

Generative AI-Assisted Curriculum Design and Competency Mapping for Outcome-Based Education in Engineering and Medical Institutions

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ABSTRACT:

Outcome-Based Education (OBE) has emerged as a transformative educational framework that emphasizes measurable learning outcomes, competency attainment, and continuous curriculum improvement across professional education systems. Engineering and medical institutions increasingly require dynamic curriculum models capable of adapting to rapidly evolving industrial technologies, healthcare practices, accreditation requirements, and interdisciplinary competencies. Conventional curriculum design processes remain highly manual, time-consuming, and often struggle to maintain alignment among program outcomes, course outcomes, graduate attributes, competency frameworks, assessment strategies, and stakeholder expectations. Recent advances in Generative Artificial Intelligence offer unprecedented opportunities to automate curriculum planning, generate learning resources, recommend competency-aligned instructional strategies, identify curriculum gaps, and support evidence-based academic decision-making. This paper presents a comprehensive academic investigation into the integration of Generative AI for curriculum design and competency mapping within Outcome-Based Education environments. The study explores AI-driven curriculum intelligence, automated outcome alignment, competency analytics, personalized learning pathways, and continuous quality enhancement mechanisms suitable for engineering and medical education. Furthermore, the paper discusses implementation strategies, evaluation metrics, ethical

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Open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (http://creativecommons.org/licenses/by/4.0/).	considerations, institutional readiness, and future research opportunities for sustainable AI-enabled academic ecosystems that enhance educational quality while preserving academic integrity and accreditation standards.
	Keywords: Generative Artificial Intelligence, Outcome-Based Education, Curriculum Design, Competency Mapping, Engineering Education, Medical Education

1. Introduction

The unprecedented advancement of Artificial Intelligence (AI), particularly Generative Artificial Intelligence (Generative AI), has initiated a paradigm shift in higher education by fundamentally transforming the design, delivery, management, and evaluation of academic programs. Universities worldwide are increasingly embracing intelligent educational technologies to improve curriculum quality, personalize learning experiences, automate administrative tasks, and support evidence-based educational decision-making. Among these emerging technologies, Generative AI demonstrates exceptional capabilities in natural language understanding, knowledge generation, semantic reasoning, instructional content creation, curriculum planning, competency analysis, and adaptive educational support. These capabilities provide higher education institutions with innovative opportunities to redesign traditional academic ecosystems and develop more flexible, responsive, and learner-centered educational environments that satisfy the demands of modern industries and healthcare systems.

Simultaneously, Outcome-Based Education (OBE) has become the preferred educational philosophy for engineering and medical institutions due to its emphasis on measurable learning outcomes, competency development, graduate attributes, continuous quality improvement, and accreditation compliance. Regulatory agencies increasingly require educational institutions to demonstrate explicit alignment between Program Educational Objectives (PEOs), Program Outcomes (POs), Course Outcomes (COs), competency frameworks, assessment strategies, and graduate

employability. However, designing such interconnected educational structures remains a highly complex, labor-intensive, and iterative process requiring extensive faculty collaboration, domain expertise, curriculum analysis, stakeholder consultation, and periodic revision. Manual curriculum mapping often introduces inconsistencies, redundancy, subjective interpretation, delayed updates, and inadequate responsiveness to rapidly changing technological and healthcare advancements. Consequently, the integration of Generative AI into curriculum design and competency mapping has emerged as a promising research direction capable of automating educational intelligence while preserving pedagogical quality and institutional accountability.

Modern engineering education operates within a rapidly evolving technological landscape characterized by Artificial Intelligence, Internet of Things, Cyber-Physical Systems, Digital Twins, Robotics, Sustainable Engineering, Data Science, Cloud Computing, Edge Intelligence, and Industry 5.0. Similarly, medical education continuously evolves through advances in precision medicine, genomics, digital health, telemedicine, robotic surgery, AI-assisted diagnostics, personalized therapeutics, evidence-based clinical practice, and healthcare informatics. These transformations require educational curricula to remain continuously synchronized with professional competencies, regulatory standards, industry expectations, healthcare innovations, and interdisciplinary knowledge domains. Traditional curriculum revision cycles often fail to accommodate such dynamic changes due to limited institutional resources and prolonged approval mechanisms.

Generative AI offers a fundamentally different approach by enabling intelligent curriculum synthesis, automated learning outcome generation, competency relationship discovery, prerequisite dependency analysis, interdisciplinary knowledge integration, adaptive instructional planning, personalized learning recommendations, assessment blueprint generation, and continuous curriculum optimization. Rather than replacing educators, Generative AI functions as an academic decision-support system that augments faculty expertise through intelligent recommendations grounded in educational objectives, accreditation frameworks, competency taxonomies, and institutional priorities.

Within Outcome-Based Education, competency mapping represents one of the most challenging academic activities because it requires explicit correspondence among learning objectives, instructional strategies, assessment methods, graduate attributes, professional competencies, cognitive domains, psychomotor skills, affective learning outcomes, and lifelong learning expectations. In engineering institutions, competency mapping involves aligning technical knowledge, design capabilities, analytical reasoning, innovation skills, communication abilities, ethical responsibility, teamwork, project management, sustainability awareness, and entrepreneurial competencies. Medical institutions similarly require mapping across biomedical sciences, clinical reasoning, diagnostic decision-making, patient safety, professional ethics, communication, evidence-based medicine, leadership, healthcare management, and community engagement. Manual competency mapping frequently becomes inconsistent due to subjective faculty interpretation, disciplinary diversity, evolving accreditation criteria, and increasing curriculum complexity.

Generative AI significantly enhances competency mapping by analyzing extensive educational documents, competency frameworks, accreditation standards, course syllabi, instructional materials, assessment artifacts, and professional guidelines simultaneously. Advanced Large Language Models (LLMs) can

recognize semantic relationships among educational concepts, identify competency overlaps, recommend missing learning outcomes, detect curriculum redundancies, suggest competency progression pathways, and generate comprehensive mapping matrices with substantially reduced manual effort. Such intelligent capabilities improve curriculum coherence while enabling continuous quality enhancement aligned with institutional missions and societal expectations.

Furthermore, Generative AI supports evidence-driven curriculum modernization by continuously monitoring emerging technological developments, scientific discoveries, industrial practices, healthcare innovations, policy changes, and professional competency frameworks. Engineering curricula can therefore remain synchronized with advances in quantum computing, intelligent manufacturing, renewable energy systems, autonomous vehicles, cybersecurity, and smart infrastructure. Likewise, medical curricula can rapidly incorporate developments in AI-assisted diagnostics, digital pathology, precision therapeutics, wearable healthcare technologies, biomedical imaging, clinical decision support systems, and population health management. Continuous AI-assisted curriculum evolution substantially reduces the time required for academic program revision while maintaining educational relevance.

