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THE GRADS EXPO 2025

Faculty of **Engineering**

Engineering Students Projects

Leading the way:
A message from the CEO

Welcome to the Engineering Graduates Exhibition 2025. Today, we celebrate more than the accomplishments of our students—we celebrate the role Bahrain Polytechnic plays in shaping a generation ready to lead in a world defined by change, complexity, and opportunity.

This exhibition is a powerful reflection of our mission: to produce work-ready graduates who think critically, act responsibly, and innovate with purpose. What you see today are the outcomes of a learning journey rooted in applied knowledge, industry collaboration, and real-world problem-solving. As Bahrain continues its transition toward a diversified, knowledge-based economy, the relevance of events like this cannot be overstated. The future will be built by individuals who can bridge the gap between academic learning and societal need—individuals like the graduates we honor today. The role of institutions like Bahrain Polytechnic becomes increasingly vital. We are proud to be shaping graduates who are not only ready for the workforce, but ready to shape it. This exhibition is also about inspiring the next generation of innovators and problem-solvers—those who will build on the ideas and skills showcased here today. This exhibition is a reminder that education is not just about knowledge—it's about shaping futures.

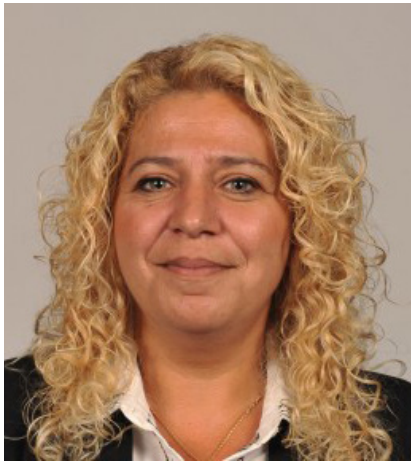
Professor Ciarán Ó Catháin
CEO Bahrain Polytechnic

A message from the DCEO

Welcome to the Engineering Graduates Exhibition 2025, a celebration of academic achievement, innovation, and the pursuit of excellence that defines Bahrain Polytechnic's educational philosophy.

This exhibition represents the culmination of years of hard work and intellectual growth. It showcases the results of our continuous efforts to provide students with a rich and dynamic learning environment—one that promotes critical thinking, creativity, and problem-solving skills. At Bahrain Polytechnic, we are deeply committed to ensuring that our graduates are not only knowledgeable but equipped with the skills needed to meet the challenges of a rapidly evolving global landscape. Through rigorous quality assurance processes and close collaboration with industry partners, we ensure that our programs are aligned with both academic excellence and the needs of the wider community. This exhibition is a reflection of what can be achieved when education is driven by quality, collaboration, and a shared vision for the future. We are excited to see how our graduates will continue to make a positive impact in Bahrain and beyond.

Dr. Louise O'Nolan
DCEO Academic Affairs & Registrar



A message from the dean

On behalf of the Faculty of Engineering at Bahrain Polytechnic, it is my pleasure to welcome you to the Engineering Project Expo 2025—a celebration of innovation, determination, and the transformative power of engineering.

This year's expo features more than 100 student projects that address some of the world's most critical challenges, including sustainability, artificial intelligence, renewable energy, automation and Industry 4.0. These projects showcase not only technical skills but also the creativity and vision that define the next generation of engineers who are prepared to shape a more sustainable and bright future for Bahrain and beyond.

The dedication of our students have demonstrated serve as a powerful reminder of engineering's vital role in driving progress. Equally, the presence and support of our industry partners and guests confirm the real-world relevance of this work and highlight the importance of collaboration between academia and industry in turning ideas into impact.
This expo is more than a showcase—it is a platform for dialogue between education and industry, theory and practice. Today, we celebrate these remarkable achievements; tomorrow, we look forward to the innovations and contributions they will inspire. Thank you for being part of this milestone in our students' journey.

Prof. Christina G. Georgantopoulou
Dean Faculty of Engineering

Faculty of Engineering 2025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By Adam Alnoaimi

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Design and Development of a Wall-Climbing Robot for High-Rise Building Glass Cleaning

This project presents the design and development of an autonomous wall-climbing robot for high-rise building glass cleaning. The robot utilizes an advanced adhesion mechanism to navigate vertical surfaces and integrates an automated cleaning system with optimized water usage. Through iterative testing in lab and real-world environments, the prototype is expected to demonstrate stable climbing performance, effective dirt removal, and adaptability to diverse glass textures. The successful implementation of this robot could revolutionize building maintenance by offering a safer, cost-effective, and sustainable alternative to manual cleaning methods, reducing risks associated with human workers at extreme heights.

By Elias Ali

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Fabrication And Testing a Blended Wing Body Aircraft

This project investigates the fabrication and testing of a Blended Wing Body (BWB) aircraft prototype to evaluate its structural and aerodynamic performance. The selected BWB model will be fabricated through precision 3D printing using high-strength plastic or resin materials, chosen for their suitability in simulating real-world operational conditions. A detailed structural analysis will be conducted to assess the prototype's integrity under various loading conditions, utilizing advanced stress analysis techniques. Following this, a series of controlled physical tests will be performed to validate the aircraft's aerodynamic efficiency, stability, and overall performance characteristics. The data derived from these tests will provide critical insights into the design's feasibility, its potential for future enhancements, and its applicability to next-generation aerospace engineering.

By Mohammed Ebrahim

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Development of a Multistage Electromagnetic type of Vibration Energy Harvester for Sustainable Structural Health Monitoring of Bridges and Flyovers

This project focuses on developing a multistage electromagnetic vibration energy harvester to power sustainable structural health monitoring systems for bridges and flyovers. The design incorporates multiple micro planar coils and magnets to maximize energy conversion from ambient vibrations. Using 3D printing for the housing and microfabrication for the coils, the prototype aims to achieve enhanced power output under simulated bridge vibration conditions. Expected results demonstrate efficient energy harvesting from low-frequency vibrations, enabling self-powered sensor networks for real-time infrastructure monitoring. The technology offers a scalable, maintenance-free solution to reduce reliance on external power sources while improving the safety and longevity of critical transportation structures.

By Ahmed Askafi

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Finite Element Analysis of Stress and Bending Behavior in Carbon Nanotube Irradiated (HDPE/EPR) Nanocomposite Shoe Soles

This project conducts a Finite Element Analysis (FEA) of stress and bending behavior in carbon nanotube-reinforced (HDPE/EPR) nanocomposite materials for shoe soles. Using SolidWorks, the analysis simulates the material's response under varying operational conditions to evaluate stress distribution and bending deformation. The incorporation of carbon nanotubes aims to enhance the composite's strength, flexibility, and overall mechanical performance. The FEA provides insights into the material's structural integrity, identifying potential failure points and ensuring durability. Based on these results, design adjustments are made to optimize the nanocomposite's performance, with manufacturing drawings created for precise fabrication to meet performance requirements for footwear applications.

By Mohammed Alamiri

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Automatic Wire Cutter and Stripper Machine

This project focuses on the design and development of an automatic wire cutting and stripping machine that can handle wires of different sizes. The machine uses a pneumatic cylinder to power the cutting blade and stepper motors to move the wire into position. A microcontroller controls the entire process to ensure accurate and consistent cutting and stripping. The design addresses common issues found in existing machines, such as limited wire size compatibility, blade wear, and uneven cuts. Durable and cost-effective components are used, and some parts are made from recyclable materials to support sustainability. Overall, the project aims to create a reliable, precise, and user-friendly machine for industrial wire processing.

By Khaled Alquraan

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Motorized Assist Spring Mashing Machine

Addressing the substantial market for diverse food processing machinery, this project introduces the automated Mashing Machine. This medium-scale device streamlines mashing through an innovative cam, shaft, and spring mechanism powered by a battery motor. The motor's rotation drives a cam, converting motion via linkages into the masher head's reciprocating action. A spring enhances the applied force for effective mashing. Constructed with a robust mild steel frame, the machine ensures consistent mashing pressure, offering a practical solution for various food processing needs requiring uniform product texture and quality.

By Hashem Mohamed

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Enhancing Energy and Material Efficiency in Advanced Manufacturing Through Post-Processing Heat Treatment of 3D-Printed Parts

Fused Deposition Modeling (FDM) is a manufacturing technique that creates polymer components with complex geometries in a layered fashion. However, the mechanical properties of these parts are generally lower than those produced using conventional methods. To enhance the structural integrity of 3D-printed polymers, post-processing heat treatment is an effective processing method. This treatment minimizes internal thermal stresses and strengthens layer adhesion, ultimately improving the mechanical performance of the printed parts. This research explores the mechanical changes done to the printed parts after heat treatment and energy consumption before and after heat processing. Destructive testing performed on the treated 3D printed samples shows a substantial improvement of mechanical properties.

