DOI: https://doi.org/10.46632/rne/1/1/4

Renewable and Nonrenewable Energy
Vol: 1(1), 2022
REST Publisher; ISBN: 10978-81-948459-2-8
Website: http://restpublisher.com/book-series/renewable-and-nonrenewable-energy/

Investigation of Industry 4.0 in the Robotized Millennium

[2]*M. Vijayalakshmi, [2]A. Pavithra, [1]R. Rajasree, [2]M. Ramachandran, [2]Sathiyaraj Chinnasamy
[1]PSN Institute of Technology and science, Tirunelveli, Tamil Nadu, India.
[2]REST Labs, Kaveripattinam, Krishnagiri, Tamil Nadu, India.
*Corresponding author Email: Vijima603@gmail.com

Abstract. Industry 4.0 Wireless Supported by connectivity and sensors Factories has machines. These sensors Display the entire production line and monitor and can make its own decisions are integrated into one system. Industry 4.0 Smart production Uses processes to produce essential waste products to meet the COVID-19 epidemic shortage. Patients need themselves Essential medical supplies to get on time, during this crisis Medical disposable items and Smart supply chain of equipment it provides Industry is 4.0 as a flexible product line Smart system used. Intelligence (I) by RTC, real-time information on Internet of Things (Yoda) and almost all other digital technologies for the entire production process. Any medical area Design and upgrade pre-designed Using software is done quickly and to print the required components Digital production such as 3D printing Uses technologies. Industrial 4.0 Technologies COVID-19Diagnose symptoms of, It is related to this disease Helps to avoid the chances of getting sick Can predict. Possible health problems and expected recovery Helps keep track of opportunities. Govt for 19 explosions Assistive Industry 4.0 Notable Technologies. Cross New Business Opportunities Is open. However, flexibility, Performance and product customization the requirements of Real to handle value creation Procedures no longer apply. Industrial 4.0, (Fourth Industrial Revolution) is a term coined in Germany; more important ideas were first published in 2011.It is the internet of future technologies Physical systems (CPS), Integration in the Internet and production systems as defined. Control computers in real time, Plan and predict Helps. In the field of technology, in the production of this concept causing revolution and related services have been discussed in research for many years. One of the basic principles for creating an industrial 4.0 environment is to connect organizations and Working value chain individually and Control each other arbitrarily.
Keywords: Cloud Computing, Block Chain, Enterprise Architecture.

1. Introduction

Industry 4.0 Hannover During the exhibit introduced on; Also, This is officially Announced Currently in the manufacturing sector in industries that because revolution will play a pioneering role Is a strategic initiative. Implements such technologies. Industry is 4.0 Embedded From systems Cyber-Physics For systems Technological evolution Indicates growth. Industry 2.0, Embedded Systems, from engine to Mechanical Contact IoT and CPS Virtual space for technologies Physics Integrate with the world. This barrier Organizational Application Integration (EAI) by the system can cope has been developed various methods and currently the fourth in the manufacturing sector causing revolution leading in industries plays a role at various platforms and targeting Industry 4.0. Hannover Exhibition Moreover, This Officially German in 2013 Strategic Announced as an attempt. Industry 4.0, also known as Industry 4.0, marks the beginning of the Industrial Revolution Industry 4.0 In the manufacturing sector of automation technologies indicates the current trend, more importantly Physical systems (CPS) The Internet of Things Cloud Computing like Industry 4.0 Technologies Includes implementation.

