Innovative Cooling Solution for Parked Vehicles in Hot Climates

Transportation

Challenge Statement

Design a sustainable, green-energy-based solution that actively maintains the interior temperature of a parked vehicle at approximately 25°C, regardless of external heat conditions. The solution must not rely on sun shades, blinds, tinted windows, or basic solar fans, which have proven insufficient. Constraints & Considerations: 1. Must operate effectively in direct sunlight and high ambient temperatures. 2. Should be compliant with regulatory norms (e.g., no tinted windows or external blinds). 3. Should utilize renewable energy sources (e.g., solar, thermoelectric, passive cooling). 4. Should be compact, vehicle-compatible, and ideally retrofit-friendly.

Background

Vehicles parked in open areas during hot summer days experience extreme cabin temperatures, often exceeding safe and comfortable limits. This heat buildup can damage interior components such as seats, infotainment systems, and spare wheels, while also making the driving experience unpleasant. Conventional solutions like sun shades or tinted windows are either ineffective or restricted by regulations.

Deliverables

A conceptual design or working prototype of a product or system that can keep the cabin temperature of a parked vehicle close to 25°C using sustainable methods. The solution should demonstrate feasibility, innovation, and practical applicability.

Passenger Comfort Modeling in an Automotive Suspension System

Transportation

Challenge Statement

Establish and validate a mathematical model that accurately represents passenger comfort parameters within a defined suspension system under real-time driving

conditions. The model should be capable of simulating comfort dynamics and be supported by physical testing to ensure correlation between theoretical predictions and actual ride experiences.

Background

In passive suspension damper systems, achieving both high performance and passenger comfort simultaneously is a complex challenge. The industry often seeks a trade-off between handling and comfort to deliver an optimal ride experience. While mathematical models for handling characteristics are well established, accurately modeling and validating passenger comfort parameters through simulation—and correlating them with real-world testing—remains a significant gap in mobility engineering.

Deliverables

A concept proposal, mathematical simulation, solution prototype, and testing and validation reports that demonstrate the effectiveness of the comfort model in real-world scenarios.

AI-Driven Non-Destructive Inspection of Automotive Composite Materials

Digital Manufacturing

Challenge Statement

Develop an AI-enabled non-destructive evaluation system that utilizes techniques such as ultrasound, X-ray, and thermography to detect micro-damages in composite materials without disassembly. The system should include real-time sensors, advanced data interpretation algorithms, and predictive modeling capabilities. It should also incorporate FMEA for failure mechanism identification, risk assessment, and design improvement. The solution must support lifecycle assessment, residual life estimation, and maintenance planning, while adhering to industry standards (e.g., ISO, ASTM). Experimental validation through full-scale testing and simulation-based performance verification should be included to ensure real-world applicability.

Background

In the automotive industry, ensuring the structural integrity of composite materials is critical for safety, performance, and reliability. However, current inspection methods for detecting micro-damages—such as delamination, voids, and fiber breakage—are often time-consuming, costly, and rely on destructive testing, which is impractical for large-scale production. There is a pressing need for a rapid, accurate, and non-destructive evaluation (NDE) technique that can be integrated into real-time manufacturing workflows.

Deliverables

A validated AI-based NDE solution capable of detecting micro-damages in automotive composites, supported by real-time data systems, predictive modeling, and compliance with regulatory standards, enabling safer, more efficient, and scalable inspection processes.

Enhancing Energy Density of EV Batteries to Overcome Range Anxiety

Digital Manufacturing

Challenge Statement

Explore and develop innovative approaches to increase the energy density of EV batteries, thereby extending driving range without compromising safety, cost-effectiveness, or manufacturability. The solution should consider advancements in battery chemistry, cell architecture, thermal management, and materials science to deliver higher energy storage within the same or smaller footprint, while maintaining safety standards and economic viability.

Background

Range anxiety remains one of the most significant barriers to the widespread adoption of electric vehicles (EVs). This concern arises from the limited driving range of current EV batteries, the scarcity of charging infrastructure, and the long time required to recharge. These limitations affect user confidence and hinder the transition to sustainable mobility solutions.

Deliverables

A concept or prototype demonstrating a high-energy-density battery solution for EVs, supported by a clear rationale for material selection, safety considerations, cost analysis, and scalability potential.

Standardized Effortless Battery Swapping Station for All Types of Electric Vehicles

Transportation

Challenge Statement

Design a standardized, user-friendly battery swapping station that supports all types of EVs with a universal battery concept. The solution should integrate with existing fuel station infrastructure, include robust battery management systems for monitoring and maintenance, and comply with government regulations and leasing models. It should offer a seamless user experience with quick swapping, digital payment systems, and minimal wait times. The goal is to provide EV users with the same level of convenience and confidence as traditional fuel vehicle users.

Background

Despite the growing adoption of electric vehicles (EVs), the lack of efficient and standardized battery swapping infrastructure remains a major barrier. Unlike internal combustion engine vehicles that benefit from quick refueling at fuel stations, EV users often face long charging times and limited access to charging points, especially during long-distance travel or in commercial fleet operations. This gap in infrastructure affects user confidence and slows down the transition to electric mobility.

Deliverables

A concept or prototype of a standardized battery swapping station featuring universal battery compatibility, infrastructure integration, real-time battery monitoring, regulatory compliance, and a streamlined user interface for fast and reliable service.

Fire Suppression Device for Electric Vehicle Battery Safety

Transportation

Challenge Statement

Design a compact, installable device for EVs that can detect abnormal temperature rise in battery packs and automatically release stored carbon dioxide to suppress fire at the onset. The system should include temperature sensors for early detection, a CO_2 storage and release mechanism, and be capable of operating autonomously within the vehicle. The solution must be reliable, cost-effective, and compatible with various EV models to enhance onboard fire safety.

Background

Electric vehicles (EVs) are increasingly facing safety concerns due to battery overheating, which can lead to fire incidents. These fires pose serious risks to passengers, property, and emergency responders, and they undermine public confidence in EV technology. Current fire mitigation strategies are reactive and often insufficient to prevent damage once thermal runaway begins.

