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Review on the Current State of the Internet of Things and its Extension and its Challenges

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ABSTRACT

This era witnessed the rapidly growing of internet technology, a huge amount of people all over the world using the internet and it applications, there are various ways and purposes for using the internet which contributed in so many fields, and one of these techniques which will be more increasing and usage is the future is the Internet of Things (IoT), which facilitate using of many embedded devices that help will be connected and controlled through the internet. The technology of the Internet of Things (IoT) relies on Cloud Computing. Cloud Computing provides a baseline that supports IoT and is built on the idea of allowing individuals to perform computing activities via internet-based services. This article presents a comprehensive survey on addresses the concerns, challenges, and existing state-of-the-art standards to emphasize and overcome most of the proposed technical solutions and it will deepen the importance of the IoT & The Internet of Everything (IoE) technology, the paper will cover and the domain of the internet of things and several technologies that widely used. The paper covered the architecture of the resulting Cloud-based IoT paradigm, as well as its new application scenarios, which will be discussed. Finally, new research directions and challenges are offered.

Keywords: Cloud-based, IoT, Cloud computing, Internet of Things, The Internet of Everything.

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I. INTRODUCTION

Humans' desire for a comfortable life stems from their curiosity about technical matters. With the inventions of new technology frontiers, mankind has been on a technical revolutionary journey during the previous few decades. These frontiers have interacted with humans and completed all tasks in a fraction of the time and with far more precision. The world is getting more connected as a result of the introduction of 'Smart Concepts. 'Hyper-connected world is a word used to describe the state of the globe today. These are all examples of smart concepts, such as smart phones, smart devices, smart applications, and smart cities. These intelligent notions comprise an ecosystem of gadgets whose primary function is to connect various devices so that data may be sent and received. The Internet of Things (IoT) is a popular technology that monitors connected smart gadgets [1]. A fourth industrial revolution has been enabled by the Internet of Things, a science fiction turned into reality. It has had a huge impact on the technical, social, economic, and political realms. Internet of Things (IoT) becomes one of the most growing field, and recently IoT is used in many applications, such as smart home appliances, which are an example of such applications.[2], smart personal assistants protective equipment such as smart personal gear, some IoT useful devices and applications for industrial assistance and so forth ..Etc Devices utilized in the Internet of Things (IoT) are generally low-powered with limited processing capacity. Whereas, the calculation component is done in the backend Cloud server. This paper evaluate how the scenario changes when computation is done in the edge Cloud, close to the data source, lowering network hop distance and data size for IoT applications. Some research created a face recognition framework as an IoT application with a computational server in two different infrastructures: a local edge Cloud close to the client and a commercial Cloud platform [3]. Implementing a portion of processing in an edge node or gateway can also significantly reduce the quantity of data packets and, as a result, network latency. Their processing time of their built system as well as network latency were tested and compared the findings show that edge Cloud, rather than core Cloud, is the better option. IoT is connecting physical devices into the digital world, but it is just the beginning. Most important is the question of what to do with all this information, and how to use the data from devices. The person's actions are based on the findings from the given or received information. Using ICT in logistics management systems has become an important factor in strengthening the competitiveness of logistics in many industries. The goal of this study is to investigate the most important aspects of IoT. The capabilities of IoT increase the system's ability to make decisions in a well-informed manner that take into account the exchanged IoT data. Data processing and analyzing are used to improve the efficiency of the system. Here, we highlight the practical applications of IoT in logistics activities, with an emphasis on product condition monitoring, freight, and warehousing; a thorough evaluation is also provided for each.

