

Internet of Things in Customer Service

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ABSTRACT

The Internet of things (or IoT) essentially means connecting any device that can be turned on and off to the Internet, where it can then be controlled remotely. The IoT also allows you to control devices remotely – meaning that you can turn off your office lights from home to save money, for example. The number of IoT-connected devices will only continue to grow over the next decade. The Internet of things and customer service are coming together to change the way companies do business. Companies and their customers both enjoy benefits by incorporating the power of the IoT in customer service. The aim of this paper is to examine the impact of IoT on customer service.

KEYWORDS: *Internet of things, IoT, industrial Internet of things, IIoT, customer service, customer service industry, automation.*

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INTRODUCTION

From air conditioning being controlled by your smartphone to being able to turn off your office lights from the comfort of your living room, the physical environment is becoming increasingly digitized. Digitization may be regarded as the transition process that companies are faced with when they start to introduce digital technologies, in order to implement a networked, intelligent company. Digital technologies can save costs on the customer side, increase flexibility and adaptability, and save time. They not only bring advantages for customers and providers, but also advantages for the environment, such as energy savings. By far the most widespread digital technology related to digital service transformation is the Internet of things (IoT). IoT devices are equipped with sensors that enable them to exchange data with a centralized network and even with each other. Across many sectors there is a growing understanding of the importance of the Internet of things (IoT) in customer service. For the first time, IoT-equipped smart devices are now communicating automatically, without human involvement. IoT technology can help a variety of companies significantly improve the customer

experience. IoT can be seen as a prerequisite for smart services, as this technology allows the collection and transmission of data from products and systems. Depending on the corporate goal, different possibilities are perceived that can be implemented through IoT [1].

OVERVIEW OF INTERNET OF THINGS

The concept of the Internet of things (IoT) has been around since the late 1990s, but it gained momentum in the 2000s with the rise of Internet-connected devices. The Internet began with some military computers in the Pentagon called Arpanet in 1969. It expanded throughout the 1980s as a set of four parallel military networks, each at a different security level. The evolution of IoT is shown in Figure 1 [2]. The core technology which gives the Internet its particular characteristics is called Transmission Control Protocol/Internet Protocol (TCP/IP), which is essentially a set of rules for communication [3].

Internet of things (IoT) is a worldwide network that connects devices to the Internet and to each other using wireless technology. These devices contain hardware such as sensors and electronics which give

them the ability to interact with other objects and to be monitored and controlled from afar. The idea is that the physical devices with sensors or the ability to capture data, shares that data with websites. The information is then used or analyzed in real time or at a later time, to create efficiencies. IoT is expanding rapidly and it has been estimated that 50 billion devices will be connected to the Internet by 2020. These include smart phones, tablets, desktop computers, autonomous vehicles, refrigerators, toasters, thermostats, cameras, alarm systems, home appliances, insulin pumps, industrial machines, intelligent wheelchairs, wireless sensors, mobile robots, etc. Figure 2 illustrates the Internet of things [4], while Figure 3 shows its various applications [5].

There are four main technologies that enable IoT [6]: (1) Radio-frequency identification (RFID) and near-field communication, (2) Optical tags and quick response codes: This is used for low cost tagging, (3) Bluetooth low energy (BLE), (4) Wireless sensor network: They are usually connected as wireless sensor networks to monitor physical properties in specific environments. Communications technologies in Internet of things are portrayed in Figure 4 [7]

IoT technology enables people and objects to interact with each other. It is employed in many areas such as smart transportation, smart cities, smart energy, emergency services, healthcare, data security, industrial control, logistics, retails, structural health, traffic congestion, manufacturing, and waste management. The Internet of things is extensively developed world-wide with a focus on civilian applications such as electric power distribution, intelligent transportation, healthcare, industrial control, precision agriculture, environmental monitoring, etc.

The growth of the internet of things (IoT) is drastically making impact on home and industry. While the IoT affects among others transportation, healthcare, or smart homes, the Industrial Internet of things (IIoT) refers in particular to industrial environments. IIoT is a new industrial ecosystem that combines intelligent and autonomous machines, advanced predictive analytics, and machine-human collaboration to improve productivity, efficiency and reliability. It is bringing about a world where smart, connected embedded systems and products operate as part of larger systems [8].

