Internet of Things: Oppositions and Applications

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Abstract
As the Internet of Things (IoT) As the Internet moves into its later stages, it becomes important to understand the different ways IoT could be used and the research challenges that come with those uses. IoT is expected to affect almost every part of daily life, from Smart Cities to Smart Healthcare, Smart Agriculture, Logistics, and Retailing, Smart Living, and Smart Environments. Even though IoT technologies have gotten a lot better in recent years, there are still a lot of problems that need to be fixed. Since the idea of the Internet of Things comes from different technologies, there are bound to be a lot of challenges to research. Because the Internet of Things is so big and affects almost every part of our lives, it is a good topic for research in many related fields, such as information technology and computer science. IoT is making it possible to do research in new ways. This document shows how IoT technologies have changed recently and talks about their possible future uses and research challenges

Keywords Internet of Things; IoT applications; IoT challenges; future of technologies; smart living; smart environment; smart agriculture

Introduction

The Internet can be described as the communication network that connects people to information, while the Internet of Things (IoT) is a networked system of differently addressable physical objects with varying degrees of processing capacity , detection and operation that the ability to interoperate and communicate over the Internet as a common platform [1]. The main objective of Internet of things is to allow objects to connect to other objects, people, at any time or anywhere through any network, route or service. The Internet of Things (IoT) is gradually being viewed as the next phase in the evolution of the Internet. IoT will allow to connect ordinary devices to the Internet to achieve a myriad of different goals. Currently, it is estimated that are only 0.6% of the devices that can be part of the IoT, so far are connected [2]. However, by 2020, more than 50 billion devices are expected to have an internet connection

The Internet has evolved from a basic computer network to a network of various devices, whereas

the Internet of Things acts as a network of multiple connected devices, a network of networks [3]. Smartphones, automobiles, industrial systems, cameras, toys, buildings, appliances, industrial systems, and a variety of other items may now communicate data via the Internet. Those devices can conduct intelligent reorganization, tracking, placement, control, real-time monitoring, and process control regardless of their size or functionality. There has been a substantial roll-out of Internet-compatible gadgets in recent years. Although it had the greatest commercial impact in the field of consumer electronics, particularly the smartphone revolution and interest in wearable devices (watches, headphones, and so on), connecting people must have simply become a fragment of a larger movement towards the integration of the digital and physical worlds.

This in consideration, the Internet of Things (IoT) is likely to continue to extend its capabilities in terms of devices and functionalities. The vagueness in the phrase things demonstrates this, making it impossible to define the growing limitations of IoT. The Internet of Things (IoT) continues to provide an almost endless range of options, not just in business but also in research. As a result, the second study focuses on the various IoT domains' prospective application areas as well as the research problems connected with these applications. The Internet of Things (IoT) is predicted to grow in importance in this setting. It continues to add new gadgets and capabilities to its repertoire. This is demonstrated by the vagueness in the phrase things, which makes defining the IoT's expanding boundaries problematic.

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POSSIBLE AREAS OF APPLICATION OF IOT

The possible applications of the Internet of Things are not only numerous, but also very diverse, since they permeate practically all aspects of the daily lives of people, institutions and society. According to [5], IoT applications cover wide areas, including the manufacturing or industrial sectors, health, agriculture, smart cities, security and emergencies among many others.

A. **Smart cities**

According to [6], the IoT plays a crucial role in improving the intelligence of cities and improving the general infrastructure. Some of the uses of IoT in creating smart cities include; smart traffic systems [7], smart buildings, traffic jams [7, 8] waste management [9], smart lighting, smart parking lots and city maps. This may include various functions such as: Monitoring of available parking within the city, monitoring of vibrations and the physical condition of bridges and buildings, installation of sound monitoring devices at sensitive points in the city and monitoring of the pedestrian and vehicle level. The IoT enabled with artificial intelligence (AI) can be used to monitor, control and reduce traffic congestion in smart cities [6]. In addition, the IoT enables the installation of adaptive intelligent and weather-dependent street lighting and the detection of debris and garbage cans by monitoring waste collection plans. Intelligent Highways can provide alerts and critical information such as: traffic jams.

