5th International Conference on Design, Research and Development

20-21 November 2025, İstanbul, Türkiye
rdconf.com

ABSTRACT BOOK

ISBN:

OR CLEVER
Science & Research Group

5th International Conference on Design, Research and Development

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ISBN:

Editor in Chief

Assoc. Prof. Dr. Zeki ORALHAN

Publisher Certificate Number: 47484
5th International Conference on Design, Research and Development Türkiye
November 20-21, 2025, İstanbul, Türkiye

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Conference Program

Paper Title	Presenter	Session Name	Date	Time	Place
An Empirical Comparison of Claude, Llama, and Gemini for Aspect-Level Sentiment	Pınar Ersoy	AI and LLM	November 20, Thursday	11:00-11:10	Center Hall
LLM-Based Contract–Invoice Compliance and Anomaly Analysis on Turkish Financial Documents	Burak Yıldızak	AI and LLM	November 20, Thursday	11:10-11:20	Center Hall
Dynamic Multi-Criteria Analysis of Travel Safety Risks with Large Language Models	Doğan Özcan	AI and LLM	November 20, Thursday	11:20-11:30	Center Hall
Doğal Dil ile Hibrit Veri Etkileşimi: Çoklu Ajan Tabanlı Yapay Zeka Destekli Analiz ve Görselleştirme Platformu	Abdulkadir Karabacak	AI and LLM	November 20, Thursday	11:30-11:40	Center Hall
Finansal Hareketlerin Analizi için Doğal Dil İşleme Tabanlı Katmanlı Mutabakat Sistemi	Dilara Hazırlar	AI and LLM	November 20, Thursday	11:40-11:50	Center Hall
Open Source LLM ile Tableau Entegreli Veri Analiz Asistanı	Buşra Sabak	AI and LLM	November 20, Thursday	11:50-12:00	Center Hall
An AI-Based Question–Answering System for Corporate Documents: VK ArtiFin	Zeynep Destan	AI and LLM	November 20, Thursday	12:00-12:10	Center Hall
Dijital Dönüşümün Satış Gücü: AgenticAI Destekli Çok Kaynaklı Veri	Kerem Yılmaz	AI and LLM	November 20, Thursday	12:10-12:20	Center Hall

Entegrasyonu ve Proaktif Satış Fırsatı Yönetimi					
Designing for Explainability and Data Sovereignty: A Design Principles Approach for LLM-Augmented FinTech Analytics	Dr. Begüm Al	AI and LLM	November 20, Thursday	12:20-12:30	Center Hall
A Modular Semantic Kernel Agent for Automated Code Review and Refactoring Feedback	Semih Yazıcı	AI and LLM	November 20, Thursday	12:30-12:40	Center Hall

Paper Title	Presenter	Session Name	Date	Time	Place
Strategic Design for Sustainability: Education and Research Examples	Elif Küçüksayraç	Green Energy and Sustanability	November 20, Thursday	11:40-11:50	Saloon 2
Kahramanmaraş Kağıt Fabrikası'nda Isı Geri Kazanımı, Mikrobiyolojik Kirlilikle Mücadele ve Su Tasarrufu Olanaklarının Araştırılması	Sibel Bilgiç Kara	Green Energy and Sustanability	November 20, Thursday	11:50-12:00	Saloon 2
Development of Ash-Based Paving Stones Through the Utilization of Industrial Ash Generated During Urban Waste Disposal Processes	Gülin Kızılay	Green Energy and Sustanability	November 20, Thursday	12:00-12:10	Saloon 2
Trisiloksan ve Polihidroksikarboksilik Asitlerin (PHCA) Pamuk (Gossypium hirsutum L.) Yetiştiriciliğinde Su Ayak İzini Azaltmadaki Etkileri	Veli İlhan	Green Energy and Sustanability	November 20, Thursday	12:10-12:20	Saloon 2
Sürdürülebilir Soğuk Zincir Lojistiği için Paradigma Değiştiren Eko-Tasarım:	Hüner Aydın	Green Energy and Sustanability	November 20, Thursday	12:20-12:30	Saloon 2

Metalize Baskı Teknolojisiyle Geliştirilen, Karbon Ayak İzi Düşük, Geri Dönüşüme Hazır Termal Örtü					

Paper Title	Presenter	Session Name	Date	Time	Place
Tarımda Dijital Denge	**Ahmet Mermer**	**Design and Material Engineering**	**November 20, Thursday**	**11:00-11:10**	**Saloon 1**
Araç İçi Hava Kalitesinin İyileştirilmesinde Biyo-Katkılı ABS Kompozitlerin Kullanımı	**Songül Kılınç**	**Design and Material Engineering**	**November 20, Thursday**	**11:10-11:20**	**Saloon 1**
Investigation of Mechanical Properties of Hemp Hurd/PP Composites for the Application of Water Irrigation Pipes	**Beyza Gizem Duman**	**Design and Material Engineering**	**November 20, Thursday**	**11:20-11:30**	**Saloon 1**
Polioksimetilen (POM) Esaslı Yataklarda Yağ Kanalı Sayısının Rotil Ömrü Üzerindeki Etkisinin İncelenmesi	**Birol Oğluoğlu**	**Design and Material Engineering**	**November 20, Thursday**	**11:30-11:40**	**Saloon 1**
Synthesis and Characterization of Stereoselective Ozonides for Sustainable Textile Wet Processes	**Orhan Işık**	**Design and Material Engineering**	**November 20, Thursday**	**11:40-11:50**	**Saloon 1**
Evaluation of ROPS and FOPS Tests for Structural Integrity of Forklifts	**Hüseyin Samet Kartal**	**Design and Material Engineering**	**November 20, Thursday**	**11:50-12:00**	**Saloon 1**
IEC 60317-46 Standardına Göre Yuvarlak Emaye Bakır Tellerde, Aromatik Polyimide Esaslı İzolasyonun Araştırılması	**Hamide Termek**	**Design and Material Engineering**	**November 20, Thursday**	**12:00-12:10**	**Saloon 1**

ve Üretiminin Optimizasyonu					
Effect of Amorphous Silica–Forming Additive on Porosity and Mechanical Strength in Autoclaved Aerated Concrete Thermal Insulation Board	Yunus Ion Grecu	Design and Material Engineering	November 20, Thursday	12:10-12:20	Saloon 1
W-Mo-Si-B Sisteminin SHS yöntemiyle Üretimi ve Karakterizasyonu	Merve Cavlak	Design and Material Engineering	November 20, Thursday	12:20-12:30	Saloon 1
Pressure-Controlled Runner Optimization and Filling Balance Analysis in Multi-Cavity Injection Molds	Muhammet Furkan Çalık	Design and Material Engineering	November 20, Thursday	12:30-12:40	Saloon 1
A Compact Non-Intrusive Measurement System for Critical Dimensions and Calibration Chart Generation of Underground Fuel Tanks	İlker Değirmencioğlu	Design and Material Engineering	November 20, Thursday	12:40-12:50	Saloon 1
Rotil-Rotbaşı Parçalarındaki Eksenel Boşluğun Nanokompozit Yataklar Kullanılarak İyileştirilmesi	Mustafa Ata Afyon	Design and Material Engineering	November 20, Thursday	12:50-13:00	Saloon 1

Paper Title	Presenter	Session Name	Date	Time	Place
Determination of Transformation Efficiency of Some Tomato Genotypes Using Agrobacterium-Mediated Transformation Method	Merve Yiğit	Food Technologies and Engineering	November 20, Thursday	13:30-13:40	Center Hall
Ev Tipi Ankastre Fırın da Kat Kat Pişirme Teknolojisi Tabanlı Enerji Verimli ve Zaman Tasarruflu Çok	İrem Bıyıklı	Food Technologies and Engineering	November 20, Thursday	13:40-13:50	Center Hall

Katmanlı Gıda Kurutma Uygulaması					
Lactiplantibacillus plantarum SH5 Kültürü ile Zenginleştirilmiş Mikrofiliz Unlarından Geliştirilen Fonksiyonel Noodle Formülasyonlarının Besinsel ve Biyoaktif Özelliklerinin İncelenmesi	Cihat Güner	Food Technologies and Engineering	November 20, Thursday	13:50-14:00	Center Hall
Nohut Ununun Besinsel Kompozisyonunun ve Ekstrüzyon Teknolojisinde Potansiyel Kullanımının Değerlendirilmesi	Gizem Şevval Tomar	Food Technologies and Engineering	November 20, Thursday	14:00-14:10	Center Hall
Doğal Maden Sulu Clean-Label Noodle Serisi: Yerli Kaynaklarla Sürdürülebilir Üretim ve Kaynak Verimliliği	Yusuf Çakmakçı	Food Technologies and Engineering	November 20, Thursday	14:10-14:20	Center Hall
The Effect of Starch and Hydrocolloids on the Stability of Emulsion Based Sauces	Çiğdem Karakaya	Food Technologies and Engineering	November 20, Thursday	14:20-14:30	Center Hall
Sinerjik Etkileri ile Bağışıklık Destekleyici Biyoaktif Bileşikler İçeren Çiğneme Tableti:Ülker Everwell Force	Büşra Örnek	Food Technologies and Engineering	November 20, Thursday	14:30-14:40	Center Hall
Yer Fıstığının Besin Bileşiminin Değerlendirilmesi	Sena Erol	Food Technologies and Engineering	November 20, Thursday	14:40-14:50	Center Hall
Development of a Symbiotic Snacks Bar Product	Merve Al	Food Technologies and Engineering	November 20, Thursday	14:50-15:00	Center Hall

Paper Title	Presenter	Session Name	Date	Time	Place

A Modular and Foldable Detector Design: An Industrial Design Approach for Spatial Efficiency and User-Centered Ergonomics	Okşan Eylül Danışman Aktay	Design	November 20, Thursday	14:00-14:30	Saloon 2
MUTFAK MOBİLYALARINDA ULTRAVİOLE TEKNOLOJİSİNİN HAMMADDELERE ENTEGRASYONU	Mehmet Oğuzhan Okuşluk	Design	November 20, Thursday	14:30-14:40	Saloon 2
Isı Yalıtımlı Cam Üretiminde Argon Gazı Dolum Prosesi ve Uygulaması	Mustafa Gökay İspirgil	Design	November 20, Thursday	14:40-14:50	Saloon 2
Experience Design through Hydrodynamic Flow Control and Geometric Innovations: ECLIPSE Water Slide	Kübra Tuna	Design	November 20, Thursday	14:50-15:00	Saloon 2
Development of a New Door System with High Thermal Resistance and Improved Sealing Performance for Refrigerated Display Cabinets	Fatma Nur Erdoğmuş	Design	November 20, Thursday	15:10-15:20	Saloon 2

Paper Title	Presenter	Session Name	Date	Time	Place
CarrGo® Sorter: Parcel Sorting System with Autonomous Multi-Robots	Ali Han Polat	Computer Science and AI	November 20, Thursday	14:00-14:10	Saloon 1
Analog Video (CVBS/AHD) Görüntünün Sayısala Dönüştürülüp Internet Ağında İletimi	Talip Ege Seçkin İlbars	Computer Science and AI	November 20, Thursday	14:10-14:20	Saloon 1

Shopperline: Gerçek Zamanlı Görüntü İşleme ile Akıllı Mağaza Analitiği Platformu	Nadir Kocakır	Computer Science and AI	November 20, Thursday	14:20-14:30	Saloon 1
A New Approach Based on Ensemble Clustering for the Fabric Color Batching Problem	Esra Tabaş Asiltürk	Computer Science and AI	November 20, Thursday	14:30-14:40	Saloon 1
The Development of a Platform as a Service for Game Key Distribution	Deniz Tahmaz	Computer Science and AI	November 20, Thursday	14:40-14:50	Saloon 1
Real-Time Vision AI for Assembly Lines: A Position Paper on Defect Detection and Throughput Gains	Safa Taner Cetin	Computer Science and AI	November 20, Thursday	14:50-15:00	Saloon 1
Design and Implementation of a Real-Time Biometric-Based Smart Monitor System	Utku Barış Yağci	Computer Science and AI	November 20, Thursday	15:00-15:10	Saloon 1
Merkezi ve güvenli bir uzaktan içerik yönetim sistemi ile derin öğrenme tabanlı müşteri analizi modüllerinin geliştirilmesi	Abdülsamet Topal (Techmax Technology Yazılım San Tic Aş) Zeynep Şevval Şener (Techmax Technology Yazılım San Tic Aş) Seda Gunes Ozturk	Computer Science and AI	November 20, Thursday	15:10-15:20	Saloon 1
Visual Discovery in Retail: Operationalizing AI-Powered Visual Search at Boyner	Mert Alacan	Computer Science and AI	November 20, Thursday	15:20-15:30	Saloon 1

Paper Title	Presenter	Session Name	Date	Time	Place

A Data-Driven Framework for API Manufacturers, Patents and Occupational Safety in Pharmaceutical Development	Diren Dilan Dernek	AI and Machine Learning	November 20, Thursday	15:20-15:30	Center Hall
The Role of ice.berg Idea Management System in Transforming Corporate Innovation Culture	Eda Çikoğlu	AI and Machine Learning	November 20, Thursday	15:30-15:40	Center Hall
Classifying Operator Experience from Electric Screwdriving Signals: A BiLSTM-Based Study with External Validation	Kader Nikbay Oylum	AI and Machine Learning	November 20, Thursday	15:40-15:50	Center Hall
Designing an AI-Powered Product Entry Assistant for E-Commerce Marketplaces: A Position Paper	Merve Elif Çelik	AI and Machine Learning	November 20, Thursday	15:50-16:00	Center Hall
Secure Use of Artifical Intelligence with Artifical Intelligence Based Control	Fatıh Mehmed Bılgın, Alı Aydın, Tugberk Zurnacı, Engın Bılıcı	AI and Machine Learning	November 20, Thursday	16:00-16:10	Center Hall
Ev Tekstili Sektöründe Stok Optimizasyonuna Yönelik Alokasyon Modeli	Merve Yılmaz	AI and Machine Learning	November 20, Thursday	16:10-16:20	Center Hall
A Temporal-Weighted Hybrid Recommender for B2B Vehicle Auctions Using Word2Vec Embeddings	Uğur Barış Öztürk	AI and Machine Learning	November 20, Thursday	16:20-16:30	Center Hall
Credit Scoring with Machine Learning Supported by E-Commerce Data	Sinan Uzun	AI and Machine Learning	November 20, Thursday	16:30-16:40	Center Hall
A Multimodal Deep Learning Framework for Predicting Machine Anomalies Using IoT-	Alper Saylam	AI and Machine Learning	November 20, Thursday	16:40-16:50	Center Hall

Enabled Vibration and Sound Data					
Sovereign, Efficient, and Reliable CPU Configuration: A Data-Driven Recommendation Module for E-Commerce	Alper Kemal Keçeci	AI and Machine Learning	November 20, Thursday	16:50-17:00	Center Hall
Leveraging Machine Learning for Real-Time Fraud Detection in Transaction Systems	Utku Barış Yağci	AI and Machine Learning	November 20, Thursday	17:00-17:10	Center Hall
Anomaly Detection System for Distributed Job Processing within Microservice Architectures	Ramazan Pekin	AI and Machine Learning	November 20, Thursday	17:10-17:20	Center Hall

Paper Title	Presenter	Session Name	Date	Time	Place
Development of a Secure Structural Component to Mitigate Environmental Contamination at Ports During the Transfer of Granular Materials in Global Maritime Logistics: Ecological Port Loading Bunker	Özge Güler	Mechanical engineering	November 20, Thursday	15:50-16:00	Saloon 1
Structural Behavior Analysis of Rail-Mounted Portal Cranes Equipped with a 360° Rotatable Spreader Mechanism Using the Finite Element Method	Samet Dönerkaya	Mechanical engineering	November 20, Thursday	16:00-16:10	Saloon 1
Improving Cold Forging of 304HC Stainless Steel through Induction Preheating: A Comparative Industrial Study	Muhammed Kaan Kılınç	Mechanical engineering	November 20, Thursday	16:10-16:20	Saloon 1

Analytical Prediction and Experimental Validation of Bolt Self-Loosening under Vibration	Can İçmez	Mechanical engineering	November 20, Thursday	16:20-16:30	Saloon 1
Finite Element Analysis of Stress Pin Application in a Lobular Cold Forging Die	Tolga Aydın	Mechanical engineering	November 20, Thursday	16:30-16:40	Saloon 1
Alüminyum Gövdeli Gemi Şaft Sızdırmazlık Elemanının Geliştirilmesi	Hasan Ertuğrul	Mechanical engineering	November 20, Thursday	16:40-16:50	Saloon 1
Tire Cavity Noise Reduction by Using Helmholtz-Based Sandwich Resonator	Berk Özgür	Mechanical engineering	November 20, Thursday	16:50-17:00	Saloon 1
Rot Mili Kapama Aparatının Tork Değerleri Üzerine İncelenmesi	Ali Yazgan-Yaser Akpınar	Mechanical engineering	November 20, Thursday	17:00-17:10	Saloon 1
hBN Katkısının Farklı POM Tabanlı Kompozitlerde (100NC ve 100KM) Çekme ve Aşınma Özelliklerinin İncelenmesi	Ali Yazgan	Mechanical engineering	November 20, Thursday	17:10-17:20	Saloon 1

Paper Title	Presenter	Session Name	Date	Time	Place
Artificial Intelligence–Based Route Optimization in Logistics: A Sustainable Approach	Cihan Özmen	Artificial Intelligence	November 21, Friday	10:10-10:20	Center Hall
Satın Alma İlişkisiyle Kurulan Müşteri–Araç Bipartit Grafı GraphSAGE Tabanlı Kenar Tahmini ve Gömme Odaklı Müşteri Segmentasyonu	Abdullah Sezdi	Artificial Intelligence	November 21, Friday	10:20-10:30	Center Hall

A Smart Shopping Cart: Shopper®	Onur Melikoğlu	Artificial Intelligence	November 21, Friday	10:30-10:40	Center Hall
Machine Learning-Based Vehicle Renewal Prediction: A Hybrid Approach for Customer Retention in Premium Automotive Markets	Selçuk Bayracı	Artificial Intelligence	November 21, Friday	10:40-10:50	Center Hall
Probability-Calibrated Ensemble Methods for Automotive CRM Lead Scoring	Bilal Sedef	Artificial Intelligence	November 21, Friday	10:50-11:00	Center Hall
AI-Powered Customer Review Management: Designing a Next-Generation NLP Platform for E-Commerce	Merve Elif Çelik	Artificial Intelligence	November 21, Friday	11:00-11:10	Center Hall
Design and Development of a Customer Data Platform for Loyalty Programs: Data Deduplication and Personalized Marketing Infrastructure	Erhan Efe	Artificial Intelligence	November 21, Friday	11:10-11:20	Center Hall
Operasyon Maliyetine Duyarlı Vektör Arama: Üretim Koşullarında ANNS Seçimi için Pratik Bir Çerçeve	Melek Turan	Artificial Intelligence	November 21, Friday	11:20-11:30	Center Hall
Airline Crew Hotel Assignment: An Optimization Framework for Fairness and Efficiency	Seyit Ulutaş	Artificial Intelligence	November 21, Friday	11:30-11:40	Center Hall
EARS-XTSK: Privacy-Preserving Global Explainability in Cross-Silo Federated Two-Tower Recommendation Systems via Server-Side TSK Fuzzy Rule Distribution	Deniz Altay Avcı	Artificial Intelligence	November 21, Friday	11:40-11:50	Center Hall

A Decision Support Framework for Customer Loyalty Program Managers: Reward Mix Optimization	Ayşe Salı	Artificial Intelligence	November 21, Friday	11:50-12:00	Center Hall
A Web-Based Credit Card Payment Architecture for Dealer Portals: Android POS Integration, Microservice Design, and Behavioural Segmentation for Data-Driven Dealer Management	Adnan Erdoğan	Artificial Intelligence	November 21, Friday	12:00-12:10	Center Hall
Operational Excellence in Customer Service via AI-Powered Call Analysis	Erem Karalar	Artificial Intelligence	November 21, Friday	12:10-12:20	Center Hall
AI-Powered Multi-Agent Fashion Assistant for Personalized Retail Recommendations	Seza Dursun	Artificial Intelligence	November 21, Friday	12:20-12:30	Center Hall

Paper Title	Presenter	Session Name	Date	Time	Place
Development of Yarn Detection Sensor for Circular Patterned Yarn Dyeing Machine	Neslihan Okyay	Textile Engineering and Industry 4.0	November 21, Friday	10:30-10:40	Saloon 1
Optimization of Sleep Comfort in Mattresses Using Temperature-Positive Sensitive New Foam Technology	Zekiye Erdoğan Karakoç	Textile Engineering and Industry 4.0	November 21, Friday	10:40-10:50	Saloon 1
An Integrated Deep Learning Framework for Automated Quality Control and Process Optimization in Slasher Indigo Dyeing	Mohammad Muttaqi	Textile Engineering and Industry 4.0	November 21, Friday	10:50-11:00	Saloon 1
Investigation of the Comfort and Quality Properties of Knitted	Yusuf Koç	Textile Engineering and Industry 4.0	November 21, Friday	11:00-11:10	Saloon 1

Garments Produced with Raised Yarn					
Development of a Process to Prevent Back Contamination Caused by Cationization After Cationic Digital Reactive Printing on Cotton Knitted Fabrics	Sena Efsun Alpaslan	Textile Engineering and Industry 4.0	November 21, Friday	11:10-11:20	Saloon 1
Ozon Yıkama İle Batik Efekt Eldesi Prosesi Geliştirilmesi	Bilge İnce Kara	Textile Engineering and Industry 4.0	November 21, Friday	11:20-11:30	Saloon 1
Çevre Dostu Denim Efektlendirme İçin Köpük ve Islak Ozon Teknolojilerinin Birlikte Kullanımı	Merve Gideroğlu	Textile Engineering and Industry 4.0	November 21, Friday	11:30-11:40	Saloon 1
The Bleaching of Woven Fabrics Using the Foam Application Technique	Aylin Kuşen	Textile Engineering and Industry 4.0	November 21, Friday	11:40-11:50	Saloon 1
Optimization of Pultrusion Process Parameters for Carbon Fiber/Epoxy Composites	Ömür Alkan	Textile Engineering and Industry 4.0	November 21, Friday	11:50-12:00	Saloon 1
Sürdürülebilir Üretim Hedefi Doğrultusunda Pamuk Liflerinin Yeni Nesil Poliakrilonitril Lifleriyle Olan Karışımlarının Reaktif Boya İle Tek Banyolu Boyanması	Seda Keskin Atak	Textile Engineering and Industry 4.0	November 21, Friday	12:00-12:10	Saloon 1
The Green Step Upper: A Novel Sustainable Bonding Method Replacing Solvent-Based Adhesives in Footwear Upper Assembly	Baris Bekıroglu	Textile Engineering and Industry 4.0	November 21, Friday	12:10-12:20	Saloon 1
An Innovative Approach to Technical Textiles: Assessing the Performance	Merve Yaralı Kınlı	Textile Engineering and Industry 4.0	November 21, Friday	12:20-12:30	Saloon 1

of Olefin-Based Outdoor Fabrics					

Paper Title	Presenter	Session Name	Date	Time	Place
Improving the Accuracy of Location Data in UWB-Based RTLS Using Deep Learning Methods	Ramazan Kavak	Electrical Electronics Engineering	November 21, Friday	10:30-10:40	Saloon 2
Artificial Intelligence-Assisted Control of Light Pipe & LED Luminaire Hybrid Tunnel Lighting System	Levent Doğan	Electrical Electronics Engineering	November 21, Friday	10:40-10:50	Saloon 2
UWB-Based High-Precision Real-Time Positioning and Multi-Dimensional Visualization	Onur Yılmaz	Electrical Electronics Engineering	November 21, Friday	10:50-11:00	Saloon 2
Çok Protokollü SCADA Mimarileri için Test Yöntemi Önerisi	Mücahit Karaman	Electrical Electronics Engineering	November 21, Friday	11:00-11:10	Saloon 2
OG Şebekenin 5G ile İzlenilmesi ve Kontrolü	Büşra Töre	Electrical Electronics Engineering	November 21, Friday	11:10-11:20	Saloon 2
Yapay Zekâ Destekli Bulut Tabanlı e-SIEM: Dağıtım Sektöründe Yerli ve Özgün Bir Güvenlik Bilgileri ve Olay Yönetimi Yazılımı	Çağrı Kandıralı	Electrical Electronics Engineering	November 21, Friday	11:20-11:30	Saloon 2
Deri Etkisinin İletken Geometrisine Bağlı Değişiminin Analizi: Busbar ve Kablo Geometrilerinin Karşılaştırması	Ahmet Can Yalçın	Electrical Electronics Engineering	November 21, Friday	11:30-11:40	Saloon 2

