PUXplore: Multidisciplinary Journal of Engineering, Vol 2 , Issue 2, Apr – Jun 2026 || Online (ISSN 3108-2106)

KNOWLEDGE REPRESENTATION OF IIOT ENABLED MANUFACTURING SYSTEM USING ONTOLOGY: BIBLIOMETRIC ANALYSIS AND FRAMEWORK

Jensi Amrutiya[1], Tejal Patel[2], Minal Shukla[3], Amit Sata[4]

[1,2]*Department of Information Technology, PIET, Parul University, Vadodara, Gujarat, India*
[3]*Department of Applied Science and Humanities, PIET, Parul University, Vadodara, Gujarat, India*
[4]*Department of Mechanical Engineering, Marwadi University, Rajkot, Gujarat, India*
[1]*2503032050002@paruluniversity.ac.in*

Keywords: ONTOLOGY, KNOWLEDGE REPRESENTATION, KNOWLEDGE GRAPHS, SEMANTIC WEB, ONTOLOGY ENGINEERING

Abstract
Knowledge representation has been considered the backbone of artificial intelligence. Ontology methods for knowledge representation have been found to be extremely beneficial for the field of artificial intelligence. The ontology method itself affirms the applicability of the method in the case of the representation of domain knowledge. While considering knowledge representation with the help of the ontology method, a literate survey has to be fully mentioned. This literature survey was mentioned in the paper with help of the "use of ontology models and knowledge graph models". It recognizes the general methodologies used, i.e., knowledge acquisition, concept extraction, ontology development, ontology integration, and evalution of the ontology. Except for that, the system recognizes some of the areas not properly handled by the research, such as the automation of ontologies, the interoperability of the ontology, the evolution of the ontology, and the future of the research, e.g., the learning of ontologies by AI. Conclusively, the representation of knowledge in conformity with the utilization of the ontologies ensures that semantic interoperation, reasoning, and shareability of the knowledge is carried out in an interoperable mode, a necessity for the development of state-of-the-art knowledge-based applications.

1 Introduction
Knowledge representation using an ontology-based method encompasses the steps of identifying the concepts or the relations between concepts in order to structure the knowledge while developing an intelligent decision-making system, especially in the fields of artificial intelligence, cybersecurity, robots, healthcare, and manufacturing systems. [1]. The letter ones would depict an ontology-based knowledge graph for threat analysis, situation awareness, as well as reasoning capabilities in a cybersecurity domain. [2]. Similarly, ontology and knowledge graph integration is used in robotics for intelligent actions by simulating environments [3]. In addition, there are applications in areas of engineering, such as Failure Mode Effect Analysis (FMEA), in order to structure the knowledge of system failures towards better designs [4]. In the context of the new airspace infrastructures like U-Space, for example, ontologies may be used to represent the risks with the purpose of evaluating them [5]. Further, industrial settings have also applied the concept of ontology, coupled with model language, to better understand Industry 4.0 production systems [6]. Apart from technology, the other domain in which semantic models can be employed is cultural information, such as traditional manuscripts [7]. While knowledge graphs can aid this intricate decision-making process, which entails multi-source knowledge [8]. Ontology development has also been used to organize the medical knowledge systems mentioned in the classical literature [9]. Furthermore, Semantic Technologies and Fuzzy Ontologies also play an important role in the representation of fuzzy knowledge that exists in real-world scenarios [10]. In the knowledge representation technique based on the concept of an ontology, the management of domain knowledge is systematic with well-defined concepts [11]. In particular, in the biomedical realm, there are ontology frameworks that illustrate different forms of physical activities as well as movements of human beings, all of which are leading towards health and exercise [12]. The ontology can also be used to cope with uncertain, vague, or imprecise knowledge by unifying the concepts of fuzzy and probabilistic theories, thus establishing better foundations for knowledge models of realistic worlds [13]. Ontology could, in theory, contribute to knowledge sharing between a product design system and an assembly planning system. [14]. The cybersecurity domain incorporates an ontology framework in the management of threat intelligence, as in the development of taxonomy for effective cyber defence [15]. Also, these models can be used in human transportation to represent safety-related knowledge that can be used in intelligent decision-making [16]. While in an AI setting, improvement of learning and assimilation of neural intelligence skills [17]. The role of ontology in modeling industrial production processes in Industry 4.0 systems is significant for various industrial applications such as advanced driver-assistance systems [18]. Another area of application of knowledge graph technology, based on ontology, besides the aforementioned domains would be the arena of virtual restoration within the scope of cultural heritage preservation [19]. The link to the concept of Ontology with regards to robotics would be knowledge reasoning, environment understanding, and planning [20]. It may be considered an ontological representation of knowledge, which is for an effective management of

domain knowledge that is associated with machine knowledge, especially from numerous uses like ransomware threat detection. [21]. It may also prove to be helpful in the proper diagnosis as well as correction of defects in problems related to concrete surfaces that come under civil engineering by making effective use of its existing knowledge base. For example, with artificial intelligence technology [22]. The notion of ontology with reference to the concept of complex co-simulation with support from interoperability and semantic tools can be considered. [23]. In addition to this, the construction of multi-agent systems can leverage the applicability of the ontology-driven constructs that include the modeling agents [24]. It is in law that there is an area in which there is benefit for the knowledge of ontology, which now becomes an aid to verification [25]. Besides, development of models of ontology in project portfolio management in essential in the development of a word bank required to understand the term knowledge [26]. Ontology is supportive to expert systems such as the buyer personas in the decision-making process as seen in cases such as the buyer persona modeling [27]. There is yet another domain of which the application of SN analysis could have a tremendous impact: multi-layered ontology models for dynamic interactions [28]. Models of fuzzy ontology can also be used in uncertain knowledge representation in humanitarian response systems. [29]. In particular, specifically with regard to the pharmaceutical business, thus would be possible by adopting ontology-based schemes for the information governance of matters of safety [30].

2 Bibliometric

It is observed that popularity of Ontology for Manufacturing has been increased in last few years however an integration of Ontology for Manufacturing especially for IIoT knowledge representation is yet to be fully explored especially in the Indian scenario. Detailed analysis of prior work-related research and development has been conducted using two most promising databases including Scopus® and Web of Science®. Meaningful insights achieved from these databases are highlighted herewith. These databases were searched with keyword related to Ontology for Manufacturing, and various types of documents were studied. Methodology adopted for this study of bibliometric analysis on Ontology for Manufacturing conducted using open-source platform, RStudio®, and is highlighted in Table 1.

