Cloud computing in industrial automation systems

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Abstract. Automated systems in industries increase production and make things more accurate. These both things give very much profit to the manufacturer. No doubt these automated systems of different types reduced the rate of error and increase efficiency but it was facing some very serious issues like loss of data, security of data, and maintenance of the automated system. These are issues where cloud computing involves resolution and provides solutions to overcome these issues. This paper describes the problems of automated systems in industry and the help of cloud computing for the mitigation of the issues faces by automated systems. In this paper discussion about the future role of cloud computing is described for enhancing the automation in industry.

1. Introduction
Terms like “cloud” and “cloud computing” have become more noticeable in recent times. Cloud computing is the new centralized online data repository tool that provides services related to servers, networking, databases, storage, analytics, and whatnot. The use of this technology makes things faster, easier and economical. The users only pay for the cloud services they use. The rest is free. This reduces the operating cost and helps in running the system both effectively and efficiently. Cloud computing is a term that is becoming very familiar now a day. It is providing solution of the issue which are creating hurdles for installation and working of automated system in the industry. Term cloud computing is defined as access of network on demand for sharing of different computing resources like applications, storage, services, servers, and networks. It has some specific properties. Cloud system provides services like storage on server and network response automatically without human interaction to each user. In cloud computing networks and servers can be accessed through many different platforms like mobiles, computers, laptops, tablets, and other resources by using web services or another standard way to access the cloud. Resources in the cloud are kept in a pool to provide services to different consumers at a time. Assignment of resources is made by using a model called multi-tenant. This model dynamically assigned the resources and reassigned them on user demand. In cloud computing consumer is not aware of the physical location of resources that are providing him services [1]. Cloud provides elasticity in services. Cloud can automatically increase the storage and computing capacity according to the needs of the user. Users can get unlimited storage space and computing power. While the use of control systems like robots and automated computers for different process handling instead of humans is called industrial automation. This automation in industry increased the manufacturing and production of industries. The operating cost of these systems is also low. It also eliminates the cost of healthcare. It also increases the
working time. It also saves the salary of workers. Maintain ace cost is much lower than the salaries of workers. This system can work 365 days of the year which results in an increase in productivity. An automated system also reduced the chances of error because machines work on fixed patterns and according to commands given to them [2].

2. Discussion
Industrial automation is defined as the use of computer systems and artificial intelligence in place of humans in different industries. It provides high quality with flexibility. It enhances the productivity as well as the safety of the system. [3] Cloud computing has made its mark in industrial automation systems as well. It not only saving time but it’s also a great source of saving money. Above that it reduces the chance of error and organizations can create reliable workflows. This plays directly on better IT and corporate management.

2.1. Cloud computing in Finance
The first and most benefit of a cloud financial system is maintenance cost is very low. There are a lot of features the financial industry could use to their advantage. SaaS programs are being adopted by many banks and insurance in order to handle records and back-office tasks. Cloud-powered AI and machine learning is being used in capital markets to help with financial data management and investment strategies [4].

2.2. Cloud computing in automotive
For the automotive industry, the best technology solutions are keeping up with data on their supply. This helps them improve their communication with their clients, to provide them with exactly what customers want. It is much easier to keep track of what parts are available for both manufacturers and automotive suppliers by keeping data in a common cloud environment. With smart cars becoming more readily available, auto companies can use cloud-based analytics solutions to use a large amount of data produced by the car on the road [4].

2.3. Cloud computing in manufacturing
Every part of a manufacturing process can be integrated with cloud solutions. It is much faster to filter different size orders through the same channels and provide products according to their need. Automation software programs can be used to automatically manage the installation, management, and configuration of cloud-based computing systems. Using cloud-based resources more efficiently. Most companies use the cloud for essential services and applications. Cloud automation is a time saver and improves cloud management, becoming more noticeable in IT companies [4].

