23rd MSU-IIT Annual In-House Review of Research and Development Projects

Monday, October 20, 2025 - Monday, October 20, 2025

MSU-IIT Gymnasium

Book of Abstracts

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Oral Presentations / 1

Epoxy-based Resin with Black Sand: An Alternative Material for Three Phase Induction Motor Stator Core

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Abstract: This paper presents an alternative material for a three-phase induction motor stator core using epoxy resin and black sand. The epoxy resin acts as a binder, while the black sand works as the magnetic material of the stator core. The epoxy base resin stator core has 36 slots, 62 turns per coil per phase per pole, and is wound in a concentric configuration. It uses 22AWG magnetic wire, and the coil is arranged in a 4-pole configuration. The test is conducted with a varying input voltage from 20V to 140V with an increment of 10V per test. The testing results show that the motor starts to rotate when the applied input voltage is at 90V with an average line current of 1.16A, and increasing the input voltage to 140V with an average line current is at 1.2A. The rotor speed of the motor ranges from 1750 rpm to 1850 rpm, respectively. All tests conducted are at no load condition.

Key Words: epoxy resin binder; black sand magnetic properties; black sand permeability; induction motor stator; stator core sheets

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AgriCerPSi - Synthesis of Agricultural Waste-Derived Ceramic Porous Silicate Particle

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Rice husk is one of the most abundant agricultural by-products in the Philippines, comprising about 20% of harvested rice by weight. Its disposal through open burning produces rice husk ash (RHA), which poses environmental risks such as air pollution, soil alkalinity alteration, and uncontrolled ash accumulation. At the same time, RHA is a rich source of silica, containing up to 80–98 wt.% SiO_2, making it a promising raw material for value-added applications. This study aims to valorize RHA by synthesizing porous silicate particles (SPPs) through a simple process. Silica (SiO_2) was extracted from calcined RHA (700 ℃) via acid treatment and subsequently synthesized into sodium silicate using NaOH solution of varying concentrations. The sodium silicate served as the precursor for SPP synthesis via the emulsion method. Sodium silicate was characterized by XRF and FTIR, while the synthesized SPPs were analyzed using N_2 adsorption–desorption (BET–BJH) to evaluate porosity. Results revealed that RHA-derived SPPs exhibit mixed micro–mesoporous silicate structures. The result of this study demonstrates that RHA can be effectively repurposed into high-quality SPPs, addressing waste management concerns while providing a sustainable silica source for advanced material applications.

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Evaluating Vector and Human Control Strategies for Dengue Transmission in the Philippines in the Absence of Vaccination

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Abstract: Dengue remains one of the most critical public health challenges in the Philippines. In the absence of an effective vaccine, the most practical means of mitigating its spread involves reducing the mosquito population and minimizing human exposure to mosquito bites. This study introduces vector and human-based control strategies, with a particular emphasis on transmission reduction. A modified Susceptible-Infected-Recovered (SIR) dengue model, based on the work of de los Reyes and Escaner, is used to incorporate these interventions. Numerical simulations are conducted to evaluate the impact of the proposed controls when applied individually and in combination. The results show that sustained maximum control efforts throughout the year significantly reduce infection levels. Notably, the simultaneous implementation of both strategies at full intensity yields the most substantial decline in dengue cases. These insights can aid public health authorities in designing more effective dengue prevention programs in the absence of vaccination.

Key Words: Vector Control; Human Control; Dengue Vaccine; Optimal Control; Pontryagin's Maximum Principle

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Transportation Network Optimization for Iligan City

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Abstract: This study applies a graph-theoretic framework to optimize traffic flow in Iligan City by integrating three key network algorithms: Dijkstra's algorithm for computing the shortest paths, the Edmonds-Karp variant of the Ford-Fulkerson algorithm for determining maximum flow, and Google OR-Tools for solving the capacitated Vehicle Routing Problem (CVRP). The road network is modeled as a directed graph, where intersections are nodes and road segments are edges with length- and capacity-based constraints. The study introduces an Integrated Traffic Flow Optimization Theorem, which formalizes the conditions under which a feasible and congestion-minimizing traffic assignment exists. Empirical data from Iligan City's road infrastructure validate the theorem, with computational results demonstrating effective shortest routing, maximized throughput between critical nodes, and feasible vehicle dispatch routes under demand constraints.

Key Words: traffic, network optimization, algorithm, Iligan City

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Nutrient Load Optimization of Hydrothermal Hydrolysate Liquor from Coffee and Cassava Waste

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Abstract: Abstract: The growing utilization of agro-industrial byproducts presents both challenges and opportunities for developing countries. In the Philippines, cassava and coffee processing generate significant wastes, particularly cassava peel (CP) and coffee husk (CH). This study explored the production of nutrient-rich hydrolysate liquor from CP and CH through hydrothermal carbonization (HTC) at 190℃ for 30 minutes under varying blend ratios. The hydrolysate liquors obtained had mass yields ranging from 48.63% to 81.96% and exhibited acidic pH values (3.34-4.14). Elemental analysis showed that 100% CP produced the highest iron (89.4 mg/L) and magnesium (680.68 mg/L) concentrations, whereas 100% CH yielded the highest phosphate (520 mg/L) and phosphorus (169.59 mg/L) levels. The 50% CP–50% CH blend yielded the highest calcium content (616.15 mg/L). Optimization identified an optimal mixture of 73.8% CP and 26.2% CH, achieving less than 10% error between predicted and experimental values for most parameters, excluding ammonia and nitrogen. These findings highlight HTC as a viable approach for recovering inorganic nutrients from CP and CH, though further optimization is needed for consistency and potential application.

Key Words: hydrothermal carbonization; hydrolysate liquor; cassava peels; coffee husks; nutrient optimization.

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Development of drone-based computer vision-assisted pavement distress detection (Phase 2)

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Abstract: Evaluating road damage conditions makes informed maintenance decisions. Distresses, such as cracking, diminish pavement functionality and reduce its service life. However, a thorough evaluation should also consider additional factors, such as obstructions (e.g., vehicles, large trees, shadows, and wet areas), to provide a comprehensive assessment of road conditions. Traditional road inspection methods are time-consuming, hazardous, and susceptible to human error. Therefore, automating the classification of pavement conditions can streamline road inspection and maintenance processes. Unmanned aerial vehicles (UAVs) have proven to be effective tools for rapidly collecting data, particularly in remote areas where assessing damage can be difficult. In this project, the proponents investigated new methods that can accelerate drone-based computer-vision assisted pavement inspection. The contributions of this work are summarized in three parts: (i) an AI-driven road lane tracking system, (ii) a new cascaded reconstruction and localization method of a 2D road map given UAV imagery, and (iii) a software application with AI-recommended reports.

Key Words: Aerial Systems: Applications; Automation Technologies for Smart Cities; Computer Vision for Transportation; Deep Learning Methods; Object Detection, Segmentation, and Categorization

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Mask, Hairnet and Handwash Monitoring System using Deep Learning and loT Technology

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Abstract: Non-compliance with hygiene protocols—such as wearing a mask or hairnet, and performing proper handwashing—in food manufacturing facilities contributes to food contamination, thereby compromising product quality, consumer trust, and brand integrity. Manual inspection methods used to monitor compliance are susceptible to human error and lack objectivity. Thus, the need for an automated solution is prominent. In response, this study developed a cabin-based system integrated with two YOLOv8-trained models: one for detecting mask and hairnet usage, and another for recognizing handwashing gestures. These models were deployed on a mini-computer (Dell OptiPlex 3080). The compliance system follows the protocol outlined as follows: (i) personnel identification via RFID scanning of the employee card, (ii) detection of mask and hairnet usage through camera input, (iii) sequential detection of handwashing gestures, (iv) regulation of door access to food manufacturing areas based on the evaluation outcome, and (v) recording of compliance results for supervisory review. The system achieved a mean Average Precision (mAP) of 99.2% for mask and hairnet compliance, and 92.7% for handwashing compliance. These experimental results support the system's potential for deployment in food manufacturing settings to facilitate compliance monitoring and reinforce food safety assurance.

Key Words: computer vision, food manufacturing, hygiene compliance, object detection

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Morphological Taxonomy of Tarantulas (Araneae: Theraphosidae) From the Selected Locations in Mindanao, Philippines

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Abstract: Traditional taxonomy, the most widely used method for examining and naming species, relies primarily on morphological characteristics, it has long served as the foundation of biological systematics and remains a vital tool in biodiversity research for species identification and classification. In the Philippines, there are currently 17 valid species of tarantulas distributed across five genera. This paper will morphologically describe the tarantulas collected and comprehensively provide their distinct characters from five sampling areas in Mindanao. The Unified Species Concept was applied as the criterion for classifying and identifying tarantula species. The specimens were preserved and examined using a standardized protocol. The findings revealed five distinct species under the subfamily Selenocosmiinae, Selenocosmiinae gen. sp. 1 "JRMPL,"Selenocosmiinae gen. sp. 2 "Cinchona,"Selenocosmiinae gen. sp. 3 "Jamboree,"and Selenocosmiinae gen. sp. 4 "Kalagonoy," including a newly described species, Orphnaecus mimbilisanensis sp. nov., which is morphologically distinct from other known Mindanao species. The five species possessed a unique spermathecal morphology with distinct formations among congeners. The palpal bulb of two species (O. mimbilisanensis and Selenocosmiinae gen. sp. 1 "JRMPL") varied in embolus and tegulum measurement. O. mimbilisanensis sp. nov. exhibited a distinct high carapace profile and is the largest in size among its congeners. This study underscores the importance of morphological taxonomy in resolving species relationships and refining classifications, contributing to a deeper understanding

of biodiversity. This highlights the Philippines'rich yet vulnerable tarantula diversity; this work reinforces the need for targeted conservation efforts and continued scientific exploration to safeguard these unique species.

