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Applications of AI in Design, Manufacturing and Production

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Abstract: ***Innovation, Adaptation and Improvement are the major thrust for the manufacturing Industries. AI, an emerging technology which is bringing a boon in the market industries. With its increasing features and technology now, it is making its way for manufacturing and product designing. When it comes to AI the base starts with machine learning which has supervised and unsupervised learning in it. Artificial Intelligence models to some extent has a conceptual adaptation of neural networks ,which works similar to that of human brain .AI analyses all the data and draws conclusions for machine and detect all the irregularities and make perfect out of it.AI in relation to CAD is a virtual assistant which gives a broad way into the areas of creativity and ideas which helps in creating multiple variants after recognising the pattern and which in turns helps in making the products in less time. The application of AI which are based upon Machine learning, Internet of things ,block-chain technology, cloud computing and cyber physical system have paved the path for significant improvement in the product designing, quality of product ,improving the manufacturing process and has reduced the time between the development of the new products and its launching while focusing on sustainability. This scientific paper describes how Artificial intelligence is applied in designing of products, interfaces, relation to CAD packages and improving the way of manufacturing which is the need of the hour and demand of society to nurture the satisfaction of customers.***

Keywords: ***Machine learning, Neural networks, Internet of things, block chain technology, cyber physical systems, smart factories, CAD packages and sustainability.***

I. INTRODUCTION

Manufacturing and the smart production are indispensable part of any economy, and the bridge tool to develop the bright future of any industry. To make industries smart and make its advancement in production is essential which leads to the stabilization of the future. At the beginning of the production and manufacturing way back to 1950's was based on the machine tools developed by humans for designing and production which usually takes more amount of time. But with the advancement of the technology and the introduction of AI into the market has given the broad perspective into the production. Deep learning algorithms and machine learning which is integral part of AI is controlling the way in the production by recognizing all the patterns the imperfections after viewing the images by inspecting all parts in the factories in less time has advanced the factories and made them call as smart factories. AI is acting as a virtual assistant for the designers so that the creativity into the products can be more focused and can lead to the production of fine goods with better features. AI has given a lot to the manufacturing industries by analysing data's AI system which can draw conclusions regarding the machine's condition and detecting all the irregularities in order to make productive maintenance. This research paper will lead its way and focus on the major topics of how AI is making its way into the production and manufacturing.



Image 1. Artificial Intelligence and its uses

II. REVOLUTION IN MANUFACTURING: AID OF AI

Artificial Intelligence using the Internet of things, cyber physical systems and predictive analytics has enabled the manufactures to increase the productivity and profit. Application of AI has empowered the factories to be transformed into smart factories and perform smart operations visually. Increasing the use of AI in Manufacturing sector will eventually lead to reduction in time, cost and operational processes.AI in the manufacturing market is predicted to develop from 1.0 billion US dollars in the year 2018 to 17.2 US billion dollars by 2025 at a compound growth of 49.5% over the estimate point.

A. Advantages of AI in Manufacturing Sector

1) Quality Improvement-AI is providing Manufacturers with key features to improve the product quality and users experience.AI provides the aid to address the growing challenges of product defects and the Recalls. Some internal and minor defects in the products which cannot be detected easily causes significant financial and reputational damage to companies. By applying AI based Predictive analytics, companies can take a proactive approach to avoid potential problems before they occur and analyse the data to know a degree of probability that Which products could be troublesome.AI-based solutions and predictive analytics detect the flaws and provide the products which are 100% defect free.



Image 2. Quality management through the assistance of AI

2) Supply chain management: AI provides the supply chain with contextual intelligence which can be used by them to reduce the operating costs and manage inventory. The contextual information and data help the companies to get back to the clients quickly. Manufacturing companies make use of AI along with Machine learning and Big-data to view new insights into different area which includes warehouse management, logistics and a keen eye on the global market.

