

# The Future of Internet of Things

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**Abstract**—We are on the verge of another industrial metamorphosis which could be entitled as fourth industrial revolution as it is addressed by the leading economists of the world. This revolution will be one of its kind, it's updated in concern with its impact and outcomes and this new amendment hold its own pros and cons. The future of internet is characterized by new technologies which will be inclusive of all the current artefacts i.e. physical, abstract, digital and biological world. This new revolution will impact all domains like economics, industries, students, common people, government and even the ones those are currently less significant. The unprecedented occurrence of new technological changes will occur at an accelerated rate, yet, is just the beginning.

**Index Terms**— IoT, sensors, revolution, technology

## I. INTRODUCTION

The term Internet of Things was coined by Kevin Ashton, cofounder of Procter and Gamble, which came to be known in 1999 as MIT's Auto-ID Centre.

IoT creates opportunities for more direct integration of the physical world with the computer based systems and this will result in improved efficiency, accuracy, effectiveness which in turn will help in reducing human intervention. There is a recent paradigm shift which has completely changed the present situation and will definitely change the future course in which the objects of day-to-day life will be equipped with microcontrollers, transceivers for digital communication that will make them able to communicate with each other and even with users making it an integral part of the internet [5]. It also encompasses technologies which are very much in news nowadays such as smart grid, smart villages, smart cities, etc. This new transformative technological changes will create a huge impact on the lives of the people. While drawing the roadmap for the future course and taking into consideration the challenges which humans are facing presently and are going to face in the near future. These transformative changes have to be dealt with utmost care because these profound changes are going to affect the masses directly and indirectly it will create a huge impact on all the things which are present today in this world, be it physical, digital and biological world.

The principle behind its working is the amalgamation of Information and Communication Technology, web and mobile technology[8]. The rising population of the world makes it as the need of the hour to take proper advantage of this technological revolution because our entire humanity is at stake as acknowledging human intervention into different fields of nature has already shown us what nature can do to us if we don't respect it. Keeping the complexity and unpredictable nature in mind, we will have to involve all the stakeholders of different fields to reach out to a common solution.

We can divide IoT into four different domains:

1. Personal & Home-at individual or home level.
2. Enterprise-at community level
3. Utilities-at regional or national level
4. Mobile-at other domains.

There is a huge cross-over of these applications and the use of data between domains [6]. "Things" in the IoT sense refers to a mixture of hardware, software, data and service.

## II. THE FUTURE OF IoT

With the elevation in the technology, more than 3.2 billion humans are now threaded to the internet and communicate with each other. People from various parts of the world are now sharing their information in more efficient and effective manner.

Communicating and sharing of information are not only limited to the humans. Now it is possible even for the machines or devices to do the same and share their information with the other machines or devices. With the aid of the internet, this scenario is possible, and has made it possible to reach out to the beneficiaries. By looking at the pace at which it is rising, people have predicted that the estimation in the coming future will reach to a point which is unimaginable. The dependency of the future of internet entirely relies upon eyeing the current scenario, what major amends have been taken place in the gone ten years. The trans-mute acknowledged today are a residue of learning from the mistakes which happened while trying out something new.

All the major efforts were put in to create a value. 99% of the start-ups fail to create and add value due to different reasons. The failure stories of the start-ups is a lesson for the present generation to learn from it and try not to repeat those same mistakes again. By looking at the pace with which we are progressing and looking at the larger issues which we have like unemployment, illiteracy, poverty, starvation, etc., internet of things needs to play an important role in the coming future to improve the lives of the people by taking one very important thing into consideration that any major changes or benefits should reach the most needy individual. Then

we can say that internet of things will help us in uniting each other rather than divide us. All efforts should be conceptualized towards major transformative changes to somehow reach to the last man standing.