Key Words: Morphology, Orphnaecus, Selenocosmiinae, spermathecae, Unified Species Concept

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Turbulence Generator Integration for Enhanced Heat and Moisture Recovery in Quasi-Counter flow Membrane Heat Exchangers

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Abstract: Abstract: Heating, Ventilation, and Air Conditioning (HVAC) systems are essential for ensuring indoor thermal comfort, humidity regulation, and air quality, yet they remain one of the largest contributors to global energy consumption. Improving the efficiency of heat exchangers within HVAC systems is therefore a critical step toward sustainable energy use. Conventional turbulence generators (TGs) have been widely applied to enhance heat transfer in traditional exchangers; however, their potential in membrane-based systems for simultaneous heat and moisture recovery remains underexplored. This study evaluates the effect of TGs on the thermal and mass transfer performance of a membrane quasi-counterflow heat exchanger using both experimental measurements and computational simulations in ANSYS Fluent. Results indicate that TG integration with inline arrangements significantly improves exchanger performance compared to smooth-channel designs. Quarter-circle TGs with a 3 mm diameter and 4 mm height yielded maximum sensible, latent, and total effectiveness values of 81.05%, 73.94%, and 77.64%, respectively. At the highest tested mass flow rate (0.000615 kg/s), the spacer with TGs achieved improvements of 8.56% in sensible effectiveness, 2.33% in latent effectiveness, and 5.04% in total effectiveness over the baseline design, corresponding to a net recovered power gain of 12.5 W. These findings highlight the potential of TG-integrated membrane exchangers to advance next-generation energy-efficient HVAC systems.

Key Words: membrane heat exchanger, turbulence generator, sensible effectiveness, latent effectiveness

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Energy and Greenhouse Gas (GHG) Auditing of Mindanao State University - Iligan Institute of Technology Buildings

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Abstract: The university consumes a huge amount of electrical energy. High electricity consumption can significantly impact both its finances and carbon footprint. Energy auditing is one of the first phase of achieving energy efficiency and reduction of carbon footprint. This study delivers the first phase of standard energy audit procedures at MSU-IIT. Specifically, the objectives are to quantify the total amount of electrical energy consumed and greenhouse gas (GHG) emissions by conducting a comprehensive diagnostic energy audit at selected buildings at MSU-IIT. Illuminance levels, temperature, humidity tests and assessment of energy-psychosocial factors of students were also conducted in this study. The study shows that the Heating, Ventilation and Air Conditioning (HVAC) consumes the highest amount of energy consumed. The main contributor to high-energy consumption and emissions in the university were attributed to inefficient air-conditioning (AC) units, the disproportion sizing of AC units relative to floor areas, low thermostat settings and poor energy-related psychosocial factors among students. Also, illuminance ratings of most of the buildings were identified as under-illuminance, which can negatively affect task performances and may impair the eyesight of the students, faculty and staff. The findings underscore the urgent need to substantially reduce in two ways: First, the technological efficiency and renewable sources. Secondly, sustainable energy practices.

Key Words: Energy audit; Climate Change; Energy Consumption; Buildings, Behavior

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Time Online sexual abuse and exploitation of children (OSAEC) survivors and at-risk children: Designing enhancing gender and social equity development intervention program

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Abstract: Online Sexual Abuse or Exploitation of Children (OSAEC) presents a critical and growing concern, with far-reaching psychological, social, and economic impacts on survivors and at-risk children. This study assessed psychological distress, life values, sense of coherence, behavioral functioning, and post-traumatic stress disorder (PTSD) symptoms to inform the development of a Gender and Social Equity Enhanced Development Intervention Program. A cross-sectional study was conducted among 100 OSAEC survivors and 2,681 at-risk children in Iligan City. Standardized assessment tools were employed to evaluate depressive symptoms, PTSD indicators, life values, sense of coherence, and strengths and difficulties. Data were analyzed using descriptive statistics supported by thematic interpretation to identify key patterns and vulnerabilities. Findings revealed elevated depressive symptoms, particularly low energy and somatic complaints, along with high PTSD symptomatology characterized by avoidance, intrusion, and hyperarousal. Survivors demonstrated moderate to low sense of coherence, reflecting limited ability to comprehend, manage, and derive meaning from their experiences. Emotional distress, conduct problems, hyperactivity, and poor peer relationships were commonly reported, while prosocial behavior remained consistently low. Both survivors and at-risk children prioritized achievement, financial stability, and independence, while group loyalty and environmental concern were rated lower, indicating a strong drive for personal control and stability. These results underscore urgent need for gender-responsive, trauma-informed interventions that integrate specialized therapies, family and community-based support, livelihood opportunities, and educational reintegration. Expanding research to capture unreported cases, diverse populations, and longitudinal outcomes is essential to strengthen evidence-based programming and promote resilience, recovery, and sustainable reintegration for affected children and families.

Key Words: Online Sexual Abuse and Exploitation of Children (OSAEC); Psychological distress; Post-traumatic stress disorder (PTSD); Trauma-informed intervention

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Language and Culture in the Dinagat Islands: Their Impact on Environmental Stewardship

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Abstract: The Dinagat Islands, located in the Caraga Region of the Philippines, possess a rich linguistic and cultural heritage that significantly shapes local environmental practices. This study investigates how language and culture influence environmental stewardship and sustainable resource management in selected municipalities and barangays of the islands. Employing a mixed-methods approach, data were collected from 150 community members, including elders, fisherfolk, teachers, youth, and local leaders, through surveys, focus group discussions, participant observation, and key informant interviews. Descriptive statistics and thematic analysis were applied to quantify language use, assess environmental awareness, and identify recurring cultural practices supporting ecological responsibility. Results reveal that 82% of respondents primarily use local dialects in environmental discourse, with Filipino and English accounting for 12% and 6%, respectively. Community participation in cultural practices—such as traditional fishing taboos, rituals, festivals, and storytelling—ranged from 58% to 76%, and high retention of language and cultural practices correlated with 85% engagement in environmental activities. The findings underscore the strong connection between linguistic and cultural preservation and pro-environmental behavior, highlighting the role of oral traditions, local terminologies, and rituals as informal regulatory systems. Declining use of local languages and reduced cultural participation pose risks to sustainable practices. Strategies emphasizing the integration of local language education, documentation of indigenous knowledge, and youth engagement are essential to strengthen environmental stewardship. This study affirms that preserving language and cultural heritage is crucial not only for maintaining community identity but also for promoting ecologically responsible behaviors and sustainable development.

Key Words: Dinagat; Islands, language; culture, environmental stewardship; indigenous knowledge

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Exploring the Impact of Family Functioning on the Depression Status of the Grade 9 High School Students in Iligan City: Basis for Designing a Family Mental Health Education Program

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Abstract: Adolescent depression is a growing public health concern, contributing significantly to global disease burden. Understanding its associations with demographic factors and family functioning is critical for informing interventions tailored to adolescent needs. This study examined the prevalence of depression among Grade 9 pupils in Iligan City, Philippines, and explored its relationship with demographic profile and family functioning dimensions. A total of 595 Grade 9 students were surveyed, of which 352 provided complete responses to the Beck's Depression Inventory (BDI) and the McMaster Family Assessment Device (FAD). Descriptive statistics, chi-square tests, and correlational analyses were employed to determine associations between demographic characteristics, family functioning domains, and depression status. Findings revealed a high prevalence of depressive symptoms, with many adolescents categorized under moderate to severe depression levels.

Among demographic variables, only sex demonstrated a significant association with depression status. More notably, multiple family functioning dimensions showed strong links to depression: poor problem-solving ($p = 0.000$), unclear role distribution ($p = 0.01$), and weak affective involvement ($p = 0.003$) were significantly associated with higher depressive symptoms. Overall mean scores across all family functioning domains exceeded the healthy cut-off, indicating pervasive dysfunction in respondents'households. While sex influences depression status, family functioning emerged as the stronger determinant of adolescent mental health. Interventions that strengthen family processes —particularly problem-solving, role clarity, and emotional engagement—are essential in reducing depressive symptoms. Family-centered programs, such as the C.A.R.E. framework (Connect, Acknowledge, Respond, Empower), may offer an effective strategy for enhancing adolescent resilience and well-being.

