

IoT and its Potential for Transforming Industries

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ABSTRACT

The Internet of Things (IoT) includes connected devices that communicate over the Internet. This technology has the potential to change industries by increasing productivity, reducing costs and improving efficiency. In manufacturing, IoT devices improve machine maintenance, supply chain management and inventory management. Healthcare uses IoT for drug tracking and patient tracking. Transportation can benefit from improved visibility and streamlining of operations. In the energy sector, IoT optimizes use and reduces waste. New IoT applications can be used in a variety of industries to increase productivity, efficiency and effectiveness.

Key words: IoT, Technology, Cost, Efficiency, Information; Devices

1. INTRODUCTION

Internet of Things (IoT) is a developing technology that has the potential to transform several industries [6]. The Internet of Things (IoT) is a network that allows devices to connect to each other and communicate on internet. Examples of these devices include cell phones, wearable technology, home appliances, and work machines. IoT technology has the potential to reduce costs, increase productivity and improve efficiency across multiple sectors.

IoT encompasses a colossal potential to alter segments, and its employments are presently being seen in numerous distinctive businesses. IoT is utilized in fabricating, for occurrence, to move forward hardware support, supply chain administration, and stock administration. IoT gadgets may offer assistance producers spare squander, boost efficiency, and raise the standard of their items by being included into the fabricating handle [7]. IoT is being utilized in healthcare to track medication utilization and screen patients from a remove. Therapeutic experts can deliver patients criticism in genuine time by utilizing this innovation and keep a closer eye on their wellbeing. Quiet results can be upgraded as a result, and healthcare costs can be diminished.

IoT is being utilised in the transportation sector to enhance safety and organize the supply chain [1]. For instance, linked automobiles may talk among themselves to lessen traffic congestion and prevent accidents. IoT devices will be used in delivery routes and track the location of goods during transportation. This will lead to a quicker and more effective

delivery of the items, cutting costs and raising client satisfaction. IoT gadgets may be utilised to optimise energy use and cut waste. Smart grids have the capacity to track energy that is being consumed and modify supply accordingly, cutting costs and enhancing supply dependability.

These represent just a small sample of the numerous sectors utilizing IoT. We should anticipate seeing even more cutting-edge IoT applications as technology advances, which will boost efficiency, lower costs, and increase production across a variety of industries.

Real-time data gathering and analysis is one of the key benefits of Internet of Things technology. This implies that companies could be able to make better judgments if they have access to correct and current information. IoT devices, for instance, can be used to continuously monitor machine performance in the manufacturing sector. This enables producers to recognize potential defects before they become serious problems and to take prompt corrective action.

A substantial amount of saving money is yet another benefit of IoT technology. Businesses may lower their operating costs and boost profitability by streamlining manufacturing processes, cutting waste, and increasing efficiency. It plays an important role in providing a sustainable environment hence creating a better business model. IoT technology implementation in a corporation, however, might also come with certain difficulties [5]. Data security is among the major difficulties. There is an increasing danger of cyber assaults as more gadgets are online. To safeguard their data and equipment from online attacks, organisations must put in place strong security measures.

2. APPLICATION OF IOT

2.1 IoT in Manufacturing

IoT technology is frequently employed in the industrial sector to streamline workflows, save waste, and raise standards. Companies may gather real-time data, analyse it, and make educated decisions to enhance efficiency and productivity by IoT device integration for industrial operations [6].

One of the main uses of IoT in manufacturing is machine maintenance. Manufacturers can reduce downtime and improve overall equipment functionality by using IoT devices to track machine performance in real-time, which can identify

potential problems before they become serious ones. Another use of IoT devices is inventory management [7]. By tracking the movement of goods in real-time, businesses can reduce waste and improve supply chain management. RFID tags, for example, can be used to monitor the flow of items in a warehouse, making it easy for businesses to find and retrieve items when needed.