### III. ABOUT THE UPCOMING TRENDS

These technological revolution through internet is not only about smart and connected machines and systems. Its scope is much wider. The other advancement and breakthroughs are in the areas ranging from gene sequencing, nanotechnology, biotechnology, healthcare, tourism, cloud data storage, transportation, artificial intelligence, and block-chain technology, quantum-computing and even moving towards renewable energies. It is the fusion of these technologies and their interaction across all domain that makes this revolution fundamentally and completely different from previous revolutions.[4] Internet of things is the interconnection of the physical devices, various vehicles, buildings and other items that are embedded with the electronics, sensors, software, actuators and with the network connectivity. It is like an umbrella that connects everything in the world. These items enable different objects to gather and transfer the information in a time bound manner and by doing data analytics we can come to know where we need to focus more and by seeing any failure in the system we can quickly resolve it.

The IoT allows the various objects to get sensed or controlled across the network connectivity that creates a huge opportunity for different physical devices to integrate more with the computer-based devices. It results in more efficiency and accuracy which consumes less time. The backbone of this process is the sensors. Without the smart and developed sensors, the entire process becomes slow and untidy.

It offers more advanced connectivity to the devices, and these devices are going beyond machine-to-machine communication by covering various protocols, domains and applications over the internet. The interconnection of the embedded devices; mainly the smart sensors or objects is now used in the automobiles which are now enabling advanced application in different areas and has even touched the city level to make its people realize what profound changes can take place when we use smart devices.

The various things of the IoT are the heart monitoring implants, electric clamps, smart watch, various autonomous vehicles that are built with the sensors and much more. The "security" and "standard" of the devices are the main concern of the internet of things that result in better outcomes.

#### A. A BRIEF ANALYSIS OF THE RELATED ADVANCEMENTS

According to the various surveys and reports, the number of connection of the human beings to the internet will reach to 38 to 50 billion in the upcoming years. The new technologies and machines of the internet of things in the market are now bringing various impacts to the automobiles, cars, business, hospitals, students, start-ups, banks, e-commerce, transportation, communication, energy, information technology sector and much more. The connected cars are expected to reach the \$54 billion in the coming two years. The health care market is also rising and will reach to the \$117 billion by 2020 which will develop the patient monitoring systems as well as the hospital's operations. Not only the health and automobile sectors are getting the benefits, but also the industries are getting more profits. With the help of the IoT, the industries are now expecting to reach the trillion zones that will add \$15 trillion to the global GDP by 2035. It will create a massive impact on the sales, productivity as well as in the jobs[1].

#### B. THE REVOLUTION: FUTURE OF BUSINESS, GOVERNMENTS, AND CONSUMERS

We are witnessing profound changes across all industries, seeing new business models coming up which are reshaping our production, consumption, transportation and delivery system.[4] Various industries and consumers have already accepted the idea of the internet of things in their business and firms for the better industrial revolution and market price. With the help of the IoT, an immense number of consumers, business holders as well as governments are interacting with the physical world. The business insider premium services are now closely observing the global market scenario of the internet of things. It helps the business and the governments to spread in more than 16 environments which include connected homes, transportation, manufacturing industries as well as in the agriculture industry. Billions of devices will be connected to the internet by 2020 which will include the traditional devices like the smart phones, tablets, smart watch and much more. More than \$6 trillion will be spent on the Internet of Things in the coming five years which will bring a great impact on the businesses. The various industries will be able to minimize the operational cost by increasing the profit and productivity.

Like the business firms, the governments are also focusing on the productivity, and after the business, they are expected to be the second-largest adopters of the IOT. More innovative use of web technologies can help public administrations modernize their structures by strengthening processes of e-governance with greater transparency, accountability and engagement between the government and its citizens. Governments must also adapt to the fact that power is shifting from state to non-state actors. Different consumers are lagging behind as compared to the business and governments, but still, they are investing in the IOT ecosystems and purchasing a number of devices to invest in the projects[2].

### IV. FUTURE PREDICTIONS OF IoT

The internet of things is now rising at a faster rate which is no more limited to the laptops, smart phones, and computers. The growth in the Internet of Things multiplied the number of devices and reached to almost 21 connected devices over the internet. It includes the washing machines, robotic vacuum cleaners, door locks, keys, toasters even toys also.