Applying the IoT to make smart cities a reality would require with RFID and sensors. Some of the applications already developed in this area are the Aware home and Smart Santander functionalities. In the United States, some major cities like Boston, have plans to implement the Internet of Things in most of their systems, connected to the Internet. These applications will offer important advances in terms of saving money and energy.

B. **Medical care**

Most health systems in many countries are inefficient, slow, and inevitably prone to errors. This can be easily changed as the healthcare

industry relies on numerous activities and devices that can be automated and expanded through technology . Additional technology that can facilitate multiple operations , such as sharing reports with multiple people and locations , keeping records and dispensing medicines, would go a long way towards transforming the health sector in [10]. Many of the benefits that IoT applications offer in healthcare can best be classified as patient, staff, and object tracking, person identification and authentication and automatic data and sensor collection. Hospital workflow can be greatly improved once the flow of patients is tracked. In addition, authentication and identification reduce incidents that can be harmful to patients, maintain maintenance records and less mismatched baby incidents. In addition, automatic data capture and transfer is critically important in process automation, shortening forms processing timelines, automated process review and medical inventory management. Sensor devices enable patient-centric functions, especially when diagnosing diseases and providing real-time information on the health indicators of patients [6]. application domains in this sector; be able to monitor patient compliance with a prescription, telemedicine solutions and patient wellness alerts. The sensors can be used for outpatients and inpatients, dental Bluetooth devices and toothbrushes, which can provide post-use information and monitor the patient. Other elements of the IoT in this function are: RFID, Bluetooth and WiFi among others. These will greatly improve the techniques for measuring and monitoring critical functions such as blood pressure, temperature, heart rate, blood sugar, cholesterol levels, and many others.

C. Smart agriculture and water management

The IoT has the ability to empower and improve the agricultural sector by studying soil moisture and, in the case of vineyards, monitoring the diameter of the trunk . IoT would make it possible to control and preserve the amount of vitamins in agricultural products and regulate the microclimate conditions to make the most of the production of fruits and vegetables and their quality. In addition, studying weather conditions allows forecasting information on ice, drought, changes in wind, rain or snow, controlling temperature and humidity to prevent fungi, and other microbial contaminants. When it comes to livestock, the IoT can help identify animals that graze in open spaces, detect harmful gases from animal excrement on farms and monitor growth conditions in offspring to improve health and chances of survival , etc. Furthermore, the application of IoT in agriculture can avoid a great deal of waste and spoilage through proper monitoring techniques and management of the entire agricultural area . It also results in better power and control of the water. In water management, the role of the IoT includes studying the suitability of water in the seas and rivers for both drinking and agriculture, detecting pressure fluctuations in pipes and the presence of liquids outside the tanks to monitor variations of water in dams, rivers and reservoirs. These IoT applications use wireless sensor networks. Examples of existing IoT applications in this area are: SiSviA, GBROOS and SEMAT.

D. Retail and logistics

Implementing IoT in the supply chain or retail management has many advantages. Some include; Compliance with storage conditions throughout the supply chain, product monitoring to allow traceability , payment processing according to location or period of activity in public transport, amusement parks, gyms and others. In stores, IoT can be applied to various applications , such as in-store guidance based on a pre-selection list , fast checkout processes such as automatic check-out using biometrics, detection of potential allergen

products and the control of product rotation in shelves and warehouses to automate replenishment procedures [12]. Some of the most widely used IoT elements in this environment include; wireless sensor networks and radio frequency identification. The merchant currently uses SAP (products and system applications) while in logistics numerous examples include quality shipping conditions, item location, detection of warehouse incompatibility problems, fleet tracking, among others. In the industrial domain, IoT helps detect gas concentrations and leaks within and around industry, and tracks toxic gases and oxygen levels within the boundaries of chemical plants to ensure the safety of goods and workers and oil observation -, gas and water levels in tanks and storage tanks. The use of IoT also helps with maintenance and repair , as systems can be configured to predict device failures while automatically scheduling regular maintenance services before devices fail. This can be achieved by installing sensors in devices or machines to monitor their functionality and sending reports occasionally.