Another example is the application of IoT to industrial quality control. IoT devices may be used to continuously check for defects and ensure that items meet the necessary criteria in terms of product quality [5]. This might benefit manufacturers by lowering waste and raising client contentment. In industrial facilities, it is also feasible to maximize the usage of IoT devices for energy efficiency [7]. Energy use may be monitored by smart energy systems, which can then adjust supply to save costs and improve supply reliability.

IoT technology in manufacturing has more advantages overall. Manufacturers may save costs and boost profitability through increasing productivity, cutting waste, and enhancing quality. IoT technology implementation in manufacturing, however, might also come with certain difficulties, such as the expense of putting in new hardware and software and the requirement for strong data security measures. General Electric (GE) is one business that has effectively applied IoT technology in manufacturing. The "Brilliant Manufacturing" system, created by GE, employs IoT gadgets to gather data from equipment on the manufacturing floor. To identify potential issues and improve machine performance, this data is analysed. The solution has enabled GE to save money by reducing downtime and increasing machine efficiency.

Another such is Bosch, which uses IoT technology in its production processes to enhance quality control. Bosch utilises IoT sensors to keep track on the standard of its goods in real-time, spotting flaws and making sure they adhere to the needed standards. Bosch has reduced waste and increased customer satisfaction as a result.

2.2 IoT in Healthcare

The healthcare industry is changing as a result of the Internet of Things (IoT), which is enabling novel treatment options, improving patient outcomes, and cutting costs. IoT devices and sensors can be used by medical professionals to collect and analyse real-time data to enhance patient care, diagnosis, and treatment.

One of the main applications of IoT in healthcare is remote patient monitoring. Wearables, smart devices, and sensors are examples of Internet of Things (IoT) technologies that can be used to monitor a patient's vital signs in real-time, including blood pressure, heart rate, and oxygen saturation levels. This reduces the need for hospitalization and enhances patient outcomes by enabling medical staff to remotely assess patients' health and take necessary action. Remote monitoring can improve quality of life and reduce hospitalization, while also allowing elderly or chronically ill patients to receive timely treatment at home. The healthcare industry is changing as a result of the Internet of Things (IoT) [1], which is enabling novel treatment options, improving patient outcomes, and cutting costs. IoT devices and sensors can be used by medical professionals to collect and analyse real-time data to enhance patient care, diagnosis, and treatment. Remote patient monitoring is one of the major uses of IoT in

medical fields. Wearables, smart devices, and sensors are examples of Internet of Things (IoT) technologies that can be used to monitor a patient's vital signs in real-time, including blood pressure, heart rate, and oxygen saturation levels. This reduces the need for hospitalization and enhances patient outcomes by enabling medical staff to remotely assess patients' health and take necessary action. Furthermore, long-term care patients or elderly patients can benefit from remote monitoring by continuing to live at home. IoT devices can potentially boost the efficacy and efficiency of hospital operations. By tracking their locations, IoT-enabled asset monitoring programs, for example, can keep an eye on how medical items, such as wheelchairs and hospital beds, are distributed and used. This can increase the overall effectiveness of hospital operations and decrease the time and effort needed to find the equipment.

The patient education and engagement processes can be enhanced with IoT technologies. Patients can receive personalised health information, reminders, and coaching through the usage of devices like smartphones, smartwatches, and smartwatch bands. This might increase patient motivation and involvement, which would result in improved health results. IoT technology has a lot to offer the healthcare industry overall. Healthcare providers may raise the standard of care and raise patient happiness through enhancing patient outcomes, cutting costs, and enabling new kinds of treatment. The necessity for strong data security measures and the integration of new hardware and software into current healthcare systems are two issues that will come up when using IoT technology in the healthcare industry [1].

Philips is one business that has effectively applied IoT technology in healthcare. IoT-enabled healthcare technologies from Philips include wearable tech, smart medical devices, and systems for remote patient monitoring. Healthcare experts have profited from these items by providing better treatment, lowering costs, and improving patient outcomes.

2.3 IoT in Agriculture

By enhancing productivity, decreasing waste, and enabling more sustainable farming practises, IoT technology has the capacity to significantly transform the agriculture sector. Farmers may gather and analyse real-time data to optimise crop yields, save costs, and conserve resources by incorporating IoT devices and sensors into agriculture operations.