II. Cloud Computing

Cloud computing empowers and it will be focused on the cloud-based IoT, this section discussed the IoT architecture and feature of the cloud cloud-based IoT platform and its interaction with three main cloud computing models: IaaS (infrastructure as a service), Paas (Platform as a service), and SaaS (software as a service). Sensing as a Service (SaaS), Data Base as a Service (DBaaS), Video Surveillance as a Service (VSaaS), and other smart services and applications are among the new scenarios enabled by cloud and IoT integration. Various live company products, research projects, and projects with freely available source code in various areas of Cloud Computing and IoT integration are Nimbits, Thing Speak, Paraimpu, Device Cloud, and Sensor Cloud. To communicate with resource-constrained entities of the IoT, web services in the architectural style of Presentational State Transfer (REST) and web transmission protocols of Constrained Application Protocol (COAP) and Message Queue Telemetry Transport (MQTT) are used. For constrained networks, IoT and cloud integration use network protocols such as IPv6 over Wireless Low Energy Personal Area Network (6LoWPAN) and IPv6 over Bluetooth Low Energy. IEEE 802.15.4, IEEE 802.11ah, Z-Wave, Wireless HART, Bluetooth, and Zigbee are link layer protocols for IoT devices that are used for short distance communication. In addition to agriculture, healthcare, smart city, video surveillance, smart home, and smart meters, IoT and cloud computing have many other applications. IoT and cloud integration involves several challenges and issues as standardization of machine to machine (M2M) communication and interoperability, power and energy efficiency of devices for data transmission and processing, big data generated by several devices, security and privacy, integration methodology, pricing, and billing, network communications, storage, etc. This paper discusses cloud and IoT adoption, their integrated architecture, integrated applications, and related challenges and issues. Embedded devices have limited storage, power, and computing capabilities and require integration of embedded devices with large pools of resources such as the cloud. The integration of this technology is expected to bring tremendous growth to promising IoT applications now and in the future. Security aspects such as device authentication and data protection are very important in this context. The research motivation for this research is to propose a secure mutual authentication protocol for IoT servers and cloud servers based on elliptic curve cryptography. In this study, the security properties of the proposed protocol are formally validated and unofficially analyzed using Internet security protocols and tools for automatic application validation, with respect to various security attributes such as device privacy, identity, etc. Compared with the related protocol. Attacks, replay attacks, password guessing attacks, mutual authentication, etc. In addition, the performance of the proposed protocol was evaluated in terms of computation, communication, memory overhead, and total computation time. A security and performance analysis revealed that the proposed protocol was superior to other related protocols.

III. Cloud as a Platform

The Internet of Things (IoT) is an Internet-based paradigm that includes several interconnected technologies for exchanging information between devices that can be identified and monitored over the Internet [4], [5]. IoT applications need to consider different factors depending on the context of the application. The collected data generated by things needs to be processed, interpreted, and stored, and all implementation decisions are critical to the success of your application. Things are rampant and there are reliability, performance, security and privacy issues. Similar problems found in mobile computing are also found in the field of mobile computing. The cloud computing model has its strengths and weaknesses. These limits lead to integration with cloud computing, which has virtually unlimited capacity in terms of storage and computing power. It is based on sharing resources and getting the most out of them.

The major end-to-end cloud IoT platforms that are currently leading the global market are Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform [6], [7]. The following analysis focuses on comparing these cloud platforms in terms of the services they provide to the IoT. Recently, some overviews of the cutting edge of IoT have been discussed [8], [9]. Shows how the future will be driven by the IoT. This white paper describes an intelligent platform that can be used to support rapid prototyping in cold chain management systems with an emphasis on end-to-end security. The topics covered will focus on real-time data collection, local data processing, and sending data to a secure cloud platform, leaving further data processing and presentations for future development.

The IoT ecosystem consists of web-enabled smart devices that collect, send, and process data from the environment using embedded systems such as CPUs, sensors, and communication hardware. By connecting to an IoT gateway or other edge device, IoT devices can exchange sensor data. Sensor data is either routed to the cloud for analysis or inspected locally. These devices may communicate with each other and respond to the information received. Individuals can manipulate the device to set up the device, give instructions, and retrieve data, but gadgets do most of the work without human involvement.

IV. The Internet of Things (IOT)

The Internet of Things (IoT) is currently revolving around the rapid growth of technology and is predicted to play a significant role in the coming days. Many researchers have turned their attention to the Internet of Things in order to uncover concerns and challenges linked to its design and architecture and security [10], [11]. The diversity of languages, protocols, and standards, as well as the lack of agreement on which works best for specific layers of the IoT, is one of the many key difficulties. It does not have a single standardization platform; the heterogeneity of connected things causes it to vary. For example, the International Telecommunication Union (ITU) is currently connecting the Internet of Things to "information that enables advanced services by connecting things (physical and virtual) based on existing and emerging interoperable information and communication technologies. It is defined as "the global infrastructure of society." .. "(ITU2012). IOT is the integration of multiple objects, networks, and communication protocols, wired and wireless sensors to acquire technology and communication solutions [12]-[14].