Deliverables

A prototype or concept of a fire suppression device for EVs, featuring integrated temperature detection and automated CO_2 release, designed for easy installation and effective response to battery fire incidents.

Framework for On-Road Dynamic Automobile Powering Using Roller Pantograph Mechanism

Transportation

Challenge Statement

Develop a framework and methodology for powering electric vehicles directly from external power lines using a Roller Pantograph Mechanism. This involves designing a

vertical pole mounted on the vehicle with a roller at its top end that draws electricity from overhead lines, similar to train pantographs but adapted for road vehicles. The solution should include the mechanical design of the roller pantograph, theoretical physics validation, and simulation analysis to demonstrate its efficiency and feasibility. A working prototype should be developed to showcase proof of concept.

Background

Electric vehicles typically rely on onboard energy storage systems such as batteries, which come with limitations including long recharging times, thermal runaway risks, and high costs. These constraints complicate EV implementation, especially for continuous or long-distance travel. Inspired by railway systems, an alternative approach is needed to power EVs dynamically without relying on onboard energy storage.

Deliverables

A complete framework and mechanism for the Roller Pantograph system, supported by theoretical validation, simulation results, and a demonstrable prototype, enabling dynamic on-road powering of EVs without onboard energy storage.

Open Road Frequency – The Future of Car-to-Car Communication

Transportation

Challenge Statement

Design and prototype a system that enables real-time, localized communication between vehicles, inspired by aviation-style shared frequencies. The solution should define a communication protocol (e.g., voice, text, symbolic alerts), ensure a distraction-free user interface, prioritize messages based on urgency, and address security, privacy, scalability, and interoperability with existing V2V, V2X, and autonomous driving systems.

Background

In aviation, pilots use a shared radio frequency to communicate with each other and with air traffic control, enhancing safety and coordination. With the rise of connected vehicles and smart transportation systems, a similar concept could revolutionize road

safety and traffic efficiency. A standardized, real-time communication system between vehicles could enable the sharing of critical information—such as hazards, traffic conditions, and emergency alerts—improving situational awareness and reducing accidents.

Deliverables

A concept design or prototype that includes UI mockups, system architecture, or a working demo. A brief technical document explaining the approach should accompany the solution. Optionally, simulation results or real-world test data can be included to validate the system's effectiveness and scalability.

CAE Analysis of Automotive Systems Integrated with ECU and Virtual Operating Conditions

Transportation

Challenge Statement

Develop a solution that integrates system CAD models with ECU software to perform dynamic CAE/CFD analysis under virtual operating conditions. The focus should be on simulating system behavior in motion, starting with thermal analysis using CFD techniques to address challenges in electric and hybrid vehicle designs.

Background

Modern automotive systems are increasingly software-driven, with countless operating scenarios that influence vehicle performance and longevity. Testing all these scenarios physically is not only impractical but also cost-prohibitive. As electric and hybrid vehicles introduce new thermal and dynamic challenges, there is a growing need for virtual testing environments that can simulate real-world conditions and software interactions.

Deliverables

A proof-of-concept that demonstrates dynamic CAE/CFD analysis of an automotive system integrated with ECU logic. The solution should include virtual simulations of system behavior under various operating conditions, with emphasis on thermal

performance. Deliverables may include simulation models, integration workflows, and documentation outlining the methodology and potential applications in future vehicle development.

Autonomous Drones: An Edge AI-Enabled Surveillance Platform

Communication and Technology

Challenge Statement

Design and build an autonomous drone platform equipped with Edge AI capabilities for real-time surveillance and threat detection. The system should demonstrate onboard video processing, object detection, and decision-making without relying on cloud or ground stations. Additionally, the solution should address power optimization challenges by proposing hardware or software strategies to support energy-efficient edge processing.

Background

Traditional surveillance systems rely on fixed cameras and centralized processing, which can be limited by environmental conditions, infrastructure dependencies, and latency. In remote or dynamic environments, drone-based surveillance offers mobility and flexibility—but streaming video to backend systems for analysis introduces high computational demands and network dependency. With recent advancements in Edge AI and onboard processing platforms like NVIDIA Jetson, drones can now perform real-time video analytics directly on-device, enabling faster decision-making, reduced latency, and improved privacy.

Deliverables

A proof-of-concept demo showcasing: Real-time video surveillance and threat detection performed entirely on the drone. Edge AI processing with measurable latency improvements. Elimination of raw video streaming to external systems. Battery optimization strategies for sustained edge processing (hardware/software). Documentation detailing system architecture, component selection, and performance benchmarks.

Enhancing Safety, Efficiency, and Predictive Maintenance in Construction Equipment Operations

Transportation

Challenge Statement

Design and develop an AI-powered web and mobile application that transforms construction equipment operations by integrating operator health monitoring and predictive maintenance. The system should use data from wearables to assess stress and fatigue levels, provide actionable alerts to supervisors, and apply machine learning to predict equipment failures based on usage patterns and environmental conditions. The application must offer a seamless user experience for both operators and fleet managers.

Background

Construction sites are complex and high-risk environments where the health and performance of equipment operators directly affect safety, productivity, and operational costs. Traditional fleet management systems often overlook human factors such as physical and mental stress, which can lead to fatigue-related incidents, inefficient equipment usage, and unexpected maintenance needs. A smarter, integrated solution is needed to monitor operator well-being and optimize equipment performance in real time.

Deliverables

A working web and mobile application that improves operator safety, reduces equipment downtime, and enhances operational efficiency. Key features should include real-time health monitoring using wearable data, predictive maintenance insights powered by AI, and intuitive dashboards for supervisors and fleet managers. The solution should demonstrate its potential to support data-driven decision-making and reduce operational risks.

Sustainability Rating and Grading Framework for Products

Digital Products

Challenge Statement

Develop a structured process for deriving sustainability ratings or grades for products at both part and system levels using life cycle assessment methodologies. The approach should consider key parameters including material composition, design attributes, manufacturing processes, and intended application. The goal is to create a model or system that can consistently evaluate and assign sustainability scores, enabling informed decision-making and promoting environmentally responsible product development.