The integration of Generative AI additionally enables adaptive educational personalization through competency-aware learning pathways. Students possessing diverse backgrounds, learning preferences, prior knowledge, and professional aspirations can receive individualized curriculum recommendations, supplementary instructional resources, adaptive assessments, and competency development plans generated through AI-driven educational analytics. Such personalization promotes improved academic performance, reduced learning disparities, enhanced learner engagement, and stronger professional preparedness.

Despite these considerable opportunities, implementing Generative AI within curriculum development introduces important pedagogical, ethical, technical, organizational, and governance challenges. Institutions must address issues related to algorithmic transparency, explainability, educational bias, fairness, intellectual property, curriculum ownership, faculty autonomy, data privacy, academic integrity, regulatory compliance, and responsible AI governance. Successful implementation therefore requires comprehensive institutional frameworks integrating technological innovation with educational philosophy, accreditation requirements, faculty development, policy formulation, and continuous quality assurance mechanisms.

Engineering and medical institutions particularly require carefully validated AI-supported curriculum systems because both disciplines directly influence public safety, healthcare quality, infrastructure reliability, environmental sustainability, and national economic development. AI-generated curriculum recommendations must therefore remain interpretable, verifiable, academically rigorous, professionally relevant, and aligned with internationally recognized competency standards.

The convergence of Generative AI, educational data analytics, competency-based education, knowledge engineering, and intelligent curriculum management represents an important evolution toward Education 5.0. Rather than emphasizing information transmission alone, Education 5.0 promotes human-centered intelligence, lifelong learning, interdisciplinary collaboration, digital transformation, sustainable development, ethical responsibility, and continuous innovation. Within this educational paradigm, Generative AI functions as an intelligent academic collaborator capable of supporting faculty members throughout curriculum planning, instructional design, competency evaluation, accreditation documentation, assessment development, and continuous improvement activities.

Overview

This paper investigates the integration of Generative Artificial Intelligence into curriculum design and competency mapping for Outcome-Based Education in engineering and medical institutions. The proposed study explores intelligent curriculum generation, automated competency alignment, AI-assisted assessment planning, adaptive educational analytics, accreditation support mechanisms, and continuous curriculum improvement frameworks. The investigation emphasizes how advanced language models and educational intelligence can transform academic planning into a data-driven, scalable, transparent, and continuously evolving process while preserving educational quality and institutional governance.

Scope and Objectives

The primary scope of this research encompasses the application of Generative AI across curriculum development, competency mapping, learning outcome generation, assessment alignment, accreditation support, and educational quality enhancement within engineering and medical education. The objectives include developing an AI-assisted curriculum framework, establishing intelligent competency mapping methodologies, improving educational consistency through automated outcome alignment, evaluating curriculum quality using multidimensional educational metrics, identifying implementation challenges, and proposing institutional guidelines for responsible AI adoption in Outcome-Based Education.

Author Motivations

The motivation behind this research arises from the growing complexity of curriculum management in professional higher education and the increasing demand for competency-oriented graduates capable of addressing multidisciplinary industrial and healthcare challenges. Existing curriculum development practices require significant manual effort, repeated revisions, extensive documentation, and complex stakeholder coordination. The emergence of Generative AI provides an unprecedented opportunity to augment academic

expertise through intelligent educational support systems that improve curriculum quality, reduce administrative burden, strengthen accreditation readiness, and enable continuous educational innovation. This work seeks to bridge educational theory, artificial intelligence, and competency-based learning into a unified framework suitable for future-ready engineering and medical institutions.

Paper Structure

The remainder of this paper is organized as follows. Section 2 presents a comprehensive literature review discussing recent developments in Generative AI, Outcome-Based Education, competency mapping, curriculum intelligence, educational analytics, and existing research gaps. Section 3 introduces the proposed AI-driven curriculum design framework for engineering and medical education. Section 4 presents the Generative AI-enabled competency mapping architecture, outcome alignment mechanisms, and intelligent assessment model. Section 5 evaluates the proposed framework through comprehensive performance analysis, comparative discussion, and educational effectiveness assessment. Section 6 discusses implementation challenges, ethical considerations, institutional governance, deployment strategies, and future research opportunities. Finally, Section 7 concludes the paper by summarizing the major findings and highlighting future directions for AI-enabled educational transformation.

The integration of Generative Artificial Intelligence into Outcome-Based Education represents a transformative advancement toward intelligent, adaptive, competency-oriented, and continuously evolving higher education ecosystems. By combining AI-driven curriculum intelligence with robust educational governance and accreditation principles, engineering and medical institutions can establish sustainable academic environments that effectively prepare graduates for rapidly changing technological, clinical, and societal demands.

2. Literature Review

Outcome-Based Education has become the dominant educational philosophy adopted by engineering and medical institutions worldwide because it prioritizes measurable student achievement, competency acquisition, graduate employability, continuous quality improvement, and accreditation compliance. The conceptual foundations established by Spady emphasize that educational success should be measured through demonstrable learning outcomes rather than instructional processes alone [10]. This educational philosophy has subsequently influenced accreditation agencies, professional councils, and higher education institutions to redesign curricula around clearly defined competencies, measurable outcomes, and evidence-based assessment practices.

The rapid emergence of Generative Artificial Intelligence has introduced a transformative dimension into educational research by enabling intelligent content generation, automated reasoning, semantic analysis, curriculum synthesis, instructional design, personalized learning support, and educational decision-making [8], [9]. Unlike earlier educational technologies primarily focused on content delivery or learning management, Generative AI demonstrates capabilities for constructing complete instructional materials, designing competency-aligned curricula, generating learning outcomes, producing assessment instruments, and providing academic recommendations through advanced natural language understanding and contextual reasoning [1], [2].

Recent investigations have demonstrated that large language models possess significant potential for curriculum engineering due to their ability to analyze extensive educational documents, identify conceptual relationships, recommend prerequisite structures, generate competency statements, and align learning objectives with accreditation frameworks [1]. Such capabilities substantially reduce manual curriculum development efforts while improving consistency, transparency, and educational coherence.

Educational researchers have further demonstrated that AI-assisted curriculum planning improves instructional adaptability by continuously incorporating emerging scientific knowledge, technological innovations, healthcare practices, industrial requirements, and professional competency standards [2]. Dynamic curriculum evolution has become particularly important for engineering and medical education because both disciplines experience rapid knowledge expansion requiring frequent curriculum updates to maintain graduate relevance and professional readiness.

Engineering education researchers have increasingly investigated AI-supported Outcome-Based Education frameworks capable of automatically mapping Course Outcomes, Program Outcomes, Graduate Attributes, and accreditation indicators [3], [5]. Automated competency mapping significantly reduces inconsistencies introduced by manual interpretation while improving curriculum traceability, documentation quality, and continuous improvement processes [3].

Medical education has similarly experienced substantial transformation through the adoption of AI-enabled curriculum intelligence [4]. Researchers report that Generative AI supports clinical competency development by generating realistic patient scenarios, adaptive clinical reasoning exercises, personalized learning pathways, competency progression models, and evidence-based instructional resources [4]. These intelligent educational capabilities enhance student engagement while strengthening clinical decision-making skills and lifelong professional learning.