Key Words: Adolescent depression; Family functioning; Problem-solving; Affective involvement; Roles; C.A.R.E. framework

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Assessing the Awareness and Implementation of Sustainable Development Goals: Alignment from Iligan City's Local Government Unit to Barangay Local Government Units

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Abstract: This study investigates the awareness, alignment, and implementation of the Sustainable Development Goals (SDGs) within Iligan City's Local Government Unit (LGU) and its 44 Barangay Local Government Units (BLGUs). Using a mixed- methods design, the research involved 528 respondents through surveys, interviews, and focus group discussions with LGU and BLGU officials and staff, aiming to measure awareness levels, identify dissemination practices, assess integration into development plans, and explore implementation barriers and enabling strategies. Results reveal a
moderate level of awareness among BLGU officials, with SDG 4 (Quality Education), SDG 3 (Good Health and Well-being), and SDG 1 (No Poverty) being the most recognized. While a majority reported partial integration of SDGs into local policies, limited resources, lack of technical capacity, and minimal data monitoring were noted as critical challenges. Correlation analysis showed that higher awareness levels were moderately linked to greater involvement and perceived effectiveness of implementation strategies. Capacity-building initiatives, community engagement, and collaboration with government and civil society were cited as key enablers. The study underscores the need for sustained capacity development, improved policy alignment, and strengthened institutional mechanisms to foster deeper SDG localization.

Key Words: Sustainable Development Goals (SDGs); SDG localization; local governance; Iligan City barangay governance; awareness; policy integration; capacity development; community engagement

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Culturally Tailored Maternal Health Care: Examining the Needs of Young Higaonon Mothers

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Abstract: The disparity in maternal and child healthcare is glaring in the global scene, and the phenomenon is evident in healthcare systems at national, regional, and local levels in the Philippines. This qualitative research aims to examine the maternal healthcare needs of the seven (7) young Higaonon mothers using the narrative inquiry inductive method. Core narratives were derived from personal narratives gathered during multiple interview sessions. Strict ethical and legal protocols, as outlined by the National Commission on Indigenous Peoples (NCIP) and the Mindanao State University –Iligan Institute of Technology, were adhered to. A simple story structure, consisting of a beginning, middle, and end, was employed. The story of young Higaonon mothers unfolds: The Beginning of Life: From Union to Fruition: A New Life in the Woman's Womb: Pregnancy (Ang Pagmamdos/ (Ab'ttong), A Woman in Travail: My Life, My Blood, My Child; My Life: Nurturing the Self (Ang Pag-amuma sa Kaugalingun), My Blood: Nourishing a new life with my blood within, (Ang Tinubdan sa Kinabuhi). My Child: Nurturing the Baby in My Womb (Ang Pag-amuma sa "binhi"o "bata"); From Contractions to Expulsion: Labor in Pregnancy (Ang Pagbati'), Childbirth (Ang Pagpanganak), From Placental Delivery to Postpartum Recovery (Ang Paggawas sa Inunlan ug Kaulian). The hallmark of the stages of pregnancy denotes the needs of the young Higaonon mothers, described in a blend of Local Wisdom in Healthcare and Utilization of Healthcare Delivery Services: A better access to distant healthcare facilities, safe health information and education, scarcity of personnel, equipment and supplies, financial constraints, communication barriers among others which form part of the recommended Integrative Higaonon Maternal Healthcare Intervention (IHMHI): A culturally sensitive approaches in Strengthening, Supporting, and Sustaining the Health Systems: access, cost, and equity.

Key Words: maternal, healthcare, young Higaonon mothers

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The Relationship between Beneficiary Involvement and SDG -Based Projects Effectiveness in Marginalized Communities: The Role of Service Quality as Moderating Variable

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Abstract: The Philippine Statistics Authority (PSA) reported an 18% poverty incidence in the Philippines in 2021, with Geographically-Isolated and Disadvantaged Areas (GIDAs) being the most affected. Mindanao, the second-largest island, hosts numerous GIDAs facing resource limitations and socioeconomic challenges. Mindanao State University (MSU), with 16 campuses, implements projects in education, health, infrastructure, and community empowerment to address these challenges. This study examines the interconnected dynamics of beneficiary involvement, service quality, and project effectiveness within MSU projects. A quantitative research approach is adopted, utilizing descriptive statistics and regression analysis, including the examination of a moderating variable, to analyze the data. Stratified random sampling was employed in the survey administration to ensure adequate representation across key subgroups of the population. Results indicate high effectiveness in enhancing knowledge (4.19), attitude (4.12), skills (4.09), and lifestyle (3.99). Overall project effectiveness scored 4.10, reflecting success in meeting objectives. A significant positive relationship (coefficient: 0.56, $p < 0.000$) was found between beneficiary involvement and project effectiveness. Service quality was identified as a partial moderator, contributing 42.9% to the total influence, with responsiveness, reliability, and empathy as key dimensions. The study underscores the importance of enhancing service quality to maximize the impact of beneficiary-driven initiatives

in GIDAs. Insights from this study provide guidance for policymakers and development practitioners to optimize project outcomes through strategic beneficiary engagement and service quality improvements.

Key Words: Geographically-Isolated and Disadvantaged Areas (GIDAs), Mindanao State University (MSU), Project Effectiveness, Service Quality, Beneficiary Involvement

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#Canceled: Predictors of Consumers'Intention to Cancel in the Philippines

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Abstract: Cancel culture is reshaping consumer-brand dynamics, yet little is known about what drives Filipino consumers to engage in such behavior. This study investigates the predictors of consumers'intention to cancel brands in the Philippines, using the Theory of Planned Behavior and incorporating demographic variables. Understanding this phenomenon is vital for businesses operating in the region, where social media activism is on the rise. A quantitative design using PLS-SEM analyzed responses from 385 participants across generations and regions. Findings reveal that attitude, subjective norms, and perceived behavioral control significantly shape cancel intentions. Notably, age and region—specifically, younger consumers and those from Visayas and Mindanao—are strong antecedents. These groups are more susceptible to social influence, have stronger self-efficacy, and express a more favorable view of canceling brands. Recommendations include culturally sensitive reputation management and localized consumer sentiment tracking. Brands must actively align values and quickly respond to controversy with concrete corrective actions.

Key Words: cancel culture; consumer behavior; theory of planned behavior; brand boycott; Philippines; PLS-SEM

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CLENS: Garbage Awareness App using Gamification and IoT

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Abstract: Solid waste management remains a persistent challenge in rapidly urbanizing cities, such as Iligan City, Philippines, where increasing waste volumes strain existing facilities. This study conceptualizes CLENs, a holistic waste management awareness system that integrates gamification, artificial intelligence (AI), and Internet of Things (IoT) technologies. The proposed system employs AI-driven computer vision for garbage classification and volume estimation, IoT sensors for real-time data collection on waste and water quality, and a gamified mobile platform to incentivize community participation in proper waste segregation. By equipping waste collection vehicles with IoT devices and cameras, CLENs enables accurate data gathering, predictive analytics for optimized collection routes, and heat maps of waste generation. Furthermore, an IoT-based water monitoring

subsystem measures critical environmental parameters, enhancing sustainability efforts. The study contributes to solid waste management research by presenting an integrated technological framework that supports local government units (LGUs), waste processors, and communities in fostering environmental responsibility. Expected outcomes include improved waste segregation compliance, optimized collection scheduling, enhanced recycling rates, and actionable insights for sustainable urban governance.

Key Words: solid waste management; gamification; Internet of Things (IoT); computer vision; environmental monitoring

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Hidden Threat Revealed: First Report of Anaplasma spp. in Goats from Northern Mindanao, Philippines

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Abstract: Goat livestock plays a vital role in the economy by providing milk and meat, while also supporting household nutrition and livelihoods, particularly among the poor and smallholder farmers. Despite their importance, goats are highly susceptible to tick infestations, which not only cause direct harm, such as irritation and anemia, but also facilitate the transmission of tick-borne pathogens like Anaplasma species, the causative agents of anaplasmosis. In the Philippines, molecular studies on Anaplasma infections in goats remain limited and have largely focused on major cities, with no reported detection of Anaplasma directly from goat-associated ticks. To address this gap, this study screened DNA extracted from goat blood using conventional polymerase chain reaction (PCR) targeting the Anaplasma 16S rRNA gene. Of the 30 goat blood samples tested, 3.33% (1/30) were positive for Anaplasma. Phylogenetic analysis revealed a close relationship to A. phagocytophilum, and further genetic comparison showed similarity to the Ap-ha strain, a major variant of A. phagocytophilum that are known to be associated with humans. However, further studies are necessary to confirm its precise identity and to rule out the possibility that it represents a novel or unclassified Anaplasma species. This study provides the first molecular evidence of Anaplasma infection in goats from Northern Mindanao, Philippines, and offers valuable insights into the presence of tick-borne pathogens affecting livestock in the region.