Background

As sustainability becomes a critical factor in product development and deployment, there is a growing need to evaluate and communicate the environmental impact of products at both part and system levels. Currently, there is no standardized method to assign sustainability ratings during product release, making it difficult to assess and compare products based on their ecological footprint. Factors such as material selection, design efficiency, manufacturing processes, and application areas all influence a product's sustainability profile.

Deliverables

A defined process or methodology for sustainability rating, along with a model or system capable of deriving and assigning sustainability grades to products based on life cycle data.

Intelligent Rubrics-Based Evaluator for Flowcharts, Algorithms, and Pseudocode

Digital Products

Challenge Statement

Develop an intelligent evaluation system capable of assessing flowcharts, algorithms, and pseudocode against a set of predefined rubrics. The system should be able to parse and interpret various file formats including .docx, .pptx, .pdf, .png, and .jpg,

analyze submissions based on rubric criteria, and generate detailed feedback. It should include a robust parser, an evaluation engine, and a user-friendly interface for both evaluators and learners. The system must also support integration with learning management systems and ensure language-agnostic evaluation of pseudocode written in different styles and conventions.

Background

Organizations regularly onboard new talent, ranging from fresh graduates to lateral hires, as part of their workforce expansion and upskilling initiatives. Assessing computational and logical thinking skills is a critical task for the technical learning and development team. These assessments often involve creating flowcharts, algorithms, and pseudocode, but manual evaluation is time-consuming, inconsistent, and prone to human error. Existing platforms do not support automated evaluation of such formats, and the lack of immediate feedback hinders the learning process. There is a need for an intelligent system that can automate evaluations based on predefined rubrics, ensuring accuracy, consistency, and timely feedback.

Deliverables

A functional prototype of the evaluation system, comprehensive documentation covering architecture and usage, integration support for LMS platforms, and automated feedback reports for evaluated submissions.

AI-Based Alarm Tracking System to Reduce Lost Production Factor in Wind Turbines

Industrial Products

Challenge Statement

Develop an AI-based tool that automates the tracking and resolution process for wind turbine alarms. The system should collect alarm data, apply root cause analysis using the DMAIC methodology, and identify the responsible stakeholders and departments—such as mechanical, electrical, or software teams. It should also trigger notifications, provide historical analytics for recurring alarms, and recommend actionable solutions. The tool must define a clear process flow for alarm handling and offer predictive insights to reduce LPF through faster and smarter resolution.

Background

Wind turbines frequently experience operational inefficiencies due to alarm-triggered downtimes, which significantly contribute to an increased Lost Production Factor (LPF)—a metric representing the percentage of potential energy not captured due to system issues. Each alarm typically requires manual intervention through service orders, during which the turbine remains inactive. With thousands of unresolved alarms across OEMs, the current approach is reactive, time-consuming, and lacks intelligent prioritization, leading to prolonged downtime and reduced energy output.

Deliverables

A functional prototype of the alarm tracking system with defined process flows, AI-driven RCA capabilities, stakeholder identification, department mapping, historical data analytics, and solution recommendations, all aimed at minimizing turbine downtime and improving energy production efficiency.

GenAI-Based Fault Detection and Resolution in Solar Farms

Industrial Products

Challenge Statement

Build a GenAI-powered solution that can accurately detect faults in solar panels using real-time monitoring, automated data collection, and advanced image analysis. The system should support predictive maintenance and integrate seamlessly with existing solar farm management tools, while being scalable, cost-effective, and compliant with industry standards.

Background

Solar farms play a vital role in sustainable energy production, but their efficiency can be compromised by faults in individual solar panels. Traditional fault detection methods are manual, slow, and error-prone. This challenge seeks to harness the power of Generative AI (GenAI) to develop an intelligent, automated system for detecting and resolving faults such as micro-cracks, hot spots, and diode failures. By leveraging real-time data, advanced image processing, and predictive analytics, the solution aims to improve reliability, reduce maintenance costs, and extend the operational lifespan of solar panels.

Deliverables

To develop a proof-of-concept model that includes sensor-based monitoring circuits for solar panels, a computer dashboard for fault detection and resolution, and a GenAI-powered automation application demonstrating algorithmic efficiency. The solution should incorporate various sensor technologies, with a detailed analysis of their pros and cons. Demonstrations using actual solar panels are encouraged to validate the approach and showcase real-world applicability.

Automated Electrical Wiring Diagram Generation Using GenAI

Industrial Products

Challenge Statement

Develop a GenAI-powered solution that can automatically generate electrical wiring diagrams from electrical panel drawings. The system should leverage image recognition and schematic generation techniques to streamline documentation, reduce errors, and improve efficiency in electrical design workflows.

Background

Creating electrical wiring diagrams from panel drawings is a manual, labor-intensive process that demands domain expertise and is prone to human error. This slows down design workflows and impacts productivity in electrical engineering documentation. With advancements in Generative AI (GenAI), there is an opportunity to automate this process by using AI-driven image recognition, symbol mapping, and schematic generation to produce accurate and standardized wiring diagrams directly from panel layouts.

Deliverables

To demonstrate a working solution that generates wiring diagrams from panel drawings using industry-standard software tools such as AutoCAD Electrical, EPLAN Electric P8, SolidWorks Electrical, SEE Electrical, or Zuken E3.series. The deliverables should include a GenAI-based automation application, proof of algorithmic efficiency, and a comparative analysis of different sensor technologies or software tools used in the solution. Demonstrations using actual panel drawings are encouraged to validate the approach.

Automating Material Selection for Design Projects Using GenAI

Industrial Products

Challenge Statement

Develop a GenAI-powered assistant that automates the material selection process by analyzing application requirements and matching them with suitable materials from global standards and literature. The solution should simulate material behavior under various conditions, prioritize sustainable and recyclable options, and provide real-time recommendations during the design phase to support faster, more informed decision-making.

Background

Selecting the right material is a critical early step in any design project, often requiring deep domain expertise and familiarity with standards like ASTM, DIN, EN, and ISO. However, organizations frequently lack specialists for every application area—such as cryogenics, mining, oil & gas, subsea, hygienic, and power systems. This gap leads to missed opportunities during bid processes and delays in product development. Engineers must manually analyze large datasets to identify materials that meet performance, cost, availability, and sustainability criteria, which is both time-consuming and resource-intensive.