The industrial Internet of things (IIoT) refers to the application of the Internet of things (IoT) across several industries such as manufacturing, logistics, oil and gas, transportation, energy/utilities, chemical, aviation and other industrial sectors. A typical industrial Internet of things is shown in Figure 5 [9].

IOT IN CUSTOMER SERVICE

With the rate by which technology grows, it seems that it is already outpacing us. Industrial revolution gave rise to the need of data/information transfer between different locations over the web. Information technology made it possible through the innovations in the network domain and Internet stood out clearly as the fastest and most trustworthy mode of data/information communication. Since inception, the Internet has turned omnipresent and has influenced all aspects of business and technology creating an unquestionable space in our lives [10]. Internet of things (IoT) has been receiving much attention as a core technology in the future incorporating things used by people and providing efficiency and convenience to lives of humans. At the same time, it is expected that things are connected with each other without or with a minimum involvement of humans through Internet generating, collecting, sharing, and utilizing information in a system environment. Such an environment is called as Internet of things. Figure 6 shows that the number of IoT-connected devices will only continue to grow over the next decade [11].

Companies operating in today's extremely competitive business landscape are continuously searching for ways to differentiate themselves from their competition.

Providing excellent customer service has become a critical aspect for success. The ability to anticipate customer needs and proactively address them can lead to increased customer satisfaction, retention, and ultimately, business growth. The rise of the Internet of things (IoT) has transformed the way businesses operate, enabling the collection and analysis of massive amounts of data in real-time. The IoT provides a vast network of connected devices that can collect data in real-time, providing businesses with the opportunity to gain valuable insights into customer behavior and preferences. By anticipating customer needs, businesses can also gain a competitive advantage in the marketplace. In addition to improving customer service, the IoT can also enhance operational efficiency [12]. Figure 7 is a representation of IoT in customer service [13].

APPLICATIONS OF IOT IN CUSTOMER SERVICE

Figure 8 indicates that customer experience use cases in IoT encompass the entire customer journey [14]. Applications of IoT in customer service include the following [10,15,16]:

- *Automation:* Automation is an excellent example of how implementing the IoT in customer service solutions can provide benefits for both a company

and its customers. From a company's perspective, automating repetitive tasks can save time and money. Agents can be more productive by addressing high-level issues while automated solutions are processing more basic customer concerns such as remotely restarting a device or checking its status. The automation made possible by employing the IoT for customer service can be used to provide self-service solutions that do not require interaction with a human agent. This raises customer satisfaction as their issues can be resolved before causing any disruption to their lives.

- *Tracking Assets:* IoT technology enables large companies to simultaneously track and manage thousands of assets, ensuring their complex systems run smoothly. For example, IoT can enable nationwide rental car fleets to track vehicles, insurance companies to offer usage-based auto insurance, healthcare companies to monitor at-home devices, and railroads to detect problems with rail cars before an emergency occurs. In the space ecosystem, companies can leverage the functionality and capabilities of the IoT by using it to provide more accurate and reliable tracking and monitoring of space assets, such as satellites or spacecraft.
- *Data Collection:* IoT devices are exceptionally effective at gathering, storing, and analyzing data. Sensors in business environments can collect valuable insights for businesses to leverage when making decisions about improving the customer experience. For example, IoT sensors could monitor how customers move around a store and interact with items in a retail environment, giving business leaders information on how to position products and aisles for more streamlined experiences. IoT systems can track data over time, providing companies with valuable guidance on how to serve their customers.
- *Inventory Management:* Companies can also use IoT to reduce the risk of inventory issues and stockouts when engaging with customers. Indeed, IoT sensors can track the availability of items in a warehouse or store room remotely and automatically update information on a company's app or website. IoT systems using radio frequency identification tags may also enable companies to monitor a particular product and information about that item through every stage of the production cycle. This can even help service agents provide better customer support by ensuring they can answer questions about where their items are in the moment.
- *Customer Relationship Management (CRM):* Customer is a person or an organization who intends to or is involved into a purchase transaction of a product or service with an organization. Consumer is the person who actually uses the product or services. Customer relationship management encompasses the knowledge about the customer to manage and serve the customer better. The three basic pillars (i.e. relationship marketing, information technology, and changing customer behavior) are responsible for a customer driven business. Businesses have different strategies to run their business wherein customer relationship management makes its place to one of the most important strategy. CRM integrates sales, marketing and customer service dynamically to generate value for the company as well as for its customers creating a win-win.
- *Reducing Food Waste:* Restaurant industry food waste causes methane gas emissions via landfills. Integrating 5G IoT sensors in the restaurant industry to manage supply and demand and automate the end-to-end food flow process at each step—from the kitchen all the way to the consumer's plate—can help reduce food waste. This can be a good use case to not only address climate change and hunger, but to also improve the customer experience.
- *Personalized Service:* Customer service can be personalized by the inclusion of IoT technology. IoT integrations add a further dimension to traditional contact center communications, enabling organizations to trigger automated, ultra-personalized communications to their customers, making the most of micro-moments. IoT devices enhance customer experience by providing real-time data and enabling more personalized services and proactive support.
- *Advanced Analytics:* Data analytics plays a crucial role in predictive customer service. Using the IoT for customer service presents companies with the possibility of using the collected data to perform advanced analytics. The data companies gather from IoT devices is processed by software in the cloud and analyzed to better understand customer trends and expectations. The insights companies gain from advanced analytics provide a competitive advantage over less data-savvy rivals. By analyzing data from various sources, businesses can identify patterns and trends in customer behavior. This information can be used to create personalized offers and promotions that are more likely to resonate with customers.

