

## *IoT: Modelling a better Society*

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*Abstract: “Civilization advances by extending the number of important operations which we can perform without thinking about them”, Alfred North Whitehead accurately quoted in 19th century. Advancements in the technology in every field directly or indirectly related to human lives are touching the sky. And the World is moving towards converging the technologies towards lives. While advancing the technology, one of the most important aspect to be looked into the societal impacts of the same. Because, more than the growth rate of the technologies, what is more imperative is the intentions behind it; we cannot mix the purpose with the tool.*

*Internet of things (IoT) is becoming most ubiquitous and beloved terminology for not only all tech savvy people but also all the revolutionaries, researchers and business visionaries. The power of connected everything around us to the internet and thus, enhancing lives makes IoT much more capable than just Digital transformation. We can say Internet of things (IoT) is nothing but interconnected, interdependent, smart and decentralized system of cooperating smart components of which humans will be creators and users. The interconnection of different devices and entities is building interconnected, low cost, efficient and smarter ecosystem than ever before.*

*Progression and development in IoT, which can ultimately bring an upgrade to all the fragments of the ecosystems, is subjected to societal re-organization, democratization and decentralization of the control over the infrastructure. IoT has power to bring the geographically and culturally scattered and divided world under one roof. The new restructured society can futuristically be expected to have intelligent helpers present in ecosystem which will enhance the day to day lives and thereby will shape up a smart future.*

*Keywords: IoT (Internet of Things), connected world, Smart World, Societal Reforms, Advancements in Society.*

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### I. INTRODUCTION

In the year 1999, a British technology Pioneer and visionary Kevin Ashton introduced a term called “Internet of Things (IoT)”. During the same time, internet became popular and the era of digital connectivity took another level. The idea proposed by Kevin spoke about an ecosystem where the objects in the physical world being connected to Internet. With the maturity and inventions in connectivity and telecommunications, the phenomenon of “Connected Everything” became popular and pervasive.

The heart of IoT remains the concept of combining and connecting the sensors, actuators, devices, networks to monitor the day to day life, actuate the regular chores. But it doesn't only contain that and what value IoT brings in is the rightness in those activities and enhance the quality of life. The entities in day to day life are getting a strong intelligent coating of technology and thus we can observe smartness in how the things are moving.

The implications and impact of IoT is huge and there have been very impressive projections made on economic aspects. Many economy visionaries and tech giants have predicted a huge business of around more than tens of Trillions with as much as

hundreds of billions devices connected and communicating via internet by 2025. What would be interesting to know is what projections and implications these advancements will have on society and lifestyle.

## II. IOT IN DAY TO DAY LIFE OF PEOPLE

“Civilization advances by extending the number of important operations which we can perform without thinking about them”, Alfred North Whitehead accurately quoted in 19th century. IoT is becoming ubiquitous in the lifestyle we are living. Right from the time we wake up or even before that to the time we are off to bed and even after that, technology has begun to assist us in every way we imagine. Let us consider a scenario and observe a common man’s life being assisted by a network of IoT solutions.

A man wakes up by alarm set automatically to ring after exactly six hours from the time at which his smart wearable notified as asleep. The first thing he notices is the LED blinking on his toothbrush. The moment he comes out of washroom, he observes the Yoga class video streaming on television which his IoT platform captured for him as he missed the class during sleep hours.

Next he takes shower where everything was preconfigured right from the water flow rate to temperature depending upon your body and weather conditions. By the time he gets ready for work, the coffee gets ready in the smart Kettle, which read the quantity of sugar recommended based upon your body sugar levels. The information about your Yoga and breakfast gets updated in system from where respective stakeholders such as your dietician, registered clinic can access.

As soon as he leaves house, the windows, curtains and doors are closed automatically and the devices in house adjust themselves in power saving mode. The networked vehicles and sensors embedded roads have communicated well in advance with the intelligent traffic system helps the vehicle to take best possible route for smooth transit. As soon as he puts his vehicle on auto drive mode, he enjoys reading news and also, replies to the emails. His cellphone automatically gets into a focused mode the moment he starts working to avoid social media distractions.