Deliverables

Deliver a GenAI-based material selection assistant that includes a searchable repository of materials sourced from standards, literature, and research papers; a material selection matrix tailored to different application domains; and an interactive chatbot interface that guides engineers through the selection process. The solution should demonstrate its ability to reduce time and cost by at least 20–30% compared to traditional methods.

Automating the Sizing and Selection of Commercial Off-The-Shelf (COTS) Parts Using GenAI

Industrial Products

Challenge Statement

Develop a GenAI-powered solution that automates the sizing and selection of COTS parts based on design parameters and application requirements. The system should analyze large datasets, simulate part performance, and recommend optimal components while considering factors such as load capacity, space constraints, material quality, cost, availability, and sustainability. The solution should also offer alternatives and highlight trade-offs to support informed decision-making.

Background

Selecting the right Commercial Off-The-Shelf (COTS) components—such as bearings, O-rings, gears, motors, valves, fittings, and fasteners—is a critical task in design projects. This process typically involves manually analyzing manufacturer catalogs and standards (ASTM, DIN, ISO, etc.), requiring deep domain expertise and significant time investment. Inaccurate selection can lead to design failures, manufacturing issues, and increased procurement and maintenance costs. Customers increasingly demand cost-effective, high-performance, and readily available COTS parts, making this task even more challenging.

Deliverables

A GenAI-based COTS selection assistant that includes a comprehensive methodology for sourcing data from standards, catalogs, literature, and research papers. Deliverables should include a COTS selection matrix tailored to various application domains and an interactive chatbot or AI interface that guides engineers through the selection process. The solution should demonstrate measurable improvements in cost and time efficiency—ideally reducing effort by 20–30%.

Chambered Full-Body Walkthrough Diagnostic Tool for Non-Invasive Health Screening

MedTech

Challenge Statement

Design and develop a multidimensional, non-invasive diagnostic system in the form of a walkthrough chamber that enables a complete health check-up while the individual simply walks through it. The system should be capable of monitoring and diagnosing key physiological systems including the central nervous system, cardiovascular health, renal function, gastrointestinal health, skeletal structure, skin, eyes, nasal passages, and reproductive organs. The process should be passive and voluntary, requiring no active participation beyond walking through the chamber. The results should be automatically processed and shared via a mobile application or through a connected healthcare provider.

Background

Traditional medical check-ups can be time-consuming, anxiety-inducing, and often involve multiple visits, high costs, and complex procedures. There is a growing need for a more seamless, efficient, and user-friendly approach to routine health diagnostics that minimizes human intervention and discomfort.

Deliverables

A conceptual design or prototype of a full-body diagnostic chamber that delivers comprehensive health reports within a defined timeframe, supported by external medical consultation if needed.

Smart Toilet for Automated Urine and Stool Analysis

MedTech

Challenge Statement

Develop a smart toilet system equipped with integrated sensors capable of automatically analyzing urine and stool samples during regular use. The system should include mechanisms for hygienic sample collection and disposal, and securely store the diagnostic data in the cloud for further analysis. The toilet seat design should support seamless integration of sensors without disrupting user comfort or functionality.

Background

Urine and stool tests are widely used for diagnosing and managing various health conditions, but they typically require manual sample collection and laboratory processing, which limits their accessibility for routine use at home. This process can be inconvenient and discourages regular health monitoring.

Deliverables

A concept or prototype of a smart toilet that includes a sample collection and disposal mechanism, a sensor-integrated toilet seat cover design, and a cloud-based data management system for health monitoring.

Search Bot for CAD Drawing and Model Retrieval in Engineering Projects

Plant Engineering

Challenge Statement

Develop a search bot capable of intelligently retrieving CAD drawings and model contents from a large engineering database. The bot should be able to interpret search queries involving keywords, numerical specifications, shapes, and model components, and return the most relevant and up-to-date files. For example, a query like “tank of xx capacity” should yield matching drawings and models instantly for quick reference and action.

Background

Due to frequent movement of business unit team members, valuable project knowledge assets are often not readily accessible across the wider delivery unit. This leads to significant time loss in locating relevant technical files, especially CAD drawings and models, which are stored in large databases on project servers. The

lack of a streamlined search mechanism hampers productivity and slows down decision-making.

Deliverables

A functional concept of a search bot with the ability to search and retrieve CAD drawings and models based on textual, numerical, and geometric inputs.

AI-Driven Testing Framework for OTT and Digital TV Ecosystems

Embedded

Challenge Statement

Develop an AI-powered automated testing framework tailored for OTT and Digital TV platforms. The solution should include capabilities such as AI-generated test cases based on user stories and requirements, self-healing test scripts that adapt to UI changes, visual testing using deep learning to detect subtle regressions, and predictive test optimization using historical data. Integration with CI/CD pipelines should enable smart test execution and AI-driven failure analysis. The framework should also support AI-powered anomaly detection, automated report generation, personalized dashboards, risk assessment, and documentation automation to streamline testing and improve release cycles.

Background

The OTT and Digital TV industry is rapidly evolving, driven by consumer demand for high-quality, personalized content across a wide range of devices and platforms. This growth introduces significant complexity in ensuring consistent performance, compatibility, and user experience across fragmented device ecosystems, varying network conditions, and diverse content formats. Manual testing is no longer scalable due to the sheer volume of devices, operating systems, and browser versions, while emerging technologies like 4K/8K resolution, HDR, and interactive features further complicate the testing landscape.

Deliverables

A comprehensive concept or prototype of an AI-enabled testing framework that includes automated test generation, CI/CD integration, intelligent reporting, and

strategic documentation tools for robust and scalable testing of OTT and Digital TV platforms.

Middleware Component to Recommend and Enhance Existing Non-Agentic Solutions to Agentic AI Frameworks

Digital Products

Challenge Statement

Build a reasoning-driven middleware engine that can analyze existing solution documentation—specifically problem definitions and solution descriptions—and recommend enhancements to convert them into agentic AI systems. The middleware should extract relevant content, assess the feasibility of agentic integration, and suggest functional and technical improvements using agentic frameworks. It should act as an intelligent layer that bridges conventional solutions with modern agentic architectures.