BENEFITS

IoT-enabled predictive customer service offers numerous benefits for businesses and customers alike. The IoT has the potential to revolutionize customer service by enabling businesses to collect, analyze, and act on massive amounts of data in real-time.

The data collected and stored in cloud-based systems and databases from intelligent, IoT-enabled devices provide a wealth of information about a company's customers. In many cases, the data available to the customer service team facilitates a speedy resolution to a customer's problem. Other benefits of IoT in customer service include [11,17,18]:

- *Competitive Advantage:* Adopting IoT-enabled predictive customer service can provide businesses with a competitive advantage by differentiating them from competitors. By delivering proactive service that meets the customer's needs before they even realize it, businesses can build a reputation for excellent customer service, leading to increased customer loyalty and market share.
- *Providing Real-time Information:* Being able to monitor what is happening in real-time to devices and infrastructure gives organizations greater control. They can monitor operations and spot issues as they develop, automatically. Predictive maintenance of equipment before it goes wrong, ensures uninterrupted service which helps to improve the overall experience. Real-time information also empowers customers. They can see when particular roads are congested and plan different routes or check pollen or pollution levels before leaving home.
- *Improving Efficiency:* IoT devices can make your operations more efficient from back to front, producing a customer experience that is quicker and more responsive. Investing in IoT brings tangible return on investment for organizations. They can monitor their activities more effectively and optimize operations to save money and time. Customers can also benefit from IoT. For instance, by automating processes between machines customers no longer have to waste time emailing to request more printer ink.
- *User Experience:* User experience is a term that refers to every aspect of a customer's interaction with your brand, products, and services. It has the potential to be transformed by the successful integration of IoT-connected devices. Every customer-facing business knows that there is one variable that is more important than all others: user experience. Word of satisfied or dissatisfied customers can quickly spread via social media and other communication channels. Ultimately, whether or not your customers are having a straightforward, simple, and stress-free experience will affect how much your company will grow.
- *Proactive Maintenance:* Unfortunately, it is impossible to completely avoid performance issues, but how your company is able to deal with them is a pivotal part of your user experience. This means that the ability of IoT devices to monitor their own performance and detect potential issues before they become visible to users can be really useful. You will be able to proactively offer support to customers and prevent bigger issues from occurring, for example by scheduling a software update.
- *Predictive Maintenance:* Predictive maintenance is also an emerging application of IoT and predictive analytics that enables businesses to anticipate when equipment is likely to fail and take proactive steps to prevent downtime. Predictive maintenance can help businesses reduce costs and improve customer satisfaction by minimizing downtime and ensuring that equipment is always available when it is needed. For example, an airline can use predictive maintenance to identify potential issues with aircraft engines and schedule maintenance proactively, reducing the risk of delays or cancellations.
- *Remote Assistance:* Although IoT devices are able to reduce the likelihood of product failures, these will still inevitably occur. However, the IoT offers a unique solution to these problems. Most devices can be controlled via remote access, meaning that your team of experts will be able to diagnose problems and find solutions directly.
- *Personalized Experience:* Making sure that your customers feel special is an important part of guaranteeing a positive user experience and the IoT will make it easier for you to design experiences that are specifically tailored for each individual user. You will be able to drive customers towards other products that they will love through data-driven product recommendations.
- *Enhanced Security:* It is critical that security is taken seriously in an IoT customer service solution. No matter how beneficial the system is, it will never reach its potential if it is not secure. IoT devices will often include features such as biometric sensors that offer greater protection of

