

WHITE PAPER

How IoT is shaping the future of the healthcare industry?

The Role of IoT in Transforming Companies

The Internet of Things (IoT) could be classified as a network or assembly of devices which is used to gather, convey and channelize data through the internet. The role of data and human lives are intertwined through an all-encompassing landscape of IoT, which transforms not just the role of business but its overall impact on the lives of the consumer, his choices of product lines, services and markets.

Studies have shown that the market for Industrial Internet of things (IIoT) would grow at a compound annual growth rate (CAGR) of over **8%** in the next four years. In the latest study of market share by Market Research Engine, the participants and company profiles included – General Electric, Intel, Cisco, ARM, Rockwell Automation, Siemens, Dassault Systems, ABB, Bosch, IBM and others. Countries like Germany, Japan and China are embracing Industry 4.0.

The advantages of IoT and its impact on businesses

Great customer experience and research insights - IoT enables greater operational scalability, rewarding customer experience and insights. Companies like Microsoft, IBM, Google, and other organizations have enabled cloud platforms, transitioning towards a shift in cutting-edge computing. Companies like Amazon have been able to see these results in their subscription service models.

Better efficiency and lower expenditure - The many benefits offered through these research insights is also a reduction in downtime leading to optimal efficiency in business processes. The use of IoT with other technologies creates an efficient shift in predictive maintenance and operations. By using algorithms, digital twins offer many benefits across industries like – gas, oil and even energy-intensive sources.

Impact on Revenue - IoT enables optimization in many key business processes which do boost efficiency and productivity. This has a direct benefit on profit margins and revenues. Research studies from the global satellite communications service Inmarsat revealed - the ascendancy of industrial IoT (IIoT) to boost revenues at an estimated \$154 million.

Competitive advantages - When these are combined with technologies such as AI, robotics, VR, AR and blockchain, it has a direct bearing on many products and services leading to new competitive advantages. This directly has an impact on untapped revenues, leading to growth.



Why should industry leverage from IoT?

Competitive differentiation - With billions of devices connected while simultaneously transmitting valuable information, businesses can leverage from market insight by measuring efficiency and performance through various benchmarking studies. This creates a holistic outlook for different siloed functions within an organization blending into the IoT architectural framework.

Better decision making - The main advantage for the industry is in the area of innovation and data analytics. With data being generated through connected devices, organizations and their management can make intelligent decisions, and also envision new models that drive innovation. This enhances better decision-making capability. With better stakeholder communications, it will directly increase shareholders' value.

Risk Management - Wearable IoT devices connected to various employees can give organizations greater access to workers in managing risk factors like health, security, location, compliance and safety guidelines. The data generated can be used to make better policies on labor tracking and employee engagement, impacting productivity and efficiency.

Automation - IoT networked devices can provide a path in executing many redundant tasks. Automation can do away with human intervention wherein IoT channels can track down information providing options to the decision-maker. This intervention increases efficiency and automates most mundane tasks which have an impact on many processes impacting growth.

Application of IoT in Healthcare

The (IoT) Internet of things has become synonymous with technology being embedded in several markets, especially healthcare which is witnessing IoT advancements in different areas. Organizations that specialize in technology or healthcare rely largely upon and invest in IoT. From Wi-Fi or Bluetooth enabled X-ray machines to wearables like bio-sensors, they provide critical data which helps health practitioners in making progress in their respective field.

Despite IoT being relatively nascent in the healthcare industry, the pace is transitioning fast, so much as the entire landscape being called the- 'Internet of Medical Things'. CISCO systems estimate- that by 2020 IoT applications would consist of 50 billion devices which will be directly connected to the internet. This offers us a new insight into IoT capabilities, by estimating and benchmarking parameters on a range of variables. Currently, there are many benefits of IoT applications that are being used in healthcare systems.