Orta Gerilim Sistemlerinde İletken Geometrisinin Elektrik Alan Yoğunluğu ve Yalıtım Dayanımı Üzerine Etkisinin İncelenmesi	**Ahmet Can Yalçın**	**Electrical Electronics Engineering**	**November 21, Friday**	**11:40-11:50**	**Saloon 2**
Busbar Enerji Dağıtım Sistemlerinin Termal Davranışının Çoklu-Fizik Tabanlı Deneysel ve Sayısal Değerlendirilmesi	**Ahmet Can Yalçın**	**Electrical Electronics Engineering**	**November 21, Friday**	**11:50-12:00**	**Saloon 2**
Industrial Validation of a Safe and Sustainable by Design (SSbD) Antimicrobial Primer for High-Touch Plastic Surfaces	**Panasonic**	**Electrical Electronics Engineering**	**November 21, Friday**	**12:00-12:10**	**Saloon 2**
Switch Components Using Glass Fiber-Reinforced Polyamide 6: A Comparative Study With Polycarbonate	**Panasonic**	**Electrical Electronics Engineering**	**November 21, Friday**	**12:10-12:20**	**Saloon 2**

Kurumsal İnovasyon Kültürünün Dönüşümünde ice.berg Fikir Yönetim Sisteminin Rolü

Eda Çikoğlu

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Özet

Küresel tedarik zincirlerinin yeniden şekillendiği, dijital teknolojilerin iş modellerini temelden dönüştürdüğü günümüzde, sürdürülebilir rekabet avantajı elde etmek artık yalnızca teknolojik altyapıya yatırım yapmaktan çok daha fazlasını gerektirmektedir. Özellikle operasyonel ölçeği yüksek sektörlerde faaliyet gösteren kuruluşlar için yenilikçiliğin kurumsal strateji ve kültürün merkezine yerleştirilmesi, dijital dönüşüm hedeflerinin başarısında kritik bir faktör haline gelmiştir. Bu çalışma, bölgesel ve uluslararası pazarda entegre lojistik hizmetleri sunan Ekol Lojistik'in Ar-Ge Merkezi tarafından geliştirilen ice.berg Kurumsal İnovasyon Yönetim Sistemi'nin, kurumun dijitalleşme ve inovasyon stratejileriyle bütünleşerek inovasyon kültürünü nasıl dönüştürdüğünü incelemektedir.

ice.berg platformu, çalışanların fikir geliştirme süreçlerine aktif olarak katılımını sağlayan uçtan uca bir yapı sunar. Fikirlerin dijital ortamda toplanması, veri temelli yöntemlerle sınıflandırılması, çok aşamalı değerlendirme süreçlerinden geçirilmesi ve uygulanmasına kadar tüm adımlar sistematik biçimde yönetilmektedir. Bu yaklaşım sayesinde fikir yönetimi ilk kez ölçülebilir bir yapıya kavuşmuş; kurum genelinde karar alma süreçlerine veri temelli bir bakış açısı kazandırılmıştır. Sistem ayrıca oyunlaştırma mekanizmaları aracılığıyla çalışan bağlılığını artırmış ve inovasyonu günlük iş yapış biçimlerinin doğal bir parçası haline getirmiştir.

Uygulamanın ilk döneminde toplanan fikirlerin yaklaşık %35'i projelere dönüştürülerek hayata geçirilmiş, bu da farklı departmanlar arasındaki iş birliğini güçlendirmiş ve kurumsal çevikliği artırmıştır. Sonuçlar, ice.berg'in yalnızca bir fikir toplama aracı olmadığını; aynı zamanda dijital dönüşüm stratejileriyle uyumlu, veri temelli karar alma ve sürekli iyileştirme odaklı bir kurumsal inovasyon altyapısı sunduğunu göstermektedir. Bu sayede Ekol Lojistik, inovasyonu stratejik bir

kurumsal yetkinliğe dönüştürerek rekabet gücünü artırmış ve sürdürülebilir bir inovasyon ekosistemi oluşturmuştur.

Anahtar Kelimeler: *Dijital dönüşüm, inovasyon yönetimi, organizasyonel çeviklik, veri temelli karar alma, sürekli iyileştirme, lojistik sektörü*

The Role of *ice.berg* Idea Management System in Transforming Corporate Innovation Culture

Abstract

As global supply chains are being reshaped and digital technologies fundamentally transform business models, achieving sustainable competitive advantage requires more than investing in new technologies. For organizations operating in large-scale, complex industries such as logistics, embedding innovation into the core of corporate strategy and culture has become a critical factor for the success of digital transformation initiatives. This study examines how the ice.berg Corporate Innovation Management System — developed by the R&D Center of Ekol Logistics, a leading provider of integrated logistics services in regional and international markets — has transformed the company's innovation culture by aligning it with its digitalization and innovation strategies.

The ice.berg platform provides a comprehensive, end-to-end framework that enables employees to actively participate in the innovation process. It systematically manages all stages — from the digital collection and data-driven classification of ideas to multi-stage evaluation and implementation. This structured approach has made innovation processes measurable for the first time, introducing a data-driven perspective into decision-making across the organization. Furthermore, integrated gamification mechanisms have increased employee engagement, embedding innovation into daily operations and strengthening a culture of continuous improvement.

In the initial implementation period, approximately 35% of collected ideas were successfully transformed into projects, enhancing cross-departmental collaboration and improving organizational agility. The results demonstrate that ice.berg is more than an idea collection tool; it is a comprehensive corporate innovation infrastructure that supports evidence-based decision-making and continuous improvement while remaining fully aligned with the company's digital transformation strategy. Through this system, Ekol Logistics has institutionalized innovation as a strategic organizational capability, strengthened its competitive position, and laid the foundation for a sustainable innovation ecosystem.

Keywords: *Digital transformation, innovation management, organizational agility, data-driven decision-making, continuous improvement, logistics industry*

Determination of Transformation Efficiency of Some Tomato Genotypes Using Agrobacterium-Mediated Transformation Method

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Abstract

Tomato (Solanum lycopersicum L.) is an important vegetable and nutritious crop plant worldwide. They are rich sources of several indispensable compounds such as lycopene, minerals, vitamins, carotenoids, essential amino acids, and bioactive polyphenols. Plant regeneration and Agrobacterium-mediated genetic transformation system from in various genotypes of tomato are necessary for genetic improvement. As is the case with other species, the genotype is reported to be one of the most significant factors affecting transformation success in tomato. The objective of this study was to ascertain the transformation efficiencies of 17 tomato genotypes that were part of the United Genetics Turkey Seed Company breeding program. This was achieved by utilising two distinct Agrobacterium strains, namely EHA105 and AGL. A total of 16,200 explants were cultured, yielding 58 plants. The transformation efficiency was found to be 0.35% for all genotypes, with the highest transformation efficiency (2.75%) being obtained from genotype UGT983. While a response was obtained from seven of the genotypes utilised in the study, plants were not obtained from 10. The strain EHA105 exhibited a higher transformation efficiency in comparison to the AGL strain. The findings of this study indicate that there is significant variation

in transformation efficiency among genotypes. In view of the findings, it was concluded that genotypes should be tested for the transfer of important genes in tomato.

Keywords: Tomato, Agrobacterium tumefaciens, Genetic transformation

Karbon Negatif Lojistik: Yapay Zeka Destekli Rota Optimizasyonu

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Özet

Günümüz dünyasında lojistik, hem ekonomik büyümenin temel itici güçlerinden biri hem de çevresel etkileriyle öncü sektörlerden biri olarak dikkat çekmektedir. Lojistik sektörü, özellikle taşımacılık alanında karayolu, demiryolu, denizyolu ve havayolu taşımacılığına dayalı çok yönlü bir operasyon ağı barındırmaktadır. Bu ağ içerisinde, özellikle karayolu taşımacılığında karşılaşılan en kritik sorunlardan biri, verimsiz güzergâh planlamaları nedeniyle araçların gereksiz kilometreler kat etmesidir. Bu durum yalnızca operasyonel maliyetleri artırmakla kalmayıp yakıt tüketimi ve karbon emisyonlarını da ciddi oranda yükseltmektedir. Artan yakıt fiyatları ve iklim değişikliğine yönelik küresel baskılar göz önünde bulundurulduğunda, bu probleme sürdürülebilir çözümler geliştirilmesi kaçınılmaz hale gelmiştir.

Ekol Lojistik, çevreye duyarlı taşımacılığı kurum kültürünün merkezine yerleştirmiş bir şirket olarak, bu vizyon doğrultusunda yapay zekâ destekli rota optimizasyonu projesini başlatmıştır. Projenin temel amacı, araçlardan ve çevresel faktörlerden elde edilen anlık verileri analiz ederek en verimli güzergâhları oluşturmak, böylece yakıt tüketimi ile karbon salınımını önemli ölçüde azaltmaktır. Bu platform, sadece operasyonel maliyetleri düşürmekle kalmayıp Ekol'ün sürdürülebilir lojistik anlayışını güçlendiren, çevre dostu bir dijital dönüşüm örneği olacaktır.

Proje hâlen başlangıç aşamasında olmasına rağmen, kapsamlı bir altyapı tasarımı tamamlanmış durumdadır. Platform; yazılım, donanım ve veri entegrasyonu açısından bütünsel bir yapıya sahiptir. Donanım tarafında, araçlara entegre edilen dinamik takip sistemleri aracılığıyla konum, hız ve yakıt tüketimi gibi veriler toplanmakta; sensörler yardımıyla hava koşulları da izlenmektedir. Bu veriler, sürücülerin erişimine sunularak Ekol'ün şeffaf ve veri odaklı operasyon yönetimi anlayışını desteklemektedir. Yazılım tarafında ise yapay zekâ algoritmaları yalnızca en

kısa rotayı değil; trafik yoğunluğu, araç kapasitesi ve teslimat önceliklerini de dikkate alarak en uygun güzergâhı hesaplamaktadır.

Ekol Lojistik, bu proje kapsamında yakıt tüketiminde %12 azalma, karbon emisyonlarında %15'e varan düşüş ve teslimat sürelerinde %10'un üzerinde iyileştirme sağlamayı hedeflemektedir. Platformun rota güncellemelerini %90'ın üzerinde doğrulukla ve 1 saniyeden kısa sürede gerçekleştirmesi planlanmaktadır. Bu hedefler, Ekol'ün çevresel sürdürülebilirlik ve operasyonel mükemmeliyet konusundaki kararlılığının bir göstergesidir.

İlk pilot uygulamanın, İstanbul'da seçilen bir dağıtım filosu üzerinden gerçekleştirilmesi planlanmaktadır. Sekiz hafta sürecek pilot süreçte iki dağıtım hattı entegre edilerek sistem performansı değerlendirilecektir. Pilotun başarı kriterleri arasında sıfır iş kazası, yakıt tüketiminde en az %12 azalma, karbon emisyonunda %15 düşüş ve %80'in üzerinde operasyonel memnuniyet yer almaktadır. Pilot çalışmadan elde edilecek veriler doğrultusunda sistemin daha geniş filolara ve operasyonlara yaygınlaştırılması hedeflenmektedir.

Ekol Lojistik, bu proje ile sadece kendi operasyonlarında değil, sektör genelinde de çevresel farkındalık ve dijital dönüşüm kültürüne öncülük etmeyi amaçlamaktadır.

Anahtar Kelimeler: Yapay Zeka, Rota Optimizasyonu, Karbon Emisyonu, Sürdürülebilir Lojistik, Yakıt Tasarrufu, Çevre Dostu Teknoloji, Ekol Lojistik

Artificial Intelligence–Based Route Optimization in Logistics: A Sustainable Approach

Abstract

In today's global landscape, logistics stands out as one of the primary drivers of economic growth and an industry with profound environmental implications. The logistics sector, particularly in the domain of transportation, operates through an extensive and multifaceted network encompassing road, rail, maritime, and air transport. Among these, road transportation remains the most dominant yet challenging mode, often facing inefficiencies in route planning that lead to unnecessary mileage, excessive fuel consumption, and elevated carbon emissions. Given the surging fuel prices and the escalating global pressures surrounding climate change, the need for sustainable, technology-driven solutions has become a strategic imperative.

In alignment with its long-term vision of environmental responsibility and operational excellence, Ekol Logistics has launched an Artificial Intelligence–based Route Optimization Project. The primary goal of this initiative is to analyze real-time data collected from vehicles and their operating environments to design more efficient routes—thereby reducing both fuel consumption and carbon emissions. The project represents a cornerstone of Ekol Logistics' broader commitment to sustainable logistics, integrating innovation with measurable ecological impact.

While still in its early phase, the project already features a comprehensive infrastructure design combining both hardware and software elements. On the hardware side, Ekol's intelligent telematics systems will capture critical data such as vehicle location, speed, and fuel consumption, while additional sensors will monitor external factors such as weather conditions. All collected data will be transparently shared with drivers through a mobile application, reinforcing Ekol's principle of data-driven transparency and operational efficiency.

From the software perspective, advanced AI algorithms will not only identify the shortest path but also evaluate traffic density, vehicle capacity, delivery priorities, and time windows to determine the most optimal route in real time. The system is designed to deliver route updates with over 90% accuracy in less than one second, ensuring seamless operational responsiveness across the logistics network.

Through this innovative platform, Ekol Logistics aims to achieve a 12% reduction in fuel consumption, a 15% decrease in carbon emissions, and more than a 10% improvement in delivery times. These quantitative objectives reflect Ekol's corporate strategy to merge digital transformation with environmental stewardship—creating tangible value for both business performance and the planet.

The first pilot phase of the project will be conducted in Istanbul with a selected distribution fleet. The pilot, planned to last eight weeks, will integrate two distribution routes for performance validation. The success criteria include zero workplace accidents, at least 12% fuel savings, a 15% reduction in emissions, and over 80% positive feedback from both drivers and operations personnel. Upon successful completion, the system will be progressively scaled to broader fleets and additional operational territories.

Ultimately, Ekol Logistics positions this initiative not merely as a technological project but as a transformational milestone—demonstrating the company's leadership in environmentally responsible, data-centric, and innovation-oriented logistics. Through this project, Ekol reaffirms its dedication to a greener, smarter, and more sustainable future for the logistics industry.

Keywords: Artificial Intelligence, Route Optimization, Carbon Emissions, Sustainable Logistics, Fuel Efficiency, Eco-Friendly Technology, Ekol Logistics

LLM-Based Contract–Invoice Compliance and Anomaly Analysis on Turkish Financial Documents

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Abstract

This study introduces an AI-based system developed to reduce human errors and fraud in corporate expense and contract management processes. In traditional methods, due to the busy schedules of managers, expense and contract compliance may be overlooked, leading to increased financial risks. The developed system provides an intelligent decision-support solution that automatically analyzes contract–invoice relationships, identifies risks, and performs budget forecasting.As part of the work, contract, invoice, and expense documents were analyzed using natural language processing (NLP) methods based on large language models (LLMs). Critical information such as parties, dates, and amounts was extracted from the documents to perform semantic similarity analysis, anomaly detection, and contract–invoice compliance assessment. Furthermore, the system incorporates text-based semantic search capabilities to locate past contracts by content and link them to newly added documents.The developed AI-powered solution accelerates decision-making by automating businesses' budgeting, auditing, and approval processes through meaningful insights derived from corporate documents. The work aims to largely automate expense approvals, detect unusual expenses early, enable text-based contract retrieval, and make financial analysis processes more accurate and reliable. In this respect, the work provides an innovative R&D contribution to financial management by developing unique natural language processing applications for Turkish-language financial and legal texts.

Keywords: Large Language Models (LLM), Natural Language Processing (NLP), Anomaly Detection, Financial Risk Assessment

Dynamic Multi-Criteria Analysis of Travel Safety Risks with Large Language Models

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Abstract

Travel safety has evolved into a complex field of research today under the influence of multidimensional risk factors such as climate change, health threats, and societal instabilities. This study develops an artificial intelligence approach that leverages large language models (LLMs) to perform dynamic risk forecasting using reliable data sources, with the aim of enhancing the safety of travelers. The aim of the work is to provide proactive risk advisories before and during travel by interpreting text-based data related to weather reports, health alerts, political developments, and environmental events. The innovative aspect of the study is the use of LLM-based inference mechanisms instead of traditional statistical models. In this way, the system not only describes the current situation but also forecasts potential risk scenarios by interpreting complex contexts derived from natural language. Large language models, by capturing semantic relations in multilingual texts, have provided the capacity to distinguish risk indicators specific to different geographies; this has made the model sensitive to cultural and linguistic diversity. Within the scope of the research and development (R&D) study, the model was evaluated in terms of predictive performance, uncertainty management, and consistency metrics. The results indicate that the LLM-based approach strengthens early-warning and decision-support mechanisms in the field of travel safety. This study demonstrates the applicability of language models to risk analysis in artificial intelligence research and provides an innovative, explainable, and sustainable methodological contribution to the travel safety literature.

Keywords: Travel Security, Large Language Models (LLM), Risk Forecasting, Natural Language Processing (NLP), Decision Support Systems

Lactiplantibacillus plantarum SH5 Kültürü ile Zenginleştirilmiş Mikrofiliz Unlarından Geliştirilen Fonksiyonel Noodle Formülasyonlarının Besinsel ve Biyoaktif Özelliklerinin İncelenmesi

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Özet

Bu proje, probiyotik mikroorganizmaların tahıl ve baklagil filizlerine entegre edilmesiyle, hem bitkisel kaynaklı probiyotik taşıyıcı matrisler geliştirmeyi hem de bu mikrofilizlerin un formunda noodle üretiminde fonksiyonel bileşen olarak kullanılabilirliğini araştırmayı amaçlamaktadır. Lactiplantibacillus plantarum SH5 suşu, antioksidan ve bağışıklık düzenleyici etkileri kanıtlanmış bir probiyotik kültür olarak seçilmiştir. Brokoli, karabuğday ve keten tohumu mikrofilizleri probiyotik kültürle zenginleştirilerek liyofilize edilmiştir. Bu ürünlerden elde edilen unlar noodle formülasyonlarına eklenmiş ve fonksiyonel gıda perspektifinden besinsel kalite ve biyoaktif potansiyelleri incelenmiştir.

Çalışma üç aşamalı bir bilimsel model üzerine kurulmuştur. İlk aşamada, probiyotik kültürle inoküle edilen tohumların filizlendirme verimliliği, biyokütle artışı ve canlı bakteri yükü analiz edilmiştir. İkinci aşamada, elde edilen mikrofiliz tozlarının toplam fenolik madde, flavonoid ve FRAP (demir indirgeme kapasitesi) değerleri spektrofotometrik yöntemlerle belirlenmiştir. Üçüncü aşamada, bu tozlarla üretilen noodle'ların protein içeriği, in vitro sindirilebilirlik, nişasta profili, mineral ve vitamin düzeyleri analiz edilmiştir. Ayrıca, simüle edilmiş gastrointestinal sistem koşullarında biyoerişilebilirlik testleri yapılarak fenolik bileşiklerin sindirim sonrası biyoyararlılığı değerlendirilmiştir.

Elde edilen sonuçlar, SH5 kültürü ile zenginleştirilmiş mikrofilizlerin noodle formülasyonlarına dahil edilmesiyle antioksidan kapasitenin %35'e kadar arttığını, protein sindirilebilirliğinin

iyileştiğini ve toplam fenolik içeriğin belirgin şekilde yükseldiğini göstermiştir. Bu bulgular, bitkisel kökenli probiyotik matrislerin geleneksel tahıl bazlı ürünlere entegre edilmesiyle süt ürünlerinden bağımsız, vegan dostu yeni bir fonksiyonel gıda platformu oluşturulabileceğini kanıtlamaktadır. Proje, biyoteknoloji ve gıda bilimi disiplinlerini entegre ederek probiyotik taşınımı, besinsel optimizasyon ve sürdürülebilir üretim alanlarında yenilikçi bir bilimsel yaklaşım ortaya koymaktadır.

Anahtar Kelimeler: Mikrofiliz, Probiyotik, Lactiplantibacillus plantarum, Fonksiyonel noodle, Biyoaktif bileşen, Biyoyararlılık

Investigation of the Nutritional and Bioactive Properties of Functional Noodle Formulations Developed from Microgreen Flours Enriched with Lactiplantibacillus plantarum SH5 Culture

Abstract

This project aims to develop plant-based probiotic carrier matrices by integrating probiotic microorganisms into cereal and legume microgreens and to investigate the potential use of these microgreen flours as functional ingredients in noodle production. Lactiplantibacillus plantarum SH5 strain, known for its proven antioxidant and immunomodulatory effects, was selected as the probiotic culture. Broccoli, buckwheat, and flaxseed microgreens were enriched with the probiotic culture and subsequently lyophilized. Flours obtained from these products were incorporated into noodle formulations, and their nutritional quality and bioactive potential were evaluated from a functional food perspective.

The study was structured around a three-stage scientific model. In the first stage, the germination efficiency, biomass yield, and viable bacterial count of seeds inoculated with the probiotic culture were analyzed. In the second stage, the total phenolic content, flavonoid concentration, and ferric reducing antioxidant power (FRAP) of the obtained microgreen powders were determined using spectrophotometric methods. In the third stage, noodles produced with these powders were analyzed for protein content, in vitro digestibility, starch profile, and mineral and vitamin composition. Furthermore, simulated gastrointestinal digestion tests were conducted to assess the post-digestion bioaccessibility of phenolic compounds.

The results demonstrated that the inclusion of SH5-enriched microgreens in noodle formulations increased antioxidant capacity by up to 35%, improved protein digestibility, and significantly enhanced total phenolic content. These findings indicate that the integration of plant-derived probiotic matrices into traditional cereal-based products can establish a novel, dairy-free, and vegan-friendly functional food platform. The project presents an innovative scientific approach by integrating biotechnology and food science disciplines to advance probiotic delivery, nutritional optimization, and sustainable food production.