By Osama Alkhayat

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Design and Development of Eco-Friendly Insulation from Agricultural Waste

The increasing demand for sustainable and energy-efficient building materials has led to the exploration of environmentally friendly alternatives to conventional insulation to serve as an alternative. Whereas this project focuses on the manufacturing of thermal insulation panels utilizing local agricultural waste, providing an environmentally friendly and cost-effective solution. Local natural agricultural waste that was used from date palm trees where it is leaves and stems, was processed and grinded to be utilized in the making of insulation composite into panels, in which their thermal conductivity is to be examined and evaluated. This research highlights the potential of agricultural waste to be a renewable resource for sustainable thermal insulation manufacturing while also contributing to waste management and minimizing dependency on petroleum products to the minimum.

By Salman Bucheery

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Numerical Analysis of Thermal Performance of a Multi-Block Wall System under Transient Uncontrolled Heat Transfer Conditions

This project investigates the thermal performance of a multi-block wall system consisting of IMSI insulation blocks under transient, uncontrolled heat transfer conditions in Bahrain. Traditionally methods include evaluation of 'Thermal Resistance (R-value) or Thermal Transmittance (U-value)' which are more suitable for steady-state controlled conditions and are inadequate for real-world scenarios with fluctuating solar radiation and wind. Therefore, the primary objective of this study is to assess the wall's performance using MATLAB, numerical analysis, through of a novel factor named as 'Thermal Impedance'. It integrates thermal resistance and thermal capacitance and provides a more comprehensive understanding of wall's time-dependent thermal performance under real conditions. extreme heights.

By Rashed Hasan

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Design And Analysis of a Pedal Powered Hacksaw

This project aims to design a Pedal Powered Hacksaw that would be used as an alternative for electric cutters. Pedaling will activate the gear and chain mechanism that would then be used to operate the hacksaw to cut the material that needed to be cut or by adjusting the chain connection, it can operate a drilling press. The suggested design can be used to cut materials like wood and steel, perform drilling and all while simultaneously improve the well-being of the user as it helps to tackle associated health issues . The design for this pedal powered hacksaw was done in the 3D modelling software SolidWorks.

By Ghazi Alrowaiei

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Battery Powered Spring Potato Machine

This project explores the design and creation of a Battery-Powered Spring Potato Machine, designed to improve the efficiency of potato preparation in farming contexts. By incorporating a solar-powered stall, the project aims to promote sustainable energy practices and lessen dependence on traditional power sources. Using SolidWorks for precise engineering drawings, the focus will be on enhancing both the machine's functionality and portability. The prototype will be built using welding techniques, ensuring it is durable and reliable in various settings. This innovative solution not only meets the increasing demand for effective agricultural tools but also highlights the significance of renewable energy in today's farming practices. Successfully implementing this project could greatly boost productivity while reducing environmental impact.

By Khaled Ali

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Designing a Plastic Shredding Machine

This project focuses on designing a plastic shredding machine to tackle the increasing challenges of plastic pollution and waste management. A durable, budget-friendly, and safe shredding machine was designed to increase flexibility and efficiency in handling various plastic types and sizes. The design minimizes manual effort, resulting in a smoother, easier, and continuous shredding process. The shredding machine increases plastic waste management by breaking down different types of plastic into small flakes, which can be easily processed and recycled. These recycled materials can be used in the manufacturing of plastic tiles and other cost-effective and eco-friendly products. The machine was thoroughly designed and studied using SolidWorks software for 3D modeling.

By Ebrahim Nooruddin

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Feasibility Study on Data Warehouses Powered by On-Grid PV Systems in Bahrain

The aim of the proposed project is to take advantage Bahrain's substantial solar energy resources and conduct a feasibility study on data warehouses powered by on-grid photovoltaic (PV) systems. With an emphasis on designing and optimizing on-grid photovoltaic systems to effectively satisfy electricity demands, this study aims to determine how well renewable energy may be integrated into the energy-intensive activities of data warehouses. The study uses complex simulation tools to investigate system performance, evaluate energy consumption patterns, and conducts economic analysis to determine cost-effectiveness. By reducing carbon emissions and encouraging clean energy, this environmentally friendly strategy supports Bahrain's sustainability objectives while providing insights into the possibilities for a more sustainable and energy-efficient digital infrastructure.

By Mohamed Alqadhi

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Optimization of Ball Valve Performance Using Finite Element Analysis and Flow Simulation

Ball valves are widely utilized in industrial applications for fluid control, necessitating high durability and efficiency under extreme operational conditions. This study aims to optimize ball valve performance through advanced Finite Element Analysis (FEA) and Flow Analysis. The structural analysis will focus on identifying stress concentration points and deformation patterns using mesh refinement to ensure accuracy. Flow simulations will evaluate pressure drop, turbulence intensity, and flow patterns through the valve. By optimizing valve geometry specifically, the ball radius, seat design, and flow path contour and selecting high-performance materials, this research seeks to enhance sealing performance, minimize material fatigue, and improve overall flow efficiency. Additionally, the study will analyze the impact of temperature and pressure variations on valve performance.

By Ziyad Al Sendi

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Design And Fabrication of Polymer Rolling Mill Machine

This project designed and fabricated a polymer rolling mill machine to process rubber, plastics, and nanocomposites efficiently. The modified system replaces an auxiliary gearbox with a main drive shaft and worm gear for speed reduction, lowering costs and maintenance. A 1 HP motor powers stainless steel rollers, ensuring durability and precise material processing. Key components like the V-belt drive and chain drive were optimized for smooth operation. Future improvements may include automation and recycled polymer compatibility. This machine offers a cost-effective, eco-friendly solution for polymer processing in research and small-scale industries. The mechanism was fully designed and analyzed through the 3D modelling software SolidWorks where manufacturing drawings were then submitted for fabrication.

By Khaled Marshad

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Optimizing External Shading Devices for Consistent Thermal Comfort

This project aims to enhance the performance of external shading devices by optimizing two key factors: the angle of installation and the choice of material. The study focuses on determining the most effective angle for shading devices to reduce solar heat gain while maintaining indoor comfort. Aluminum was chosen as the material of the prototype for its excellent thermal properties, durability, and lightweight nature. Measurements were taken for the prototype to ensure accurate results and to assess the performance of the shading devices under various environmental conditions, ultimately contributing to improved energy efficiency in buildings.

By Salman Qambar

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Development of a Plastic Shredder Machine for Eco Furniture Applications

This project aims towards manufacturing a shredder which targets the issue of plastic waste in Bahrain. The shredder is manufactured to be portable and less expensive compared to shredders on the market. Various types of machining methods are carried out within this project such as lathe, drilling, bending and welding alongside using CNC machines to maintain the accuracy and attain their expected performance. The performance of the prototype will be measured and compared to commercially sold shredders based on the ability to shred the following types of plastics HDPE, LDPE, PP and PS. Additionally, the size of shredded plastic flakes will be measured with the aim of getting 0-10 mm flakes in size and weighed within an hour aiming towards getting ±10kg of flakes per hour.

By Abdulla Alameeri

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Design and Fabrication of an Ice Box System for Enhancing Racing Car Performance

Racing car engines often struggle with performance degradation during hot weather conditions due to reduced air density and lower oxygen content. This project aims to improve racing car performance under such conditions by designing a simple, cost-effective ice box cooling system. Unlike expensive and complex conventional solutions, this system cools air by passing it through an ice-filled chamber before entering the engine. The cooled, denser air carries more oxygen, enhancing combustion efficiency and boosting engine power. This approach offers a practical alternative to advanced intercoolers and chemical-based cooling systems, making it accessible for various racing vehicles.

By Hasan Mandeel & Faisal Ali

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Design of an IoT-Enabled Smart Medication Dispenser – Pill Pal

Pill Pal is an IoT-enabled smart medication dispenser designed to improve medication adherence. This project outlines the design and implementation of a system featuring a microcontroller, servo motor-driven dispensing, and real-time scheduling. Integrated sensors monitor medication levels and dispensing confirmations. A cloud-connected mobile application allows remote monitoring and control, including customizable dosage schedules, reminders, and alerts. This project details the development of the hardware and software components, including the design of the dispensing mechanism and the implementation of the IoT communication protocol. This design aims to provide a reliable and accessible solution for individuals with complex medication regimens, promoting better health outcomes through timely and accurate medication management.