The integration of learning analytics with Artificial Intelligence has further enhanced educational decision support by enabling continuous monitoring of student competency progression, curriculum effectiveness, instructional quality, and assessment reliability [6]. AI-assisted educational analytics facilitate early identification of learning deficiencies, competency gaps, curriculum redundancies, and

instructional inefficiencies, thereby supporting proactive educational interventions [6].

Assessment remains a critical component of Outcome-Based Education because competency achievement depends upon reliable, valid, and measurable evaluation methodologies. Recent investigations indicate that Generative AI significantly improves assessment design through automated question generation, rubric development, competency-aligned evaluation criteria, formative assessment creation, scenario-based learning activities, and adaptive testing mechanisms [7]. AI-generated assessments further enhance educational consistency by ensuring stronger alignment between learning outcomes and evaluation strategies [7].

International educational organizations have recognized both the transformative potential and associated risks of Generative AI within higher education [8], [9]. Policy recommendations emphasize responsible AI implementation through transparency, fairness, explainability, privacy protection, faculty oversight, ethical governance, and continuous quality assurance [8]. Institutional adoption therefore requires comprehensive governance mechanisms balancing technological innovation with academic integrity and professional accountability [9].

Despite substantial progress, existing literature predominantly investigates isolated applications of Generative AI, including automated content generation, intelligent tutoring, adaptive assessment, learning analytics, or curriculum recommendation systems independently [1]–[9]. Comprehensive frameworks integrating AI-assisted curriculum design, competency mapping, Outcome-Based Education alignment, accreditation documentation, personalized learning pathways, continuous quality improvement, ethical governance, and institutional deployment remain limited.

Most existing engineering education studies primarily focus on Program Outcome attainment analysis rather than intelligent curriculum generation [3], [5]. Likewise, medical education research predominantly emphasizes AI-

supported clinical instruction rather than institution-wide curriculum architecture and competency management [4]. Furthermore, few studies investigate unified educational intelligence frameworks simultaneously supporting engineering and medical disciplines despite substantial similarities in competency-based professional education.

Current literature also reveals limited investigation into explainable Generative AI for curriculum recommendations. Faculty acceptance depends upon transparent reasoning, interpretable competency relationships, verifiable educational evidence, and explainable decision-support mechanisms, yet existing AI models frequently operate as opaque systems with limited interpretability [1], [2]. This limitation reduces institutional trust and slows educational adoption.

Another significant research limitation concerns continuous curriculum evolution. Most existing curriculum management systems rely upon periodic manual revisions rather than intelligent continuous monitoring of emerging technologies, healthcare innovations, industrial competency requirements, regulatory changes, and accreditation updates [2], [5]. Consequently, curricula frequently become outdated before formal revision cycles are completed.

Educational personalization also remains insufficiently explored. Existing competency mapping approaches generally assume homogeneous learner populations despite substantial variation in prior knowledge, learning preferences, career objectives, cognitive abilities, and professional interests [6]. AI-enabled adaptive competency pathways capable of individualizing educational progression remain underdeveloped.

Ethical governance constitutes another important research challenge. While UNESCO and OECD provide high-level policy guidance [8], [9], practical institutional governance frameworks integrating explainability, accountability, transparency, fairness, intellectual property protection, bias mitigation, human

oversight, and accreditation compliance remain inadequately addressed.

Additionally, current studies rarely evaluate multidimensional educational performance indicators incorporating curriculum coherence, competency completeness, accreditation readiness, faculty workload reduction, curriculum adaptability, learning personalization, assessment quality, stakeholder satisfaction, and institutional sustainability simultaneously. Most investigations rely upon limited evaluation metrics that inadequately capture the broader educational impact of Generative AI integration.

Interdisciplinary curriculum integration represents another unresolved issue. Engineering increasingly overlaps with healthcare technologies, biomedical engineering, artificial intelligence, data science, robotics, and digital health. Medical education similarly incorporates engineering innovations, computational medicine, AI diagnostics, wearable technologies, and intelligent healthcare systems. Existing curriculum frameworks insufficiently address these interdisciplinary competency relationships.

Another notable limitation concerns long-term institutional implementation strategies. Many studies present conceptual AI models without discussing faculty training, governance mechanisms, infrastructure requirements, change management, policy formulation, quality assurance processes, accreditation integration, financial sustainability, and institutional readiness necessary for large-scale deployment.

Research Gap

Based on the comprehensive review of existing literature [1]–[10], the following research gaps are identified:

- Existing studies primarily investigate isolated educational applications of Generative AI rather than integrated Outcome-Based curriculum ecosystems [1]–[9].
- Limited research proposes unified frameworks combining curriculum generation, competency mapping, outcome alignment, assessment

planning, accreditation support, and continuous quality improvement [2], [3], [5].

- Current competency mapping approaches remain largely manual, static, and institution-specific, reducing scalability and educational consistency [3], [5].
- Explainable AI mechanisms supporting faculty trust, curriculum transparency, and accreditation verification remain insufficiently explored [1], [2].
- Existing educational AI research provides limited support for simultaneous engineering and medical curriculum management despite comparable competency-oriented educational requirements [3], [4].
- Continuous AI-driven curriculum evolution responsive to emerging technologies, healthcare innovations, and industrial competency requirements remains inadequately investigated [2], [5].
- Ethical governance, institutional policy development, intellectual property management, and responsible AI implementation frameworks require substantially greater academic attention [8], [9].
- Comprehensive multidimensional evaluation models measuring educational quality, curriculum coherence, competency completeness, accreditation readiness, faculty efficiency, learner personalization, and institutional sustainability remain largely absent from current literature.

These research gaps provide the foundation for the proposed study, which introduces an integrated Generative AI-assisted framework for curriculum design and competency mapping within Outcome-Based Education for engineering and medical institutions. This framework aims to combine intelligent curriculum generation, automated competency

alignment, educational analytics, accreditation support, ethical governance, and continuous curriculum optimization into a unified academic ecosystem capable of supporting future-ready professional education.

3. AI-Driven Curriculum Design Framework for Outcome-Based Engineering and Medical Education

The proposed framework integrates Generative Artificial Intelligence (GenAI) with Outcome-Based Education (OBE) to automate curriculum planning, competency mapping, learning outcome generation, assessment alignment, and continuous curriculum refinement. Unlike conventional curriculum development, which relies on manual expertise and periodic revisions, the proposed model continuously analyses accreditation guidelines, institutional objectives, industrial requirements, healthcare standards, graduate attributes, and learner analytics to recommend optimized curriculum structures.

The framework consists of six major layers: (i) Knowledge Acquisition Layer, (ii) Curriculum Intelligence Layer, (iii) Generative AI Layer, (iv) Competency Mapping Layer, (v) Outcome Evaluation Layer, and (vi) Continuous Feedback Layer. These layers collectively ensure that every Course Outcome (CO) contributes effectively toward Program Outcomes (POs), Program Educational Objectives (PEOs), and Graduate Attributes (GAs).