Keywords: Microgreens, Probiotics, Lactiplantibacillus plantarum, Functional noodles, Bioactive compounds, Bioaccessibility

Doğal Maden Sulu Clean-Label Noodle Serisi: Yerli Kaynaklarla Sürdürülebilir Üretim ve Kaynak Verimliliği

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Özet

Erişler Gıda Ar-Ge Merkezi tarafından yürütülen bu proje, Türkiye'nin zengin doğal maden sularını gıda üretiminde fonksiyonel bir bileşen olarak değerlendirerek sürdürülebilir, katkısız ve yerli kaynak odaklı bir üretim modeli geliştirmeyi amaçlamaktadır. "Doğal Maden Sulu Clean-Label Noodle Serisi" kapsamında, ithal asit düzenleyici, kabartma ajanı ve emülgatörler tamamen çıkarılmış; bu katkıların fonksiyonları, yüksek mineralli doğal maden sularının (Ca^{2+}, Mg^{2+}, Na^{+}, HCO_3^{-}) teknolojik etkileriyle sağlanmıştır. Böylece hem ithalat bağımlılığı azaltılmış hem de yerli kaynaklara dayalı çevre dostu bir üretim sistemi oluşturulmuştur.

Proje kapsamında gerçekleştirilen laboratuvar çalışmaları ve proses optimizasyonları, sürdürülebilirliğin bilimsel temellerine dayanmaktadır. Maden suyunun iyonik yapısı, hamur reolojisinde doğal kabarma, protein-polimer stabilizasyonu ve viskozite kontrolü sağlayarak kimyasal katkıların fonksiyonel eşdeğerini oluşturmuştur. Kızartmasız üretim hatlarında kullanılan clean-label formülasyon, yağ absorpsiyonunu düşürerek buhar ve konveksiyon pişirme sistemleriyle uyumlu hale getirilmiştir. Bu sayede proses enerjisinde %12, yağ tüketiminde %20 oranında azalma sağlanmıştır. Ayrıca ısı geri kazanım sistemlerinin entegrasyonu ile üretim başına enerji tüketimi 0,72 kWh/kg'dan 0,63 kWh/kg'a düşmüştür. Yerli üretim hat ekipmanları ve dijital kontrol sistemleri sayesinde hammadde kullanımında %5 tasarruf elde edilmiştir.

Sonuç olarak, proje kapsamında yıllık 28 ton kimyasal katkı maddesi üretimden elimine edilmiş, karbon ayak izinde yaklaşık %16 azalma öngörülmüştür. Türkiye'de atıl durumda bulunan maden sularının gıda zincirine kazandırılmasıyla doğal kaynak israfı önlenmiş, yerli kaynak kullanım oranı %100'e çıkarılmıştır. Bu çok katmanlı yaklaşım, SKA 9 (Sanayi, Yenilikçilik ve Altyapı), SKA 12 (Sorumlu Tüketim ve Üretim) ve SKA 13 (İklim Eylemi) hedeflerine doğrudan katkı

sağlamaktadır. Doğal maden sulu clean-label noodle üretimi, hem çevresel etkiyi azaltan hem de döngüsel ekonomi anlayışını güçlendiren bilimsel bir sürdürülebilirlik modeli sunmaktadır.

Anahtar Kelimeler: Sürdürülebilir üretim, Clean-label, Maden suyu, Enerji verimliliği, Döngüsel ekonomi, Karbon yönetimi

Clean-Label Noodle Series with Natural Mineral Water: Sustainable Production and Resource Efficiency through Local Inputs

Abstract

This project, conducted by the Erişler Gıda R&D Center, aims to develop a sustainable, additive-free, and locally sourced production model by utilizing Turkey's rich natural mineral waters as a functional component in food manufacturing. Within the scope of the "Clean-Label Noodle Series Produced with Natural Mineral Water," imported acid regulators, leavening agents, and emulsifiers have been completely removed, while their technological functions have been replaced by the natural effects of high-mineral-content waters (Ca^{2+}, Mg^{2+}, Na^{+}, HCO_3^{-}). Thus, import dependency has been reduced, and an environmentally friendly, resource-efficient production system based on local inputs has been established.

Laboratory studies and process optimizations conducted within the project are grounded in scientific principles of sustainability. The ionic composition of mineral water provided natural leavening, protein–polymer stabilization, and viscosity control in dough rheology, acting as a functional equivalent to chemical additives. The clean-label formulation used in non-fried production lines decreased oil absorption and became compatible with steam and convection cooking systems. As a result, process energy consumption was reduced by 12%, and oil usage decreased by 20%. Additionally, the integration of heat recovery systems lowered the energy consumption per kilogram of production from 0.72 kWh/kg to 0.63 kWh/kg. The use of domestically manufactured equipment and digital control systems also achieved a 5% saving in raw material utilization.

As a result, approximately 28 tons of chemical additives have been eliminated from annual production, leading to an estimated 16% reduction in the carbon footprint. By integrating underutilized Turkish mineral waters into the food supply chain, the project prevented natural resource wastage and achieved 100% domestic sourcing. This multi-layered approach directly contributes to the UN Sustainable Development Goals (SDGs) — SDG 9 (Industry, Innovation, and Infrastructure), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action).

The production of clean-label noodles with natural mineral water represents a scientifically grounded model of sustainability, simultaneously reducing environmental impact and reinforcing the principles of the circular economy.

Keywords: sustainable production, clean-label, mineral water, energy efficiency, circular economy, carbon management

Operasyon Maliyetine Duyarlı Vektör Arama: Üretim Koşullarında ANNS Seçimi için Pratik Bir Çerçeve

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Özet

Yüksek boyutlu uzaylarda benzerlik araması, çağdaş yapay zekâ yığınlarının kritik bir bileşenidir; ancak üretim ortamlarında "en iyi" yaklaşık en yakın komşu araması, tek bir doğruluk-hız eğrisiyle belirlenemez. Bu çalışma, açık kaynak bir vektör veritabanı üzerinde farklı indeks ailelerini, yalnızca kalite ve gecikmeye göre değil; aynı zamanda kaynak-normalize edilmiş verim, bellek ayak izi ve disk etkinliği gibi operasyonel maliyet boyutlarıyla birlikte inceler. Değerlendirme, indeks kurulumundan çevrim içi sorgulamaya uzanan uçtan-uca bir profil çıkartarak, her yaklaşım için ayırt edici operasyonel imzalar elde eder: kimileri yüksek kaliteyi görece yüksek bellek bedeliyle, kimileri de gerçek zamanlı yüklerde daha düşük kaynakla ama sınırlı kalite tavanıyla sunar. Çalışmanın katkısı iki yönlüdür: (i) tek boyutlu kıyasları, "kalitenin bedeli" (cost-of-quality) eğrileri ve Pareto sınırı görselleştirmeleriyle çok ölçütlü bir karar alanına taşımak; (ii) uygulayıcıların hizmet seviyesi hedefleri ve bütçe kısıtlarına göre hızlı seçim yapabilmesi için pratik bir karar kılavuzu ve ayar reçetesi sunmak. Bulgular, belirli iş yükleri için tek bir "kazanan"dan çok, kısıta duyarlı optimumların varlığını gösteriyor ve mimari tercihlerde ölçülebilir, tekrarlanabilir bir yöntem öneriyor.

Anahtar Kelimeler: Yaklaşık En Yakın Komşu Araması (ANNS), Vektör Arama, Operasyonel Maliyet, Üretim Sistemleri, Çok Ölçütlü Optimizasyon

Operation Cost-Aware Vector Search: A Practical Framework for ANNS Selection in Production

Abstract

Similarity search in high-dimensional spaces is a critical component of contemporary AI stacks; however, in production environments, the "best" Approximate Nearest Neighbor Search (ANNS) cannot be determined by a single accuracy-latency curve. This study evaluates different index families on an open-source vector database, considering not only quality and latency but also operational cost dimensions such as resource-normalized throughput, memory footprint, and disk I/O. The evaluation provides an end-to-end profile, from index build to online querying, capturing distinctive operational signatures for each approach: some offer high quality at a relatively high memory cost, while others provide lower resource usage for real-time workloads, albeit with a limited quality ceiling. The contribution of this work is twofold: (i) moving beyond single-dimensional benchmarks to a multi-criteria decision space, visualized through "cost-of-quality" curves and Pareto frontier visualizations; and (ii) presenting a practical decision guide and tuning recipes for practitioners to make rapid selections based on their service-level objectives (SLOs) and budget constraints. The findings demonstrate the existence of constraint-aware optimums for specific workloads, rather than a single "winner," and suggest a measurable, repeatable methodology for making architectural choices.

Keywords: Approximate Nearest Neighbor Search (ANNS), Vector Search, Operational Cost, Production Systems, Multi-Criteria Optimization

Shopperline: Gerçek Zamanlı Görüntü İşleme ile Akıllı Mağaza Analitiği Platformu

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Özet

Günümüz perakende sektöründe müşteri davranışlarının doğru şekilde analiz edilmesi, satış stratejilerinin optimizasyonu ve operasyonel verimliliğin artırılması açısından kritik öneme sahiptir. Shopperline, bu gereksinimleri karşılamak üzere geliştirilmiş, ileri seviye yapay zekâ tabanlı bir akıllı mağaza analitiği platformudur. Sistem, object detection, object tracking, face detection, age/gender classification gibi derin öğrenme tabanlı algoritmalarla çalışarak mağaza ortamlarında ziyaretçi ve müşteri davranışlarını gerçek zamanlı olarak analiz eder. Shopperline, CPU, GPU ve gömülü sistemler dahil olmak üzere farklı donanım yapılarına uyum sağlayabilir. IP kameralar, web kameraları ve gömülü sistem kameraları gibi farklı veri kaynaklarından gelen görüntüleri işleyebilir. Bu çok yönlü mimarisi sayesinde, hem büyük ölçekli perakende zincirlerinde hem de küçük işletmelerde yüksek performanslı analizler gerçekleştirebilir. Sistem, 11 farklı modülden oluşur: Kişi Sayma, Demografik Kişi Sayma, Yüzden Demografik Analiz, Kuyruk Yönetimi, Isı Haritası, Duygu Analizi, Rota Analizi, Düşme Tespiti, Yasaklı Bölge İzleme, Market Arabası İhlâl Tespiti ve Demografik Bilgilerle İçerideki Toplam Kişi Sayısı. Bu modüller, mağaza içi müşteri trafiğinin ve davranışlarının bütüncül bir şekilde izlenmesini sağlar. Shopperline, yalnızca teknik olarak güçlü değil, aynı zamanda kullanıcı dostu bir arayüze de sahiptir. Geliştirilen raporlama modülleri, etkileşimli widget'lar ve görsel analiz panelleri sayesinde kullanıcılar anlık olarak verileri izleyebilir ve karar süreçlerini kolayca yönetebilir. Sistemde kullanılan sınıflandırma ve analiz algoritmaları, gelişmiş, hibrit ve optimize edilmiş yöntemler içermekte olup, özgün ve patent potansiyeli taşımaktadır. Bu sayede Shopperline, yalnızca bir görüntü işleme aracı değil, aynı zamanda ticari zekâya dayalı bir karar destek sistemi işlevi görür. Sonuç olarak, Shopperline; yüksek doğruluk, esnek mimari, güçlü algoritmalar ve

modern arayüzüyle perakende analitiğinde yeni bir standart oluşturmayı hedefleyen yenilikçi bir sistemdir.

Anahtar Kelimeler: Görüntü İşleme, Yapay Zekâ, Perakende Analitiği, Nesne Takibi, Duygu ve Demografik Analiz

Shopperline: An Intelligent Retail Analytics Platform with Real-Time Computer Vision

Abstract

In today's retail industry, accurately analyzing customer behavior is crucial for optimizing sales strategies and enhancing operational efficiency. Shopperline is an advanced AI-driven intelligent retail analytics platform developed to address these challenges. The system leverages deep learning–based algorithms such as object detection, object tracking, face detection, and age/gender classification to analyze customer and visitor behaviors in real time within store environments. Shopperline is designed to operate efficiently across diverse hardware configurations including CPU, GPU, and embedded systems. It can process visual data from multiple input sources such as IP cameras, web cameras, and embedded vision modules. This flexibility allows the system to deliver high-performance analytics both in large-scale retail chains and small-scale stores. The platform consists of 11 modular components: People Counting, Demographic People Counting, Facial Demographic Analysis, Queue Management, Heatmap Generation, Emotion Analysis, Route Tracking, Fall Detection, Restricted Zone Monitoring, Shopping Cart Violation Detection, and Total Occupancy with Demographic Information. Together, these modules provide a comprehensive understanding of in-store customer flow and behavioral patterns. Beyond its robust analytical core, Shopperline features a user-friendly interface that integrates interactive dashboards, reporting modules, and real-time visualization widgets. These tools empower users to monitor key performance metrics and make data-driven decisions effortlessly. The classification and analysis algorithms used in the system incorporate advanced, hybrid, and optimized methods, featuring originality and patentability potential. Consequently, Shopperline serves not only as a computer vision tool but also as an AI-powered decision support system for retail intelligence. With its high accuracy, scalable architecture, and modern design, Shopperline aims to establish a new standard in retail analytics and intelligent surveillance systems.

Keywords: Computer Vision, Artificial Intelligence, Retail Analytics, Deep Learning, Behavior Analysis

A Modular and Foldable Detector Design:

An Industrial Design Approach for Spatial Efficiency and User-Centered Ergonomics

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Abstract

Metal detectors are portable devices intended for long-duration field use, and field observations show that users operate these systems for approximately 1 to 9 hours while carrying them across various terrain conditions. Literature on handheld product design clearly identifies weight distribution, grip ergonomics, repetitive motion load, and musculoskeletal strain during prolonged carrying as critical design challenges. Elam (2018) emphasizes that if handheld devices are not ergonomically designed, they cause rapid fatigue, grip discomfort, and decreased operational precision; therefore, decisions related to size, form, and modular configuration have a direct influence on reducing ergonomic load. Similarly, The Nautical Institute (2004) states that grip form, center of mass, device length, and carrying duration significantly affect user performance and safety, noting a direct correlation between physical dimensions and physical exertion in long-duration operations.

In existing metal detector systems, excessive device length, large storage volume, and single-function architecture contribute to user fatigue during prolonged carrying. Users also face logistical challenges during vehicle-to-field transitions and often need to transport multiple devices to accommodate different sensor requirements. This increases ergonomic load and reduces operational efficiency. As highlighted in the literature, foldability, modularity, and volume reduction are effective industrial design strategies to mitigate physical burden in portable equipment.

This study examines how Conrad Engineering's GR4 and GR4 Dual models address these challenges. The GR4 model operates with a Magnetic Field Gradiometer (MFS) head, requiring a stable distance above the ground for accurate detection. The GR4 Dual uses a Pulse Induction (PI) head, where the coil must remain parallel and extremely close to the surface to minimize mineralization effects and enhance deep target identification. To enable users to operate both sensing modalities within a single platform, a pogo-pin modular head system was developed. The

device consists of three main components, forming a mechanically and electrically modular assembly.

The design process was informed by field observations, ergonomic analyses, and user studies. Through a foldable upper structure, the device length was reduced from 100 cm to 45 cm, achieving a 55% reduction in volume. This figure was calculated using CAD-based bounding box measurements in both operational and folded configurations. Assembly time was evaluated through an "assembly time study" conducted with 12 users across three trials, revealing that the modular architecture reduces setup time by 25%.

A review of the literature indicates that foldable product design is widely regarded as an effective strategy for improving spatial efficiency and portability in handheld devices (Patil, Deshmukh & Kadam, 2020). The GR4 platform integrates this approach with modular architecture to deliver a field-ready, portable, ergonomic, and performance-focused industrial design solution.

Keywords: modular design, foldable product, metal detector, industrial design, portability, spatial efficiency

IEC 60317-46 Standardına Göre Yuvarlak Emaye Bakır Tellerde, Aromatik Polyimide Esaslı İzolasyonun Araştırılması ve Üretiminin Optimizasyonu

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Özet

Kapalı ve yarı kapalı yapıların (alışveriş merkezleri, yeraltı otoparkları, tüneller ve yüksek katlı binalar) yangın senaryolarında en kritik hususlardan biri, dumanın kontrollü ve hızlı biçimde tahliye edilmesidir. Bu işlevi yerine getiren duman egzoz sistemlerinin temel bileşenlerinden olan F300 ve F400 sınıfı duman tahliye motorları, yangın koşullarında 300–400 °C sıcaklıklarda en az iki saat süreyle kesintisiz çalışabilme gerekliliği nedeniyle yüksek ısıl ve elektriksel dayanım ister. Motor performansının sürekliliğini belirleyen en kritik elemanlardan biri ise stator sargılarında kullanılan emayeli bakır tellerin izolasyon yapısıdır.

Bu çalışma kapsamında, yüksek sıcaklık koşullarına dayanımın artırılması amacıyla 0,56 mm iletken çapında iki farklı izolasyon sistemine sahip emayeli tel numuneleri üretilmiş olup, üretim optimizasyon çalışmaları yapılmıştır. Numuneler; IEC 60317-46 standardına uygun polyimide esaslı ve IEC 60317-57 standardına uygun polyamide-imide (PAI) esaslı yuvarlak emayeli bakır tellerden oluşmaktadır. Üretilen teller, proje paydaşı motor üreticisi tarafından F300 ve F400 sınıfı duman tahliye motorlarının stator sargılarında uygulanmış; ardından motorlar EN 12101-3 standardı doğrultusunda tanımlanan yüksek sıcaklık dayanım testlerine tabi tutulmuştur.

Çalışmada, polyimide ve polyamide-imide bazlı emaye sistemlerinin yüksek sıcaklık altında gösterdiği dielektrik dayanım, yapısal bütünlük, termomekanik stabilite ve izolasyon performansı kapsamlı olarak karşılaştırılmıştır. Elde edilen bulgular doğrultusunda, F300 ve F400 sınıfı motor uygulamaları için optimum izolasyon yapısının belirlenmesi hedeflenmiştir.

Bu araştırmanın çıktılarının, duman tahliye motorlarında kullanılacak emayeli bakır tellerin uluslararası standartlarla uyumluluğunun doğrulanmasına, motorların yüksek sıcaklık altında operasyonel güvenilirliğinin artırılmasına ve ilgili endüstriyel uygulamalara bilimsel dayanak sağlanmasına katkı sunması beklenmektedir.

Anahtar Kelimeler: Emayeli Bakır Tel, Polyimide, IEC 60317-46, EN 12101-3, F300, F400, Duman Tahliye Motoru

Investigation and Optimization of the Production of Round Enameled Copper Wires with Aromatic Polyimide-Based Insulation According to IEC 60317-46 Standard

Abstract

One of the most critical issues in fire scenarios for enclosed and semi-enclosed structures (such as shopping malls, underground car parks, tunnels, and high-rise buildings) is the controlled and rapid extraction of smoke. F300 and F400 class smoke exhaust motors, which are essential components of smoke exhaust systems performing this function, require high thermal and electrical endurance since they must operate continuously for at least two hours under fire conditions at 300–400 °C. One of the most critical elements determining the continuity of motor performance is the insulation structure of the enameled copper wires used in the stator windings.

In this study, to enhance resistance under high-temperature conditions, enameled wire samples with a conductor diameter of 0.56 mm and two different insulation systems were produced, and production optimization studies were carried out. The samples consist of round enameled copper wires based on polyimide in accordance with IEC 60317-46 and polyamide-imide (PAI) in accordance with IEC 60317-57. The produced wires were applied to the stator windings of F300 and F400 class smoke exhaust motors by the project partner motor manufacturer; subsequently, the motors were subjected to high-temperature endurance tests defined according to the EN 12101-3 standard.

In the study, the dielectric strength, structural integrity, thermomechanical stability, and insulation performance of polyimide- and polyamide-imide-based enamel systems under high temperatures were comprehensively compared. Based on the findings, the optimum insulation structure for F300 and F400 class motor applications was determined.

The outcomes of this research are expected to contribute to verifying the compliance of enameled copper wires used in smoke exhaust motors with international standards, enhancing the operational reliability of motors under high-temperature conditions, and providing a scientific basis for related industrial applications.

Keywords: Enameled Copper Wire, Polyimide, IEC 60317-46, EN 12101-3, F300, F400, Smoke Exhaust Motor

Improving Cold Forging of 304HC Stainless Steel through Induction Preheating: A Comparative Industrial Study

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Abstract

This study evaluates the effectiveness of infrared (IR) and induction preheating in the cold forging of 304HC grade stainless steel hexagonal nuts (DIN 934, sizes M8 and M10). The primary objective is to investigate the effects of preheating method and applied temperature on material formability, tool life, and surface quality. Preheating is particularly critical in cold forming of austenitic stainless steels, which exhibit high strain-hardening behavior and limited formability at room temperature.

The experiments were conducted on multi-station cold forging presses using Ø11.75 mm and Ø16 mm 304HC stainless steel wire rods for M8 and M10 nuts, respectively, under real industrial conditions. All process parameters, including die performance, forging loads, and part hardness, were monitored throughout.

In the IR-based trials, the material was intended to be heated to 250–350 °C, but due to radiative losses and continuous feeding, actual temperatures reached only ~135–150 °C and dropped to approximately 60 °C by the final forging station. This insufficient heating resulted in minimal change: forging loads, surface defects, and hardness levels remained similar to those observed under non-heated conditions. Tool wear and punch breakage also occurred at comparable rates, indicating limited impact on die longevity. Moreover, the IR system showed low thermal efficiency at industrial production speeds, leading to substantial energy loss.

In contrast, induction heating was applied in a stepwise manner, with the material preheated to 250, 300, and 350 °C in successive trials. The increased temperature progressively reduced the material's flow stress and delayed the onset of strain-induced martensitic transformation, thus preserving the austenitic phase and enhancing ductility. Induction heating also ensured more uniform thermal distribution, smoother material flow, and a marked reduction in forging loads and surface cracking. The increase in hardness observed in forged parts was attributed to both plastic deformation and partial martensitic transformation. Nuts forged under induction preheating showed significantly lower hardening: core Vickers hardness dropped to ~140 HV and

surface hardness to ~250 HV, whereas unheated samples showed ~390 HV (core) and ~430 HV (surface). Tool life was also notably improved, with single die sets producing approximately 66,000 nuts at 300 °C and 67,000 at 350 °C — a 25–30% increase in productivity relative to IR or no preheating. In addition, induction heating proved far more energy-efficient by directly delivering heat into the material with minimal losses.

Overall, the study demonstrates that under the tested conditions, induction preheating is a more energy-efficient and stable solution for cold forging of stainless steels, offering enhanced process reliability, improved part quality, and extended tool life under high-volume production conditions. Furthermore, a finite element simulation using Simufact is planned to analyze die stress distribution, billet temperature gradients, and forging load profiles for both heating methods. These results will support further optimization of the preheating process. Additionally, future work will include microstructural analysis of the forged components to evaluate grain deformation, martensite formation, and the heat-affected zone behavior across different preheating conditions.

