Disruptive Technologies: Internet of Things

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Abstract

Transformational technologies can change the information technology landscape at a high level. These technologies are known as disruptive. One of the fastest growing emerging technologies is the Internet of Things, or IoT. While IoT devices have existed for over 20 years, the last decade has seen a substantial shift in the impact of these devices on the world. From smart watches being able to detect atrial fibrillation to self-driving cars, IoT devices have changed human interaction with computing devices. This emerging technology has ushered in a change so dramatic that our lives will change in ways we have yet to comprehend. This study will investigate the history of IoT and explore the ways this disruptive technology will forever alter humanity.

Brief History of Internet of Things

Science fiction television shows and movies have depicted technology far beyond what has been obtainable. Movies such as Star Wars and television shows such as Star Trek have been a symbol of future technology. However, this has changed over the decades from hypothetical to reality. One of the most notable technological advancements has been the Internet of Things, or IoT. In the mid 1960's, during the infant stages of the internet, we had a few interconnected computers that had the ability to communicate with each other. This was quickly expanded in the late 1960's into the ARPANET. Educational and Governmental organizations were the main users on this early version of the internet. In the 1980's, the commercialization of these interconnected computers ushered in the modern-day internet. It became apparent that the internet was going to be world altering. By the 1990's, we began to see the dot-com boom. We started to see the big names we know today: Google, Yahoo, AOL, Microsoft, Apple, and others.

Not only did we see a shift to the digital age, we also saw technological advancements the were societal changes themselves. Devices that were only seen in science fiction moves, such as a Star Trek communicator, a small device that allowed people to communicate with other at far distances, were now possible with Bluetooth. The largest shift came when technology advanced the creation of small devices that had the ability to connect to the internet. In the 1990's, these devices were labeled Internet of Things.

Discussion

There are many different definitions of Internet of Things. An accepted universal description defines IoT as "a family of technologies whose purpose is to transform any type of

object, even without originally a digital “nature”, into a device connected to the Internet, likely to take advantage of all the features owned by the objects born to use the network…” (Carayannis, Giudice, & Soto-Acosta, 2018). These devices can behave like a sensor, such as a thermometer or motion detector. Because they are connected to the internet, they can send the information they collect to anyone. This information can be used to make instant decisions. IoT is not limited to sensors. There are thousands of possibilities for devices to be implemented into our daily lives. In the beginning of the rise of IoT devices, their main goal was to streamline processes and turn profits. This paradigm has shifted to utilize IoT is a wider use case than ever before.

IoT in the Smart Home

The modern IoT device can encompass various aspects of technology. One of the most popular uses for IoT is in the home. Today, we have hundreds of different products that can make our homes ‘smart’. The most popular IoT device in most homes today is the voice assistant. The main players in the voice assistant arena are Google and Amazon. These voice assistants have dramatically altered the way we live our daily lives. The disruption can be seen and felt by nearly everyone, across all walks of life. Users who are uncomfortable or even unable to manipulate a smart phone or computer, now have voice assistants at their disposal. Individuals with disabilities and senior’s with limited physical ability can now utilize the power of the internet to get help, ask questions, make appointments, and contact loved ones, all with a simple IoT voice assistant. Upwards of 80% of homes in America claim to use some for of voice assistant. In addition to the voice assistant, other aspects of the smart home have disrupted our daily routines. For example, many people are moving away from old home security systems such as ADT, and are installing ‘smart’ security systems such as SimpliSafe and Ring Security. These new IoT home security systems have given people more control than ever before over their

homes security. We have full video feed access, alert notifications, and intelligent, AI based system. In the past, if you were not home and there was an alarm, you would not know until the authorities were called and you were alerted. Sometimes this would take hours. With IoT and the always on internet, the sensors will alert the homeowner instantly, the very moment a detection is noticed. With IoT security cameras, we can now check in on our homes from anywhere in the world and can even answer the doorbell from across the globe. With IoT, smart homes have revolutionized our lives and introduced a new level on technological convenience that we have ever seen before.

IoT and the Automobile Industry

Another disrupted area of technology that IoT has affected is the automobile industry. We have had services such as GPS, On Star, and other 'connected' services for years. However, Tesla has pushed the entire automotive industry into a new technological era. Not only are Tesla vehicles connected to the internet, they utilize AI in ways were never thought possible until now. Tesla was not the first company to make an electric car. Toyota, Ford, and Chevrolet have all been manufacturing electric vehicles for years. Tesla was able to bring modern technology and innovation into their vehicles is ways the major automobile companies could not. With Tesla's self-driving mode and interconnected sensors, they have forever changed the way the automobile industry will function. All major manufactures are now in the process of creating their own 'smart' cars in the Tesla image. Companies such as Rivian, Lucid, and Faraday Futures have all jumped into the electric car industry in response to Tesla's rise to EV dominance. Tesla's use of IoT technology will forever change how automobiles are made and dramatically alter the way we interact with our automobiles.