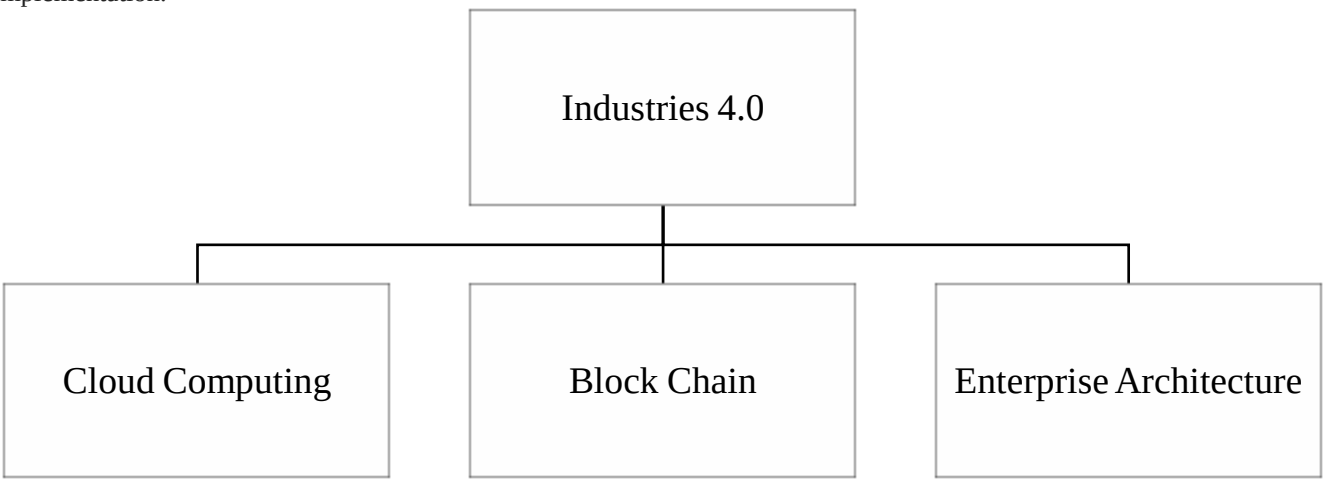

FIGURE 1. Industries 4.0

Industrial 4.0 Embedded systems Semantic machine-to-machine communication IoT and CBS Technologies Virtual space. Physics Integrates with the world. Organizational application Integration is many data sources Includes Many data sources, Processes Applications Of sites and standards Coordination. By Creating an integrated framework, various systems of EAI And applications Integrates internally and internally Software, hardware and standards By integrating, EAI facilitates the seamless Data and information Exchange required for Business 4.0. Completed in the future sector, workshop equipment in CPS is the Sensor data and organizational Information Integrating settings during this process, Great amounts data Cloud computing Save Analysis Data Center and are uploaded to generate results that Production process Leads. Provides big data and Big data analysis Improving processes, Reducing costs and improving functionality Such production Benefits to companies efficiency.

2. Industries 4.0

Industrial 4.0 Industrial IoT Cognitive with applications Uses computer techniques; Many machines, Processes and From systems Real-time data To analyze This is data science And uses analytical models; Then automates production accordingly So far, different Manufacturing Industries IoT And using IoT In the production process Manufacture, distribution, Improve transportation, service and maintenance. Supply and Adoption. However, there is no comprehensive study of the challenges and Industry in the manufacturing sector Barriers to implementation. Therefore, these papers belong to the expert basically productive Business 4.0 implementation in the field Read and analyze the challenge Aims to do. Feedback and descriptive modeling (ISM). ISM analysis explores the challenges of a framework, identifies the relationships between these challenges, and the challenges of identifying the root because that triggers other challenges. How they affect each other shows that. Industry coaches and managers can use this analysis to identify which challenge plays a key role.