Key Words: anaplasmosis, Ap-ha strain, phylogenetic analysis, tick-borne pathogens, 16S rRNA

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Silent Saboteurs: (The Hidden Impact of Parasites on Livestock Productivity and Public Health) A case in Iligan City, PhilippineS

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Abstract: Livestock farming is crucial for global food security, economic development, and cultural practices. Northern Mindanao was one of the key contributors to the country's cattle, goat, and pig livestock production. Parasite infections in livestock hinder productivity, affecting animal health, causing economic losses, and posing a public health risk. This study determined parasite infections in three major livestock commodities: cattle, goats, and pigs in selected areas in Iligan using the Formalin Ethyl Acetate Technique (FEACT) and post-mortem examinations. Parasites recovered in cattle accounts 53% or 17 out of 32 samples were infected with Fasciola, Schistosoma, Trichuris, Balantidium, Strongyle, and Paramphistomum. Notably, 50% of the population is infected with Fasciola. In goats, Strongyloides, Trichostrongylus, Haemonchus, Trichuris, and Coccidians were recovered from 38 of 45 or 84.4% of fecal sample, where Strongyloides sp. prevails at 73.3%. In pigs, 37 of 50 or 74% of fecal samples were infected with four nematode species were identified: Hookworm, Strongyloides sp., Trichuris sp., and Ascaris sp., in which Strongyloides sp. had the highest prevalence at 34%. Higher risk from polyparasitism recorded 18 unique cases across all sample livestock. This confirms that parasitic infections are progressive in the area and possibly occur in active transmission to other animals, including humans. Potential public health risks associated with poor animal hygiene emphasize the importance of proper animal farming management, routine deworming, clean water, and improved husbandry practices as a responsibility delegated among farmers, stakeholders, community veterinarians, local and national government in achieving Sustainable Development Goals 2,3, and 12.

Key Words: Infections; Trematode; Nematode; Protozoans; Farm Animal

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Integrating Morphological and eDNA Approaches for Diatom Community Monitoring to Support Sustainable Aquaculture in Lake Buluan, Maguindanao, Philippines

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Abstract: Lake Buluan, the third-largest lake in the Philippines, sustains rich aquatic biodiversity and supports extensive aquaculture. However, decades of anthropogenic pressures, including domestic wastewater, aquaculture effluents, and agricultural runoff, have degraded water quality. This study assessed morphologically, the composition and distribution of freshwater diatoms across six stations inside and outside fish pens to evaluate their potential as bioindicators of ecological change. Nineteen species were recorded, with 11 present in both inside (IFB) and outside (OFB) fish pens. Dominant taxa—Nitzschia serpentiraphe, Gomphonema montanum, and Aulacoseira islandica—occurred at nearly all stations and are linked to nutrient-rich sediments and organic pollution. Site-specific patterns emerged: Nitzschia liebethruthii dominated IFB1 and IFB3 but was absent in IFB2 and most OFB sites, whereas Nitzschia inconspicua showed the opposite trend. The exclusive occurrence of Eunotia monodon and Cymbella tumida in OFB stations suggests more acidic or oligotrophic conditions outside enclosures. Rare taxa (Sellaphora sp., Grammatophora angulosa) contributed to richness in non-enclosed areas. Moreover, next-generation sequencing (NGS) data confirmed the dominance of Nitzschia spp., indicating mild environmental stress and ecological plasticity which is, typical for tropical shallow lakes. Findings underscore diatom monitoring as a sensitive, cost-effective tool for assessing aquaculture impacts and advocate its integration into freshwater ecosystem management.

Key Words: diatom, lake, bioindicators, aquaculture

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Theoretical investigation of carbon nitride nanothreads and polymer nanocomposites

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Abstract: Incorporating nanoscale reinforcements into polymer matrices offers an effective way to enhance the multifunctional performance of polymer nanocomposites. Carbon-based nanomaterials (CNMs) are widely explored for this purpose because of their exceptional strength, stability, and large interfacial surface area that enable efficient stress transfer. Among them, diamond nanothreads (DNTs) have attracted attention for their one-dimensional sp^3-bonded framework and hydrogen-terminated surfaces, which impart remarkable tensile strength, stiffness, and torsional resistance. Extending this concept, carbon nitride nanothreads (CNNTHs) have emerged as new candidates. The incorporation of nitrogen atoms enhances their structural versatility and narrows their electronic band gaps, making them attractive for designing polymer nanocomposites that combine robust mechanical properties with tunable electronic properties. This study employs first-principles simulations to explore the interfacial interactions and electronic properties of CNNTH/polymer nanocomposites. Cellulose and epoxy matrices were modeled in various orientations relative to CNNTHs. Charge Density Difference (CDD) and Electron Localization Function (ELF) analyses revealed charge redistribution primarily along the interface, with no ELF overlap, indicating interactions dominated by van der Waals forces. Electronic structure calculations further showed a 1 eV reduction in band gap compared to DNT/polymer systems. These results demonstrate CNNTHs' potential as reinforcements for high-performance polymer nanocomposites in advanced structural systems and flexible electronics.

Key Words: polymer; CNNTH; nanocomposites; electronic properties

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Spatio-temporal modelling of Dengue Cases in Caraga Region, Philippines

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Abstract: Dengue fever remains a public health concern in tropical countries such as the Philippines. Identifying and monitoring high-risk areas is essential for creating early-warning strategies to reduce transmission and prevent future outbreaks. This paper focuses on spatio-temporal analysis of weekly dengue case counts in the Caraga region of Mindanao, Philippines, from 2009 to 2024. Count data is typically characterized by overdispersion, spatial dependency, and temporal autocorrelation, which classic time series methods cannot fully address. We present the Negative Binomial INGARCHX model, which improves classic Poisson models by addressing overdispersion and including exogenous factors with delayed effects. The method uses a Bayesian hierarchical framework with predefined prior distributions for key parameters. To improve efficiency and convergence, parameters are estimated using an adaptive Markov Chain Monte Carlo algorithm. Results show that the proposed model produces in-sample predictions closely aligned with the observed data and the

diagnostic analysis does not show significant residual autocorrelation. The analysis shows clear geographic variation, with nearby places showing the highest spatial influence, while geographically isolated areas have much weaker effects. We conclude that the proposed model sufficiently and effectively captures the temporal and spatial patterns in the data. It offers an interpretable and flexible tool for modeling infectious diseases where both space and time are relevant.

Key Words: Spatio-Temporal analysis, Negative Binomial, INGARCH, MCMC method

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A new species and a new isolate of 'ZOMBIE FUNGI' in Rogongon, Iligan City and their Biocontrol potential against plat insect pest Tetranychus urticae

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Abstract: Given rising resistance and ecological concerns linked to chemical pesticides, entomopathogenic fungi (EPF) offer promising alternatives. Over 1,000 entomopathogenic species are in families Clavicipitaceae, Cordycipitaceae, and Ophiocordycipitaceae in the order Hypocreales. Insects often exhibit "zombie-like" behavior when infected and can be used as biopesticides. With the Philippines as a megadiverse country, survey on EPF could lead to the discovery of new species or isolates that can effectively control insect pests. Herein, two EPF were isolated from naturally infested insect hosts in Sikyop, Rogongon, Iligan City with Ophiocordyceps rogongonensis as the new species and Cordyceps javanica as the new isolate. Fungal identification was done using morphological and molecular approaches. Furthermore, C. javanica was assessed for its biocontrol potential against the two-spotted spider mite (Tetranychus urticae), a major pest affecting crop productivity. For the biocontrol assay against insect pest, T. urticae, a modified leaf-disc bioassay with spray application was conducted using three fungal concentrations (1×10^6, 1×10^7, 1×10^8 conidia/mL), Spirodiclofen (0.02% v/v), and a negative control. C. javanica exhibited strong virulence against T. urticae. The fungal colonization induced progressive mycosis, with 1×10^8 conidia/mL outperforming spirodiclofen by 53 hours. Probit analysis revealed decreasing LC_0 values and shorter LT_0 estimates with increasing dose and time. This is the first report of C. javanica from the Philippines and the identification of new species O. rogongonensis While molecular analysis for the new species and its biopesticidal potential are ongoing, field validation for both EPF is recommended to support its integration into pest management strategies.

Key Words: Ophiocordyceps rogongonensis ,Cordyceps javanica, biopesticide, fungi

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Aryl Thiosemicarbazone Hybrids as Potential Antioxidant Agents

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Abstract: Skin aging is a complex process influenced by oxidative stress, inflammation, and enzymatic activities that compromise essential proteins for structural integrity and promote hyperpigmentation. These processes result in wrinkles, loss of elasticity, and uneven skin tone making them central targets in cosmeceutical development. Conventional antioxidants and depigmenting agents

often exhibit limitations such as instability and adverse effects thereby prompting the search for novel synthetic scaffolds with improved efficacy and safety. This study focused on the evaluation of arylated thiosemicarbazone derivatives as antioxidant agents for cosmetic applications. The primary goal was to determine their antioxidant properties. Specifically, antioxidant activity was assessed through DPPH and ABTS radical scavenging assays. Results demonstrated that all tested compounds exhibited dose-dependent antioxidant activity with the highest activity observed at 1000 μM. Among the series, compound 000A demonstrated the strongest antioxidant activity achieving 55.7% scavenging in the DPPH assay and 39.9% in the ABTS assay although its efficacy remained lower compared to the reference standard ascorbic acid. Structural analysis indicated that unsubstituted aromatic rings enhanced radical stabilization, while electron-withdrawing substituents and steric hindrance limited its activity. In conclusion, arylated thiosemicarbazone derivatives, particularly compound 000A, demonstrates a promising scaffold for the development of anti-aging cosmeceuticals. Furthermore, these findings highlight the importance of structural features in modulating compounds to improve its biological activity.