During the lunch time, he is suggested about the exciting lunch plans with his nearby friends. He is also suggested a healthy and tasty food providers nearby to enjoy. On the way back to home, his phone takes input about evening plans and understands that he wishes to cook good Italian dishes. He chooses couple of dishes for dinner plate and finds the ingredients, missing in kitchen, at his doorstep from nearby grocery shop. In his cooking adventure, he gets assisted by chef from his favorite restaurants on a small screen near the kitchen stove along with soft music that the speakers play based upon his taste. He enjoys the yummy dinner and sleeps with a peace of mind.

If the above example is to be summarized, we are surrounded with IoT solutions. Not only a common man is benefitted but if we consider the elderly people and the differently-abled people will find this as a blessing. The fascinating part is most of the above things except machine intelligence, are already there in market being used in day to day lives. Not only these but there are plentiful of solutions in all the domains advancing and converging to come under a roof. These have been discussed in details in subsequent sections.

## III. A SOCIETAL PERSPECTIVE ON IMPLICATIONS OF IOT

Technological advancements now a days, predominantly what falls under the sky of IoT, is not only limited to technologists or business people but it intends to be more for a user than maker. Optimizing the resources and maximizing the usability is where IoT finds a way through. Let us discuss through majority of the sections where we can find IoT has started a journey.

### a. Lifestyle: Connecting lives & bringing them closer

Internet of Things means different things to different people. One thing that can be said for sure is IoT is much more than just connecting the devices. It has a power to connect people from diverse geographic and divided places. In most of the parts of the world, difference in lifestyles of metro cities, towns and villages strongly exist. Only beautiful roads aren’t sufficient to

connect them but we need a balance in the facilities too. With IoT, one can foresee a personalized but uniform way of lifestyle being provided to almost every individual. Everyone can expect the type of solution that they are looking for irrespective of where they belong to. Be it the way we shop, to the way we travel, we control the things around us, the medical assistance we receive, the help from the expertise we get, the knowledge we can gain from where we wish to obtain, everyone will get everything of same quality. Thus, helping to bridge the gap and build a balanced society

*b. Energy: Smarter the energy, sustainable the world*

If the basic needs of the human being were to be revised, “Energy” would be one to find a place in crucial necessities. Optimized use of energy has always been a driving force for enormous innovations. Optimized supply of energy can also be achieved by solutions like Smart energy. Many government organizations of various countries are investing in IoT smart energy solutions in order to make use of produced energy extensively and make it available to everyone impeccably. Thus the smart energy makes energy creations and distribution systems smarter. This indeed leads to smarter, greener and sustainable system.

*c. Farming: Roots need to be strengthen*

Farming as a primary occupation has been in practice ever since humans started living in colonies and way before civilized. Need for food still remains a necessity for human being and to maintain the demand and supply of the same is indispensable for the whole world. As per the predictions by experts, the human population on the earth is predicted to grow as much as ten billions by 2050. And the demand for all has to be fulfilled. When we say IoT will help to improvise this, we do not essentially mean it increases cultivation percentage directly; but smart agriculture assisted by IoT will surely bring a difference.

As per the researches by Market and Market, with IoT acting as a catalyst in traditional farming making it smart agriculture, is expected to grow from approximately \$6 Billion to \$12 Billion by 2023 with a compound annual growth of 14% in five years. Traditional farming assisted by low cost soil sensors and smart actuators for automated farming activities will be a huge help for optimizing the cost. The decision makings at various stages or even in day to day activity empowered by environmental predictions, expert opinions and comparative study with fellow farmers across the globe will surely add value. Concepts like livestock monitoring, precision farming, agriculture drones, smart greenhouse is gaining popularity and with growing maturity, it will be a huge help for farmers and farming stakeholders.

*d. Banking*

“The Financial service sector has been slow to embrace IoT- but look hard enough and you find some banking bright lights leading the way”, Dough Drainwater, a visionary mentions in one of his reports. It will be only fair to say that banking sector is one of the area where adaption is of IoT ecosystem has been a challenge. The major reason for this remains the security and privacy. However, having said that, the essence of IoT has succeeded in enhancing the banking experience of the consumers. Digitization brought the banking to people’s doorstep and even on phones. The bank service providers are able to take help of the data collected from network of the devices, sensors, connected platforms, retail groups about a user and gather the information about their wishes, perception, patterns and expectations. This can help the bank service providers to personalize and contextualize the service being offered. This indeed enriches the banking experience of the end user.