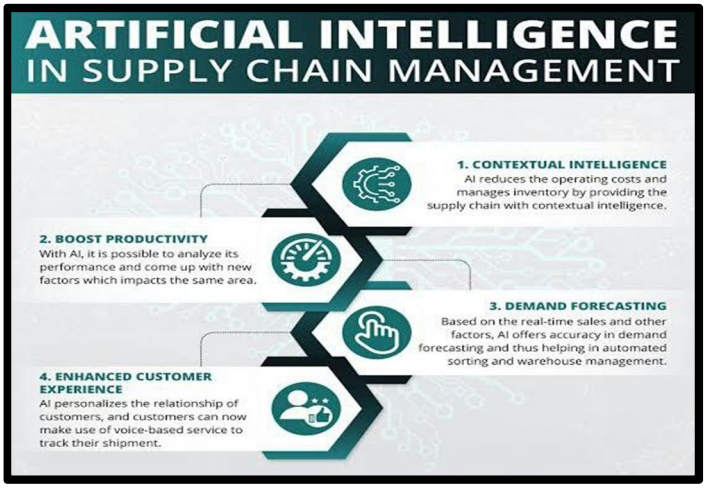


Image 3. Supply chain management using AI

3) Robotics: Building on the advances made in Mechatronics, electrical engineering and computing, Robotics with AI is developing increasingly sophisticated sensorimotor functions that give machines the ability to adapt to their ever-changing environment. The most Important application of AI in robotics is for the task of perception. Robots can sense the environment by means of circuits, integrated sensors and computer visions. Perception is essential for creating an artificial sense of self-awareness in the Robot. Robotics with the convergence will really prove a masterstroke in leading towards Industry 4.0 which is essentially important.

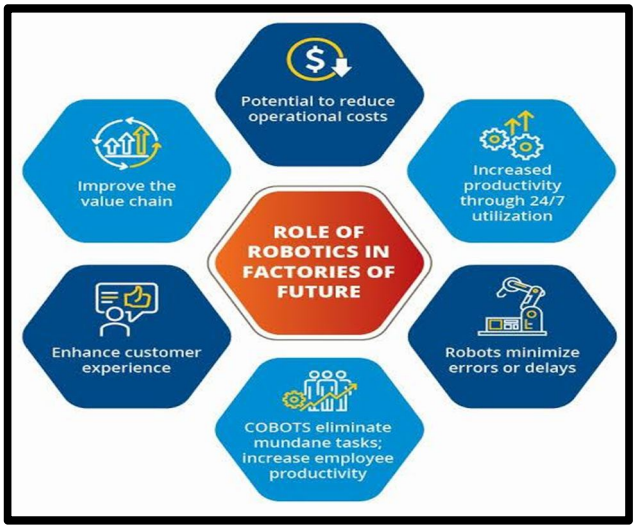


Image 4. Roles of robotics in development of factories

III. TRANSFORMATION IN PRODUCT DESIGN AND DEVELOPMENT

Process, Production and analysis are the 3 major areas which are transformed by AI for the overall high-quality products with no defects.AI based aps and software act as an interface between machine and human beings which works in both General AI (GAI) and applied AI (AAI) functionalities. Mostly AI based products are interactive apps and complex software service which employ AAI and Machine learning to keep their users informed and well assisted. Service-based systems and processes when aided by AAI offer highly consistent production without major interruptions has made tremendous impact on product development by offering tangibly superior new products development, keeping a strong connection with the market and user details, requirements and conceptualisation.AI is now also used to train the robots and technology leaders have now adopted AI to decipher complex CAD codes to assemble robots parts. It combines the capabilities of different technologies like reinforcement learning, unsupervised learning, supervised learning and creates a strong connectivity among the global market. The key focus of AI in CAD is design optimization achieved through the creation of more intelligent designs which are lighter, stronger, economical, more artistic and is present to a degree in the CAD systems that Include topology optimization and generative design capabilities.

