A Study on Internet of Things Architecture andApplications

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Abstract

In recent times, the Internet of Things (IoT) technology has been the attraction of the research community in automation engineering. The Internet of Things (IoT) is predicted to significantly influence consumer products, business, and culture in general, it is still in its early stages. The IoT technology is applicable in any industry where automation is required such as industrial automation, home automation, and defense sector. The architecture of IoT is significant and it is a layer-by-layer structure. We have discussed each layer of IoT architecture. This paper provides an overview of IoT, focusing on driver technology solutions and system architecture. There are several challenges in IoT technology, and we have also discussed it in detail.

Keywords: Architecture, Challenges, Security, Privacy, IoT (Internet of Things)

1. Introduction

The Internet of Things is 20 years old but the actual idea of connected devices. Let us fast forward to year 1990, when John Romkey created a IoT system, that able to switch on and off the home devices over the internet [1]. So in this hardware we are basically the sensors, the actuators and the drivers which are necessary for driving all these small parts which are there inside this IoT devices. Sensors are important for getting input from the environment like temperature, humidity, light. These sensors is used for driving that particular kind of activity this is linked with the embedded system now this embedded system is there inside the IoT device like they have different types of communication protocols [2]. A communication protocol in IoT have uses the Wi-Fi technology like the wireless fidelity we have the Bluetooth over smart small range distances then we have the Ethernet protocol which is also used for short distance communication short distance can say Internet transfer. Wireless communication protocol used for in communicating with the IoT, then you have the IPV 6 that is the Internet Protocol version 6 addressing schemes for all the subnet mask and the IP assignment that we will explain why we have the use the IPV 6 addressing schemes in IoT and not the IPV 4 then you have the connection services in this this can be number of things like we have the all the storage mechanisms and all the connection services are recruited in this so this all sounds to be embedded systems [3]. The Web API similarly this web is employee for this as well that is connection of peripheral services and then you have the other devices like we have number of devices which will be coming in the future so everything is connected by means of where we are or some other kind of API to the Internet so this is the block diagram inside for the IoT architecture [2,4]. I have discussed that IV 6 addressing schemes employed in this and why not IPV 4 so there is a short note on this so now you know that required devices required number of different devices to communicate so different devices in this must be uniquely so obviously there

are many number of devices. The IoT requires to identify port number of other devices unique which has unique Mac address which has unique IP addresses [5]. The IoT technology have most attracted research domain for scientists as well the engineer have given their full effort to shape the IoT technology. Present time, it uses home automation, industries automation, defense sector and so on. The benefits of this IoT system that we can access our home or industries device through internet from anywhere in the world. This make the IoT system very beautiful and useful for any system. In the future, IoT devices are applicable in these sectors such as logistics, home automation, energy, smart city, defence, smart village, industrial automation [2,3,6].

Fig.1. Internet of Things applications (Ref_7)

2. Review of literature:

The history of the Internet of Things IoT starts with Norman Joseph woodland invented the barcode in 1850. There are several reviews of the literature are available regarding IoT technology. A considerable number of articles have been published to focus on and research IoT devices. We are going to discuss some of them. A comprehensive study on IoT technology has been presented by Apostolos et. Al in the current year, 2023 [7]. They have intensely focused on the security of the IoT application architecture. More than forty protocols have been implemented in the IoT technology, and they have been reviewed in depth. These protocols are categorized based on specific IoT system settings such as sensors, energy management, and communication between machines and humans.

Another research article presented on security verification protocol for IoT sensors data access. In this reviewed article, they have studied the eight major IoT system platforms. These platforms provide information regarding proposed infrastructure, third-party intelligent

application development, the adopted devices, and the security system of the IoT system. They have mainly focused on the security of IoT systems, which is very important for any system [8].

Vikas Hassija et al. in 2019, they have reported the security challenges and sources of threat in the IoT technology. In this article, they have discussed security, developed technology related to IoT, and future aspects of this technology [9].

The four new technologies such as machine learning, data science, artificial intelligence, and blockchain, have emerged with the IoT technology [10].

IoT-based green agriculture has a booming application of this technology. Next, it aims to attack models have to target IoT green agriculture applications into five categories such as integrity, availability, confidentiality, authentication, and privacy of the system [11].

