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Development of 3D Modelled, Skill/Training Center in REVIT

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Abstract*: The goal of the project is to create an optimised layout design for imparting training at training centre using Revit software. The training center deals with identifying and rectifying mistakes made by workforce in the industry by improving their skills. The model focuses on space utilization, improved space allocation for workstations, class rooms and emergency exit areas. It's also designed considering futuristic scope of integrating new technology in the training center.This study highlights the importance of effective space planning in skill development centers (otherwise called training centers) to create a productive and learner-friendly environment while maintaining compliance with safety and accessibility standards*

Keywords: Revit software

I. INTRODUCTION

The primary purpose of establishing Training center in an industry is to developskill, knowledge, enhance safety, ensure standardisation, boost productivity, reduce operational defects, encourage innovation and develop leadership among contractual workforce, associates, employees and executives working in an organisation.
The aimof the project is to design and develop a 3D training center (Skill development center) layout with Revit software with due consideration to maximize functionality, accessibility, and space efficiency.
This paper discusses design considerations and showcases the rendered 3D model created for addressing the purpose.

A. Background

Layout is the general arrangement of facilities and components in an area. It is vital and primarily designed / developed to avoid suprises and rework post implementation. It is used in manufacturing, building designs, graphics and user interfaces. It uses computer aided design (CAD) models generated in software's like Revit and AutoCAD.
Layout design utilizes techniques to maximize space and productivity. Multiple layout planning tools and techniques exist and a few are explained -Systematic Layout Planning (SLP) is used for sequential analysis, CRAFT is used for optimization of existing layouts, CORELAP is used for design based on adjacency, heuristic algorithms (Mathematical optimization) applications are used for mathematical optimization. This optimization can be performed with techniques such as AutoCAD, Revit (2D/ 3D modeling), CATIA, SolidWorks (modeling).
Well designed layouts facilitateseffective use of space, easy movement of work, and safety. They are attained by maintaining working conditions in the most efficient way. Optimal designing results in easy accessibility, responsible allocation of facilities, and effective learning for the trainees.
With the growing need for qualified professionals in sectors, training centers with modern facilities are the need of the hour. Proper planning for a layout must be done by incorporating classrooms, practice areas, equipment storage space, and safety corridors to facilitate practical learning.
Generally training are imparted to over-come Human errors. Typical mistakes committed by industry workforce are as below:

- Omission (28.1%)

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- Excessive/insufficient repetition (0.2%)
- Wrong order (0.7%)
- Early/ late execution (0.2%)
- Execution of restricted work (1.1%)
- Incorrect selection (17.5%)
- Incorrect counting (0.9%)
- Mis-recognition (16.4%)
- Failing to sense danger (1.7%)
- Incorrect holding (0.3%)
- Incorrect positioning (5.0%)
- Incorrect orientation (10.1%)
- Incorrect motion (0.1%)
- Improper holding (2.0%)
- Inaccurate motion (8.8%)

These are the common type of mistakes that are done by the any humans and employee in an organisation are no exception. Therefore, to overcome these types of mistakes, training are needed to be imparted and Skill development centers play a pivotal role. Therefore, design of are to be taught in the skill development center.

B. Research Gap

Population of India is around 146Cr. 9.95% of population falls under the average employable age group of 18 to 24 years and increases with population at growth rate of 0.88%.The technological advancements and industrialisation (Industry 1.0 to 5.0) progress complicates further with constant gap between the actual skill level requirements to the need as per the industry. As a result, there increases a need for skill development centers.

Additionally the lack of scientific studies to emphasize layout floor planning at an optimum level with focus on maximizing the space utilization efficiency, trainee travel, and security adds to the existing complexity.

Existing research focuses on training processes and course planning but does not significantly address facility impact on effective training. Hence the need for development of Layout specific to training center development.