E. **Smart Living**

In this domain, IoT can be applied in remote control devices whereby one can remotely switch appliances on and off hence preventing accidents as well as saving energy [1, 3]. Other smart home appliances include refrigerators fitted with LCD (Liquid Crystal Display) screens, enabling one to know what is available inside, what has over stayed and is almost expiring as well as what needs to be restocked. This information can also be linked to a smartphone application enabling one to access it when outside the house and therefore buy what is needed. Furthermore, washing machines can allow one to remotely monitor laundry. In addition, a wide range of kitchen devices can be interfaced through a smartphone, hence making it possible to adjust temperature, like in the case of an oven. Some ovens which have a self-cleaning feature can be easily monitored as well. In terms of safety in the home, IoT can be applied through alarm systems and cameras can be installed to monitor and detect window or door openings hence preventing intruders [3]..

F. **Intelligent Environment**

The environment affects all elements of life, from people to animals, birds, and even plants, who have all been influenced in some manner by an unhealthy environment. There were various efforts to establish a healthy environment in terms of removing pollution and minimising resource waste, but the existence of industries, waste transportation, and careless and dangerous human behaviours are all aspects that continually hurt the ecosystem. As a result, the environment demands sophisticated and creative approaches to waste monitoring and management, resulting in a large volume of data which drives governments to create environmental protection systems. The detection, monitoring, and assessment of items in the environment that provide potential advantages for attaining sustainable living and a green world should be made possible through the integration of smart environmental strategies with IoT technology. Through collecting data from distant sensors in cities and offering 2 /7 geographic coverage, IoT technology allows you to monitor and regulate air quality and find better methods to handle traffic bottlenecks in big cities. Furthermore, IoT technology may be used to monitor water contamination levels and, as a result, inform water usage decisions. IoT may also be used in trash management, which includes a variety of waste kinds such as chemicals and toxins that are

damaging to the environment, humans, animals, and even plants. Environmental protection may be done through limiting industrial pollution using real-time monitoring and management systems linked with supervision and decision networks. This helps to cut down on waste [13]. By exchanging information and data, the Internet of Things may be leveraged to provide substantial accuracy and high precision in weather forecasting. Weather systems may gather data from moving cars, such as air pressure, humidity, temperature, light, motion, and other variables, and transfer it wirelessly to weather stations using IoT technology. Sensors are installed in vehicles and even buildings to collect data, which is then saved and analysed to help in weather forecasting. Radiation also endangers the environment, human and animal health, and agricultural output. IoT sensor networks can identify leaks and disperse deterrence by continuously monitoring radiation levels, especially around nuclear power plants.

III. RESEARCH CHALLENGES

To determine the success of certain applications and their functioning, there must be sufficient feasibility across many domains for the all the prospective IoT applications stated above. The IoT, much every other kind of technology or invention, has its own set of challenges and consequences that must be addressed before it can be widely used. Although current IoT technologies have advanced significantly in recent years, there are always a number of issues that need to be considered, opening the way for new research directions. Many research problems will certainly occur as a result of the notion of IoT arising from various technologies utilised in Al Capturing, collecting, exchanging, processing, deriving, transmitting, reporting, managing, and storing data. As a result, these research difficulties that demand attention cover a variety of study disciplines [1].

A. Privacy and Security

Because IoT has now become a critical component of the internet's future with some of its rising usage, it demands the necessity to appropriately handle security and trust functions. Researchers are aware of the flaws that many IoT devices now have. Furthermore, because IoT is built on the basis of current wireless sensor networks (WSN), it inherits the same privacy and security problems that WSN does [3, 15]. Various attacks and flaws in IoT systems demonstrate the necessity for comprehensive security architectures that secure data and systems from beginning to finish. Several attacks take use of flaws in specific devices to obtain access to their systems and, as a consequence, make safe equipment vulnerable [16, 17] . That security gap further stimulates complete security solutions, which include efficient research in applied cryptography for data and system security, noncryptographic security approaches, and frameworks which athatid developers in developing secure systems on heterogeneous devices. More research on cryptographic security services that can run on resource restricted IoT devices is required. It could allow a variety of experienced people to securely utilize and install IoT systems, despite the fact fact practically all IoT devices have insufficient user interfaces. Additional areas such as communication secrecy, trustworthiness, and authenticity of communication partners, message integrity, and supplemental safety criteria are included in addition toward the protection and security components of the IoT. Features such as the ability to block multiple parties from communicating could be included. In commercial transactions, for example, smart objects must still be protected from facilitating rivals' access to secret information stored in the devices and therefore exploiting this knowledge.