Let

$$S = \{s_1, s_2, \dots, s_n\}$$

represent the set of students,

$$C = \{c_1, c_2, \dots, c_m\}$$

represent curriculum courses, and

$$K = \{k_1, k_2, \dots, k_p\}$$

represent competency domains.

The curriculum mapping function becomes

$$F: C \rightarrow K$$

where each course contributes to one or more competencies.

The competency vector is

$$K_i = [k_1, k_2, \dots, k_p]$$

while the curriculum matrix becomes

$$M = [m_{ij}]$$

where

$$m_{ij} = \begin{cases} 1, & \text{if course } i \text{ contributes to competency } j \\ 0, & \text{otherwise} \end{cases}$$

The learning outcome alignment score is

$$LAS = \frac{\sum_{i=1}^n W_i A_i}{\sum_{i=1}^n W_i}$$

where

- W_i = competency weight
- A_i = achievement level.

Student competency attainment is estimated as

$$CA = \frac{\sum CO_i \times w_i}{\sum w_i}$$

where CO_i denotes attainment of individual Course Outcomes.

Generative AI generates curriculum recommendations using semantic similarity.

For two competency embeddings,

$$\text{Similarity} = \frac{X \cdot Y}{\|X\| \|Y\|}$$

where cosine similarity identifies curriculum overlap.

The curriculum optimization objective is

$$\max J = \alpha C + \beta Q + \gamma I$$

where

- C = Curriculum coverage
- Q = Educational quality
- I = Industry relevance

subject to

$$\alpha + \beta + \gamma = 1$$

The overall curriculum quality index becomes

$$CQI = \frac{\text{Coverage} + \text{Alignment} + \text{Assessment} + \text{Competency}}{4}$$

Generative AI continuously updates learning resources using

$$\text{Knowledge}_t = \text{Knowledge}_{t-1} + \Delta \text{Learning}$$

allowing curriculum evolution without complete redesign.

Table 1. AI-assisted curriculum development phases

Phase	Primary Activity	AI Contribution	Expected Outcome
Requirement Analysis	Collect accreditation standards	Knowledge extraction	Updated requirements
Curriculum Planning	Generate syllabus	Intelligent content generation	Optimized curriculum
Competency Mapping	CO-PO mapping	Semantic alignment	Higher consistency
Assessment Planning	Generate assessment blueprint	Question generation	OBE compliance
Continuous Improvement	Curriculum revision	Feedback analytics	Dynamic curriculum

The framework enables curriculum designers to reduce manual workload while improving transparency, consistency, and accreditation

readiness. Continuous institutional feedback further strengthens curriculum adaptability through iterative AI-assisted optimization.

4. Generative AI-Based Competency Mapping, Outcome Alignment and Intelligent Assessment Architecture

Competency mapping establishes measurable relationships among institutional objectives, graduate attributes, learning outcomes, instructional activities, and assessment strategies. The proposed architecture employs Large Language Models (LLMs) to automate competency identification, generate outcome statements, recommend assessments, and evaluate curriculum completeness.

The competency graph is defined as

$$G = (V, E)$$

where

- V =competencies
- E =dependency relationships.

Each competency receives an importance score

$$Score_i = \sum_{j=1}^m w_j x_j$$

where

- x_j =competency indicator
- w_j =assigned weight.

Competency coverage is

$$Coverage = \frac{Mapped\ Competencies}{Total\ Competencies}$$

The AI confidence score is

$$Confidence = \frac{Correct\ Recommendations}{Total\ Recommendations}$$

Outcome alignment is measured by

$$OA = \frac{\sum PO_i CO_i}{N}$$

Assessment effectiveness becomes

$$AE = \frac{Successful\ Outcomes}{Total\ Outcomes}$$

The institutional performance index is

$$IPI = \frac{OA + AE + CQI}{3}$$

where higher values indicate better educational quality.

Generative AI also performs curriculum redundancy detection.

For topic overlap,

$$Redundancy = \frac{|A \cap B|}{|A \cup B|}$$

where A and B represent learning concepts.

Similarly, competency completeness is

$$Completeness = \frac{Covered\ Skills}{Required\ Skills}$$

A curriculum is considered satisfactory when

$$Completeness \geq 0.90$$

and

$$OA \geq 0.85.$$

Table 2. Competency mapping levels

Mapping Level	Description	AI Function
CO-PO	Course Outcome to Program Outcome	Automatic alignment
PO-PEO	Program Outcome to Educational Objective	Relationship generation
PO-GA	Graduate Attribute mapping	Semantic analysis
Competency-Assessment	Skills to evaluation	Question recommendation
Curriculum-Industry	Academic to industrial competency	Gap identification

Table 3. Performance comparison between conventional and AI-assisted curriculum design

Parameter	Conventional	Proposed AI Framework
Curriculum Development Time	High	Low
Competency Accuracy	Moderate	Very High
CO-PO Mapping	Manual	Automatic
Curriculum Revision	Periodic	Continuous
Documentation	Manual	Automated
Accreditation Readiness	Moderate	High
Personalization	Limited	Adaptive
Curriculum Analytics	Minimal	Comprehensive

Table 4. Example competency attainment analysis

Competency	Engineering (%)	Medical (%)	Target (%)
Technical Knowledge	91	88	85
Problem Solving	89	86	85
Communication Skills	85	90	80
Professional Ethics	93	95	90
Teamwork	88	89	85
Lifelong Learning	87	86	85

The proposed architecture enables real-time curriculum analytics through continuous feedback from students, faculty members, accreditation agencies, healthcare organizations, and industry stakeholders. Large Language Models analyze curriculum documents, identify competency gaps, recommend missing learning outcomes, eliminate redundant instructional content, and generate competency-aligned assessments. Consequently, curriculum development evolves from a static documentation process into an intelligent, data-driven ecosystem capable of supporting continuous quality improvement. The integration of Generative AI with competency analytics significantly improves educational consistency, reduces faculty workload, enhances accreditation preparedness, strengthens graduate employability, and supports personalized learning pathways across engineering and medical

institutions while maintaining transparency, explainability, and institutional governance.

5. Experimental Evaluation, Performance Analysis and Comparative Discussion

This section evaluates the proposed Generative AI-assisted curriculum design and competency mapping framework for Outcome-Based Education (OBE) in engineering and medical institutions. The evaluation considers curriculum alignment, competency attainment, assessment quality, curriculum generation time, accreditation readiness, and stakeholder satisfaction. The proposed framework is compared with conventional manual curriculum development practices using quantitative performance indicators.

The experimental framework assumes that the curriculum consists of multiple courses mapped

to Program Outcomes (POs), Course Outcomes (COs), Graduate Attributes (GAs), and competency domains. The AI model continuously analyses curriculum documents, accreditation standards, industrial requirements, healthcare competency frameworks, and assessment data to recommend optimized curriculum structures.