Key Words: Thiosemicarbazone; antioxidant; skin-aging

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Rehabilitation Reimagined: Integrating AI and Smart Wearable Innovations in Clinical Gait Biomechanics to Optimize Musculoskeletal Recovery

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Abstract: Traditional motion capture systems in clinical rehabilitation rely on cumbersome marker-based technologies that are costly, slow to set up, and often uncomfortable for patients. Current musculoskeletal rehabilitation methods lack real-time, objective data analysis capabilities, which limits the accuracy of treatment plans and personalized care in clinical settings. This study aims to improve clinical analysis and rehabilitation methods by combining AI-powered real-time markerless motion capture technology with affordable smart wearables and force platforms. The project focuses on forming collaborations with the Physical Medicine and Rehabilitation Departments of major hospitals around Mindanao, with the goal of enhancing musculoskeletal rehabilitation results. Our method leverages OpenCap technology with iOS devices for real-time markerless motion capture, capturing inverse kinematics and kinetics. Custom Python scripts will analyze gait cycles, identify normal trends, and detect abnormalities. Innovative smart wearables, insole sensors, non–invasive glucose monitors, and low-cost, eco-friendly 3D force platforms will be built, calibrated, and optimized to be synchronized with the OpenCap data. This integrated approach offers a more accessible, affordable, and precise method for clinical gait analysis compared to traditional systems. The multi-modal data integration, which combines motion capture, force platforms, and wearable sensors, allows for accurate, personalized rehabilitation plans. The project lays a foundation for better diagnoses, treatments, and management of gait disorders, ultimately improving musculoskeletal recovery outcomes through advanced technology integration in clinical practice.

Key Words: Markerless Motion Capture; Clinical Gait Analysis; Smart Wearables; Force plates; Musculoskeletal Rehabilitation

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Assessing Fish Biodiversity and Ecological Health through its Physico-Chemical Parameters in Iligan Bay, Mindanao, Philippines

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Abstract: Fish biodiversity and ecological health in Iligan Bay, Northern Mindanao, were assessed through analysis of species composition, catch abundance, and catch per unit effort (CPUE). Monthly landing surveys conducted from April to August 2025 at Linamon, Calangahan, and Manticao recorded twelve fish species from seven families, including Scombridae, Clupeidae, Engraulidae, Balistidae, Belonidae, Mugilidae, and Carangidae. Results revealed Bali sardine (Sardinella lemuru) as the most abundant species (40.70%), followed by anchovy (Encrasicholina oligobranchus, 13.43%) and bigeye scad (Selar crumenophthalmus, 11.33%). The dominance of these small pelagic fishes indicates a shift in catch composition from historically larger, high-trophic-level species to smaller, fast-growing species, reflecting national patterns of overfishing and ecosystem decline. CPUE values showed spatial variation: Sigpaw and Gillnets yielded the highest catches in Calangahan, while Castnets were more productive in Linamon and Punta Silum. These outcomes highlight the influence of gear selectivity, habitat conditions, and localized fishing pressure. The heavy reliance on small pelagic resources underscores the vulnerability of small-scale fishers to declining stocks and competition with commercial fleets. The findings provide an important baseline for sustainable fisheries management in Iligan Bay, emphasizing the need for effective monitoring, gear regulation, and habitat conservation to secure biodiversity and the livelihoods of fishers.

Key Words: ligan Bay, fish composition, catch per unit effort, small pelagic fisheries

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Development of drone-based computer vision-assisted pavement distress detection (Phase 3)

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Abstract: Road inspection monitors distress progression and detects surface deterioration, which equips timely maintenance that extends the service life of transportation infrastructure. However, most UAV-based automated systems are optimized for structured environments and struggle with unstructured roads—common in developing countries—due to missing lane markings, irregular surfaces, inconsistent signage, and frequent visual obstructions. The key contribution of this project lies in its focus on unstructured roads, particularly those in developing countries where unique challenges such as combined asphalt-concrete lanes are prevalent. Thus, in Phase 3, we refined our pavement management system to align with standard practices which primarily identify pavement panels as either concrete or asphalt. We increased our dataset to include a new set of distresses, such as cracking (transverse, longitudinal, and crocodile), wearing surface (rutting, bleeding, and flushing), edge breaks, potholes (base failure and surface failure), patches, and joint defects. Then, we developed a strategy to localize distressed panels in the map and grade their severity. Lastly, we created a web application that can perform standard evaluation procedures and provide Artificial Intelligence-driven recommendations. The implementations of several features are still ongoing.

Key Words: Aerial Systems: Applications; Automation Technologies for Smart Cities; Computer Vision for Transportation; Deep Learning Methods; Object Detection, Segmentation, and Categorization

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Synthesis and Characterization of Nanocrystalline Cellulose from Waste Cassava Pulp for Potential Supercapacitor Integration

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Abstract: Amid growing environmental concerns and biomass waste accumulation, this study aims to valorize cassava pulp—a readily available agricultural by-product in the Philippines—by producing nanocrystalline cellulose (NCC), a high-value material with broad industrial applications and sustainability potential. This study explores the synthesis and characterization of NCC extracted from waste cassava pulp sourced in Northern Mindanao, Philippines. Extraction was performed via mixed acid hydrolysis using formic acid and sulfuric acid, following alkaline pretreatment with sodium hydroxide and bleaching with sodium hypochlorite. The effects of acid concentration, temperature (70–90℃), and hydrolysis time (1–6 hours) on extraction yield were investigated. Results showed that increasing these parameters initially improved yield, but excessive values led to a decline. Optimization yielded the most favorable conditions at 71 wt% formic acid, 77℃, and 3.6 hours, achieving an extraction yield of 67.272%± 2.295%. FTIR confirmed successful removal of lignin and hemicellulose, while SEM and dynamic light scattering (DLS) revealed nano-sized cellulose particles ranging from 15 nm to 687 nm.

Key Words: nanocrystalline cellulose; mixed acid hydrolysis; waste cassava pulp; supercapacitor; energy storage

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Preparation of waste mussel (Mytella strigata) shells as precursor for development of apatite powders

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Abstract: This study investigates the extraction of calcium oxide (CaO) from waste mussel shells (Mytella strigata) as a precursor for synthesizing bioceramics, specifically hydroxyapatite (HAp). Mussel shells, a byproduct of the seafood industry, are rich in minerals, particularly calcium. Additionally, they contain a significant amount of calcium carbonate (CaCO3), which can be thermally decomposed into calcium oxide through calcination at temperatures ranging from 700℃ to 1000℃. Consequently, innovation is essential to maximize the utilization of mussel shells. The extracted CaO serves as a key raw material in the synthesis of bioceramics, which are recognized for their biocompatibility, bioactivity, and applications in medical fields such as bone prosthetics and tissue engineering. Characterization techniques like X-ray fluorescence (XRF) and scanning electron microscopy (SEM) were employed to ensure the purity and suitability of the calcium oxide for bioceramic production. This process provides a sustainable, low-cost alternative to traditional methods of obtaining calcium precursors while also promoting the recycling of waste materials. The study highlights the potential of utilizing waste mussel shells as a renewable source for calcium oxide, contributing to the utilization of hydroxyapatite non-medical applications.

Key Words: waste mussel shells; calcium oxide; calcium carbonate; morphology; composition

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Bioacoustic Signal-Based Insect Classification System Using Machine Learning

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Abstract: Orthoptera species are effective bioindicators due to their sensitivity to environmental changes, particularly those linked to climate change, making their acoustic behavior a reliable measure of ecosystem health. Recent advancements in Artificial Intelligence, particularly in Machine Learning, enabled automated detection and classification of these species through their bioacoustics signals. The WaveNet model, which processes raw audio and learns to distinguish the unique waveforms of different species, was used in this study. This effectively captures temporal patterns in sound, featuring causal and dilated convolutions that enable accurate species classification. WaveNet has achieved a precision, recall, and F1-score of 98.0%. The WaveNet model was successfully deployed on a Jetson Nano, a compact edge computing device equipped with a MEMS microphone, allowing real-time recording, processing, and analysis of insect sounds directly in the field.

Key Words: Orthoptera species; Machine Learning; Edge Computing Device; Jetson Nano; WaveNet

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Mask, Hairnet and Handwash Monitoring System using Deep Learning and IoT Technology (Phase 2)

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Abstract: Food safety and hygiene are critical to public health, with international organizations such as WHO and FAO emphasizing the importance of preventing contamination and ensuring compliance across the food chain. In the food industry, workers are required to wear masks and hairnets and practice proper handwashing, yet current compliance verification relies heavily on manual inspection, which is prone to human error and inconsistency. This study presents the development of an IoT-enabled smart cabin system integrated with a web application for automated monitoring of mask, hairnet, and handwashing compliance using machine learning models. The system was implemented using ROS 1 Noetic to coordinate detection, database logging, and hardware control, supported by YOLOv8-based object detection models. A dataset of over 14,000 annotated frames was collected and processed, covering proper and improper mask and hairnet usage as well as five

distinct handwashing steps. The mask-hairnet detection model achieved a precision of 0.975, recall of 0.976, and mAP@0.5 of 0.984, while the handwashing detection model achieved precision of 0.954, recall of 0.938, and mAP@0.5 of 0.963. Grad-CAM visualizations confirmed that both models learned meaningful features, focusing on relevant facial, headwear, and hand regions. Results demonstrate that the integrated system enables accurate real-time compliance monitoring, with detection logs securely stored in a MySQL database and accessible via a web-based interface. This approach reduces reliance on manual inspections, improves consistency, and supports process automation in the food industry, contributing to enhanced food safety and worker hygiene practices.