By Ali Almehza

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Enhancing Building Energy Efficiency Through Solar Power Integration

This project examines strategies for improving energy efficiency in buildings by incorporating solar power solutions. It focuses on the role of solar panels, optimized insulation, and energy-efficient systems in reducing electricity demand. The study evaluates the feasibility and effectiveness of these methods in Bahrain's climate, considering both economic and environmental factors. A comparative analysis will be conducted to identify the most practical and sustainable approaches for reducing energy consumption. The findings aim to provide a framework for integrating renewable energy solutions into modern building designs to achieve greater efficiency and sustainability.

By Fawaz AlQasimi

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The Impact of 3D Resin Printing on Material Waste Reduction and Cost Efficiency in Watchmaking

This project examines the impact of 3D resin printing on the watchmaking industry, focusing on its role in reducing material waste and production costs. Traditional manufacturing methods often generate significant waste and high operational expenses. By implementing 3D resin printing, manufacturers can utilize additive processes that minimize waste by up to 90% while allowing for greater customization and design flexibility. This study employs quantitative analysis and case studies from Qannati Lab to demonstrate the technology's economic benefits, including reduced material costs and enhanced production efficiency.

By Dalal Alawadhi

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Arterial Blood Pressure Analysis by SolidWorks - Human Heart Blood Flow Wave Propagation

This project focuses on the analysis of arterial blood pressure through a simulation-based study of human heart blood flow and wave propagation. The objective is to understand the dynamic behavior of blood flow in arteries and how pressure waves travel through the vascular system. A detailed 3D model of the human heart and arterial network is utilized using SolidWorks to replicate realistic blood flow conditions. The simulation helps in visualizing pressure changes and identifying factors affecting wave propagation under various physiological conditions. This study provides insight into cardiovascular behavior and can support future medical research and device development. All models and simulations were conducted using SolidWorks, with results presented through pressure and flow rate graphs for analysis.

By Feras Alaseeri & Mazin Salmeen

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Design And Fabrication of Polymer Rolling Mill Machine

This project designed and fabricated a polymer rolling mill machine to process rubber, plastics, and nanocomposites efficiently. The modified system replaces an auxiliary gearbox with a main drive shaft and worm gear for speed reduction, lowering costs and maintenance. A 1 HP motor powers stainless steel rollers, ensuring durability and precise material processing. Key components like the V-belt drive and chain drive were optimized for smooth operation. Future improvements may include automation and recycled polymer compatibility. This machine offers a cost-effective, eco-friendly solution for polymer processing in research and small-scale industries. The mechanism was fully designed and analyzed through the 3D modelling software SolidWorks where manufacturing drawings were then submitted for fabrication.

By Yusuf Ali

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Design and Development of a Pedal Powered Hacksaw

This project involves designing and fabricating a pedal-powered hacksaw, using bicycle pedals to convert human energy into mechanical motion. The goal is to create an eco-friendly, cost-effective tool that reduces energy consumption while providing efficient cutting for light to medium tasks in off-grid environments.

By Ali Alekri

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Design and Development of a Solar Powered Desalination Plant for Agricultural Purposes in Bahrain

This project aims to design and manufacture a desalination plant that uses solar energy as its source of energy. The goal of the project is to provide pure water for agricultural purposes in Bahrain using a clean source of energy. Through using solar energy, the project aims to reduce the emissions of carbon and contribute towards achieving the SDG's 7,8 and 9. Since Bahrain uses seawater, this project shall provide an alternative way of desalinating water that reduces harmful emissions and contributes towards making Bahrain green.

By Husain Shehab

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Shaded Serenity: Designing and Manufacturing an Outdoor Pergola with Solar and Natural Cooling

This project addresses Bahrain's rising urban heat and energy demands by creating a sustainable outdoor cooling system in Hamad Town Walkway. It integrates solar energy, water recycling, and passive cooling strategies to enhance public comfort. A key feature is the reuse of AC condensation water, stored underground and used in a solar-powered misting system that cools surrounding air by 3.39°C. Powered by monocrystalline solar panels and batteries, the pergola also utilizes high thermal mass materials, reflective paints, and shading elements for passive cooling. Thus, this self- sustaining design reduces environmental impact and energy use.

By Ahmed Hasan

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Shaded Serenity: Designing and Manufacturing an Outdoor Pergola with Solar and Natural Cooling

The project offers an eco-friendly solution to Bahrain's urban heat and high cooling energy use by introducing a self-sustaining outdoor structure in Hamad Town Walkway. Combining solar power, recycled AC condensation water, and passive cooling, it enhances comfort in public spaces. The system collects and stores condensation underground, using it in a solar-powered misting system that lowers air temperature by 3.39°C. Powered by solar panels and batteries, it operates independently from the grid. Passive elements like thermal mass materials, reflective coatings, and natural shading boost its effectiveness. Planned enhancements include smart airflow control and wind catchers, making the design adaptable and scalable for broader applications in Bahrain's sustainable urban development.

By Ahmed Alkooheji

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Design and Analysis of a Tube Pulling Mechanism

This project aims at innovating a design for a tube pulling mechanism which tackles an industry-specific problem related to the copper tube manufacturing process of Mueller Middle East. The gear and a pulley mechanism with adaptable center height rollers were used to reduce manual involvement within the manufacturing operation in cases wheremanufacturing defects cause production to stop. The designed mechanism can be utilized for pulling variety of copper tubes with varying diameter and effectively improves the efficiency of the existing production process. The mechanism was fully designed and analyzed through the 3D modelling software SolidWorks where manufacturing drawings were then submitted for fabrication.

By Abdulla Salman & Fadhel Haji

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Design and Development of locomotion Design of a Bio-Inspired Soft Crawler Robot for Pipeline Inspection

This project presents a low-cost, bio-inspired soft crawler robot designed for pipeline inspections, primarily targeting the oil and gas sector in Bahrain. The robot utilizes pneumatically actuated soft components, enabling it to navigate pipelines of various shapes and sizes. The design, developed using SolidWorks, features both linear and radial actuators that mimic the motion of a worm. To ensure optimal performance, the robot's locomotion system has been thoroughly analyzed and optimized using Finite Element Analysis (FEA) in ANSYS. Fabrication was carried out using 3D-printed mold casting. Lastly, the robot will undergo testing in a practical environment to assess its actual movement and performance within a pipeline. Equipped with a camera for real-time defect detection, this lightweight and robust design offers superior adaptability and cost-effectiveness compared to traditional rigid robots.

By Ali Ali

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Solar Powered Water Purification System

In the context of this project, a commercial inverse–osmosis water purification system was powered by a solar panel and specifically its centrifugal pump which covered the hydraulic losses of the filtering system. The pump energy consumption versus the filtered water volume was recorded for various time intervals as well as the energy generated by the solar panel and that stored in the system's battery. The purpose of this project is the use of a water filtering system along with a water cooler at areas where there is absence of electric grid.

By Talal Abdulla

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Comparative Analysis of 3D Printed Resins for Watch Design Applications: A Case Study with Qannati Watches

This study provides a comparative analysis of various 3D-printed resins to determine their suitability for watch design applications, conducted in collaboration with Qannati watches. By evaluating key mechanical properties such as tensile strength, creep resistance, and thermal performance, the research identifies optimal resin materials for luxury watch components. Additionally, resin exposure tests investigate how heat affects dimensional stability, shrinkage, and detailing accuracy. Findings from this research will assist Qannati Watches in selecting the most effective resins, enhancing their product precision, durability, and overall aesthetic quality.

By Husain Ali & Noor Abdulla

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Aerodynamic Design and Control System Implementation for Performance Optimization of F1 Helmets

This project aims to improve the aerodynamics of an f1 helmet using Computational Fluid Dynamics (CFD) simulation, while maintaining the safety standards of the helmet. The pre-optimized helmet will be tested, and the results will be used to evaluate and analyze the airflow and drag characteristics of the helmet. Moreover, a structural analysis, Finite Element Analysis (FEA) will also be conducted on the pre-optimized design, to act as a benchmark for the safety standard of the helmet. After the results are obtained, the helmet is then optimized aerodynamically by adding various design iterations and the results are compared to ensure a noticeable improvement in its aerodynamics without affecting the safety factor. Additionally, sensor technology is to also be implemented in the helmet, where the driver's heartbeat, blood pressure, body temperature, and oxygen.

By Mohamed Yusuf

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Wind Catcher Passive Cooling : An Experimental Study

This project explores the performance of a wind catcher for passive ventilation and cooling, inspired by traditional Middle Eastern designs. A scaled model was constructed and tested in a subsonic wind tunnel at Bahrain Polytechnic to evaluate its effectiveness under various wind directions. The building thermal loading was simulated by electric resistances, and the temperature distribution was recorded via thermocouples. The aim of this project was to assess the cooling potential of a wind catcher under well controlled experimental conditions, providing insight into its application for sustainable ventilation in Bahrain's climate.