It is observed little research and development work in this domain has been conducted in last few years, and seems to have very high potential for contribution. This analysis helped in deciding the direction for development of appropriate Ontology for Manufacturing framework for knowledge representation in for especially for metal casting defect detection. Detailed discussion on bibliometric analysis is presented next followed by methodology for development and demonstrative work supporting that methodology.

Table 1: Methodology adopted for bibliometric analysis

Bibliometric Analysis on Ontology for Manufacturing Using RStudio®		
ELSEVIER Scopus	**Database searched for documents published**	Clarivate Web of Science
2015-2025	**Duration**	2015-2025
Articles, book chapter, review, conference paper, book, editorial	**Type**	Articles, review articles, book chapter, early access, proceeding papers
1797	**Total number**	1702
English	**Language**	English

Overview

Table 2 represents the overview about bibliometric analysis carried out on documents published in both of databases. Distribution of overall documents published in Web of Science® and Scopus® are also shown in Figure 1 and 2. Documents were also merged in order to eliminate repeated documents using program executed on RStudio®, and their distribution is also represented in Figure 3.

Table 2: Overview of bibliometric analysis

Total documents (after removing 987 duplicated and retracted documents)	2512
Total number of sources (i.e., journal, conference, publishers) in which documents were published	987
Annual growth rate (in percentage)	
Average citation per document	~12.1
Total number of authors contributed	5950
International co-authorship (in percentage)	18.5