C. Objective

The objective of this project is to develop an organized and flexible design for a skill development center that optimizes space, and provides a safe environment for users. The layout space designed should be scalable considering future training needs. The project will utilize Revit 3D modeling software to accurately visualize and validate the concept for the design space while making sure the final layout meets current functional needs and strategic long-term goals, as building modeling in maintaining the risk of work injury and accident within bounds.

All the above literatures emphasise the need for training without the requirement of Layout planning and its methodology specific to Training center determined by a further analysis of the original proposed space. The 3D model outputs are in STL file format.

II. LITERATURE REVIEW

Kumar & Singh (2020) investigated the use of parametric design in Revit to allow for flexible space layouts in modular training centers by utilizing 3D models for maximizing space and flexibility to varying training needs.Borrmannet al. (2021) examined the abilities of artificial intelligence-supported building information modeling approaches that can transform training center planning, including generative design methods to enhance the layout planning and subsequent automated allocation of space allocation, in real-time, based on space usage data.Schleich et al. (2020) exhibited how machine learning models can be successful for anomaly detection in BIM-based training centers, to limit downtime, enhance resource management, and improve thereliability in training.Patel et al. (2022) researched the merging of IoT and AI for BIM to create intelligent training environments that adapt to learning, by modifying resources like lighting

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and temperature in real-time, allowing for optimally conditioned learning environments, as well as increased efficiency. Ghaffarianhoseini et al. (2023) discussed their findings that Revit-based energy analysis can produce training centers that take a greener approach, through the managing of energy consumption by utilizing renewable energy, and consequently, the sustainability effort yields favourable results without compromising the impact of the learning environment's standard. Zhang et al. (2024) underscored the validity of using AI-based generative design in Revit for training centers by discussing how it provides automation to the layout planning process which optimizes the use of material, saves on construction costs, and enhances schedule efficiencies.Hosseini et al. (2024) discussed the benefits of cloud-based collaborative platforms for BIM-based designs that have the ability for real-time revisions and expanded collaborative opportunities with all different stakeholders involved in different training center construction projects for improved communication and project delivery.Lin et al. (2021) studied the intersection of BIM with IoT-based intelligent monitoring systems for real-time supply of information as part of maintenance and management of training centers, eventually enhancing the building operations and training environments.Yang et al. (2023) described BIM-based safety simulation training, detailing the effectiveness of virtual site visits through 3D-

III. METHODOLOGY

A. Data Collection and Requirement Analysis

As a first step, data gathering initiated to determine the functional and space requirements of the skill development center. Existing skill development centers were analysed and in person visits made as well.

Design of a training center revolves around type training to be provided, number of trainees to be accommodated / tutored or trained at a time, available area of the site allocated for training and number of staffs.

Researching the existing skill development centers helpedto study the data that are required to design a customized one. In addition, local and international designs were also studied and multiple interviews conducted across the industry to understand the training center requirements.

Finally, the site-specific available area analysis, climate, and future developments considerations are used as input for the design process.

B. Conceptual Layout Development

The first step in the Layout development is to sketch or create a conceptual layout of the building at macro level. This normally done to ensure stakeholder alignment as a proto to avoid major rework at later stage of the project. The macro level layouts were sketched in AutoCAD. These layouts included separations in zones for classrooms, training space, offices, equipment storage, safety areas. The floor plan designed considering modifications or additions which are likely to occur as the future training needs and outcomes develop in conjunction with potential for future technology.

A floor plan (*Figure 1.0*), for the proposed skill development center, demonstrates some functional areas to include training zones, classrooms, VR training zone, pantry, lobby, toilet, and storages. The floor plan 2D provides macro level understanding, however depth impact lacks and hence understanding issues writ physical space raises as a challenge. Hence the need to migrate to 3D.