By Yusuf Tariq

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Manufacturing a Plastic Shredder

This project focuses on the design, manufacturing, and testing of a plastic shredding machine developed for Ecoworks, a company committed to sustainable waste management solutions. The aim of the project is to support plastic recycling efforts by building an efficient and reliable shredding system capable of handling various types of plastic waste. While my primary responsibility lies in the testing phase, I have also contributed significantly to the design and manufacturing processes. The shredder was developed using SolidWorks for 3D modeling and design analysis, ensuring structural integrity and functionality before fabrication. Through iterative testing and refinement, the project seeks to optimize shredding performance, reduce waste processing time, and support Ecoworks' mission of promoting environmental sustainability through practical engineering solutions.

By Yousif Saeed

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Design and Simulation of Blended Wing Body Plane

This project focuses on designing and analyzing a Blended Wing Body (BWB) aircraft to optimize load distribution and material selection. The conceptual design looks into using composite materials to improve structural efficiency while keeping the aircraft lightweight. Three different models will be designed using SolidWorks, each varying in shape and structural configuration. One model will be selected based on its lift-to-drag (L/D) ratio, simulation results, material selection, and stress analysis. The selected design will undergo further analysis to assess its overall performance and structural integrity under simulated conditions.

By Ahmed Hasan

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وزارة شؤون البلديات والزراعة
Ministry of Municipalities Affairs and Agriculture

Designing and Manufacturing a Pergola Integrating Solar Power and Water Recycling for Sustainable Outdoor Cooling

The project offers an eco-friendly solution to Bahrain's urban heat and high cooling energy use by introducing a self-sustaining outdoor structure. Combining solar power, recycled AC condensation water, and passive cooling, it enhances comfort in public spaces. The system collects and stores condensation underground, using it in a solar-powered misting system that lowers air temperature by a drastic margin. Powered by solar panels and batteries, it operates independently from the grid. Passive elements like thermal mass materials, reflective coatings, and natural shading boost its effectiveness. Planned enhancements include smart airflow control and wind catchers, making the design scalable for broader applications in Bahrain's sustainable urban development.

By Moosa Mohamed

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Optimization of Natural Gas Pipeline Networks for Hybrid Energy Systems

This study explores the optimization of natural gas pipeline distribution systems integrated with a hybrid power generation framework in Bahrain,where natural gas accounts for over 80% of the energy supply. Centered on Diyar Al Muharraq, the research examines how pipe material, diameter, and thickness influence flow rate, pressure, and temperature to improve efficiency and sustainability. Two 1-meter prototypes are analyzed: a baseline model and an optimized design intended for HDPE, tailored for Diyar Al Muharraq. Using compressed air to mimic summer and winter conditions, the prototypes undergo experimental testing, with theoretical predictions based on continuity and Darcy-Weisbach equations estimating pressure drops (e.g., 0.190 bar/m for the baseline and 0.328 bar/m for the optimized design in summer). Bahrain's humid, high-temperature environment accelerates corrosion in carbon steel, heightening methane leak risks, whereas HDPE provides superior corrosion resistance and reduced friction. The optimized prototype meets a summer gas turbine demand of 2,334.53 kW/hour at a flow rate of 0.003502 m^3/s. Findings aim to guide the development of efficient pipeline systems, cutting energy losses by up to 10% and aligning with Bahrain's targets of 20% renewable energy by 2035 and net-zero emissions by 2060.

By Saud Masoud

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Hazardous waste management of a shopping center in Bahrain

The aim of this project was to propose a method for reducing improper waste disposal at shopping centers. In this context, a prototype sorting device was designed and fabricated
including a moving belt to transfer various types of waste, like metals, plastic and paper, inductive sensors which based on the type of the waste material activate air jets to separate light materials from the heavy ones and magnets to separate iron-steel waste from the rest.

By Moh'd Abbas & Khalid Salah

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Design, Optimization, and Development of a Soft Robotic Gripper for Food Industry

This project aims to design, optimize, and fabricate a soft robotic gripper which grasps delicate food products within an automated processing lines. A bio-inspired pneumatic actuators with a soft gripping surface is designed considering various handled objects requirements. The designed gripper is optimized to enhance its grasping capabilities including the required grasping force and volume. The gripper is designed using SolidWorks and structurally analyzed through ANSYS, after which it is fabricated using 3d printed mold casting. The optimized gripper should minimize product damage, reduce contamination risk, and adapt to various shapes and sizes of food items. Furthermore, it can be utilized for handling a wide variety of food products and effectively improves the reliability and hygiene standards of the existing automation process.

By Ali Alhelow

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Design and Simulation Optimization of a Cold Storage system

The main goal of the project is to design and optimize a cold which will be able to work in subzero conditions by thoroughly examining and selecting the most ideal insulation materials. We will identify solutions which will increase efficiency while maintaining the required temperature. Additionally, we will also review different refrigerants to determine the most efficient refrigerant that should be used in the system which also has a low environmental footprint, and effective performance across several operating conditions. Moreover,
the insight gained will help us design a cold room design that has high efficiency, sustainability, and reliability. Finally, the project will be concluded by a design of the cold room using SolidWorks.

By Zaid Ashraf

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Computer Numerical Control (CNC) Cutting Edge Machine Vacuum Cleaning -Assembly and Application

This project focuses on the application and assembly of a vacuum system designed for post-cutting efficient glass particle removal in the Computer Numerical Control (CNC) glass cutting edge machine. A functional prototype is designed, involving precise component fabrication, welding, and assembly. The vacuum system is integrated into the CNC cutting table to make a forward and backward movement for comprehensive cleaning. Rigorous testing will validate the system performance, effective particle removal, and operational reliability. The application of the proposed cleaning system enhances workplace safety and product quality in the glass cutting industry.

By Ahmed Aman

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Optimization of Process Flow: Engineering a Sustainable Pipeline Solution

This project aims to design and evaluate a bypass pipeline solution to address an operational inefficiency in the hydrocracking plant at Bapco Refining, where a pump is currently used unnecessarily during steady-state conditions. By utilizing the natural pressure available in the system, the proposed bypass eliminates the need for the 196 kW pump, resulting in reduced energy consumption and equipment wear. An optimized pipeline layout was developed, and suitable construction materials were selected to ensure corrosion resistance and compatibility with the process fluid. The design was fully modeled and analyzed using SolidWorks, with detailed manufacturing drawings prepared for implementation. The proposed solution provides a sustainable and cost-effective enhancement to the current operation at Bapco Refining.

By Jaffar Mohamed

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Developing safety headphones and enhancing noise reduction for Bahrain International Airport operators

This project focuses on designing a lightweight safety headset with improved passive noise insulation for airport ground staff at Bahrain International Airport. Workers are exposed to noise levels exceeding 100 dB(A), increasing the risk of noise-induced hearing loss. Existing headsets are often too heavy and lack sufficient insulation, leading to discomfort and reduced usage. The proposed design uses advanced materials such as memory foam and acoustic insulation layers, optimized for weight, comfort, and thermal performance. Calculations include mass, heat transfer, and noise attenuation. The project supports SDG 3 by promoting safer working environments and contributes to Bahrain's goals for innovation and occupational health improvement.

By Ali Hasan

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Fuel Tank Optimization

This project involves the design of an optimized car fuel tank with improved internal baffling and support for multiple fuel pumps, enhancing fuel delivery under dynamic conditions.The tank is engineered to mount directly to the OEM bolting points, ensuring a seamless, high-performance upgrade without structural modifications.

By Isa Ali

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Design and Optimization of Autonomous Irrigation Water Pumping Systems: A Case Study in Bahrain for Ministry of Municipalities Affairs

This project aims to design and optimize an Autonomous Irrigation Water Pumping System, tailored to the environmental and infrastructural conditions of the Kingdom of Bahrain, in alignment with the requirements of the Ministry of Municipalities Affairs. With increasing demand for sustainable water management, the project focuses on improving the irrigation efficiency through the integration of intelligent, automated pumping technologies. The system will be conceptualized and modeled using SolidWorks, followed by performance simulations to evaluate hydraulic behavior and energy consumption. Optimization strategies will be explored to enhance overall efficiency and reduce operational costs. The outcomes of this study are expected to provide a foundational framework for the future implementation of smart irrigation systems in Bahrain.

By Talal Issa

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Design and Fabrication of Precision Mechanical Watch using LCD Technology

This final year project, in collaboration with Qannati Watches, focuses on the design and fabrication of a precision mechanical watch integrated with LCD technology. It aims to bridge the elegance of traditional horology with the innovation of modern digital displays. The hybrid timepiece merges mechanical movements with LCD functionality, offering a unique user experience while preserving the craftsmanship associated with luxury watches. The prototype highlights micro-mechanical engineering, synchronization challenges, and aesthetic designs showcasing the potential for innovation within the high-end watchmaking industry.