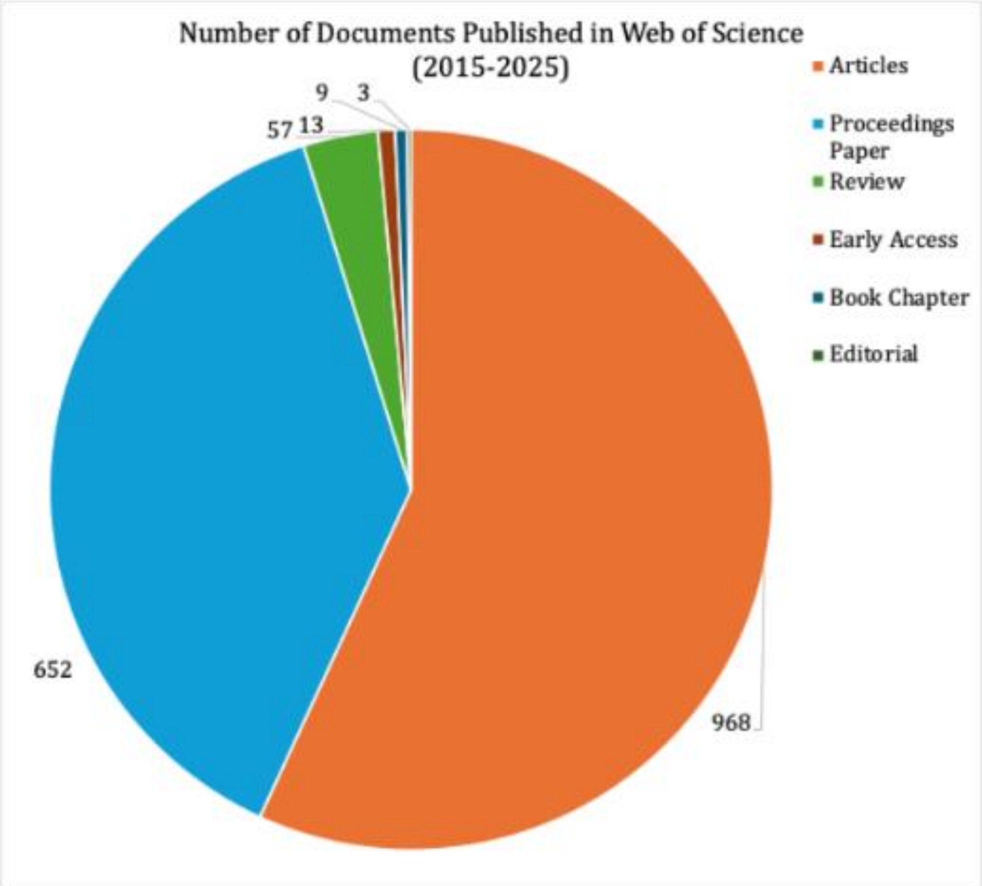

Figure 1: Type of documents published in Web of Science®

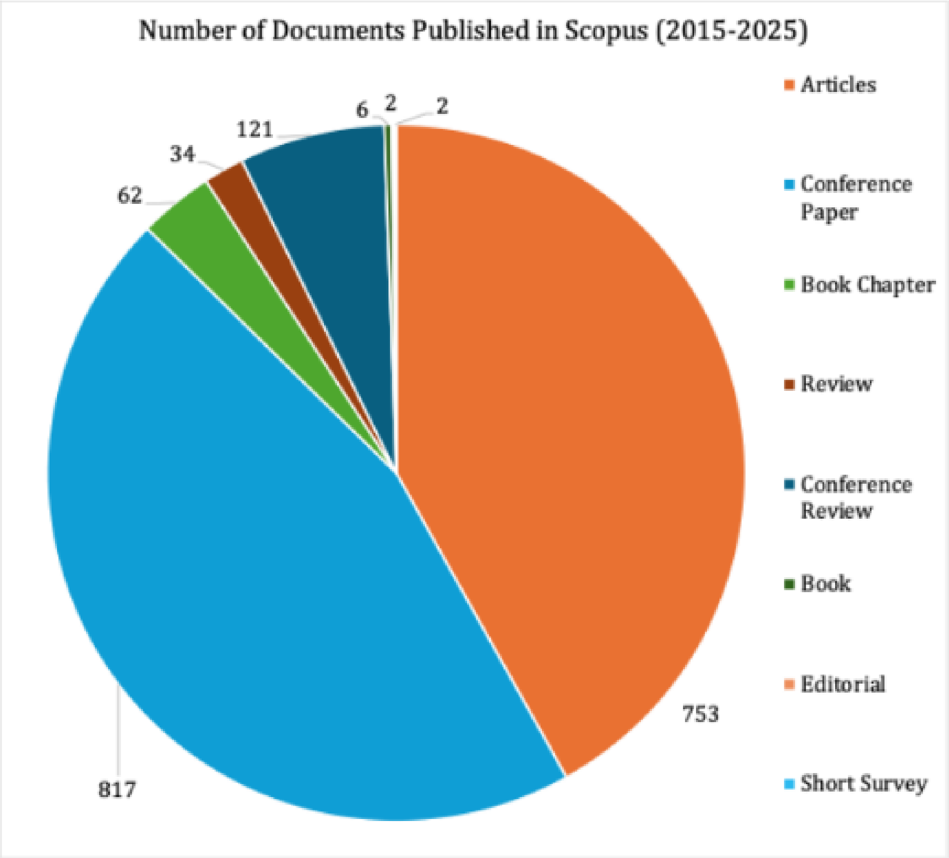

Figure 2: Type of documents published in Scopus®

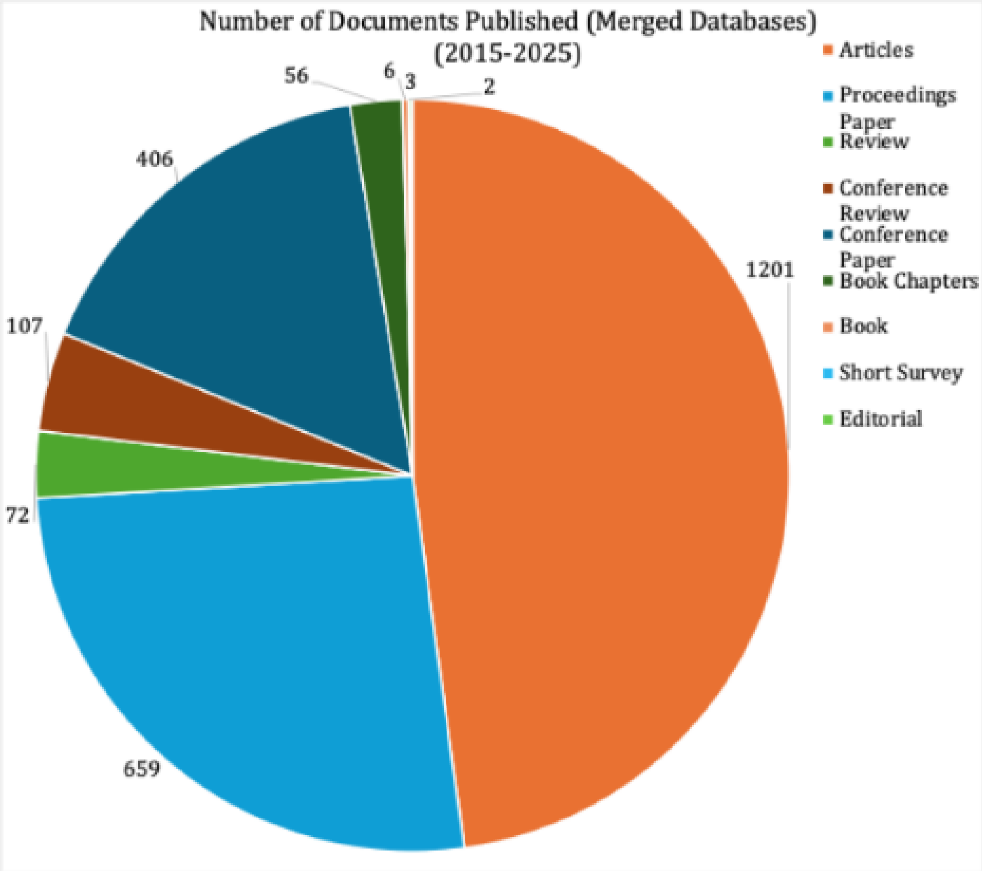

Figure 3: Distribution of documents in merged databases

Year-wise publication is also checked (Figure 4), and it was observed that number of documents published in the domain of Ontology for Manufacturing is relatively steady, were in range of 182-291 publications every year since 2015. Highest increment (in percentage) in number of documents published in a year was observed in 2022 where it was in range of 17.5%.

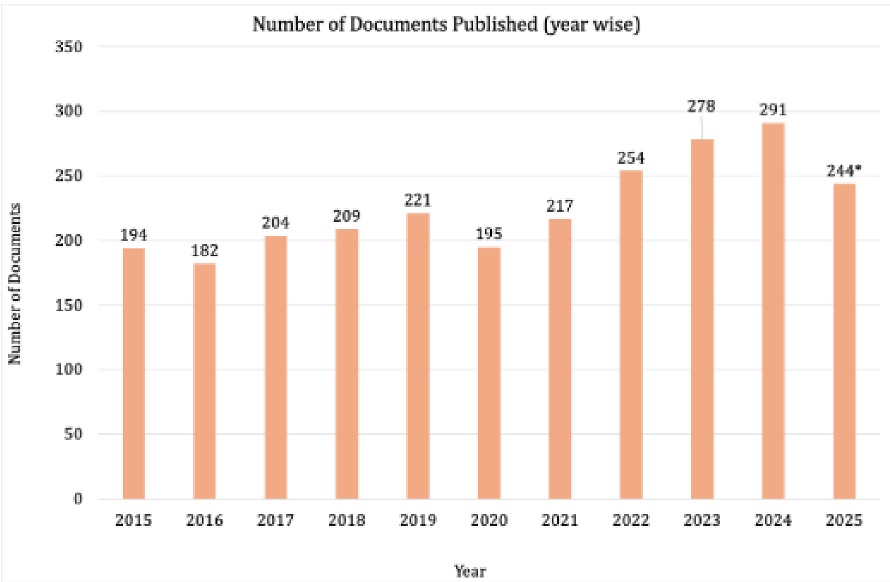

*Figure 4: Year wise publication of documents (*data is till December 2025)*

Major contributors including researchers, their affiliations, countries, sources, etc. are also found out using systematic bibliometric analysis, and is highlighted herewith.

Contributors and Collaboration

Authors conducted remarkable research in the domain of extending an application of Ontology for Manufacturing, and their publication, as well as h-index are represented in Figure5. r. Kiritsis D has highest number of documents published (i.e., 37) and h-index (=13) in this domain.

Also, most cited country and their average citations per document are shown in Figure 6. It is observed that China has maximum number of citations followed by USA, Italy, Germany and UK. However, average citations per article is highest for Thailand (i.e., 105) followed by Newzeland (i.e., 50.40). Number of documents published by India in this domain, and number of citations per article is relatively low as the concept of Ontology for representing manufacturing knowledge is not fully explored.

