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Internet of Things Technologies and Issues: A Survey

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ABSTRACT

Internet of Things (IoT) was at the outset called as Internet of Everything (IoE). Objects in the IoT are assigned unique IDs. They have the ability to transmit data over a network of physical and virtual objects without the need for human-to-human or system-to-system communication. Devices linked to the internet may talk to one other and other internet-connected gadgets using this technology. IoT is also described as Web-connected objects orThings. IoT Systems middleware can be defined as a software intermediary betweenIoT devices and applications. IoT intends to unite everything under a common infrastructure within the world. The main purpose of this article is to make an IoT survey, sorts of architectures, therefore the technologies utilized in our lifestyle, and smart environment. Furthermore, this study serves as a solid starting point for future IoT research.

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1. INTRODUCTION

IoT is the exciting industrial revolution in the computing age[3][8]. Everywhere in the globe, it provides a wide range of possibilities and affects all of us. Smart cities may be constructed with the use of IoT, which handles parking spots, street lights, irrigation facilities, urban noise, and garbage in real-time applications using sensors. It has the ability to create secure and efficient smart homes. The IoT can create a smart ecosystem that automatically monitors pollutants from the air and water and enables the rapid identification of tsunamis, earthquakes, forest fires and many other terrible natural calamities.

The IoT is a network of interconnected things, such as digital and mechanical machinery, each with its own unique identity. Products related to the "smart home" concept, such as home security systems, lighting fixtures, thermostats, cameras, and other appliances that support multiple common communities and can be controlled via devices connected to those communities such as smartphones and smart speakers, are where IoT technology has the greatest impact on the consumer market.

2. IoT ENABLED TECHNOLOGIES

As illustrated in Fig. 1, IoT is a network that includes millions of users from a wide range of sectors such as the public and private sectors; academics; businesses; and government agencies; as well as both local and worldwide networks. It uses wireless, electrical and optical networking methods to create the networks [1][10]. As exciting as IoT has the potential to be, it is difficult to keep track of all of the components that make up a complete picture of the physical world. The two IoT APIs (Application Programming Interface) are available,

1. REST (REpresentational State Transfer) based API
2. Web socket-based API.

IoT is an umbrella term for a variety of technologies. Listed below are the IoT-enabled technologies.

- Cloud computing
- Big Data Analytics
- Embedded Systems
- Security Protocols
- Architecture
- Communication Protocols
- Web Services
- Mobile Internet
- Semantic Search Engine

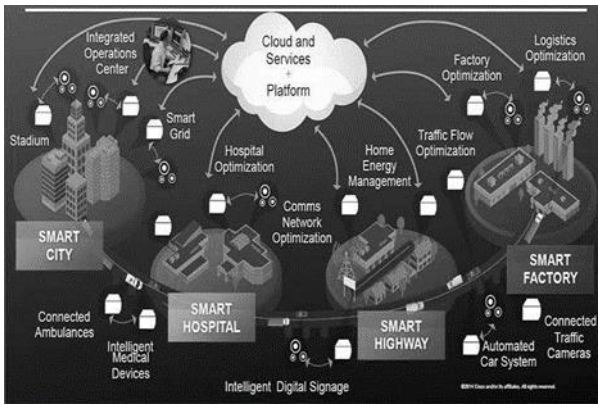

Fig.1. IoT Sensor World [22]

Goals for the IoT are :

- In order to serve as a link between the rich and the impoverished.
- To help those in need by distributing the world's resources.
- Proactive rather than reactive behaviour

3. EVOLUTION OF IoT

Internet use was introduced in the 1980s. To make the internet more widespread, the World Wide Web (WWW) came online in 1991. There is a connection between mobile phones and the internet, resulting in the creation of mobile internet. Connecting devices and social networking are allowing consumers to connect to each other via the internet. In the next phase of the IoT, every gadget around us will be connected to the internet and will be able to communicate with each other, as shown in Fig.2. The IoT connects all smart devices to the Internet. Human involvement is required for them to speak with each other. It's the newest and best-documented idea in the IT industry. It piques the interest of users by allowing them to connect at any time, from any location, and by giving each thing a unique identifier [8].