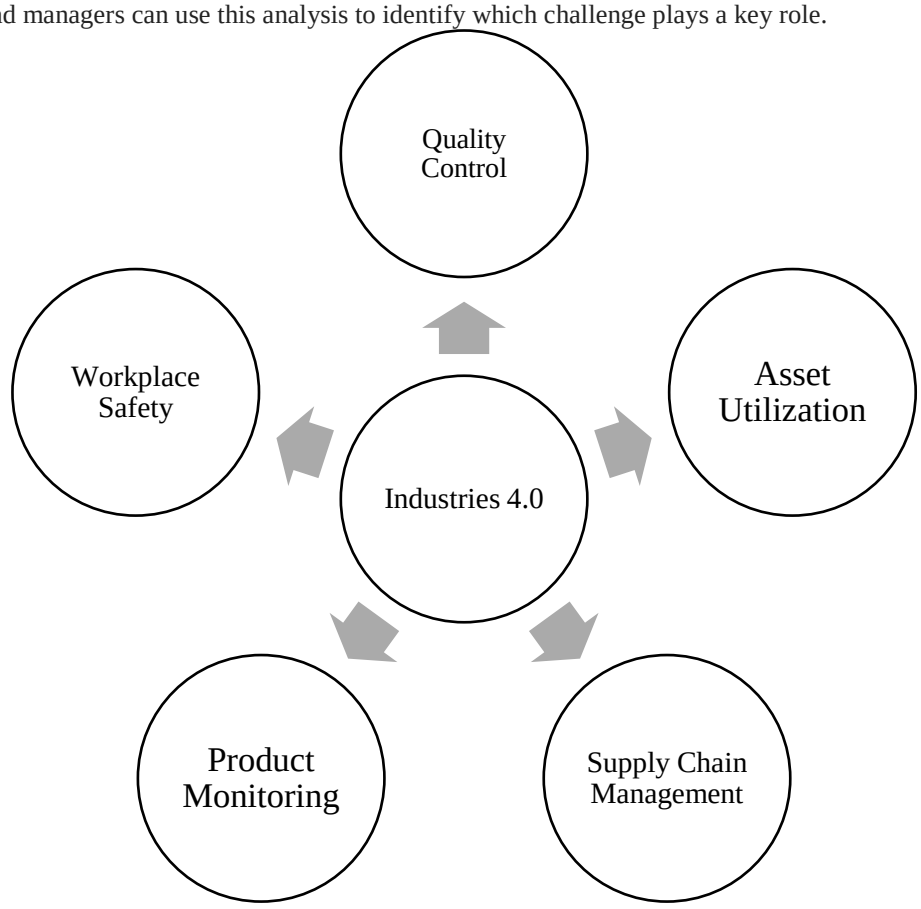

FIGURE 2. Transform industrial Process

Industrial in Brazil for performance Industrial 4.0 related Of technologies Expected benefits To understand Because our main purpose, We have defined Industrial 4.0's technologies as independent variables, industrially accepted Technologies And expected benefits these dependent industry sectors. Variables. Technologies, both of CNI (2016) survey are provided by As given in Table 3, Industrial 4.0 Technologies by 9 technologies Are represented And in the literature Of the 14 major benefits featured There are expected benefits. Of our regression model From independent variables In the CNI survey Considered two Technologies We did not include.4.0 is the digitalization, upgrade And product customization; Automation and adaptation; Man mechanical communication (HMI); Value Added Services and Businesses and automated data transfer and communication. These features Internet technologies And for advanced m Industry 4.0 Smart methods only Not very relevant, But provide analysis and new opportunities for Industry 4.0 Smart Production and Cognitive Production manufacturing companies, also known as Value Added and Knowledge Management Industry 4.0. Their modernization Feel the vision Design to help them Manufacturing, Raw and Inventory Use the data.

3. Cloud Computing

The operation of a modern company, involving many decision-making functions, requires a huge Amount of information and serious calculation. At one point For manufacturing companies Servers and Decision-making units Many computer like Resources were needed Because of this Inefficient data Exchange and Partitioning, low productivity And production resources Less optimal use. Cloud computing for such problems an effective solution Provides All data is personal or can be stored on Public Cloud Servers, in this way Complex decision making Cloud tasks by computing can support. Cloud computing A search engine From the site Is computer technology that can deliver performance. Currently different Internet services to deliver Is the main site. Virtualization technology Cloud computing Flexible extensions, Dynamic allocation, Resource sharing and Provides with other features. Cloud computing model Software, hardware Operating systems and other information required Technical Infrastructure resources Services included Provides to the user Computers and for storage systems rely on access as needed Application requirements Depending on the user Utilizes resources. Most recently, Production Fourth Industrial Is on the verge of revolution. The introduction of CPS will be one of the most revolutionary changes in the Fourth Industrial Revolution. Industry 4.0 of the eighteenth century Held late to the first industrial revolution then the fourth As the Industrial Revolution Described. Industry 4.0 Primarily CPS, IoT And cloud computing Indicated by, although it also relies on smart devices with IoT, CPS, Cloud Computing And BPM (Business Process Management) Third industry Revolutionary machines And processes Industry 4.0 Although automation is the focus seeks fully integrated solutions in end-to-end digitalization and integration of the digital industrial ecosystem.

4. Block Chain

The Black Chain is a distributed ledger that simulates and shares with members of the Pier to Bear (P2P) network. Recently, the Black Chain concept has attracted attention in distributed technologies such as IoT as it enhances security and privacy, improves system error tolerance, provides faster resolution and compatibility, and creates a scalable network and saves cost and time by eliminating intermediaries. Black chain technology has been introduced in many industries, including machine-to-machine communication in the electrical system, food supply chain monitoring system, decentralized logistics function and decentralized data sharing between healthcare applications And financial services to the banking sector. However, there is no systematic study of the integration of block chain technology in production systems, and distributed ledgers must have some key features for successful use in IoT / CPS applications, such as power consumption, the ability to execute orders automatically (e.g. smart contract), and network access. Network type (public or private). Study identifies three distributed ledgers most suitable for IoT / CPS applications: Ethereal Hyper ledger Fabric and IOTA. The architectural framework of block chain technology can develop many key features as described below modeling business and production processes are important in the Industrial 4.0 Environment, Because Production processes Artificial intelligence, Robots, Machine learning And the cloud Using digital are supported in the system Computer, RFID and module chain