Precision farming is the main IoT uses in agriculture. Precision farming involves gathering information on soil moisture, temperature, and other environmental variables using IoT devices like sensors, drones, and GPS. By revealing when to water, fertilise, and harvest crops, this data may then be utilised to maximise agricultural output. This may increase crop yields, cut expenses, and help farmers use less water and fertiliser.

The management of animals can also be improved by IoT technology. Livestock may be tracked in real-time for location, health, and behaviour using IoT devices like RFID tags and smart collars. The health of animals can be tracked, prospective health issues may be found, and feeding plans can be made more effective using this data. To guarantee that creatures are getting the best nutrition and hydration, IoT

technology may also be utilised to check the standard of feed and water.

IoT in agriculture also has a place in supply chain management [1]. Crops may be tracked as they move from the field to the market using IoT-enabled logistics systems to keep tabs on their position and state. By ensuring that crops are transported and kept in the best possible conditions, this information may be utilised to streamline logistics and lower waste. To maintain crops fresh and safe for consumption throughout storage and shipping, IoT technology may also be employed to check the condition of the crops. IoT technologies may also help agriculture be more environmentally sustainable. Farmers can optimise irrigation and use less water by monitoring soil moisture, temperature, and other environmental parameters. To make sure that farming practises are not affecting the environment, IoT technology can additionally be employed to check the characteristics of the air and water. IoT-enabled sensors can also be utilized to track fertiliser and pesticide usage, assisting farmers in minimising their use and environmental effect. IoT technology in agriculture has a lot of advantages overall. IoT technology may assist farmers in cutting expenses and increasing their bottom line by enhancing production, decreasing waste, and allowing more sustainable agricultural practises. IoT adoption in agriculture, however, can also include specific difficulties, including the requirement for strong data security measures and the integration of new hardware and software into current farming systems. John Deere is one business that has effectively applied IoT technology to farming. John Deere has developed a number of IoT-enabled farming instruments, such as combines and tractors. These instruments could be used to measure the temperature, moisture content, and other environmental factors of the soil. Farming operations can be made more cost-effective and efficient with the help of this information.

Another example is IBM's Watson Decision Platform for Agriculture, which uses artificial intelligence and Internet of Things sensors to provide farmers with information on crop yields, soil moisture, and other environmental variables. Allowing farmers to choose when to plant, irrigate, and harvest their crops will boost productivity and cut down on waste.

2.4 IoT in Transportation

The Internet of Things (IoT) is significantly changing the transportation sector by allowing businesses to increase operational effectiveness, increase safety, and save costs. Transportation businesses may gather and analyse real-time data and make better decisions and perform better by linking infrastructure, cargo, and vehicles to the internet.

Fleet management is one of the main uses of IoT in the transportation industry. Vehicle position, speed, and fuel consumption may be tracked in real time with IoT-enabled sensors and devices [3]. By making use of this data, delivery times, route optimization, and fuel efficiency can all be increased. To minimize downtime and boost vehicle performance, fleet managers may also utilise IoT technology to monitor the condition of their vehicles, spot possible problems, and plan maintenance in advance. Additionally, Applications of IoT technology can enhance cargo management and tracking. IoT-enabled sensors can be used to track the location and condition of cargo in real time [3],

providing shippers and carriers with vital information about the movement and condition of their cargo. Better logistics, a decrease in theft and property damage, and an increase in customer satisfaction are possible outcomes.

Another application of IoT in transportation is traffic management. By employing IoT-enabled sensors to track traffic flow and congestion in real-time, transportation agencies can improve traffic signals, reroute traffic, and reduce congestion. This might reduce fuel use and emissions, minimize travel times, and improve the efficiency of transportation networks.

