



BEUMER GROUP

BEUMER Digitalization – 6-Week Training & Project Report

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Team for Belt RUL Model: Mandeep Rana & Sravan

Git Repository (IO-Link Sensor Monitoring System): [Link](#) (Under guidance of Ganesh Sir)

Docker Pull Image: `docker pull`

`mandeeprana1/iolink_sensor_monitoring:latest`

Week-wise Training & Project Progress

Week 1 (Week 41) – Foundation Week

- Studied **BEUMER Digitalisation vision, strategy, and initiatives**
- Gained understanding of **Digital Twin, IoT, and Data Analytics**
- Learned **Industrial IoT architecture:** PLC → Gateway → Cloud
- Studied ongoing digitalization projects: **Fillpac, Bucket Elevator, BHS Monitoring**
- Completed **hands-on study** for understanding digital ecosystem

Week 2 (Week 42) – IoT Connectivity and Data Flow

- Studied **IoT sensors, edge devices, and gateways**
 - Learned **data flow protocols**: MQTT (publish-subscribe), REST APIs
 - Overview of **Elastic Stack** (Elasticsearch, Logstash, Kibana)
 - Hands-on setup: **Node-RED + MQTT broker** to simulate data streaming
 - Limitation: **Virtual/simulated data used**, no physical sensors
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Week 3 (Week 43) – Data Collection & Visualization

- Deep dive into **data acquisition, preprocessing, and time-series data**
 - Implemented **Python random sensor data generator** (Producers simulation)
 - Connected data to **MQTT broker** and ingested into **Elasticsearch**
 - Visualized data using **Kibana dashboards** (histograms, trends)
 - Archived simulated data into CSV for staging
 - Outcome: Functional **Python → MQTT → Elasticsearch → Kibana pipeline**
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Week 4 (Week 44) – AI/ML in Industrial Context

- Introduction to **Machine Learning & Predictive Maintenance**
 - Learned **Python for data science**: NumPy, Pandas, Scikit-learn
 - Hands-on: **Built simple anomaly detection model** with sample equipment data
 - Discussed **model deployment** and integration with dashboards
 - Applied ML concepts to **Belt RUL Prediction Model** (data preparation, feature engineering, health score calculation)
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Week 5 (Week 45) – Application-Oriented Learning

- Learned **Cloud & Edge Computing** in BEUMER architecture
- Studied platforms: **Azure IoT, AWS IoT, On-Prem solutions**
- Covered **data security & governance** in industrial digitalization
- Case study: **Digital Twin for Bucket Elevator / BHS**
- Group Project Assignment: Build **mini digitalization prototype** using learned pipeline

Projects Implemented

1. IO-Link Sensor Monitoring System

- Real-time monitoring of ultrasonic distance & vibration sensors
- Containerized solution: Node-RED → Elasticsearch → Flask API → Kibana
- Alerts based on ISO standards
- Docker pull: [mandeeprrana1/iolink_sensor_monitoring:latest](https://hub.docker.com/r/mandeeprrana1/iolink_sensor_monitoring)
- GitHub: [IO-Link Sensor Monitoring](https://github.com/mandeeprrana1/IOLINK-Sensor-Monitoring)

2. Belt RUL Prediction Model (Ongoing)

- Random Forest model predicting **Remaining Useful Life**
- 1.6M+ sensor readings → 700+ engineered features
- Outputs: Health Score, RUL in days, maintenance alerts
- Benefits: 20-30% belt life extension, 50-70% downtime reduction

3. Customer Feedback System

- React + Node.js + MongoDB full-stack web application
- Digitizes global feedback collection
- Improved submission time 70–80%, error rate <2%, centralized storage
- Deployable globally (Netlify, MongoDB Atlas)

Week 6 (Week 46) – Assessment & Wrap-Up

- **Group Project Presentations** completed
 - Reviewed learnings from all 5 weeks: IoT, Data, AI/ML, Cloud
 - Discussed **career paths in digitalization**
 - Consolidated **hands-on practical skills**:
 - IoT connectivity, data streaming, visualization
 - ML model development & predictive maintenance
 - Full-stack web applications & feedback systems
 - Confirmed ability to **build, deploy, and monitor industrial digital solutions**
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Key Achievements

- Fully operational **IO-Link Sensor Monitoring System** with Docker & Elasticsearch
 - Successfully implemented **Belt RUL Prediction Model** for proactive maintenance
 - Developed **Customer Feedback System** for global digitization of forms
 - Built **end-to-end data streaming pipeline** (Python → MQTT → Elasticsearch → Kibana)
 - Gained expertise in **IoT, AI/ML, Cloud, and full-stack application development**
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Conclusion

- **6-week training** provided a structured approach from **theory** → **hands-on** → **practical implementation**
- Demonstrated competence in **industrial IoT monitoring, predictive maintenance, and digital transformation projects**

- Laid foundation for **future digitalization initiatives**, AI-driven analytics, and advanced industrial applications

Special Thanks to Digitalization Team Members.