3. Internet of Things (IoT)

The Internet of Things (IoT) is the model of connecting any device through the internet and also controlling its functionality. It is an intelligent network of sensors, electronic devices, and controlling devices connected over the internet. The next generation of technology comes with this IoT technology. In the future, all household equipment, medical devices, smart cities, and road networks will be equipped with IoT technology.
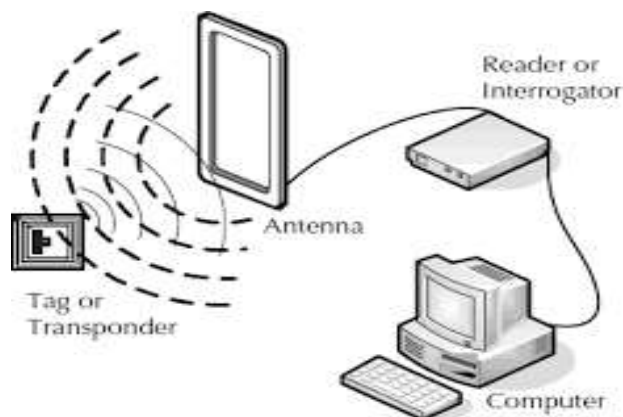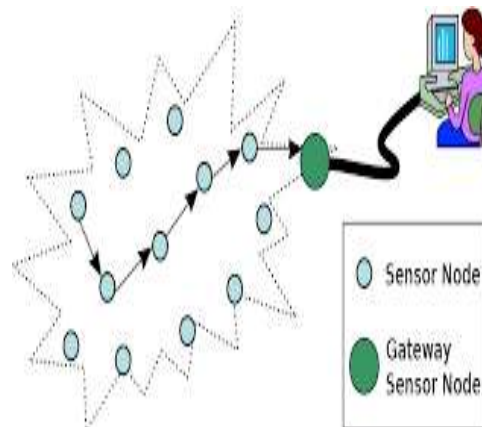

Fig.2 Simple application of IoT (ref_12)   Fig.3 IoT network system (ref_12)

4. IoT Architecture

The most important part of IoT technology is the architecture. The architecture is defined as the total working definition of IoT is layer by layer structure. The architecture of IoT divided into seven layer structure. All the layers having its own importance and working protocol [13]. These seven layers are depicted in figure 5. First, we discussed about physical devices and controller layer. In this layer all the physical components such pressure sensor engages the number of liquids tanks or gas tank. When any system connect to internet, a cyber security is very important factor to secure our IoT device data [6].