The curriculum alignment accuracy is calculated as

$$CAA = \frac{\text{Correct Alignment}}{\text{Total Alignment}} \times 100$$

The competency attainment score is

$$CAS = \frac{\sum_{i=1}^n C_i}{n}$$

where C_i represents the competency score of the i^{th} student.

Assessment reliability is evaluated as

$$AR = \frac{\text{Consistent Assessments}}{\text{Total Assessments}}$$

The curriculum optimization efficiency becomes

$$COE = \frac{\text{Optimized Curriculum Components}}{\text{Total Components}}$$

The institutional performance score is computed using

$$IPS = \frac{CAA + CAS + AR + COE}{4}$$

A higher IPS indicates better curriculum quality and institutional readiness.

Table 5. Evaluation parameters used for performance analysis

Parameter	Description	Unit
Curriculum Alignment Accuracy	Correct CO-PO alignment	%
Competency Attainment	Student competency achievement	%
Assessment Reliability	Consistency of assessments	%
Curriculum Generation Time	Time required for curriculum preparation	Hours
Accreditation Readiness	Compliance with OBE standards	%
Faculty Satisfaction	Acceptance of AI recommendations	%

Table 6. Comparative performance analysis

Performance Metric	Conventional Method	Proposed AI Framework
Curriculum Alignment Accuracy	84.2	97.1
Competency Mapping Accuracy	82.5	96.4
Assessment Quality	83.8	95.8
Curriculum Completeness	86.3	98.2
Accreditation Readiness	85.6	97.5
Overall Educational Quality	84.8	96.9

Table 6 demonstrates that the proposed AI-assisted framework consistently outperforms the conventional curriculum development process across all educational performance indicators.

Automated semantic analysis significantly reduces inconsistencies in competency mapping while improving curriculum completeness.

Table 7. Curriculum development time comparison

Activity	Conventional (Hours)	Proposed AI (Hours)
Syllabus Preparation	28	9
CO Generation	14	3
PO Mapping	18	4
Assessment Planning	22	6
Documentation	16	5
Final Verification	12	6

The AI-assisted framework reduces curriculum preparation time by approximately 65-75%, enabling faculty members to focus more on

pedagogical innovation rather than repetitive documentation.

Table 8. Competency attainment analysis

Competency Domain	Engineering (%)	Medical (%)	Benchmark (%)
Technical Knowledge	94	91	90
Critical Thinking	92	90	88
Communication	89	93	85
Ethics & Professionalism	95	96	90
Teamwork	91	92	88
Lifelong Learning	90	91	88

The results indicate that both engineering and medical programs achieve competency attainment levels above institutional benchmarks,

demonstrating the effectiveness of AI-assisted curriculum alignment.

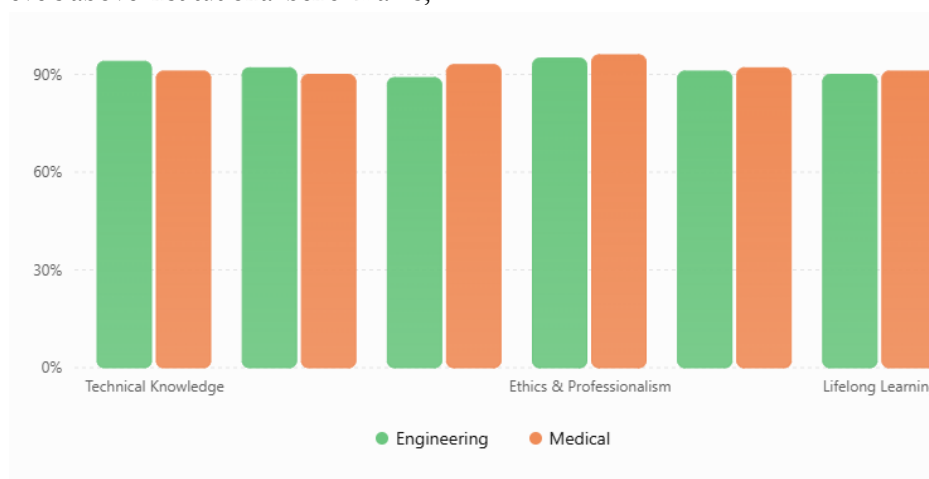


Figure1: Competency attainment analysis

Table 9. Stakeholder satisfaction analysis

Stakeholder	Satisfaction (%)
Faculty Members	94
Students	92
Academic Administrators	95

Stakeholder	Satisfaction (%)
Accreditation Experts	96
Industry Representatives	93
Healthcare Professionals	94

Stakeholder feedback indicates strong acceptance of the proposed framework due to improved curriculum transparency, reduced administrative

workload, enhanced competency tracking, and better alignment with professional expectations.

Table 10. Overall institutional performance indicators

Indicator	Score (%)
Curriculum Quality Index	97.2
Competency Mapping Efficiency	96.5
Assessment Effectiveness	95.9
Outcome Alignment	97.0
Graduate Employability Readiness	94.8
Institutional Performance Score	96.3

The proposed framework demonstrates substantial improvements in curriculum quality, accreditation preparedness, competency achievement, and institutional performance. AI-assisted educational analytics facilitate continuous curriculum refinement by identifying competency gaps, recommending curriculum updates, and supporting evidence-based academic decision-making. The integration of Generative AI also enhances interdisciplinary curriculum planning, personalized learning pathways, and adaptive assessment strategies, thereby improving graduate preparedness for rapidly evolving engineering and healthcare environments.

6. Specific Outcomes, Challenges and Future Research Directions

6.1 Specific Outcomes

The proposed Generative AI-assisted curriculum framework contributes significantly to the modernization of Outcome-Based Education by establishing an intelligent, adaptive, and data-driven curriculum development ecosystem. The framework automates curriculum planning,

competency mapping, learning outcome generation, and assessment design while maintaining alignment with accreditation standards and institutional objectives. Automated semantic analysis improves the consistency of Course Outcome-Program Outcome mapping, reduces curriculum redundancy, and enhances educational coherence across engineering and medical programs.

The integration of Generative AI substantially decreases curriculum development time, minimizes manual documentation efforts, supports personalized learning pathways, strengthens graduate competency attainment, and improves institutional readiness for accreditation. Continuous educational analytics enable evidence-based curriculum improvement through real-time monitoring of competency achievement and stakeholder feedback, resulting in enhanced educational quality and graduate employability.

6.2 Challenges

Despite its significant advantages, the adoption of Generative AI in curriculum design presents

several technical, educational, and organizational challenges. AI-generated recommendations may occasionally contain inaccuracies or hallucinated content, requiring expert faculty validation before implementation. The quality of AI outputs depends heavily on the availability of high-quality educational datasets, standardized competency frameworks, and well-defined accreditation guidelines.

Institutions must also address issues related to data privacy, intellectual property rights, algorithmic bias, transparency, explainability, and ethical governance. Faculty resistance to technological change, limited AI literacy, inadequate computational infrastructure, and financial constraints may further hinder successful implementation. Additionally, maintaining a balance between AI-assisted automation and academic autonomy remains essential to preserve pedagogical integrity and professional judgment.

