The Internet of Things (2016)

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Abstract

The Internet of Things (IoT) is a novel concept and is aimed at enabling the interconnection and integration of the physical world and the IT space. It is represented by the network of physical objects on the planet and the way they imact the living standards of the people across the globe. In this article , we aim to briefly discuss the concept, how it integrates the trend of future networking, facilitating an IT industry revolution. Then, we present some applications of this technology, thereafter pointingout the limitations of IoT and the security issues associated with the cincept.The article highlights the key problemswhich get solved and which form the basis of future research directions.

I. INTRODUCTION

The Internet of Things is a novel concept for all; however, it has been in existence since the '80s. Kevin Ashton, the creator of Auto ID Labs at MIT, coined the term 'Internet of Things' in 1999 ([1], [2]). The Internet of Things, in a nutshell, is a network of all the physical objects on the planet. Each such device is embedded with sensors and network connectivity chips for the purpose of data exchange between different devices. Every node on this network, just like those on the Internet, has a unique identification. This can be in the form of IP Address, RFID tags and many more. But, there are some issues we must resolve to use the Internet of Things. We will need advanced cryptography algorithms to keep our data and ourselves safe; Privacy and anonymity will also become a concern.

II . BRIEF DESCRIPTION AND DISCUSSION

The Internet of Things (IoT) is a network of all the physical objects on the planet. Kevin Ashton coined this term in 1999([1], [2]). Since the inception of this concept, it has been implemented in various forms. However, it has not been completely implemented. It will take a few decades for everything on the planet to be connected to everything else, and by everything; we mean absolutely everything we can think of. Once implemented, all the objects on the face of the earth will be connected to each other. These devices will be able to exchange data, and as a result, we will be able to design better artificial intelligence devices as well. This is based on one simple formula- sense, communicate, and manage.

This would allow us to create Personal Assistants that would be able to understand our actions, somewhat like Jarvis in Iron Man. This robot will analyze all our actions and observe us before it begins functioning. Once functioning, this robot will be able to provide you with all sorts of help you need. Although this may seem far from possible, we can build such a device with the help of Artificial Intelligence and Internet of Things ([1], [3]).

What was mentioned above is just the tip of the iceberg. There are many more uses and benefits of the Internet of Things. It can be used in many fields and professions that include, but are not limited to, Medicine, Industry, Manufacturing, Security, Technology, Artificial Intelligence, Space, Business, Marketing and Human resources.

Note that the sensors mentioned below will not be of use if the data collected is not used and reported to the authorities. This will only be helpful if these sensors are connected to each other through a network- The Internet of Things.

III. APPLICATIONS

A) Applications in Houses

Internet of Things has also found its way into homes. IoT can be used to design smart homes, which are houses with intelligent locking systems. These houses can be locked and opened using any mobile device, with the help of credentials. The sensors in the system, which are a part of the IoT, analyze certain behavioral traits. These traits help to distinguish a resident from an intruder. If an Intruder enters the house, the system gets alerted, and this in turn alerts the police, thus reducing crime as well. This would not have been possible in an ordinary house.

The Internet of Things will make our life more comfortable in many ways- big and small. Let us take, for example, an air conditioner and a microwave, both connected to the IoT. These devices will be embedded with receiver/transmitter chips that will allow them to function remotely. While coming home from the office, you switch on the A/C and heat the food you left in the microwave. When you come home, you have food to eat and a comfortable place to eat that food. Adding to this, you could remotely play

music and set the lighting. This is one way in which your life will become extremely comfortable([2], [4]).

B) Applications In Business

This technology can also be used by business owners to understand the preferences of the consumers. Sensors on the IoT will sense and analyze the activities of the consumer, which will then be used by businesses to understand the shopping preference of the consumer. This will have a massive impact on data collection companies as well as businesses. The consumers will be able to find products suited for them based on their past shopping preferences [1].

C) SMART Applications

Another application would be SMART devices, such as smart wearables. A smart wearable will measure the heart rate, stress levels and many other biological parameters to check the health of a person. Any drastic deviation from the normal would result in a notification to the medical authorities. This will make disease diagnosis easier and more accurate. The medical professionals would also be made aware of the medications that the patient has been using, and hence, they would be able to prescribe better medication as well. With further advancements in technology and proper analysis of the vital signs, the doctors would be able to foresee if the body is working properly and whether it is about to enter a state of emergency. Thus, there would be an improvement in emergency medical response.

Another idea based on SMART is Smart City. This will be a city in which everything, and I mean everything, will be connected to a network that can be accessed by the people of that city. Firstly, it will make data collection easier. And secondly, the people of that city would live more harmoniously. To explain the aforementioned statement, let us discuss an example. Imagine a city in which parking spots, restaurants, hotels and other places had sensors. These sensors would upload their status (capacity filled) on a common platform, making it easier for the people to decide where to go, eat and stay. This would also reduce intolerance to an extent, since there would be no fights over parking spots and seats in restaurants.

The Internet of things can also be used to make Smart traffic control systems. These systems would consist of sensors that measure traffic patterns on different roads and direct the drivers on a route with less traffic. And since these systems would be connected to a central system, which is in turn connected to the roads, there would be no traffic jam. Also, the traffic lights, which are a part of the system, would allow the lane with more traffic to move faster. This would reduce travel time and make travel easier for all.