Background

Many existing solutions across industries—whether traditional software or basic AI/ML implementations—are designed without agentic capabilities. These solutions often lack autonomous reasoning, decision-making, and adaptability, which limits their potential in dynamic environments. With the emergence of agentic AI frameworks like ReAct, Chain of Thought, and CrewAI, there is an opportunity to transform these static systems into intelligent, context-aware agents.

Deliverables

A middleware concept or prototype that takes in problem and solution definition documents, analyzes them using AI, and provides recommendations for transforming the solutions into agentic AI systems, including functional and technical enhancement strategies.

AI and Computer Vision-Based Non-Destructive Testing for Industrial Materials

Digital Manufacturing

Challenge Statement

Develop an AI model using computer vision techniques to automatically detect and annotate defects in NDT images. The model should be trained to identify crack locations, depths, and types across various testing methods and materials, preferably industrial-grade stainless steel or aluminum (e.g., MS950/1200, AL6061). The system should be trained and tested using an 80/20 dataset split and be capable of analyzing radiographic and other NDT images to produce reliable predictions.

Background

Non-Destructive Testing (NDT) methods such as ultrasonic, radiographic, magnetic particle, and penetrant testing are essential for evaluating material integrity without causing damage. However, these processes are time-consuming, costly, and heavily reliant on expert interpretation of radiographic outputs to detect defects like cracks and determine their depth. Automating this process can significantly improve efficiency and consistency in industrial inspections.

Deliverables

A dataset of annotated NDT images with defect details, along with an AI-based prediction model capable of identifying cracks and their characteristics across different materials and testing methods.

Autonomous Networks for 5G Network Management Using Digital Twins

Communication and Technology

Challenge Statement

Develop a digital twin-based solution for autonomous 5G network management that integrates real-time data, predictive AI models, and aligns with xNF deployment standards. The system should support interoperability, enable efficient performance monitoring, and facilitate predictive maintenance. As 5G evolves and transitions toward 6G, the solution should be adaptable to emerging use cases and capable of supporting smarter, more resilient network operations across diverse industry applications.

Background

While 5G technology offers significant advancements in speed, latency, and connectivity, its deployment and maintenance introduce complex challenges in system integration, network management, and predictive maintenance. As the ecosystem expands to support applications like autonomous vehicles, industrial IoT, private enterprise networks, and healthcare, the need for intelligent, adaptive, and scalable network management becomes critical.

Deliverables

Constructive digital twin models for 5G network deployment and automation, demonstrating predictive, adaptive, and intelligent network management capabilities.

Design a Scalable AI-Driven Workforce Digital Twin to Optimize Skill Deployment, Task Allocation, and Productivity Across Multiple Manufacturing Sites

Digital Manufacturing

Challenge Statement

Propose a conceptual design or working prototype of a Workforce Digital Twin platform that can virtually model and simulate the workforce layer of a manufacturing plant or network of plants. The system should capture real-time signals from IoT devices, wearables, cameras, mobile apps, and HR systems to predict optimal workforce deployment based on skills, fatigue, production needs, and task

priorities. It should recommend dynamic reallocation of workers during shift changes, absenteeism, or demand surges, and provide dashboards and alerts for floor supervisors and planners. The platform should also support AI agents or simulations to evaluate “what-if” workforce scenarios, with added capabilities for multi-site orchestration, ergonomic risk modeling, and compliance-aware scheduling.

Background

Manufacturing enterprises today face increasing complexity due to product variability, supply chain disruptions, and a diverse workforce. Many plants still rely on spreadsheets, tribal knowledge, or basic MES-level visibility for workforce management, leading to uneven skill utilization, unpredictable labor demand, and poor responsiveness to unplanned events. This siloed approach also makes it difficult to scale best practices across sites. With advancements in digital twins, AI/ML, computer vision, and edge computing, there is now an opportunity to model and optimize human operations with the same precision as machines.

Deliverables

A detailed concept or prototype including an idea summary, problem statement, solution design with key technologies and architecture, data sources, expected business impact, and a roadmap for scalability. Optional deliverables include wireframes, architecture diagrams, or a proof-of-concept video.

Automation in Drawing and Datasheet Conversions Using AI and Gen-AI

Digital Products

Challenge Statement

Develop an AI or Gen-AI based cloud solution capable of reading and converting engineering drawings and datasheets from any input format—including scanned images and handwritten documents—into native formats compatible with 1D and 2D data-centric engineering applications. The solution should enable rapid transformation of legacy documents into structured digital assets, supporting data-centricity, ease of future updates, and integration into digital twin environments. The system should deliver converted outputs in under 120 seconds to enhance operational efficiency.

Background

Engineering teams often work with drawings and datasheets that exist in non-native, non-data-centric formats, including scanned documents and handwritten records. This lack of structured digital data creates inefficiencies in engineering workflows, complicates updates, and hinders the creation of digital twins. Manual conversion is time-consuming and error-prone, making it difficult to maintain consistency and speed in data handling.

Deliverables

An AI or Gen-AI powered cloud-based application that automates the conversion of diverse drawing and datasheet formats into native, structured formats suitable for engineering platforms, enabling fast, accurate, and scalable digitization.

AI-Driven BOM Converter

Digital Manufacturing

Challenge Statement

Design and develop an AI-powered BOM Converter that automates the transformation of eBOM into mBOM. The solution should intelligently restructure the BOM, incorporate necessary manufacturing details, and optimize it for production workflows.

Background

Current processes for converting Engineering Bill of Materials (eBOM) to Manufacturing Bill of Materials (mBOM) are manual, error-prone, and inefficient. This leads to increased effort, higher chances of mistakes, and elevated manufacturing and assembly costs.

Deliverables

A software solution that facilitates seamless and intelligent eBOM to mBOM conversion.

AI-Powered Video Localization Across Multiple Languages

Communication and Technology

Challenge Statement

Design an AI-driven solution capable of processing high-quality, large-sized video files and localizing them into multiple languages. The system should automate transcription, translation, and audio dubbing while maintaining contextual accuracy and synchronization.