IoT devices are transforming healthcare in many areas. Smart devices are connected to global information networks which can be accessed anytime and anywhere. Hospitals, by enabling IoT devices can keep tabs on medical devices, patients and personnel. IoT based healthcare systems and their applications include many other systems - Cloud computing, grid computing, big data, connected networks, AI, AR and wearable technologies. IoT technologies increase efficiency by lowering operational costs and also provides new insights to patient healthcare.



The advantages of IoT in healthcare

Cancer Treatment

IoT-enabled applications have benefited a lot of patients suffering from cancer. In 2018, data from a randomized clinical trial of over 300 patients receiving treatment for head and neck cancer was presented at the ASCO Annual Meeting. In the trial, they used a blood-pressure cuff and Bluetooth enabled weight scale along with an app for tracking symptoms. Through a smart monitoring system such as CYCORE, they were able to detect symptoms related to cancer while comparing patients visiting the physician every week. The American Society of Clinical Oncology had concurred through results wherein smart technology helped simplify care for patients by checking emerging side-effects and quickly easing the burden of the patients.

Diabetes Management

IoT devices and various technologies have enabled smart devices that monitor glucose levels of diabetic patients at continuous intervals. These are also known as Continuous Glucose Monitors (CGM) that help administer treatment to patients. Many smart CGMs like Freestyle Libre and Eversense send data and information of blood glucose levels to applications on various devices like Android, iPhone and the Apple Watch.

Other devices like Insulin pens or pen caps like InPen, Gocap, and Esysta have the capability to automatically record the amount, time, and type of insulin injected in a particular dose, and recommend the correct type of insulin injection at the right time. Google Life Sciences in 2014 also now known as Verily, a subsidiary of Google's parent company Alphabet announced that

it would be developing a smart contact lens that could measure tear glucose, helping a lot of patients.

Treatment of Asthma

Smart technological devices have been giving increased insight and control over asthmatic patient's symptoms and enabling treatment through connected inhalers. Propeller Health is one of the biggest producers of smart inhaler technology. A sensor is attached to an inhaler or a Bluetooth spirometer. This is again connected with the app and helps people with Chronic Obstructive Pulmonary Disease (COPD) and asthma.

IoT in Mental Healthcare

In 2003, the World Health Organization conducted a large study on psychiatric patients and found that over 50 % of the medicines were not taken as per the directive of the psychiatrist. The company Proteus' system has created pills which dissolve in the stomach and produce small signals that are picked by the sensor worn on the body. Many trials have been done through the process of administering medication for treating a range of psychiatric illnesses.

Cognition Kit Limited and Takeda Pharmaceuticals have introduced a platform for measuring cognitive health functions and assessing Major Depressive Disorder (MDD). The Apple watch app used for monitoring and assessment found a high level of compliance in regards to the treatment of many mood disorders and other cognitive problems.

How IoT technologies work on medical devices

The benefits of IoT technologies in healthcare have helped patients in remote locations, especially where doctors are not available. Healthcare facilities by adopting embedded solutions for medical devices, also enabled through IoT have helped many of these patients in remote regions. Embedded medical devices reduce the limitations of time to diagnose and treat many patients since most systems run on a processor which is high-speed, also including a sound and complex operating system interface.

Embedded medical devices work by connecting hardware to the list of diseases, which is used for examination. The device system would have a touchscreen interface for the respective users in order to input data for processing and analysis. As any user inputs the data (With relation to various diseases) into the system, it automatically correlates and matches the symptoms existing on the file, which again matches with the input. This is one of the ways the system responds to inputs and generates a particular prescription for a disease.

Key Highlights

ECG Sensor

The (ECG or EKG) electrocardiogram is a popular diagnostic tool which is used regularly to assess the muscular and electrical functions of the heart. It can detect a range of cardiac pathology like infarction, myocardial ischemia, palpitations and syncope.

Glucometer

With a prick of a syringe on the skin, a small drop of blood is obtained on a test strip while the meter reads and calculates the level of glucose in the blood, through the Glucometer.

Airflow Sensor

The nasal airflow sensor is another device used to monitor the rate of airflow in a patient who is need of respiratory help.