Keywords: cold forging, induction preheating, infrared preheating, stainless steel (304HC)

Sürdürülebilirlik için Stratejik Tasarım: Eğitim ve Araştırma Örnekleri

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Özet

Endüstriyel tasarım, çağın gerekliliklerine adapte olarak hızla gelişen genç bir disiplindir. Sürdürülebilirlik, günümüz tasarım projeleri ve araştırmalarının temel hedefi olması gereken amaçları kapsamaktadır. Stratejik tasarım ise, tasarım yönetiminin bir alt konusu olarak tasarımcıların endüstride ve toplumda aldığı yeni görevleri kapsayan bir yaklaşımdır. Tasarımcılar günümüzde şirketlerin stratejik kararlar alma süreçlerinde söz sahibidir, sürdürülebilirlik hedefli çalışan organizasyonlarda ve de dünyada etkisi yüksek olan dijital girişimlerde kurucu veya yönetim ekibinde rol almaktadır. Tasarımcıların sürdürülebilirlik için geliştirdiği araçlar 1990'lardan beri gelişmektedir. Yaklaşımlardan bazıları daha çok çevre odaklı iken, bazıları sosyal konulara odaklanmaktadır. Döngüsel ekonomiye katkı sağlamayı amaçlayan döngüsel ürün tasarımı (circular product design) ve sürdürülebilirliğe geçişi desteklemeyi amaçlayan geçiş tasarımı (transition design) gibi yaklaşımları kapsamaktadır. Tasarımın stratejik karar alma süreçlerinde kullandığı en önemli araçlar, insan ihtiyaçlarını belirlemeye yönelik araştırma yöntemleri ve fikirlerin hayata geçme sürecinde üretilen prototiplemedir. Prototip, sadece ürün geliştirme süreçlerinde kullanılmaz, fiziksel tiplerin yanı sıra senaryolar, hikâyeleştirme, ortaklaşa tasarım setleri gibi formlarda da oluşturulmaktadır. Prototiplemenin amacı, karar verme süreçlerine bilgi sağlamaktır, disiplinler arası çalışan ekiplerin bir arada çalışmasını sağlayacak araçlardır. Bu çalışmada sürdürülebilirlik için tasarım, stratejik tasarım ve prototipleme konularının bir üniversite endüstriyel tasarım programında lisans ve yüksek lisans seviyesinde nasıl ilişkilendiği, kamu kurumları ve endüstri ile iş birliklerinin nasıl kurgulandığı vaka çalışması yöntemi ile paylaşılmaktadır. Bulgular, zaman içerisinde çalışmaların değişim yönünü göstermektedir. Sürdürülebilirliğin temel amaç olarak eğitim ve araştırmaya entegre edilmiş olması, ürün odaklı yaklaşımların yanı sıra servis ve ürün-servis sistemlerinin tasarımının yaygınlaşması ve üç boyutlu yazıcılar gibi teknolojiler yoluyla prototipleme süreçlerinin dijitalleşmesi öne çıkan sonuçlar arasındadır. Çalışmanın sürdürülebilirlik odaklı stratejik süreçler yürüten eğitim, araştırma ve sektörel çalışmalara katkı sağlaması amaçlanmıştır.

Anahtar Kelimeler: Prototipleme, Girişimcilik, Tasarım Odaklı Düşünme

Strategic Design for Sustainability: Education and Research Examples

Abstract

Industrial design is a young discipline rapidly evolving to adapt to the demands of the times. Sustainability encompasses the objectives that should be the primary goal of today's design projects and research. Strategic design is a subfield of design management and encompasses the new roles designers are taking in industry and society. Designers today take roles in companies' strategic decision-making processes, serve as founders or board members of organizations working towards sustainability, and in digital ventures with high global impact. The tools developed by designers for sustainability have been evolving since the 1990s. Some approaches are more environmentally focused, while others focus on social issues. These include circular product design, which aims to contribute to the circular economy, and transition design, which aims to support the transition to sustainability. The most important tools used by designers in strategic decision-making processes are research methods to identify human needs and prototyping, which is produced in the process of bringing ideas to life. Prototyping is not only used in product development processes; in addition to physical prototypes, it is also created in forms such as scenarios, storytelling, and collaborative design kits. The purpose of prototyping is to inform decision-making processes and provide tools for interdisciplinary teams during collaboration. This study presents a case study to share how design for sustainability, strategic design, and prototyping are linked to undergraduate and graduate levels in a university's industrial design program and how collaborations with public institutions and industry are structured. The findings illustrate the direction of change in these studies over time. Among the findings are the integration of sustainability into education and research as a primary objective, the change of product-focused approaches to service and product-service system design, and the digitalization of prototyping processes through technologies such as 3D printing. The study aims to contribute to education, research, and sectoral studies that implement sustainability-focused strategic processes.

Keywords: Prototyping, Entrepreneurship, Design Thinking

Mutfak Mobilyalarında Ultraviole Teknolojisinin Hammaddelere Entegrasyonu

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Özet

Bu çalışma kapsamında, mutfak mobilyalarında hijyen standardını yükseltmek amacıyla, ultraviyole (UV-C) tabanlı sterilizasyon teknolojisi ilk kez doğrudan mobilya yapısına entegre edilmiştir. Gıda ile doğrudan temas eden çatal, bıçak, tabak ve saklama yüzeylerinin bulunduğu çekmece ve üst modüllerde, bakteri yükünü minimize eden bir sistem geliştirilmiştir.

Projede, LED tabanlı ve gömme montajlı UV-C modüller, mobilya yüzey bütünlüğünü bozmadan entegre edilmiştir. Sistem, sensör destekli akıllı otomasyon sayesinde yalnızca kapalı konumda aktif hale gelmekte; bu sayede kullanıcı güvenliği tam olarak sağlanmaktadır.

Gerçekleştirilen mekanik testlerde UV modül entegrasyonunun gövde rijitliği veya bağlantı dayanımı üzerinde olumsuz bir etkisi gözlenmemiştir. ISO 22196 standardına göre yürütülen mikrobiyolojik testlerde, Escherichia coli ve Staphylococcus aureus bakterilerinde %99,99'a varan azaltım elde edilmiştir. Isıl analizlerde ise yüzey sıcaklığı 32,8 °C'yi aşmamış, suntalam yüzeylerde deformasyon gözlenmemiştir.

Sonuç olarak, UV-C teknolojisinin üretim süreçleriyle uyumlu ve güvenli biçimde mobilya yapısına entegre edilebileceği bilimsel olarak kanıtlanmıştır. Geliştirilen sistem, kullanıcı müdahalesine gerek duymadan çalışan, otomatik sterilizasyon sağlayan yeni nesil bir mobilya modülü olarak, seri üretim için hazır hale getirilmiştir.

Anahtar Kelimeler: UV-C, mutfak mobilyası, sensör kontrollü sistem, sterilizasyon, ISO 22196

Integration of Ultraviolet (UV-C) Technology into Kitchen Furniture Materials

Abstract

This study introduces a novel integration of ultraviolet (UV-C) sterilization technology into kitchen furniture, aiming to redefine hygiene standards in storage environments. The system was specifically designed for drawers and upper cabinets containing utensils and materials in direct contact with food, targeting a substantial reduction of microbial contamination.

LED-based recessed UV-C modules were engineered to be seamlessly embedded within furniture surfaces without compromising structural or aesthetic integrity. The sterilization system operates fully autonomously, activated only when the compartments are closed, thanks to sensor-assisted smart automation ensuring user safety.

Mechanical and structural evaluations confirmed that the UV module integration did not adversely affect cabinet rigidity or joint stability. According to ISO 22196 microbiological tests, Escherichia coli and Staphylococcus aureus populations were reduced by up to 99.99%, while thermal monitoring showed a maximum surface temperature of 32.8 °C with no material degradation.

The findings demonstrate that UV-C sterilization technology can be safely and efficiently adapted to industrial furniture production. The developed autonomous module provides continuous, maintenance-free disinfection, representing a new generation of smart and hygienic furniture systems ready for mass production and commercialization.

Keywords: UV-C, kitchen furniture, sensor-controlled module, sterilization, ISO 22196

The Effect of Starch and Hydrocolloids on the Stability of Emulsion Based Sauces

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Abstract

Mayonnaise and mayonnaise-based variety sauces are important "oil in water emulsions" and widely used all around the world. To address consumer health concerns, various oil content levels are engineered in emulsions by utilizing alternative raw materials and processing conditions.

Typical mayonnaise contains oil, water, egg, vinegar, salt and other optional ingredients like flavors and spices. As oil being the main health concern, while reducing the oil content, alternative ingredients like starch and hydrocolloids are used for structuring. While this replacement requires an overall formulation change, the primary production challenge is the instability and emulsion breakdown over time.

In this study, 32% oil mayonnaise base is used and two sets of samples prepared using two different types of starches which are waxy corn starch and tapioca starch. Additional samples are prepared by adding four different hydrocolloids separately (xanthan gum, guar gum, citrus fiber, pectin) to see their impact on stability. The samples are prepared on a pilot scale and stored at 25°C for 6 weeks. pH, acidity, consistency and color measured on weekly basis to observe the potential change in those parameters over time.

While the consistency is provided in almost every combination, "xanthan gum (0.5%)-waxy corn starch, guar gum (0.5%)-waxy corn starch" and "tapioca starch only, guar gum (0.5%)-tapioca starch" combinations have the highest consistency. pH has slightly increased (≈0.1) in the samples prepared with waxy corn starch, whereas the pH change is around 0.3 in the samples prepared

with tapioca starch. There is no color or significant acidity changes observed in any starch type and starch- hydrocolloid combination, along the 6 weeks of storage time.

In conclusion, adding starch and hydrocolloids help compensating the structural impact of oil in emulsion-based products at different levels. As processing conditions also have an impact on the results, this study can be further validated with factory-scale production samples.

Keywords: Starch, Hydrocolloids, Emulsion, Stability, Mayonnaise

Ozon Yıkama İle Batik Efekt Eldesi Prosesi Geliştirilmesi

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Özet

Çalışmanın ilk amacı, %100 pamuklu kumaşlardan dikilen bedenlerde katlama ve bağlama yöntemi kullanılıp ardından beden boyama yapılması ile rastgele batik efekti oluşturulması prosesindeki direkt boyarmaddeler kaynaklı meydana gelen düşük haslıkların iyileştirilmesidir. Bu iyileştirme yanı sıra katlama-bağlama tekniğindeki bedenlerin tek tek elle katlanarak bağlanması ortadan kaldırılarak el işçiliğinin azaltılması ile prosesin hızlandırılması ve maliyetin düşürülmesi de hedeflenmiştir. Ters batik tekniğine dayalı olarak geliştirilmiş yeni proseste katlama-bağlama tekniği kaynaklı bağlanan yerlerin boya almayarak doğal görüntüyü bozması ile el işçiliğini artırması ve direkt boyaların düşük haslık değerleri tamamen ortadan kaldırılmıştır. Katlama-bağlama işleminin dezavantajları bedenlerin elle aynı şekilde katlanıp bağlamadan, belli sayıda düzenli şekilde ağ halinde örülmüş poliester filelere doldurulup sıkıştırılarak bağlanması işlemi ile ortadan kaldırılmıştır. Bu bağlama sisteminde batik efekt eldesi için kullanılabilen tek boya türü olan direkt boyaların haslık dezavantajı da ters batik tekniği temel alınarak yapılan; aşınabilir reaktif boyalarla boyanmış kumaşlardan dikilen bedenlerin yeni geliştirilmiş olan katlama-fileleme tekniği ile hazırlandıktan sonra ozon yıkama ile yıkanarak batik efektlendirilmesiyle ortadan kaldırılmıştır.

Anahtar Kelimeler: Batik, Ozon Yıkama, Batik Boyama, Batik yıkama

Development of a Process for Obtaining a Batik Effect Using Ozone Washing

Abstract

The primary objective of this study is to improve the low fastness levels caused by direct dyes in the process of creating a random batik effect by folding and tying garments made from 100% cotton fabrics and then dyeing them. In addition to this improvement, the goal is to accelerate the process and reduce costs by eliminating the need to manually fold and tie each garment individually in the folding-tying technique, thereby reducing manual labor. In the new process developed based on the reverse batik technique, the folding-tying technique has been improved to prevent the tied areas from absorbing dye and spoiling the natural appearance, thereby enhancing the craftsmanship and completely eliminating the low fastness values of direct dyes. The disadvantages of the folding-tying process have been eliminated by filling and compressing the garments into woven polyester nets as certain number and regularly, rather than folding and tying them by hand one by one. The disadvantage of direct dyes, which are the only type of dye that can be used to achieve a batik effect with this tying effect, has been eliminated by applying an ozone wash to garments made from fabrics dyed with fadeable reactive dyes and prepared using the newly developed folding-mesh technique.

Keywords: Batik, Ozone Wash, Batik Dyeing, Batik Washing

Çevre Dostu Denim Efektlendirme İçin Köpük ve Islak Ozon Teknolojilerinin Birlikte Kullanımı

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Özet

Denim giysi üretimi; su, enerji ve kimyasal tüketimi nedeniyle tekstil sektöründe çevresel etkisi en yüksek olan üretim alanlarından biridir. Günümüzde sürdürülebilir üretim anlayışı, denim yıkama proseslerinde su ve kimyasal kullanımını azaltmaya yönelik yenilikçi teknolojilerin geliştirilmesini zorunlu hale getirmiştir. Bu kapsamda köpük ve ozon teknolojileri, çevresel etkileri azaltma ve proses verimliliğini artırma potansiyelleriyle öne çıkmaktadır. Köpük yıkama, düşük flotte oranı sayesinde su kullanımını önemli ölçüde azaltırken, ozon işlemi güçlü oksidatif etkisiyle ağartma aşamasında kimyasal gereksinimini düşürmektedir.

Bu çalışmada, denim yıkamada köpük ve ozon teknolojilerinin kombine edilerek uygulandığı çevre dostu bir proses geliştirilmiştir. Köpük sistemi, ağartma kimyasalını taşıyıcı ortam olarak kullanarak kimyasalın kumaş yüzeyine homojen şekilde yayılmasını sağlamış ve böylece daha düşük miktarda ağartıcıyla etkili sonuçlar elde edilmiştir. Ardından ürünler köpüklü hâlde doğrudan ozonlama işlemine tabi tutulmuş ıslak ozon prosesi uygulanmıştır. Bu yöntem sayesinde ozonun kumaş üzerindeki etkisi artırılmış, renk açma performansı iyileştirilmiş ve kimyasal kullanımında ek bir azalma sağlanmıştır.

Elde edilen sonuçlar, köpüklü ıslak ozon işleminin endüstriyel ölçekte uygulanabilir, düşük çevresel etkiye sahip bir alternatif oluşturduğunu göstermektedir. Bu kombinasyonla su tüketiminde %50'nin üzerinde düşüş gözlemlenmiştir. Kimyasal ve işlem süresinde %15-25 azalma görülmüş ve ağartma prosesinde reaksiyon sıcaklığına gerek duyulmadığı için ısı enerjisi tasarrufu sağlanmıştır. Çalışma, sürdürülebilir denim yıkamada köpük ve ıslak ozon teknolojilerinin birlikte kullanımının etkinliğini ortaya koyarak, çevre dostu üretim süreçleri için yenilikçi bir yaklaşım sunmaktadır.

Anahtar Kelimeler: Denim Yıkama, Sürdürülebilirlik, Köpük aplikasyon, Ozon Gazı

The Combined Use of Foam and Wet Ozone Technologies for Environmentally Friendly Denim Finishing

Abstract

Denim garment production is one of the most environmentally impactful areas of production in the textile industry due to its consumption of water, energy and chemicals. Today, the concept of sustainable production necessitates the development of innovative technologies aimed at reducing water and chemical usage in denim washing processes. In this context, foam and ozone technologies stand out for their potential to reduce environmental impacts and increase process efficiency. Foam washing significantly reduces water consumption thanks to its low flotation ratio, while the ozone process reduces chemical requirements during the bleaching stage with its powerful oxidative effect.

In this study, an environmentally friendly process was developed by combining foam and ozone technologies in denim washing. The foam system ensured the homogeneous distribution of the bleaching chemical on the fabric surface by using it as a carrier medium, thus achieving effective results with a lower amount of bleach. The products were then subjected to direct ozonation in a foamy state, applying a wet ozone process. This method increased the effect of ozone on the fabric, improved colour removal performance, and provided an additional reduction in chemical use.

The results obtained demonstrate that the foamed wet ozone process is an industrially applicable alternative with low environmental impact. This combination has been observed to reduce water consumption by over 50%. A 15-25% reduction in chemicals and processing time has been achieved, and heat energy savings have been realised as the bleaching process does not require reaction temperatures. The study demonstrates the effectiveness of combining foam and wet ozone technologies in sustainable denim washing, offering an innovative approach for environmentally friendly production processes.

Keywords: Denim Washing, Sustainability, Foam Application, Ozone Gas

Finite Element Analysis of Stress Pin Application in a Lobular Cold Forging Die

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Abstract

This study aims to investigate the applicability of the stress pin approach, which generates localized compressive pre-stress within the die to reduce the maximum principal stresses observed in asymmetric cold-forged forms—particularly in applications where the geometry is formed by upsetting. High maximum principal stresses often occur in the die of asymmetric cold-forged parts, significantly limiting die life. Global shrink fitting is widely used to enhance the compressive pre-stress; however, the achievable shrink-fit level is restricted by the yield strength of the case material and is typically insufficient for lobular geometries. In this context, the present study examines the adaptation of stress pins, which generate localized compressive pre-stress in targeted regions of the die. A bolt with a lobular shaft form featuring more than two lobes was selected as the reference product, and the methodology was developed based on the principles introduced by Killmann and Merklein [1]. Unlike global shrink-fitting, the stress-pin approach targets only the regions with high stress concentration. These critical zones are first identified through finite element analysis, after which pins are press-fitted into pockets positioned near the identified areas. The interference fit of the pins induces localized compressive stresses, which counteract the tensile principal stresses generated during forming. The pin diameter, interference level, distance from the forming zone, pin angle and pin quantity were optimized through iterative die analyses conducted in Simufact Forming. Each design variation was evaluated in terms of the induced compressive pre-stress, the maximum principal stresses generated during forming, and the stress distribution around the pin after insertion. The results show that proper optimization of stress pins can enhance local pre-stress levels and reduce the maximum principal stresses in the die, indicating a positive contribution to die life.

Keywords: Bolt, Stress pin, Cold forming, Die.

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Nohut Ununun Besinsel Kompozisyonunun ve Ekstrüzyon Teknolojisinde Potansiyel Kullanımının Değerlendirilmesi

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Özet

Son yıllarda bitkisel protein kaynaklarına yönelik artan tüketici ilgisi, sürdürülebilir ve besleyici bileşenlerin gıda formülasyonlarında kullanımını teşvik etmektedir. Bu kapsamda nohut unu; glutensiz yapısı, düşük yağ içeriği ve fonksiyonel bileşen profili ile özellikle ekstrüzyon teknolojisiyle üretilen atıştırmalıklarda dikkat çekici bir hammaddedir. Ekstrüzyon işleminde hammadde bileşimi, ürünün şişme davranışı, gözenek yapısı ve nihai doku özellikleri üzerinde belirleyici rol oynamaktadır.

Bu çalışmada, dört ticari nohut unu numunesinin besinsel kompozisyonları ve partikül boyutu dağılımları analiz edilmiş; ardından ekstrüzyon işlemindeki patlama performansları değerlendirilmiştir. Sonuçlar, protein ve nişasta içeriği daha yüksek, lif düzeyi ise düşük olan Numune 2 ve Numune 3'ün belirgin patlama kapasitesi gösterdiğini ortaya koymuştur. Buna karşın, lif oranı yüksek olan Numune 1 ve protein düzeyi düşük olan Numune 4'te patlama gözlenmemiştir. Bu bulgular, ekstrüzyon sırasında şişme ve gözenek oluşumunun protein–nişasta dengesi ve lif seviyesine bağlı olarak matriksin gaz tutma kapasitesiyle yakından ilişkili olduğunu göstermektedir.

Sonuç olarak, nohut unu ekstrüde atıştırmalıklarda besin değerini artırmak ve bitkisel protein oranını yükseltmek amacıyla etkili bir bileşen olarak değerlendirilebilir. Ancak istenen doku, hacim ve patlama düzeyinin sağlanabilmesi için formülasyonda protein–nişasta oranı ve lif içeriğinin dikkatle optimize edilmesi gerekmektedir.

Anahtar Kelimeler: Nohut unu, Ekstrüzyon, Patlama performansı, Protein–nişasta dengesi, Diyet lifi, Partikül boyutu, Bitkisel protein, Fonksiyonel gıdalar

Evaluation of the Nutritional Composition and Potential Use of Chickpea Flour in Extrusion Technology

Abstract

In recent years, the increasing consumer interest in plant-based protein sources has encouraged the use of sustainable and nutritious ingredients in food formulations. In this context, chickpea flour stands out as a promising raw material for extruded snack products due to its gluten-free nature, low fat content, and functional component profile. In extrusion processing, the compositional characteristics of the raw material play a critical role in determining the expansion behavior, porosity, and final textural attributes of the product.

In this study, the nutritional compositions and particle size distributions of four commercial chickpea flour samples were analyzed, and their expansion performance during extrusion processing was evaluated. The results showed that Samples 2 and 3, which had relatively higher protein and starch contents and lower dietary fiber levels, exhibited pronounced expansion capacity. In contrast, no expansion was observed in Sample 1, which had a high fiber content, and Sample 4, which had a lower protein level. These findings demonstrate that expansion and pore formation during extrusion are closely linked to the protein–starch balance and fiber content, which together influence the matrix's gas-holding capacity.

In conclusion, chickpea flour can be effectively utilized in the development of extruded snack products to enhance nutritional value and increase plant-based protein content. However, to achieve the desired texture, volume, and expansion characteristics, careful optimization of the protein–starch ratio and dietary fiber level in the formulation is required.

Keywords: Chickpea flour, Extrusion, Expansion performance, Protein–starch balance, Dietary fiber, Particle size, Plant-based protein, Functional foods

Yer Fıstığının Besin Bileşiminin Değerlendirilmesi

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Özet

Son yıllarda tüketicilerin sağlıklı beslenme ve fonksiyonel gıdalara yönelik ilgisinin artması, besin öğesi yoğunluğu yüksek bitkisel hammaddelerin önemini artırmıştır. Bu çalışmada, yer fıstığı (Arachis hypogaea L.) örneklerinin nem, toplam yağ, protein, diyet lif, yağ asidi profili ve E vitamini içerikleri belirlenmiş; sonuçlar literatür ve diğer bitkisel kaynaklarla karşılaştırılmıştır. Analiz sonuçlarına göre yer fıstığı örneklerinde ortalama %1,74 nem, %52,40 yağ, %24,64 protein, %15,54 diyet lifi, %7,92 doymuş yağ asidi, %44,43 doymamış yağ asidi ve 126,55 mg/kg α-tokoferol E vitamini tespit edilmiştir. Düşük nem oranı mikrobiyal stabilite açısından avantaj sağlarken, protein içeriği ayçiçeği tohumu gibi diğer yüksek proteinli bitkisel kaynaklarla benzer olup, birçok ürün formülasyonunda alternatif bir protein kaynağı olarak değerlendirilebilir. Ayrıca, doymamış yağ asidi oranı zeytinyağı gibi tekli doymamış yağ asidi açısından zengin yağlarla benzer düzeydedir. Bu bulgular, yer fıstığının fonksiyonel ve besleyici özellikleriyle gıda endüstrisinde stratejik bir bileşen olarak değerlendirilme potansiyelini ortaya koymaktadır.