Background

With the rapid growth of global video content, there's an increasing need to make videos accessible in multiple languages. Traditionally, this involves manual transcription, translation, and subtitle synchronization—an expensive and time-consuming process. Advances in AI offer promising alternatives, but achieving the right balance of performance, cost, and accuracy remains a challenge.

Deliverables

to develop an AI model and supporting solution that can transcribe audio and video content, generate accurate captions, translate them into multiple languages, and perform voice dubbing with appropriate gender and tone. The solution should also ensure subtitle and audio synchronization, including lip-syncing. As a bonus, the system may include a quality check feature to detect and correct mismatches between text and audio in the generated videos.

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Agentless Endpoint Protection: Efficient, Reliable, and Cost-Effective

Digital Products

Challenge Statement

Design a strategic, agentless endpoint protection solution that enhances visibility and threat response capabilities across physical devices. The system should simplify operations, close security gaps, and complement existing agent-based tools by providing coverage for endpoints that are difficult to manage or monitor.

Background

Endpoint security in most organizations still relies heavily on agent-based EDR (Endpoint Detection and Response) solutions. While effective, these tools can be difficult to manage across diverse environments, especially on legacy systems or devices with compliance and performance constraints. Deploying and maintaining agents on every endpoint is time-consuming and often impractical. This challenge explores the potential of agentless EDR as a flexible, scalable alternative that

leverages existing infrastructure—such as network traffic, virtualization layers, and cloud APIs—to monitor and protect endpoints without the overhead of traditional agents.

Deliverables

To develop a proof-of-concept solution that demonstrates agentless endpoint protection using existing infrastructure. The deliverables should include a working model that showcases real-time threat detection and response, integration with current security systems, and a user-friendly dashboard for monitoring. The solution should emphasize efficiency, reliability, and cost-effectiveness, and provide evidence of its scalability and performance across varied environments.

High-Fidelity Prediction of Stiffness in Stamped Panels Using AI/ML

Transportation

Challenge Statement

Develop a scalable AI/ML solution that can accurately predict the stiffness and deformation behavior of stamped components based on their geometric shape and applied load. The goal is to replace time-intensive CAE simulations with a fast, high-fidelity predictive model that provides immediate feasibility feedback to design teams during shape change proposals.

Background

In automotive design, evaluating the stiffness of stamped panels is traditionally done using CAE software, which involves multiple preprocessing steps and significant computation time. Any change in the panel's shape or form requires repeating these steps, slowing down the design iteration process. This inefficiency creates bottlenecks, especially when quick feedback is needed by styling teams during early design phases.

Deliverables

An AI/ML-based predictive tool that closely correlates with physical test data and CAE results. The solution should demonstrate high accuracy in forecasting stiffness and deformation across a range of component shapes and load conditions.

Deliverables should include the trained model, validation results, and a user interface or API for quick integration into design workflows.

Automated Validation of Flow Instrument Installation in 3D Piping Models

Plant Engineering

Challenge Statement

Develop an intelligent, automated solution that analyzes 3D piping models to validate flow instrument installations. The system should: Detect flow instruments and measure upstream and downstream straight pipe lengths, ensuring compliance with design standards and manufacturer specifications. Identify fluid flow direction and verify that rotameters are correctly oriented. The solution should use AI, rule-based logic, or geometric analysis to perform these checks efficiently and accurately.

Background

In engineering design, 3D modeling tools are widely used to represent complex piping and instrumentation systems. Ensuring correct installation of flow instruments—such as rotameters and flow meters—is critical for system performance, safety, and compliance. Two key validation tasks—verifying straight pipe length requirements and checking rotameter orientation—are often performed manually, making the process time-consuming and error-prone.

Deliverables

A working prototype or script (e.g., Python I38tool, CAD plugin, or API) that can: Identify flow instruments within 3D models. Measure and validate straight pipe lengths upstream and downstream of each instrument. Check rotameter orientation against the defined flow direction. Additionally, a detailed review report should be provided, highlighting any deviations and offering recommendations for correction.

AI (Agentic) Enabled Agile Automated Threat Modeling

Digital Products

Challenge Statement

Design an AI-powered, agentic, and modular threat modeling framework tailored for engineering sector cybersecurity. The solution should be interactive, agile, and capable of adapting to new threat vectors in real time. It must support use cases such as AI-enabled medical devices and other complex systems, providing automated analysis, risk identification, and mitigation strategies.

Background

Traditional threat modeling is often manual, static, and time-consuming, relying on limited interactivity and outdated data flow diagrams. This approach struggles to keep pace with the rapidly evolving cyber threat landscape, especially in industries adopting GenAI and Agentic AI technologies. As a result, many organizations accumulate security debt, leaving developers and operations teams vulnerable to emerging threats. There is a pressing need for a dynamic, scalable, and intelligent threat modeling framework that adapts to modern engineering use cases.

Deliverables

a working prototype or concept of an AI-enabled threat modeling framework that includes: Interactive and modular components for dynamic threat analysis. Integration of agentic AI capabilities for autonomous threat detection and response. Use case demonstration (e.g., AI-enabled medical devices). Documentation outlining the system architecture, methodology, and adaptability to evolving threats.

Invisible Watchdogs: Wi-Fi Sensing for Home Monitoring and Surveillance

Communication and Technology

Challenge Statement

Design a Wi-Fi Sensing-based solution for home and indoor surveillance that leverages signal disruptions caused by movement to detect presence and activity. The system should use standard Wi-Fi gateways to interpret signal variations (e.g., phase, amplitude, frequency) and enable use cases such as intrusion detection, smart lighting automation, elder care monitoring, and foot traffic analysis—without compromising privacy.

Background

Traditional surveillance systems rely heavily on cameras and object detection technologies, which are effective but come with limitations such as privacy concerns, poor performance in low-light conditions, and high deployment costs. To address these challenges, Wi-Fi Sensing offers a promising alternative by repurposing existing Wi-Fi infrastructure to detect motion, presence, and activity without visual monitoring.