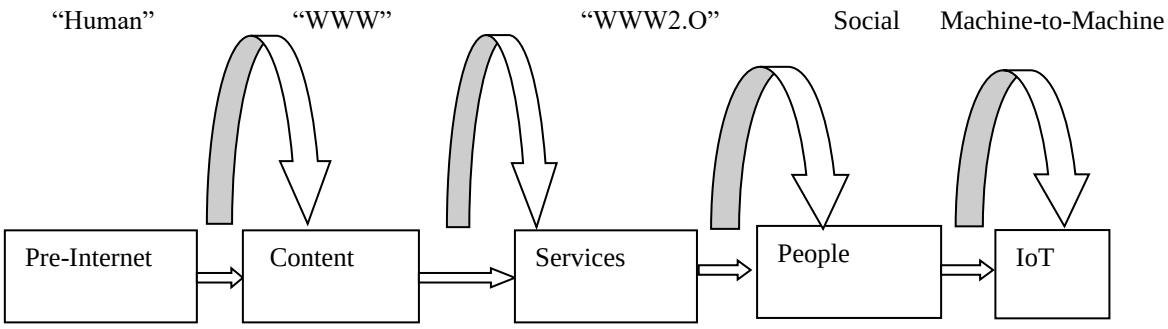

Fig.2. Evolution of IoT

Five-layer architectural model of IoT is presented in Fig.3. The IoT's physical sensors are represented by the object layer, which is also known as a perception layer. The purpose is to gather the information from numerous devices and process it. Analyzing data such as GPS position and the weight and acceleration of an object are all possible with sensors like these [11]. Data is transferred from an object and afterwards managed by the channels as part of Object Abstraction. RFID, 3G, GSM, UTMS, WIFI, and Bluetooth are just a handful of the ways in which data may be sent between different devices [11].

The Service Management Layer, also known as the middleware layer, connects the service-supported addresses and names to the middleware layer's service. Because of this layer, IoT programmers are no longer reliant on the hardware platform to do their work. A decision-making layer analyses and distributes the data it receives [11]. Those services are provided by the Application layer to customers. The service provided must satisfy the requirements of the client. As a result, smart house and home automation markets will grow in the future [7] .

Creating a business model, flowcharts, and graphs all fall under the purview of the Business layer. IoT system-related elements are supported by this software. It can be used to compare each layer's output to an expected one in order to improve the privacy of the user.

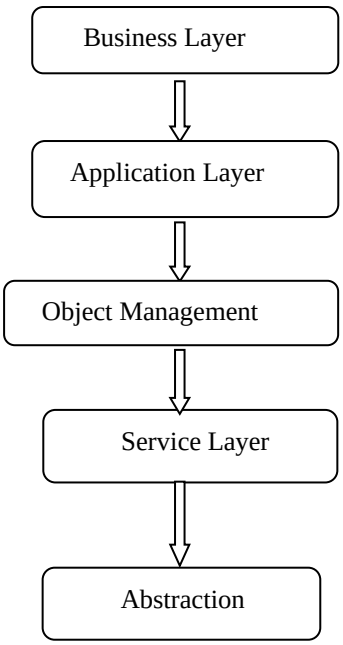

Fig.3. Five-Layer IoT Architecture Model

4. COMPONENTS OF IoT

Infrastructure and communication networks will be impacted by IoT if the following hardware requirements are met. IoT is made up of the following components [4]: 1) The source of power and the management 2) Sensors or Actuators 3) Computer 4) The amount of memory that can be stored in a computer in addition to wireless connectivity, UI/UX is an important consideration.

The IoT's operational components include:

- Component for interfacing with other IoT devices.
- Component for process and analysis.
- Component for internet Interaction
- Component for handling web services of applications
- Component to integrate application services.
- User interface to access IoT

A. Device

There is a unique identifier for each IoT device. Ssensors, actuators, electronics, software, and network connection are all included into the physical device, allowing it to gather and share data with other similar items. It has the capacity to sense, act, and monitor remotely. For data processing, data is often routed to centralised servers or cloud-based application backends. The computational capabilities of constrained devices (such as power, storage, and so on) are limited due to their compact size.

B. Local Network

The IoT is a network of linked devices that generates a large amount of data. Sensors collect data, which is then routed via a network of routers, bridges, LAN, MAN, and WAN components. Wi-Fi, Wi-Max, Ethernet, LET, and other technologies may also be used to link sensors to networks (Long Term Evolution). IoT network adoption has taken off in this manner.

1) High data rate

2) Low prices if data usage

3) IPV6 deployment

C. Internet

Using the web protocol suite, a global network of linked computer networks is known as the internet. Networks from the local to the global scale make up this network's structure. In today's world, media, telephone, internet television, emails, and other types of electronic communication are ubiquitous. Students are increasingly using the internet to read magazines, newspapers, and books. The internet has thus allowed and expedited new types of human engagement via online forums, instant messaging, and social media networking.

D. Backend Services

User administration is simple and fast using this product's data storage. Every IoT strategy aims to provide a visually appealing product. The front end of an IoT system is responsible for providing end users with services that increase their quality of life or safety. The product sends data to the cloud as soon as it has acquired enough data. You will have access to the servers where the cloud data is stored and processed.