5. Enterprise Architecture

An Organizational Structure (EA) provides a framework organization and contains key organizational components such as the organization's objectives, organizational structures, and information infrastructure and business process. The innovations made within the organization, such as the Improving the quality and timing of re-engineering and information flow of business processes, if the EA system truly represents the characteristics and character of the organization. Integration, integration and integrated applications have been identified as an important issue in the Industrial 4.0 environment. Factories in different industrial sectors and in different geographical areas will be merged Information infrastructure and business process. The or integrated with each other. Most likely, a company will have some legacy settings that they already want to use; in the meantime, it will add new applications to the process. The distribution of genres indicates a greater focus on industry 4.0 related technologies / tools and applications in the recent literature. Industry 4.0, which is not only an integration of CPS, ICT, Enterprise Architecture (EA) and IoT, but also an executable process. CSU notes that in addition to Iota, CBS, ICD, big data and cloud computing, various industry information integration methods and techniques have been used in Industrial Integration and Business Process Management Workflow Management (WM) for Industrial 4.0.), Enterprise Application Integration (EAI), Service Oriented Architecture Grid Computing, Enterprise Resource Planning (ERP) and Supply Chain Management (SCM). These advanced algorithms integrating industry information, significantly improve the performance of enterprise information systems (EISs). As Romero & Veranda points out, EIS is an integrated system that integrates physical systems, decision-making systems, and information systems. EISs provide IT platforms for businesses to coordinate and operate customized business processes and to share information on all functional aspects.

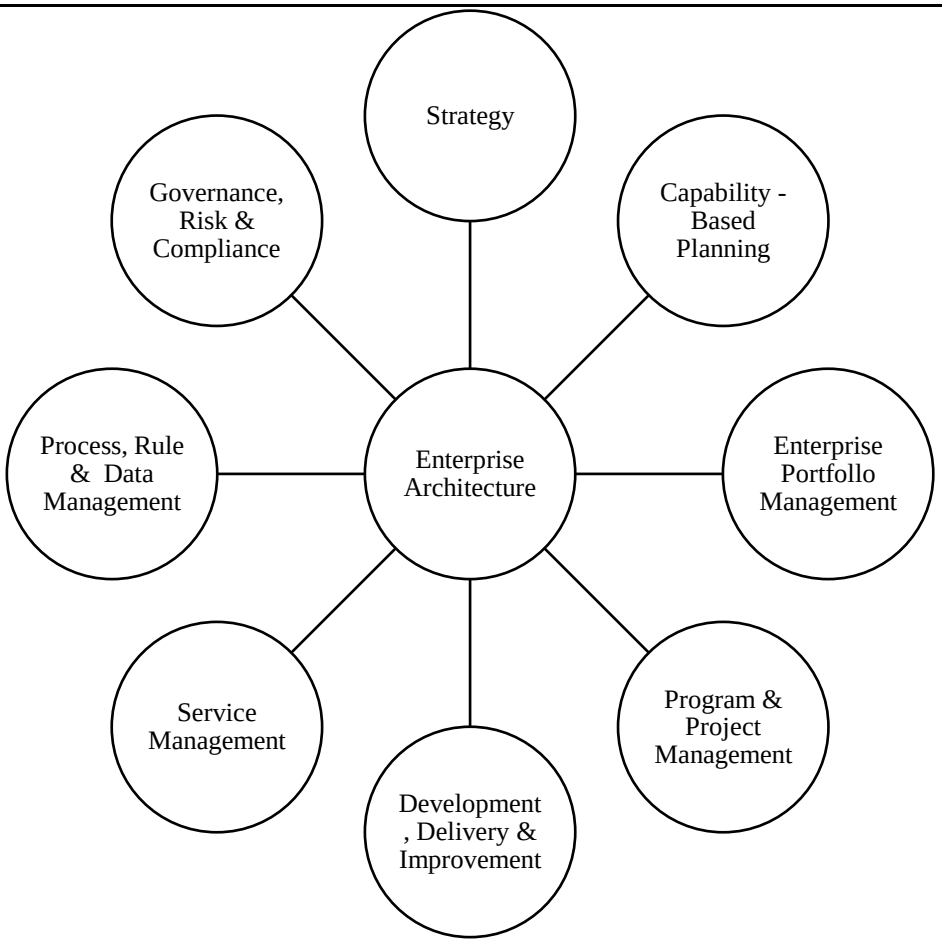

FIGURE 3. Business Outcomes with Enterprise Architecture

6. Conclusion

Current research focuses on Stock of Industry 4.0 in Pakistan's manufacturing And Services Department. Data were collected through a survey questionnaire Functional status of textiles and logistics from staff (managers) sector. Industry 4.0 is still a growing topic in literature and industrial applications. Therefore, the number of scientific publications is still low compared to other mature topics in the field of engineering. The ideas and technologies mentioned are highly relevant to the manufacturing industry and in the medium and long term, Companies and full value Will significantly change the competition between the chains. A block chain is decentralized, so no authority can authorize transactions or set specific rules for accepting transactions.