IOT refers to the networked interconnection of every time objects Which makes them smart devices [15]. The Internet of Things is a new topic of technological, social and economic importance. Consumer goods, durable consumer goods, automobiles and trucks, industrial and utility components, sensors, etc. As mentioned. An application that automatically or semi-automatically integrates real objects and locations with the Internet. The definition of the Internet of Things (IOT) is the connection and data exchange between real-world and virtual-world (Internet) devices. These devices include PCs, notebooks, tablets, PDAs, smartphones, refrigerators, TVs, smart homes, cars, etc., but also extend to everything including animals. This connection is triggered by a sensor that receives data from objects or the Internet. , And there are many methods that have been proposed and applied to these issues [16]-[20]. The are some good methods have been applied in IoT such as

V. IOT Architecture

The Internet of Things has five layers:

1. According the studies the IOT has some common layers [2], [20] as shown in Fig. 1.
2. Device Layer: Consists of an object and a sensor device.
   Type of sensors:
   - RFID
   - 2D-barcode-Infrared sensor, depending on the technique of item recognition.

   The sensor devices acquire data from the object in this layer.

   Location, temperature, direction, motion, vibration, acceleration, humidity, chemical changes in the air, and so on can all be included in this data.

   The gathered data is subsequently sent to the Network layer for secure transfer to the data processing system.
3. Network Layer: the network layer is taking charge of transferring data from the devices that has sensor and pass it to the information processing system. And it is rely on the sensor devices, various types of transmission method can be used whether it wireless or wire, and the technology used can be 3G, Wi-Fi, Bluetooth, UMTS ZigBee, infrared, and so on.
4. Transmission Layer" Network Layer": This layer is responsible for transferring data from sensor devices to the data processing system. Depending on the sensor devices, the transmission method can be wired or wireless, and the technology used can be 3G, UMTS, Wi-Fi, Bluetooth, infrared, ZigBee, and so on.
5. Middleware Layer: in this layer there are so many types of services are implemented by IoT devices.
   Only other devices that implement the same type of service will connect to and communicate with each device. This layer is responsible **It is** for service management and has a database connection. Receives data from the network layer and stores it in a database. Perform extensive calculations before processing the data and making autonomous decisions based on the results.
6. Application Layer: his layer, often referred to as the interface layer, allows for full control. Sensor data is processed based on the data received from the sensor. Examples include smart cities, smart farming, smart homes, intelligent transportation systems, and other applications.
7. Business Layer: This layer is responsible for managing the entire IoT system, including apps and services. Create business models, graphics, flowcharts, etc. based on the data received from the application layer. The true success of IoT technology also depends on a solid business strategy. Based on the results of the analysis.

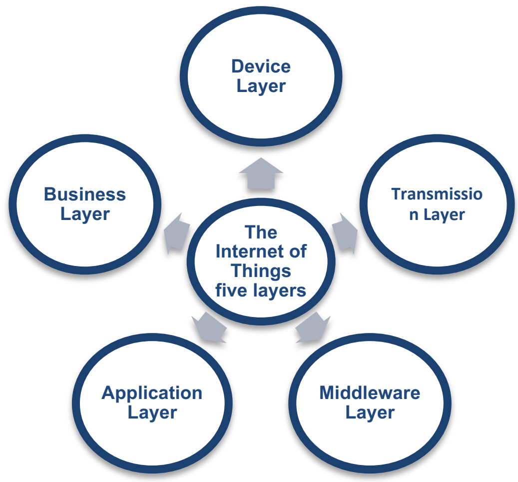

Fig 1. The Internet of Things five layers.

VI. Integration Issues in Cloud Computing

Currently, most applications and data are provided from the cloud, and cloud computing is the basis for providing various services via the Internet. Cloud services include resource tools and applications such as networks, databases, data storage, servers, software, etc. As long as electronic devices have access to the Internet and the data and software programs to run it, the new trend in the Internet of Things is that everything is connected to the Internet. This means that a huge amount of information is being generated, and the Internet of Things (IoT) is so widespread that the amount of data that the IoT can generate and the storage capacity of the Internet are issues. It is important to integrate with cloud computing. Raise things. In general, the IoT can benefit from the infinite possibilities and resources of the cloud (storage, processing, communications, etc.)

The cloud can provide **IoT** services such **as:**:

- Internet of things management
- Configure IoT services
- Implementation of applications and services
- provide the intermediate layer between the things and the applications, hiding all details

On the other hand, Cloud can benefit from IoT by:

- Scale-up.
- Delivering new services.
- An effective and affordable solution for connecting, tracking and managing anytime, anywhere using custom portals and integrated apps.
- High-speed network availability enables effective monitoring and control of remote ones, their coordination, communication, and real-time access to generated dataAll This will impact future application development, where information gathering, processing, and transmission will generate new challenges, especially in a multi-cloud environment.

Integration benefits:

- Data and application sharing.
- Delivering personalized applications.
- Apply automation to data collection and distribution at a low cost.