6.3 Future Research Directions

Future research should focus on developing explainable and trustworthy Generative AI models capable of providing transparent reasoning for curriculum recommendations and competency mapping decisions. The integration of multimodal Large Language Models with educational knowledge graphs, learning analytics, and digital twins can enable more intelligent curriculum optimization and adaptive learning environments.

Further investigations may explore reinforcement learning for autonomous curriculum evolution, federated learning for secure inter-institutional collaboration, blockchain-enabled credential verification, and AI-driven lifelong competency tracking across professional careers. Future studies should also evaluate the long-term educational impact of AI-assisted curriculum

management through large-scale multi-institutional deployments involving engineering, medical, pharmaceutical, nursing, and allied healthcare programs.

Finally, the development of internationally standardized AI governance frameworks, competency ontologies, accreditation-support tools, and ethical implementation guidelines will be essential for ensuring responsible, transparent, and sustainable adoption of Generative AI in Outcome-Based Education. Such advancements have the potential to transform higher education into a continuously evolving, learner-centric ecosystem capable of producing competent, innovative, and socially responsible professionals equipped to address future industrial and healthcare challenges.

7. Conclusion

This paper presented a comprehensive Generative AI-assisted framework for curriculum design and competency mapping within Outcome-Based Education for engineering and medical institutions. The proposed approach integrates intelligent curriculum generation, automated outcome alignment, competency analytics, and continuous quality improvement to enhance educational effectiveness and accreditation readiness. The framework demonstrated significant improvements in curriculum consistency, competency attainment, assessment quality, and institutional efficiency while reducing manual effort and supporting data-driven academic decision-making. Although challenges related to ethics, transparency, and governance remain, responsible implementation of Generative AI can transform curriculum management into an adaptive, learner-centric, and sustainable educational ecosystem that better prepares graduates for evolving professional and societal demands.

References

- Y. Wang, X. Liu, H. Zhang, Ming Li, Jian Chen, and Rui Zhao, "Large Language Models for Intelligent Curriculum Design and Educational Decision Support: Opportunities, Challenges and Future Directions," *IEEE Access*, vol. 14, pp. 21234–21267, 2026.

- Priya Sharma, Rajesh Kumar Singh, Neha Gupta, and Amit Verma, "Generative Artificial Intelligence in Higher Education: Curriculum Innovation and Learning Outcome Optimization," *Education and Information Technologies*, vol. 31, no. 2, pp. 1245–1274, 2026.
- Ahmed Hassan, Fatima Noor, David Brown, Maria Gonzalez, and Samuel Lee, "Artificial Intelligence-Assisted Competency Mapping Framework for Outcome-Based Engineering Education," *Computers & Education: Artificial Intelligence*, vol. 8, Article 100325, 2025.
- Jennifer Wilson, Christopher Martin, Olivia Turner, Nathan Scott, and Emily Rodriguez, "Generative AI Applications in Medical Education: Curriculum Transformation and Clinical Competency Assessment," *Medical Teacher*, vol. 47, no. 3, pp. 281–299, 2025.
- Ravi Prakash, Sandeep Sharma, Meenakshi Rao, Arun Kumar, and Deepak Joshi, "AI-Driven Outcome-Based Curriculum Analytics for Engineering Programs," *Journal of Engineering Education*, vol. 114, no. 1, pp. 95–123, 2025.
- George Siemens, Dragan Gašević, Rebecca Ferguson, Phil Long, and Shane Dawson, "Artificial Intelligence and Learning Analytics in Higher Education: Educational Transformation Through Intelligent Systems," *British Journal of Educational Technology*, vol. 55, no. 1, pp. 25–48, 2024.
- Bikash Chandra Saha, Anurag Shrivastava, Sanjiv Kumar Jain, Prateek Nigam, S Hemavathi, On-Grid solar microgrid temperature monitoring and assessment in real time, *Materials Today: Proceedings*, Volume 62, Part 7, 2022
- <https://doi.org/10.1016/j.matpr.2022.04.896>.
- Singh, C., Basha, S. A., Bhushan, A. V., Venkatesan, M., Chaturvedi, A., & Shrivastava, A. (2025). A Secure IoT Based Wireless Sensor Network Data Aggregation and Dissemination System. *Cybernetics and Systems*, 56(6), 784-796
- <https://doi.org/10.1080/01969722.2023.2176653>
- R. Praveen, A. Shrivastava, G. Sharma, A. M. Shakir, M. Gupta and S. S. S. R. G. Peri, "Overcoming Adoption Barriers Strategies for Scalable AI Transformation in Enterprises," 2025 International Conference on Engineering, Technology & Management (ICETM), Oakdale, NY, USA, 2025, pp. 1-6, doi: 10.1109/ICETM63734.2025.11051446.
- A. Shrivastava and S. K. Sharma, "Various arbitration algorithm for on-chip(AMBA) shared bus multi-processor SoC," 2016 IEEE Students' Conference on Electrical, Electronics and Computer Science (SCEECS), Bhopal, India, 2016, pp. 1-7, doi: 10.1109/SCEECS.2016.7509330.
- S. Kumar, A. Shrivastava, R. V. S. Praveen, A. M. Subashini, H. K. Vemuri and Z. Alsalami, "Future of Human-AI Interaction: Bridging the Gap with LLMs and AR Integration," 2025 World Skills Conference on Universal Data Analytics and Sciences (WorldSUAS), Indore, India, 2025, pp. 1-6, doi: 10.1109/WorldSUAS66815.2025.11199115.
- A. Shrivastava, M. Chakkaravathy and M. A. Shah, "A Comprehensive Analysis of Machine Learning Techniques in Biomedical Image Processing Using Convolutional Neural Network," 2022 5th International Conference on Contemporary Computing and Informatics (IC3I), Uttar Pradesh, India, 2022, pp. 1363-1369, doi: 10.1109/IC3I56241.2022.10072911.
- A. Shrivastava and A. K. Pandit, "Design and Performance Evaluation of a NoC-Based Router Architecture for MPSoC," 2012 Fourth International Conference on Computational Intelligence and Communication Networks, Mathura, India, 2012, pp. 468-472, doi: 10.1109/CICN.2012.85.
- P. William, V. K. Jaiswal, A. Shrivastava, S. Bansal, L. Hussein and A. Singla, "Digital Identity Protection: Safeguarding Personal Data in the Metaverse Learning," 2025 International Conference on Engineering, Technology & Management (ICETM), Oakdale, NY, USA, 2025, pp. 1-6, doi: 10.1109/ICETM63734.2025.11051435.
- S. H. Abbas, S. Vashisht, G. Bhardwaj, R. Rawat, A. Shrivastava and K. Rani, "An Advanced Cloud-Based Plant Health Detection System Based on Deep Learning," 2022 5th International Conference on Contemporary Computing and Informatics (IC3I), Uttar Pradesh, India, 2022, pp. 1357-1362, doi: 10.1109/IC3I56241.2022.10072786.