Reference

[1]. Xu, Li Da, Eric L. Xu, and Ling Li. "Industry 4.0: state of the art and future trends." International journal of production research 56, no. 8 (2018): 2941-2962.\

[2]. Zhou, Keliang, Taigang Liu, and Lifeng Zhou. "Industry 4.0: Towards future industrial opportunities and challenges." In 2015 12th International conference on fuzzy systems and knowledge discovery (FSKD), pp. 2147-2152. IEEE, 2015.

[3]. Mittal, Sameer, Muztoba Ahmad Khan, David Romero, and Thorsten Wuest. "A critical review of smart manufacturing & Industry 4.0 maturity models: Implications for small and medium-sized enterprises (SMEs)."Moktadir, Md Abdul, Syed Mithun Ali, Simonov Kusi-Sarpong, and Md Aftab Ali Shaikh. "Assessing challenges for implementing Industry 4.0: Implications for process safety and environmental protection." Process safety and environmental protection 117 (2018): 730-741.

[4]. Shahdad, Syed Yasmeen, Mudassir Khan, Habeeba Sultana, Mohammad Ashfaq Hussain, and Syeda Meraj Bilfaqih. "Routing Protocols for Constraint Devices Internet of Things Network." In 2019 International Conference on Communication and Signal Processing (ICCSP), pp. 0114-0117. IEEE, 2019.

[5]. Thoben, Klaus-Dieter, Stefan Wiesner, and Thorsten Wuest. "“Industrie 4.0” and smart manufacturing-a review of research issues and application examples." International journal of automation technology 11, no. 1 (2017): 4-16.

[6]. Raviraja, S., and Saif Saeed Osman. "A novel technique for malaria diagnosis using invariant moments and by image compression." In 4th Kuala Lumpur International Conference on Biomedical Engineering 2008, pp. 730-733. Springer, Berlin, Heidelberg, 2008.

[7]. Müller, Julian Marius, Oana Buliga, and Kai-Ingo Voigt. "Fortune favors the prepared: How SMEs approach business model innovations in Industry 4.0." Technological Forecasting and Social Change 132 (2018): 2-17.

[8]. Kiruthiga, G., and M. Mohanapriya. "An adaptive signal strength based localization approach for wireless sensor networks." Cluster Computing 22, no. 5 (2019): 10439-10448.

[9]. Goyal, Vishal, Vinay Kumar Deolia, and Tripti Nath Sharma. "Neural network based sliding mode control for uncertain discrete-time nonlinear systems with time-varying delay." International Journal of Computational Intelligence Research 12, no. 2 (2016): 125-138.

[10]. Khanna, M. Rajesh, A. Rengarajan, R. Prabu, and S. Siva Shankar. "Perception and Eradication of Energy Exhausting Attacks in WSN." Indian Journal of Science and Technology 9, no. 22 (2016).

[11]. Prasetyo, Hoedi, d Wahyudi Sutopo. "Industri 4.0: Telaah Klasifikasi aspek dan arah perkembangan riset." *Jurnal Teknik Industri* 13, no. 1 (2018): 17-an26.

[12]. Balaji, L., K. K. Thyagharajan, Chandrasekaran Raja, and A. Dhanalakshmi. "An optimal mode selection algorithm for scalable video coding." International Journal of Computational Vision and Robotics 10, no. 2 (2020): 143-155.

[13]. Shankar, S. Siva, and A. Rengarajan. "Puzzle based highly secure steganography." In 2017 International Conference on Algorithms, Methodology, Models and Applications in Emerging Technologies (ICAMMAET), pp. 1-5. IEEE, 2017.

[14]. Prakash, B., S. Jayashri, and T. S. Karthik. "A hybrid genetic artificial neural network (G-ANN) algorithm for optimization of energy component in a wireless mesh network toward green computing." Soft Computing 23, no. 8 (2019): 2789-2798.

[15]. Barbosa, José, Paulo Leitão, Damien Trentesaux, Armando W. Colombo, and Stamatis Karnouskos. "Cross benefits from cyber-physical systems and intelligent products for future smart industries." In 2016 IEEE 14th International Conference on Industrial Informatics (INDIN), pp. 504-509. IEEE, 2016.

[16]. Khan, Mudassir, and Aadarsh Malviya. "Big data approach for sentiment analysis of twitter data using Hadoop framework and deep learning." In 2020 International Conference on Emerging Trends in Information Technology and Engineering (ic-ETITE), pp. 1-5. IEEE, 2020.