By Sanad Abdullah

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Energy–Efficient Heat Control System For Glass Tempering Machine

This project aims to design and implement an energy-efficient heat control system for the glass tempering process at City Glass. To address excessive energy consumption and inconsistent heating, the system utilizes an Arduino Uno with integrated temperature and thickness sensors to dynamically regulate heat according to glass dimensions. It accommodates various glass thicknesses (4 mm – 10 mm) and minimizes heat loss through advanced insulation and optimized heating element placement. The mechanical layout was designed using SolidWorks, and a functional prototype was manufactured. The proposed system enhances production quality, reduces operational costs, and supports sustainability objectives.

By Ali Abuidrees

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Condition Assessment and Performance Analysis of Smart Irrigation Water Pumping System: A Case Study for Ministry of Municipalities Affairs in Bahrain

This project aims to develop and optimize an Autonomous Irrigation Water Pumping System tailored to Bahrain's infrastructure and environmental conditions. It addresses the need for effective irrigation solutions while supporting the Ministry of Municipalities Affairs' sustainable water management goals. By integrating automated systems that adapt to environmental changes, the project seeks to improve irrigation efficiency. The study evaluates the current system, identifies key performance factors, and proposes smart irrigation solutions focused on automation. A performance analysis of the proposed system will assess its effectiveness, providing insights and a framework for the future implementation of smart irrigation systems in Bahrain to promote sustainable water use.

By Ahmed Darwish

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Computer Numerical Control (CNC) Cutting Edge Machine Vacuum Cleaning -Design

This project focuses on the application and assembly of a vacuum system designed for post- cutting efficient glass particle removal in the Computer Numerical Control (CNC) glass cutting edge machine. A functional prototype is designed, involving precise component fabrication, welding, and assembly. The vacuum system is integrated into the CNC cutting table to make a forward and backward movement for comprehensive cleaning. Rigorous testing will validate the system performance, effective particle removal, and operational reliability. Application of the proposed cleaning system enhances workplace safety and product quality in glass cutting industry.

By Mohamed Mohsen

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Integration of Smart Labeling and Filtration Unit Design for Efficient Water Management in Sustainable Glass Manufacturing

This project aims to Integrate a Smart Labeling and Filtration Unit Design for Efficient Water Management in Sustainable Glass Manufacturing. The first stage of the system is to minimise the residue coming from the labels that entered the washing process with the glass by on cooperating QR code scanning off the glass before entering the machine. The second stage is adding filtration to the water reservoir of the washing machine to sustain the quality of the water needed for the washing process and prevent any unwanted damage on the glass. The system was fully designed in 3D modelling software SolidWorks and the designed system was presented to city glass for practical implementation.

By Ali Ayoob

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Case study on Tank 760 incident at Sitra Tank Farm

This project presents an optimized design for the floating roof of Tank 760 at BAPCO Refining, developed in response to a recent operational incident. The design incorporates lessons learned and adheres to API 650 and 653 standards to enhance structural integrity and safety of the floating roof. Through Finite Element Analysis and design analysis, improvements are proposed for the pontoon structure, center deck, and associated fittings. The solution is tailored to local climate conditions and operational requirements, while supporting Bahrain's Economic Vision 2030 by promoting sustainability and industrial advancement.

By Jaafar Yusuf

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Design of Steel Rolls stand

This project focuses on the design and development of a steel rolls stand for SULB Company BSC, aimed at enhancing the storage and handling of heavy steel rolls. The primary objective is to design a robust and efficient stand capable of securely holding steel rolls during industrial operations. The project begins with a conceptual and structural design phase, followed by a detailed analysis to ensure the stand meets operational requirements. A significant aspect of the work involves evaluating the safety of the stand through comprehensive risk and industry safety standard studies. The final phase includes the construction of a prototype to validate the design under practical conditions. This integrated approach ensures the stand is not only functional but also safe and industry compliant.

By Qasim Maki

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Design of Double - Glazed Solar Panel Window

This project focuses on designing a double-glazed solar panel window for commercial and industrial use, following City Glass specifications. The window will combine energy efficiency with solar power generation, helping improve insulation while producing renewable energy. Using SolidWorks, a detailed 3D model will be created to refine the design and ensure it meets structural and performance requirements. From this model, 2D drawings will be generated to guide the fabrication process, ensuring accurate manufacturing. The goal is to develop a practical and sustainable solution that integrates seamlessly into modern buildings, enhancing both energy efficiency and functionality.

By Ali Meshkhas

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Designing of a Safety Control Braking System for a VAWT

This project focuses on designing a safety control braking system for a Vertical Axis Wind Turbine (VAWT) tailored for City Centre Bahrain. The system uses an interworking gear mechanism within the gearbox to apply braking and reduce turbine speed during high wind conditions, enhancing operational safety and efficiency. The design was modeled and analyzed using SolidWorks software to ensure functionality, durability, and performance under varying wind speeds. The proposed solution offers a reliable, mechanical-based control method to protect the turbine from overspeed damage, contributing to safer and more sustainable wind energy utilization in urban environments.

By Fawzia Mohamed

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Testing and optimization of Electrostatically Driven Fog Collection Using Space Charge Injection

The growing global concern over freshwater scarcity, particularly in arid and semi-arid regions, necessitates innovative solutions for water collection. This research focuses on the testing and optimization of an electrostatically driven fog collection system that employs space charge injection to improve the attraction and accumulation of water droplets through high-voltage electrostatic forces. The primary objective of this study is to assess the system's efficiency by analyzing the rate of water collection under varying environmental conditions, charge intensities, and electrode configurations. The results will provide critical insights into optimizing electrostatic fog harvesting techniques, enhancing system performance, and advancing the potential for large-scale water collection applications. This research aims to contribute to more effective and sustainable solutions for addressing global water scarcity.

By Ali Alnakkas

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Design and fabrication of Electrostatically Driven Fog Collection Using Space Charge Injection

This project focuses on the design and fabrication of an electrostatically driven fog collection system that employs space charge injection to enhance the capture of water droplets from fog using high-voltage electrostatic forces. The primary objective is to develop a functional prototype capable of effectively collecting water by generating and controlling space charge injection, thereby improving droplet attraction and coalescence. Key design considerations include the optimization of electrode configuration, charge distribution, and overall system stability. Experimental testing will be conducted to evaluate the efficiency of water collection and the performance of electrostatic forces in enhancing the fog harvesting process. The findings will contribute to advancing electrohydrodynamic methods for atmospheric water collection, offering valuable insights for future enhancements in fog harvesting technology and its potential scalability for addressing water scarcity.

By Abdulrahman Noor

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Optimization of Natural Gas Pipeline Networks for Hybrid Energy Systems

This project presents an optimized design for a hybrid energy system in the city of Diyar Al Muharraq, Bahrain, which integrates solar panels, wind turbines, the utility grid, and a medium-pressure natural gas distribution network (MPDN). The system supplies piped natural gas (PNG) for two critical purposes: fueling small-scale gas turbines for electricity generation, and providing low-pressure gas for residential cooking and heating. The aim is to minimize the total cost of the system—including both capital and operational expenses—while achieving at least a 15% reduction in emissions. The small-scale gas turbines provide fast-response during low solar or wind output allowing more flexibility compared to large powerplants. Gas flow, pressure loss, and thermal stress under summer and winter conditions are simulated using ANSYS Fluent, with results feeding into a MATLAB-based optimization loop driven by a Genetic Algorithm (GA). The algorithm optimizes pipeline dimensions, material selection, gas turbine flow rate, and operating pressure to ensure the system remains within safe flow velocity, acceptable pressure drop, and structural stress limits compliance with ASME B31.8 pipeline design standards. By coordinating solar, wind, natural gas, and grid power, and optimizing the MPDN, the system delivers a cost-effective, reliable, and low-emission energy solution tailored to urban development in Bahrain.

By Nayef Alqassab

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Glass Sand Recycling and Fabrication of a Sustainable Alternative in Concrete

The increasing concern about environmental sustainability in construction has highlighted the need to explore alternative materials that reduce environmental impact. This study investigates the use of powder glass or sand glass as a replacement for traditional sand in concrete mixtures. The research aims to assess the mechanical properties, including compressive strength, tensile strength, and flexural strength, of concrete modified with recycled glass aggregates. Recycled glass aggregates, sourced from post-consumer glass waste, are ground to a fine powder and substituted for natural sand in concrete formulations. The study also explores the impact of powder glass on the density, durability, and workability of the concrete. Cement and clean water, along with commercially available materials, are combined with powder glass in varying proportions to form the concrete composite. Several mechanical tests are carried out to evaluate the properties of the concrete, including tensile strength tests using a universal testing machine (UTM), hardness testing for surface strength, and heat resistance testing to determine thermal stability under varying temperatures. The results indicate that the incorporation of powder glass in concrete enhances its mechanical performance, including increased tensile strength and improved heat resistance compared to conventional concrete. Additionally, the modified concrete exhibits promising durability, showing potential for long-term performance in structural applications. This study contributes to the advancement of sustainable construction practices by reducing reliance on natural sand and utilizing recycled materials to enhance concrete properties. The findings also suggest the need for further optimization of the mix design and workability characteristics to improve the practical application of recycled glass in concrete.