3. The issue with industrial automation system
Industrial automation is usually adopted for the reduction of accidents industry and it is used for increasing efficiency. An automated system like robots, equipment that works autonomously, and automated conveyor system are used in the industry which is increasing efficiency and production. There are different types of industrial automation systems are working in the industry. These systems are producing data and worked through different kinds of automation like fixed, programmable, and integrated automation. As described above the goal of an automated system is to improve efficiency than it is very important to make an analysis of data which is produced by these systems. This analysis can be used for making actionable intelligent systems. Cloud computing makes manipulation of data much easier which is produced by these automated systems. Data manipulation is not the only issue that automated systems are facing. There are some other issues in automated systems in the industry are existed. Automation in industry and system control is still relied on legacy security for dealing with threats that are creating hurdles. It was a good policy in the past and it was working. But after introducing IP-based communication in the automated system of industries relying on these outdated and traditional security tools is increasing risks for data leakage [6]. Because automated cyber-attacks can easily found
vulnerabilities in the systems which are working on IP-based communication. Unplanned failure of automated systems has also affected the system and it is also a big challenge for the automation of industry. According to an estimation unplanned downtime causes the loss of $260000 per hour for the manufacturers who are using automated systems in their companies. This estimation is taken from all the businesses. Cloud computing provides solutions for all these issue and addition of internet of things devices in the automation of industry make this mitigation process very easy [7].

4. The role of cloud computing for mitigation of automated systems issues in the industry
The centralization feature of cloud computing provides a very good solution to issues facing by automated systems of industry. Role cloud computing in mitigation of issue related to automated systems of industry are given below.

4.1. Enhance analysis of data
All the automated systems used in the industry are controlled through data and its manipulation. Such scheduled operations that pass the instruction to the function for executing on time are created from previous data. Cloud computing allows the automated systems in industries to perform the scheduled operation in real-time and provide all the required computing resources to handle big data sets [8]. In cloud computing, it does not matter that data is complex or large because cloud computing provides more computing resources for complex data which can be easily handled for generating analytics of data.

4.2. Enhancement in measures for cybersecurity
Cybersecurity is always a big issue for automated systems in industries. Because due to automation IoT devices usage is increasing. These devices need many communication protocols which left many vulnerabilities which can easily be exposed by cybersecurity attacks. A centralized system of industrial cloud computing helps in overcoming this issue and provides storage for complex and large data sets. We can say that technologies used in automated completely depend on cloud computing for protection from cyberattacks. In the area of cybersecurity cloud computing technology is excelling day by day. It is due to the continuous updating of cloud computing involved in the industry. This is also due to options of using SIEM tools and integration of third-party security information for enhancing security [9]. Cloud computing also provides easy data recovery in case of data loss from the data which was stored as backup.

4.3. Define the future of automation systems in industries
The future of automated industrial systems is based on emerging technology such as the internet of things, Artificial intelligence, edge computing, and Machine learning. Integrating these technologies with the current system needs simulation to see the effects before implementation. Cloud computing provides an environment for testing and doing analysis for integration [10].

4.4. Enhance consolidation of workload
Centralization of cloud used in the industry plays a vital role for effective automation of industrial systems. It is the industrial cloud which helps in combining different industrial automation system in a single secure and measurable platform [9]. In this way, the network and IT infrastructure involved in handling the operation of the industry can be reduced. This system also reduced the maintenance and management cost of the system because it is easy to handle all the resources in one place instead of handling them at many different platforms [11].

5. Conclusion
Many fields have already adopted cloud computing in their manufacturing, supplying, or selling businesses. These businesses are prime examples to see how beneficial it can be to integrate and implement cloud computing in industrial automation systems. These examples can also be used for
analysis and learning of better usage of cloud computing in a future implementation. The benefits of cloud computing are still being measured against the risks of output loss, protection, availability, and unknown server locations in the process control industry. Virtualized servers, however, are becoming increasingly more attractive to end-users with the bevy of technological advances. For older, space-constrained plants that need these latest developments in equipment, where few applications can be sustained in a small, cloud environment, the rise of cloud computing eventually requires survival. This may also contribute to the transfer of secondary monitoring and expert systems to the cloud as well. We will possibly see more and more of these systems being virtualized, providing plant operators with more cost and space advantages.

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