[17]. Nagy, Judit, Judit Oláh, Edina Erdei, Domician Máté, and József Popp. "The role and impact of Industry 4.0 and the internet of things on the business strategy of the value chain—the case of Hungary." Sustainability 10, no. 10 (2018): 3491.

[18]. Raviraja, S., and Saif Saeed Osman. "A novel technique for malaria diagnosis using invariant moments and by image compression." In 4th Kuala Lumpur International Conference on Biomedical Engineering 2008, pp. 730-733. Springer, Berlin, Heidelberg, 2008.

[19]. Raja, Chandrasekaran, and Narayanan Gangatharan. "Incorporating Phase Information for Efficient Glaucoma Diagnoses Through Hyper-analytic Wavelet Transform." In Proceedings of Fourth International Conference on Soft Computing for Problem Solving, pp. 329-343. Springer, New Delhi, 2015.

[20]. bidin, Shafiqul. "Greedy Approach for Optimizing 0-1 Knapsack Problem." Communications 7 (2017): 1-3.

[21]. Lu, Yang. "Industry 4.0: A survey on technologies, applications and open research issues." *Journal of industrial information integration* 6 (2017): 1-10.

[22]. Rao, P. Srinivasa, and S. Satyanarayana. "Privacy preserving data publishing based on sensitivity in context of Big Data using Hive." Journal of Big Data 5, no. 1 (2018): 1-20.

[23]. Imran, Muhammad, Waseem ul Hameed, and Adnan ul Haque. "Influence of industry 4.0 on the production and service sectors in Pakistan: Evidence from textile and logistics industries." *Social Sciences* 7, no. 12 (2018): 246.

[24]. Santos, Reginaldo Carreiro, and José Luís Martinho. "An Industry 4.0 maturity model proposal." *Journal of Manufacturing Technology Management* (2020).

[25]. Manikandan, G., G. Bhuvaneswari, K. G. Saravanan, M. Parameswari, and D. Sterlin Rani. "Traffic Control Loss and to Handle Seamless Mobility in a Heterogeneous Network with Lesser Transmission Delay." In 2021 5th International Conference on Trends in Electronics and Informatics (ICOEI), pp. 708-715. IEEE, 2021.

[26]. Agrawal, Alka, Vishal Goyal, and Puneet Mishra. "Adaptive control of a nonlinear surge tank-level system using neural network-based PID controller." In Applications of artificial intelligence techniques in engineering, pp. 491-500. Springer, Singapore, 2019.

[27]. Mohankumar, Madhan, A. N. Shankar, T. S. Karthik, R. Saravanakumar, Hemakesavulu Oruganti, S. Venkatesa Prabhu, and N. Rakesh. "A Comparative Study on Crack-Healing Ability of Al2O3/SiC Structural Ceramic Composites Synthesized by Microwave Sintering and Conventional Electrical Sintering." Advances in Materials Science and Engineering 2021 (2021).

[28]. Khan, Mudassir, Aadarsh Malviya, and Surya Kant Yadav. "Big Data Approach Of Sentiment Analysis Of Twitter Data Using K-Mean Clustering Approach." International Journal of Mechanical and Production Engineering Research and Development (IJMPERD) 10, no. 3 (2020): 6127-6134.

[29]. Prasetyo, Hoedi, and Wahyudi Sutopo. "Industri 4.0: Telaah Klasifikasi aspek dan arah perkembangan riset." *Jurnal Teknik Industri* 13, no. 1 (2018): 17-26.

[30]. Müller, Julian M., and Kai-Ingo Voigt. "The impact of industry 4.0 on supply chains in engineer-to-order industries-an exploratory case study." IFAC-PapersOnLine 51, no. 11 (2018): 122-127.

[31]. Kumari, G. Vimala, G. Sasibhushana Rao, and B. Prabhakara Rao. "New bacteria foraging and particle swarm hybrid algorithm for medical image compression." Image Analysis & Stereology 37, no. 3 (2018): 249-275.

[32]. Lakshmi, S. Venkata, Sujatha Krishnamoorthy, Mudassir Khan, Neeraj Kumar, and Varsha Sahni. "Quantum Cryptography: In Security Aspects." In Limitations and Future Applications of Quantum Cryptography, pp. 47-61. IGI Global, 2021.

[33]. Sangeetha, S. Brilly, R. Sabitha, B. Dhiyanesh, G. Kiruthiga, N. Yuvaraj, and R. Arshath Raja. "Resource Management Framework Using Deep Neural Networks in Multi-Cloud Environment." In Operationalizing Multi-Cloud Environments, pp. 89-104. Springer, Cham, 2022.