By Husain Shehab

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Ministry of Municipalities Affairs and Agriculture

Designing and Manufacturing an Outdoor Pergola with Solar and Natural Cooling

This project addresses Bahrain's rising urban heat and energy demands by creating a sustainable outdoor cooling system in Hamad Town Walkway. It integrates solar energy, water recycling, and passive cooling strategies to enhance public comfort. A key feature is the reuse of AC condensation water, stored underground and used in a solar-powered misting system that cools surrounding air by 3.39°C. Powered by monocrystalline solar panels and batteries, the pergola also utilizes high thermal mass materials, reflective paints, and shading elements for passive cooling. Thus, this self-sustaining design reduces environmental impact and energy use.

By Hussain Shehab & Sayed Mahfoodh

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RC Submarine Explorer

This project presents the design of a controllable submarine prototype for water exploration. The designed submarine lays the foundation for future versions capable of deeper and more complex underwater operations. The submarine is operated by a ballast system using a syringe driven by a 3D-printed gear mechanism to control buoyancy through water intake and expulsion. The submarine also integrates a live-feed camera for real-time monitoring and navigation. In today's world, wireless underwater communication with acceptable data rates remains a major technological challenge due to the poor penetration of RF signals. This project aims to explore and evaluate different approaches to overcome this limitation. As part of this effort, we are testing how deep standard Wi-Fi signals can function underwater for both control and video streaming. While Wi-Fi is used in this prototype, the ultimate goal is to exploit the advanced solution, optical communication for future underwater systems. By combining engineering systems, this project opens pathways for scalable, affordable underwater communication.

By Abdullah Alqassas

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Analysis of Grid-Tie Inverter

This research focuses on Grid-Tie Inverters (GTIs), which play a vital role in integrating renewable energy sources (RES) into electrical grids. It presents an extensive study and model of GTI along with an exploration of various configurations, topologies, and control strategies that are used to achieve effective and dependable power conversion and grid synchronization. An in-depth simulation is created using multiple MATLAB codes linked with Simulink models to show the practical application through a wise selection of some of the principles discussed. The research seeks to give a broad understanding of GTIs and their role in aiding the shift from fossil fuel-dependent systems to eco-friendly and sustainable energy systems.

By Hussain Ahmed

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Cash in Transit Security System

This project presents a functional prototype of a secure cash-in-transit system utilizing RFID-based authentication, motorized gate control, and an integrated alarm system. The system is powered by an Arduino microcontroller, which processes RFID tag data to determine access authorization. Upon successful authentication, a servo-driven gate opens to allow access, while unauthorized attempts trigger an audible alarm and visual alert via LEDs. The prototype demonstrates a cost-effective and scalable solution for enhancing the physical security of cash handling and transport operations. Designed for educational and practical applications, this system emphasizes real-time decision-making, access control, and automation in security-critical environments.

By Ali Albinali

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Electrical Impedance Tomography: Current Injection Circuit

Electrical Impedance Tomography (EIT) is an advanced imaging technique used for visualizing the internal conductivity distribution of an object. This paper presents the design and implementation of a current injection circuit for EIT systems. The proposed circuit facilitates controlled and precise current injection into the subject, ensuring optimal excitation of the electrodes while minimizing noise and interference across various impedance conditions. The performance of the current injection circuit is evaluated through Multisim simulation, demonstrating its effectiveness in enhancing image quality and resolution in EIT applications. The findings indicate that the designed circuit improves the accuracy of impedance measurements and contributes to the reliability of EIT systems in real-time imaging scenarios.

By Osama Salama

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Hybrid Power System

This project explores the integration of lithium battery technology into hybrid power systems to enhance generator performance. Traditional generators rely on fossil fuels, leading to high costs, increased emissions, and inefficient operation. The proposed hybrid system utilizes lithium batteries to store excess energy, reducing fuel consumption and ensuring a more stable power supply. The objectives of this project include improving generator efficiency, reducing environmental impact, and optimizing energy management through battery integration. The methodology involves analyzing power demand, selecting appropriate lithium battery configurations, and developing a control system to ensure seamless energy transition between the generator and the batteries. Experimental and simulation-based approaches will be used to evaluate system performance. Key findings indicate that lithium batteries can significantly lower generator fuel consumption, increase operational lifespan, and minimize carbon emissions. The results demonstrate that hybrid power systems provide a cost-effective and sustainable solution for various applications, particularly in remote or off-grid locations. The study concludes that lithium-based hybrid systems can play a crucial role in advancing energy sustainability and efficiency.

By Qaem Albaqal

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Integration of Wave Energy Converters (WECs) into Marine Ships

This project aims to harness the power of ocean waves through the integration of wave energy converters (WECs) into marine ships to perhaps present the marine industry as a more sustainable industry. Exploring the potential of WECs to reducing the reliance on fossil fuels, resulting in less greenhouse gas emissions. Moreover, benefits like auxiliary power generation and longer travel distance are highlighted along with technical challenges to space constraints, weight limitation, etc. Key findings and examinations on various WEC technologies and their fundamentals are explored thoroughly to integrate them effectively into the industry with some designs. The economic feasibility and impact of WECs integration on performance, marine environments, and mobility.

By Abeer Salman

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IoT-Based Smart Lighting and Security Automation System

Previous research studies have explored the integration of lighting and security by using motion-detecting sensors to turn on lights, but few have discussed using randomized lighting to simulate occupancy as a proactive measure against intrusion. The proposed system in this paper used an ESP32 microcontroller with an ultrasonic sensor and addressable LEDs to achieve this. A captive portal was used for access control instead of a conventional mobile application to reduce the attack radius of hackers. It also features dual lighting modes: an active mode that randomizes the light patterns and an ambient mode where lights are pre-programmed based on different users (owner or guests) entering the home.

By Manar Alwadaei

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Advanced Modeling, Analysis and Control of a Vertical Rocket

As space missions progress, the challenge of controlling finless rockets has grown, necessitating innovative solutions for flexibility and precision. This project explores the dynamics of a finless rocket using a linearized six-degrees-of-freedom (6DOF) state-space model. Advanced control strategies, including Proportional-Integral-Derivative (PID), Linear Quadratic Regulator (LQR), and Model Predictive Control (MPC), were developed to stabilize the rocket, optimize trajectory tracking, and enhance disturbance rejection. Observer-based techniques, including Kalman Filtering, were implemented to estimate unmeasured states and improve feedback. This project bridges the gap between theory and practical applications, laying the foundation for future research in adaptive rocket control for next-generation space missions.

By Mohamed Mohamed

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Sun-Tracking Solar System

This project presents the design and implementation of a dual-axis sun tracking solar system. The system aims to maximize solar energy capture by automatically orienting a photovoltaic panel perpendicular to the sun's rays throughout the day. Utilizing light-dependent resistors (LDRs) as sensors and a microcontroller for intelligent control, the system drives servo motors to adjust the panel's azimuth and elevation angles. This dynamic tracking mechanism is expected to significantly improve energy generation compared to stationary solar panels. The project showcases a practical application of renewable energy technology and highlights the potential for increased efficiency in solar power harvesting.

By Ali Hasan & Sanad Sanad

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Motor Current Signature Analysis: Design and Implementation

This project presents the design and implementation of a real-time Motor Current Signature Analysis (MCSA) system for fault detection in electric motors. A Current Transformer (CT) is used to acquire motor current signals, which are analyzed using Fourier Transform (FFT) and Wavelet Transform (WT) techniques to identify faults such as broken rotor bars and stator winding short. The system is integrated with MATLAB for real-time data acquisition and monitoring. To support usability and diagnostic capabilities, a MATLAB-based application was developed to automate analysis and generate diagnostic reports. The project aims to enhance motor reliability and enable predictive maintenance through accurate fault classification and signal analysis.

By Ebrahim Maki

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Phased Array Antenna System

A phased array sensor monitoring antenna is an advanced, electronically steered system made of multiple radiating elements. By adjusting the phase of signals at each element, it steers beams without moving parts, enabling rapid, precise signal or target tracking. This technology is vital in radar, 5G telecommunications, defense, space communication, and medical imaging. Its ability to scan and transmit to multiple directions simultaneously enhances speed, reliability, and accuracy. Though complex and costly, phased arrays offer scalability, high resolution, and adaptability. Integrated phase shifters and advanced signal processing enable dynamic beamforming and multi-target tracking, positioning phased arrays as essential components in next-generation sensing and communication systems.