B. Data processing, analysis and management

The variety of both the IoT and the massive number of data generated make data processing, analysis, & management a tremendous problem, especially in the age of big data [18]. Currently, most systems download data and conduct computationally heavy operations on an international cloud platform using centralised systems. Traditional cloud architectures, from the

other hand, are viewed as ineffectual in transferring the massive volumes of data created and consumed by IoT-enabled devices, and then in continuing to maintain the related computational load while meeting time limitations [19]. Therefore, most systems rely on current solutions such as Mobile Cloud Computing and Fog Computing, both based on Edge processing, to alleviate this IoT challenge. Because these information-centric systems help in retrieving content and accessing services efficiently, they appear to be of great value not only for access but also for transferring and managing and transferring the content generated. . However, this solution presents several challenges, such as: how to competently expand the ICN paradigm beyond the edge of the fixed network, how to include mobile and static IoT devices like and how to divide the functionality of the ICN into devices with limited resources [19]. Data analysis and context are critical to the success of IoT, but they also present significant hurdles. To accomplish intelligent IoT operations, data must be gathered and used intelligently. As a result, the development of machine learning methods and artificial intelligence algorithms based on neural work, genetic algorithms, evolutionary algorithms, and a variety of other artificial intelligence systems is critical for automated decision-making.

C. Monitoring and Sensing

While technologies related to monitoring and sensing have made enormous progress, they are constantly evolving with a particular focus on energy efficiency and the appearance of form. Sensors and tags would normally have to be constantly active to obtain instant data, this aspect makes it essential for energy efficiency, especially in extending the useful life of the. At the same time, new advances in nanotechnology/biotechnology and miniaturization of the have allowed the development of nanoscale sensors and actuators.

D. Communication protocols M2M (Machine-to-Machine)

While there are already IoT-oriented communication protocols such as Restricted Application Protocol (CoAP) and Message Queue Telemetry Transport (MQTT), there is still no standard for an open IoT. Although all objects require connectivity, every object doesn't need to be Internet-compatible, as they only need to have some capacity to put their data on a particular gateway. Additionally, there are many options in terms of suitable wireless technologies such as LoRa, IEEE 802.15., and Bluetooth, although it is unclear whether these available wireless technologies can continue to cover the broad range of IoT connectivity in the future communication protocols for devices are the driving force in updating IoT applications and constitute the framework of data flow between sensors and physical objects or the outside world. Although different MAC protocols have been designed for various domains with frequency division multiple access, time division multiple access, and carrier detection multiple access (FDMA, TDMA, and CSMA) for the low efficiency of free traffic collisions, more circuits at nodes are needed respectively. The main objectives of the transport layer include ensuring end-to-end reliability as well as performing end-to-end congestion control. In this regard, most protocols are unable to cooperate adequately from one end to the other. Reliability [20].

E. Blockchain of Things (BCoT)

The merger of Blockchain and Internet of Things Similar to IoT, blockchain technologies have also gained enormous popularity since their introduction in 2018. too, although blockchain has been implemented and first used as the technology behind the Bitcoin cryptocurrency, it is now used in multi-faceted non-monetary applications [21]. Miraz argues that both IoT and Blockchain can reinforce each other, by removing their respective inherent architectural limitations [22]. The technology behind IoT is WSN. Therefore, similar to WSN, IoT also suffers from security and privacy concerns. Rather, the top reasons for the trend of blockchain implementation in non-monetary applications are due to its built-in security, immutability, trust, and transparency. These attributes are driven by the blockchain consensus approach and the use of Distributed Ledger Technologies (DLT) which require a large dependency on participating nodes. Therefore, the merger of this two Blockchain and Internet of Things (IoT) technologies conceives a new notion, namely the Blockchain of Things (BCoT) in which blockchain strengthens the IoT by providing

additional layers of security while the IoT things can serve as participating nodes for blockchain ecosystems [22]. Thus, blockchain-enabled IoT ecosystems will provide better overall security [23] and benefit each other.