It's possible that IoT technology will be used to improve traffic safety. IoT-enabled sensors can be used to monitor driving habits [3], identify indicators of fatigue and attention problems, and alert drivers to potential hazards. Infrastructure such as highways, bridges, and tunnels may be made safer by IoT technology by keeping an eye out for wear and tear and alerting authorities to any maintenance issues. Another application of IoT in transportation is traffic management. By employing IoT-enabled sensors to track traffic flow and congestion in real-time [3], transportation agencies can improve traffic signals, reroute traffic, and reduce congestion. This might reduce fuel use and emissions, minimize travel times, and improve the efficiency of transportation networks.

IoT technology may also be utilised to increase road safety. IoT-enabled sensors may become accustomed to track driver behaviour, spot signs of attention and exhaustion, and warn drivers of impending dangers. By monitoring for wear and tear and warning authorities of possible maintenance concerns, IoT technology may additionally be employed for increase the safety of infrastructure like bridges, tunnels, and roads. IoT technology has a lot to offer the transportation industry overall [1]. IoT technology may aid transportation firms in remaining competitive in a sector that is getting more crowded and difficult to operate in by increasing operational efficiency, enhancing safety, and lowering costs. The necessity for strong data security measures and the integration of new hardware and software into current transportation systems are two problems that might arise when using IoT technology in the transportation sector. UPS is one business that has effectively applied IoT technology in the transportation industry [1]. UPS has created a number of IoT-enabled solutions that may be used to gather and analyse real-time data on vehicle performance, cargo status, and delivery schedules. These solutions include telematics devices and cargo sensors [2]. Routes may then be optimised, fuel consumption can be decreased, and customer happiness can be increased using this data.

Another such is the IoT-enabled Sentilo traffic control system used by the city of Barcelona. Transportation authorities may improve traffic signals, redirect traffic, and ease congestion by using Sentilo's IoT-enabled sensors to monitor traffic flow, air quality, and noise levels [2]. Travel times and emissions have been significantly decreased as a result, benefiting both the quality of life for locals and tourists.

3. OPPORTUNITIES IN IOT

Internet of Things (IoT) is a network of linked machines, sensors, and gadgets that exchange data and communicate with one another online [3]. By increasing operational effectiveness, enhancing customer experience, and IoT has the power to completely change entire industries by opening

up new business opportunities. There are challenges to be overcome before the full potential of IoT can be realized.

- **Improved operational efficiency:** Increased operational effectiveness: By giving real-time data and insights into operations, IoT technology may help businesses optimise processes, cut costs, and increase productivity.
- **Enhanced customer experience:** By leveraging data to understand consumer behaviour and preferences, IoT technology may assist businesses in offering a more individualised and interesting customer experience [1].
- **Increased safety and security:** By keeping an eye on resources, machinery, and people and warning stakeholders of possible dangers or hazards, internet of things technology may increase safety and security.
- **Greater environmental sustainability:** By maximising resource utilisation, minimising waste, and enhancing energy efficiency, IoT technology may assist businesses in lessening their environmental effect.
- **New business models:** By delivering real-time data on product usage and performance [4], IoT technology can help new business models, such as product-as-a-service, allowing businesses to provide clients with more individualised and adaptable offerings.

4. CHALLENGES OF IOT

- IoT has the potential to drastically change industries as well as how we live and work, but there are a number of problems that still need to be resolved.
- **Security and Privacy:** Two of the main problems facing IoT are security and privacy [1]. the possibility of cyberattacks brought on by the billions of devices connected to the internet, which could jeopardize data and systems. IoT devices have the capacity to collect vast amounts of personal data, thus protecting the security and safety of this information is crucial.
- **Interoperability:** IoT systems and devices can be produced by a number of companies and may employ several communication protocols, which is challenging to incorporate them into current systems. The utility of IoT systems and devices may potentially be constrained by interoperability problems.
- **Scalability:** Systems may provide a challenge due to the increasing number of IoT platforms. Businesses need to set up the right infrastructure and resources in order to effectively manage and grow their IoT initiatives.
- **Cost:** Implementing IoT can be expensive, especially the small and medium-sized businesses [4]. Companies must carefully evaluate the benefits and drawbacks of IoT installations and look for ways to cut costs and improve efficiency.
- **Data overload:** The volume of data generated by IoT devices may be challenging to handle and evaluate. To ensure that efficiently gather, process, and analyse IoT data, businesses must have the necessary equipment and knowledge.