Also, bank service providers can keep a better track of their customers such as business groups, farmers and individual load buyers via various social media well in advance and thus taking better decisions than waiting for any peak point.

*e. Healthcare*

Healthcare is one the domains that adopted IoT in very early stage. IoT has brought a transformation in the way in which the care is delivered. IoT brings a seamless and hassle-free and end to end connectivity among the patient, the clinical service providers, the smart medical devices, the medical experts, the caretakers and the caregivers and builds a strong healthcare ecosystem. Wearable have become a popular term in health world, which facilitates real time monitoring of our vitals without

disturbance in day-to-day activities. By making use of them, Physical Activity Monitoring for Aging People, Sportsmen Care, Patients Surveillance, Chronic Disease Management, continuous monitoring of ICU patients, Hygienic hand control, Dental Health, Skin Health is possible with less efforts and more accuracy resulting in better patient outcome.

Consider devices that not only assist you in monitoring enlisted parameters but also help to monitor nervous system behavior. For example devices like 'sleep pills' are there in market that tracks your sleep behavior, monitors the environment of your bedroom and reinvents the alarm. It simply can be attached to your bed and invisibly tracks your sleep at night. You don't need to put on any uncomfortable wearables or remember to charge something or press a button. It knows when you're falling asleep, soundly asleep, thrashing about, or waking up. The data can be visualized on your mobile application. If any abnormal behavior found, the same can be shared with doctor before the problem reaches any critical stage. Thus, with the capabilities of IoT one can get assistance in near real-time to avoid any mishaps.

Internet of Things has proven to be a blessing predominantly for elderly people, differently abled people and patients suffering from chronic diseases and need a continual monitoring. Smart and interconnected medical devices are capable of taking decisions and notifying the medical experts well in advance and thus serve people better. People living in remote areas of the world can leverage the solutions and get benefitted.

#### *f. Manufacturing : Industry 4.0 and IIoT*

Smart manufacturing, smart factories, Industry 4.0, Industrie 4.0, Industrial Internet of things (IIoT), are the terms interchangeably used by the technologists, have very optimistic side if we look from business perspective. However, the societal impacts of the same all together open the gates to the newer abilities and better and brighter work culture in world. Since the machines used for manufacturing and the processes to operate them attain autonomy with appropriate regulations, newer lever of collaborations among direct workers, machines, sensors, business generators, business consumers and most importantly, end users. With every evolutions in industrial manufacturing we have touched newer heights in easing human's job. Following the legacy, with IIoT, lower skilled jobs be it of physical or cognitive type, are expected to be performed by machines. People associated with manufacturing are expected to be upgraded in the skills perform quality work.

With these adoptions, there comes an augmentation in the safety standards and security at work. On the other side, it will definitely contribute to boost the productivity meeting the market demands. Thus, IIoT subsidizes to reduce wastes, optimize and ascertain resources and enhance productivity

#### *g. Transportation*

Internet of Things has been revolutionary in upgrading the transportation be it smart cars, connected trucks network, various type of vehicles enabled with V-V (Vehicle to vehicle) communication, smart sensors enabled transportation platforms (roads, railway tracks etc.) smart traffic and weather forecasting systems. An interconnected network of this brings an enriched experience and ease in day to day lives.

When IoT comes in mind of common users, it's not only about ease, safety and Security, but also about facilities and luxuries. In vehicle infotainment is buzz word in automotive industry. Applications like Music and video streaming is popular. This can be achieved by enabling audio/video player with smart connectivity and streaming data. Another application called phone activation over voice command is an added facility.

#### *h. Infrastructure*

When we say Smart infrastructure of the surrounding, it indeed means smart homes, smart buildings and thereby smart societies. Smart home brings real time monitoring and action of different things present at home such as water leakages, gas monitoring, temperature monitoring, safety and security monitoring. The lightening conditions, temperature control and major the household appliances such as AC, refrigerator etc. can be monitored and controlled easily by using a smart device too. Scaling

down to a larger aspect, measuring these parameters for buildings, apartments will make the city smarter bringing betterment in lives.

