Theme 4: Industry 5.0 & Smart Automation

Human-centric automation and next-generation manufacturing technologies

A01 Collaborative Robot Task Allocator

Problem Statement:

Design an algorithm that dynamically assigns tasks between human workers and collaborative robots based on task complexity, worker fatigue levels, robot availability, and production priorities.

Domains: Human-Robot Collaboration | Task Scheduling | Manufacturing

Expected Outcome: Task allocation interface with efficiency and safety metrics

A02 Predictive Quality Control System

Problem Statement:

Build a system that uses sensor data from manufacturing equipment to predict product quality issues before they occur, enabling parameter adjustments to prevent defects.

Domains: Quality Assurance | Predictive Analytics | Process Control

Expected Outcome: Quality prediction dashboard with parameter adjustment recommendations

A03 AR-Guided Assembly Assistant

Problem Statement:

Create an augmented reality application that guides workers through complex assembly procedures, highlighting next steps, showing 3D part placement, and verifying correct completion.

Domains: Augmented Reality | Worker Training | Assembly Guidance

Expected Outcome: AR prototype demonstrating guided assembly workflow

A04 Factory Energy Consumption Optimizer

Problem Statement:

Design a system that coordinates production scheduling with energy management, shifting energy-intensive operations to off-peak hours while meeting production deadlines.

Domains: Production Planning | Energy Management | Optimization

Expected Outcome: Scheduling tool with energy cost and carbon savings projections

A05 Worker Ergonomics Monitor

Problem Statement:

Build a computer vision system that monitors worker postures and movements, identifies ergonomic risks, and provides real-time feedback to prevent repetitive strain injuries.

Domains: Occupational Health | Computer Vision | Worker Safety

Expected Outcome: Monitoring system with risk alerts and posture correction suggestions

A06 Digital Work Instructions Generator

Problem Statement:

Create a tool that automatically generates step-by-step digital work instructions from engineering documents, CAD models, or video recordings of expert workers performing tasks.

Domains: Knowledge Capture | Document Generation | Worker Training

Expected Outcome: Instruction generator with multimedia output capabilities

A07 Smart Tool Tracking System

Problem Statement:

Design a system that tracks tool locations, usage patterns, and condition in a factory, reducing search time, preventing loss, and scheduling maintenance based on actual use.

Domains: Asset Tracking | Tool Management | Operational Efficiency

Expected Outcome: Tracking dashboard with location maps and maintenance alerts

A08 Production Line Bottleneck Detector

Problem Statement:

Build an analytics tool that processes production data to identify bottlenecks in manufacturing lines, simulate improvement scenarios, and recommend capacity balancing strategies.

Domains: Production Analytics | Simulation | Process Improvement

Expected Outcome: Bottleneck analysis tool with improvement simulations

A09 Supplier Risk Assessment Dashboard

Problem Statement:

Create a dashboard that aggregates multiple data sources to assess supply chain risks, including supplier financial health, geopolitical factors, and historical delivery performance.

Domains: Supply Chain | Risk Management | Data Integration

Expected Outcome: Risk dashboard with early warning indicators and mitigation suggestions

A10 Machine Learning Defect Classifier

Problem Statement:

Develop an image classification system that automatically categorizes manufacturing defects from camera images, helping quality inspectors focus on ambiguous cases.

Domains: Computer Vision | Quality Inspection | ML Classification

Expected Outcome: Defect classifier with confidence scores and inspector interface

A11 Predictive Maintenance Scheduler

Problem Statement:

Design a system that combines equipment sensor data with production schedules to optimally time maintenance activities, minimizing both unexpected failures and unnecessary downtime.

Domains: Predictive Maintenance | Scheduling | Asset Management

Expected Outcome: Maintenance scheduler with downtime and cost optimization

A12 Worker Skill Gap Analyzer

Problem Statement:

Build a platform that assesses worker skills against job requirements, identifies training needs, and recommends personalized learning paths for Industry 4.0/5.0 capabilities.

Domains: HR Tech | Skills Assessment | Learning Management

Expected Outcome: Skills assessment tool with personalized training recommendations

A13 Sustainable Packaging Optimizer

Problem Statement:

Create a tool that suggests optimal packaging designs and materials to minimize waste, shipping volume, and environmental impact while ensuring product protection.

Domains: Packaging Design | Sustainability | Optimization

Expected Outcome: Packaging advisor with environmental impact comparisons

A14 Voice-Controlled Machine Interface

Problem Statement:

Design a voice interface for factory equipment that allows operators to query machine status, report issues, and access documentation hands-free while working.

Domains: Voice UI | Human-Machine Interface | Accessibility

Expected Outcome: Voice interface prototype with natural language command processing

A15 Production Carbon Footprint Tracker

Problem Statement:

Build a system that calculates real-time carbon footprint of production activities by tracking energy use, material consumption, and waste generation across manufacturing processes.

Domains: Carbon Accounting | Manufacturing Analytics | Sustainability

Expected Outcome: Carbon tracking dashboard with reduction opportunity identification

A16 Autonomous Mobile Robot Fleet Coordinator

Problem Statement:

Design a coordination system for multiple autonomous mobile robots in a warehouse, managing traffic, preventing collisions, optimizing routes, and handling dynamic obstacles.

Domains: Robotics | Multi-agent Systems | Warehouse Automation

Expected Outcome: Fleet coordinator with simulation and visualization

A17 Smart Safety Gear Monitor

Problem Statement:

Create an IoT system that monitors whether workers are wearing required safety gear in hazardous zones and alerts supervisors to compliance issues in real-time.

Domains: Workplace Safety | IoT | Compliance Monitoring

Expected Outcome: Safety monitoring system with zone-based compliance tracking

A18 Recipe Optimization for Process Industries

Problem Statement:

Build a system that optimizes manufacturing recipes (chemicals, food, pharmaceuticals) by analyzing historical batch data to identify parameter combinations that maximize yield and quality.

Domains: Process Optimization | Data Mining | Manufacturing Science

Expected Outcome: Recipe optimizer with yield improvement projections

A19 Remote Expert Assistance Platform

Problem Statement:

Design a platform that connects on-site technicians with remote experts through video, AR annotations, and shared sensor data to solve complex equipment problems without travel.

Domains: Remote Assistance | AR/VR | Expert Systems

Expected Outcome: Remote assistance prototype with annotation and data sharing

A20 Circular Economy Material Tracker

Problem Statement:

Create a system that tracks materials through the product lifecycle, enabling manufacturers to recover and reuse components, manage take-back programs, and report circularity metrics.

Domains: Circular Economy | Material Tracking | Sustainability Reporting

Expected Outcome: Material tracking platform with circularity dashboards