

Internet of Things : Characteristics and Applications

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Abstract: Internet of Things is connecting devices to the Internet and to other connected devices. The IoT is a huge network of connected things and users. Devices collect and share the data. There are number of devices of different nature and sizes. e.g. Smart microwaves, automatically cook food, self-driving cars, wearable fitness devices etc. These devices collect the statistics that can be used further for improvement of work done. This paper presents the basic characteristics of IoT with the common application areas developed or under development so far.

I. Introduction

The Internet of Things (IoT) is the system of physical devices, vehicles, house machinery and different things implanted with hardware, software, sensors, actuators, and network which empowers these articles to associate and exchange information. IoT frameworks enable clients to accomplish further robotization, search, and combination inside a system. They enhance the compass of these territories and their precision. IoT frameworks uses existing and developing new inventions so that it can detect, perform systems administration, and mechanical technology. IoT checks the usage of modern technological advancements of software, equipment costs which is falling day to day, and present users states of mind towards innovation. Its new and propel components acquire significant changes in the conveyance of items, products and administrations; and the social, economical and political effect of those progressions.

II. IoT Basic Characteristics

The most vital characteristics of IoT incorporate artificial intelligence (AI) , availability, sensors, active arrangements, and little small devices. A concise audit of these highlights is given below:

Artificial Intelligence – IoT works in the direction to make anything "smart", which means it improves each existing part with the addition of information accumulation, artificial intelligence calculations, and associated network. The era of artificial intelligence helps to make the modern world machines artificially smart and enables them for decision support system. Artificial intelligence system refers to the knowledge base of particular domain to work upon.

Availability – New empowering innovations for systems administration, and particularly IoT organizing, mean

systems are never again only attached to real suppliers. Systems can exist on a significantly littler and less expensive scale while as yet being useful. IoT makes these little systems between its framework devices.

Sensors – Sensors are most useful for working of IoT. IoT loses its refinement without sensors. They go about as characterizing instruments which change IoT from a standard detached system of gadgets into a dynamic framework prepared to do genuine combination. The devices with the sensors, sense and record the information in an organized format.

Active Engagement – Much of the present association with associated innovation happens through latent commitment. IoT presents another worldview for active substance, item, or then again benefit engagement. Active engagement is helpful to respond and work efficiently.

Small Devices – Devices, as anticipated, have turned out to be littler, less expensive, and that's only the tip of the iceberg capable after some time. IoT exploits reason fabricated little devices to convey its accuracy, adaptability, and flexibility.

IoT – Advantages:

IoT is helping in each and every area of life and business. Here are following advantages of IoT. Present analytics has the disadvantage of lack in accuracy but IoT transforms the current analytics of less accuracy into more effective and better engagement. IoT technologies help in customer engagement improvement, device usage and also newer ideas for technology improvement. Current analytics IoT clarifies the improvement of resources usage. current analytics provides apparent insight, but IoT provides real world information that leads to more effective management of resources available. Information collection has limitation of passive usage. IoT delimits the same and places the

information at right place, so that users who really need the same can analyze. It provides the accurate picture of information available.

IoT - Disadvantages:

There are number of challenges with IoT, here is list of major issues.

1. Security: IoT connects a number of devices over networks. Security is the major concern as different devices are connected via network. Probability of attack cannot be avoided over the network.
2. Privacy: As lot of data is shared over network, along with personal data. So privacy leakage is also possible.
3. Complexity: As there are a number of devices of different nature need to be connected via network, then the system becomes quite complicated. Devices need to be compatible to be connected to each other via network. So the complexity of the system need to be ensured.
4. Flexibility: Flexibility is the major concern of connecting the devices of different nature with each other. Integration of different incompatible devices is also not possible every time.
5. Compliance: IoT needs to comply with regulations. Complexity makes the issue of compliance which is very much challenging.

III. IoT - Hardware:

IoT includes devices for remote dashboard, Controlling, Bridging devices, Sensors, Computer Servers. These devices manage the primary functions to communicate with each other via some compatible means.

(a) IoT Sensors

IoT sensor is the most important part of hardware. Sensors constitutes a number of modules like sensing modules, power management, RF and energy modules. RF performs communication through signal, wifi, zigbee, radio transmissions, bluetooth and BAW. Sensors perform sensing via active and passive measurement devices like temperature sensors, magnetometers proximity sensors, gyroscopes image sensors, acoustic sensors light sensors, pressure sensors gas RFID sensors, humidity sensors micro flow sensors etc.

(b) Wearable Electronics

Wearable electronic devices are worn on body parts, e.g. Helmet and Glasses are wearable on Head. Jewellery

items and Collars on Neck, Watches, wristbands and rings on arms etc.

(c) Standard Devices

Mobile phones, Tablets and Desktops are the integral parts of IoT. Mobile phones provide remote services and required settings. Desktop computers provide control over system and corresponding settings. Tablets provide the control over system similar to desktop. Other standard devices are routers & switches.

IV. IoT - Software:

IoT software is mainly responsible for collection of data, real time data analytics of and application & process extension in IOT system network.

Data Collection

Data collection part of software performs sensing the things, then measuring the data, filtering the light data and security of the same. Then the main responsibility lies in aggregating the same. There are certain rules and regulations followed to aggregate the data from versatile devices on different networks. Then it distributes the same according to the settings. The system also works in distributing the same back over the different devices, if required. Then it transmits the data to central repository over server.

Device Integration

Integration binds all system devices to form body of the IoT system. Integration part verifies that all the parts are co-operating and there is required and compatible networking between them. The applications are defining software technologies as without technology IoT system does not exist. Software integrates applications, along with rules and limitations to allow them to co-ordinate with each other.

Real-Time Analytics

Data is input from various devices to perform analysis and required actions. Analysis is done based on various design metrics and automation related task is done .

