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USE OF IOT IN ADVANCEMENT OF COMPUTER AIDED MANUFACTURING

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ABSTRACT

Two technologies that are gaining importance in the manufacturing sector are IoT (Internet of Things) and CAM (Computer-Aided Manufacturing).The internet of things (IoT) is a network of objects and sensors that can communicate and collect data. IoT devices and sensors can be used in the manufacturing sector to track inventory levels, track machine performance, and gather real-time data on many elements of the production process. Contrarily, CAM refers to the use of software to automate and regulate production procedures. Toolpath generation, product design, and production equipment control are all possible using CAM software. When IoT and CAM are combined, CAM software can leverage the real-time data gathered by IoT devices to improve production operations. reduce waste, and improve product quality For instance, IoT sensors can deliver real-time information on machine performance, allowing CAM software to alter production processes in real-time to maximise productivity and lower errors. Additionally, IoT sensors can be used to keep track of the condition of machines and other pieces of equipment. This allows computer-aided manufacturing (CAM) software to forecast maintenance needs and schedule preventative maintenance, which lowers downtime and boosts overall equipment effectiveness. Overall, IoT and CAM integration can significantly enhance production processes, resulting in more productivity, lower costs, and higher-quality products.

I. INTRODUCTION

The term "Internet of Things" (IoT) describes a network of actual objects that are linked to the internet and are capable of contacting one another and other devices. These gadgets, which can be anything from straightforward sensors to intricate machines, are outfitted with sensors, processors, and communication technologies so they can gather and exchange data with other gadgets or servers. Smart homes, industrial automation, healthcare, and environmental monitoring are just a few of the many uses for IoT technology. The term "Computer-Aided Manufacturing" (CAM) describes the use of software to automate and regulate manufacturing procedures. Machines used in manufacturing processes, such as CNC (computer numerical control) machines, robots, and 3D printers, can be designed and programmed using CAM systems. By automating repetitive activities and enabling manufacturers to make accurate, complicated products, CAM software improves productivity, quality, and cost-effectiveness. In fields including aerospace, automotive, and electronics manufacturing, CAM is frequently employed. A more effective and connected manufacturing process may result from the merging of CAM (computer-aided manufacturing) with IoT (Internet of Things). Real-time monitoring and control of the manufacturing process can be accomplished by integrating IoT sensors and devices into the machinery. IoT sensors, for instance, can be installed on equipment to measure a variety of characteristics, including temperature, humidity, and vibration. In order to find patterns and potential problems in the production process, this data can then be gathered and examined. Incorporating CAM software with IoT sensors allows manufacturers to make automatic adjustments to production settings based on data obtained, such as changing the pace of a production line in response to workload. A more proactive maintenance strategy may result from the convergence of IoT with CAM. The ability to identify potential faults before they develop into major difficulties is made possible by continuously monitoring equipment and gathering data on its performance. This could lessen equipment downtime and increase overall equipment efficiency.

II. METHODOLOGY

By allowing the machines to connect with one another, share data, and make decisions based on real-time information, CAM and IoT integration can significantly improve the production process. The procedures and instances of combining CAM and IoT are as follows:

Data Gathering: Using IoT devices like sensors, RFID tags, and barcode readers, the first step is to gather data from the machines and sensors. Information on machine performance, temperature, humidity, energy use, and

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other factors may be included in this data. As an illustration, RFID tags can be used to track the movement of raw materials and completed goods in a factory, and temperature sensors can be inserted in machines to check their temperature.

Data Transmission: In order to analyse and process the data gathered from the devices and sensors, a central system must receive it. Wireless communication technologies like Wi-Fi, Bluetooth, and cellular networks can be used for this. Using Wi-Fi or cellular networks, for instance, data gathered from RFID tags and temperature sensors can be sent to a central database. Data processing is required to produce actionable insights once data has been gathered and delivered. Machine learning algorithms that can spot patterns and abnormalities in the data can be used for this. To identify any unusual spikes or declines in temperature that would point to a failure, machine learning techniques can be employed to analyse the temperature data gathered from the devices

Making decisions: The CAM system can decide how to optimise the production process based on the insights gained from the data. This can entail changing the settings on the equipment, planning maintenance, or moving the materials. For instance, the CAM system can automatically change a machine's parameters to lower the temperature and stop it from malfunctioning if it is overheated.

