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A Comprehensive Study on Industry 4.0 Technologies

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ABSTRACT: Nowadays machines which have Artificial intelligence are mostly used in Fourth Industrial Revolution (Industry 4.0). Recently smart machines perform digitalization and automation in industry so there is no need for human intervention. Internet of Things, Cloud Computing, Cognitive Computing, Mobile Computing, Artificial Intelligence and Robotics are used in Industry 4.0. At present most of the manufacturing industries utilize the advanced innovative technologies and smart machines to improve the quality of industry levels. Therefore, the industries can provide better quality products to its customers. This article helps to understand the various emerging technologies of Industry 4.0.

KEYWORDS: AI, Artificial Intelligence, Augmented Reality, Cloud Computing, Cognitive Computing, Data Analytics, Industry 4.0, IoT, Robotics, Smart Factory

I. INTRODUCTION

In recent years the fourth industrial revolution is one of the most trending topics around the world. It is a new phase in the Industrial Revolution that connects intelligent machines with the help of communication technology that is it connects physical world with digital world. It is based on the implementation of the latest digital tools to collect the required data in real time and analyze it then provides useful information to the manufacturing system.

Fourth Industrial Revolution has the basic concept of smart factory, where the machines are integrated with men through Cyber Physical Systems (CPS). The main goal of Smart factory is to make production more competitive, efficient and flexible. Cloud Computing, Internet of Things (IoT), Big data analytics, Cognitive Computing, Mobile Computing, Artificial intelligence (AI) and Autonomous Robots prompt actions and control each other. Industry 4.0 makes industries very smarter and flexible[1].

II. NEED OF INDUSTRY 4.0

In Industry 4.0 we can produce high quality and more innovative products in rapidly. We can use resources in efficient manner. In addition we can reduce operating cost using the technologies of Industry 4.0

Predictive maintenance strategies and advanced technologies like Artificial Intelligence, Internet of Things, Cloud Computing, Mobile Computing, Cognitive Computing, Big Data Analytics helps the manufacturers to increase throughput, decrease downtime and reduce the cost of supplying parts[2].

III. INDUSTRY 4.0 TECHNOLOGIES

Industry 4.0 integrated with the latest technologies to get efficient and effective outcome with optimum utilization of resources in manufacturing. Moreover it improves product quality, workers safety and industrial operations. The following diagram Fig.1 presents the various innovative technologies of Industry 4.0.

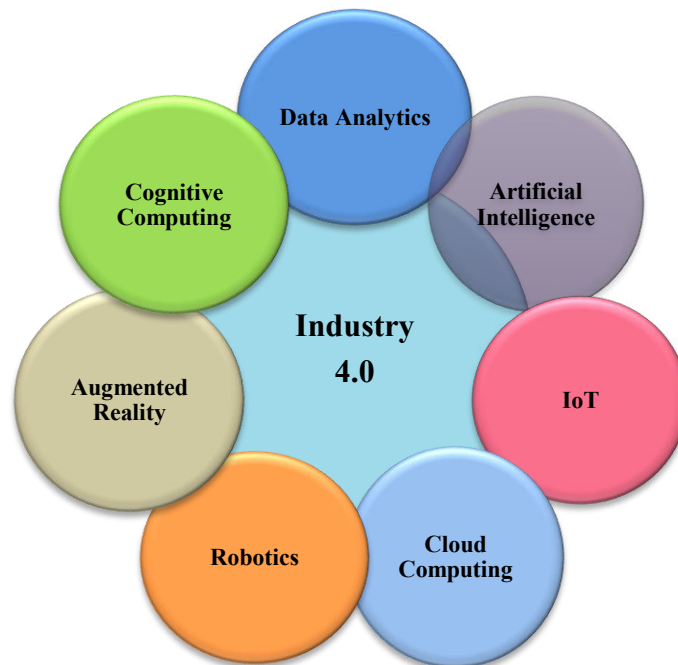


Fig 1: Technologies of Industry 4.0

Latest technologies used in Industry 4.0 are given below.

Artificial Intelligence

Nowadays industries are facing many challenges in terms of market demand and competition. Increasing profitability and reducing costs are essential objectives to survive in highly competitive markets. Artificial Intelligence revolutionizes the industry field by representing a new production factor that can drive business profitability.

In Manufacturing Artificial Intelligence is used in product design and analysis, process control, quality inspection systems, welding quality analysis, machine maintenance analysis, planning and management [3].

IoT

Recently IoT is the new wave of technological innovation that brings changes in the business all around the world. IoT enabled tools and machines remotely manage the factory units in efficient manner. Moreover, it monitors the production flow activities and provides better management of operational cost. In addition it improves the overall workers safety and security in the factory. Nowadays IoT enabled devices change the life style of human beings. It makes workers life simple and more comfortable in their working environment [4].

Cloud Computing

Cloud computing is a promising technology that bring revolutionary changes in Industry 4.0. It is a combination of various latest computing technologies. Moreover, it can play a most important role in data transfer and communication. Recently in Manufacturing and Automation the Cloud could increase productivity, quality, efficiency, flexibility and versatility of almost all automation systems. Cloud technologies have become a remarkable source of inspiration for entrepreneurs in today's world. Cloud-based manufacturing (CBM) contributes significantly to the success of Industry 4.0[5].

Robotics

Nowadays Robotics brings new opportunities to manufacturing industry. Robots are used in manufacturing to perform more complex task. In addition robots perform industrial work rapidly and efficiently than humans. Moreover it improves productivity and product quality.

The autonomous industrial robots play an important role in the smart factories. It assists the human workers in many ways. It monitors everything about a production process like decision making, optimization of the production, minimization of energy consumption, diagnosing and recovering faults [6].

Collaborative robots are designed for the interaction with humans and support workers in Manufacturing. These robots perform the work with more accuracy, reliability and efficiency.

Cognitive Computing

Cognitive computing and analytics contribute a major role in Industry 4.0. Nowadays more industries utilize cognitive computing and AI driven robots to perform complex task. Cognitive analytics has been used to improve workflow processes, detecting fraud. Most popular companies such as IBM, Google, Microsoft, LinkedIn, Facebook, and Netflix have already integrated cognitive analytics into their software products [7].

Augmented Reality

Augmented Reality enables workers to be easily integrated into the digital environment. It supports to the industry for maintenance applications, assembly, and repair of machinery [8].

Augmented Reality is a precious tool for improving and accelerating product and process development in numerous industrial applications. It is used to recognize and avoid design errors in early stages of the development process. In addition, it improves reliability and safety of robotic systems. Moreover, it reduces costs and improves performances of maintenance systems[9].

Data Analytics

Data Analytics are used in manufacturing firms to take smarter decisions in business and produce better business outcomes. In addition it is used in production management, supply chain optimization, price optimization and smart factory design.

At Present the intelligence of the autonomous robot is supported by the latest technologies like Big Data, Artificial Intelligence and Cloud Computing which enable the robots to access the knowledge from various databases, publications, simulation tools and open-source software.

In the last two decades data has been increasing exponentially in various fields. Big data analytics tools are the best solution for Industry 4.0 for formatting, cleaning and transforming vast industrial data[10].

IV. CONCLUSION

Due to globalization, increase of market competition and rapidly changing customer's demands there is many changes in production in the 21st century. In the modern world companies are eager to introduce new technologies to improve the product quality, optimum resources utilization and reduce risks. An innovative business model coupled with the latest technical tools guarantees the success of a company. This article presents the various technologies of Industry 4.0 like AI, IoT and Cloud Computing.

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