By Ghufran Alhumood

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Designing a Turbine System to Convert Water Flow into Electrical Energy

The purpose of this project is to design an innovative turbine system that efficiently converts water flow into electrical energy. By harnessing the kinetic energy of water flow, this system aims to provide a sustainable and eco-friendly power generation solution. The project involves evaluating various turbine designs, selecting the most suitable configuration, and prototyping the chosen design to ensure optimal performance. Advanced software tools such as SolidWorks will be utilized for detailed modeling, simulation, and analysis. The project will assess multiple turbine designs to identify the most efficient and practical solution for implementation. Prototyping and testing will follow to verify performance metrics, efficiency, and reliability. Ultimately, this project seeks to contribute to the broader goal of enhancing energy efficiency and promoting the use of renewable energy sources. The results of this study could be applied to various settings, offering a reliable and clean energy alternative that minimizes environmental impact.

By Mohammed Habib

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Automated Laundry Folding Machine

This project aims to tackle a problem every household has it is a cumbersome task that everyone dislikes which is folding clothes after washing them, this project aims to reduce the time it takes to fold clothes, via the use of microcontrollers and servo motors. It is expected to reduce the time to fold a laundry load by at least 30%.

By Dana Albanna

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Development of Smart Irrigation Water Pumping System: A Case Study for Ministry of Municipalities Affairs in Bahrain

The project aims to analyse existing irrigation water station at one of the government sites that operates manually and develop a smart irrigation water pumping station for Ministry of Municipalities Affairs, Bahrain. By employing a Programmable Logic Controller (PLC) and different sensors, various parameters of water like level, flow, temperature, pressure, pH level and turbidity will be monitored. The operations could be controlled remotely without the need for direct human intervention. This automation will increase water distribution efficiency, reduce manual labour cost and contribute to sustainable use of water resources, aligning with Sustainable Development Goals (SDGs).

By Ali Alhalwaji

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Design of Double - Glazed Solar Panel Window

This project focuses on designing a double-glazed solar panel window for commercial and industrial use, following City Glass specifications. The window will combine energy efficiency with solar power generation, helping improve insulation while producing renewable energy. Using SolidWorks, a detailed 3D model will be created to refine the design and ensure it meets structural and performance requirements. From this model, 2D drawings will be generated to guide the fabrication process, ensuring accurate manufacturing. The goal is to develop a practical and sustainable solution that integrates seamlessly into modern buildings, enhancing both energy efficiency and functionality.

By Yusuf Alqadeeri , Mohammed Ameer, Reem Alhasan

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Sustainable Living Through Solar-Powered Homes & Greenhouses

This project presents a working prototype of an integrated smart system powered by solar energy, combining a smart house and a smart greenhouse. The smart house features automated controls to simplify daily routines, such as lighting, temperature, and security systems. The smart greenhouse includes intelligent irrigation and environmental monitoring to optimize plant growth. Both systems are managed using lot technology, with sensors and actuators controlled by Arduino or ESP32 microcontrollers. Solar panels supply renewable energy to the entire setup, promoting sustainability. This project demonstrates how solar power and smart automation can work together to create an efficient, eco-friendly living and farming environment, suitable for modern, sustainable lifestyles.

By Lulwa Almuraisi & Haya Aldosseri

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Smart school bus system

This project presents the design and implementation of a dual-axis sun tracking solar system. The system aims to maximize solar energy capture by automatically orienting a photovoltaic panel perpendicular to the sun's rays throughout the day. Utilizing light-dependent resistors (LDRs) as sensors and a microcontroller for intelligent control, the system drives servo motors to adjust the panel's azimuth and elevation angles. This dynamic tracking mechanism is expected to significantly improve energy generation compared to stationary solar panels. The project showcases a practical application of renewable energy technology and highlights the potential for increased efficiency in solar power harvesting.

By Sami Bawazir

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Real-Time Low-Latency FPV Head-Tracking System for Drone Applications (Project Sky Eye)

This project, titled Project Sky Eye , develops a cost-effective, real-time FPV head-tracking system for drones. It uses nRF24L01 modules for low-latency wireless communication and the MPU6050 IMU for precise motion tracking, enabling intuitive drone control via head movements. A key innovation is the dual-camera setup: an RGB camera for visual inspections and a thermal camera for gas leak detection, critical for industries like oil and gas. Built with affordable components, including an Arduino Uno Wi-Fi Rev 2, the system costs under $87. Rigorous testing ensures <20ms latency and ±3° precision. By enhancing safety and efficiency in hazardous environments, Project Sky Eye advances drone technology for industrial and recreational use.

By Ayoob Taha & Yousif Artan

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Air toxicity analyzer - Integrated phone app monitoring

This project aims to develop a Portable Air Toxicity Analyzer with an integrated smartphone application to monitor harmful gases in everyday environments, particularly in regions with poor air quality like Bahrain. The device utilizes MQ-series ensors to detect pollutants such as smoke, isobutane, methane, and carbon monoxide and provide real-time data on air toxicity levels. Unlike industrial-grade analyzers, this system is designed for consumer use, offering an affordable, user-friendly solution to raise public awareness of air pollution exposure. The analyzer wirelessly transmits data to a mobile app, where users can view detailed air quality metrics and health recommendations. By making air toxicity monitoring accessible to the public, this project aims to encourage individuals to be more aware of the air they regularly breathe and help them take the appropriate actions. These harmful gases are commonly completely invisible and people often find out when it’s too late.

By Moh’d Asbool & Ali Husain

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Solar-Powered EV Charging Station: Dynamic Sun Tracking with Real-Time Energy Monitoring through Mobile App

With the increasing adoption of solar energy worldwide, optimizing the efficiency of solar panels remains a critical challenge. Maximizing power generation is a key concern in solar energy systems. This project proposes the development of a Solar Farm Tracking System integrated with a Maximum Power Point Tracking (MPPT) solar charger. The system will employ an MPPT algorithm to enhance charging efficiency, ensuring optimal power extraction from the solar panels. Additionally, a mobile application will be developed to monitor and display real-time power generation data to be used as a charging station for electric cars. The implementation will be based on Arduino, providing a cost-effective and scalable solution.

By Abdulrahman Yassein

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Automated buffer inventory

This project develops an automated buffer inventory system using a Raspberry Pi 4 with a night vision camera and PIR motion sensors to track inventory in low-light storage environments. Designed to replace manual processes, the system captures item images upon motion detection, extracts text via OCR (Optical Character Recognition), and logs data for real-time monitoring. This project demonstrates a cost-effective, sustainable solution for inventory management, aligning with Industry 4.0 and Bahrain’s Vision 2030 sustainability goals.

By Ali Yusuf

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Automated Load Delivery System

In-house logistics of company premises that are done manually can lead to errors, delays, increased costs and disruptions in the workflow. This project analyzes this problem by the implementation of an automated system of delivery whereby loads are transported from warehouses to production sites without any human interference. The prototype is a line follower that depends on marked paths to travel along. It transports loads smoothly and without interruption. Forklifts that are stationary load and unload the truck independently without any type of manual intervention necessary. The project is an affordable and scalable solution for the optimization of industrial material handling that enhances the safety productivity and overall efficiency.

By Mohamed Bakhsh, Mohamed Hasan, Ali Alaraibi

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Conducting A Fault Analysis of The GPIC Power Distribution Network

This project focuses on conducting a comprehensive fault analysis of the Gulf Petrochemical Industries Company (GPIC) power distribution network. The objective is to evaluate system performance by analyzing fault current levels, voltage profiles, and power flow under different operating conditions. The study utilizes theoretical calculations and simulation tools to assess network reliability and identify potential areas for optimization. Additionally, the research explores the integration of additional equipment, such as pumps and motors, to enhance efficiency and stability. The findings aim to provide insights for improving industrial power system reliability and contribute to the advancement of fault analysis in large-scale electrical networks.

By Ahmed Aljasim & Yusuf Qamber

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Design and implementation of a glass defect a reader/detector

This project aims to design a device capable of recognizing a defect in a glass sheet during or after processing which allows for automation of City Glass operations. The Contact Image Sensors and Arduino micro-controller will be used to reduce manual involvement within the quality control operation in cases where manufacturing defects may pass due to human error causing unnecessary losses. The designed device can be applied for glass defect detection including air bubbles, and defects that are visible from a certain distance on various glass shapes and sizes. The device is to be designed on the software end in MATLAB and C/C++ to determine the parameters that constitutes an air bubble , scratch and or cracks. As SolidWorks Model model will be created and then fabricated.