Final step: The CAM system may put the conclusions that were reached during data analysis and decision-making into action. This may entail instructing the machinery, altering the production procedure, or warning employees. As an illustration, the CAM system can automatically schedule a maintenance appointment and notify the appropriate employees if it deems that a machine needs maintenance.

III. MODELING AND ANALYSIS

Years ago, the concept of incorporating sensors and chips into actual physical objects would have seemed absurd and unfeasible. But it became a reality because of the Internet of Things. Within a short period of time, this technology has developed into the key concept for many firms. Driving, cooking, shopping, manufacturing, and other elements of daily living have all undergone significant change as a result of the Internet of Things. Today, a lot of IoT gadgets are emerging. By the end of 2019, 8.3 billion IoT-active devices, excluding smartphones, tablets, and laptops, are forecast to exist. By 2025, there will be 29.7 million Internet of Things devices across a variety of businesses. Numerous IoT projects today focus on logistics, customer service, security and operations, facility and asset management. IoT is therefore a promising technological development, if not a foundational element of business in 2020 and beyond. So, let's explore the top IoT examples in manufacturing in more detail.

1. Predictive Maintenance

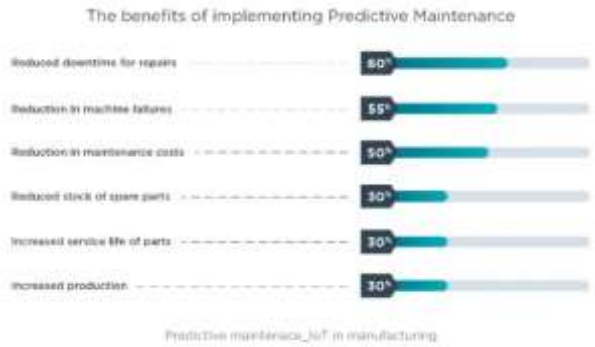

Figure 1: The benefits of implementing predictive maintenance

IFTTT, cloud/API, or legacy systems producers can receive crucial maintenance data by integrating IoT-driven devices with a variety of sensor points (temperatures, vibration, voltages, currents, etc.). With the use of this information, it is possible to gauge the state of a piece of equipment, identify danger indications, send out notifications, and initiate the appropriate repair procedures. In this way, IoT turns maintenance into a quick and automated process that predicts a failure well in advance. Furthermore, because the actions are conducted only when they are required, it promotes cost savings over conventional preventive procedures. When managers receive accurate data in a timely manner, they can identify broken plant gear. Additionally, it is beneficial to carefully plan maintenance activities and keep systems operational while personnel are still doing the job. IoT could increase equipment lifespan, contribute to plant safety and lower the risks of accidents that affect the environment negatively

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2. Remote Control of Production

You can gather and analyse the massive data sets required for monitoring various field devices like switches, valves, and other indication elements by reallocating your company's computational resources to a custom cloud or by connecting the device to one of the well-liked BAAS (backend as a service) or PAAS (platform as a service) cloud computing models.

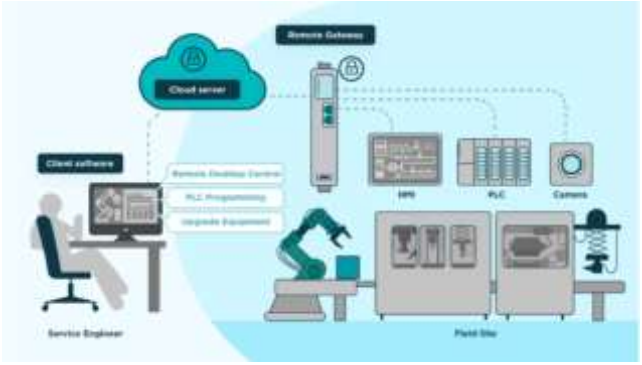

Figure 2

IoT allows for the transmission of this data to the industrial automation system, which guarantees complete machinery control throughout the production process. IoT devices inserted into remote control systems are already paying off for the telecommunications, oil and gas, and power generating industries. The centralised control over the production gear is the most noticeable aspect of remote production control in industrial automation systems. A far clearer and quicker understanding of the actual production field may be gained through information collected through distant control. It aids employees in their analysis of corporate data. With all of this, IoT technology becomes a key tool for assuring secure automated manufacturing, keeping an eye on the workforce, and locating employees.