Anahtar Kelimeler: Yer fıstığı (*Arachis hypogaea L.*), protein, doymamış yağ asidi, E vitamini, diyet lif, besleyici bileşen

Evaluation of the Nutritional Composition of Peanuts

Abstract

In recent years, consumers' interest in healthy eating and functional foods has increased, highlighting the importance of plant-based ingredients with high nutrient density. In this study, the moisture, total fat, protein, dietary fiber, fatty acid profile, and vitamin E content of peanut (Arachis hypogaea L.) samples were determined, and the results were compared with literature data and other plant-based sources. The analyses revealed that the peanut samples contained an average of 1.74% moisture, 52.40% fat, 24.64% protein, 15.54% dietary fiber, 7.92% saturated fatty acids, 44.43% unsaturated fatty acids, and 126.55 mg/kg α-tocopherol vitamin E. The low moisture content provides an advantage in terms of microbial stability, while the protein content is comparable to other high-protein plant sources, such as sunflower seeds, making peanuts a potential alternative protein source in various product formulations. Additionally, the proportion of unsaturated fatty acids is similar to that of oils rich in monounsaturated fatty acids, such as olive oil. These findings indicate that peanuts possess functional and nutritional properties that make them a strategically valuable ingredient for the food industry.

Keywords: Peanut (*Arachis hypogaea L.*), protein, unsaturated fatty acid, vitamin E, dietary fiber, nutritious ingredient

Kahramanmaraş Kağıt Fabrikası'nda Isı Geri Kazanımı, Mikrobiyolojik Kirlilikle Mücadele ve Su Tasarrufu Olanaklarının Araştırılması

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Özet

Atık kâğıt geri dönüşüm süreçlerinde kullanılan kapalı devre su sistemleri, mikroorganizmaların çoğalması için oldukça elverişli bir ortam oluşturmaktadır. Bu koşullar altında gelişen bakteriler, üretim hattında jelimsi tabakalar (şlaym) meydana getirerek ekipmanlarda tıkanmalara, üretim kesintilerine ve ürün kalitesinde dalgalanmalara yol açmaktadır. Çalışma kapsamında yapılan incelemeler, özellikle devir daim sularında bakteri yoğunluğunun belirli bölgelerde arttığını ve bunun üretim sürecine doğrudan olumsuz etkiler yarattığını ortaya koymuştur.

Mevcut durumda mikrobiyolojik kirliliğin kontrolü büyük ölçüde biyosit gibi kimyasallara dayanmaktadır. Ancak bu yöntemler uzun vadede sürdürülebilir değildir. Kullanılan kimyasallar yalnızca üretim hattında kalmayıp, su buharı ile atmosfere taşınarak kokuya neden olmakta ve çalışan sağlığı üzerinde potansiyel riskler barındırmaktadır. Ayrıca bakterilerin üretim hattına en yakın ve kritik noktalarda yoğunlaşması, ürün kalitesini düşürmekte ve proses verimliliğini azaltmaktadır.

Geri dönüştürülmüş elyaf (RCF) kullanan kâğıt ve karton makineleri, işlenmemiş liflere kıyasla çok daha fazla safsızlık içerdiği için yüksek bakteri aktivitesine maruz kalmaktadır. Bu durum pH düşüşü, yüksek iletkenlik, nişastanın bozunması, kötü koku oluşumu ve tehlikeli gaz salınımı gibi ciddi problemlere neden olmaktadır. Literatürde, bu sorunların bazı durumlarda ölümcül kazalara yol açtığı da rapor edilmiştir. Mikrobiyal kirliliğin artması yalnızca üretim hattında biyofilm oluşumuna değil, aynı zamanda hammadde ve katkıların bozulmasına da sebep olmakta ve önemli ekonomik kayıplar yaratmaktadır. Kahramanmaraş Kâğıt Fabrikası'nda yapılan saha gözlemleri de bu durumu doğrulamaktadır. Fabrikanın PM1 makinesinde mikrobiyolojik kirliliğe bağlı şlaym

tabakaları, üretim duruşları arasında önemli bir paya sahiptir. Bu duruşlar doğrudan üretim kayıplarına yol açarken, makinenin boşuna çalışmaya devam etmesi nedeniyle ton başına enerji tüketimini artırmaktadır.

Bu çalışmada önerilen yöntem, devir daim suyunun sıcaklığının artırılarak mikrobiyal gelişimin baskılanmasına dayanmaktadır. Mevcut durumda 28–32 °C aralığında seyreden devir daim suyunun, haube sisteminden çıkan atık flaş buharın değerlendirilmesiyle 46–52 °C seviyelerine çıkarılması planlanmıştır. Literatür bulguları da bu yaklaşımı desteklemektedir; yaklaşık 30 °C'de bakteriyel gelişimin hızla arttığı, 50 °C'nin üzerinde ise baskılandığı bilinmektedir. Kapalı devre su sistemlerinde besin açısından zengin beyaz suyun mikroorganizmalar için uygun bir ortam oluşturduğu göz önünde bulundurulduğunda, sıcaklık kontrollü bu yaklaşımın önemi daha da belirgin hale gelmektedir.

Sıcak su uygulamasının sağlayacağı faydalar yalnızca biyolojik kontrol ile sınırlı değildir. Bu yöntem sayesinde bakteri kaynaklı üretim kayıpları azaltılabilir, kimyasal (biyosit) tüketiminde düşüş sağlanabilir, enerji verimliliği artırılabilir ve dolayısıyla üretim maliyetleri düşürülebilir. Ayrıca sıcak suyun kurutma süreçlerinde kullanılması kâğıdın daha hızlı kurumasına olanak sağlayarak makine hızını artıracak ve üretim kapasitesini yükseltecektir. Böylelikle önerilen yaklaşım, kimyasal bağımlılığını azaltan, çevresel sürdürülebilirliği destekleyen ve ürün kalitesini artıran yenilikçi bir çözüm olarak öne çıkmaktadır.

Kâğıt üretim süreçlerinde karşılaşılan mikrobiyolojik kirliliğin başlıca etmenleri arasında bakteriler (Bacillus spp., Achromobacter spp., Enterobacter spp., Pseudomonas spp., Clostridium vb.), mantarlar (Aspergillus, Penicillium, Saccharomyces vb.) ve algler bulunmaktadır. Birincil lif kullanan bir tesiste Tepidimonas ve Chryseobacterium türlerini belirlemiş, kâğıt makinesi mikrobiyomlarının küresel ölçekte hâlen bütüncül şekilde araştırılmadığını belirtmiştir. Geri dönüştürülmüş kâğıt üretiminde sorunlara yol açan bakteri türleri daha da az incelenmiştir. Düşük veya sıfır atık su bulunan sistemlerde Enterococcus ve Bacillus'un baskın türler olduğunu, başka bir çalışmada ise iki farklı makinede Actinobacteria ve Bacteroidetes filumuna ait türlerin bulunduğunu bildirmiştir.

Geleneksel olarak toksik biyositler veya slimisitler ile kontrol edilmeye çalışılan biyofilm oluşumu günümüzde alternatif yöntemlerle de hedeflenmektedir. Enzimler, bakteriyofajlar, biyo-dağıtıcılar ve biyokontrol ajanları tek başına veya biyositlerle birlikte kullanılarak biyofilm tabakalarının ortadan kaldırılmasında etkili olabilmektedir. Örneğin proteaz, α-amilaz ve β-glukanaz içeren enzim karışımlarının kâğıt hamuru ve endüstriyel sistemlerde biyofilm oluşumunu önemli ölçüde azalttığı gösterilmiştir. Ancak literatürde yer alan bu yöntemlerin çoğu, kimyasal ya da biyolojik katkılara dayalıdır.

Bu çalışmada ise mevcut prosesin atık ısı kaynağından elde edilen enerjiyle devir daim suyunun ısıtılması ve mikrobiyolojik kirliliğin yoğunlaştığı bölgelerde bu sıcak suyun kullanılması üzerine odaklanmaktadır. Sıcaklık artışı, mikroorganizmaların yaşam dengesini bozarak biyofilm

gelişimini baskılamakta; böylece hem kimyasal bağımlılığını ortadan kaldırmakta hem de enerji ve su tasarrufu sağlamaktadır. Bu özellikleriyle çalışma hem çevresel fayda hem de proses verimliliği açısından literatürdeki yaklaşımlardan ayrılmakta ve özgün bir değer sunmaktadır.

Çalışma kapsamında haube sisteminden çıkan 85 °C sıcaklıktaki atık flaş buharın geri kazanılarak devir daim suyunun sıcaklığının 28–32 °C'den 46–52 °C'ye yükseltilmesi hedeflenmiştir. Laboratuvar testleri, sıcaklık artışının ATP değerlerinde dramatik bir azalmaya yol açtığını göstermiştir: 25 °C'de 46.754 RLU olan bakteri yükü, 50 °C'de 6.100 RLU'ya, 75 °C'de 414 RLU'ya kadar düşmüştür. Ayrıca viskozite 48 cP'den 24,8 cP'ye gerilerken pH ve iletkenlik değerlerinde kayda değer bir değişiklik gözlenmemiştir.

Mekanik testler de bu sonuçları desteklemektedir. SCT değeri 25 °C'de 1,5 kN/m iken 50 °C'de 1,7 kN/m'ye yükselmiş, porozite ise 4,6 sn'den 6,9 sn'ye çıkmıştır. Kopma mukavemeti 35 °C'de 1996 m ile en yüksek seviyeye ulaşmıştır. Bu bulgular, sıcak su uygulamasının yalnızca biyolojik kontrol sağlamadığını, aynı zamanda ürün kalitesinde de artışa yol açtığını göstermektedir.

Enerji geri kazanım hesaplamaları, yılda 63.000 kWh enerji tasarrufu, 2.200 kg biyosit tüketiminde azalma, 6.750 m³ temiz su tasarrufu ve 32 ton CO_2 emisyonunda düşüş sağlanabileceğini göstermektedir. Bu kazanımlar hem çevresel sürdürülebilirlik hem de işletme ekonomisi açısından önemli katkılar sunmaktadır.

Sonuçlar, sıcaklığın mikrobiyolojik aktivite üzerinde baskılayıcı etki gösterdiğini ve biyosit kullanımına duyulan ihtiyacı önemli ölçüde azalttığını ortaya koymaktadır. Ayrıca mekanik testlerdeki iyileşmeler, sıcak su uygulamasının yalnızca biyolojik kontrol değil, ürün kalitesinde de gelişme sağladığını göstermektedir. Enerji geri kazanımıyla elde edilecek ekonomik ve çevresel katkılar, bu yöntemi sektörel ölçekte uygulanabilir kılmaktadır.

Bu çalışma, geri dönüşümlü kâğıt üretiminde mikrobiyolojik kirliliğin kontrolü için atık ısı geri kazanımına dayalı sıcak su yönteminin etkili bir çözüm olduğunu göstermektedir. Kimyasal bağımlılığın azalması, enerji verimliliğinin artması, su tasarrufu ve CO_2 emisyonlarının düşürülmesi sayesinde hem çevresel hem de ekonomik kazanımlar sağlanabilecektir.

Anahtar Kelimeler: Atık kağıt geri dönüşümü, Kağıt üretimi, Mikrobiyolojik kirlilik kontrolü, Enerji geri kazanımı

Investigation of Heat Recovery, Combating Microbiological Contamination, and Water Conservation Opportunities at the Kahramanmaraş Paper Factory

Abstract

Closed-loop water systems used in waste paper recycling processes create an environment highly conducive to the proliferation of microorganisms. Under these conditions, bacteria develop, forming slimy layers (slime) on the production line, leading to equipment clogging, production interruptions, and fluctuations in product quality. Studies conducted within the scope of this work have revealed that bacterial density increases in certain areas, particularly in circulating water, and that this has a direct negative impact on the production process.

Currently, the control of microbiological contamination relies heavily on chemicals such as biocides. However, these methods are not sustainable in the long term. The chemicals used do not remain solely on the production line but are carried into the atmosphere with water vapor, causing odors and posing potential risks to worker health. Furthermore, the concentration of bacteria at the points closest to and most critical for the production line reduces product quality and decreases process efficiency.

Paper and cardboard machines using recycled fiber (RCF) are exposed to high bacterial activity because they contain significantly more impurities compared to virgin fibers. This situation causes serious problems such as pH drop, high conductivity, starch degradation, odor formation, and hazardous gas emissions. The literature reports that these problems have led to fatal accidents in some cases. Increased microbial contamination not only causes biofilm formation on the production line but also leads to the deterioration of raw materials and additives, resulting in significant economic losses. Field observations at the Kahramanmaraş Paper Factory confirm this situation. Slime layers caused by microbial contamination in the factory's PM1 machine account for a significant proportion of production stoppages. These stoppages directly lead to production losses and increase energy consumption per ton due to the machine continuing to run unnecessarily.

The method proposed in this study is based on suppressing microbial growth by increasing the temperature of the circulating water. Currently ranging between 28–32 °C, the circulating water is planned to be raised to 46–52 °C by utilizing waste flash steam from the hood system. Findings in the literature also support this approach; it is known that bacterial growth increases rapidly at approximately 30°C and is suppressed above 50°C. Considering that nutrient-rich white water in closed-loop water systems creates a suitable environment for microorganisms, the importance of this temperature-controlled approach becomes even more apparent.

The benefits of hot water application are not limited to biological control. This method can reduce bacteria-related production losses, decrease chemical (biocide) consumption, increase energy efficiency, and consequently lower production costs. Furthermore, the use of hot water in drying processes will enable the paper to dry faster, increasing machine speed and production capacity. Thus, the proposed approach stands out as an innovative solution that reduces chemical dependency, supports environmental sustainability, and improves product quality.

The main factors contributing to microbiological contamination in paper production processes include bacteria (Bacillus spp., Achromobacter spp., Enterobacter spp., Pseudomonas spp., Clostridium, etc.), fungi (Aspergillus, Penicillium, Saccharomyces, etc.), and algae. In a facility using primary fiber, Tepidimonas and Chryseobacterium species were identified, and it was noted that paper machine microbiomes have not yet been comprehensively studied on a global scale. Bacterial species causing problems in recycled paper production have been studied even less. It has been reported that Enterococcus and Bacillus are the dominant species in systems with low or zero wastewater, while another study found species belonging to the Actinobacteria and Bacteroidetes phyla in two different machines.

Biofilm formation, traditionally controlled with toxic biocides or slime control agents, is now also targeted with alternative methods. Enzymes, bacteriophages, biodispersants, and biocontrol agents, used alone or in combination with biocides, can be effective in removing biofilm layers. For example, enzyme mixtures containing protease, α-amylase, and β-glucanase have been shown to significantly reduce biofilm formation in paper pulp and industrial systems. However, most of the methods described in the literature are based on chemical or biological additives.

This study focuses on heating the recirculating water using energy obtained from the waste heat source of the existing process and using this hot water in areas where microbial contamination is concentrated. The increase in temperature disrupts the life balance of microorganisms, suppressing biofilm development; thus, it eliminates chemical dependency and saves energy and water. With these characteristics, the study stands out from approaches in the literature in terms of both environmental benefits and process efficiency, offering unique value.

The study aimed to recover waste flash steam at 85 °C from the hood system and raise the temperature of the circulating water from 28–32 °C to 46–52 °C. Laboratory tests showed that the temperature increase led to a dramatic decrease in ATP values: the bacterial load, which was 46,754 RLU at 25 °C, decreased to 6,100 RLU at 50 °C and 414 RLU at 75 °C. Furthermore, while viscosity decreased from 48 cP to 24.8 cP, no significant changes were observed in pH and conductivity values.

Mechanical tests also support these results. The SCT value increased from 1.5 kN/m at 25 °C to 1.7 kN/m at 50 °C, while porosity increased from 4.6 s to 6.9 s. The breaking strength reached its highest level at 35 °C with 1996 m. These findings show that hot water treatment not only provides biological control but also leads to an increase in product quality.

Energy recovery calculations show that 63,000 kWh of energy savings, a reduction of 2,200 kg in biocide consumption, 6,750 m³ of clean water savings, and a decrease of 32 tons in CO_2 emissions can be achieved annually. These gains offer significant contributions in terms of both environmental sustainability and operational economics.

The results demonstrate that temperature has an inhibitory effect on microbial activity and significantly reduces the need for biocide use. Furthermore, improvements in mechanical tests indicate that hot water treatment not only provides biological control but also enhances product quality. The economic and environmental benefits achieved through energy recovery make this method feasible for implementation on an industrial scale.

This study demonstrates that the hot water method based on waste heat recovery is an effective solution for controlling microbial contamination in recycled paper production. Reduced chemical dependency, increased energy efficiency, water savings, and lower CO_2 emissions will provide both environmental and economic benefits.

Keywords: Waste paper recycling, Paper production, Microbiological contamination control, Energy recovery

Isı Yalıtımlı Cam Üretiminde Argon Gazı Dolum Prosesi ve Uygulaması

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Özet

Enerji verimliliği ve sürdürülebilir yapı teknolojilerinin önem kazandığı günümüzde, ısı yalıtımlı cam sistemleri binalarda ısı kayıplarını azaltmanın en etkili çözümlerinden biri haline gelmiştir. Bu sistemlerde performansı belirleyen en kritik unsurlardan biri, camlar arasındaki boşluğa doldurulan gaz türüdür. Argon gazı, düşük ısı iletkenliği, kimyasal kararlılığı ve uygun maliyeti nedeniyle sektörde en yaygın kullanılan dolgu gazıdır.

Günümüzde gelişen üretim teknolojileri sayesinde, ısıcam üretim hatlarında argon gazı dolumu tam otomatik sistemler aracılığıyla gerçekleştirilmektedir. Bu otomasyon sistemleri, dolum oranını hassas sensörlerle izleyerek yüksek doğrulukta ve tekrarlanabilir üretim sağlar. Ayrıca entegre sızdırmazlık kontrol üniteleri sayesinde, cam içindeki argon oranının uzun süre korunması garanti altına alınır.

Bu çalışmada otomatik argon dolum sistemlerinin ısıcam üretim makinelerine entegrasyonu, proses adımları, kalite kontrol mekanizmaları ve EN 1279 standardı çerçevesinde yapılan test yöntemleri detaylandırılacaktır. Sunumun amacı, ısıcam üretim makinelerinde otomasyon tabanlı gaz dolum teknolojilerinin enerji verimliliğine ve üretim kalitesine sağladığı katkıları paylaşmaktır.

Anahtar Kelimeler: Isı yalıtımlı cam, argon gazı, otomatik dolum sistemi, üretim makineleri, enerji verimliliği, EN 1279

W-Mo-Si-B Alaşımının SHS ile Üretimi ve Karakterizasyonu

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Özet

Son birkaç yılda yüksek sıcaklık yapısal uygulamalarda Mo-Si-B alaşım sistemleri için çaba gösterilmesinde odak haline gelmiştir. Bu alaşımların yüksek erime noktaları, üstün mukavemet ve iyi oksidasyon direnci özellikliklere sahip olabilecek intermetalik malzemeler geliştirilmektedir. Bununla birlikte, oda sıcaklığında düşük sıcaklıklarda kırılma tokluk özelliği yansıtabilecek ve yüksek sıcaklıklarda da oksidasyon direnci mükemmel davranış sergileyebilecek birçok araştırma çalışmaları yapılmaktadır. Bu nedenle, bizim çalışmamızın odağında yeni nesil ultra yüksek sıcaklık malzeme uygulamalarında gelecekte aday olabilecek yeni bir intermetalik kompozit malzeme geliştirmek, artan çevre enerji zorluklarına çözüm yolu sağlanabilecek ve hem kimyasal hem de fiziksel özelliklere güç kazandırmak için W ilave edilerek W-Mo-Si-B alaşım sistemi üzerinde çalışılmış ve bu alaşımının karakterizasyonu incelenmiştir. Ürünlerin kimyasal bileşenleri, fazlarını ve mikroyapıları incelenerek derinlemesine araştırılmıştır. Ek olarak, endüstriyel uygulamalarda sürdürebilir malzeme üretimine katkı sağlaması için W-Mo-Si-B alaşımı kendi kendine ilerleyen yüksek sıcaklık sentezi (SHS) ile üretim yapılmıştır.

Anahtar Kelimeler: SHS, Mo-Si-B, W-Mo-Si-B, İntermetalik kompozit malzemeler, Yüksek sıcaklık alaşımlar

Test Method Recommendation for Multiprotocol SCADA Architectures

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Abstract

In recent years, the role of automation and control systems in modern electricity distribution networks has increased significantly. With the integration of distributed energy resources (DER) and renewable power plants, SCADA (Supervisory Control and Data Acquisition) architectures have become increasingly complex. SCADA systems enable distribution utilities to monitor, control, and analyze the grid in real time, thereby supporting not only operational efficiency but also system reliability, resilience, and cyber security. However, during commissioning processes, thousands of signals transmitted from the control center to remote terminal units (RTUs), protection relays, and intelligent electronic devices (IEDs) must be verified end-to-end. When traditional Point-to-Point (PTP) tests are performed manually in the field, various challenges arise, including time loss, increased costs, extended planned outages, and occupational safety risks. The SCADA PTP Test Emulator developed in this study addresses these challenges by transferring testing activities to a laboratory environment. Using a Hardware-in-the-Loop (HIL) approach, the system simulates real conditions of substations and distribution centers while supporting multi-device integration through globally adopted communication protocols such as IEC 60870-5-104, Modbus RTU/TCP, and IEC 61850. This capability enables fully vendor-independent operation and seamless communication with devices from different manufacturers,

including RTUs, IEDs, PLCs, power analyzers, and gateways. Thus, the heterogeneous device landscape of distribution networks can be modeled in the laboratory with high fidelity.

The emulator architecture consists of digital input/output modules, industrial communication units, a panel test set, fault detection algorithms, and web/mobile-based visualization modules powered by computer hardware. This structure allows SCADA and RTU configurations to be validated before field deployment, enables automatic detection of incorrect mappings or missing signals, and standardizes the overall testing process. The developed system reduces commissioning times, lowers operational costs, enhances personnel safety, improves operational efficiency, and provides pre-field testing and training capabilities.

Beyond serving as a validation tool for commissioning and operations teams, the test set also functions as a comprehensive laboratory platform that supports education in SCADA and energy automation technologies. Its modular design enables one-to-one modeling of real field connections and signal flows, offering students, technicians, and new engineers a practical training environment through visual feedback components. In this way, the system stands out as a multi-purpose testing and training platform that can be used both for validating operational processes and supporting in-house technical development and training programs.

With these characteristics, the study demonstrates the applicability of hardware-based simulation in SCADA testing processes and represents the first multi-protocol laboratory testing infrastructure tailored to the needs of the electricity distribution sector in Türkiye. The system architecture was developed under the leadership of GDZ Electricity Distribution Inc., in partnership with Boğaziçi Electricity Distribution Inc., and with consultancy from Endoks Energy Inc.

