of a Thing. (choose one)**
   - Tampering and Protection Module (TPM)
   - Trusted and Protected Module (TPM)
   - Things Protection Module (TPM)
   - Trusted Platform Module (TPM)

c. **Choose the correct names of the four layers of IoT according to the boxes in the figure. (choose one)**
   - (1) Things, (2) Network, (3) IoT Platform, (4) Effect
   - (1) Things, (2) Internet, (3) Cloud Servers, (4) Application
   - (1) Sensors, (2) Internet, (3) IoT Platform, (4) Application
   - (1) Sensors, (2) Network, (3) Cloud Servers, (4) Effect

Theme 1: Industrial IoT and Network Communications

- **Positioning**

    a. **Name the four terminologies used in tracking and wayfinding?**
       - Positioning
       - Wayfinding
       - Tracking
       - proximity

    b. **RSSI-based positioning is often unreliable due to the drops of the signal level by at least 75% if we double the distance between the object and the network node. Give at least one solution to enhance the accuracy in an RSSI-based positioning system?**
       - One solution to enhance accuracy in an RSSI-based positioning system is to use multiple anchor nodes.

    c. **Write down at least four tracking technologies for indoor use cases?**
       - Ultra-Wideband radio tracking
       - Wi-Fi
       - Bluetooth Low Energy (BLE)
       - Infrared (IR)

a. **In which tracking method does a device send out a data packet that the network uses when triangulating the position of the device? (choose one)**
   - Network-centric tracking method.
   - Network-device tracking method.
   - Device-centric tracking method.
   - Device-network tracking method.

b. **The following is one of the tracking technologies in indoor use cases. (choose one)**
   - Radio Network Tracking.
   - Proprietary RF tracking.
   - Ultra-Wideband radio tracking.
   - Dual-radio tracking.

c. **Following are the four terminologies used in tracking and wayfinding. (choose one)**
    - Tracking, wayfinding, RSSI, and fingerprinting.
    - Positioning, fingerprinting, tracking, and wayfinding
    - Positioning, wayfinding, tracking, and proximity
    - Fingerprinting, proximity, tracking, and wayfinding

Theme 2: Robotics

a. **What is an industrial robot and what are its advantages?**
    - An industrial robot is a machine used in factories or warehouses to automate tasks like painting or moving materials.
    - Advantages include: Increased efficiency, High precision and Safety

b. **What is an industrial robot cell? And what is an industrial robot line?**
    - An industrial robot cell is a small, enclosed area where a single robot or a few robots perform specific tasks, such as welding or assembly.
    - An industrial robot line is a larger setup where multiple robot cells are connected together in a sequence to perform different tasks in a production process, like assembling parts or packaging products.

c. **Give an example of an industrial robot cell and an industrial robot line?**
    - Industrial Robot Cell Example: A welding robot cell where a robot automatically welds parts together in a small, enclosed area.
    - Industrial Robot Line Example: An assembly line in a car factory, where multiple robot cells work together to assemble different parts of a car.

a. **Why do we use robots in industries? (choose one)**
    - It increases productivity, safety, efficiency, and quality.
    - Robots are very intelligent and perform all the tasks accurately.
    - It saves human effort and power.
    - It increases production process, security, efficiency, and quality.

b. **An industrial robot includes the following. (choose one)**
    - The robot arm, including actuators; the central unit, including teach pendant and any communication interface with hardware and software.
    - The manipulator, including actuators; the controller, including teach pendant and any communication interface.
    - The actuator, including manipulator; the pendant, including controller and any communication interface.
    - The robot arm, including sensors; the controller, including actuators and any communication interface.

c. **An industrial robot cell is defined as follows. (choose one)**
    - A cell of robots including associated sensors and actuators and the associated safeguarded space and protective measures.
    - A cell of one or more robot systems including associated sensors and actuators and the associated safeguarded space and protective measures.

- A cell of one or more robot systems including associated machinery and equipment and the associated operators with a protective measure.
- A cell of one or more robot systems including associated machinery and equipment and the associated safeguarded space and protective measures.

Theme 2: CAN Bus

a. **What is the largest size of a CAN packet and what is bit-stuffing?**
   - The largest size of a CAN packet is 8 bytes (or 64 bits).
   - Bit-stuffing is a technique used in CAN to ensure the data frame is properly organized.

b. **Twisted pair wires are often used for CAN networking. Describe which layers CAN standards work in an OSI network model?**
   - Physical Layer is responsible for actual transmission of bits.
   - Link Layer handles the packaging data into frames.

c. **What is CAN and which industries use CAN?**
   - CAN (Controller Area Network) is a communication system that allows devices to talk to each other in a network, mainly used in cars and machinery.
   - Industries that uses CAN: Industrial Automation, Medical Devices and Automotive

a. **Which layers in the OSI model are relevant for the CAN standards? (choose one)**
   - Networking layer and Communication Layer
   - Application Layer and Session layer
   - Data Link layer and Physical layer
   - Networking layer and Physical layer

b. **Why are twisted pair wires often used for communication? (choose one)**
   - To control bus area network communication.
   - To enable a controller area network (CAN) bus communication.
   - To achieve lower latency and higher fault tolerance in communication.
   - To achieve higher data rate speed and fault tolerance in communication.

c. **For CAN, what speeds can we accomplish? (Choose one)**
   - Lowest speed < 125kbit, Highest speed = 125-1000kbit, and CAN-FD: 5Mbit
   - Lowest speed = 125kbit, Highest speed > 125-1000kbit, and CAN-FD: 15Mbit
   - Lowest speed = 125kbit, Highest speed = 125-1000kbit, and CAN-FD: 50Mbit
   - Lowest speed > 125kbit, Highest speed > 125-1000kbit, and CAN-FD: 500Mbit