Fig. 4. IoT architecture with input, gateway, and cloud server with mobile app (ref_12).
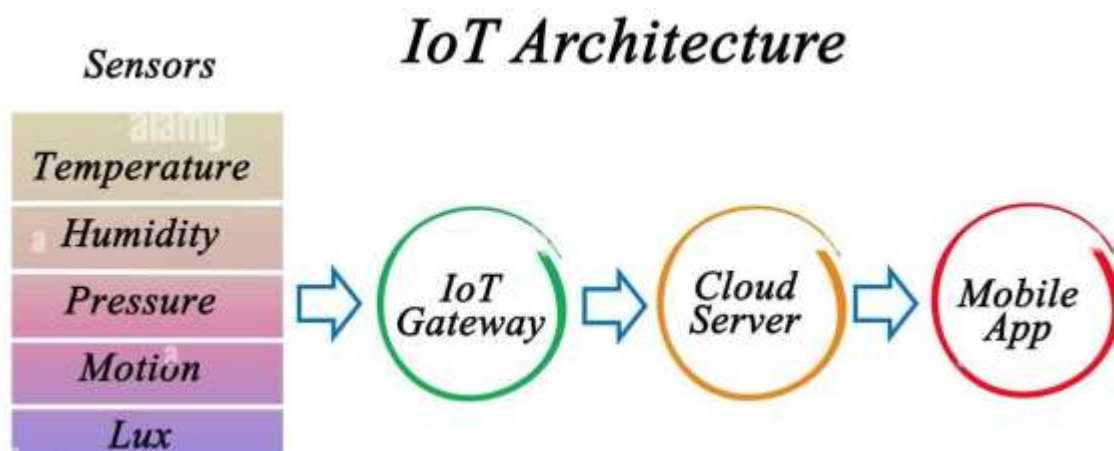
The second layer is connectivity, it is about the communication and processing unit of IoT system. Through this layer all the devices have able to communicate each other and send the data through internet. The data computing job has been done by edge computing layer. The storage of data has been process with the help fourth layer data accumulation layer [12]. The aggregation of data and application of these data in the form of report, analytical data have process in fifth and sixth layer. Lastly, seventh layer is the user interface layer, where user give the input and see the report of IoT system. In the layer, People have interacting with output of IoT system. The security is most important, when your data are on internet.. Cyber attackers have attack and take your important information from IoT data on internet. Among the most popular types of attacks in this layer are a man in the middle attack in which hackers manipulate devices in real time, storage attack in which the hackers download the gathered data from IoT. The exploit attack, in which scammers find loopholes and utilised them for unauthorised access to IoT systems [13]. Application layer represents all devices that use the IoT devices. Among the most popular ways to attack devices in this layer are cross site scripting, in which hackers insert a piece of code.
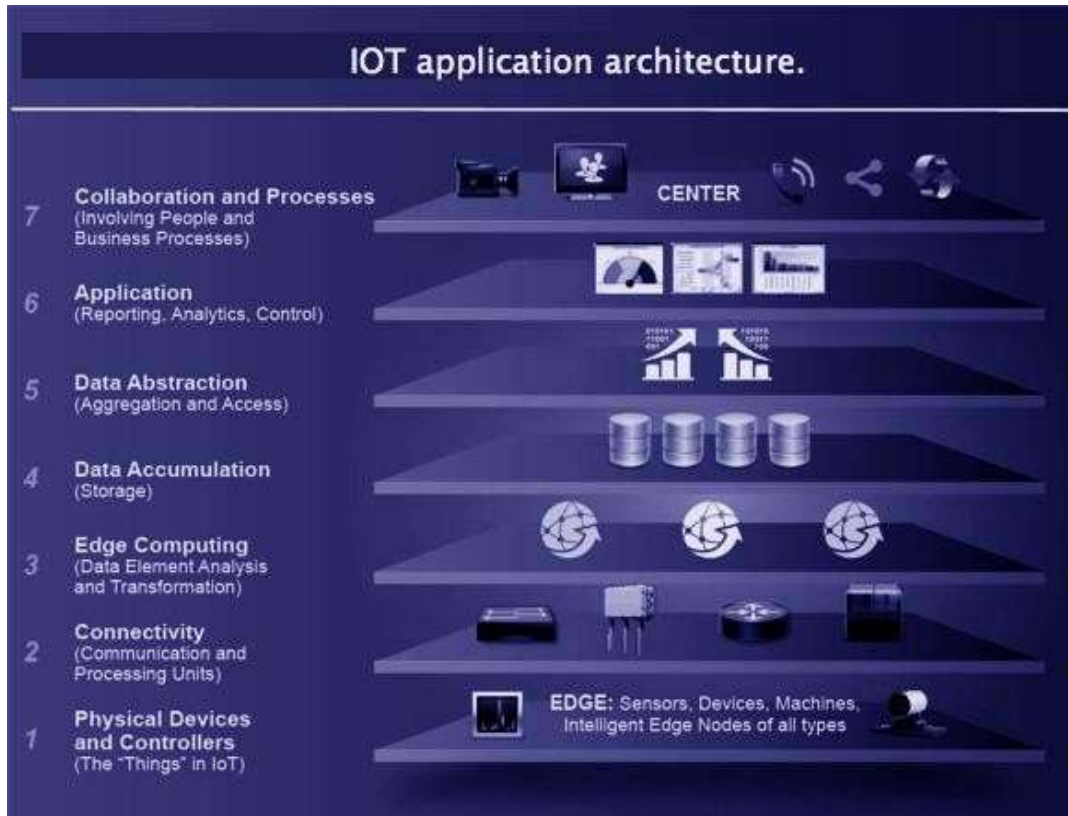
Fig. 5. Seven layers of IoT application architecture (ref_12).