[34]. Abidin, Shafiqul, Mohd Izhar, and Vikas Rao Vadi. "5th Generation Wireless Communication Revolution: A Recent Study." Novel Perspectives of Engineering Research Vol. 3 (2021): 113-118.

[35]. Goyal, Vishal, Puneet Mishra, and Vinay Kumar Deolia. "A robust fractional order parallel control structure for flow control using a pneumatic control valve with nonlinear and uncertain dynamics." Arabian Journal for Science and Engineering 44, no. 3 (2019): 2597-2611.

[36]. Sekaran, S. Chandra, V. Saravanan, R. RudraKalyanNayak, and S. Siva Shankar. "Human Health and Velocity Aware Network Selection Scheme for WLAN/WiMAX Integrated Networks with QoS." Int. J. Innov. Technol. Explor. Eng.(IJITEE), ISSN: 2278-3075.

[37]. Lin, Kuan Chung, Joseph Z. Shyu, and Kun Ding. "A cross-strait comparison of innovation policy under industry 4.0 and sustainability development transition." Sustainability 9, no. 5 (2017): 786.

[38]. Chouchene, Amal, Adriana Carvalho, Tânia M. Lima, Fernando Charrua-Santos, Gerardo J. Osório, and Walid Barhoumi. "Artificial intelligence for product quality inspection toward smart industries: Quality control of vehicle non-conformities." In 2020 9th international conference on industrial technology and management (ICITM), pp. 127-131. IEEE, 2020.

[39]. Goyal, Vishal, Vinay Kumar Deolia, and Tripti Nath Sharma. "Robust sliding mode control for nonlinear discrete-time delayed systems based on neural network." Intelligent Control and Automation 6, no. 01 (2015): 75.

[40]. Loganathan, K., Nazek Alessa, Ngawang Namgyel, and T. S. Karthik. "MHD flow of thermally radiative Maxwell fluid past a heated stretching sheet with Cattaneo–Christov dual diffusion." Journal of Mathematics 2021 (2021).

[41]. Vadi, Vikas Rao, Naveen Kumar, and Shafiqul Abidin. "Classifying time-bound hierarchical key assignment schemes." In Advances in Computer, Communication and Computational Sciences, pp. 111-119. Springer, Singapore, 2021.

[42]. Sathish, E., G. Manikandan, and G. Bhuvaneswari. "Design and development of multi controlled smart bike." Materials Today: Proceedings (2021).

[43]. Einabadi, Behnam, Armand Baboli, and M. Ebrahimi. "Dynamic Predictive Maintenance in industry 4.0 based on real time information: Case study in automotive industries." IFAC-PapersOnLine 52, no. 13 (2019): 1069-1074.

[44]. Khan, Mudassir, Aadarsh Malviya, and Surya Kant Yadav. "Big Data and Social Media Analytics-A Challenging Approach in Processing of Big Data." In ICCCE 2020, pp. 611-622. Springer, Singapore, 2021.

[45]. Kareem, Sameem Abdul, S. Raviraja, Namir A. Awadh, Adeeba Kamaruzaman, and Annapurni Kajindran. "Classification and regression tree in prediction of survival of aids patients." Malaysian Journal of Computer Science 23, no. 3 (2010): 153-165.

[46]. Kumari, G. Vimala, G. Sasibhushana Rao, and B. Prabhakara Rao. "Flower pollination-based K-means algorithm for medical image compression." International Journal of Advanced Intelligence Paradigms 18, no. 2 (2021): 171-192.

[47]. Raviraja, S., Gaurav Bajpai, and Sudhir Kumar Sharma. "Analysis of detecting the malarial parasite infected blood images using statistical based approach." In 3rd Kuala Lumpur International Conference on Biomedical Engineering 2006, pp. 502-505. Springer, Berlin, Heidelberg, 2007.

[48]. Alessa, Nazek, K. Tamilvanan, K. Loganathan, T. S. Karthik, and John Michael Rassias. "Orthogonal stability and nonstability of a generalized quartic functional equation in quasi--normed spaces." Journal of Function Spaces 2021 (2021).

[49]. Bakhtari, Ahmad Reshad, Vineet Kumar, Mohammad Maqbool Waris, Cesar Sanin, and Edward Szczerbicki. "Industry 4.0 implementation challenges in manufacturing industries: An interpretive structural modelling approach." Procedia computer science 176 (2020): 2384-2393.

[50]. Bhardwaj, Jatin, Siddharth Gautam, Harshit Yadav, Nitin Tyagi, and Shafiqul Abidin. "Taxonomy of Cyber Security in Medical Science." In Emerging Technologies in Data Mining and Information Security, pp. 371-380. Springer, Singapore, 2021.