Let us take an example of smart home wherein we have Gas sensor deployed in kitchen. It will continuously sense if LPG leakage is there and send this data to cloud of that home owner via gateway. If gas leakage is found, it will send an alert to your smart phone. May you be anywhere in the world, you can take control actions such as turning the main switch of home off. This avoids accident probability at home; saving our vitals. This will primarily help the home owner and his family as he gains a safety measure and also insurance providers. Smart homes are built upon equivalent ideas wherein various conditions enlisted above can be monitored and controlled. Consider an example of waste management which will be part of smart city. In developing countries, waste management is a major issue. Smart waste management ensures to address problem to a better extent. Level sensors deployed near the dustbins at home, the dustbin conditions can be continuously monitored. This information can be shared with web servers of municipal waste collection authorities and private waste companies through Gateway residing at home. In this way, we can monitor dustbin levels continuously. Once filled, a message can be sent to respective authorities. This will help them to calculate optimized collection schedules and routes based on real-time monitoring of each waste container. Thus, cutting costs by optimizing waste collection logistics. This way, not only home owners will get monetary benefits as he can pay on need basis but also municipal corporation as their work will be easier. And more than this, it will help our surroundings to be cleaner and healthier.

#### **IV. IOT: A SOLUTION TO GLOBAL ISSUES**

Advancements in technology are supposed to serve majorly two purposes. One being to enrich and enhance the lifestyle; other is an essential one that is to be a problem solver. If the technology doesn't bring in a sustainable solution to the problem, it is not fit for adoption and people.

UN is still struggling for addressing global issues like healthcare for underdeveloped and developing countries, security, water crisis, climate change etc. apart from the peace-keeping mission. IoT as a future of converged technologies and an integral part of ecosystem in future has a moral responsibility to assist the problem solving minds in the world.

When it comes to the issue like climatic changes, the primary root cause of the same is pollution for which numerous factors are responsible. Solutions like Smart environment and Smart energy that deals with pollutant monitoring and taking control measures for the same can help to optimize the problem and create a difference in pollution levels. Also the advancements in the transportation, inventions of electric cars, rails, Smart traffic system are big help in reducing the carbon footprints.

One of the major issues according to the United Nations is healthcare of people from different geographies and origins. As stated in section 3, IoT in healthcare has capability to eradicate the issues of medical assistance and providing right time help. As IoT continues to grow, it is expected that devices will be capable of diagnosing the diseases and going further, it may suggest preventions as well in advance.

There are many such other solutions like Smart energy, Smart education system, Smart environment, Smart transportation, and Smart wearables etc. that are extending their inventions for addressing the problems. IoT enables these solutions to be great assistants in resolving various issues.

#### **V. CHALLENGES IN ADOPTING IOT TODAY**

When we are discussing about the positive implications of IoT on societal aspects, it is important to analyze the challenges that may lead to antagonistic situations. The major concern today remains the small age of IoT and the maturity it has attained in terms of the implementations and usability. This makes its smooth socializing in life challenging. The major concerns are discussed below

### A. Privacy Violation

Since the atomic element in the entire IoT as a concept remains the data points, the integrity and privacy of them is a key trait. The data points are nothing but the records and the patterns and information about the user's day to day lifestyle, activities, Things that they use, monitor and control, Things they plan next etc. Using these data, the immoral minds can do wonders. And violating in your personal lifestyle in near real time seems anthropologically challenged.

### B. Security concerns

In any of the solutions IoT is part of, goes through a journey of data generation, transportation to cloud platform, storage of this data and consumption of the same. Lack of strong security provisions at every stage and also as a whole makes it prone to theft. This data can be eavesdropped and consumed for personal benefits. This is one of major reasons of slowness in banking adopting IoT.

### C. Decentralized control over regulatory rights

IoT aims at bringing an equality and uniformity in the way it is available to every individual. The solutions are anticipating to solve the issues without human interventions and automatically. This may lead to the decentralization of the authorities and may lead to regulatory issues.

## VI. CONCLUSION

Internet of Things (IoT) with time is going to bring transformations in the society. It intends to enhance the life of people and is capable of solving the problems in their lives. With maturity and security concerns addressed, IoT can be seen as strong pillar of society in future.

In this IoT enabled environment, living can not only be simpler but also smarter, secure, healthier. It benefits end user, business people, government and indeed to society. The monetary benefits are combined along with benefits to environment and thus we can look forward towards a sustainable developed society.

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