5. IoT Applications:

The Internet allows IoT devices to connect all together and communicate to the users. The sensor data have been collected by IoT devices and take decision on automated tasks [14]. The IoT technologies are applicable where we need an automated system. A short discussion on applications of IoT device and technology has been as follows.
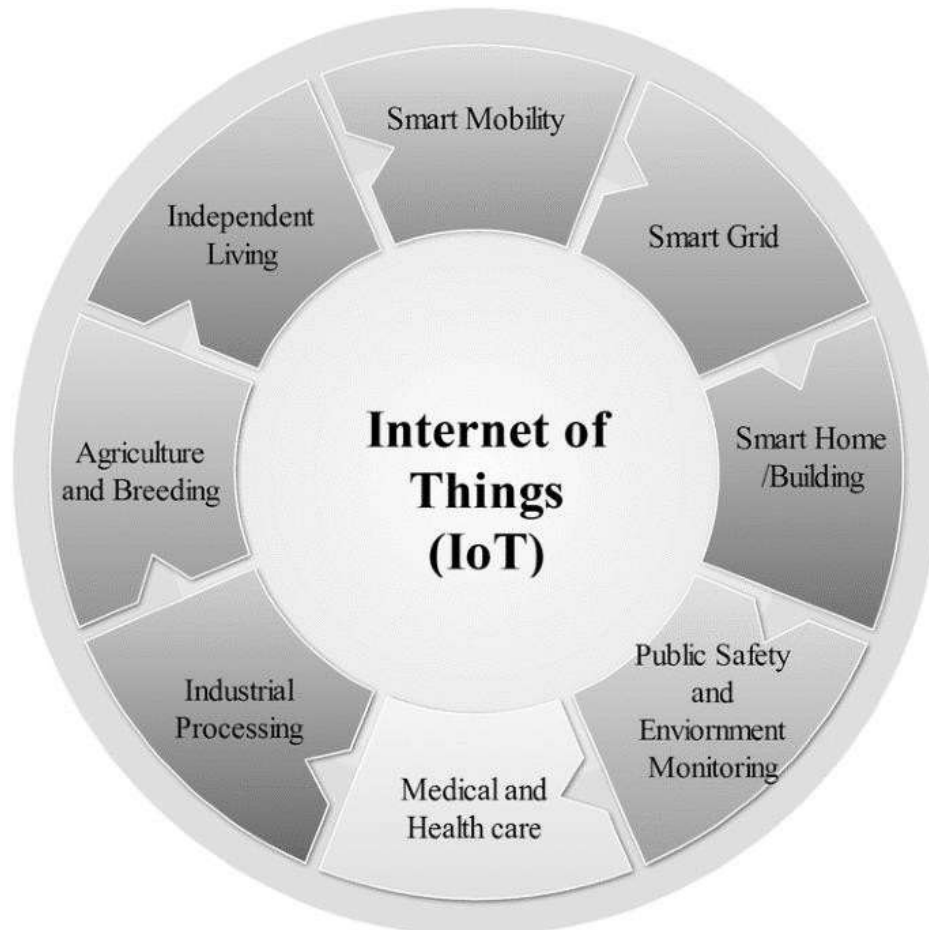

Fig. 5. Applications of IoT technology [ref_10].

IOT is a smart electronic device and it made smart environment where IoT is connected. The major applications of IoT in the consumer applications, industrial applications, infrastructure applications [15]. These includes connected what he called smart Homes, wearable technology and even appliances with remote monitoring capabilities if we consider a smart home. Based on platform that control smart devices of home appliances can be synced with one another. Smartphone is more than enough to control all these appliances at home. Let's say that you are

returning home after work, your car back system automatically, your house door locks automatically, your lights and ACS are switching on but themselves and your coffee machine starts making your favourite coffee [16]. The most important application of IoT is used in healthcare, it enables remote health monitoring. In the transportation sector, we can talk about smart traffic control, smart car parking, vehicle control, safety and even broad assistance. Now let's go into the industrial applications where we talk about manufacturing, which is smart manufacturing and agriculture. So, in the smart manufacturing. Smart manufacturing systems will be able to automatically old the more raw materials as a supplies go down and complete orders [17]. They can also prepare distribution networks once we are completed. These can include collecting data on temperature, wind speed test in a station and even soil concept. This data can be used to automate farming techniques and reduce effort need to manage their crops. The overall goal is that the data from census. Open with the farmers knowledge will help in increase farm productivity. Now it's about the infrastructure applications. IoT has reduced human involvement and productivity increases [18].

6. IoT Challenges:

There are challenges in IoT technology, and some critical issues are discussed. The important challenges in security of data. When it is connected through internet, data cyber security of sensors data are critical [19]. When all the smart devices connected through IoT, data storage capacity problem arises. The privacy of data of user, because all the IoT devices have been connected together and send data on server [20,21]. Anyone can access these data, which are stored on the server. So, the rule and regulations have been implemented to protect user data in IoT technology.

Conclusion

The IoT is new emerging technology, which makes life easy, and all smart devices are connected through the internet. It uses artificial intelligence to take decision on basis of gathered information from sensors. In this article, we have discussed about history of IoT, important, architecture, technologies, applications, various challenges in this technology. This article open a new window for researcher for solution of it challenges. Therefore, the summary of the above that the IoT is only the technology solution, which give fully automation in industries, home, defense e.tc. In the future, all electronics gadgets have IoT devices and connected together, talk together and work with smart decisions as well as automation.

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