[51]. Suhasini, S., J. M. SheelaLavanya, M. Parameswari, G. Manikandan, and S. Gracia Nissi. "Input Based Resource Allocation in Motion Estimation using Re-configurable Architecture." In 2021 Fifth International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud)(I-SMAC), pp. 1091-1095. IEEE, 2021.

[52]. Sasibhushana Rao, G., G. Vimala Kumari, and B. Prabhakara Rao. "Image compression using neural network for biomedical applications." In Soft computing for problem solving, pp. 107-119. Springer, Singapore, 2019.

[53]. Geethamani, R., T. S. Karthik, M. Deivakani, Vishal Jain, Anand Mohan, Meenu Chopra, Cosmena Mahapatra, and T. C. Manjunath. "Implementation of wireless home-based automation and safety arrangement using power electronic switches." Materials Today: Proceedings (2021).

[54]. Pasi, Bhaveshkumar Nandanram, Subhash K. Mahajan, and Santosh B. Rane. "The current sustainability scenario of Industry 4.0 enabling technologies in Indian manufacturing industries." International Journal of Productivity and Performance Management (2020).

[55]. Geetha, D., V. Kavitha, G. Manikandan, and D. Karunkuzhali. "Enhancement and Development of Next Generation Data Mining Photolithographic Mechanism." In Journal of Physics: Conference Series, vol. 1964, no. 4, p. 042092. IOP Publishing, 2021.

[56]. Ahlam, B. Q. A., and Z. Abdul Rahim. "A review of risks for Bim adoption in Malaysia construction industries: multi case study." In IOP Conference Series: Materials Science and Engineering, vol. 1051, no. 1, p. 012037. IOP Publishing, 2021.

[57]. Rao, P. Srinivasa, K. Thammi Reddy, and MHM Krishna Prasad. "A novel and efficient method for protecting internet usage from unauthorized access using map reduce." International Journal of Information Technology and Computer Science 3 (2013): 49-55.

[58]. Mishra, Puneet, Vishal Goyal, and Aasheesh Shukla. "An improved grasshopper optimization algorithm for solving numerical optimization problems." In Advances in Intelligent Computing and Communication, pp. 179-188. Springer, Singapore, 2020.

[59]. Li, Ling. "China's manufacturing locus in 2025: With a comparison of "Made-in-China 2025" and "Industry 4.0"." Technological Forecasting and Social Change 135 (2018): 66-74.

[60]. Abidin, Shafiqul. "Enhancing security in WSN by artificial intelligence." In International Conference on Intelligent Data Communication Technologies and Internet of Things, pp. 814-821. Springer, Cham, 2018.

[61]. Chitra, P., T. S. Karthik, S. Nithya, J. Jacinth Poornima, J. Srinivas Rao, Makarand Upadhyaya, K. Jayaram Kumar, R. Geethamani, and T. C. Manjunath. "Sentiment analysis of product feedback using natural language processing." Materials Today: Proceedings (2021).

[62]. Caesarendra, Wahyu, Bobby K. Pappachan, Tomi Wijaya, Daryl Lee, Tegoeh Tjahjowidodo, David Then, and Omey M. Manyar. "An AWS machine learning-based indirect monitoring method for deburring in aerospace industries towards industry 4.0." Applied Sciences 8, no. 11 (2018): 2165.

[63]. Chandrasekaran, Raja, and Balaji Loganathan. "Retinopathy grading with deep learning and wavelet hyper-analytic activations." The Visual Computer (2022): 1-16.

[64]. Thangamani, Thulasimani, R. Prabha, M. Prasad, Usha Kumari, K. V. Raghavender, and Shafiqul Abidin. "WITHDRAWN: IoT Defense Machine Learning: Emerging Solutions and Future Problems." (2021): 104043.

[65]. Sanders, Adam, Chola Elangeswaran, and Jens P. Wulfsberg. "Industry 4.0 implies lean manufacturing: Research activities in industry 4.0 function as enablers for lean manufacturing." Journal of Industrial Engineering and Management (JIEM) 9, no. 3 (2016): 811-833.

[66]. Moiceanu, Georgiana, and Gigel Paraschiv. "Digital Twin and Smart Manufacturing in Industries: A Bibliometric Analysis with a Focus on Industry 4.0." Sensors 22, no. 4 (2022): 1388.

[67]. Widayani, A., E. S. Astuti, and M. Saifi. "Competence and readiness of small and medium industries against of industrial revolution 4.0." In IOP Conference Series: Earth and Environmental Science, vol. 485, no. 1, p. 012114. IOP Publishing, 2020.