VII. The Internet of Everything (IOE)

The Internet of Everything (IoE) is considered the extention of IoT and it relies on a concept that aims to look at the larger picture in which the IoT fits. and also some researchers discussed extended the IoE [21] which is now leads to Internet of Nano Things (IoNT), the research done by [22]-[24] discussed deeply most of related work on to Internet of Nano Things (IoNT), The Internet of Everything is rely on In very broad terms, integration of the process of connecting different sub-systems such as intelligent systems that connecting between people, process, data and things. It is an extension of Internet of Things. Nowadays the IoE is considered one of the emerging technology of this era of technology [25]. When you look deeper at IoE, you'll notice it really is also about the vision of a distributed network [26] with the rapidly growing concern on the edge of *computing, in combination with cloud services* in times of ongoing decentralization, some digital transformation enablers and a focus on IoT business outcomes. When we have a look or make some comparison between the Internet of Things which is mainly is approached from the perspective of connected devices, their sensing capabilities, communication possibilities and, in the end, the device-generated data which are analyzed and leveraged to steer processes and power numerous potential IoT use cases, the Internet of Everything concept rely to offer big scale and a broader view. the Internet of Everything is coined by Cisco [27], [28] at it first time but now it also used by some other enterprises. Knowing that Cisco isn't just a big player in the Internet of Things geography but also, among others takes a commanding part in networks, security, technologies for mortal commerce (in business) and the optimization of business and artificial processes, there's also a imprinting aspect to the Internet of Everything. Furthermore, while Cisco tends to portray the Internet of Everything as a next stage in the Internet of Things, it is just as much a part of the Internet of Things as it is of the third platform and hyper-connected distributed reality, which is seen as the foundational technology and process stack enabling digital transformation, with a big role for distributed networks and computing, both of which are important to Cisco.

VIII. Challenges

The IoT has many challenges that authors trying solve and find solutions that could eliminate and enhance it implementations , so that you can create a huge community of billions or trillions of "things" connected and communicating with one another, are dealing with many technical and application .theses challenges could be classified into common class such as classified [29] Global cooperation, Ethics, control society, surveillance, consent and data driven life, Business models, new currencies in IoT and trust, Technological challenges, and Finding the perfect balance between top down planning and bottom up innovation. Also there are some other important challenges that faces the IoT, issues with security, Lack of regulation that recurring feature of technical advancements is that government regulation frequently lags behind the current state of technology. With the rapid expansion of IoT that occurs every day, the government is lagging behind, and businesses are frequently left without critical information they require to make choices. About IoT, Challenges with compatibility Where New waves of technology are notorious for having a slew of competitors vying for market dominance, and the Internet of Things is no exception. This might be good news because it gives consumers more options, but it can also lead to annoying compatibility concerns. Compatibility issues are emerging in the domain of home mesh networks. Bluetooth has long been the industry standard for IoT device compatibility. In fact, it was named after Harald Bluetooth, an ancient ruler who was notable for uniting warring tribes. When it comes to home automation via mesh networking, however, various competitors have emerged, including protocols like Zigbee and Z-Wave, to challenge Bluetooth's mesh network offers. It could take years for the market to settle down sufficiently to crown a single global home IoT standard., some unfractured challenges such as Limited bandwidth, and finally Customer expectations With so much competition in the IoT market, clients who don't get what they want won't hesitate to go for it elsewhere. Customers expect a smoother, more modern experience, therefore businesses looking to enter this competitive and inventive field should be prepared for a market that never stops moving. Began, Kate the Internet of Things (IoT) is a fascinating field with a lot of potential to revolutionize how we live, work, and play. However, in order for the IoT to remain safe and productive, the tech sector, government, and consumers must all agree on security and performance issues.

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IX. Conclusion

Smart everyday things, automated real-time insights, and information-centric networks are three pillars of the Internet of Things, which links product, process, people, and data into one coherent environment. We discussed the Internet of Everything (IoE) area in this study, including its architecture, related difficulties, and obstacles. This paper also touched the recent IoE technologies which compared and analyzed based on their benefits and limitations, as well as the author's name and year of research. The purpose of this paper was to identify IoT field and it bounding that effected on it domain. Based on the survey of the research the recently done on this area. This paper covered deeply most of important issues which included IoT concepts and architecture, cloud computing, Cloud as a platform, and Integration Issues in Cloud Computing, The Internet of Everything (IoE),and finely the paper discussed the most common challenges that facing the Internet of thing (IoT).

Conflict of Interest

Authors declare that they do not have any conflict of interest.

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