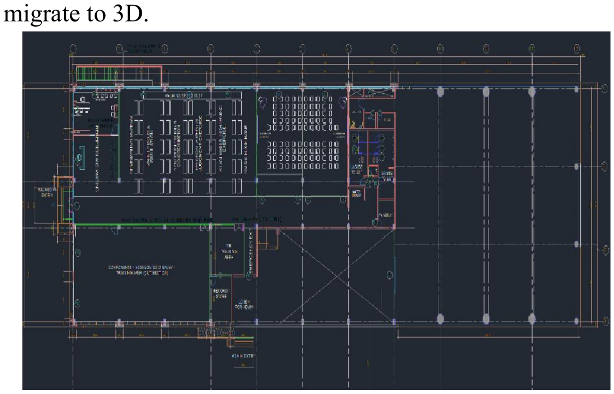

Figure 1.0 2d conceptual design

C. 3D Modelling Using Revit Software

To overcome shortcomings of 2D, we have used Revit software to develop a detailed 3D model of the skill development center. Modeling is to develop structural components such as walls, floor, doors, windows and workstations in the correct positional location. Change management were instigated for handling multiple changes which were raised during the development process from various stakeholders.

Figure (1.1) shows a 3D wire-frame view of a layout for a skill development center. The wire-frame view highlights the structural elements including walls, doors, and partitions, and functional spaces including classrooms, administration, gathering spaces, and pathways of access. The wire-frame offers a much more advanced visualization of the interior spaces and circulation flows within the building.

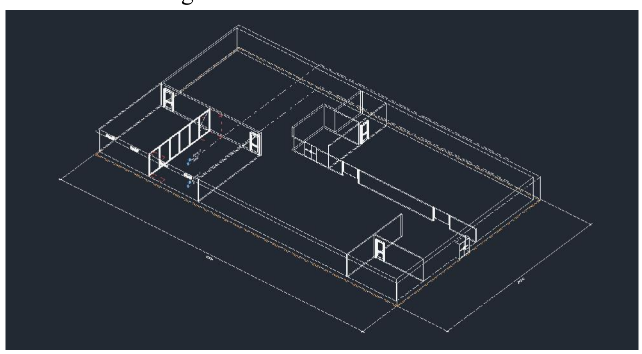

Figure 1.1: 3D concept Design

Figure (1.2) shows a layout of typical workstationplanned for use in the training center. It can be observed the pedagogy of learning is “hands-on training” and the same is enabled in the layout along with other tools and equipments. Peg boardsare designed for training on the fastening mechanisms (how the nuts &bolts should be tighten or loosed) in the wheels.The dimensions and properties of the workstation are represented in Table 1.0.

Dimension	1800 x 500 x 1900
Materials Used: Frame Working board Board Backing Name board	 Aluminium Laminated plywood Synthetic material PVC

Table 1.0: Workstation properties

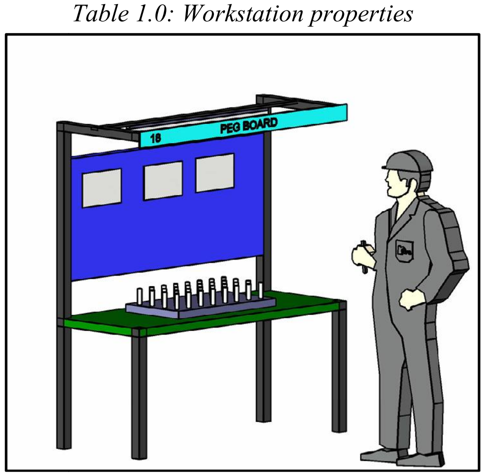

Figure1.2 Layout of Pegboard Workstation

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D. Evaluation and Optimization

Upon generation of 3D model, repeat analysis is conducted to analyse the efficiency of the model with regard to space usage, workflow, and safety compliance protocols via feedback from stakeholders and refined.

Safety features like the position of emergency exits, fire safe features, and accessibility are checked to make sure it is in placed as per the safety precaution regulations. The developed 3D model werefine tuned / altered with respect to safety & ergonomics feedback also.

E. Finalization and Documentation

Upon completion of the change requests, the design is finalised and documented for implementation.The documentation process starts with preparation of layout drawings, 3D images, technical specification booklet to make certain that the design of the facility is visually known.