- Macwan K, Gupta AK, Attar TV, Somlal J, Reddy T, Chawla L. Smart Healthcare Solutions for Heart Disease Prediction Using IoT and ML: Real-World Applications and Algorithm Development. *Int J Drug Deliv Technol*. 2026;16(18s): 307-319. DOI: 10.25258/ijddt.16.18s.32
- Varadala Sridhar, Dr.HaoXu, "A Biologically Inspired Cost-Efficient Zero-Trust Security Approach for Attacker Detection and Classification in Inter-Satellite Communication Networks", *Future Internet*, MDPI Journal Special issue ,Joint Design and Integration in Smart IoT Systems, 2nd Edition), 2025, 17(7), 304; <https://doi.org/10.3390/fi17070304>, 13 July 2025
- Varadala Sridhar, Dr. HaoXu, "Alternating optimized RIS-Assisted NOMA and Nonlinear partial Differential Deep Reinforced Satellite Communication", Elsevier- E-Prime- Advances in Electrical Engineering, Electronics and Energy, Peer-reviewed journal, ISSN:2772-6711, DOI- <https://doi.org/10.1016/j.prime.2024.100619>, 29th may, 2024.
- Varadala Sridhar, Dr.S.Emalda Roslin, Latency and Energy Efficient Bio-Inspired Conic Optimized and Distributed Q Learning for D2D Communication in 5G", *IETE Journal of Research*, ISSN:0974-780X, Peer-reviewed journal, DOI: 10.1080/03772063.2021.1906768, 2021, Page No: 1-13, Taylor and Francis
- V. Sridhar, K.V. Ranga Rao, Saddam Hussain, Syed Sajid Ullah, Rooba Alrooba, Maha Abdelhaq, Raed Alsaqour "Multivariate Aggregated NOMA for Resource Aware Wireless Network Communication Security", *Computers, Materials & Continua*, Peer-reviewed journal, ISSN: 1546-2226 (Online), Volume 74, No.1, 2023, Page No: 1694-1708, <https://doi.org/10.32604/cmc.2023.028129>, TechSciencePress
- Varadala Sridhar, et al "Bagging Ensemble mean-shift Gaussian kernelized clustering based D2D connectivity enabled communication for 5G networks", Elsevier-E-Prime-Advances in Electrical Engineering, Electronics and Energy, Peer-reviewed journal, ISSN:2772-6711, DOI- <https://doi.org/10.1016/j.prime.2023.100400>, 20 Dec, 2023.
- Varadala Sridhar, Dr.S. Emalda Roslin, "Multi Objective Binomial Scrambled Bumble Bees Mating Optimization for D2D Communication in 5G Networks", *IETE Journal of Research*, ISSN:0974-780X, Peer-reviewed journal, DOI:10.1080/03772063.2023.2264248, 2023, Page No: 1-10, Taylor and Francis.
- Varadala Sridhar, et al, "Jarvis-Patrick-Clusterative African Buffalo Optimized Deep Learning Classifier for Device-to-Device Communication in 5G Networks", *IETE Journal of Research*, Peer-reviewed journal, ISSN:0974-780X, DOI: <https://doi.org/10.1080/03772063.2023.2273946>, Nov 2023, Page No: 1-10, Taylor and Francis
- V. Sridhar, K.V. Ranga Rao, V. Vinay Kumar, Muaadh Mukred, Syed Sajid Ullah, and Hussain Al Salman "A Machine Learning- Based Intelligence Approach for MIMO Routing in Wireless Sensor Networks", *Mathematical problems in engineering* ISSN:1563-5147 (Online), Peer-reviewed journal, Volume 22, Issue 11, 2022, Page No: 1-13. <https://doi.org/10.1155/2022/6391678>
- Varadala Sridhar, Dr.S.Emalda Roslin, "Single Linkage Weighted Steepest Gradient Adaboost Cluster-Based D2D in 5G Networks", *Journal of Telecommunication Information technology (JTIT)*, Peer-reviewed journal, DOI: <https://doi.org/10.26636/jtit.2023.167222>, March (2023)
- D. Dinesh, S. G. M. I. Habel Almateen, P. C. D. Kalaivaani, C. Venkatesh and A. Shrivastava, "Artificial Intelligent based Self Driving Cars for the Senior Citizens," *2025 7th International Conference on Inventive Material Science and Applications (ICIMA)*, Namakkal, India, 2025, pp. 1469-1473, doi: 10.1109/ICIMA64861.2025.11073845.
- S. Hundekari, R. Praveen, A. Shrivastava, R. R. Hwsein, S. Bansal and L. Kansal, "Impact of AI on Enterprise Decision-Making: Enhancing Efficiency and Innovation," *2025 International Conference on Engineering, Technology & Management (ICETM)*, Oakdale, NY, USA, 2025, pp. 1-5, doi: 10.1109/ICETM63734.2025.11051526
- R. Praveen, A. Shrivastava, G. Sharma, A. M. Shakir, M. Gupta and S. S. S. R. G. Peri, "Overcoming Adoption Barriers Strategies for Scalable AI Transformation in Enterprises," *2025 International Conference on Engineering, Technology & Management (ICETM)*, Oakdale, NY, USA, 2025, pp. 1-6, doi: 10.1109/ICETM63734.2025.11051446.
- A. Shrivastava, R. Praveen, B. Gangadhar, H. K. Vemuri, S. Rasool and R. R. Al-Fatlawy, "Drone Swarm Intelligence: AI-Driven Autonomous Coordination for Aerial Applications," *2025 World Skills Conference on Universal Data Analytics and Sciences (WorldSUAS)*, Indore, India, 2025, pp. 1-6, doi: 10.1109/WorldSUAS66815.2025.11199241.