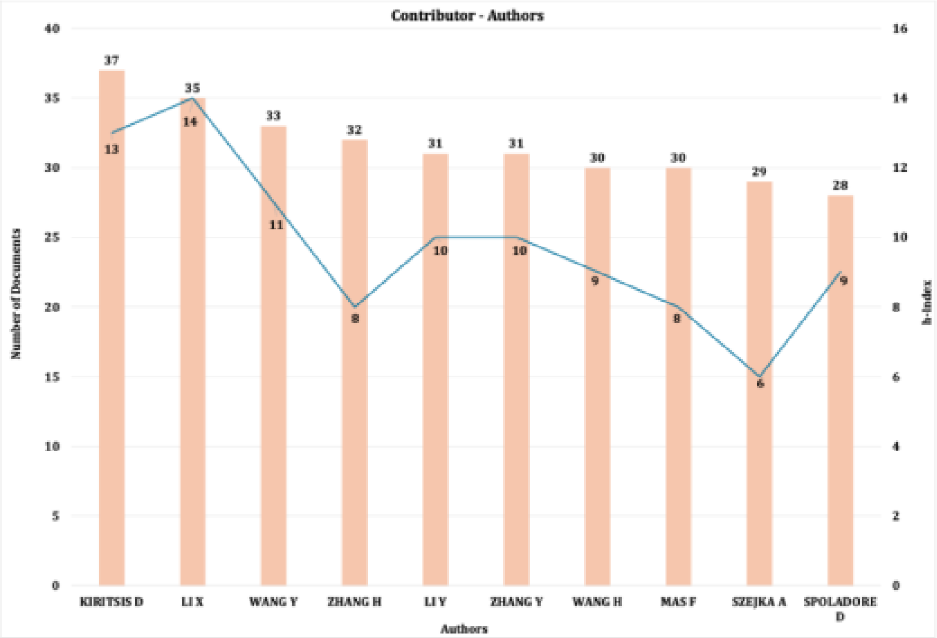

Figure 5: Top 10 Authors, and Their h index

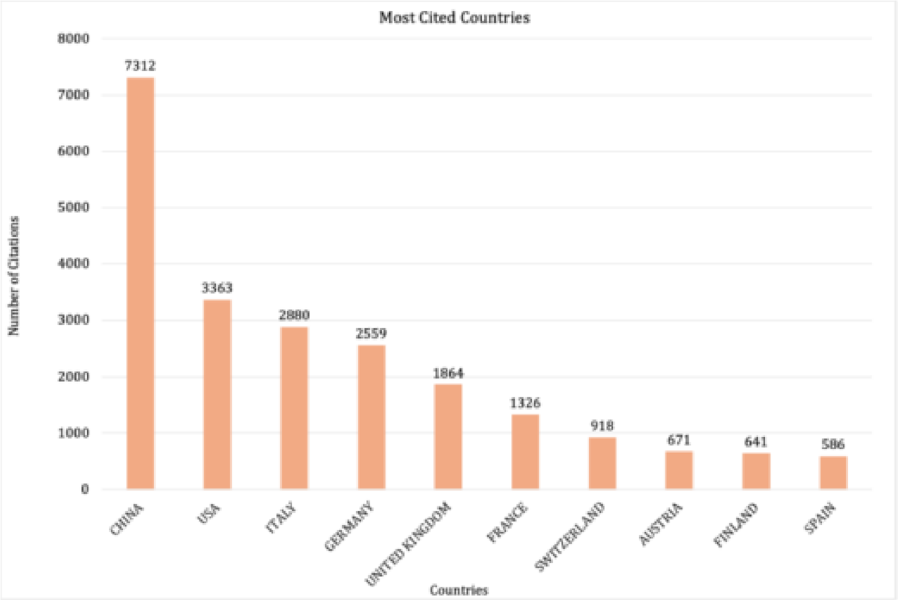

Figure 6: Most cited Countries

Specific three-field plot is generated highlighting authors, affiliated institutes and countries to highlight contribution, and is illustrated in Figure 7. It is observed that Dr Kiritsis from XI'an Jiaotong University have remarkably contributed in this domain.

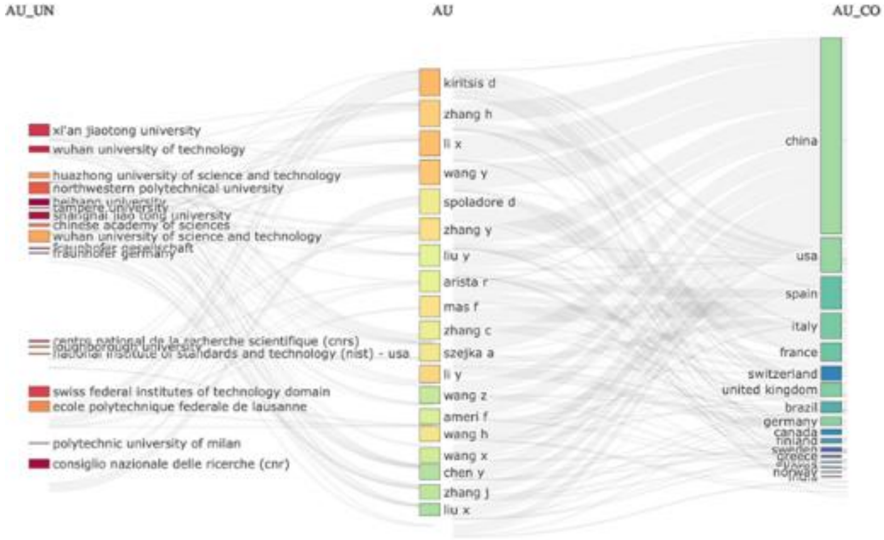

Figure 7: Three field plot highlighting institutes, authors and countries working in this domain

Collaborative research plays very important role especially in this domain. It was observed that 18.51% of documents has international co-authorship, and overview of collaboration between various countries is shown in Figure 8. China has developed strong collaboration with UK for 45 documents and with USA 26 documents. USA has published 16 documents with France; 13 with UK; and with Germany 10 documents. Concept of Ontology for representing manufacturing knowledge is India is relatively unexplored, and India has collaborated with Sweden for publication of two documents.

Figure 8: Collaboration between various countries for research in the domain of Ontology for Manufacturing

Various keywords used other than in these documents were also studied, and observed that keyword related to casting, metal castings, Industrial Internet of Things (IIoT), Internet of Things (IoT). It was found that Ontology for Manufacturing especially for IIoT enabled metal casting, or for IIoT application is rarely explored. Ontology for representing manufacturing knowledge especially for IIoT enabled metal casting can be represented. Detailed technical literature highlighting application of ontology for representing knowledge of IIoT enabled metal casting is summarized next.