Application and Process Extension

Existing systems and software is extended to more useful system. Integration of predefined devices is done to allow mobile devices or instruments access. It helps to get more productivity with accurate data.

V. IoT - Technology and Protocols:

IoT uses standard rules and regulations along with network technologies. These technologies perform particular actions as per requirement. Main technologies and protocols are -

(i) NFC & RFID

RFID is radio frequency Identification and NFS is near field communication are straight-forward, easy with low energy levels and flexible protocols for identifying and access tokens. These regulations are used for connections bootstrapping and payment gateways as well. RFID is duplex communication and tracks the associated tags. NFC is used for electronic devices and mainly for mobiles and other primary standard devices.

(ii) Low-Energy Bluetooth

Low Energy Bluetooth is the low energy and long use IoT function while using bluetooth technology which provide extended support to system.

(iii) Low-Energy Wireless

Low energy wireless system is used because of its less requirement of energy. All the power requiring devices and connections can be down with depletion of energy over time. But Low energy wireless need less power and lasts for long time.

(iv) Radio Protocols

Private area networks are created using radio protocols, e.g. ZigBee, Z-Wave and Thread are the radio protocols. The protocols are low power and performs well to provide more throughput. This provides higher output at lower cost value.

(v) LTE-A

LTE-A, or LTE Advanced, is the higher version of LTE which consumes low power, provides bigger coverage area and reduce the latency of its output. Hence the output is efficient comparatively.

(vi) WiFi-Direct

WiFi Direct provides peer to peer network with increase in speed and minimizing latency time. It also don't need the access point. As a result speed is high with lesser throughput.

VI. Common Application areas of IoT

IoT has large application area along with the large number of users. Users of IoT begins from single home users who want to lower the power consumption of their homes and counts to the large industries and organizations that want to make their organizations more efficient. IoT increasing the use of technology in

performing advanced automations, following are the common areas of applications of IoT.

Engineering, Industry, and Infrastructure

IoT in these areas help in enhancement or development, promotion of things as well as their concerned security. IoT provides the system with new methods development required for engineering the things, industry and corresponding infrastructure required. There are number of areas where IoT incorporates the technologies with the client requirements, products enhancement, hardware refinement and related issues.

Using the same in engineering services, industrial growth and respective infrastructure development is useful and is mere the start which can lead to doing everything intelligently as human beings can do.

Government and Safety

IoT is helping government sectors to work for the welfare of society. IoT connected to government and security helps the government in implementation of modified laws with technologies. A number of areas in government sector are using the same with financial administration, smart cities development, smart nation development. For instance, IoT can enable city organizers to have a clearer perspective of the effect of their plan, and governments have a superior thought of the neighborhood economy.

Home and Office

In our day by day lives, IoT gives a customized understanding from the home to the workplace to the associations we oftentimes work with. This enhances our general fulfillment, upgrades efficiency, and enhances our wellbeing and security. For instance, IoT can enable us to redo our office space to enhance our work.

Health and Medicines

IoT drives us towards our envisioned eventual fate of pharmaceutical which misuses a very coordinated system of advanced therapeutic gadgets. Today, IoT can significantly upgrade therapeutic research, gadgets, care, and crisis mind. The coordination of all components gives more exactness, more scrupulousness, quicker responses to occasions, and steady change while lessening the ordinary overhead of therapeutic research and associations.

Other Application Areas of IoT:

1. IoT in Media, Marketing, & Advertising, helps to improve marketing and delivery contents. Also IoT works to improvise advertising.

2. IoT applications of Environmental Monitoring are wide. IoT helps is gathering Water and Air Pollution, forecasting weather and Commercial Farming

3. IoT applications in Manufacturing industries are using modern distribution and analysis along with standard analysis. Intelligent product enhancements, dynamic response to market demands, low cost, optimized resource use and wastage reduction are key areas that are impacting manufacturing.

4. IoT applications are also applicable in Energy Consumption. How to reduce the energy usage and maximize its time span is the key goal. Residential and commercial energy usage are using IoT applications to maximize throughput.

5. IoT has major growing area in healthcare applications. Technologies are facilitating health areas to improvise the treatment. Health care research area, development of new devices for treatment and emergency care are major areas in healthcare industry to work upon.

6. IoT in building and housing applications allows to automate the residential and commercial sites. Providing safe, healthy, Environment friendly and quality life are major goals of the technology usage.

7. IoT is improving the transportation application area including personal and commercial vehicles, trains, UAVs, and other equipment. Technology has also improved traffic control, parking, fuel consumption and much more.

8. IoT in education sector is extremely beneficial. It modifies and improves instruction by permitting enhancement of all substance and types of conveyance. It empowers teachers to offer concentration to people and their strategy. It additionally diminishes costs what's more, work of instruction through mechanization of regular assignments outside of the real training process.

9. IoT is helping in Government sector for the welfare of society. It supports smart cities and smart nations. City planning and management, national defense, and minimizing unemployment are the key work areas with the help of IoT technologies.

10. IoT upgrades law authorization associations and rehearse, and enhances the justice framework. The

innovation helps straightforwardness, circulates basic information, and evacuates human mediation where it demonstrates superfluous.

11. IoT is helping end users and customers. Shoppers advantage by and by and professionally from the improvement and information examination of IoT. IoT innovation acts like a group of individual colleagues, counselors, and security. It improves the way user live, work, and play.

VII. Conclusion:

We have studied in the paper about IoT and their basic characteristics. There are a number of advantages of IoT to make the things connected and artificially intelligent, but at the same time we can't avoid concerns like complexity, security, flexibility and compatibility of the devices. Then the common application areas and other application areas are discussed. Wide scope of research is there in the field of IoT and sky is the limit.

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