Key Words: Computer vision, hygiene compliance, object detection

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Portable PLC Based Automatic ABACA Fiber Extraction Machine using Decortication Method

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Abstract: Abaca fibers are highly valued for their renewable, biodegradable, sustainable, and eco-friendly qualities, making them an excellent alternative to synthetic fibers. However, the conventional extraction process remains labor-intensive and hazardous. This study presents the development of a PLC-based automatic abaca fiber extraction machine using the decorticating method. The prototype was designed, fabricated, and evaluated based on its efficiency, performance, and operational safety. Key components of the machine include a Programmable Logic Controller (PLC) for automation, a Variable Frequency Drive (VFD) for motor speed control, and a Human-Machine Interface (HMI) for real-time monitoring. Developed at Mindanao State University –Iligan Institute of Technology, the prototype underwent multiple test runs to assess its repeatability, efficiency, and capacity. The machine achieved a decorticating efficiency of 72.34%, with processing capacities of 3.67 g/hr . It also attained a 100% success rate (519.4 g output), demonstrating strong functional reliability in extracting abaca fibers. Additionally, performance evaluations conducted with 25 abaca farmers indicated generally positive feedback, particularly highlighting the machine's potential to enhance safety and productivity. The results suggest that the proposed design offers a viable solution to the challenges associated with traditional abaca fiber extraction.

Key Words: programmable logic controller (plc), decortication method, human machine interface (HMI), automated system, abaca extraction

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Exploring Smart Village Readiness in Local Contexts: A Case Study using Technology, Organization, and Environment Lens

Authors: Andrea Nicole Bautista[1]; Mary Ann Gliefen Bermudo[1]; Jerina Jean Ecleo[1]; Adrian Galido[1]

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Abstract: This study explores the readiness of two barangays in Iligan City to adopt smart village initiatives using the Technology–Organization–Environment (TOE) framework. A qualitative case study design was employed, drawing on semi-structured interviews with barangay officials and

secondary data. The findings show that while both barangays have started digital initiatives, differences emerge in their technological capacity, organizational structures, and environmental support. Barangay 1, with its larger population and agricultural-business profile, has invested in advanced ICT tools and partnerships, while Barangay 2, a smaller coastal barangay, remains in a transitional phase but has identified ambitious plans for ICT-based services. Common challenges include limited budgets, weak institutionalization of ICT roles, and dependency on external actors. The study contributes to the growing literature on smart villages by highlighting how local context shapes readiness and by emphasizing the need for integrated strategies that combine infrastructure, human capacity, and multi-level governance support.

Key Words: smart village; readiness; case study; TOE framework

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CerMetaCS: Ceramic-Metal Composites for Structural Applications

Authors: Ivyleen Bernardo-Arugay[1]; Leaniel Silva[1]; Christnel Ceballos[1]; Katrina Miguel[1]; Michelle Gay Coral[1]; Christian Julle Saladaga[1]; Hannaloe Olaco[1]; Raymond Rivera Virtudazo[1]

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Abstract: Composite materials consist of a matrix and a filler, which, although immiscible, work synergistically to enhance strength and reduce weight, making them ideal for portable structural applications. Polymers are commonly used but often lack the required mechanical strength. To address this limitation, CerMetaCS, a ceramic–metal composite, was developed to enhance the performance of ceramic–polymer systems. Ceramic inserts from mining silt waste, with a high modulus of rupture, were used as fillers in an aluminum matrix for ballistic applications. Two fabrication routes were tested: investment casting and permanent mold. Investment casting failed to form complete layers, making the permanent mold a more suitable method for CerMetaCS fabrication. Characterization confirmed the suitability of local Nickel and Gold Mine Wastes (high Fe2O3, SiO2) as reinforcement. Ballistic tests showed ceramic-reinforced composites outperformed monolithic aluminum, demonstrating both enhanced impact resistance and a sustainable approach to waste valorization.

Key Words: cermet; composite materials; ceramic-metal composite; mining wastes; sustainable materials; waste valorization

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Effects of Mixing Time and Hydrogen Peroxide Concentration on the Synthesis of Foamed Self-Supporting Zeolite

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Abstract: This study investigates the synthesis of foamed self-supporting zeolite (SSZ) using metakaolin and Luinab red clay (Iligan City, Philippines) as aluminosilicate sources. The research examines how mixing time and hydrogen peroxide concentration affect the direct foaming of geopolymer gel. Rheological tests were conducted on the geopolymer mixture to correlate viscosity with mixing time. The impact of mixing durations (30-60 minutes) and hydrogen peroxide concentrations (0.5-1.0 wt%) on key response variables, including relative foam height, pore volume, porosity, and specific gravity, was analyzed. The results revealed transition times for manual and spindle mixing of 39.62 and 35.73 minutes, respectively. Optimal gel workability was observed within the 30–60-minute range, with a maximum viscosity of 5580 cP. Although variations in mixing time did not significantly affect the response variables, they caused a slight reduction in relative foam height (from 1.51 to 1.48) and porosity (from 51% to 48%), along with an increase in specific gravity (from 0.86 to 1.13). Changes in hydrogen peroxide concentration significantly influenced relative foam height (ranging from 1.34 to 1.66), pore volume (from 0.63 to 1.20 cm3), and porosity (from 34% to 66%), with minimal impact on specific gravity. Scanning electron microscopy and diffractogram analyses confirmed the presence of octahedral NaX zeolite. The findings suggest that both hydrogen peroxide concentration and mixing time are crucial in the direct foaming process; longer mixing times may increase geopolymer gel viscosity, which can impede foaming, while higher hydrogen peroxide concentrations generally improve foaming. These factors are important considerations in the fabrication of SSZ.

Key Words: self-supporting zeolite; mixing time; hydrogen peroxide concentration

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Phase 2: Predicting River Water Levels and Barangay-Level Weather for Enhanced Local Resilience of Iligan City

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Abstract: In an era where climate change exacerbates the frequency and severity of natural disasters, the necessity for precise, localized, and predictive climate monitoring systems is paramount, particularly for vulnerable communities like Iligan City. This paper details Phase 2 of the "Centralized Weather Prediction and Monitoring System," which transitions from hardware deployment to the implementation of advanced machine learning models for weather and river water level forecasting. The scope of this phase encompasses the implementation, training, and validation of a Gradient Boosting Machine (XGBoost) model for multi-parameter weather prediction and a novel rate-of-change algorithm for near-future water level forecasting. The methodology involved refining the hardware for improved data accuracy, developing robust data pre-processing pipelines to handle sensor anomalies, training the predictive models on historical and real-time data, and integrating these models into a user-centric dashboard for real-time visualization. The system demonstrates strong predictive performance, with low Mean Absolute Error (MAE) across key weather variables. This work successfully bridges the gap between raw data collection and actionable, predictive intelligence,

Key Words: hyperlocal weather forecasting, river level prediction, machine learning, XGBoost, CNN-LSTM, disaster risk reduction, low-cost sensor networks, Iligan City

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Development of Anodic Cementation Reactor from Recycled Aluminum Cans to Selectively Recover Gold from Refractory Gold

Ores using Copper Ammoniacal Thiosulfate solution as Lixiviant

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Abstract: The depletion of high-grade gold ores and the environmental impacts of traditional cyanidation have prompted the exploration of alternative gold recovery methods. Inspired by the previous study of Zoleta et al. (2023), which demonstrated the use of aluminum powder as a cementation agent for selective gold recovery, this research investigates the use of cast aluminum derived from recycled cans as a cost-effective and safer alternative to zero-valent aluminum powder for recovering gold from refractory gold ores using copper ammoniacal thiosulfate solution. Two anodic cementation reactor prototypes were designed using SOLIDWORKS and fabricated through sand casting. The experiments examined the effects of reactor design, agitation speed, cementation time, and iron oxide addition on gold recovery selectivity. Gold and copper recoveries were determined using Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP-AES), while the surface morphology and elemental composition of the iron oxide before and after cementation were analyzed using Scanning Electron Microscopy with Energy-Dispersive X-ray Spectroscopy (SEM-EDS). Results showed that Au recovery remained consistently high, ranging from 97.19% to 98.17%. Notably, the A1B2R2 configuration—combining low agitation, extended contact time, and Reactor 2—achieved the lowest Cu recovery at 26.44%, indicating strong selectivity toward gold. These findings demonstrate the practical potential of using cast aluminum reactors made from recycled cans for safer, selective, and cost-effective gold recovery from refractory ores.