By Kawthar Mohsen & Murtadha Nawar

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Smart school bus system

In hot climates like Bahrain, air conditioners run nonstop, yet the clean water they produce as condensate is often wasted.This project transforms that waste into value through an IoT-powered system that collects, filters, and reuses AC condensate for smart irrigation. Equipped with sensors to monitor water quality (pH, TDS, temperature, pressure, and flow), and a moisture-based irrigation trigger, the system ensures efficient and sustainable water use. Controlled via a custom Blynk dashboard, it also features manual override and emergency stop for safety. The result is a low-cost, scalable solution that blends environmental responsibility with practical engineering, making it ideal for homes, buildings, and future smart cities.

By Daniah Radhi & Raneem Alawadhi

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AI-Integrated Automated Sorting System Using PLC Technology for Efficient Material Handling

This project presents the development of an AI-integrated automated sorting system that combines sensor-based material detection with PLC-controlled mechanisms to enhance efficiency in industrial material handling. A Raspberry Pi is used to detect and classify materials such as plastic, metal, and glass, with classification signals sent to an Allen-Bradley PLC via relays. The PLC processes the input and controls sorting actions using actuators like air jets and electromagnetic separators. The system is designed to reduce manual labor, increase sorting accuracy, and improve operational speed. It offers a reliable, scalable, and sustainable approach suited for smart manufacturing, industrial automation, and resource optimization across various production environments.

By Ammar Radhi

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LiDAR-based Objects Detection System

This project develops a LiDAR-based object detection system using the LD19 sensor and a Raspberry Pi, enhanced with the Raspberry Pi Camera Module V2. The objective is to create a real-time detection system capable of identifying objects in various environments, improving applications in robotics and autonomous navigation. The LD19 sensor provides high-resolution distance measurements, while the camera captures visual data, both processed with algorithms implemented on the Raspberry Pi. The project includes hardware assembly, software development, and testing toevaluate performance metrics such as accuracy and response time. Finally, results demonstrate the system's effectiveness in real-time object detection, contributing valuable insights into the practical applications of LiDAR and camera technology in autonomous systems.

By Yusuf Alsekri , Zaid Ashraf, Ahmed Darwish

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Automated Vacuum for CNC cutting table for City Glass Company

The aim of this project is to design, manufacture, assemble, program and test a vacuum machine specifically designed for the CNC cutting table that in City Glass Company, it is designed to improve the cleaning method, while simultaneously cutting cleaning time. This project will make the cleaning more efficient, making sure to remove all glass particles from the table and not leave any glass that might damage the new product. There are many softwares used from designing to testing vacuum machine, such as SolidWorks, and RSXLogics5000 for programming. The expected result is to have an increase of 95% in efficiency and a reduction of at least 50% in time, this will result in an increase in productivity, where more glass will be processed.

By Husain Mohamed

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Smart Wear

This project introduces a smart wear system designed to monitor athletics, constructors, workers etc. performance using wearable technology. A sensor-integrated vest collects real-time data such as heart rate and motion and much more is available, for now a Lilypad microcontroller, accelerometer, and heart rate sensor. The data is visualized through LED indicators and transmitted to the Blynk app for remote monitoring. The system was modeled in SolidWorks and programmed using Arduino, offering an efficient solution for performance tracking and health monitoring in sports.

By Faisal Ayyash

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3D Printer Filament Recycling Machine and A Recycled 3D Printer Model

This project involves designing and building a machine to recycle PET plastic into 3D printer filament. The goal is to create a system that processes waste plastic into usable filament for 3D printing. The project consists of two main components: a plastic recycling machine that cuts and extrudes PET plastic into filament, and a 3D printer that uses this recycled filament. This work focuses on the development of these machines and their integration into a sustainable workflow for 3D printing. The project aims to provide a practical solution for recycling plastic waste into a resource for additive manufacturing.

By Aliya Ansari & Eslam Omar

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AI Based Crop Monitoring System

This project presents an AI-based crop management system that automates irrigation and fertilization using real-time soil moisture, humidity, and pH data. Sensors which measure moisture, humidity and pH feed inputs to AI algorithms, triggering water and fertilizer pumps to optimize resource delivery, reduce waste, and enhance crop health. This system collects real-time data on environmental factors such as humidity, soil moisture, and pH and collected data then analyzed to provide actionable insights for farmers, helping them make decisions on resource allocation. The system minimizes manual intervention, improves sustainability, and boosts agricultural efficiency through intelligent, data-driven automation.

By Faisal Ayyash

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Self-driving/parking car using LiDAR sensors and obstacle detection using AI

The aim of this project is to design and implement a self-driving/parking car using Arduino LiDAR sensors and camera technology. This project aims to develop an autonomous car that is capable of navigating through complex environments by integrating multiple sensor inputs for obstacle detection and navigation. The device uses a camera to visually identify obstructions and road conditions and a LiDAR sensor to estimate distances precisely. The project focusses on real-time data processing and decision-making algorithms to enable safe and effective mobility using the Arduino platform. Optimising the vehicle's response to changing obstacles managing power supply requirements, and guaranteeing reliable sensor data integration are some of the main problems.

By Omar Althawadi

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Power Energy Threshold Monitoring System

This project aims to develop an energy monitoring device for factories to optimize energy consumption and reduce wastage. It will monitor energy usage across the Main Distribution Board (MDB), Sub Distribution Board (SDB), and Final Distribution Board (FDB) using sensors for real-time data analysis. Customized thresholds will be established in consultation with the factory owner, allowing the system to automatically disconnect electrical supply when consumption exceeds limits. By enhancing energy efficiency and promoting sustainable practices, this solution will help factories achieve better energy management, lower operational costs, and contribute to environmental sustainability.

By Ahmed Ahmed

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Microcontroller leak and illegal water connection detector system

This project presents the design and implementation of a microcontroller-based verification system to monitor pressure signals in a water distribution network. The system uses two pressure transmitters connected to a microcontroller, to measure pressure at two identical points in the network. By continuously comparing the analog inputs from both transmitters, the system can detect discrepancies that may indicate unauthorized connections or leaks within the water system. In the event of a pressure discrepancy, the microcontroller triggers an alert, enabling the party responsible for any detected illegal connection or leak to be identified. This proactive monitoring approach not only enhances the safety of water distribution systems but also helps conserve resources and reduce operational costs associated with undetected leaks. The project leverages the real-time data processing capabilities of microcontrollers, ensuring accurate and timely detection of anomalies. In addition, the system can be integrated with user-friendly monitoring and reporting interfaces, providing stakeholders with actionable insights into the status of the network. By implementing this verification system, we aim to contribute to improved water resource management, while emphasizing the importance of maintaining system integrity and accountability. This project not only addresses practical challenges in water management but also serves as an educational endeavor, enhancing our understanding of microcontroller applications in real-world scenarios. The actual cost of the project demonstrates the economic feasibility of its implementation, given its significant impact on preserving public money and stopping the waste of national wealth, namely water. It also maintains the efficiency of the water distribution network, given that the authorities responsible for monitoring water consumption use technology and methods that do not meet the required level in preserving water wealth and stopping or reducing illegal use.

By Jasim Althawadi , Sayed Hasan, Shubbar Ahmed , Yaser Abdulrasool , Abdulla Alkhateeb

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TunnelGuard

The Ministry of Works (MOW) in Bahrain struggles with flash flooding in road tunnels, endangering public safety due to delayed responses from manual monitoring and fragmented communication via emails and WhatsApp. To address this, TunnelGuard an AI-powered flood prevention system is proposed. Leveraging AWS cloud services, the prototype integrates IoT sensors and weather data to predict flooding risks, trigger automated barriers for tunnel closure, and issue real-time alerts to authorities and the public. By shifting from reactive to proactive management, TunnelGuard enhances emergency response, minimizes disruptions, and ensures safer infrastructure. This project demonstrates how smart automation and predictive analytics can revolutionize flood mitigation, offering a scalable model for resilient urban mobility.

Where Innovation Meets Impact – Shaping Sustainable Solutions for Tomorrow's Challenges.

As the Engineering Project Expo 2025 comes to a close, we extend our deepest gratitude to all participants, partners, and attendees. This year's event has truly embodied our vision of Innovation · Sustainability · Industry Solutions, showcasing groundbreaking ideas that will shape the future of engineering. Your enthusiasm, collaboration, and commitment to sustainable progress have made this Expo unforgettable. Together, we've pushed boundaries, sparked new connections, and proven how engineering can drive meaningful change.

Until next year—keep innovating, keep inspiring, and let's continue building a brighter tomorrow.

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