Deliverables

A demonstrable proof-of-concept showcasing Wi-Fi Sensing capabilities for presence and movement detection. The solution should include signal interpretation logic, a basic interface for monitoring activity, and documentation outlining the use cases, system architecture, and potential for scalability and integration with smart home ecosystems.

LiveSpeak: AI-Based Live Event Captioning via Speech Recognition

Communication and Technology

Challenge Statement

Develop a real-time speech-to-text solution for live events that ensures high accuracy and low latency. The system should evaluate cloud-based services for speech recognition and explore Edge AI approaches for on-device processing using AI-enabled SoCs. The goal is to build a scalable and responsive captioning system that can be deployed across various live event scenarios.

Background

While audio-to-text conversion is a well-established technology in video broadcasting and OTT platforms, applying it to live events presents unique challenges. Live speech recognition must operate with high accuracy and minimal latency, which is difficult due to background noise, speaker variability, and real-time processing constraints. This is especially critical for applications like live sports broadcasts, news coverage, and educational events, where real-time multilingual captioning can significantly enhance accessibility and engagement.

Deliverables

A demonstrable proof-of-concept showcasing live speech-to-text conversion with measurable latency metrics. The solution should include a working prototype, evaluation of different processing approaches (cloud vs. edge), and documentation detailing system architecture, performance benchmarks, and potential for multilingual support.

Flexible Robotic Arm for Safe and Adaptive Industrial Operations

Digital Manufacturing

Challenge Statement

Design a flexible robotic arm system that can be easily integrated into manufacturing setups. The system should support adaptive gripping for objects of various sizes, include reserve power capabilities to safely release objects during power failures, and enable automatic homing. The solution should also simplify installation and maintenance by minimizing cabling and improving modularity.

Background

In industrial environments requiring precise and adaptive movements, traditional robotic arms often face limitations such as positional inaccuracies due to belt flex, complex homing procedures, and vulnerability to abrupt power losses. These issues can disrupt operations and damage equipment or products. Additionally, the ability to grip objects of varying sizes and the complexity of setup—often involving extensive cabling—pose challenges for integration and maintenance.

Deliverables

A working prototype or concept design of a robotic arm system featuring: Adaptive gripping mechanisms for variable object sizes. Reserve power functionality for safe object release and homing during outages. Simplified integration and setup with reduced cabling. Documentation should include system architecture, control logic, and use case demonstrations in industrial scenarios.

Self-Driving Pathological Lab: Robotic Automation for Medical Testing

Digital Manufacturing

Challenge Statement

Design and deploy a mobile robotic automation system for pathology labs that can autonomously handle sample processing tasks. The system should feature a collaborative robot (Cobot) mounted on an Autonomous Mobile Robot (AMR), equipped with a precision vision system, modular grippers, and seamless integration with Laboratory Information Management Systems (LIMS). It must meet high standards of accuracy, safety, and compliance for medical and pharmaceutical environments.

Background

Pathology labs around the world rely heavily on human labor for routine testing tasks such as handling blood, urine, and stool samples. This dependency is increasingly unsustainable due to rising labor costs and a shortage of skilled personnel, especially in many countries. These repetitive tasks are ideal candidates for automation, which can improve efficiency, reduce errors, and ensure consistent quality in medical diagnostics.

Deliverables

A demonstrable solution that includes: Autonomous navigation with advanced sensors for safe movement across lab spaces. Software for seamless integration with diagnostic equipment and lab systems via standard APIs. Workflow management and intelligent task prioritization capabilities. Human-robot collaboration features such as voice commands, chatbots, and audio recognition. Modular design with interchangeable grippers for handling various sample types. AI-powered vision system for color recognition and landmark identification. Programming of AMR for room-to-room navigation and Cobot for sample pick-and-place operations. A cost-

optimized, fully integrated prototype with documentation covering system architecture, safety protocols, and compliance standards.

Adopting a Super capacitor or hybrid energy storage system that combines supercapacitors and batteries that significantly improves energy efficiency and reliability across various lighting applications.

Smart World

Challenge Statement

Adopting a supercapacitor-based or hybrid energy storage system—which combines the rapid charge/discharge capabilities of supercapacitors with the high energy density of batteries—can significantly enhance the efficiency, reliability, and sustainability of various lighting applications. This approach addresses key limitations of traditional battery-only systems, such as slow charging, limited cycle life, and poor performance in extreme conditions. By integrating supercapacitors, lighting systems benefit from: • Instant power delivery for quick activation • Extended operational life due to reduced battery stress • Lower maintenance requirements • Improved energy retention, especially in intermittent-use scenarios

Background

Lighting systems, especially those used in emergency, portable, and solar-powered applications, demand energy storage solutions that are both efficient and reliable. Traditional batteries, while offering high energy density, often fall short in terms of power delivery and lifespan. Supercapacitors, on the other hand, provide rapid charge/discharge capabilities and long cycle life but suffer from high self-discharge rates, leading to energy loss during idle periods. To address these limitations, adopting a hybrid energy storage system that combines supercapacitors and batteries presents a promising solution. This approach can significantly enhance the performance of lighting applications such as: • Emergency Lighting • Portable

Lighting and Dynamo Torches • Touch-Activated Lights • Solar Streetlights • Smart Building Lighting

Deliverables

The proposed solution is expected to deliver a functional and demonstrable model that showcases a significant reduction in power consumption or battery usage—ideally by at least 40% compared to current commercial lighting systems. This outcome will be supported by • Validation Data • Material and System Design Documentation • Scalability Assessment • Cost Analysis • Sustainability Considerations

AI-Driven Urban Mobility Optimization for Sustainable Smart Cities

Transportation

Challenge Statement

Develop an intelligent, real-time urban mobility management solution that leverages AI, machine learning, and IoT to analyze traffic flow data, identify congestion hotspots, and dynamically optimize signal timings and routing. The system should integrate data from GPS, traffic cameras, sensors, and public transport networks to create a unified traffic intelligence dashboard for city planners and traffic authorities. It must be scalable, adaptable to different urban environments, and user-friendly for both administrators and commuters. Features such as real-time commuter alerts, multi-modal transport integration, and predictive congestion modeling should be included to enhance effectiveness and sustainability.