customer details and data. Remote monitoring will also mean that your customers can be confident that you can protect their devices should they be lost or stolen. This will help your users to feel valued and secure when they interact with your brand.

- *Simple Integration:* One of the best things about the IoT is that you should be able to quickly and simply integrate it alongside your legacy systems. By integrating IoT devices with an automated receptionist, customers can interact with the system using voice commands or through smart devices. This means that you will be able to see the benefits of the IoT in your customer service without having to make huge investments, while you will be agile enough to also integrate advanced AI analytics going forward.

CHALLENGES

Utilizing IoT for predictive customer service presents challenges and limitations. Data privacy and security concerns must be addressed, and technical challenges, such as integration and data management, must be overcome. Inaccurate or incomplete data can lead to incorrect predictions and decisions. In a world where devices will be equipped with the ability to understand contexts and communicate with one another, new and bigger security threats will arise. Other challenges of IoT in customer service include the following [11,18]:

- *Expensive Implementation:* It can be expensive to implement and maintain an IoT customer service system. There are the initial costs of providing IoT devices and maintaining them to ensure consistent connectivity to facilitate data transmission. Additional costs are required to procure the cloud systems necessary to process the data and furnish the expected benefits.
- *Technical Challenges:* There is no doubt that implementing IoT solutions can be complex; it requires technical knowledge of a range of different devices and systems. While overcoming these technical challenges will require investment, this will also make sure that your organization is well-prepared for a world that is only going to become more reliant on technology.
- *Privacy Concerns:* Maintaining user privacy and complying with regulations like GDPR is crucial when dealing with personal data. Almost all of the benefits of IoT customer service come from leveraging customers' personal data. This obviously increases the risk that comes with potential data breaches or hacking. You can start to mitigate these concerns by being open with

your users about your privacy policy, while also investing in strong and effective remote access security.

- *Reliability:* With the effectiveness of IoT devices so heavily reliant on a stable Internet connection, some users are reluctant to adopt them. After all, you do not want to lose all usability simply because of a network disruption; the frustration this will cause will undo any benefits for user experience. To avoid these issues, try to ensure that any IoT devices that you integrate into your operations are not entirely dependent on an Internet connection. All of this will ensure that reliability issues are rare, leaving your customers only with a positive user experience.
- *Potential Risks:* Despite the security measures built into IoT devices and end-to-end encryption, there are always potential data risks. IoT endpoints can pose an attractive target for hackers and misconfigured equipment may not provide the necessary degree of security. Companies need to prioritize the security of customer data or risk losing their confidence.
- *Threats to the Human Workforce:* The automation and efficiency provided by using the power of the IoT in customer service can pose threats to the human workforce. In some cases, companies may be able to reduce the number of customer service agents in favor of automated, IoT-driven solutions. This may threaten to eliminate a class of jobs that previously required a skilled and trained individual to perform effectively. Societies will have to decide how far to take the automation and efficiency made possible by IoT customer service solutions.

FUTURE OF IOT IN CUSTOMER SERVICE

The Internet of things opens a world of opportunities and brings us one step closer to those science "future homes" in the movies. It is evident that the future is going to be increasingly interconnected and intelligent, with the IoT becoming more ubiquitous every day. Integrating IoT devices into your organization's operations will allow you to leverage greater insights into your customers' behavior through enhanced data collection.

The organization's profit model will undergo significant changes in the future. This will mean that you can produce even more personalized experiences [11].