Then, the people could only get stuck at a Toll Booth. But there are solutions for that too. RFID tags can be used to see which car passes through the road. This would also make it easier for the authorities to track a vehicle. If some day, your car gets stuck on the road, you won't need to call up the roadside assistance helpline. The company would know that your car stopped working, and with the help of sensors, they would be able to identify the erratic behavior of certain parts and analyze the reason for the roadside stop. Car companies will also help you keep your car safe. The car will automatically collect data and transmit it to the provider company, which would analyze the data and remind you to get repairs and change certain parts. These will not be possible without the Internet of things([2], [4]}.

D) Applications in Tracking

The IoT is a network. Devices connected to a network are called nodes, and the location of these nodes can be easily found out. What has been explained in the previous statement is of daily use. In simple terms, you will never again lose your car keys, mobile phone or wallet. These devices will be connected to the IoT network, and you will be able to find the location of these things in a jiffy, since they are nodes on a network.

E) Applications in the Environment

Environmentalists can also use this network to their advantage. They can fit sensors in soil patches, water bodies and in open areas. These sensors would collect data levels, which would be synthesized and analyzed in laboratories. This information will be able to accurately measure the quality and levels of the air, water and soil. Similarly, environmentalists would be able to analyze the behavior of wild animals if the animals were a part of this network. These animals would be fitted with wireless chips to maintain their count and measure their health. This data would be uploaded to the network, only to be accessed by experts. Further, experts would be able to study behavioral patterns in these animals. A collection of all these data parameters would help us improve their living conditions.IoT could also help the wildlife guards to prevent poaching of animals by unauthorized hunters and poachers.

Imagine if there was a sensor at the different depths of the earth. These sensors would measure normal circumstances in those layers, and report any change in those levels to the disaster management authorities. Then, we would be able to predict an earthquake before it happens. This will help us evacuate the will-be--affected regions and mitigate the impact of the forthcoming disaster. This will be able to save hundreds of lives in a single run [1].

F) Applications in Maintenance

The Internet of Things can also help us maintain constructions and structures that have been fitted with sensors. Let us take, for example, a bridge that has been fitted with a sensor which checks for cracks and faults in the structure. If there has been degradation, the sensor would report it to the construction authorities to prepare for a repair process. This would also help prevent accidents, since the constructions would be maintained properly. If the constructions were not maintained, the car, which is a part of the network would get alerted, hence, saving lives ([1], [3], [4]) .

G) Applications in Industries

Every task has a budget. And in industries, and even at homes, we must abide by a budget. The smart energy optimization system consists of circuit boards that are connected to all other electronic devices using electricity. This system keeps the electricity under check, and gives an alert to the owners of the home/office about the consumption. If the budget is crossed, the system breaks all circuits, hence symbolizing that the budget has been crossed. This, along with constant alerts, keeps energy levels in check and thus, reduces the budget [3].

H) Applications in Making New Technology

Another novel topic of interest these days is wireless charging. Wireless charging is a process that can be used to charge a device with electromagnetic induction. There could be a variant to this technology. This variant would allow us to charge mobile phones over a wireless network. The magnets around us, which will be connected to the IoT, could produce a magnetic field with continually changing magnetic flux. This change in magnetic flux would be able to charge mobile devices. This technology is far from achievable at the current level of technology, but as we progress, we might be able to achieve this feasibly.

I would require the reader to take a note that the aforementioned technologies are either not built and are still under consideration or have not been given thought([1], [3], [4])

IV. PROBLEMS

The 'Internet of Things' is a new concept for all and it is undergoing a research-and-planning phase. During this phase, the feasibility of these applications is checked and technological advances are made. In this phase, we were able to identify certain problems that could evolve if we were to make IoT a worldwide phenomenon.

A) Interconnectivity

One of the major problems we would face while implementing IoT is of Interconnectivity. Since all devices would have different platforms and the user would have many devices to control, the user would have to learn to use many platforms. But this problem could be resolved if we develop a Universal Platform for connectivity. This would allow the user to use one simple platform to control all devices. And since the purpose of IoT is to make life more comfortable, this is a problem that must be resolved ([1], [3]).

B) Feasibility

We might also face economic feasibility issues while developing this technology. This is because all devices must be fitted with new technology to connect them to the IoT, and these devices could be very expensive to the user, since the user has to embed this technology in many objects. If this technology is not feasible for the general public, the concept of IoT would remain theoretical and not reach the people. Hence, the technology must be made cheaper.

C) Energy resources

We face yet another problem in the implementation process. We do not have enough resources to provide IPv6 addresses to more than 20 billion objects, that too in the next 4 years. Hence, we must provide 6LowPAN (Low Power IPv6 over Private Area Network) IP addresses to abide by the energy budget.

D) Privacy

Our privacy will soon become a problem. We will no longer be able to stay anonymous. Since all the data we use is stored somewhere, whoever gets access to this data gets to know all about our personal information. This puts our lives at risk. This data could also be misused by companies to target consumers for their benefit, erstwhile putting the consumer in jeopardy. Let us take, for example, a Medicare company that wants to sell its emergency care to a consumer. If the consumer is about to undergo a stage of emergency, the company could display advertisements to thwart all the ways to contact any other medical agency, making that Medicare Company the consumer's only choice. The data, which was to be made available to health professionals, could be made available to these companies. Hence, we must also lay down a certain ethics code for the IoT [1].

E) Security

Security will be a major concern while developing the IoT network. Since all these object are connected to one network, a cyber attack on one node of the network exposes all the other nodes to grave danger. If one part is exposed to danger, the others become vulnerable too. Hence, enough attention must be paid to the development of new security algorithms. New methods of data transmission that are less prone to interception should be developed al well ([1], [3], [5]).

Note that the article above is based on the information gathered from the references mentioned on the following page.

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