Keywords: SCADA, Point-to-Point Test, Emulator, Hardware-in-the-Loop, Operational Efficiency

Çok Protokollü SCADA Mimarileri için Test Yöntemi Önerisi

Özet

Modern elektrik dağıtım şebekelerinde otomasyon ve kontrol sistemlerinin rolü son yıllarda önemli ölçüde artmıştır. Dağıtık enerji kaynaklarının (DEK) ve yenilenebilir enerji santrallerinin entegrasyonu ile birlikte, SCADA (Supervisory Control and Data Acquisition, Merkezi Kontrol ve Veri Toplama Sistemi) mimarileri daha karmaşık bir hâl almıştır. SCADA sistemleri; dağıtım şirketlerine şebekeyi gerçek zamanlı izleme, kontrol etme ve analiz etme imkânı tanıyarak yalnızca operasyonel verimliliği değil, aynı zamanda sistem güvenilirliği, dayanıklılığı ve siber güvenliği de desteklemektedir. Ancak, bu sistemlerin devreye alma süreçlerinde kontrol merkezinden RTU'lara (Remote Terminal Unit), koruma rölelerine ve akıllı elektronik cihazlara (IED) iletilen binlerce sinyalin uçtan uca doğrulanması gerekmektedir. Geleneksel Noktadan-Noktaya (Point-to-Point, PTP) testler manuel olarak sahada yürütüldüğünde; zaman kaybı, artan maliyet, planlı kesinti süresi uzaması ve iş güvenliği riskleri gibi zorluklar ortaya çıkmaktadır.

Bu çalışmada geliştirilen SCADA PTP Test Emülatörü, test faaliyetlerini laboratuvar ortamına taşıyarak bu sorunlara çözüm sunmaktadır. Sistem, Döngüdeki Donanım (Hardware-in-the-Loop, HIL) yaklaşımıyla trafo ve dağıtım merkezlerindeki gerçek koşulları simüle ederken; IEC 60870-5-104, Modbus RTU/TCP ve IEC 61850 gibi dünya genelinde kullanılan haberleşme protokolleri üzerinden çoklu cihaz entegrasyonunu desteklemektedir. Bu özellik, test setinin tamamen marka bağımsız çalışabilmesini sağlayarak farklı üreticilere ait RTU, IED, PLC, enerji analizörü ve gateway gibi cihazlarla sorunsuz iletişim kurmasına olanak tanımaktadır. Böylece dağıtım şirketlerinin sahadaki heterojen cihaz yapısı, laboratuvar ortamında gerçeğe en yakın şekilde modellenebilmektedir.

Emülatör mimarisi; dijital giriş-çıkış modülleri, endüstriyel haberleşme birimleri, pano test seti, hata tespit algoritmaları ve bilgisayar donanımlı web/uygulama tabanlı görselleştirme modüllerinden oluşmaktadır. Bu yapı, RTU ve SCADA konfigürasyonlarının sahaya çıkmadan önce doğrulanmasını, yanlış eşleme veya eksik sinyallerin otomatik tespit edilmesini ve testlerin standardize edilmesini sağlamaktadır. Geliştirilen sistem, devreye alma sürelerini azaltarak operasyonel maliyetleri düşürmekte, personel güvenliğini artırmakta, operasyonel verimliliği artırmakta ve saha öncesi test ve eğitim imkânı sunmaktadır.

Ayrıca test seti, yalnızca işletme ve devreye alma ekiplerine yönelik bir doğrulama aracı olmanın ötesinde, SCADA ve enerji otomasyon teknolojileri alanında eğitim verilmesine olanak sağlayan kapsamlı bir laboratuvar platformu niteliği taşımaktadır. Modüler yapısı sayesinde gerçek saha

bağlantıları ve sinyal akışları birebir modellenebilmekte ve görsel geri bildirim bileşenleri aracılığıyla öğrencilere, teknisyenlere, yeni başlayan mühendislere uygulamalı bir eğitim altyapısı sunulmaktadır. Böylelikle sistem, hem operasyonel süreçlerin doğrulanmasında hem de kurum içi teknik gelişim ve eğitim programlarında kullanılabilecek çok amaçlı bir test ve öğretim seti olarak öne çıkmaktadır.

Bu yönüyle çalışma, SCADA test süreçlerinde donanım tabanlı simülasyonun uygulanabilirliğini ortaya koyarak Türkiye'de enerji dağıtım sektörüne özgü ilk çok-protokollü laboratuvar test altyapısını temsil etmektedir. Bu sistem mimarisi çalışmaları, GDZ Elektrik Dağıtım A.Ş. yürütücülüğünde, Boğaziçi Elektrik Dağıtım A.Ş. paydaşlığında ve Endoks Enerji A.Ş. danışmanlığında gerçekleştirilmiştir.

Anahtar Kelimeler: SCADA, Noktadan-Noktaya Test, Emülatör, Döngüdeki Donanım, Operasyonel Verimlilik

Alüminyum Gövdeli Gemi Şaft Sızdırmazlık Elemanının Geliştirilmesi

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Özet

Günümüzde şaft geçişlerinde kullanılan sızdırmazlık elemanları, gemi ve endüstriyel makinelerde güvenlik ve verimlilik açısından kritik öneme sahiptir. Mevcut uygulamalar, genellikle elastomer contalar, metal muhafazalar veya yağlama destekli sistemler üzerine kuruludur. Ancak bu yapılar, montaj sırasında hizalama hatalarına karşı hassas olup birleşim noktalarında sızıntı riski barındırmakta, uzun süreli kullanımda korozyon ve aşınma sorunları ile karşılaşmaktadır. Ayrıca kauçuk veya yaylı mekanizmalara dayalı çözümler, yüksek basınç, titreşim ve sıcaklık altında deformasyona uğrayarak sızdırmazlık performansını kaybederken, yağlama gerektiren sistemler bakım maliyetlerini artırmakta ve çevresel riskler oluşturmaktadır. Bu yetersizlikler, daha dayanıklı, montajı kolay, bakım gereksinimi düşük ve korozyona dirençli yenilikçi tasarımlara olan ihtiyacı ortaya koymaktadır.

Bu çalışmada, özellikle endüstriyel makine ve denizcilik uygulamalarında güvenli montaj sağlamak amacıyla kullanabilecek puzzle tipi bir sızdırmazlık elemanı tasarım, geliştirilmesi ve üretilmesi amaçlanmıştır. Bu tasarımın en önemli avantajı, denizcilik uygulamalarında sıklıkla karşılaşılan sızdırma, montaj zorlukları ve korozyon problemlerine etkili çözümler sunmasıdır. Üç parçalı puzzle tipi geçmeli tasarım, tamamlayıcı (dişi-erkek) bağlantı noktaları sayesinde parçaların montaj sırasında otomatik olarak hizalanmasını sağlayarak, işçilik kaynaklı hataları minimize eder ve montaj süresini kısaltmaktadır. Geçmeli bağlantı yapısı sayesinde birleşim noktalarındaki temas yüzeyi artırılarak sızdırmazlık performansı maksimum seviyeye çıkarılmaktadır. Dış yüzeyde bulunan kanal, O-ring, conta veya sıkıştırma teli gibi ek elemanların yerleştirilmesine olanak tanıyarak yüksek basınç ve titreşim altında dahi güvenli bir bağlantı

sağlamaktadır. Kullanılan karbon grafit ve korozyona dayanıklı alüminyum alaşımı, deniz ortamındaki aşındırıcı etkiler karşısında uzun ömür ve bakım kolaylığı sunmaktadır. Ayrıca yapının hafif olması, montaj ve taşıma süreçlerini kolaylaştırırken, sistemin genel maliyetini de düşürmektedir. Tüm bu özellikler, güvenlik, dayanıklılık ve operasyonel verimlilik açısından mevcut sistemlere kıyasla önemli üstünlükler sağlamaktadır.

Anahtar Kelimeler: Sızdırmazlık elemanları, Puzzle tip Şaft sızdırmazlık elemanı, Korozyon direnci, Denizcilik uygulamaları, Karbon-grafit entegrasyonu

Development of an Aluminum Body Ship Shaft Sealing Element

Abstract

Sealing elements used in shaft passages today are of critical importance for ensuring safety and efficiency in marine and industrial machinery applications. Current implementations are generally based on elastomeric gaskets, metal housing, or lubrication-assisted systems. However, these structures are sensitive to misalignment during assembly, prone to leakage at joint interfaces, and susceptible to corrosion and wear over long-term use. Moreover, solutions based on rubber or spring mechanisms lose their sealing performance under high pressure, vibration, and temperature, while lubrication-dependent systems increase maintenance costs and pose environmental risks. These limitations highlight the need for innovative designs that are more durable, easy to assemble, low-maintenance, and resistant to corrosion.

In this study, a puzzle-type sealing element was designed, developed, and manufactured to ensure reliable assembly, particularly for industrial machinery and marine applications. The main advantage of this design is its ability to effectively address common issues in marine environments such as leakage, assembly difficulties, and corrosion. The three-piece interlocking puzzle-type structure enables automatic alignment of parts during installation through complementary (male-female) connection points, thereby minimizing assembly errors and reducing installation time. The interlocking connection design increases the contact surface area at the joints, maximizing sealing performance.

Additionally, an external groove allows the integration of auxiliary components such as O-rings, gaskets, or compression wires, ensuring a secure connection even under high pressure and vibration conditions. The use of carbon graphite and corrosion-resistant aluminum alloy provides long service life and ease of maintenance against the aggressive marine environment. Furthermore, the lightweight structure facilitates assembly and transportation processes while reducing the overall system cost. All these features offer significant advantages over existing systems in terms of safety, durability, and operational efficiency.

Keywords: Sealing elements, Puzzle type shaft sealing element, Corrosion resistance, Marine applications, Carbon-graphite integration

Deri Etkisinin İletken Geometrisine Bağlı Değişiminin Analizi: Busbar ve Kablo Geometrilerinin Karşılaştırması

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Özet

Bu çalışmada, kesit alanları eşit olan dikdörtgen kesitli busbar iletkeni ile silindirik geometrideki kablo iletkeninin deri etkisine bağlı elektromanyetik davranışı karşılaştırılarak; geometrinin endüktans, AC direnç, manyetik akı yoğunluğu, akım yoğunluğu dağılımı ve güç kayıpları üzerindeki etkisi incelenmiştir. Çalışmada Sonlu Elemanlar Yöntemi (FEM) tabanlı kararlı hal AC analizleri kullanılarak frekansa bağlı direnç değerleri, iç ve dış manyetik alan dağılımları ve güç yayılımındaki farklılıklar karşılaştırmalı olarak sunulmuştur.

Elde edilen sonuçlar, aynı DC direncine sahip olmalarına rağmen dikdörtgen iletken ile silindirik iletkenin AC koşullarda belirgin şekilde farklı davrandığını göstermektedir. Silindirik iletkenler radyal olarak simetrik bir akım dağılımı sunsa da deri etkisi altında kesitin etkin kullanımı sınırlanmakta, daha yüksek AC direnç ve daha yüksek tepe akım yoğunluğu ortaya çıkmaktadır. Buna karşılık dikdörtgen kesitli busbarlar, bir doğrultuda daha geniş yüzey uzaması sayesinde akımın dış bölgelere daha etkin yayılmasına olanak tanımakta; incelenen konfigürasyonlarda daha düşük AC direnci, kritik bölgelerde daha düşük tepe manyetik akı ve daha dengeli akım yoğunluğuna sahiptir. Bunların neticesinde de kayıplar iletken geometrisi boyunca daha dengeli bir dağılım sergilemiştir. Elde edilen bu bulgular, malzeme ve kesit alanı sabit kalsa dahi iletken

geometrisinin yüksek akımlı AC uygulamalarında endüktans, kayıplar ve genel elektromanyetik performans üzerinde belirleyici bir parametre olduğunu ortaya koymaktadır.

Anahtar Kelimeler: Deri etkisi, iletken geometrisi, busbar, silindirik iletken, endüktans, AC direnç, manyetik akı yoğunluğu, akım yoğunluğu, elektromanyetik güç yoğunluğu, FEM analizi.

Analysis of the Geometry-Dependent Variation of the Skin Effect: A Comparative Study of Busbar and Cable Conductors

Abstract

In this study, the electromagnetic behavior associated with the skin effect is comparatively evaluated for a rectangular busbar conductor and a cylindrical cable conductor having identical cross-sectional areas. The influence of conductor geometry on inductance, AC resistance, magnetic flux density, current density distribution, and power losses is examined in detail. Steady-state AC analyses based on the Finite Element Method (FEM) are employed to obtain frequency-dependent resistance values, internal and external magnetic field distributions, and differences in power dissipation, all of which are presented in a comparative manner.

The obtained results indicate that, despite having the same DC resistance, the rectangular and cylindrical conductors exhibit markedly different behaviors under AC conditions. Although cylindrical conductors provide radially symmetric current distribution, the effective utilization of their cross-section becomes limited under the skin effect, leading to higher AC resistance and increased peak current density. In contrast, rectangular busbars allow the current to spread more effectively toward the outer regions due to their extended surface in one direction; in the analyzed configurations, they exhibit lower AC resistance, lower peak magnetic flux in critical regions, and a more uniform current density distribution. Consequently, power losses are more evenly distributed along the conductor geometry.

These findings reveal that, even when material and cross-sectional area are kept constant, conductor geometry is a decisive parameter influencing inductance, losses, and overall electromagnetic performance in high-current AC applications.

Keywords: Skin effect, conductor geometry, equal cross-section, busbar, cylindrical conductor, inductance, AC resistance, magnetic flux density, current density, electromagnetic power density, FEM analysis.

Orta Gerilim Sistemlerinde İletken Geometrisinin Elektrik Alan Yoğunluğu ve Yalıtım Dayanımı Üzerine Etkisinin İncelenmesi

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Özet

Bu çalışma, orta gerilim (OG) busbar sistemlerinde iletken geometrisinin elektrik alan yoğunluğu, kısmi deşarj (PD) başlama gerilimi ve genel yalıtım dayanımı üzerindeki etkilerini incelemektedir. Dikdörtgen, dairesel ve pah kırılmış çeşitli kesit geometrileri, COMSOL Multiphysics kullanılarak gerçekleştirilen sayısal elektrostatik analizlerle değerlendirilmiştir. Elde edilen sonuçlar; keskin köşelerin, küçük köşe yarıçaplarının ve yüksek en-boy oranına sahip kesitlerin lokal elektrik alan gerilimini belirgin şekilde artırdığını, bunun ise PD başlama gerilimini düşürerek yalıtım güvenilirliğini olumsuz etkilediğini göstermektedir. Ayrıca, köşe yarıçapının artırılması, kesit oranlarının optimize edilmesi ve alan gradyanlarının yumuşatılması gibi geometrik iyileştirmelerin alan yoğunlaşmasını bastırdığı ve uzun dönem yalıtım dayanımını artırdığı ortaya konmuştur. Çalışma, OG busbar tasarımında iletken geometrisinin kritik rolünü vurgulamakta ve PD riskinin azaltılması ile dielektrik dayanımın artırılmasına yönelik mühendislik yönlendirmeleri sunmaktadır.

Anahtar Kelimeler: Orta gerilim busbar, elektrik alan yoğunluğu, iletken geometrisi, kısmi deşarj, dielektrik dayanımı, elektrostatik analiz, yalıtım tasarımı.

Analysis of Conductor Geometry Influence on Electric Field Density and Dielectric Withstand Capability in Medium-Voltage Systems

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Abstract

This study investigates the influence of conductor geometry on electric-field intensification, partial discharge (PD) inception, and overall insulation strength in medium-voltage (MV) busbar systems. Various conductor cross-section profiles, including rectangular, circular, and chamfered geometries, were analyzed using numerical electrostatic simulations performed in COMSOL Multiphysics. The results demonstrate that sharp edges, small corner radii, and high aspect-ratio cross-sections significantly increase localized electric-field stress, thereby reducing the PD inception voltage and compromising dielectric reliability. The study also shows that appropriate geometric optimization—such as increasing edge radius, adjusting cross-section proportions, and smoothing electric-field gradients—effectively suppresses field enhancement and improves long-term insulation performance. These findings highlight the critical role of conductor geometry in MV busbar design and provide engineering guidelines for minimizing PD risk and enhancing dielectric robustness.

Keywords: Medium-voltage busbar, electric field intensification, conductor geometry, partial discharge, dielectric strength, electrostatic analysis, insulation design.

Busbar Enerji Dağıtım Sistemlerinin Termal Davranışının Çoklu-Fizik Tabanlı Deneysel ve Sayısal Değerlendirilmesi

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Özet

Bu çalışma, doğal konveksiyon koşullarında çalışan busbar enerji dağıtım sistemlerinin termal davranışının deneysel ve sayısal olarak karşılaştırılmasını sunmaktadır. Deneysel sıcaklık artışı ölçümleri, akım taşıyan busbar örneklerinin kararlı ve geçici durumlarda değerlendirildiği kontrollü bir test düzeneğinde elde edilmiştir. Buna paralel olarak, sayısal simülasyonlar Joule ısı üretimi, ısı iletimi ve doğal konveksiyon mekanizmalarını içeren çoklu fizik tabanlı modeller kullanılarak gerçekleştirilmiştir. Deneysel ve sayısal sonuçların karşılaştırılması, özellikle konvektif ısı transfer katsayısı (h) ve malzeme özelliklerinin doğru kalibrasyonu ile sıcaklık farklarının ±2 °C mertebesine indirilebildiğini göstermektedir. Elde edilen bulgular, yüksek akımlı busbar sistemlerinin termal tasarım güvenilirliğini artırmak için doğrulanmış sayısal modeller ile laboratuvar ölçümlerinin birlikte kullanılmasının önemini vurgulamaktadır.

Anahtar Kelimeler: Busbar sistemleri, termal davranış, doğal konveksiyon, çoklu-fizik modelleme, deneysel doğrulama, sayısal analiz, Joule ısısı, CFD simülasyonu.

Multiphysics Experimental and Numerical Evaluation of Thermal Behavior in Busbar Energy Distribution Systems Under Natural Convection

Abstract

This study presents a comprehensive multiphysics experimental and numerical evaluation of the thermal behavior of busbar energy distribution systems operating under natural convection conditions. Experimental temperature-rise measurements were conducted using a controlled test platform where high-current busbar samples were examined under steady-state and transient conditions. Parallel to the laboratory tests, numerical simulations were developed using multiphysics modeling techniques incorporating Joule heating, heat conduction, and natural convection. A comparative analysis between experimental and simulation data demonstrates that temperature deviations can be reduced to within ±2 °C through accurate calibration of material properties and boundary conditions, particularly the convective heat transfer coefficient (h). The results emphasize the significance of integrating validated numerical models with experimental measurements for enhancing the reliability and accuracy of thermal design in high-current busbar systems.

Keywords: Busbar systems, thermal behavior, natural convection, multiphysics modeling, experimental validation, numerical analysis, Joule heating, CFD.

Merkezi Ve Güvenli Bir Uzaktan Içerik Yönetim Sistemi Ile Derin Öğrenme Tabanlı Müşteri Analizi Modüllerinin Geliştirilmesi

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Abstract

Bu bildiri, dijital signage ekosistemi için geliştirilen Akıllı İçerik Yönetimi platformunun Ar-Ge süreci, teknik bileşenleri ve sektörel katkılarını ortaya koymayı amaçlamaktadır. Türkiye ve dünyada hızla büyüyen dijital ekran çözümleri pazarında, içerik yönetimi hâlen manuel işlemler, cihaz bağımlılığı, sınırlı veri analizi ve güvenlik açıları nedeniyle operasyonel zorluklar içermektedir. Proje kapsamında geliştirilen sistem; merkezi, güvenli, yapay zekâ destekli, bulut tabanlı ve ölçeklenebilir bir yapı sunarak bu sorunlara çözüm odaklı bir yaklaşım geliştirmektedir. Proje kapsamında geliştirilen platform, bir yandan bulut tabanlı içerik yönetim sistemi (CMS) ile ekranların uzaktan yönetimini sağlarken, diğer yandan gerçek zamanlı görüntü işleme ve derin öğrenme modülleriyle müşteri davranışlarını analiz etmektedir. Bu yapı sayesinde sistem, sadece içerik dağıtımı yapan geleneksel ekran kontrol çözümlerinden ayrışarak, veri odaklı karar mekanizmaları içeren ileri seviye bir akıllı dijital signage mimarisi sunmaktadır. Görüntü işleme modülleri, YOLOv8 tabanlı nesne tanıma, DeepSORT ile kişi takibi, CNN modelleri ile yaş ve cinsiyet sınıflandırması yapmaktadır. Bu algoritmalar GPU hızlandırma sayesinde gerçek zamanlı çalışmakta, 15–30 FPS performans seviyesine ulaşmaktadır. Böylece müşteri sayımı, yoğunluk ölçümü, demografik analiz ve davranış analitiği gibi çıktılar, pazarlama ve içerik planlama süreçlerini otomatik olarak optimize edebilmektedir.

Projede geliştirilen platform, API tabanlı entegrasyon mimarisi ile CRM, POS, e-ticaret sistemleri ve kampanya yönetim araçlarıyla entegre çalışabilmektedir. Bu sayede perakende, restoran zincirleri, oteller, bankacılık, akıllı şehir uygulamaları, sağlık kuruluşları ve toplu taşıma gibi çok farklı sektörlerde doğrudan kullanılabilir modüler bir çözüm sunmaktadır. Ar-Ge sürecinde Agile metodolojisi, CI/CD, konteyner tabanlı dağıtım, MLOps ve edge computing gibi modern yazılım geliştirme yaklaşımları kullanılmıştır. Proje çıktıları yalnızca bir ürün geliştirme çalışması olmanın ötesine geçerek, ülkemizde görüntü işleme, derin öğrenme ve

bulut tabanlı yazılım geliştirme ekosistemine katkı sağlayan bir Ar-Ge modeli ortaya koymaktadır. Sonuç olarak bu çalışma, bilgilendirme ekranları (dijital signage) pazarında yüksek katma değerli, yerli, yapay zekâ destekli, güvenli ve veri odaklı bir platform olarak sektörel dönüşümü hızlandırmayı hedeflemektedir.

Anahtar Kelimeler: yapay zeka tabanlı içerik yönetimi, bulut tabanlı cms, bilgilendirme ekranları

Abstracts of Full Papers that published in The European Journal of Research and Development

A Compact Non-Intrusive Measurement System for Critical Dimensions and Calibration Chart Generation of Underground Fuel Tanks

Published: Dec 31, 2025

DOI: https://doi.org/10.56038/ejrnd.v5i1.724

Article ID: 724

Keywords:

CalibeX-Pro Calibration Chart Underground Fuel Tanks Laser EDM ATEX Explosion-proof Non-destructive Inspection OIML R 71

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Abstract

This paper presents a compact, non-intrusive measurement system designed for determining the critical dimensions and generating calibration charts of underground fuel tanks via a 2-inch access port. The system employs a laser electronic distance measurement (EDM) device located outside the Zone 0 hazardous environment, with the beam directed into the tank through a mirror-based tilt mechanism. A key contribution is the ability to generate accurate calibration charts. Mirror tilt actuation is controlled via a linear actuator, where the non-linear relation between displacement and angular rotation can be resolved either through a lookup table or analytically as the mechanical linkage properties are known. The methodology involves coarse scanning for tank geometry estimation followed by targeted high-resolution scans at critical angles to derive diameter, length, dome geometry, and inclination. Real-world results demonstrate

volumetric accuracy better than 0.2%, with an expected performance of 0.3% [1] in calibration chart generation, confirming that the system meets industrial standards for underground storage tank metrology, including OIML R 71.