Future scalability in the layout plan is also considered in order to support future changes or expansions of the training aspect of the center such that future change or expansion will be integrated as demands for effective training change.

Such a systematic approach guarantees the project deliverable to design a center for skill development to be operating, effective, and responsive to future demands. The 3D layout was created with Revit software to enable design precision and to present a realistic visual view of the facility so that workflow and resource allocation can be optimized.

Figure1.3 workstation view

Figure 1.3 illustrates the positioned workstations in the 3d skill development center. Each workstation have the specific position as per the workflow required for training.

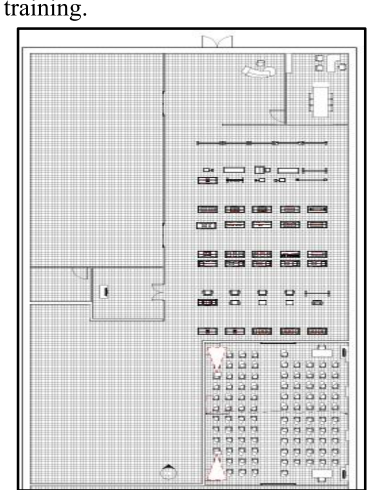

Figure 1.4:3D Layout

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F. Key Parameters

The skill development center design accommodates the objectives of space efficiency, safety, and flexibility. These include well-organized spaces like classrooms, training spaces, administrative areas, and storages, to facilitate efficient work flow and optimal space usage. Safety access was also provided through emergency exits, fire protection, accessibility ramps, creating a space that will be able to shift to fit future requirements. The efficient allocation and optimization of resources plan for a neat environment by leveraging the positioning of training, seating, and storage units so the space is used in an optimal manner by maximising area.

IV. RESULTS AND DISCUSSION

The design of the training center provided a functional, efficient and sustainable layout appropriate for a contemporary training environment. Using digital tools such as AutoCAD and Revit, 2D and 3D plans were developed to fully utilize the space while considering comfort and safety for the occupants. The design successfully integrated practicality and modern aesthetics while considering training needs that may evolve.

A. Space Optimization and Visualization

In the layout, space was assigned to many different training needs, spaces such as classrooms, workshops, office, and utilities were provided to allow for movement and efficient workflow. 2D floor plans were developed with AutoCAD, and Revit was used to produce the necessary 3D modeling. Revit gave stakeholders the opportunity to visualize the plans and assess light and ventilation before the drawing was finished in a near to real environment. The opportunities for future expansion are also possible with modular spaces and the needed flexibility is built-out ofthe new training center.

B. Safety Accessibility

Safety is prioritized in the design stage itself, with fire exits and emergency response systems. Accessibility is enhanced through barriers, ramps and doors such that special personal (individuals with disability) can comfortably and easily pass through. Digital modeling software allowed the layout to be visualized and confirmed before construction started, ensuring a usable and safe building for existing and future requirements that was well planned and completely secure. The design estimations and computations are also provided.

C. Validation of Visualization Results

The proposed design of the training center was thoroughly analyzed using a 3D Revit model which enhanced the assessment of visual experience and space usage. The model gave understanding to the distribution of light, the consistency of air flow and the overall look and feel of the space, such as color placement, surface material, and light for each workstation. It allows for fine tuning the details before building it into the real life. The model evolved to become a feasible and realistic one maintaining the operating efficacy as well as user comforts.

D. Equations

S. No	Parameters	Equations
1	Space Utilization Efficiency	$Efficiency = \left(\frac{Usable\ area}{Total\ Area}\right) X\ 100$
2	Occupant Capacity Calculation	$Capacity = \left(\frac{Total\ Usable\ area}{Space\ required\ per\ person}\right)$

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3	Lighting Requirement Calculation	$Illuminance\ (Lux) = \left(\frac{\text{Total Luminous Flux}}{Floor\ spare\ area}\right)$
4	Ventilation Rate Calculation	$Air\ flow\ rate = (\text{Room Volume x Air changes per hr}$