Interoperability: Traditionally as regards the internet, interoperability has always been and continues to be a basic fundamental value because the initial prerequisite in Internet connectivity necessitates that connected systems have the ability to speak a similar language in terms of encodings and protocols. Currently, various industries use a variety of standards in supporting their applications. Due to the large quantities and types of data, as well as heterogeneous devices, using standard interfaces in such diverse entities is very important and even more significant for applications which support cross organizational, in addition to a wide range of system limitations. Therefore, the IoT systems are meant towards being designed to handle even higher degrees of interoperability [2].

OBJECTIVES

- To study and understand IOT and its role in consumer electronics.
- To study the impact of IOT products on increased relevance of customer behavior.
- To study the relationship between the internet of things and the applications of internet-based business models with physical products.

SCOPE OF THE STUDY

The scope of the study realized that they have several businesses which considerable advantages that using the internet may provide. Since then, huge corporations have been able to conduct business with clients at any time, from anywhere, and in connection to everything, necessitating the development of a more complete concept than the internet. The Internet of Things is a concept (IoT). In many stages of the selling, purchasing, and marketing process, IoT will affect decision-making style. As a result, every individual and corporation should understand exactly what the Internet of Things is, as well as how and why they should incorporate it into their operations.

SIGNIFICANT OF THE STUDY

In this study, they present an IoT-based smart e-marketing system. This strategy helps marketers to satisfy their consumers' expectations for products and services, resulting in a high level of customer satisfaction. In addition, it helps marketers to access new data sources and identify customer preferences and behaviours. Therefore, it allows marketers to supply clients with better matches to what they require**.** Researchers utilised food commodities as an example of items in this system, but it has the potential to be adapted to a wide range of other things in our everyday life.

Although the suggested system may prevent various risks and hacking processes, more government engagement in creating legal bases is significant and would improve the proposed system.

STATEMENT OF THE PROBLEM

The statement of the problem the increasing development and application of smart and IoT (Internet of Things)-based technologies has opened the door to a plethora of new possibilities in technical breakthroughs for a variety of different elements of human existence. IoT technologies' primary purpose is to simplify procedures in many industries, to enhance the efficiency of systems (technology or specialised processes), and, ultimately, to improve the overall quality of life for all people involved. Sustainability has emerged as a critical issue for the global population, with the dynamic development of IoT technologies bringing a variety of useful benefits. However, this rapid development must be carefully monitored and evaluated from an environmental standpoint in order to limit the presence of harmful impacts and ensure the intelligent utilisation of limited global resources.

LIMITATION

Customers would be assisted in picking the finest product or service using this strategy. They want to increase our IoT research outputs, applications, and services in the future, with the goal of applying them to many domains in agriculture, health, and industry. They will also use the suggested neutrophil approach in a variety of settings, including not just assisting consumers, but also assisting marketers and companies.

EXPECTED OUTCOMES

Consumers International is sceptical that consumer protection as it is now envisioned and executed will be adequate to defend consumers' rights in an increasingly connected Internet of Things world.

While data privacy and network security have gotten a lot of press, broader questions about what it means to be an user of digitally networked products and services require immediate attention.
To yet, important choices concerning how new linked technology applications would be deployed do not appear to have taken customers' interests into account or included proper representation. The problem of control and agency, which is at the heart of the new relationship between customers and providers, has received little attention. Because of the pervasiveness of the technology and its components, it is subject to national, sectoral, and legal control. To be able to communicate and realise consumer rights, this must be better understood.

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