Internet of things will be naturally formed in human lives while providing new values to humans. Beyond doubts, we can state that the future of the systems that acquire data is going to be the Internet of things. IoT

is eventually referred to as an integration of data through the incorporation of complicated technologies. It is expected that Internet of things will change information communication and industrial infrastructure with various types of technologies including the sensor, actuator, and user device and network technologies. The considerable potential of IoT customer service solutions makes it very likely that they will become the norm across all sectors of business and industry. While some companies will be at the forefront of this technology, it will be quite sometime before all of this becomes commonplace. Already, countless manufacturing and engineering companies have begun to embrace the technology, helping them monitor solutions, gather information, and control tools from afar [19].

CONCLUSION

Across many sectors there is a growing understanding of the importance of the Internet of things in customer service. IoT-equipped smart devices are now communicating automatically, without human involvement. Experts see IoT as the natural trajectory of web innovations, which increases connectivity this time not between people but between things. But all this is rooted to the need to redefine customer experience and offer something yet unheard of to consumers. Currently there are almost all devices coming in the market with connectivity; hence we can state that IoT is no more a conjecture but a reality. IoT devices are smarter than current smart technologies.

If brands want to expand beyond what they are today, it is a no-brainer that they should embrace the concept of IoT. Organizations that ignore this emerging paradigm will have a hard time competing with their market rivals. Generating competitive advantages through services is considered more sustainable, as these need to be identified by competitors before copying. More information about Internet of things in customer service can be found in the books in [20,21] and the following related journal: *IEEE Internet of Things Journal*.

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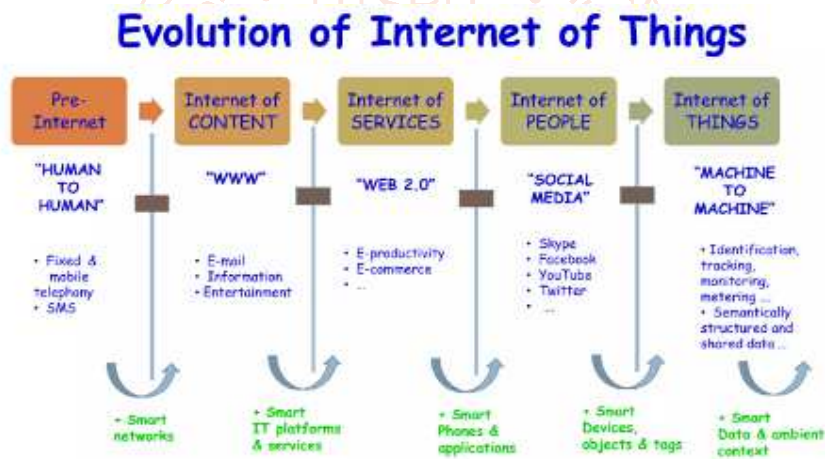


Figure 1 The evolution of IoT [2].



Figure 2 The Internet of things [4].



Figure 3 Applications of IoT [5].

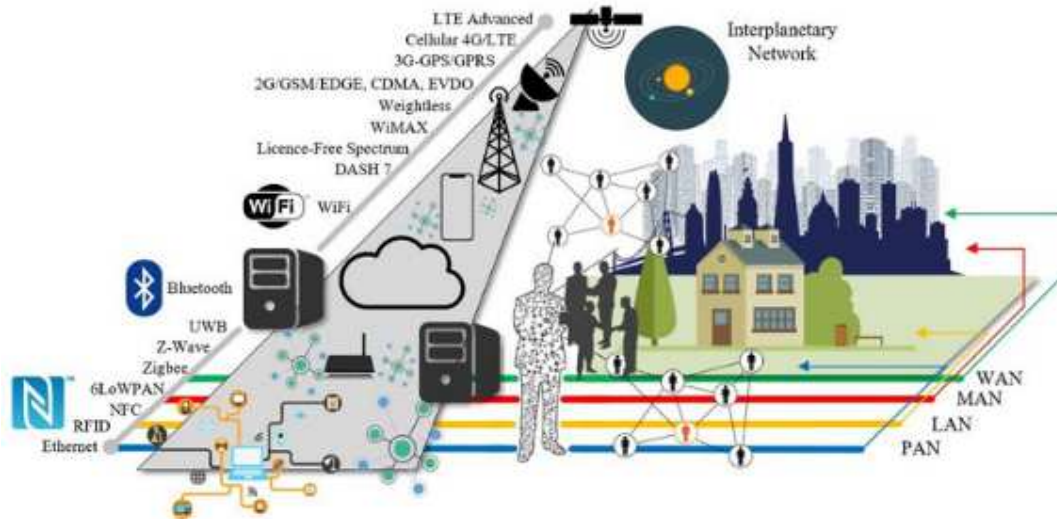


Figure 4 Communications technologies in Internet of things [7].