Table 1.1: Equation table

The Table 1.1 presents key equation for the following computations:

1. Space Utilization Efficiency:

Reception area =*2 persons*
Staff room =*6 persons*
Workstation (50) =*50*
Classroom = 100 *students+2 staffs*
Total people =160 people
Usable area =160*2.5=400m²
Total area =630m²

Calculation:
Efficiency = (400 / 630) × 100 **= 63.4%**
(Only one person is allowed for single workstation at a time)

2. Occupant capacity:
Space Required per Person= 2.5m²
Total usable area =400m²
Calculation:
Capacity = 400 / 2.5
= 160 people

3. Lighting Calculation:
Total Luminous Flux = 120,000 lumens
Area = 400 m²
Calculation:
Illuminance = 120,000 / 400
= 300 lux

4. Ventilation Rate Calculation:
Total Volume = 1890 m³
Air Changes per Hour (ACH) = 6
Calculation:
Air Flow Rate = 1890 × 6
= 11,340 m³/hr

It helps in optimizing building design and space management by measuring efficiency, accommodation capacity and air flow requirements.

E. Future Scope

Future scope involves evolving training requirements and technological advancements like Incorporating newer digital technologies such as Virtual Reality (VR)in technical and practical learning environments. It is a scalable and modular design that can be easily expanded by introducing new training labs, equipment, and specialized areas as the new technology is introduced in the market.

F. Conclusion

The training center successfully achieves all functional, technological and sustainability objectives of a modern learning environment. Through efficient planning of space, ergonomics, use of digital tools such as AutoCAD and Revit, a realistic and productive layout was created. Smart technologies and safety features systems ensure that the center is not only effective today but adaptable for future requirements. In conclusion, the project shows how well-planned design can enhance the quality of training, users comfort and long-term operational effectiveness.

REFERENCES

[1]. Samogorov, Vitaly &Gricevich, Nikita. (2024). Principles for designing emergency response training centers. Innovative Project. 8. 85-89. 10.17673/IP.2023.8.14.9.

[2]. Azad, Rezvan&Shakour, Mahsa&Moharami, Narjes. (2024). Designing an evaluation tool for evaluating training programs of medical students in clinical skill training center from consumers' perspective. BMC Medical Education. 24. 10.1186/s12909-024-05454-7.

[3]. (2025). Practical aspects of ergodesign of occupational health and safety training centers. XXI century. Technosphere Safety. 10. 77-89. 10.21285/2500-1582-2025-10-1-77-89.

[4]. Prabhakar, Sonam &Nimesh, Ashok. (2022). Skill development programmes for women in India: current status and future perspectives. World Journal of Advanced Engineering Technology and Sciences. 7. 128-136. 10.30574/wjaets.2022.7.1.0105.

[5]. safety and safe work environment." International Journal of Safety and Security Engineering 10.5 (2020): 689-698.

[6]. Coordinators, National. Managing and resolving conflicts effectively in schools and classrooms.

[7]. Liu, Xinxia, et al. "Safety climate, safety behavior, and worker injuries in the Chinese manufacturing industry." Safety science 78 (2015): 173-178.

[8]. Estudillo, Barbara, Francisco J. Forteza, and José M. Carretero-Gómez. "Effectiveness of training in reducing accidents in construction companies." Journal of Safety Research 92 (2025): 283-291.

[9]. Sharma, Ravi, and Dharmesh K. Mishra. "The role of safety training in original equipment manufacturing companies on employee perception of knowledge, behavior towards

[10]. Wang, Sicheng, et al. "Workforce development in the trucking industry: A comprehensive analysis of truck driver training entities." Transport Economics and Management 3 (2025): 23-34.

[11]. Karthikeyan, C., and Sonia Singh. "Skill Development Challenges in the Era of Artificial Intelligence (AI)." Integrating Technology in Problem-Solving Educational Practices. IGI Global, 2025. 189-218.