Key Words: Selective Cementation; Refractory Gold Ores; Cast Aluminum Reactor; Ammoniacal Thiosulfate; Gold Recovery

Baseline Analysis of ICT Laboratory Assets and Stewardship Practices at MSU-IIT College of Computer Studies

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Abstract: This study establishes a baseline profile of ICT laboratory assets and stewardship practices at the College of Computer Studies (CCS), Mindanao State University–Iligan Institute of Technology (MSU-IIT). An audit documented 118 assets distributed across six laboratories, organized into system units, input devices, connectivity components, and shared displays. With a student population exceeding 700, the availability of fewer than 120 system units underscores the strain on access, particularly in high-enrollment programs. To complement this structural profile, surveys were conducted among students and faculty (n = 97) and laboratory technicians (n = 3), focusing on three dimensions of stewardship: policy awareness, responsibility in equipment use, and issue-reporting practices. Findings show a strong culture of responsibility among students and faculty, while technicians emphasized persistent concerns about unauthorized access. These results highlight both the strengths of user stewardship and the vulnerabilities of manual monitoring in high-demand laboratories. The convergence of equitable asset distribution, embedded stewardship norms, and custodial vigilance points to institutional readiness for an RFID-enabled Asset Management System (AMS). The baseline therefore provides the empirical foundation for subsequent phases of the project, where automated monitoring can strengthen accountability, sustain instructional equity, and enhance governance in ICT resource management.

Key Words: ICT assets; stewardship practices; higher education; RFID AMS; MSU-IIT

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Carbon Sequestration through Seeded Mineral Carbonation of Scubbed CO2 in a Semi-batch Reactor

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Abstract: This study investigated seeded magnesium carbonation for mineral-based CO2 capture. In a semi-batch reactor set-up, with optimal operational parameters identified: high initial carbonate (15 mM), pH 10, a 1:1 magnesium to carbonate ratio, and 200 rpm stirring, all enhancing reaction kinetics and granule formation. Subsequently, in a fluidized bed reactor (FBR) application, increasing the seed dose improves carbonate removal but diminishes granulation due to excessive nucleation, highlighting the need to optimize seed load for balanced efficiency and granule size. With comprehensive product characterization (FTIR, SEM, TGA, XRD), confirmed hydrated magnesium carbonate synthesis, primarily well-ordered hydromagnesite. This product exhibited unique hierarchical lamellar morphology and a three-stage decomposition, affirming its stability for long-term CO2 storage. Experimental results consistently validated thermodynamic predictions from Visual MINTEQ, reinforcing speciation modeling reliability and establishing key trends in reaction efficiency, product morphology, and process behavior. This research provides essential baseline data for future optimization and scale-up of seeded magnesium carbonation in FBRs, significantly advancing mineral-based carbon capture technologies.

Key Words: carbon sequestration; magnesium carbonation; CO2 capture; fluidized bed reactor; mineral carbonation

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BahuraKrete™: Advancing Coral Reef Restoration with 3D-Printed and/or Precast Lightweight Foamed Concrete Artificial Reefs with Circular Fish Foaming Agent and Agro-Industrial Wastes

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Abstract: Coral reef degradation—driven by climate change, pollution, and destructive human activities—continues to threaten marine biodiversity, prompting widespread use of artificial reefs (ARs), with concrete ARs being the most common intervention. Traditional concrete ARs, while widely used, are often heavy, less porous, and challenging to transport and deploy, limiting their restoration effectiveness. In response, this study introduces an innovative coral reef restoration strategy through the development of 3D-printed and precast ARs made from a waste-derived lightweight foamed concrete mix with apparent porosity of 60–80% (vs. 5–20% in conventional concrete), densities above 1030 - to 1200 kg/m3 (50% lighter than standard concrete), and compressive strengths exceeding 10 MPa—suitable for underwater use. The formulation partially replaces ordinary Portland cement (OPC) with fly ash and limestone, and incorporates a protein-based foaming agent derived from fish waste, stabilized by nanosilica extracted from rice hull ash. This circular approach transforms agro-industrial and fishery by-products into high-value, marine-safe materials. Initial runs focused on printability, buildability, and strength considering foam to paste ratio (30-40%) and water to cementitious ratios showed excellent layer stability. Printed specimens achieved a 28-day compressive strength of 15.79 MPa at 1329 kg/m³, while cast samples ranged from 1150 to 1360 kg/m³.

Microstructural analysis confirmed an open pore network and favorable water absorption properties that support biofilm formation and marine colonization. These findings affirm the material's ecological compatibility and structural resilience, making it a viable substrate for long-term reef restoration. The project demonstrates how circular economy principles and eco-engineered materials can drive sustainable innovation in marine conservation and scalable solutions to biodiversity loss.

Key Words: coral reef degradation, artificial coral reefs (AR), 3D-Printed and Precast ARs, fish-waste foaming agent, lightweight foamed concrete.

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Development of a Data-Driven Automated Wing Wall Window for Enhanced Wind-Induced Ventilation in Buildings

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Abstract: In the Philippines, the hot and humid climate makes natural ventilation essential, particularly since many households rely on single-sided façades and cannot afford air-conditioning. A widely used passive solution is the wing wall, which channels outdoor wind into the living space to improve airflow and cooling. However, conventional wing walls are inherently limited: their performance depends heavily on wind speed, direction, and installation angle, meaning one fixed design cannot ensure consistent ventilation. To address this challenge, our project introduces a data-driven, adaptive wing wall window that automatically adjusts in real time to changing wind conditions. The study begins with controlled wind-tunnel experiments that reproduce atmospheric boundary layer (ABL) behavior. Using the tracer gas method, we evaluate ventilation effectiveness and then construct a prototype. Experimental results are used to train an artificial neural network (ANN), which generates predictive airflow response curves. These predictions are further validated with CFD simulations before being integrated into the automated prototype. The expected outcome is an intelligent, responsive window system that not only enhances indoor air quality and comfort but also reduces reliance on energy-intensive air-conditioning. By aligning passive design with machine learning, the project aims to deliver a scalable solution for healthier and more sustainable homes in the Philippines.

Key Words: Wing wall, Wing wall window, Automated adjustable wing wall window prototype, Ventilation, Single-sided ventilation, CFD, Air Change Rate, Purging Flow Rate

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Impression, Perception, and Acceptance of Open Educational Resources (OER) among Junior and Senior Undergraduate Students at the Mindanao State University - Iligan Institute of Technology (MSU-IIT)

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Abstract: Universities stand at the forefront of equipping learners for the demands of the digital era. In this transformative landscape, Open Educational Resources (OERs) have emerged as valuable tools in making education more accessible, cost-effective, and inclusive. This study examined the impression, perception, and acceptance of OER among junior and senior undergraduates at the Mindanao State University–Iligan Institute of Technology (MSU-IIT). Specifically, it sought to assess their awareness of OER, factors influencing acceptance, and barriers to adoption. Anchored on a descriptive survey design, 374 students were proportionally selected from seven colleges through stratified random sampling with balanced gender representation. A researcher-made questionnaire, validated by four expert reviewers, was administered and further supported by reliability testing and ethical review. Data analysis employed descriptive statistics to identify trends in awareness, perception, and use. As of September 19, 2025, partial data from 121 respondents revealed varied levels of awareness and experience. Most students (76%) used OER for personal learning, while 24% were unsure or had not used them, indicating gaps in recognition and exposure. About 66.1% observed OER integration in their courses, while 29.8% were uncertain, suggesting that OER might be used but not clearly identified in classroom practices. Notably, 90.9% had not attended any OER-related training, and 37.2% first learned about OER through this survey, showing limited institutional promotion. These findings highlight the potential of OER to support equitable learning but also point to the need for stronger awareness campaigns, faculty training, and clearer integration strategies to maximize their educational value.

Key Words: descriptive statistics; digital era; equitable learning; stratified random sampling; universities

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Gabay at tuntunin sa pagsasalin tungo sa pagbuo ng polisiya para sa programa ng MSU-IIT na nagsasagawa ng bilinggwal na talatanungan

Authors: Loi Vincent Deriada[1]; Alia Ramber[1]; Mary Ann Sandoval[1]; Clarisse Ann Ventic[1]

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Abstract: Sa komunidad ng pananaliksik sa MSU-IIT, marami ang nagsasagawa ng mga talatanungan upang makalikom ng datos sa kani-kanilang mga pananaliksik. Madalas din sa kanilang mga pinapasagutan na talatanungan ay mayroong mga katumbas na salin. Kung kaya't , ang pag-aaral na ito ay may layuning bumuo ng isang manwal na magiging gabay para sa mga mananaliksik na nagsasagawa ng mga bilingual questionnaire. Sandigan sa pag-aaral na ito ang pananaw ni Hanz Vermeer na skopos, tuon nitong tingnan ang pagsasalin bilang may tuon at sentro sa pagbibigay pokus ng salin. Sa pag-aaral na ito, kasalukuyang inaanalisa ang mga nakalap na datos, subalit ayon sa inisyal na analisis isa sa mga hakbang na isinasagawa ng mga mananaliksik sa MSU-IIT upang isalin ang kanilang mga talatanungan ay ang paggamit ng machine translator tulad ng google translation. Subalit, isa sa iminumukngkahing gabay ay ang pagsangguni sa mga eksperto ng isinasalin na wika upang magkaroon ng balidasyon. Gayundin, maraming hamon ang nakikita ng mga mananaliksik sa kani-kanilang mga isinasagawang talatanungan, tulad na lamang ng paghahanap ng malapit na katumbas ng mga teknikal o sayantepikong termino. Nakikitang maaaring maging imungkahi nito o gabay ay ang paglalagay ng paglalarawan sa loob ng talatanungan batay sa terminong mahirap isalin o hanapan ng katumbas na salita. Batay rito, nakitaan ng mga mananaliksik ang pangangailangan ng komunidad ng mananaliksik sa MSU-IIT na magkaroon ng isang manwal upang maaaring babalik-balikan ang iilang mga mungkahi, gabay at hakbang sa tuwing magsasagawa ng mga bilingwal na talatanungan.