IoT in Healthcare

Healthcare is another area that IoT has changed in unforeseen ways. Every aspect of healthcare now has the ability to be digital, which then allows for IoT devices to streamline patient care and data collection. IoT products such as Fitbit and Apple Watch are able to connect to our healthcare providers, giving them up to date, detailed information about the patient. Even medication can be monitored via IoT connected devices to prevent errors in medication delivery and consumption. All of the patient' medical data can be correlated into a single data point and a "comprehensive picture of their health at each moment can improve treatment and responsiveness, even if the patient is not in the hospital" (Pisani, Oliveira, Eduardo S. Gama, Bittencourt, & Borin, 2020).

Large Scale IoT

A new revolution of IoT is now beginning to be implemented into entire cities. Sensors can be placed around an entire city and give the authorities a deeper insight. These sensors can include air quality, parking space availability, traffic conditions, city wide surveillance cameras, and even the level of trash in a container. Utilizing these and other IoT devices in a city can lead to better quality of life for the citizens by increasing the efficiency of the city itself. "Integrating smart objects into the urban physical infrastructure also contributes to improving flexibility, reliability, and efficiency in infrastructure operation, as well as increasing safety and reducing both the costs and the number of workers necessary for building and maintenance" (Pisani, Oliveira, Eduardo S. Gama, Bittencourt, & Borin, 2020). There have been numerous smart cities planned and we are now seeing the early stages of their life cycle. Life in these cities will undoubtedly be drastically different than a few years ago.

IoT and the Future

While the future remains unknown, we can assume that IoT will play a large role in future life for humanity. “The National Intelligence Council (NIC) of the United States selected IoT as one of six technologies that has potential impacts on national interests through 2025” (Lee, Bae, & Kim, 2017). With the exponential growth of technology and the number of IoT devices already in use around the world, we will only see an increase in the life altering changes they carry with them. IoT is likely to have a global impact on humans in the future. With hundreds of satellites orbiting the Earth, the ability for any device, anywhere in the world, to have full access to the internet has the ability to change even the most remote locations in the world. For example, Project Loon is utilizing IoT technology to provide internet to areas that have suffered natural disasters by way of high-altitude balloons. Militaries across the globe are now using satellites to control unmanned areal vehicles to monitor remote locations for security. Kochi National College of Technology (KNCT), Earthquake Research Institute, University of Tokyo, Hitachi Zosen Corporation, Japan Aerospace eXploration Agency (JAXA), and National Institute of Information and Communications Technology (NICT) have banned together to develop a tsunami detection system to help catch these devastating natural disaster as early as possible. IoT sensors relay water level information in real time to various locations that can process the data.

There will also be benefits for big data companies by way of IoT devices. These devices gather millions of data points that can be used in various ways. Big data companies already use the data they collect to provide services and make profits for shareholders. With the introduction of IoT devices, the amount of data collected will grow exponentially. This effect will be both positive and negative for the world at large. The data collected from personally worn IoT devices

such as fitness trackers and smart watches with GPS, can be used to target consumers with personalized ads based on their health statistics and GPS location. This concept is already in play with various companies. For example, it is already widely known that Google utilizes the data they collect for ads. Google recently acquired FitBit, the largest fitness tracking company. The shear amount of data Google will be collecting for these IoT devices is unknown. This level of data collection will be unprecedented and will be a disruptive force in the IoT world. Some may consider this massive data collection as a negative, however, one can argue that this could be a positive. Take health statistics as an example. Fitbits collect heartrate data and blood oxygen level with some of their IoT trackers. This information could not only be collected by Google, it could also be shared by Google with your healthcare provider. You doctor could have up to date statistic on your health via a link between them and Google. This link could provide early warning signs to the doctor that could potentially prevent a medical emergency and save lives. While some may not agree that Google should be in the healthcare business, some may find the connection worth the effort if it has a positive impact on their health.

Another Aspect of big data that could be disrupted by IoT is unexpected risk. “According to a number of researchers, data leaks could severely impact individual privacy by revealing sensitive personal information such as personal habits or personal financial information” (Brous, Janssen, & Herder, 2020). Security must be at the forefront of any IoT development. Unfortunately, the future of IoT is unknown, however, the security implications are known. Bad actors will undoubtedly target big data companies at increasing rates in the coming years. Big data has always been a large target of these cyber criminals because data is valuable. The more valuable the data, the bigger the profit, and higher the risk factor for the company. The disruption

these risks will bring to the table are currently unknown and will be unavoidable. For this reason, developers must remain focused of IoT security.

Conclusion

Technology growth has the capacity to change the world. With the creation of IoT devices, we have witnessed disruptions to our way of life that were not even conceived until now. Our homes know when we arrive and when we leave. Our lights obey our commands. We can ask a digital person almost anything and receive an answer in seconds. Our cars paired with advanced AI are able to park and even drive themselves. Our healthcare has turned digital and allows our doctors to catch health problems quicker than ever before. Big data now has the ability to collect more of our personal data than we even thought possible. All of these concepts were made possible by the injection of IoT devices into our daily lives. While the future is undetermined, one things is guaranteed; IoT will continue to disrupt our lives in ways we have yet to fathom.

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