[12]. Joshua, James Adinoyi, Aniedi Daniel Usoro, and DimkpaIgwebuike Edward. "Effect of Revit and

[13]. AutoCAD Softwares on Students' 3D Skill Performance in Modelling Building Drawings in Technical Colleges in Akwa Ibom State." International Journal of Vocational Studies and Library Science 5.1 (2024).

[14]. Bhaduri, Srinjita, Katie Van Horne, and Tamara Sumner. "Designing an informal learning curriculum to develop 3D modeling knowledge and improve spatial thinking skills." Extended abstracts of the 2019 CHI conference on human factors in computing systems. 2019.

[15]. housney Mahmoud, Sawsan. "Effectiveness of modeling strategy on the functional locomotor skills development for intellectualy disable childrens."

[16]. Detsimas, Nicole, et al. "Workplace training and generic and technical skill development in the Australian construction industry." Journal of management development 35.4 (2016): 486-504.

[17]. Qodirov, F. "ADVANTAGES AND DISADVANTAGES OF IMMITATION TRAINING." ACUMEN: International journal of multidisciplinary research 2.2 (2025): 296-301.

[18]. Horton, John J., and Prasanna Tambe. "The death of a technical skill." Information Systems Research (2025).

[19]. Hannah, Richard, Julie Matuszczak, and Melissa Briggs. "VR Study Highlights the Need for an Adaptive Learning Environment in Industrial Safety Training." Journal of Educational Technology Systems (2025): 00472395251330646.

[20]. Marchiori, Raissa, Siyuan Song, and Jewoong Moon. "Developing heat stress training assessments: A training-driven methodology approach to enhance safety in the constructionindustry." Journal of Safety Research 92 (2025): 262-271.

[21]. Han, Yu, et al. "Process and outcome-based evaluation between virtual reality-driven and traditional construction safety training." Advanced Engineering Informatics 52 (2022): 101634.

[22]. Casey, Tristan, et al. "Making safety training stickier: A richer model of safety training engagement and transfer." Journal of safety research 78 (2021): 303-313.

[23]. Chen, Kuang-Jou, et al. "Training and dashboard design: Impact on operator performance and mental workload for flight safety." Safety Science 181 (2025): 106700.

[24]. Qodirov, F. "ADVANTAGES AND DISADVANTAGES OF IMMITATION TRAINING." ACUMEN: International journal of multidisciplinary research 2.2 (2025): 296-301.

[25]. Aida, Imamović, Kablar Omer, and OručMirsada. "REQUIREMENTS FOR SAFE WORK WHEN USING A FORKLIFT TRUCK."

[26]. Bunn, Terry L., et al. "Quantitative and Narrative Analysis of Dump Truck-Related Injuries and Fatalities in the United States." Safety 11.1 (2025)

[27]. Toole, Ruth D., et al. "Using a Farm Safety Checklist to Assess Learner Performance Following a Safety Education Training." Journal of Agricultural Safety and Health (2025): 0.

[28]. Cavataro, Benjamin L., Maya L. Seshan, and Stephen W. Hargarten. "Firearms Industry Immunity From Safety Regulation—A Call to Action." JAMA Health Forum. Vol. 6. No. 1. American Medical Association, 2025.

[29]. Choueiri, E. M. "Road safety stakeholder collaboration: insights from Lebanon and the United States." Advances in Transportation Studies 65 (2025).

[30]. Rodriguez, Anabel, et al. "Promoting Workplace Health, Safety, and Well-Being Among Essential Agricultural Workers Through Vaccine-Preventable Infectious Diseases Training in the Rio Grande Valley." Journal of Agromedicine 30.1 (2025): 57-67.

[31]. Sands, Kenneth S., and Min Jae Suh. "Roofers' Perceptions on Topics of Heat Safety." International Journal of Construction Education and Research (2025): 1-19.

[32]. Memarian, Babak, Sara B. Brooks, and Jean Christophe Le. "Pre-task planning for construction worker safety and health: Implementation and assessment." American journal of industrial medicine 68 (2025): S88-S97.