E. Applications

Every piece of information gathered by the linked devices may be shared with people, the cloud apps, and other devices. Lifestyle data is equally gathered and used by the linked gadgets. We are moving from computers and smartphones to smart homes and cities as well as wearables and health care as the Io). The IoTs' most critical uses are [12],

1. Smart Home

The IoT has made it possible for a smart home to perform duties such as turning off lights when you leave the house and unlocking the door for guests who need temporary access [12].

2. Wearable’s

Globally, demand for wearables has been particularly strong. It is possible to wear or carry wearables. They can detect and transmit user data. Information on fitness, health, and enjoyment is provided by these gadgets [12].

3. Connected Cars

Cars that are "connected" have internet connections built right in and may share that connection with other devices both inside and outside the vehicle. In the future, automobiles will communicate with each other and notify drivers of other vehicles' whereabouts. Sensors on traffic signs, bus stops, and other devices connect with them. Aside from that, they'll get notifications on traffic updates and rerouting. You may use them as a digital assistant, interacting with your home, business, and other smart devices to collect information about your day.

4. Smart Cities

The IoT is creating a lot of interest among the world's population with this application. Sensors and internet-connected monitoring equipment have been incorporated into smart cities. It is possible to use the acquired data to manage sewage systems and power plants, among other things. Smart cities include a variety of features, such as integrated energy and water systems, high levels of public safety, and environmental monitoring. To engage directly with the city's infrastructure, it employs IoT to gather and analyse data.

5. IoT in Agriculture

An increasing number of farmers are turning to "smart farming." Crops, rainfall, and soil nutrition are all monitored using IoT devices in the field.

5. SENSORS

A. Sensor Types

Some of the most often used kinds of sensors are listed below:

1) Light Sensor
2) Temperature sensor
3) Force Sensor
4) Position Sensor
5) Speed sensor
6) Sound Sensor
7) Chemical Sensor

B. Sensor Classes

A sensor's output and data type are two separate classes. Digital and analogue signals may be seen in the output. Scalar and vector data types are available in the Data type.

1. Analog Sensors

Continuous signals are generated by analogue sensors. These sensors include accelerometers, light sensors, sound sensors, temperature sensors, and so on. Accelerometers are devices that measure changes in vibration, location, velocity, and other aspects of motion. All of these values are discrete, yet in fact they are continuous in nature. Measures the liquid temperature and reacts constantly to changes when the liquid heats up or cool down.

2. Digital Sensors

Analytical measurements are often performed using digital sensors. A binary output signal, in the form of logic 1 or logic 0, is generated by digital sensors. The shortcomings of analogue sensors are being addressed by digital sensors. A single bit (serial transmission) or a combination of bits (one-byte output) may be generated (parallel transmission).

3. Scalar Sensors

This kind of sensor produces an output signal or voltage that is directly proportional to the measured quantity. Because they can only convey information by measuring their values in terms of their magnitude, scalar quantities include things like temperature, colour, pressure, strain, and many more.

4. Vectors Sensors

This is because the magnitude and direction of the volume being measured are directly proportional with vector sensors. Vector quantities are necessary to convey all important information in physical quantities such as image, velocity, sound, orientation/acceleration, etc.

6. ISSUES IN IoT

1) As the customer and business demands of IoT change daily, the technology itself involves extensively connected devices because of which the huge number of devices are involved here due to which the cost of maintenance and servicing will increase rapidly. A country's economy will be negatively impacted because of it. This problem can be solved by developing sensors and devices that require minimal or no maintenance. Preventing certain economic situations by reducing the cost of servicing will help.

2) Aside from that, most of the devices used here use batteries, and once the sensor is out in the field, it is nearly impossible to replace its battery, resulting in high power consumption and, ultimately, a global energy crisis. To overcome these challenges and make more devices that run on renewable energy, we need to design sensors that don't require any battery changes over their lifetimes. IoT and solar energy integration is the most recent example.

3) IoT devices suffer from poor service and performance when their connections to the internet aren't working properly. Almost all base stations and gateways are built with a maximum number of concurrent users in mind; if that number is exceeded, some users will be unable to access the network. For the Internet of Things (IoT) to work, a country must have reliable, low-cost, and easy-to-use internet access.

4) Self-configuration: Internet of Things (IoT) devices should be programmed so that they can be customised to a specific environment by their owners.

5) A common communication standard is still a question mark in the development of it. Internet of Things (IoT) aims to make things easier to use and connect with each other. As a result, some standard communication protocols supporting network heterogeneity and interoperability must be established, making further development of the technology much easier.

7. CONCLUSION

A major goal of the IoT is to provide a unique route for our contemporary existence. Connecting smart gadgets, technology, and apps is intended to demonstrate better quality of life. As a result, numerous new technologies are finding their way into our daily lives, making our lives easier and more convenient. Still, IoT has a wide range of applications, from transportation to government to healthcare to education. This article discusses the importance of enabling technologies and the need for the IoT.

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