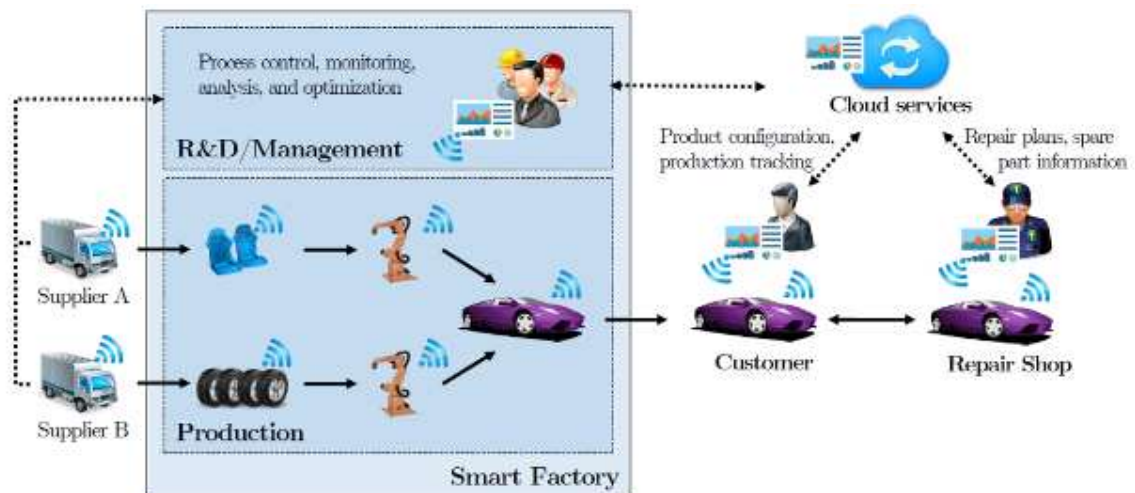


Figure 5 A typical industrial Internet of things [9].

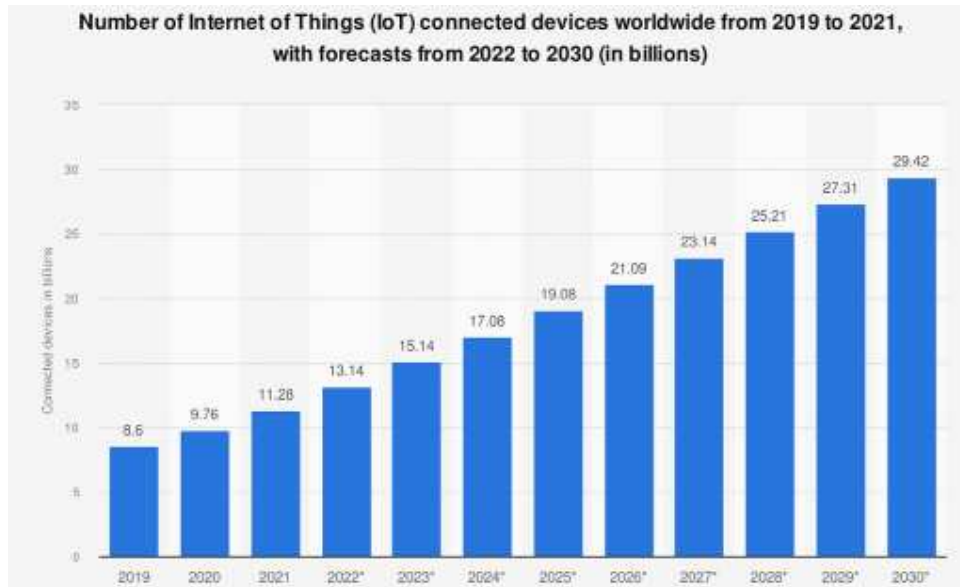


Figure 6 The number of IoT-connected devices will continue to grow over the next decade [11].



Figure 7 A representation of IoT in customer service [13].



Figure 8 Customer experience use cases in IoT encompass the entire customer journey [14].