[33]. Denisa, EngMateiAndrada, and Eng Ligia IoanaTuhu. "HEALTH AND SAFETY OF WORKERS IN THE MINING INDUSTRY FOLLOWING THE IMPLEMENTATION OF ARTIFICIAL INTELLIGENCE."

[34]. Skjold, Trygve. "Teaching process safety in the twenty-first century." Journal of Loss Prevention in the Process Industries 94 (2025): 105538.

[35]. Rahman, Md Mostafizur, et al. "Occupational health safety in aquaculture: A case study on semi-intensive shrimp farmers of Bangladesh." PloS one 20.2 (2025): e0315075.

[36]. Yao, Wenyan, et al. "Can Employee Training Stabilise the Workforce of Frontline Workers in Construction Firms? An Empirical Analysis of Turnover Intentions." Buildings 15.2 (2025): 183.

[37]. Nguyen, Minh Van, et al. "Investigating the impacts of psychological safety climate on mental ill health in the Vietnamese construction industry." Engineering, Construction and Architectural Management (2025).

[38]. Swinderman, R. Todd. "How training improves safe and efficient conveyor design decisions." Mining Engineering 77.2 (2025).

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[39]. Khan, Waseem S., EylemAsmatulu, and Ramazan Asmatulu. "Nanotechnology safety in the automotive industry." Nanotechnology Safety. Elsevier, 2025. 77-96.

[40]. Khan, Waseem S., EylemAsmatulu, and Ramazan Asmatulu. "Nanotechnology safety in the automotive industry." Nanotechnology Safety. Elsevier, 2025. 77-96.

[41]. Yin, Yichen, et al. "Development and effectiveness analysis of a safety management model for SMEs integrating lean management innovation with SQCDP framework." PloS one 20.1 (2025): e0316299.

[42]. Hassan, Capt Mohamed HM, and Capt Ahmed Mohamed Aly Salem. "The Role of New Technologies and Digital Transformation in Enhancing Maritime Education and Training."

[43]. Sultan, Reija Lyn N. "FACTORS AFFECTING SUSTAINABILITY OF SMALL AND MEDIUM ENTERPRISES IN FOOD INDUSTRY IN DAET, CAMARINES NORTE: BASIS FOR BUSINESS STRATEGY FORMULATION."

[44]. Wang, Sicheng, et al. "Workforce development in the trucking industry: A comprehensive analysis of truck driver training entities." Transport Economics and Management 3 (2025): 23-34.

[45]. Chen, Kuang-Jou, et al. "Training and dashboard design: Impact on operator performance and mental workload for flight safety." Safety Science 181 (2025): 106700.

[46]. Marchiori, Raissa, Siyuan Song, and Jewoong Moon. "Developing heat stress training assessments: A training-driven methodology approach to enhance safety in the construction industry." Journal of Safety Research 92 (2025): 262-271.

[47]. Afa, Rim, IssamSobhy, and AbderrahimBrakez. "Application of BIM-Driven BEM Methodologies for Enhancing Energy Efficiency in Retrofitting Projects in Morocco: A Socio-Technical Perspective." Buildings 15.3 (2025): 429.

[48]. Fernández Rodríguez, Juan Francisco, et al. "Data Transfer Reliability from Building Information Modeling (BIM) to Life Cycle Assessment (LCA)—A Comparative Case Study of an Industrial Warehouse." Sustainability 17.4 (2025): 1685.

[49]. Nasir, MJ Mohammad, P. Ravi Prakash, and Mayank Suman. "An Automated BIM-GRIHA15-LCA Framework for Building Sustainability Assessment." Journal of Building Engineering (2025): 111908.

[50]. Guo, Haojie, et al. "UAV-BIM-BEM: An automatic unmanned aerial vehicles-based building energy model generation platform." Energy and Buildings 328 (2025): 115120.

[51]. Nawari, N., L. Itani, and E. Gonzalez. "Understanding building structures using BIM tools." Computing in Civil Engineering (2011). 2011. 478-485

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