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Role of IOT Based Technologies in Ensuring Sustainable Development

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Abstract: The Internet of Things (IoT) technologies have started to impact society as a whole and have become a key enabler for sustainable development. The rapid development and implementation of smart and IoT based technologies have allowed for various possibilities in technological advancements for different aspects of life. The main goal of IoT technologies is to simplify processes in different fields, to ensure a better efficiency of systems (technologies or specific processes) and finally to improve life quality. The Internet-of-Things, or IoT is a network of connected computing devices, mechanical and digital machinery, objects, animals, and people that may exchange data across a network without requiring human-to-human or human-to-computer interaction. An IOT ecosystem is made up of web-enabled smart devices that gather, send and act on data using embedded systems including CPUs, sensors, and communication gear. Manufacturing, transportation, and utility companies are where IoT is most prevalent. However, it has also identified applications for businesses in the fields of agriculture, home automation, supply chain management, smart cities, healthcare, and environmental monitoring, which has prompted some businesses to undergo digital transformation. Apart from this, there are many other challenges, like handling data security, left over life of battery, closure of entire system due to interference of small number of bugs and absence of an international standard for IoT interoperability. So, in order to avoid the appearance of negative impacts and ensure the wise use of finite global resources, the dynamic growth of IoT technologies needs to be carefully analysed from an environmental point of view.

Keywords: IoT, Sensors, Data security, Sustainable development

I. INTRODUCTION

The Internet of Things (IoT) is the network of physical objects—devices, vehicles, buildings and other items—embedded with electronics, software, sensors, and network connectivity that enables these objects to collect and exchange data. The IoT allows objects to be sensed and controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems and resulting in improved efficiency, accuracy and economic benefit; when IoT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologies such as smart grids, smart homes, intelligent transportation and smart cities. Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the existing Internet infrastructure. Experts estimate that the IoT will consist of almost 50 billion objects

The investigation of process parameters on MRR in CNC turning has been extensively studied for various materials. However, brass, with its unique material properties, warrants a dedicated investigation to understand the specific effects of process parameters on MRR in this context. The findings of this research will contribute to the body of knowledge regarding the machining of brass material and provide practical guidance to manufacturers for optimizing CNC turning operations. The objective of this experimental investigation is to analyse the effect of process parameters on Material Removal Rate (MRR) in CNC turning operations specifically for brass material.

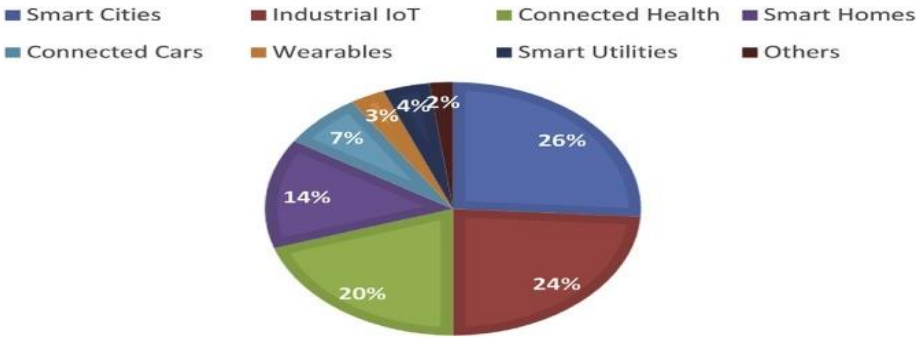

Fig.1 IoT in different sectors

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The survival of civilisation has taken precedence over the preservation and protection of the environment over the last three decades.

The global environmental problem has given rise to ideas like sustainability and sustainable development. Sustainable development can "preserve the world for future generations and improve quality of life". Sustainability has two basic objectives: "living within the ecological limits and meeting the needs of everyone". It emphasises "triple bottom line" approaches, as social, environmental, and economic obligations. Sustainable development prioritises "natural balance" to protect the "quality of life of future generations" while also being environmentally friendly.

Applications for the Internet of Things (IoT) are cited because they have the potential to improve the environment. According to researchers, IoT can aid in the fight against climate change, resource shortage, and species endangerment.

It has the ability to take care of some of the most pressing demands in terms of the environment, economy and people. Recently, researchers have looked into the positive connection between IoT and sustainability. The growth of the Internet of Things, with its multiple applications across various industries, has shown to be quite advantageous.