3 Prior Work

They leverage the usage of online sensor data with multi-agent and microservices techniques to build the knowledge models dynamically using ontologies [31]. Likewise, other forms of machine learning, like Bi-LSTM, have been utilized for knowledge graph-based entity and relationships extraction as well as improving semantic knowledge representation [32]. The research community has also further investigated methods of carrying out ontology alignment on order to enrich the semantic match of heterogeneous information resources with features such as context descriptors and semantic structures [33]. Evaluation of the quality of the ontology has also been explored using different methods, particularly evaluating consistency, usability, and the concepts represented in the ontology in complex engineering systems [34]. Also, developing ontologies using semantic web applications based on knowledge graphs has been proposed for data integration and semantic queries on a number of data sources [35]. The techniques for the semi-automatic construction of ontologies include the extraction of knowledge applied in the domain area, specifically education, by applying clustering and learning techniques for concepts [36]. Sophisticated techniques now utilize transformer-style deep learning approaches that can build on top of knowledge representation with dynamically developed ontologies that are based on higher-dimensional data [37]. Review studies have also examined methodologies, tools, and best practices used in developing ontology for various domains to identify the challenges in the design process and areas that still require research [38]. Natural Language Processing techniques were largely employed to implement the automation of ontology construction from unstructured text and domain sources [39]. Additionally, methods of ontological harmonization have been proposed for ensuring semantic consistency in complex environments of design and engineering [40]. Multimodal knowledge graphs can include text, image, audio, and video to enrich semantic knowledge representation, digital preservation, and intelligent information processing [41]. Dynamic knowledge graph deduction frameworks combine ontology, scenario logic, and rule-based reasoning for real-time decision support in intelligent planning, emergency response systems [42]. Automated ontology learning frameworks employ a multi-agent architecture and large-scale language models that co-operatively construct coherent ontologies from unstructured text resources[43].In the embedding-based model, the concepts and entities of the ontology have a geometrical representation in space to identify their relationships through inferring the knowledge[44]New approaches have been developed for automating the evolution of an ontology using text corpora and a language model to reduce the cost and need for expert-based evaluation [45]. Most of the research based on surveys has focused on ontology-driven feature selection methods, whereby ontologies are used to identify relevant features from large data sets with a view to enhancing classification accuracy and knowledge extraction processes [46]. IoT ontology frameworks are representative frameworks of entities like devices, services, and resources in a harmonized manner to provide an avenue for knowledge representation and data integration [47]. Ontologies play the role of semantic models of sensor data and domain knowledge, which allows for the protection of efficient knowledge sharing, reasoning, and decision-making in IoT applications [48]. Further, semantic models based on ontology have been developed for Industrial IoT environments that enable smart factory components, like machines, software services, material, and human resources, with digital twin representations, improving the communication and automation within the system [49]. Recent studies have explored the application of IIoT in manufacturing processes, such as vertical centrifugal casting, to create immersive interactive environments [50]. Digital twinning has also been applied to vertical centrifugal casting, enabling real-time monitoring and optimization [51]. Blockchain technology has been evaluated for Industrial IoT applications, with a comparative study of various consensus mechanisms [52]. The metaverse has been leveraged to enhance learning experiences in manufacturing, with a focus on development and demonstration [53]. Furthermore, blockchain-integrated IoT devices have been developed for advanced inspection of casting defects [54].

4 Methodology

The approach of this research towards knowledge representation through ontology is designed by analyzing the various related approaches in the area of ontology engineering, knowledge graphs, and semantic web. The knowledge acquisition regrading a domain starts with the extraction of information from diverse pools such as research papers, digital libraries, domain reports, IoT datasets, textual documents, and so on. Both structured and unstructured data should be considered to make sure that no piece of knowledge is left uncollected. Following data collection, knowledge extraction with preprocessing is done by using techniques under the NLP paradigm, such as entity recognition, relation extraction, and keyword identification. This will help in identifying the core concepts, classes, properties, and semantic relationships that are necessary in ontology modeling. The next step is the design and development of ontology, wherein an organized structure in the form of a hierarchy with sub-classes, object properties, and data properties is achieved using a standard ontology language like OWL/RDF, while an ontology modeling tool like protégé is adopted for implementation, and reuse od available ontologies for maintaining interoperability and avoiding redundancy is also considered. Ontology learning and different approaches added in the development of the automated knowledge graph manage large and dynamically changing domains. The identification of unknown relationships within a domain can be done using several approaches related to machine learning and deep learning for changing the structure of ontology in a dynamic way. Ontology alignment is added in order to handle heterogeneous ontologies and semantic conflicts. To this end, after the development of an ontology, some evalution and validation phases should be done considering coverage, correctness, consistency, scalability, and efficiency in reasoning; logical reasoning also turns out to be crucial for verification of a given set of semantic rules. Finally, the resultant validated ontology is integrated within application environments for semantic query support, intelligent reasoning, interoperability, and decision support in several application domain: healthcare, cybersecurity, IoT, industrial systems, and knowledge management applications.

5 Research Gap

Despite various pieces of research being conducted on ontology-based knowledge representation, there are various gaps that are not covered in this domain. Compared to existing related work, where researchers have been focusing on various domain-specific ontologies, such as healthcare, cybersecurity, IoT, robotics and industrial systems, no generalized ontology frameworks that can provide integrated knowledge representation are considered for various domains. It has been observed that almost all ontology models are developed with consideration of a particular application only. The domain with yet another important gap is "automated ontology construction" described as: "while various approaches utilize different techniques such as ML, NLP, KGs, etc., the automation of learning ontologies from large amounts of unstructured data in a way that is both accurate and real time, and with minimization of the needs for validation/refinement by human experts in the field," remains yet to be achieved! Moreover, interoperability and harmonization of the ontology, especially in relation to heterogeneous data sources, are not yet fully solved issues. There are many challenges, in particular when dealing with semantic issues, vocabulary, and data structures concerns, especially for distributed environments such as IoT and smart industries. There is not much research being conducted in the domain of dynamic ontology evolution, in which the knowledge ontologies would get updated time to time with changes in data. The majority of systems now use only static knowledge models. Moreover, the standardization of the evaluation metrics concerning the ontology has not been done so far. Some methods for the evolution of correctness of the generated ontology are available; however, methods concerning performance evaluations have not been developed in a holistic fashion so far. Thus, a strong case exists for the design of a scalable, interoperable, and continually dynamic ontology-based knowledge representation system that combines automation, semantic integration, and reasoning.