Development of Yarn Detection Sensor for Circular Patterned Yarn Dyeing Machine

Published: Nov 29, 2025

DOI: https://doi.org/10.56038/ejrnd.v5i1.688

Article ID: 688

Keywords:

Yarn break sensors Patterned circular dyeing technology Smart Production and Automation in Textiles

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Abstract

The textile industry has undergone a radical transformation in recent years, driven by digitalization, automation, and the pursuit of sustainable production. In this transformation, electronic and computer-based sensor technologies are gaining prominence in critical areas such as production line monitoring, process control, quality assurance, and energy efficiency. This study examines the development of a yarn detection sensor for a circular machine featuring patterned yarn dyeing technology. Unlike traditional dyeing methods, this technology combines the yarn transfer process with the dye spray system, enabling direct patterning of the yarn. Only the required

amount of dye molecules chemically reacts with the yarn, resulting in significant savings in water and energy consumption. The system, with 36 independent dyeing stations, offers flexible production; however, yarn breaks, resulting from factors such as yarn raw material, strength, twist, and friction, lead to production losses and defective package formation. The import of currently used yarn detection sensors poses a significant disadvantage in terms of cost and lead time. Therefore, this study has developed a domestically produced sensor that can instantly detect yarn breaks, communicate with the machine in real time, and automatically stop the station. The developed system will minimize production losses and delivery delays, saving energy and resources. Consequently, the design and integration of a domestic yarn detection sensor will not only improve production quality and efficiency, but will also contribute to reducing external dependency and promoting environmental sustainability. In this respect, the study can contribute to advancements in smart production technologies in the textile industry.

Analytical Prediction and Experimental Validation of Bolt Self-Loosening under Vibration

Published: Dec 3, 2025

DOI: https://doi.org/10.56038/ejrnd.v5i1.693

Article ID: 693

Keywords:

Self-loosening Fasteners Vibration Junker test Analytical Modeling

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Abstract

The self-loosening of bolted joints under vibrational loading remains a persistent challenge in many engineering applications, especially in the automotive industry, where safety and reliability are of paramount importance. Predicting self-loosening behavior is challenging because numerous parameters influence joint performance, as well as the limitations of conventional experimental testing. This study presents a novel analytical model for predicting bolt and nut loosening behavior under transverse vibration. The model extends existing approaches by incorporating additional parameters such as displacement, clamping force, and under-head friction torque. To enhance usability, the model was implemented in an MS Excel–based calculator with macro functions, enabling engineers to perform loosening analyses under varying conditions. The model adapts and extends existing approaches from the literature by incorporating an energy equilibrium approach, which calculates bolt rotation by balancing the torsional strain

energy accumulated during vibration with the kinetic energy released once the applied torque exceeds the critical threshold. The analytical predictions were validated through Junker vibration tests, showing strong agreement with experimental data. The proposed model and tool provide a practical and accessible method for predicting loosening, thereby enabling the design of safer and more reliable fasteners while strengthening industrial competitiveness.

A New Approach Based on Ensemble Clustering for the Fabric Color Batching Problem

Published: Dec 5, 2025

DOI: https://doi.org/10.56038/ejrnd.v5i1.700

Article ID: 700

Keywords:

Color batching Ensemble clustering DBSCAN algorithm K-means algorithm Agglomerative clustering

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Abstract

The fashion industry is one of the industries most influenced by aesthetics and quality. This necessitates that products manufactured for this industry possess high quality and aesthetic appeal. Denim products are among the most frequently used in this industry for various purposes. This study proposes an ensemble clustering approach for visually sorting batches to reliably classify color consistency in denim fabrics. First, separate batches were obtained using three common methods (DBSCAN, hierarchical clustering, and K-Means) with 800×800 pixel RGB images of fabric samples for each order. Then, an ensemble rule based on the majority principle was designed to reduce inconsistencies

between methods and balance random initialization and parameter sensitivity. Each sample was assigned to the final batch according to the majority preference among the batches given by the three algorithms. It is evaluated that the proposed approach by comparing it with reference batch assignments predefined by experts. The outputs of the individual algorithms and the ensemble results are compared each other. The findings show that the ensemble rule produces more stable batches that are closer to expert decisions. While preserving the strengths of the individual methods, the ensemble rule reduces the impact of their weaknesses.

Synthesis and Characterization of Stereoselective Ozonides for Sustainable Textile Wet Processes

Published: Dec 6, 2025

DOI: https://doi.org/10.56038/ejrnd.v5i1.701

Article ID: 701

Keywords:

Stereoselective ozonide synthesis ozonolysis textile applications cyclic voltammetry

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Abstract

This study focuses on the stereoselective synthesis of ozonides for potential applications in different textiles processes. By synthesizing controlled ozonide in a closed-circuit reactor, high stereoselectivity (>90% ozonide formation) was achieved, enabling sustainable denim fading, cotton bleaching and/or different textile washing processes. This method will significantly reduce water usage and chemical discharge compared to traditional processes. In-depth analyses using UV-vis spectroscopy, FTIR, NMR, X-ray diffraction (XRD), cyclic voltammetry (CV), and oxidation-reduction potential (OPR) measurements demonstrate selective chromophore degradation without cellulose degradation, confirming the role of ozonide intermediates in targeted oxidation. This innovation aligns with the EU Green Deal principles, which promote circular economy

applications in textiles. Its scalability and low energy profile highlight its applicability for eco-efficient textile production.

Development of a New Door System with High Thermal Resistance and Improved Sealing Performance for Refrigerated Display Cabinets

Published: Dec 7, 2025

DOI: https://doi.org/10.56038/ejrnd.v5i1.704

Article ID: 704

Keywords:

Refrigerated display cabinet energy efficiency sealing performance thermal resistance door design

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Abstract

In this study, a new door system design was developed for the door-to-door and door-to-frame junctions of the Refrigerated Display Cabinet (RDC), where energy savings are

concentrated. The aim is to improve sealing performance by reducing thermal bridges, thereby reducing the system's overall energy consumption. As part of the design, the silicone filling volume in the door bottom mold was increased, a magnetic seal element was integrated, and a new door gasket was developed. Test studies were conducted in accordance with ISO 23953-2:2023, and comparative analyses were performed using the current system. Experimental results showed that the new design improved heat transfer efficiency by increasing the temperature difference between the evaporator inlet and outlet. Additionally, the average product temperature in the cabinet was improved by up to 5%. According to energy consumption analyses, annual energy consumption decreased from 13,231 kWh to 6,906 kWh, resulting in approximately 47.8% energy savings. Carbon emissions calculations over a ten-year lifespan showed a decrease from 82,033 kg of CO_2 to 42,816 kg of CO_2. As a result, the new door system was evaluated as a long-lasting solution that increases energy efficiency, contributes to environmental sustainability, and provides a more sustainable solution.

Machine Learning-Based Vehicle Renewal Prediction: A Hybrid Approach for Customer Retention in Premium Automotive Markets

Published: Dec 7, 2025

DOI: https://doi.org/10.56038/ejrnd.v5i1.692

Article ID: 692

Keywords:

Customer retention prediction Vehicle renewal forecasting Automotive analytics Machine learning Logistic regression Predictive modeling Random forest

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Abstract

Customer retention and vehicle renewal prediction remain critical challenges in premium automotive markets. This study presents a comprehensive data-driven framework for predicting BMW customer renewal probability using historical transactional and behavioral data from Borusan Otomotiv's enterprise systems. We developed a hybrid machine learning model that integrates Random Forest feature selection with Binary Logistic Regression to achieve interpretability while maintaining predictive accuracy. The model leverages customer demographics, service engagement metrics, and ownership patterns to generate individual-level renewal probability scores.

Evaluated on 1,211 holdout observations through temporal validation, the model achieved 77% overall accuracy and an AUC-ROC of 0.80, demonstrating strong discriminatory power in distinguishing between renewal and non-renewal customers. Model outputs are transformed into five operational risk grades (G1-G5) and seamlessly integrated into Salesforce CRM, enabling proactive customer relationship management and targeted retention strategies.

Key empirical findings indicate that service expenditure patterns, time since last purchase, and multi-vehicle ownership significantly influence renewal likelihood. The framework bridges predictive analytics with operational deployment through automated data pipelines and continuous model monitoring, representing a practical approach to data-driven customer retention in the automotive sector.

UWB-Based High-Precision Real-Time Positioning and Multi-Dimensional Visualization

Published: Dec 10, 2025

DOI: https://doi.org/10.56038/ejrnd.v5i1.721

Article ID: 721

Keywords:

UWB RTLS Positioning VPS Real-Time Tracking 3D Visualization Kalman Filter TWR Industrial

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Abstract

This study presents a high-precision indoor positioning and multi-dimensional visualization system, named Virtual Positioning System (VPS), which utilizes Ultra-Wideband (UWB) technology. The VPS features an integrated architecture comprising

portable Tag devices, fixed anchor units, a data collector called Position Box, and a web-based server. Tests conducted in various scenarios (office, factory, and retail environments) demonstrated that the system achieves a positioning accuracy of ±30 cm and provides high data stability.

The Two-Way Ranging (TWR) algorithm and Kalman filter minimize measurement noise, while IEEE 802.3-based communication prevents data loss. The 2D and 3D visualization modules provide capabilities for movement tracking, density mapping, and area-based analysis. In particular, 3D visualization enhances operational awareness by providing depth perception in multi-story buildings or metal-dense environments. The VPS is well-suited for future developments in terms of energy efficiency, signal stability, and visualization performance, adding value to industrial, corporate, and security-focused operations.

CarrGo® Sorter: Parcel Sorting System with Autonomous Multi-Robots

Published: Dec 10, 2025

DOI: https://doi.org/10.56038/ejrnd.v5i1.722

Article ID: 722

Keywords:

Autonomous Robots AGV Route Optimization Warehouse Automation Logistics Robotics Traffic Management Smart Sorting System

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Abstract

This paper presents the design, development, and validation of the CarrGo® Sorter System, an autonomous multi-robot sorting system for logistics and cargo handling environments. The system automates parcel classification, routing, and transferring operations using a fleet of Automated Guided Vehicles (AGVs) controlled by a software. Each robot is equipped with embedded sensors, magnetic line follower, and RFID-based localization to navigate a structured grid platform. By integrating barcode reader and real-time communication protocols, the CarrGo® Sorter System achieves high sorting throughput with reduced dependency on human operators. Simulation and field tests demonstrated that the system can increase sorting speed while avoiding collision risk through centralized traffic management. The results support the potential of multi-agent robotic platforms to improve intralogistics by combining embedded control, intelligent coordination, and autonomous navigation.

Effect of Amorphous Silica–Forming Additive on Porosity and Mechanical Strength in Autoclaved Aerated Concrete Thermal Insulation Board

Published: Dec 12, 2025

DOI: https://doi.org/10.56038/ejrnd.v5i1.657

Article ID: 657

Keywords:

Autoclaved aerated concrete Thermal insulation board Chemical agent Tobermorite Monte Carlo method

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Abstract

Autoclaved aerated concrete (AAC) thermal insulation board has a density of 130–155 kg/m³, a compressive strength above 0.4 MPa and a thermal conductivity value of 0.045

W/m.K. It is a Class A non-combustible, mineral-based and non-toxic material and used for thermal insulation from the outside, inside, in the middle, underground, on floors, and roof surfaces. The porous structure of the material decisively affects its mechanical and thermal conductivity properties. In this study, the potential for pore size reduction was evaluated by adding ratios of 0%, 0.1%, 0.25%, 0.5%, 0.75% and 1% amorphous silica-forming additive to the AAC thermal insulation board by mass. Furthermore, the mechanical performance was compared with the corresponding pore size characteristics. In determining the pore distribution, the air pores in the structure were examined by image analysis technique based on the Monte Carlo approach. When the density and compressive strength of the samples obtained after hydrothermal curing were compared with the A value, it was observed that the highest increase was 29.94% with a 1% additive rate. Scanning electron microscope (SEM) and X-ray diffraction (XRD) analyses showed that the amount of tobermorite increased continuously up to a dosage of 0.5%. The fact that the addition of the admixture by mass reduces the pore diameter, reduces density and increases compressive strength reveals that the amorphous silica-forming additive is usable in AAC thermal insulation board. Achieving the same compressive strength with less material during the production phase and reducing per-unit energy consumption during service due to improved thermal insulation associated with smaller pore sizes are critical for lowering the carbon footprint.

Secure Use of Artificial Intelligence with Artificial Intelligence Based Control

Published: Dec 12, 2025

DOI: https://doi.org/10.56038/ejrnd.v5i1.736

Article ID: 736

Keywords:

Artifical Intelligence Nature Language Processing Named Entity Recognition Sensitive Data Collection

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Abstract

Artificial intelligence applications have increased in recent years, providing benefits that increase the productivity of individuals and organizations. Individuals and organizations consult with AI tools in many areas, seek their assistance, and create value using these tools. However, the use of AI tools brings with it various security concerns. Open-source AIs have higher capabilities than those hosted on-premise environments. This encourages individuals and organizations to use open-source or paid versions. This study aims to identify and prevent unauthorized sharing of potentially sensitive data with third parties during paid or open-source use of AI tools using AI-assisted detection

and prevention. The study, aims to use a combination of natural language processing, big data, and machine learning methods during detection processes, will also focus on customizing the models to be organizations or person-focused, in addition to general sensitive data, and increasing success in capturing sensitive data by fine-tuning the models. It will enable the implementation of blocking or masking processes after a successful detection process.

Development of a Process to Prevent Back Contamination Caused by Cationization After Cationic Digital Reactive Printing on Cotton Knitted Fabrics

Published: Nov 27, 2025

DOI: https://doi.org/10.56038/ejrnd.v5i1.680

Article ID: 680

Keywords:

Digital Printing Reactive Printing Cationization CHPTAC Cotton Knitted Fabric

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Due to the restricted fixation and hydrolysis of reactive dyes, digital inkjet printing on cotton materials presents difficulties with low color output and substantial wastewater formation. Cotton can be cationically modified to improve color strength, decrease salt requirements, and boost dye absorption and fixation. However, conventional two-stage cationization methods are time-consuming and water-intensive, and they frequently result in back staining when the cloth is washed, with unfixed colors discoloring the white (unprinted) portions. By adopting a rotary printing process to directly put cationic printing primer onto cotton knitted fabrics, this study explores a novel one-step method to address these problems. We created three distinct pretreatment formulations: two with varying quantities of sodium hydroxide and 3-chloro-2-hydroxypropyl trimethylammonium chloride (CHPTAC) and a reference with no cationic ingredients. These formulations were applied to fabric, then digitally printed, air dried and steamed.

In order to assess how well the printed fabrics prevented back-contamination, they were subsequently put through two distinct post-washing techniques; rope washing and open-width washing. The primary objective was to determine whether a combined cationization and printing process could simplify workflow and significantly reduce water and chemical consumption while ensuring print quality. The level of back contamination was assessed qualitatively by visually assessing the contamination of white areas after each washing process. The results from this study will provide important insights into the discussion on the industrial applicability of cationic cotton, particularly by addressing the issue of persistent contamination and exploring more sustainable, one-step processing solutions. The results obtained from this study contribute to the development of more efficient and environmentally friendly digital printing processes for cotton fabrics by providing important insights into the discussions on the industrial applicability of cationic cotton fabric, particularly by addressing the issue of persistent contamination in cationization and investigating more sustainable, one-step process solutions.

Improving In-Vehicle Air Quality with Bio-Additive ABS Composites

Published: Dec 12, 2025

DOI: https://doi.org/10.56038/ejrnd.v5i1.715

Article ID: 715

Keywords:

Interior trim Bio-composite Recycled ABS TOC Sustainable materials VOC emission

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Abstract

In recent years, significant research efforts have focused on improving indoor air quality in vehicles and reducing volatile organic compound (VOC) emissions. Interior trim components release harmful gases, particularly under elevated temperature conditions, due to the degradation of organic structures, posing health risks to passengers. This risk is especially critical for children and animals who are exposed to prolonged travel periods in service vehicles. In this study, bio-based additives were incorporated into recycled acrylonitrile butadiene styrene (ABS) matrices used in interior trim sheet production to reduce environmental impacts and improve thermal performance. A mixture obtained from marine-origin algae and terrestrial plant powders (nettle, oak, and poplar leaves) was added to recycled ABS at 2 wt%. Total Organic Carbon (TOC) measurements were conducted under ambient conditions. Results showed that carbon emissions from bio-additive plates were 87.7% lower than those from non-additive plates. These findings demonstrate that natural additives exhibit gas adsorption capabilities within ABS matrices and offer an effective and sustainable alternative for improving in-vehicle air quality. In this context, the present work provides an important contribution both to recycling-based polymer utilization and to the development of eco-friendly, bio-composite automotive materials.

Design and Development of a Customer Data Platform for Loyalty Programs: Data Deduplication and Personalized Marketing Infrastructure

Published: Dec 14, 2025

DOI: https://doi.org/10.56038/ejrnd.v5i1.732

Article ID: 732

Keywords:

Customer Data Platform (CDP) Data Deduplication Personalized Marketing Loyalty Programs Big Data Analytics

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Abstract

This position paper presents the architecture and deployment of a Customer Data Platform (CDP) for the Koçtaş loyalty program to enhance data quality, unification, and personalization-based marketing strategies. The project entails bringing together disparate customer data collected across multiple channels into a single, deduplicated data store to enable advanced analytics and AI-driven personalization. By employing a combination of big data technologies, cloud infrastructure, and machine learning algorithms, the proposed system will enable real-time data processing of information, customer segmentation, and predictive modeling. Through this system, the platform will enhance marketing performance, customer satisfaction, and operational efficiency while adhering to data privacy legislations such as GDPR and KVKK compliance. The article situates the project within the contexts of customer relationship management (CRM),

loyalty program studies, and personalization studies. It discusses data consolidation, deduplication, and system development processes, highlighting innovative elements such as adaptive algorithms, real-time learning processes, and secure data management. Expected gains are increased marketing ROI, additional loyal customers, and streamlined operational processes. The paper concludes with the analysis of the long-term potential contribution of the project and with future research avenues for large-scale data-driven marketing infrastructures.

A Multimodal Deep Learning Framework for Predicting Machine Anomalies Using IoT-Enabled Vibration and Sound Data

Published: Dec 15, 2025

DOI: https://doi.org/10.56038/ejrnd.v5i1.726

Article ID: 726

Keywords:

Predictive Maintenance Anomaly Detection Vibration and Acoustic Analysis Deep Learning Smart Manufacturing

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Abstract

Unplanned machine downtimes caused by component failures, overheating, or mechanical stress significantly impact manufacturing efficiency and profitability. Predicting such failures before they occur is a core objective of smart manufacturing and Industry 4.0. Leveraging recent advances in sensor technology and machine learning, this study proposes an anomaly detection architecture that predicts the operational state of manufacturing machines one step ahead, enabling early detection of potential downtime.

The system integrates two primary data sources: vibration signals collected by an IoT-enabled device and sound recordings obtained from a microphone positioned close to the manufacturing equipment. These complementary signals capture the machine's dynamic behaviour under varying operational conditions. While vibration and line status data are

directly utilized, sound recordings undergo pre-processing using a low-pass filter to remove irrelevant background noise. The filtered recordings are segmented into one-minute intervals, and statistical features are extracted in both time and frequency domains, including mean, standard deviation, skewness, and kurtosis. Since the available dataset covers only one day, a moving block bootstrap technique is employed to improve robustness and generalization.

Two deep learning architecture, Long Short-Term Memory (LSTM) and Multi-Layer Perceptron (MLP), are implemented to forecast the machine state at time t + 1. The dataset, consisting of nine features and approximately 13,200 samples, is divided into training, validation, and test sets in a 70/15/15 ratio. Both models are trained using the Adam optimizer and binary cross-entropy loss. Performance is evaluated using precision, recall, and F1 score metrics.

Overall, the proposed approach demonstrates that combining vibration and acoustic data with deep learning can effectively predict machine anomalies in real time, contributing to proactive maintenance and reduced production downtime in smart manufacturing environments.

Probability-Calibrated Ensemble Methods for Automotive CRM Lead Scoring

Published: Dec 17, 2025

DOI: https://doi.org/10.56038/ejrnd.v5i1.717

Article ID: 717

Keywords:

Lead scoring Ensemble learning Probability calibration Automotive CRM Customer conversion prediction XGBoost Random Forest Gradient Boosting

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Abstract

Accurately predicting sales conversion in automotive CRM systems is critical for optimizing marketing spend and sales team efficiency. This study presents a calibrated ensemble framework combining XGBoost, Gradient Boosting, and Random Forest classifiers to predict lead conversion probability in automotive dealership operations. Using 62,859 real-world leads collected between July 2024 and July 2025, we developed a systematic pipeline encompassing behavioral feature engineering, statistical feature selection, ensemble modeling, and probability calibration via Platt scaling. The calibrated ensemble achieved an AUC of 0.841, Brier score of 0.146, and 19% improvement in top-decile precision over baseline logistic regression. The framework provides actionable lead segmentation into four priority tiers, directly supporting sales resource allocation and marketing campaign optimization. Results confirm that probability calibration is

essential for automotive CRM applications where predicted scores inform operational decisions.

A Smart Shopping Cart: Shopper®

Published: Dec 17, 2025
DOI: https://doi.org/10.56038/ejrnd.v5i1.723
Article ID: 723
Keywords:
Embedded Design Computer Vision Deep Learning IoT UX RTLS Smart Shopping Cart

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Abstract

This study presents the design and development of Shopper®, a smart shopping cart system that integrates embedded hardware, computer vision, and real-time localization technologies to enhance the in-store shopping experience. The system combines a custom control panel, dual-camera based barcode recognition architecture, loadcell weight tracking, and a mobile-based authentication mechanism. The Shopper® autonomously verifies items, updates shopping cart contents, and initiates automatic checkout when reaching designated payment zones. By merging user experience design (UX) principles with embedded IoT hardware, the solution reduces queue times and enriches the consumer's shopping journey. The results indicate a significant improvement in transaction speed and customer satisfaction, supporting the viability of smart carts as an effective bridge between physical and digital retail ecosystems.

A Temporal-Weighted Hybrid Recommender for B2B Vehicle Auctions Using Word2Vec Embeddings

Published: Dec 19, 2025

DOI: https://doi.org/10.56038/ejrnd.v5i1.718

Article ID: 718

Keywords:

Recommendation systems Vehicle auctions Word2vec embeddings Temporal weighting B2B analytics

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Abstract

Used car auction platforms face unique challenges in personalized recommendation due to extreme data sparsity, high inventory turnover, and real-time operational constraints. This study develops and evaluates a hybrid recommendation system combining Word2Vec embeddings for categorical vehicle attributes with standardized numerical features, applying temporal decay weighting to prioritize recent user interactions. Deployed on Azure infrastructure, the system was evaluated using 12 months of transaction data from a Turkish B2B auction platform comprising 5,322 users, 24,987 vehicles, and 1.87 million interactions. Offline evaluation demonstrates superior performance over baselines (Hit Rate@10: 0.456 vs 0.234 popularity baseline, 94.9% improvement). Production deployment over six months (April–September 2025) generated 977 recommendation-driven sales representing 15.26% of total platform

transactions and 17.27M TL in commission revenue. Quasi-experimental analysis revealed a 26.7% increase in monthly purchase frequency among active users, yielding 420 incremental transactions. Results demonstrate how interpretable temporal-weighted embedding models generate measurable commercial value in high-turnover, data-sparse B2B marketplaces.