With the rise in the attacks of the hackers, the researchers have developed a modified version of the codes which will only infect the windows computers. Some cities are also getting smart with the use of the IOT devices that save both money and time. With

the help of the Internet of Things, the artificial intelligence is also developing and becoming an important part of the life. From the coffee maker to the smart hubs, all are connected to the internet to collect the data. The routers are also becoming more secure and protect the users from the attacks of the hackers. They have the ability to protect the devices which are connected to each other. With the rise in the demand and popularity of this process, various industries, business and the consumers are getting involved with the IOT and purchasing the devices. They can produce multiple products within fewer periods in a faster and smarter way. Soon, almost all the relevant and essential industries will be adopting it for their own betterment[3].

With continuously increasing computing power and due to financial constraint globally we are seeing a fall in hardware prices therefore it is economically feasible to connect anything to the internet. Intelligent sensors are already available at very competitive prices. All things will be smart and connected to the internet which will enable greater communication.

In the future, every physical thing could be connected to communication infrastructure.

Get together of the people will be seen less. People will see each other online through Skype, video-conferencing, etc.

People will be totally occupied in the virtual world.

Hologram technology will be used in designing, research and development, communication, etc.

The interactions involved in IoT will provide many conveniences and better services for individuals but can create opportunities to violate privacy. The privacy policy for each domain must be specified. Once specified proper norms have to be followed, the individual application or the whole IoT infrastructure must enforce it. One of the important concern about privacy is that the system interacts with other systems which have their own privacy policies. Different privacy policies may lead to inconsistencies in the IoT world, therefore a separate department to monitor all this possibilities needs to come up to work towards resolving these issues[7].

## A. ADVANTAGES

- It will help in increasing efficiency in using the resources.
- Productivity will increase through automation and even the manufacturing unit will grow exponentially when the material used reaches on time to the production requirement
- It will improve the quality of life of its people when it is economically feasible to connect anything to the internet.
- It will have positive effect on the environment by reducing the stress on the end and even help in mitigating climate change through traffic control management system and air quality control management system to check air quality.
- With change in policies and making it mandatory for construction industry to construct green building will help in considerable amount of reducing stress on environment by following specific norms and standards.
- The general population will have more access to the resources. It will help in lowering the cost of delivering services.
- There will be more transparency while using the state resources because the central command management system will help in keeping track of the movement of resources.
- There will be more transparency around the use and state of resources by using RFID module while transport of resources and even monitoring the use of state resources through satellite images or even by using drones.
- When people will enjoy using the services providing to them there will be awareness among different group. This will lead to more demand for storage of bandwidth.
- There will be shift in labour market and skills of the people.
- There will be creation of new business ventures by using artificial intelligence.
- The various products which are designed are to be “digitally connected” for monitoring through sensors and by installing a chip in the product to keep a check of its movement.
- There can be addition of digital services on top of products.
- Internet of things will be enabled to perceive their environment comprehensively and react & act autonomously.
- Every company will be potentially called a software company.
- In the future course, the business model of the company will be impacted by the value of the data.
- There will be very higher utilization rates of machines, tools, equipment and infrastructure.[4]

## B. LIMITATIONS

- Automation will lead to massive job losses in different sections.
- There will be job losses for unskilled labour.
- There are chances of specific surveillance on individuals.
- Hacking the whole system by hackers can create major havoc.
- There are chances of security threat if the system is not well protected with the help of highly skilled experts.
- Since all the things are interconnected, any system getting hacked can create a major problems which can have a negative impact on other systems which are interconnected.[4]
- Technology taking control over human life. Our lives will be increasingly controlled by technology and will be dependent on it.
- Human life can become more rigid.
- Our thinking ability can change which can even create harm on our creativity.
- The data storage can go in wrong hands if there are loopholes in the security system.

## V. CONCLUSION

All the eminent entities like stakeholders of the global society-governments, business, academia, bureaucrats, technocrats, spiritual gurus and civil society are liable to unitedly work together so as to get a profound cognizance of the emanated trends that are transpiring at such rapid pace within the society today. The fact the uncertainty surrounding the development and acceptance of emerging new technologies implies the unveiled variability as to how this transformations would unfold, the complexity and interconnection across various sector are hailing in one voice unanimously that we all need to work together.

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