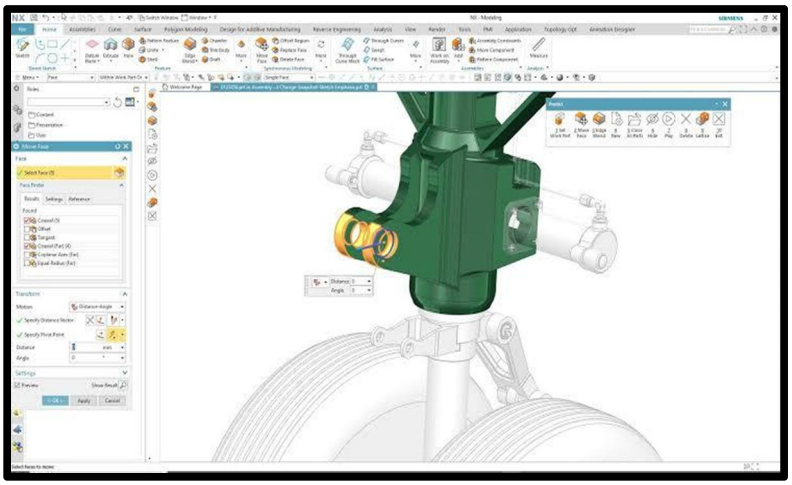


Image 5. Product designing mechanisim



Image 6. Product manufacturing mechanism

IV. ARTIFICIAL INTELLIGENCE AS CO-ARTIFICIER OF DESIGNERS CONSCIENTIOUS OR NOT

Assisting abilities and decision-making processes are of prime importance today and that is progressively and appropriately being done by AI. AI has given a breakthrough to a wide range of designing opportunity and has assisted many ethical designers as well, but still there are many misconceptions which are juggling these days and one of them is "Future of designers because of AI". It is totally understandable that creating a supervised algorithmic replica is not an unchallenging task, it requires patience, knowledge and a lot of experience. The foremost thing that any professional and experienced designer bring in their mind before designing is that not to completely depart everything on supervised machines. Professional designers use AI based replica's for creating effective designs for products in minimum time. For example, printing details of the packaged product multiple times while manufacturing it. Meanwhile these replicas perform an exceptional task not only as artificier but also as a righteous virtual being, one the common example is adobe sensei. It is an AI based investiture that is working skilfully to an acceptable extent. Nevertheless, AI can't take the complete charge when it comes to product design, still human assistance is essential in some cases of creativity as human brain is still the prime requirement for regulating the proper functioning and also to make a proficient decision at a time.



Image.7 AI replica with various abilities

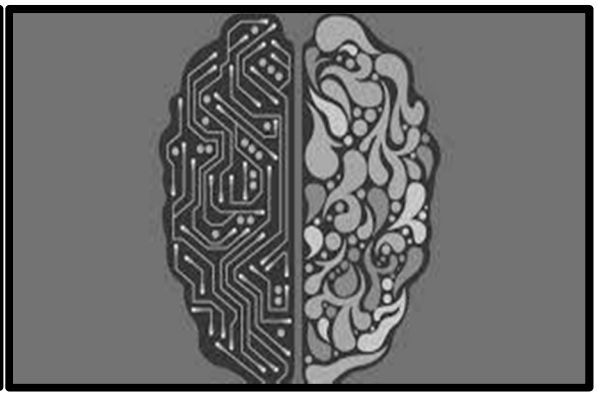


Image.8 Assistance between AI and Brain

V. USE OF AI IN MAKING OF SMART INDUSTRY

The advancement into the industries in terms of manufacturing have been increasing on the rapid rate. AI with its involvement into the industries is making the industries even much smarter. Use of AI into industries 4.0 is using the intelligent software solution so that can be used to analyse high volume of data generated by the factories to identify the pattern, flaws and all the irregularities and generate the product in minimum amount of time with much more perfection and more advancement in that. Industries are using AI to understand all the reserve understanding interpretation and analyse the available data and make the manufacturing process more efficient and reduce the energy consumption , AI in the product can be the autonomous cars which uses sensors so that it can detect all the hurdles into its way and analyse all the turns and perfect parking sites.