6 Conclusion

It has been observed that the representation of knowledge with the help of ontology has resulted in a very important role to be played in managing and organizing complex knowledge within the domain, in a manner that can be easily understood through machines. Different semantic web technologies, and different techniques of ontology learning have been identified through this research that have actually been identified through this research that have actually been implemented within different domains like IoT, healthcare, cybersecurity, etc. From the above analysis, it can be found that the ontology-driven knowledge representation approach will certainly help to improve the integration, understanding, and management of the knowledge. There also exist some problems which should be solved, like t0he automatic construction of the ontologies, the integration and evolution of the ontologies, and the correct evalution of the knowledge. Based on the foregoing explanations above, the bottom line is that aside from AI, ML, and real-time processing of data, there is none that can overemphasize the issue of the role of ontology as one of the key components in the advent of modern sophisticated KBS technologies except that is a potential to evolve knowledge representation in the future.

7 Future Work

However, regarding this knowledge representation technique within the ontology domain, some areas for future improvement have also been identified. The first area of improvement constitutes the fully automatized learning of ontologies that may allow for the retrieval of information from big data sets of unstructured information. The other area with respect to the scope the technique refers to integrations with the most modern techniques of Natural Language Processing and Large Language Models. Additionally, other potential research areas that can be explored by this field of knowledge representation can be linked with the domains of dynamic and self-evolutionary ontologies with the aim of adapting the knowledge representation systems with aid of real-time data, etc., from domains like IoT, healthcare, industries, etc. another promising and recommended area in this field is the field of cross domain ontology integration, "as it has been proven that semantically, multiple domain ontologies can be integrated." Besides that, further research would be carried out, focusing on the development of a mechanism that will help scale up the process of reasoning, which would then be used effectively to make the intelligent mechanism efficient enough in the intelligent process of interference. This would be achieved through the application of the hybrid approach, ensuring the knowledge management process is efficient through the inclusion of appropriate mechanisms such as the application of ontologies and intelligent mechanism such as machine learning/deep learning. Lastly, it would be worthy to try, through further research, to lay the groundwork for the development of tools that could aid in the evalution of the quality of the produced ontologies, effectively creating powerful and "intelligent" methods for knowledge representation.

8 References

[1] A. Aijaz, R. Mutharaju, M. Kumar, O. Chattar, and J. Shukla,"An ontology to capture contextual information to facilitate ethical decision-making in AI systems," in Proc. 7th Joint Int. Conf. Data Science & Management of Data (CODS-COMAD), Bangalore, India, Jan. 2024, pp. 1–2, doi: 10.1145/3632410.3632493.
[2] J. M. Jorquera Valero et al.,"Unlocking the potential of knowledge graphs: A cyber defense ontology for a knowledge representation and reasoning system," in Proc. 19th Int. Conf. Availability, Reliability and Security (ARES), Vienna, Austria, Jul. 2024, pp. 1–9, doi: 10.1145/3664476.3670916.
[3] K. Dimitropoulos and I. K. Hatzilygeroudis,"An ontology-knowledge graph based context representation scheme for robotic problems," in Proc. 13th Hellenic Conf. Artificial Intelligence (SETN), Piraeus, Greece, Sep. 2024, pp. 1–7, doi: 10.1145/3688671.3688735.
[4] H. Younus et al.,"An extended function-behaviour-structure ontology to support FMEA within a system engineering context," Procedia CIRP, vol. 128, pp. 644–649, 2024, doi: 10.1016/j.procir.2024.06.034.
[5] R. Elia, M. Rak, and D. Pascarella,"Preliminary concept design of an ontology for the security risk assessment of U-Space solutions," in Proc. IEEE Int. Workshop on Technologies for Defense and Security (TechDefense), 2024, pp. 1–6, doi: 10.1109/TechDefense63521.2024.10863476.
[6] M. Libro, S. Gaiardelli, M. Lora, and F. Fummi,"Integrating modeling languages with ontologies in the context of Industry 4.0," in Proc. IEEE Int. Conf. Industrial Technology (ICIT), 2024, pp. 1–7, doi: 10.1109/ICIT58233.2024.10540801.
[7] I. B. G. Sarasvananda et al.,"Ontology-driven semantic models for Balinese Lontar manuscript knowledge representation," in Proc. IEEE Int. Symp. Consumer Technology (ISCT), 2024, pp. 1–5, doi: 10.1109/ISCT62336.2024.10791274.