Pressure-Controlled Runner Optimization and Filling Balance Analysis in Multi-Cavity Injection Molds

Published: Dec 20, 2025

DOI: https://doi.org/10.56038/ejrnd.v5i1.720

Article ID: 720

Keywords:

Injection molding Runner design Filling balance Rheological analysis Multi-cavity mold Pressure distribution Moldex3D

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Abstract

In this study, the effects of runner-system design on filling balance and pressure distribution in multi-cavity injection molds were investigated through Moldex3D simulations. Four runner configurations—H-type, Symmetrical-type, Star-type, and Fishbone-type—were evaluated using the material SCHULAMID® 6 MV14 FR4 K1681. The simulation results revealed that runner geometry has a decisive influence on filling uniformity, and they further demonstrated the effectiveness of a pressure-controlled runner approach in improving overall product quality. The findings highlight the importance of rheology-based optimization in runner-system design. This study differentiates itself from previous research by providing a comparative analysis of multiple runner types and by demonstrating that balanced filling can be successfully achieved not only in molds with 2^n cavity counts but also in intermediate cavity numbers such as 12 and 14. The rheology-based pressure-controlled methodology presented here introduces a new optimization perspective for multi-cavity injection mold design.

Anomaly Detection System for Distributed Job Processing within Microservice Architectures

Published: Dec 21, 2025

DOI: https://doi.org/10.56038/ejrnd.v5i1.744

Article ID: 744

Keywords:

Anomaly Detection Distributed Systems Microservices LSTM Autoencoder Isolation Forest One-Class SVM Ensemble Learning Soft Majority Voting Silent Failure Mobile Payments

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Abstract

Mobile payment systems process millions of transactions daily across distributed microservice architectures, where operational anomalies and silent failures can lead to financial losses and system instability. Traditional threshold-based monitoring is insufficient for detecting subtle, context-dependent deviations that evolve with user behavior and workload patterns. This study introduces a self-learning hybrid anomaly detection framework that integrates Isolation Forest, LSTM Autoencoder, and One-Class SVM to capture statistical, temporal, and structural deviations in operational metrics. Model outputs are fused using a calibrated soft majority voting strategy based on normalized anomaly scores. The trained framework is deployed as a containerized microservice, enabling real-time anomaly assessment based on live operational statistics. Experimental evaluation across a fifteen-month dataset demonstrates that the ensemble improves detection robustness and reduces false negatives compared to individual models and simple averaging strategies. The results highlight the system's ability to

detect silent failures and abnormal behaviors that occur without explicit exceptions while maintaining scalability and adaptability in complex financial microservice environments.

AI-Powered Multi-Agent Fashion Assistant for Personalized Retail Recommendations

Published: Dec 24, 2025

DOI: https://doi.org/10.56038/ejrnd.v5i1.755

Article ID: 755

Keywords:

Visual Search Multimodal AI GroundingDINO SigLIP Milvus Retail Intelligence Semantic Search AI in E-Commerce Omnichannel Retail Customer Experience

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Abstract

As fashion retail navigates a new era shaped by heightened consumer expectations and rapidly evolving digital interactions, the need for deeply personalized, stylistically coherent, and context-aware recommendation systems has become paramount.

Traditional engines, reliant on static rules or collaborative filtering, often fall short in capturing the complexity of human taste and the visual-semantic richness inherent in fashion products. This paper introduces Boyner's AI-powered Multi-Agent Fashion Assistant, an enterprise-grade personalization platform architected on Microsoft Azure AI Foundry. The system orchestrates multiple specialized agents to deliver real-time, occasion-aware, and visually grounded fashion recommendations across omnichannel touchpoints. Leveraging multimodal embeddings, behavioral clustering, semantic search, and real-time trend signals, each agent operates with a distinct cognitive function, from silhouette-based outfit pairing to brand–season compatibility evaluation. Our implementation demonstrates how agentic AI systems can bridge the gap between algorithmic precision and stylistic intuition in large-scale fashion environments. The assistant not only enhances conversion and engagement metrics but also redefines the digital shopping journey as an explainable, adaptive, and human-centric dialogue. By operationalizing multi-agent orchestration within a live retail environment, Boyner pioneers a new paradigm in AI-powered visual discovery, offering a scalable blueprint for next-generation personalization in the global fashion ecosystem.

A Web-Based Credit Card Payment Architecture for Dealer Portals: Android POS Integration, Microservice Design, and Behavioural Segmentation for Data-Driven Dealer Management

Published: Dec 24, 2025

DOI: https://doi.org/10.56038/ejrnd.v5i1.734

Article ID: 734

Keywords:

Web-based payment systems Android POS machine learning segmentation analysis big data analytics microservice architecture

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Abstract

Digital transformation in financial services has accelerated the need for secure, scalable, and user-centric payment infrastructures across various industries This study presents the design and implementation of a web-based credit card payment architecture integrated into the Dealer Web Portal (BWP), enabling dealer-initiated bill payments through Android POS ecosystem. The work covers three major dimensions: the development of a microservice-based web architecture using REST/SOAP services; real-time, bi-directional communication between the web portal and Android POS devices; and an unsupervised machine learning framework for behavioural segmentation using large-scale bill payment data. Multiple clustering algorithms, including K-Means, DBSCAN, Mean Shift, Spectral Clustering, and Hierarchical Clustering, were evaluated, with K-Means yielding the most meaningful segmentation results based on Purity, NMI, and Silhouette metrics. Segment outputs enabled dynamic commission policies, targeted dealer interventions, and time-series behavioral insights. The results demonstrate that the proposed architecture significantly enhances operational efficiency and data-driven

decision making. This study provides one of the first integrated examples of Android POS–web portal interoperability combined with large-scale behavioural segmentation in Türkiye's bill-payment ecosystem.

Improving the Accuracy of Location Data in UWB-Based RTLS Using Deep Learning Methods

Published: Nov 28, 2025

DOI: https://doi.org/10.56038/ejrnd.v5i1.677

Article ID: 677

Keywords:

UWB RTLS DW1000 TWR NLOS Multipath Autoencoder LSTM Deep Learning

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Abstract

In Real-Time Location Systems (RTLS) using Ultra-Wideband (UWB) technology, the Decawave DW1000 uses the Two-Way Ranging (TWR) method to obtain the location of a moving object. Multipath propagation occurring under NLOS conditions systematically negatively affects time-leads and distance measurements; this increases the bias (positive bias) and widens the variance, leading to instability in the location data. In this study, an autoencoder-based measurement improvement method proposed for the tag location data obtained using the TWR method. The raw TOF (time of flight) and range measurements obtained from the DW1000 are simultaneously integrated into a low-dimensional latent space with features such as RSSI and CIR-based quality metrics (e.g., first-path amplitude/index, channel energy, pulse width indicators). The denoising/regularized reconstruction process suppresses the jump and bias components in the location data caused by NLOS; thus, the improved measurements can increase the

stability and repeatability of location data when used with classical Gauss-Newton location. This approach can trained with a highly dynamic setup (especially using clean LOS records), reducing the burden of relying on field geometry; its modular architecture allows for minimal integration into the existing TWR software chain. Experimental analysis and visualizations were performed on different indoor scenarios (office, corridor, and semi-open space layouts) using MATLAB. This method has been shown to provide a consistent reduction in mean error metrics (MAE/RMSE), a significant improvement in axis bias errors (95th/97th percentile), and location path continuity, while also eliminating erroneous outliers originating from instantaneous NLOS

An Empirical Comparison of Claude, Llama, and Gemini for Aspect-Level Sentiment

Published: Nov 23, 2025

DOI: https://doi.org/10.56038/ejrnd.v5i1.659

Article ID: 659

Keywords:

Natural Language Processing Sentiment Analysis Generative AI Large Language Models

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Abstract

Aspect-based sentiment analysis provides granular insights into customer feedback by identifying discrete aspects, such as features or topics, and assigning a corresponding sentiment to each. This study assesses three large language models, hereafter referred to as LLMs, namely Google Gemini 2.5 Flash-Lite, Anthropic Claude Sonnet-4 delivered through AWS Bedrock, and Meta LLaMA 3.3 70B delivered through AWS Bedrock, using a real-world multilingual corpus of 7,841 Turkish mobile banking app reviews from İşbank in Turkey. We employ a prompt-based tagging protocol to extract aspect–sentiment pairs from every review, and we compare accuracy, F1-score, inference cost, and latency. The results show that all three LLMs can execute multilingual aspect extraction and sentiment categorization without task-specific fine-tuning. Claude Sonnet-4 attains the highest F1 for aspect extraction and the highest sentiment accuracy, although it incurs a markedly higher inference cost. Gemini 2.5 Flash-Lite achieves competitive accuracy at a fraction of the price, making it well-suited for high-volume analytics. Meta LLaMA at the 70B scale accessed through AWS Bedrock exhibits intermediate performance with moderate cost and latency. We provide detailed performance tables and figures, along with best-practice guidance for enterprise deployment. AWS Bedrock enables the strategic selection of Claude and LLaMA 3.3 70B for multilingual sentiment

analysis, offering valuable insights from app reviews within scale, accuracy, and budget constraints.

Evaluation of ROPS and FOPS Tests for Structural Integrity of Forklifts

Published: Nov 24, 2025

DOI: https://doi.org/10.56038/ejrnd.v5i1.668

Article ID: 668

Keywords:

ROPS FOPS Forklift Protective Structure Test Safety Requirement

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Abstract

This study examines the Roll-Over Protective Structure (ROPS) and Falling Object Protective Structure (FOPS) tests and their results for forklifts. The main focus of the study is the evaluation of the cabin safety of a forklift with a lifting capacity of 3.5 tons. Within this scope, the compliance of the protective structures with the international standards ISO 3471 and ISO 3449 has been thoroughly analysed.

In the ROPS tests, the applied force and energy values under lateral, rear, and vertical loading conditions were calculated; the test setup, the applied loads, and the resulting deformations in the structure were investigated. Furthermore, in the FOPS test, the required energy levels were evaluated, and the results of the tensile tests conducted to verify the mechanical integrity of the fasteners (bolts) after the impact test were presented.

A Decision Support Framework for Customer Loyalty Program Managers: Reward Mix Optimization

Published: Nov 27, 2025

DOI: https://doi.org/10.56038/ejrnd.v5i1.679

Article ID: 679

Keywords:

Convex Optimization Customer Loyalty Programs Multi-Layer Perceptron Perceived Value Unit Reward Cost

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Abstract

Customer Loyalty Programs are a proven methodology for establishing and maintaining customer relationships. With the development of mobile technologies and the power of digitalization, what was once a simple punch card has now evolved into a full-fledged mobile application. The paradigm shift has opened up research areas on an individual customer level, especially in non-contractual traditional commerce, which was previously impossible due to a lack of loyalty data. The cost and budget of Customer Loyalty Programs increase with their strategic value. Balancing the attractiveness of a reward to the customer with the unit cost to the organization is essential for designing

effective programs. In this study, we propose a framework that combines the attractiveness and unit cost of rewards to provide an optimized reward mix, thereby aiding Customer Loyalty Program managers in their decision-making processes.

An Innovative Approach to Technical Textiles: Assessing the Performance of Olefin-Based Outdoor Fabrics

Published: Dec 3, 2025

DOI: https://doi.org/10.56038/ejrnd.v5i1.691

Article ID: 691

Keywords:

Olefin yarn Acrylic yarn Technical textiles Outdoor textiles UV resistance Water repellency

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Abstract

In recent years, consumer preferences have undergone significant transformations driven by socio-cultural, economic, and demographic factors, resulting in a growing demand for innovative and sustainable textile products. The intensifying competition in the global market, along with evolving consumer expectations, necessitates that firms within the textile industry not only adapt to technological advancements but also develop sustainable solutions. Within this framework, Menderes Tekstil has emerged as a pioneer

in the field of outdoor technical textiles by introducing an innovative production process through the utilization of olefin yarns. Compared to acrylic and polyester yarns, olefin-based fabrics demonstrate superior mechanical performance, offering twice the tensile strength of acrylic and approximately 30% greater strength than polyester. In addition, these fabrics exhibit water- and oil-repellency, ultraviolet resistance, mold resistance, and stain resistance, thereby ensuring durability and suitability for outdoor applications. The recyclability of olefin yarns further reinforces an environmentally responsible production approach, contributing to broader sustainability objectives. Specifically developed for demanding applications such as garden furniture, umbrellas, awnings, and marine textiles, these products not only address a critical gap in the textile market but also enhance the competitive capacity of the firm by combining innovative features, environmental advantages, and high added value.

Development of Ash-Based Paving Stones Through the Utilization of Industrial Ash Generated During Urban Waste Disposal Processes

Published: Dec 12, 2025

DOI: https://doi.org/10.56038/ejrnd.v5i1.712

Article ID: 712

Keywords:

Industrial ash Paving stones Recycling Waste management Sustainability

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Abstract

With the increase in urban waste and industrial activities, significant quantities of ash are generated from waste incineration plants, cement factories, and energy production facilities. These ash wastes pose critical environmental challenges such as land occupation, soil contamination, and groundwater pollution, making their sustainable management essential. This study aims to utilize industrial ash waste as an alternative raw material in the production of paving stones used in infrastructure applications. Ash-based paving solutions reduce dependence on natural stone and sand resources,

contributing to resource conservation; additionally, they help lower environmental impacts by reducing cement consumption and related carbon emissions.

Within the scope of this study, manufacturability, mechanical strength, durability, and environmental performance criteria were evaluated. The results indicate that ash-based paving blocks offer an economical and sustainable alternative to conventional products. This approach enables the transformation of waste materials into value-added products instead of disposal, supporting the development of low-cost and environmentally friendly building materials.

Aligned with European Union environmental policies, this study supports the use of long-lasting, environmentally conscious, and aesthetically favorable products in urban planning and infrastructure applications. The findings demonstrate that industrial ash waste can become a valuable resource for the construction materials industry.

Structural Behavior Analysis of Rail-Mounted Portal Cranes Equipped with a 360° Rotatable Spreader Mechanism Using the Finite Element Method

Published: Dec 10, 2025

DOI: https://doi.org/10.56038/ejrnd.v5i1.716

Article ID: 716

Keywords:

EN 13001 Portal Crane Spreader Trolley Von Mises Stress SEA FEA Crane Systems

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Abstract

Rail-Mounted Gantry (RMG) cranes are complex lifting systems widely used in container terminals and industrial sites to ensure the safe handling of heavy loads in both horizontal and vertical planes. One of the main subsystems of these cranes is the trolley , which operates in conjunction with the spreader responsible for carrying and transferring the load. In recent years, designs incorporating 360° rotatable spreader mechanisms have provided significant flexibility in load positioning but have also introduced complex stress distributions in connection regions. In this study, the structural behavior of the spreader component of an RMG-type portal crane was analyzed using the Finite Element Method (FEM). The investigation covered static, buckling, and fatigue strength assessments, with all calculations performed in accordance with DIN EN 13001-3-1+A2 and EN 13001-3-8 standards. During the modeling phase, the steel framework of the spreader structure, along with its welded and bolted joints, was represented in detail.

Separate loading scenarios were established for different spreader configurations (rotated positions of 0°, 45°, and 90°), and lifting loads, wheel reaction forces, and boundary conditions were applied in compliance with relevant standards. The analysis results showed that the maximum Von Mises stresses remained below the material yield limit, and the fatigue strength in critical connection areas (such as drum plates, connecting bolts, and weld seams) satisfied the S6 stress range class requirements. Furthermore, the deformations observed in the spreader were within allowable limits, confirming that the structure possessed adequate rigidity against buckling. In conclusion, the RMG portal crane design equipped with a 360° rotatable spreader system was found to be structurally safe in terms of both static and fatigue performance, demonstrating compliance with international standards. This study contributes to the engineering-level optimization of spreader–trolley interaction in next-generation RMG crane systems.

Investigation of Mechanical Properties of Hemp Hurd/PP Composites for the Application of Water Irrigation Pipes

Published: Dec 9, 2025

DOI: https://doi.org/10.56038/ejrnd.v5i1.707

Article ID: 707

Keywords:

Hemp hurd Hemp hurd/PP thermoplastic composite materials Bending properties Coupling sleeve for the water irrigation pipes

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Abstract

In this study, for the first time, a new generation hemp hurd/PP composite material coupling sleeve prototype production was performed for the water irrigation pipes. Within the scope of experiments, at first hemp hurds were prepared by using cyclic grinding machine. Later, the compounds of hemp hurds (0 wt%, 10 wt%, 20 wt% and 30 wt%) and polypropylene (PP) were prepared using double screw extruder machine at Ondokuz Mayıs University. After that, the specimens of 0 wt%, 10 wt%, 20 wt% and 30 wt% hemp hurd reinforced polypropylene (PP) composites were fabricated using

injection molding machine. Three points bending tests were performed on the fabricated specimens with INSTRON 5982 100 KN universal test device at Ondokuz Mayıs University (OMU) KITAM Central laboratory. Prototyping of hemp hurd/PP composite material coupling sleeves were produced using plastic injection machines of Poelsan Plastik Sanayi ve Ticaret A.Ş. Long-term tightness test under internal pressure was conducted on the fabricated coupling sleeves in Poelsan Plastik Sanayi ve Ticaret A.Ş. According to the bending test results, the bending modulus of specimens were increased by increasing hemp hurd content. The highest bending strength was obtained by 10 wt% hemp hurd powder reinforced PP composites (46.5 MPa). The findings showed that the coupling sleeves manufactured from hemp hurd/PP composite material can be successfully used as an alternative to %100 PP material coupling sleeve under similar service conditions in water irritation systems.

Artificial Intelligence-Assisted Control of Light Pipe & LED Luminaire Hybrid Tunnel Lighting System

Published: Dec 23, 2025

DOI: https://doi.org/10.56038/ejrnd.v5i1.747

Article ID: 747

Keywords:

Tunnel lighting Artificial intelligence Light pipe (light tube) Artificial neural networks Illuminance control

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Abstract

Tunnels are designed as infrastructure elements that facilitate smoother traffic movement, enhance operational safety, and minimize environmental effects. However, when adequate lighting is not provided in tunnels, sudden transitions from bright outdoor environments to dim indoor spaces cause temporary vision loss while the eyes adapt to the new environment. Sudden changes in light at tunnel entrances and exits can disorient drivers and increase accident risks. Daylight offers a mix of wavelengths and color temperatures that provide optimal visual conditions for humans. In this study, an energy-efficient hybrid tunnel lighting system combining light tubes with artificial lighting was designed, and an artificial intelligence–based control system dependent on daylight was developed for this setup. To make tunnel conditions more efficient and comfortable for drivers, a control system incorporating an artificial neural network (ANN) algorithm was designed to apply the instantaneous outdoor illuminance level at the tunnel entrance. The control system results were analyzed, indicating that approximately 25.30% energy savings can be achieved compared to conventional lighting control methods, along with an expected improvement in drivers' visual comfort.

Designing for Explainability and Data Sovereignty: A Design Principles Approach for LLM-Augmented FinTech Analytics

Published: Dec 18, 2025

DOI: https://doi.org/10.56038/ejrnd.v5i1.749

Article ID: 749

Keywords:

FinTech Design Science Research Explainable AI LLM Data sovereignty Predictive analytics

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Abstract

This study reports on the design and development of a practical analytics system that responds to the growing need for data-driven work among users without formal training

in programming or data science. The system uses large language models (LLMs) to support natural language interaction and to guide users through common data analysis tasks. Compared with typical analytics tools, the system does more than simply run models in the background. It explains in plain language what each model is doing and why particular results appear, and it walks the user through the choice of methods step by step. The architecture can connect to different locally deployed LLMs – for example LLaMA, Qwen or DeepSeek, so organisations are not locked into a single provider. All interaction takes place through a chat-style interface: users upload a dataset, describe their question, and the system handles the configuration and code. The artefact was shaped through a Design Science Research (DSR) process, with several iterations of design, feedback and revision involving potential users. In its current form, a proof-of-concept implementation and scenario-based examples show that non-technical users are able to understand their data more clearly and make more informed choices among analytical options. Taken together, these features point to a practical and adaptable framework that brings explainable, LLM-supported analytics within reach of a much wider group of professionals.

Classifying Operator Experience from Electric Screwdriving Signals: A BiLSTM-Based Study with External Validation

Published: Nov 26, 2025

DOI: https://doi.org/10.56038/ejrnd.v5i1.669

Article ID: 669

Keywords:

BiLSTM Time-series classification Multimodal data fusion Operator experience level classification

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Abstract

This study presents a deep learning–based approach to objectively classify operator experience levels (Novice–Intermediate–Expert) from multivariate signals and user interactions obtained during electric screwdriving operations. The dataset comprises 64 participant-specific files, each containing multiple tightening trials. Windowing was performed independently per file; short segments unsuitable for windowing were excluded, yielding 3,326 time windows (2,958 for training/testing; 368 for independent validation). A two-layer Bidirectional LSTM (BiLSTM) architecture was employed and evaluated on both the train–test split and an external validation set constructed from 12 previously unseen files. On the test set, the model achieved 76% overall accuracy with macro-averaged precision/recall/F1 of 77%/76%/76%. Class-wise analysis indicated stronger separability for the Expert class (recall ≈ 84%) and comparatively lower performance for Intermediate (recall ≈ 66%). On the hold-out validation set, accuracy was 75.00%, with a mean predicted probability of 85.0%, indicating moderate-to-high confidence. The findings show that while BiLSTM provides a solid foundation for time-

series classification, its effectiveness may be limited for complex patterns without a convolutional front end.

Optimization of Pultrusion Process Parameters for Carbon Fiber/Epoxy Composites

Published: Nov 27, 2025

DOI: https://doi.org/10.56038/ejrnd.v5i1.672

Article ID: 672

Keywords:

Pultrusion Carbon Fiber Reinforced Polymer (CFRP) Optimization

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Abstract

This study investigates the effects of key pultrusion process parameters—including temperature profile, fiber volume ratio (FVR), preformer geometry, resin viscosity, and line speed—on the production stability and mechanical performance of carbon fiber/epoxy composite profiles. Continuous carbon fiber rovings were impregnated with epoxy resin and processed through a multi-zone heated die under varying operating conditions. Tensile properties were evaluated in accordance with ASTM D3039 to ensure standardized and comparable mechanical characterization. Experimental observations revealed that even small adjustments in thermal management, heating zone positioning, preformer compression and eye diameter, fiber volume ratio, resin rheology, fiber type, squeezer configuration, and pulling speed produced significant variations in surface quality, flow behavior, resin backflow, fiber congestion, and overall process stability. The optimal process window was achieved at a line speed of 30–35 cm/min and an FVR range of 65–70%, with improved results obtained by shifting the initial heating zone backward, reducing the final preformer diameter, and utilizing lower-viscosity resin systems. The findings provide a comprehensive process–property relationship for carbon pultrusion and offer a practical guideline for industrial optimization aimed at achieving stable production and high-quality composite profiles.