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Unlike the general AI which is concerned with the human intelligence the industrial AI is more concerned with the application such that the technology which in turn is increasing customer values, productivity improvement and the insight things. With increasing data and advancement in the time data integration has become the important part of the industries with the good flow of data that can be well integrated with no creation of mess and with no fuss and make it work smartly. AI sees huge transformation of economy unstoppable transformation of the industry and made them call as SMART INDUSTRY.

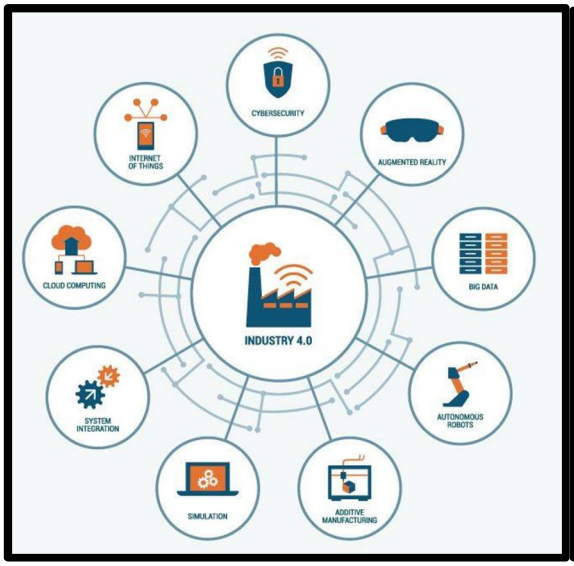


Image.9 Smart manufacturing

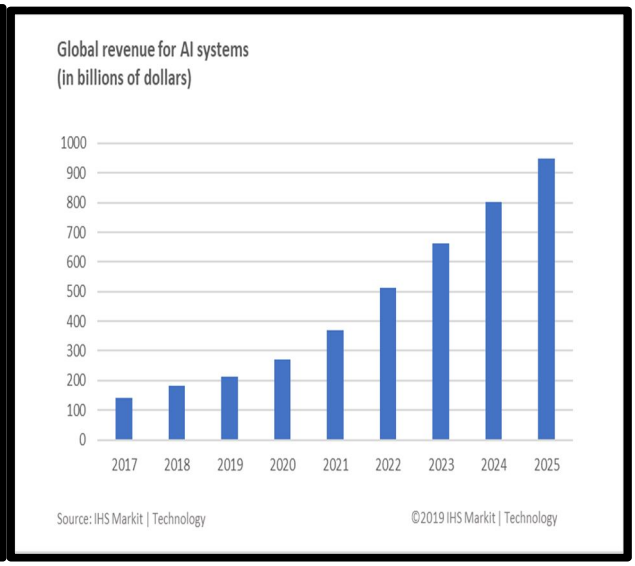


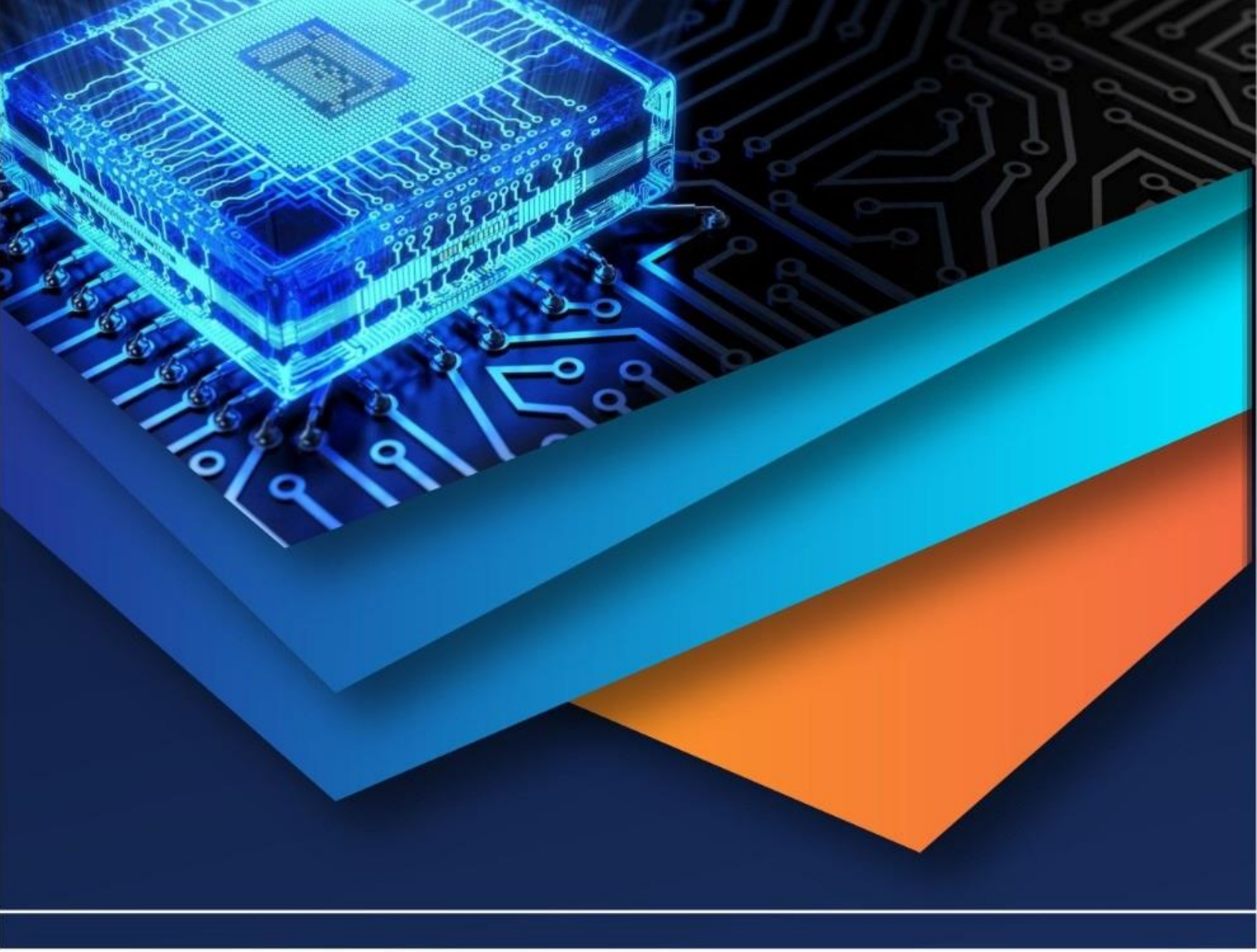
Image.10 AI transformation across industry

VI. CONCLUSION

An application of Artificial intelligence technology is being used in the area of computer aided design and manufacturing. In the era of technology advancement, the aid of Artificial Intelligence is playing an important role in transforming the industry into Smart Industry, which is part of the fourth industrial Revolution 4.0. Artificial intelligence has transformed the traditional manufacturing and Industry practises with its latest smart technology. It is the integral part of the new Industrial revolution which enables the companies to create smarter products and services by reducing costs and increasing efficiency. It combines the capabilities of different technologies and set a continuous flow of all departments which are interconnected with each other.AI is a huge learning potential, armed with data about how people use a certain product, a team can then build better designs for all type of Products. Just like all other ground breaking technologies that have come before it, AI has already started to change the world. Business that will not embrace this technology will soon left in the dust by the competition who will have realized the immense profitability that AI brings to the table. In closing it is appropriate to quote Mr. YannLe Cun (Professor, New York University) "Our intelligence is what makes us humans, and Artificial intelligence is an extension of that quality

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