Background

Rapid urban population growth is leading to a surge in private vehicle usage, outpacing the development of public transport infrastructure and smart mobility solutions. This results in severe traffic congestion, especially during peak hours, causing longer commute times, increased fuel consumption, and elevated stress levels. The environmental impact is also significant, with higher carbon emissions from idling and stop-start traffic. Despite various initiatives, the lack of integrated traffic management systems, poor data utilization, and limited adoption of emerging technologies continue to hinder progress toward sustainable urban mobility.

Deliverables

A functional prototype of an AI-powered urban traffic optimization platform, featuring a real-time dashboard with traffic heatmaps, dynamic signal control algorithms, congestion prediction modules, and mobile integration for commuter alerts, supported by documentation on system architecture, data flow, and scalability.

Model-Based Design Concept for a System with Two Isolated Vibrating Systems

Industrial Products

Challenge Statement

Develop a model-based, multibody dynamic simulation framework capable of predicting and evaluating the vibration behavior of two or more isolated systems within a shared enclosure. The solution should include mathematical modeling using line body techniques to simplify computational requirements and reduce simulation time. The model should be able to estimate individual and combined vibration effects, enabling early-stage design decisions that minimize structural risks and improve system reliability.

Background

In industries such as HVAC, equipment often comes as a single box unit containing multiple mechanical components, both moving and non-moving. These components can act as independent sources of vibration, which may interact and propagate through the structure, leading to system-wide resonance, discomfort, or even permanent damage. Currently, there is no standardized methodology to predict the vibration levels of each isolated system and their cumulative impact on adjacent components during the early design phase, making it difficult to prevent failures proactively.

Deliverables

A scalable and computationally efficient modeling approach or prototype that can simulate multiple vibration sources, predict their interactions, and support design

optimization across various industrial applications, with zero licensing cost and minimal computational overhead.

Enhancing Cybersecurity Resilience in the IT Industry Using AI

Cybersecurity

Challenge Statement

Develop an AI/ML-powered cybersecurity framework that can detect and neutralize emerging threats in real time, reduce detection time by at least 50%, and enable faster recovery from incidents. The solution should include automated incident response capabilities, integrate seamlessly with existing IT infrastructure, and incorporate a behavioral analytics-driven training platform to reduce human-related vulnerabilities.

Background

The IT industry faces an ever-growing wave of cyber threats, including ransomware, phishing, and data breaches. Traditional cybersecurity systems often struggle to keep up with the speed and sophistication of these attacks, resulting in delayed threat detection, extended recovery times, and significant financial and reputational damage. There is a pressing need for intelligent, adaptive solutions that can proactively defend digital infrastructure and empower organizations to respond swiftly and effectively.

Deliverables

To deliver a fully functional software solution capable of real-time threat detection and classification using advanced machine learning techniques. The solution should include a continuously updated threat intelligence database, a performance report demonstrating a 50% reduction in detection time through simulated attack scenarios, and a user-friendly security awareness training platform. Additional deliverables include a working prototype, comprehensive user manuals, and API documentation to support deployment and integration into existing security ecosystems.

SmartOps AI – Autonomous Incident Resolution Engine

Digital Products

Challenge Statement

Traditional incident management in DevOps environments is often reactive, fragmented, and heavily dependent on manual intervention. This leads to longer Mean Time to Recovery (MTTR), increased operational costs, and reduced system reliability. As organizations adopt hybrid and multi-cloud infrastructures, the complexity of managing incidents across platforms like AWS, Azure, and GCP continues to grow. There is a need for intelligent, automated solutions that can detect, analyze, and resolve issues with minimal human involvement.

Background

SmartOps AI – Autonomous Incident Resolution Engine

Deliverables

Develop an AI-powered autonomous incident resolution engine capable of operating across hybrid and multi-cloud environments. The system should integrate with popular monitoring tools (e.g., CloudWatch, Prometheus, Azure Monitor), use machine learning models trained on historical incident data for root cause analysis, and implement self-learning mechanisms to improve over time. Automated workflows should be created using CI/CD tools such as Azure DevOps to enable real-time issue resolution.

Bringing Healthcare to Everyone: Real-Time Monitoring and AI Solutions

MedTech

Challenge Statement

Design an AI-powered healthcare solution that enables real-time patient monitoring and prioritization. The system should include a wearable device to track vital signs and detect early indicators of health issues, a remote dashboard for clinicians to

monitor patients, and an AI model that helps prioritize care based on urgency. The solution must be cost-effective, scalable, and suitable for deployment in rural and resource-constrained settings.

Background

Many healthcare systems, especially in remote and underserved areas, struggle with real-time patient monitoring due to limited resources and infrastructure. This lack of timely data can delay diagnosis and treatment, increasing health risks. There is a growing need for affordable, scalable solutions that leverage wearable technology and AI to improve access to care and enable proactive health management.

Deliverables

A prototype of a wearable monitoring device, a user-friendly dashboard for remote patient tracking, and an AI model that supports patient triage based on health data. The solution should demonstrate its potential to improve healthcare accessibility, reduce response times, and support data-driven decision-making in clinical settings.

AI-Based Cost-Effective Agile & Mobile Blade Balancing Equipment for Large Wind Turbines

Industrial Products

Challenge Statement

Wind turbine blades for 10 MW machines and above are extremely large, heavy, and complex in shape. Due to manual layup processes during manufacturing, the center of gravity (CG) often deviates from its intended design location. This misalignment can lead to turbine instability, premature bearing damage, altered natural frequencies, and reduced overall turbine lifespan. Blade balancing is essential before installation, but current methods are labor-intensive, time-consuming, and lack mobility.

Background

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of gravity (CG) often deviates from its intended design location. This misalignment can lead to turbine instability, premature bearing damage, altered natural frequencies, and reduced overall turbine lifespan. Blade balancing is essential before installation, but current methods are labor-intensive, time-consuming, and lack mobility.

Deliverables

Scaled-down working concept models and mechanisms, a PLC program for CG and load balancing, and AI-driven data analysis tools to detect and explain CG deviations during manufacturing.