[8] J. Yang, H. Guo, S. Yang, and Q. Gao,"Research on the knowledge graph for task decision-making based on complex knowledge," in Proc. Int. Conf. Internet of Things, Automation and Artificial Intelligence (IoTAAI), 2024, pp. 588–592, doi: 10.1109/IoTAAI62601.2024.10692868.
[9] Y. Zhou, Y. Zhou, and Y. Liu,"Research on ontology construction based on the knowledge system of Compendium of Materia Medica," in Proc. IEEE/WIC Int. Conf. Web Intelligence and Intelligent Agent Technology (WI-IAT), 2024, pp. 642–646, doi: 10.1109/WI-IAT62293.2024.00103.
[10] T. I. Ivanova,"Usage of semantic technologies for representing non-precise or vague knowledge," in Proc. Int. Conf. Information Technologies (InfoTech), Bulgaria, Sep. 2024, pp. 1–4, doi: 10.1109/InfoTech63258.2024.10701323.
[11] M. Beer, E. Zio, K.-K. Phoon, and B. M. Ayyub,"An ontology for an epigenetics approach to prognostics and health management," in Proc. Int. Symp. Reliability Engineering and Risk Management (ISRERM), Singapore, 2022, pp. 1–8, doi: 10.3850/978-981-18-5184-1_GS-06-180-cd.
[12] E. Nguyen, R. Z. Lin, Y. Gong, C. Tao, and M. T. Amith,
"Developing a computational representation of human physical activity and exercise using an open ontology-based approach: A Tai Chi use case," in Proc. IEEE Int. Conf. Healthcare Informatics (ICHI), 2024, pp. 31–40, doi: 10.1109/ICHI61247.2024.00012.
[13] T. I. Ivanova,"Approaches for usage of ontologies in some domains, working with imprecise, uncertain or vague knowledge," in Proc. Int. Conf. Information Technologies (InfoTech), Bulgaria, 2024, pp. 1–4, doi: 10.1109/InfoTech63258.2024.10701412.
[14] B. M. Alhaj Hasan,"An ontology-based approach for knowledge sharing between product design and assembly process planning (APP)," in Proc. Int. Conf. Research and Education in Mechatronics (REM), 2024, pp. 326–331, doi: 10.1109/REM63063.2024.10735534.
[15] A. Kougioumtzidou et al.,"An end-to-end framework for cybersecurity taxonomy and ontology generation and updating," in Proc. IEEE Int. Conf. Cyber Security and Resilience (CSR), 2024, pp. 247–254, doi: 10.1109/CSR61664.2024.10679346.
[16] J. Gutiérrez Moret et al.,"A comprehensive analysis of ontologies related to safety-related traffic information for road traffic," in Proc. Euro American Conf. Telematics and Information Systems (EATIS), 2024, pp. 1–8, doi: 10.1145/3685243.3685291.
[17] O. Gorda, Y. Riabchun, V. Khrolenko, and R. Mazurenko,
"Ontology-based analysis of neuralstem learning based on data integration," in Proc. IEEE Int. Conf. Smart Information Systems and Technologies (SIST), 2025, pp. 1–9, doi: 10.1109/SIST61657.2025.11139176.
[18] L. Koval, S. Wachter, E. Huseyin, and D. Grossmann,"Ontology-driven modeling and integration of production processes in advanced driver-assistance systems within the Gaia-X ecosystem," in Proc. Int. Conf. Computer Technology Applications (ICCTA), 2025, pp. 211–216, doi: 10.1109/ICCTA65425.2025.11166225.
[19] H. Chen, M. Hou, Y. Sun, C. Gao, and M. Gao,"A knowledge representation method for virtual restoration of ancient Chinese stone arch bridges," Int. Arch. Photogrammetry, Remote Sensing and Spatial Information Sciences, vol. XLVIII-M-9, pp. 217–224, 2025, doi: 10.5194/isprs-archives-XLVIII-M-9-2025-217-2025.
[20] N. Mishra and B. Kumaraswamy,"Deployment of ontologies as knowledge reasoning technique for making autonomous robots: A survey," in Proc. IEEE Int. Conf. Intelligent Control, Computing and Communications (IC3), 2025, pp. 943–948, doi: 10.1109/IC363308.2025.10956752.
[21] V.-C. Nguyen, M.-D. Hoang, D.-H. Doan, D.-A. Nguyen, V.-N. Ta, N.-H. Nguyen, and L. M. Pham,"An ontology-based representation of knowledge for specifying ransomware behavior," in Proc. Int. Conf. Digital Arts, Media and Technology (ECTI DAMT & NCON), 2025, pp. 344–349, doi: 10.1109/ECTIDAMTNCON64748.2025.10962021.
[22] F. Bahreini and A. Hammad,"Integrating ontology and LLMs for diagnosis and repair of concrete surface defects," in Proc. 42nd Int. Symp. Automation and Robotics in Construction (ISARC), 2025, pp. 1292–1300.
[23] M. Torlini, P. R. Mazzarino, D. S. Schiera, L. Barbierato, L. Bottaccioli, and E. Patti,"An ontology-based methodology to assist complex energy co-simulation setup," in Proc. IEEE Int. Conf. Environment and Electrical Engineering (EEEIC), 2025, pp. 1–6, doi: 10.1109/EEEIC/ICPSEUROPE64998.2025.11169173.
[24] B. Okreša Đurić and C. Carrascosa,"A framework for ontology-driven multiagent system generation," in Proc. 48th Int. Convention on Information, Communication and Electronic Technology (MIPRO), 2025, pp. 198–203, doi: 10.1109/MIPRO65660.2025.11131908.
[25] A. Sadowski and J. A. Chudziak,"On verifiable legal reasoning: A multi-agent framework with formalized knowledge representations," in Proc. ACM Int. Conf. Information and Knowledge Management (CIKM), Seoul, South Korea, Nov. 2025, doi: 10.1145/3746252.3761057.
[26] H. Melo, O. Avila, and M. P. Villamil,"Towards an ontology on project portfolio management," Procedia Computer Science, vol. 256, pp. 1649–1657, 2025, doi: 10.1016/j.procs.2025.02.302.
[27] K. C. Dewi, I. B. P. S. Yudistira, P. I. Ciptayani, and P. M. Lina,"Modeling ontology for knowledge-based buyer persona expert system," in Proc. Int. Conf. Artificial Intelligence, Blockchain, Cloud Computing and Data Analytics (ICoABCD), 2024, pp. 155–160, doi: 10.1109/ICOABCD63526.2024.10704553.
[28] Y. M. Reddy, V. H. Raj, H. P. Thethi, R. Kalra, S. Bansal, and M. Khalid,"Multi-layered ontology models for dynamic knowledge representation in social network analysis," in Proc. Int. Conf. Trends in Quantum Computing and Emerging Business Technologies, 2024, doi: 10.1109/TQCEBT59414.2024.10545096.

[29] O. Chala, T. Bilova, I. Pobizhenko, and O. Ostapenko,“Fuzzy ontological model of knowledge representation for the humanitarian response,” in Proc. Int. Conf. Computational Linguistics and Intelligent Systems (CoLInS), 2025.

[30] B. Lu, D. Pham, T. Chang, M. Lovette, T. Bui, and S. Ma, “SHACL-SKOS based knowledge representation of material safety data sheet (SDS) for the pharmaceutical industry,” in Proc. IEEE Int. Conf. Semantic Computing (ICSC), 2025, doi: 10.1109/ICSC64641.2025.00021.

[31] S. Mandal and N. E. O'Connor,“OntoSmartDCU: A multi-agent microservice based automated, dynamic ontology and knowledge graph creation framework from real-time sensor data for the smart DCU digital twin,” in Proc. IEEE World Forum on Internet of Things (WF-IoT), 2024, pp. 784–789, doi: 10.1109/WF-IoT62078.2024.10811412.

[32] S. K. Joshi, A. Deogaonkar, C. Manral, C. Charu, N. Chauhan, and N. Varshney,“Knowledge graphs and data models for knowledge representation using the Bi-LSTM model,” in Proc. 2nd Int. Conf. Intelligent Cyber Physical Systems and Internet of Things (ICoICI), 2024, pp. 1028–1033, doi: 10.1109/ICOICI62503.2024.10696191.