Key Words: pagsasalin; gabay sa pagsasalin; bilingual questionnaire; translation manual

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Assessing the Physical-Practical, Socio-Emotional, and Cognitive-Metacognitive Skills of SHS TVL Track Students

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Abstract: This study intends to assess the competencies of Senior High School TVL students in their physical-practical skills, cognitive-metacognitive skills, and socio-emotional skills. Utilizing an exploratory sequential mixed methods design, the study engaged 15 teachers and 30 students in focus group discussions, followed by a survey of 300 purposively selected respondents. Findings reveal that students exhibit consistent competence across physical-practical, cognitive-metacognitive, and social-emotional domains, with notable strengths in integrity, teamwork, and empathy. However, gaps in self-directed learning and public communication suggest areas for instructional improvement. No significant differences were found by gender or school, though older students demonstrated stronger socio-emotional skills. The lack of correlation between academic grades and skill proficiency underscores the need for performance-based assessment models. These results advocate for integrated, flexible, and future-oriented instructional strategies to better prepare learners for nonlinear career pathways in the Fourth Industrial Revolution.

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The Role of Artificial Intelligence in Enhancing Education Tools: Ethical Considerations, Inclusivity and Societal Impact

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Abstract: Artificial Intelligence (AI) is rapidly transforming education by enhancing personalization, efficiency, and inclusivity. Yet, its adoption raises pressing concerns about ethics, equity, and broader societal impacts. This study investigated the role of AI in education across three dimensions: ethical considerations, inclusivity, and societal impact. Specifically, it examined issues of privacy, bias, and transparency; evaluated inclusivity for diverse and marginalized learners; and analyzed societal outcomes such as student engagement and teacher roles, while offering recommendations for educators, policymakers, and developers. Guided by the OECD 2030 Learning Compass and informed by Technology Acceptance and Unified Theory of Acceptance and Use of Technology Models (TAM/UTAUT), the study employed a sequential explanatory mixed-methods design. A structured survey was administered to 290 participants (65 teachers, 40 administrators, and 185 students), with the instrument validated through pilot testing of 40 respondents. Quantitative analysis using descriptive statistics, ANOVA, and regression showed that ethical considerations ($\beta = .16$, $p = .001$) and inclusivity ($\beta = .41$, $p < .001$) significantly predicted societal impact, whereas privacy concerns, though high across groups, did not. Qualitative findings from open-ended surveys and focus group discussions reinforced these results, revealing optimism among administrators, caution among teachers, and mixed but privacy-conscious views among students. The study concludes that AI can serve as a catalyst for equitable, future-ready education if guided by ethical safeguards, inclusive design, teacher training, and strong governance policies.

Key Words: Artificial Intelligence; Education; Ethics; Inclusivity; SDG 4; SDG 10

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Gender Disparities in the Juvenile Justice System of Iligan City and Cagayan de Oro City

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Abstract: This study explores gender disparities in the juvenile justice systems of Iligan City and Cagayan de Oro City, with particular attention to diverse gender identities, including male and non-binary youth. By integrating case narratives and analyzing systemic barriers, the study provides a nuanced understanding of how gender shapes juvenile justice experiences. This study also examines gender disparities in the juvenile justice system, focusing on positive developments and gender-responsive practices. Using a mixed-methods approach, quantitative data from 2019 to 2024 juvenile offender records were analyzed alongside qualitative interviews with juvenile justice officers, social workers, and youth offenders. The data revealed that although male juveniles comprise the majority of cases (approximately 70%), female juveniles demonstrate higher engagement in rehabilitation programs, including educational, psychosocial, and life skills interventions. There has been a notable reduction in detention durations for female juveniles, reflecting a shift toward restorative justice and alternatives to incarceration. Qualitative findings highlighted increased gender sensitivity training among juvenile justice personnel, which improved their capacity to address the unique needs of female offenders and foster supportive environments. Tailored rehabilitation programs addressing gender-based challenges, such as violence and discrimination, received positive feedback from participants, contributing to successful reintegration. Community-based interventions and active family involvement were more prominent in female juvenile cases, further enhancing rehabilitation outcomes. Institutional commitment to gender equity was demonstrated through policy reforms promoting non-discrimination and equitable access to services. These findings underscore the progress made in reducing gender bias within juvenile justice systems and the importance of sustaining gender responsive practices. Continued emphasis on gender sensitivity training, community involvement, and alternative rehabilitation programs can strengthen juvenile justice outcomes for all genders. This study contributes valuable insights for policymakers and practitioners aiming to foster an inclusive, equitable, and effective juvenile justice framework.

Key Words: Gender disparities; Juvenile justice system; Rehabilitation programs

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Gender Equality in Obtaining a Deeper Understanding of the Implementation of Sustainable Cities and Communities Amid the COVID-19 Pandemic

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Abstract: This study explored the role of gender equality in achieving a deeper understanding of the implementation of Sustainable Cities and Communities (SDG 11) amid the COVID-19 pandemic. Framed within the context of inclusive and equitable urban development, the research employed a mixed-methods approach, combining qualitative insights with quantitative data to investigate gendered perspectives on sustainability during a public health crisis. A total of 178 participants were purposively selected, ensuring representation across gender identities and socio-cultural backgrounds. The purposive sampling method enabled the identification of key informants whose lived experiences and professional roles were directly relevant to the objectives of the study. Findings indicate that women were well-represented in city department offices, suggesting significant strides toward

gender parity in local governance and urban planning. This gender balance reflects an encouraging trend: men and women, including marginalized groups and indigenous peoples, are increasingly gaining equitable access to knowledge, participation, and economic opportunities related to sustainable urban development. Moreover, the study found that access to training and capacity-building programs on sustainable cities and communities was viewed by participants as the most effective strategy for fostering inclusive development during and after the pandemic. Training activities were particularly instrumental in amplifying gender-aware perspectives, allowing both women and men to contribute to community resilience and sustainable recovery strategies. In conclusion, the study underscores that gender equality is not only a goal in itself but a vital catalyst for advancing sustainability in urban settings. The COVID-19 pandemic, while disruptive, has created opportunities to reframe policies and practices through a gender lens, promoting inclusive, safe, resilient, and sustainable cities for all.

Key Words: Gender Equality; Sustainable Cities and Communities; COVID-19 Pandemic

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The Experiences of Male and Female Students of BET - Mechanical Engineering Technology, MSU-IIT, Iligan City: A Longitudinal Study

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Abstract: This longitudinal research project investigates the academic performance and gendered experiences of the pioneering cohort of the Bachelor of Engineering Technology major in Mechanical Engineering Technology (BET-MET) under the revised curriculum at MSU-IIT, Iligan City, Northern Mindanao, Philippines. It specifically analyzes the academic progression of male and female students from first year to fourth year, using their official grades recorded in the MSU-IIT computer system. The study combines both quantitative and qualitative approaches to provide a comprehensive understanding of students' academic outcomes and their gendered experiences within the program. A survey questionnaire was used to gather quantitative data from students, while individual interviews and Focus Group Discussions (FGDs) with faculty members captured qualitative insights. Wilcoxon' s rank-sum test, also known as the Mann-Whitney U test, as adapted from Felder et al. (1998), was applied to determine significant differences in academic performance between male and female students. Additionally, qualitative content analysis was employed to interpret the narratives gathered from interviews and focus group discussions (FGDs). Findings reveal that students, regardless of gender, placed significant value on their coursework and demonstrated a strong sense of academic autonomy. However, female students reported instances of gender discrimination, particularly during their On-the-Job Training (OJT), pointing to persistent gender inequality in workplace environments. Furthermore, gender biases were identified in the curriculum and instructional practices of the BET-MET program. In light of these findings, the study recommends the implementation of a Phase 2 Gender Sensitivity Training Program targeting stakeholders of the BET-MET program under the College of Engineering and Technology (COET) as part of its Gender and Development (GAD) Extension initiative. This initiative aims to foster a more inclusive, equitable, and gender responsive academic environment.

Key Words: Gender and Engineering Education; Longitudinal Study; Mechanical Engineering Technology