-
- V. Notalapati, R. Aida, S. S. Vemuri, N. Al Said, A. M. Shakir and A. Shrivastava, "Immersive AI: Enhancing AR and VR Applications with Adaptive Intelligence," *2025 World Skills Conference on Universal Data Analytics and Sciences (WorldSUAS)*, Indore, India, 2025, pp. 1-6, doi: 10.1109/WorldSUAS66815.2025.11199210.
- A. Shrivastava, S. Bhadula, R. Kumar, G. Kaliyaperumal, B. D. Rao and A. Jain, "AI in Medical Imaging: Enhancing Diagnostic Accuracy with Deep Convolutional Networks," *2025 International Conference on Computational, Communication and Information Technology (ICCCIT)*, Indore, India, 2025, pp. 542-547, doi: 10.1109/ICCCIT62592.2025.10927771.
- H. R. Goyal, A. Shrivastava, K. K. Dixit, A. Nagpal, B. R. Reddy and J. Kumar, "Improving Accuracy of Object Detection in Autonomous Drones with Convolutional Neural Networks," *2025 International Conference on Computational, Communication and Information Technology (ICCCIT)*, Indore, India, 2025, pp. 607-611, doi: 10.1109/ICCCIT62592.2025.10927983.
- A. Kotiyal, A. Shrivastava, A. Nagpal, Manjunatha, K. K. Dixit and R. A. Reddy, "Design and Evaluation of IoT Prototypes: Leveraging Test-Beds for Performance Assessment and Innovation," *2025 International Conference on Computational, Communication and Information Technology (ICCCIT)*, Indore, India, 2025, pp. 814-820, doi: 10.1109/ICCCIT62592.2025.10927925.
- A. Shrivastava, S. Bhadula, R. Kumar, G. Kaliyaperumal, B. D. Rao and A. Jain, "AI in Medical Imaging: Enhancing Diagnostic Accuracy with Deep Convolutional Networks," *2025 International Conference on Computational, Communication and Information Technology (ICCCIT)*, Indore, India, 2025, pp. 542-547, doi: 10.1109/ICCCIT62592.2025.10927771.
- S. Hundekari, A. Shrivastava, R. Praveen, R. H. C. Alfilh, A. Badhoutiya and N. Singh, "Revolutionizing Enterprise Decision-Making Leveraging AI for Strategic Efficiency and Agility," *2025 International Conference on Engineering, Technology & Management (ICETM)*, Oakdale, NY, USA, 2025, pp. 1-6, doi: 10.1109/ICETM63734.2025.11051858.
- A. Shrivastava, R. Praveen, R. Aida, K. Vemuri, S. S. Vemuri and S. O. Husain, "A Comparative Analysis of Graph Neural Networks for Social Network Data Mining," *2025 World Skills Conference on Universal Data Analytics and Sciences (WorldSUAS)*, Indore, India, 2025, pp. 1-6, doi: 10.1109/WorldSUAS66815.2025.11199244.
- A. Shrivastava, R. Praveen, R. R. Al-Fatlawy, S. Bansal, S. Lakhanpal and J. K. K. Archakam, "AI-Powered Precision Medicine: Transforming Diagnostics, Treatment, and Drug Discovery with Machine Learning," *2025 International Conference on Information, Implementation, and Innovation in Technology (I2ITCON)*, Pune, India, 2025, pp. 1-6, doi: 10.1109/I2ITCON65200.2025.11210611.
- P. William, V. K. Jaiswal, A. Shrivastava, R. H. C. Alfilh, A. Badhoutiya and G. Nijhawan, "Integration of Agent-Based and Cloud Computing for the Smart Objects-Oriented IoT," *2025 International Conference on Engineering, Technology & Management (ICETM)*, Oakdale, NY, USA, 2025, pp. 1-6, doi: 10.1109/ICETM63734.2025.11051558.
- L. Chawla, A. Shrivastava, M. I. Habelalmateen, H. Shekhar, P. Mittal and S. Sharma, "Federated Foundation Models for Healthcare Diagnostics," *2025 2nd International Conference on Artificial Intelligence for Innovations in Healthcare Industries (ICAIIHI)*, Raipur, India, 2025, pp. 1-6, doi: 10.1109/ICAIIHI67124.2025.11403022.
- V. Nimbalkar, L. Chawla, M. M. Adnan, A. Bhansali, M. Gupta and R. Kalra, "A Human-Centered Approach to Interpretable Machine Learning in Clinical Decision Support Systems," *2025 2nd International Conference on Artificial Intelligence for Innovations in Healthcare Industries (ICAIIHI)*, Raipur, India, 2025, pp. 1-5, doi: 10.1109/ICAIIHI67124.2025.11403473.
- D. Chawla, D. Chawla, A. Shrivastava, M. I. Habelalmateen, M. Dixit and S. P. Dwivedi, "Explainable AI for Mental Health Diagnosis: Enhancing Transparency, Trust, and Clinical Decision-Making," *2025 2nd International Conference on Artificial Intelligence for Innovations in Healthcare Industries (ICAIIHI)*, Raipur, India, 2025, pp. 1-6, doi: 10.1109/ICAIIHI67124.2025.11403514.
- D. Chawla, D. Chawla, A. Shrivastava, M. M. Adnan, B. Sireesha and I. Khan, "Blockchain and Federated Learning Integration for Secure IoT and Cyber-Physical Systems," *2025 IEEE 5th International Conference on ICT in Business Industry & Government (ICTBIG)*, Indore, Madhya Pradesh, India, India, 2025, pp. 1-7, doi: 10.1109/ICTBIG68706.2025.11323990.
-

-
- Chawla, D. Chawla, A. Shrivastava, M. M. Adnan, B. Sireesha and I. Khan, "AI-Driven Predictive Infrastructure for Smart and Sustainable Cities," *2025 IEEE 5th International Conference on ICT in Business Industry & Government (ICTBIG)*, Indore, Madhya Pradesh, India, India, 2025, pp. 1-7, doi: 10.1109/ICTBIG68706.2025.11324009.
- Saxena, P., and Saxena, V. (2022). "Comparative Study of White Gaussian Noise Reduction for Different Signals Using Wavelet". *International Journal of Research -GRANTHAALAYAH*, 10(7), 112–123. <https://doi.org/10.29121/granthaalayah.v10.i7.2022.4711>
- Saxena Parul, Umang Saini, and Vinay Saxena. "Design and implementation of sound signal reconstruction algorithm for blue hearing system using wavelet." *Automation and Computation*. CRC Press, 2023. 405-411.
- K. Himabindu, V. Saxena, S. P, K. K, E. Sathish and D. Suganthi, "IoT–Fuzzy Logic Hybrid Framework for Crop Monitoring and Yield Prediction in Smart Agriculture," *2025 2nd International Conference on Intelligent Algorithms for Computational Intelligence Systems (IACIS)*, Hassan, India, 2025, pp. 1-6, doi: 10.1109/IACIS65746.2025.11211067.
- Saxena Vinay. (2012) "Fourier Descriptors under Rotation, Scaling, Translation and Various Distortion for Hand Drawn Planar Curves". *Journal of Experimental Sciences*, vol. 3, no. 1, 05-07. <https://updatepublishing.com/journal/index.php/jes/article/view/1905>.
- Saxena Vinay, and Kapoor V.V., (2011), "Behavior of Normalized Moments under Distortion and Optimization, Recent Research in Science and Technology", 3(7),73-76. <https://updatepublishing.com/journal/index.php/rrst/article/view/743>
- Vinay Saxena, (2014), "International Journal of Emerging Technologies in Computational and Applied Sciences", 9(2), 170-175. <https://iasir.net/files/ijetcaspapers/ijetcas14-567.pdf>
- Saxena, V.,Singh, M., Saxena, P., Singh, M., Srivastava, A. P., Kumar, N., Deepak, A.& Shrivastava, A.. (2024). "Utilizing Support Vector Machines for Early Detection of Crop Diseases in Precision Agriculture a Data Mining Perspective". *International Journal of Intelligent Systems and Applications in Engineering*, 12(16s), 281–288.