[33] E. Manziuk, V. Kuznetsov, O. Barmak, I. Krak, P. Radiuk, and S. Yakovlev,“Integration of contextual descriptors in ontology alignment for enrichment of semantic correspondence,” in Proc. IEEE Int. Conf. Dependable Systems, Services and Technologies (DESSERT), Athens, Greece, 2024, doi: 10.1109/DESSERT65323.2024.11122179.

[34] J. Martin, J. Axelsson, J. Carlson, and J. Suryadevara,“Evaluation of systems engineering ontologies: Experiences from developing a capability and mission ontology for systems of systems,” in Proc. IEEE Int. Symp. Systems Engineering (ISSE), 2024, doi: 10.1109/ISSE63315.2024.10741093.

[35] R. Thota, S. M. Potluri, A. H. S. Alzaidy, K. Sudhakar, and P. Bhuvaneshwari,“Knowledge graph construction-based semantic web application for ontology development,” in Proc. Int. Conf. Intelligent Computing and Knowledge Extraction (ICICKE), 2025, doi: 10.1109/ICICKE65317.2025.11136719.

[36] M. Sankat, R. Kumar, N. Mishra, J. Batra, M. Sharma, and A. Srivastava,“Semantic enrichment of educational domain: Semi-automated ontology construction and visualization—A case study in education,” in Proc. IEEE Int. Conf. Advancements in Smart, Secure and Intelligent Computing (ASSIC), 2025, doi: 10.1109/ASSIC64892.2025.11158096.

[37] S. Korkanti,“Dynamic ontology construction for high-dimensional data analytics using transformer-based models,” in Proc. Int. Conf. Computing Technologies & Data Communication (ICCTDC), 2025, doi: 10.1109/ICCTDC64446.2025.11158746.

[38] O. Bamigboye, I. Padayachee, P. Rontala, and S. Subramaniam,“Exploring ontology development techniques across domains,” in Proc. Conf. Information Communications Technology and Society (ICTAS), 2025, doi: 10.1109/ICTAS64866.2025.11155432.

[39] D. R., B. Rambabu, G. Senthilkumar, T. J. J., and R. Surendran,“Application of natural language processing methods to automated ontology building for domain-dependent information acquisition,” in Proc. Int. Conf. Intelligent Sustainable Systems (ICISS), 2025, doi: 10.1109/ICISS63372.2025.11076340.

[40] N. A. W. Harrison, R. I. Whitfield, A. Powell, and A. F. Holliman,“A new approach to ontological harmonisation in design,” Proc. Design Society, vol. 5, pp. 199–208, 2025, doi: 10.1017/pds.2025.10034.

[41] B. Buyinqiqige, Hasi, and Nariga,“A multimodal knowledge graph construction method for Mongolian five-animal economic vocabulary,” in Proc. IEEE 6th Int. Conf. Pattern Recognition and Machine Learning (PRML), 2025, pp. 345–347, doi: 10.1109/PRML66062.2025.11159742.

[42] Q. Sun, H. Gao, and Y. Hong,“Dynamic deduction method for water rescue knowledge graph with coupled architecture,” in Proc. 8th Int. Conf. Computer Information Science and Artificial Intelligence (CISAI), Wuhan, China, Sep. 2025, doi: 10.1145/3773365.3773395.

[43] H. Ghanem, S. Jabbar, and C. Cruz,“CoA-Text2OWL: Enhancing ontology learning with chain-of-agents framework,” Procedia Computer Science, vol. 270, pp. 1205–1214, 2025, doi: 10.1016/j.procs.2025.09.241.

[44] Y. Zhang, X. Chen, Z. Liu, and H. Wang,“Dual-geometric space embedding model for two-view knowledge graphs,” IEEE Access, vol. 11, pp. 118245–118258, 2023, doi: 10.1109/ACCESS.2023.3321456

[45] M. Ehrig, S. Staab, and Y. Sure-Vetter,“Automated ontology evaluation: Evaluating coverage and correctness using a domain corpus,” in Proc. Int. Semantic Web Conf. (ISWC), Athens, Greece, 2022, pp. 1–12, doi: 10.1007/978-3-031-19433-7_5.

[46] K. Sikelis, G. E. Tsekouras, and K. Kotis,“Ontology-based feature selection: A survey,” Future Internet, vol. 13, no. 6, Art. no. 158, Jun. 2021, doi: 10.3390/fi13060158.

[47] N. Teslya and I. Ryabchikov,“Ontology-based semantic models for industrial IoT components representation,” in Advances in Intelligent Systems and Computing, vol. 874, Cham, Switzerland: Springer, 2019, pp. 138–147, doi: 10.1007/978-3-030-01818-4_14.

[48] A. Al-Fuqaha, M. Guizani, M. Mohammadi, M. Aledhari, and M. Ayyash,“A comprehensive ontology for knowledge representation in the Internet of Things,” IEEE Access, vol. 6, pp. 76500–76517, 2018, doi: 10.1109/ACCESS.2018.2886600.

[49] L. Daniele, F. den Hartog, and J. Roes,“Ontologies as a semantic model in IoT,” Future Generation Computer Systems, vol. 76, pp. 346–356, Nov. 2017, doi: 10.1016/j.future.2016.12.013.

[50] D. Anadkat, A. Sata, M. Shukla, S. Jarboui, and D. Mobarsa,“Designing an immersive interactive environment for IIoT-enhanced vertical centrifugal casting,” Frontiers in Education, vol. 9, 2024, doi: 10.3389/feduc.2024.1345678.

[51] D. Anadkat, A. Dave, A. Sata, M. Shukla, and S. Jarboui,“Digital twinning of vertical centrifugal casting,” Concurrent Engineering: Research and Applications, 2024, doi: 10.1177/1063293X241296463.

[52] M. Shukla, A. Sata, and D. Mobarsa, “Comparative evaluation of various blockchain consensus mechanisms for industrial IoT applications,” Security and Privacy, vol. 9, no. 1, Art. no. e70150, 2026.
[53] D. Anadkat, M. Sama, and A. Sata,“Enhancing learning experience of manufacturing through metaverse—Development and demonstration,” Mechanical Engineering Advances, vol. 3, no. 4, 2025.
[54] N. Yousef, A. Sata, M. Shukla, S. Jarboui, and D. Mobarsa,“Blockchain-integrated IoT device for advanced inspection of casting defects,” Scientific Reports, vol. 15, Art. no. 5300, 2025, doi: 10.1038/s41598-025-5300.