Any environmental issue can benefit from the Internet of Things, "from reducing water-related disasters and economic losses, to energy efficiency, to better and larger scale connectivity, and to effective water management decision making".

Additionally, it was stated that "high technologies like digitalization, information technology (IT), information and communication technology (ICT), internet of things (IoT), internet of business (IoB), internet of energy (IoE), and internet of manufacturing (IoM) are high technology techniques to implement strategies and solutions needed for sustainable development".

Industrial ecology, ecological engineering, earth systems engineering, environmental sustainability and green engineering are all fields where IoT may support sustainable development.

II. OBJECTIVE

- To judge how far IOT has simplified processes of technological benefit in different fields.
- to make a comparison between benefit and costs associated with IoT
- To figure out barriers and challenges in case of implementation of IOT

A. Application

- Water Management:

IoT enables understanding of changes in water quality of a particular reservoir. The connection of different sensors and monitoring systems help in providing the water level and flood warnings as well as foresee other disasters such as earthquakes and potential landslides in prone areas.

- Wildlife:

IoT also allow real time detection of animals. In case of any disease outbreaks, it will be useful for control, survey and prevention of such scenarios. For this, the livestock would be fitted with special chips (RFID) and readers would for placed in the designated monitoring spots.

- Buildings:

Those who dismissed smart home technology as unrealistic playthings for lazy youngsters are increasingly finding it hard to resist the charms of IoT-powered smart home devices.

- Waste Water:

SeWatch, a wastewater and sewerage wireless monitoring system provides a system-wide reporting solution for combined sewer overflow and sanitary sewer overflow discharge or overflow. Water level sensors for sewer system manholes relay information to an application running on a PC or server which alerts on computer screen or via SMS about manhole overflow and spill-over.

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B. Summary of Benefit & Risk

TABLE1 SUMMERY OF BENEFITS AND RISK

Type	Benefit	Risk
Strategic	Enhanced forecasting & Trend analysis, transparency & customer empowerment	Non compliance to regulations, weak data policy and data security
Tactic	Improved planning, efficient enforcement of regulations, improved health and safety measure	High implementation cost, Trust related issues
Operational	Improved efficiency, effectiveness and flexibility of service, Real time of monitoring	IT infrastructure limitation, Data management issues

- It is seen from above table that by analysing data generated by IoT devices, businesses can identify issues and problems that lead to inefficiencies and then take actions to address them, save money by reducing energy consumption, help to collect customer data, ability to analyse real time data point, help business to achieve data security and accuracy. Apart from above benefits it has some bottlenecks.

Undoubtedly IoT has increasing application in many fields including waste management. Let's visualize how it can help to promote smart city by adopting Smart Waste Management.

A. Challenges-

Fig. 2 IoT in Smart Waste Management

- Security related challenges (lack of encryption, insufficient testing & updating, default password, IoT Malware)
- Design Related challenges (Data Security, network security
- Scalability includes data management, network capacity, device management
- Reliability means ability of a system to perform its intended function consistently. So, it includes data failure, network connectivity, data accuracy.
- Power Consumption challenges includes battery life, energy efficiency.
- Deployment challenges include connectivity, network infrastructure
- Landfilling: The most popular and affordable technique of trash disposal is landfilling. It is also known as a waste site or a garbage dump. It is a designated space on the ground where waste can be kept until it is disposed of by incineration, burial, or another means.

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- Combustion: It is a method of burning waste that involves lighting the waste on fire. In addition to producing heat and electricity, this process also releases airborne toxins.
- Recycling: It involves physically reassembling garbage to produce a new good. Typically, e-waste, metals, glass, and plastics are recycled.
- Reprocessing of living things- Through composting, organic waste can be transformed into fertile soil.
- IoT data analytics and contemporary IoT solutions work together to discover problems and make improvements over time. Large-scale waste management can be time-consuming and expensive, making it a difficult task. We require IoT-driven solutions to reduce costs caused by the operational inefficiencies of conventional waste collection and disposal practices.

III. CONCLUSION

It can be concluded that IoT technologies have great potential to support and enable sustainable development. The role of IoT in sustainability research is vast, with scientific research in many various industries. It is used in farming, water management, recycling and has the potential to play a vital role in community management and stability, through the development of smart cities. The paper concludes with implications for research, practice, and policy and future analysis and research directions. IoT technologies are undergoing continuous and real changes at the moment.

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