- **Power Consumption:** It could be challenging to provide continuous power to IoT devices in remote or difficult-to-reach areas [1]. To minimise power usage, energy-efficient IoT devices and systems must be created.
- **Network Reliability:** The proper operation of the devices depends on network connectivity. IoT gadgets possibly fail or stop working entirely due to poor network connectivity, which can seriously interrupt business operations.
- **Ethical Considerations:** IoT technology presents moral questions about things like the possibility of spying or the exploitation of personal data for profit [3]. When deploying IoT, businesses must think about the ethical ramifications and take steps to be ethically responsible.
- **Standardization:** To ensure compatibility, interoperability, and security with the wide variety of IoT systems and devices already in use, standardisation is crucial. Lack of standardisation may result in security flaws and compatibility problems.
- **Regulatory Compliance:** Regulatory compliance will be more crucial as IoT technology becomes more widely used. Businesses need to ensure that all applicable laws and standards including those relating to data protection and industry-specific requirements are followed by their IoT installations.

5. CONCLUSION

In summary, Internet of Things (IoT) is a revolutionary technology that could upend many industries and drastically alter how we work and live. IoT technology has the power to enhance customer experiences, reduce expenses, boost output, and boost operational effectiveness. It can also promote creativity, create new sources of income, and make new business models possible.

IoT technology has proven to have significant benefits through its usage in variety of industries, such as transportation, healthcare, agriculture, and industry. Since there are many ways to improve the Internet of Things, its full potential has not yet been realized. Although Internet of Things possesses a lot of potential, there are several challenges that come with it, such as concerns about privacy and security, interoperability, cost, data overload, power consumption, network stability, ethical issues, standardization, and regulatory compliance. These problems need to be altered in order to guarantee the safety, dependability, and morality of IoT installations and to completely grasp the possibilities of this revolutionary technology.

In general, IoT technology the capacity to change sectors and open up new options for both consumers and enterprises. It's going to be fascinating to watch how IoT technology is employed in new ways and the effects it has on the world around us as it continues to develop and grow.

REFERENCES

- [1] Emiliano Sisinni, Member, IEEE, Abusayeed Saifullah, Member, IEEE, Song Han, Member, IEEE Ulf Jennehag, Member, IEEE and Mikael Gidlund, Senior Member, IEEE **“Industrial Internet of Things: Challenges, Opportunities,**

and Directions” 2018 IEEE TRANSACTIONS ON INDUSTRIAL INFORMATICS,

[2] F. Group, “**Wireless HART specification,**” 2007, <http://www.hartcomm2.org>.

[3] J. Akerberg, M. Gidlund, and M. Bjorkman, “**Future research challenges in wireless sensor and actuator networks targeting industrial automation,**” in Proceedings of the 9th IEEE International Conference on Industrial Informatics, 2011, pp. 410–415.

[4] M. R. Palattella, M. Dohler, A. Grieco, G. Rizzo, J. Torsner, T. Engel, and L. Ladid, “**Internet of things in the 5G era: Enablers, architecture, and business models,**” IEEE Journal on Selected Areas in Communications, vol. 34, no. 3, pp. 510–527, 2016.

[5] L. D. Xu, W. He, and S. Li, “**Internet of things in industries: A survey,**” vol. 10, no. 4, pp. 2233–2243.

[6] W. He and L. Xu, “**A state-of-the-art survey of cloud manufacturing,**” International Journal of Computer Integrated Manufacturing, vol. 28, no. 3, pp. 239–250, 2015. [Online]. Available: <https://doi.org/10.1080/0951192X.2013.874595>

[7] Chen Yang, Weiming Shen, Xianbin Wang “**Applications of Internet of Things in manufacturing**” 2016 IEEE 20th International Conference on Computer Supported Cooperative Work in Design (CSCWD)