Bachelor Thesis Options

Macro–Topic: Real-Time Monitoring for Industrial IoT Systems

#	**Working Title**	**Core Idea**
1	Edge-AI Anomaly Detection for Connected Electric-Vehicle Fleets	Design a low-latency, in-vehicle edge module (SoC + RF front-end) that fuses CAN-bus, vibration and thermographic data, runs a lightweight CNN to spot drivetrain faults, evaluates OTA model updates, and benchmarks sub- 5 ms end-to-end detection over a 5G–V2X link.
2	Ultra-Low-Power Sensor Node for Real-Time Soil & Crop-Health Analytics	Build a sub-GHz LoRa/BLE dual-radio node with capacitive soil-moisture, multispectral and micro-weather sensors. Implement on-node TinyML to classify stress levels (drought, nutrient deficit) and trigger precision-irrigation actuators. Validate energy budget ($< 50\,\mu$W sleep, < 30 mA TX) and < 10 s decision loop.
3	Time-Sensitive Networking over 5G for Autonomous Agri-Robots	Prototype a TSN-aware 5G NR-U bridge that guarantees deterministic $<$ 1 ms jitter for LiDAR/IMU streams on field robots. Design FPGA-based traffic-shaper hardware, measure synchronization accuracy (IEEE 802.1AS) and assess impact on real-time path-planning safety.
4	Digital-Twin-Enhanced Predictive Maintenance for Industrial Crop-Processing Lines	Develop an OPC UA gateway that mirrors live motor-current and thermal-image data into a physics-informed digital twin running on an edge GPU. Implement reinforcement-learning agents that schedule maintenance windows and compare downtime versus baseline PID scheduling.

Table 1: Four bachelor-thesis possible directions

A bit more computer science near

#	**Working Title**	**Computer-Science Focus**
1	Federated Edge–Cloud Learning for Anomaly Detection in Connected Vehicle Fleets	Design a communication-adaptive federated-learning framework that trains lightweight CNNs on in-vehicle ECUs, aggregates models in the cloud, and detects concept drift in real time. Evaluate bandwidth savings, convergence speed and sub-5 ms inference latency over 5G V2X links.
2	Streaming Graph Neural Networks for Spatio-Temporal Crop-Stress Prediction	Implement an Apache Flink pipeline that ingests multispectral, weather and soil-sensor streams, constructs evolving farm graphs and runs incremental GNN inference to forecast stress hotspots within 10 s. Benchmark resource usage on Kubernetes and study model-update frequency.
3	Formally Verified TSN Middleware over 5G for Autonomous Agri-Robots	Develop a deterministic scheduling middleware that maps IEEE 802.1Qbv time slots onto 5G NR-U slices. Use model checking (TLA$^+$ / UPPAAL) to prove bounded jitter (< 1 ms). Deploy on ROS 2 robots and measure end-to-end control-loop stability.
4	Digital-Twin Maintenance Scheduling with Reinforcement Learning in Crop-Processing Lines	Build a physics-informed digital twin that mirrors OPC UA sensor streams into a containerised micro-service. Integrate a deep RL agent (PPO/DQN) that selects maintenance windows; compare downtime, energy cost and model sample-efficiency against rule-based baselines.

Table 2: Four computer-science flavoured thesis directions under the shared macro-topic.