IV. RESULTS AND DISCUSSION

Advantages:

Enhanced Efficiency: By enabling machines to connect with one another, share data, and make decisions based on current information, CAM and IoT integration can enhance efficiency. This can minimise downtime, enhance the calibre of the output, and streamline the manufacturing procedure.

Predictive Maintenance: By continuously tracking machine performance, the CAM system may anticipate when maintenance is necessary, minimising the possibility of unplanned downtime.

Cost Savings: By maximising energy use, cutting waste, and increasing general efficiency, CAM and IoT integration can reduce costs.

Increased Flexibility: IoT devices can gather information from a variety of sources, enabling the CAM system to alter the manufacturing process in response to shifting conditions.

Improved Quality: The CAM system can identify flaws and quality problems before they grow into larger problems by monitoring and analysing data in real-time.

Disadvantages:

Implementation costs: CAM and IoT integration necessitates a large investment in IoT hardware, software, and infrastructure. For smaller firms, this may provide a challenge.

Data Security: There is a risk of data breaches and cyber assaults because IoT devices collect and transmit sensitive data.

Complex Integration: CAM and IoT integration can be challenging and calls for extensive technical knowledge and training. IoT devices must be maintained and kept up to date, which can be expensive and time-consuming.

Reliability: If IoT devices or communication networks malfunction, the CAM system may not operate as intended, thereby disrupting production. CAM and IoT integration can significantly enhance the production process and ultimately lead to cost savings, increased efficiency, and higher product quality, despite some drawbacks.

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V. DECLARATION

The manufacturing sector offers a large future potential for the fusion of IoT (Internet of Things) with CAM (Computer-Aided Manufacturing). Here are some conceivable developments in the future:

Utilising Edge Computing More: Edge computing is a computing design that moves processing power closer to the data-generating devices. By lowering latency and bandwidth consumption, this technology makes it simpler to handle and process massive amounts of data from IoT devices. Edge computing may be used more frequently in the future to manage the growing volume of data produced by IoT devices in the manufacturing sector.

increased Utilisation of Predictive Analytics: Predictive analytics analyses data and makes predictions about future occurrences using machine learning algorithms. Predictive analytics may be used more frequently in manufacturing in the future to forecast product demand or to determine when machines require maintenance.

Augmented reality (AR) can be used to overlay digital information over the real world, giving workers access to real-time information regarding the manufacturing process. Future manufacturing may make greater use of AR to boost productivity, decrease errors, and boost safety.

Digital twin adoption: A digital twin is a virtual representation of a real-world item, such as a machine or a process. A digital twin of the physical object can imitate its behaviour and forecast its future performance by employing IoT sensors to collect data about the physical object. To improve productivity and decrease downtime, more manufacturers may start using digital twins in the future. Blockchain is a distributed ledger system that allows for the safe storage and sharing of data between numerous parties. Blockchain technology may eventually be combined with IoT and CAM to enhance data security, boost transparency, and simplify supply chain management. Overall, the potential for merging IoT and CAM in production is encouraging, and in the years to come, we may anticipate the emergence of additional ground-breaking products and technology.

VI. CONCLUSION

In conclusion, the manufacturing sector's use of IoT and CAM has the potential to fundamentally alter how goods are made. Manufacturers may increase productivity, decrease downtime, optimise energy use, and enhance overall product quality by using IoT devices and data analytics. The advantages of integrating these technologies are substantial and widespread, despite some obstacles including installation costs and worries about data security. The future of manufacturing will require the integration of IoT and CAM because as time goes on, more cutting-edge solutions and technologies are likely to appear in this area.

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