Blood Pressure Sensor

The blood pressure sensor records the patients' blood pressure in two different numbers - systolic and diastolic pressure.

Temperature Sensor

This sensor allows users to check body temperature. This device is used to treat a number of diseases which are related to characteristic changes of temperature in the human body.

Challenges of IoT in healthcare

IoT-enabled devices have a range of advantages but there are also some areas which need to be looked at thoroughly. The 'Internet of Medical things', although being highly-efficient and revolutionary, has its own set of challenges. These challenges come with technical issues and adaptation lag challenges which have to be resolved. The main issue affecting many industries (Including Healthcare) which overlap through the use of IoT technologies are predominantly Security, Functionality, Risk and Regulation.

Key Highlights

- Most IoT systems rely on these four components – domain transformation, semantic transformation, syntactic transformation and contextualization. This is used to achieve interoperability among many components. Many IoT devices do not have embedded virtualization capability which allows for an additional level of abstraction, providing the device with a generic management channel. This has an effect on the functionality of many systems.
- Many IoT sensors and devices generate enormous amounts of data. This data needs to be analyzed and hence there is a huge requirement of data repositories for storage. This lack of available memory can become a challenge, if not dealt rightly in the future. Most IoT systems are connected to the internet and so the sensitive data of patients could be exposed to vulnerability.
- The advancement and application of IoT technologies also have to be in purview with the rule of policy and law. The aspect of who owns and controls which data and in deciding where it goes opens a whole new area of regulatory loopholes and challenges vis-à-vis IoT application and policies.
- A lot of attention is required in data security which would necessitate additional funding. The security measures ought to be on par with the advancement of these new technologies. Security properties of IoT systems are based on specific security models. The adding of new devices only increases the complexity of the security architecture (With regards to OEM, sensors and new security approaches)
- There is also a risk of unauthorized access to centralization which can be misused by many hackers or criminals. Privacy-preserving technologies need to go beyond privacy principles (Ex – Challenging existing deficiencies by homomorphic encryption or searchable encryption are potential ideas)

Use Cases & Applications in different industries

IoT technologies in healthcare offer phenomenal advantages for hospitals, physicians and patients. There are also cases wherein IoT applications have cross-functional uses and its application and benefits outweigh traditional systems across a wide range of industries. These technologies can transform the way in which both the industry and the government communicate or possibly the two having a symbiotic relationship, impacting the larger perspective towards growth. Here are three cases of different industries that are witnessing transformation by adopting IoT-enabled technologies

Smart Cities

According to a major study by the UN Department of Economic and Social Affairs, the world population will peak in 2021 to 3.4 billion and then decline by 3.05 billion in 2050. Investing in smart cities and financial models can create new outliers towards economic growth and possible sustainable solutions.

City lighting (Lumca Lighting) in Quebec City is one of the examples wherein smart cities host a collection of other industries which includes-city lighting, wastewater management, city transit, traffic management etc. In Oakland and Wayne Countries, the Suburban Mobility Authority for Rapid Transit Authority operates a fleet of more than 300 biodiesel and hybrid-electric buses.

IoT applications are also used in wastewater treatment and environmental restoration projects. Digi Remote Manager provides remote management solutions to monitor IoT device deployment on various devices, sensors and modules. In the U.S these solutions have created supply chain efficiencies and also reducing transportation costs.



Blockchain

IoT applications have an impact not just on driverless cars, smartphones, consumer products or goods, but also deeply impacting the blockchain technology. At the heart of the blockchain is Bitcoin and Ethereum, wherein transactions are stored and recorded on many computers in a peer-to-peer network without the necessity of a centralized regulatory authority or third party. Blockchain as a technological catalyst has an overarching effect and potential over operational, regulatory, economic and other technological systems. This would impact supply chains, products, compliance systems and methods of transacting.

Cryptocurrency and blockchain solutions have advanced rapidly. Australia, Japan, Switzerland and China have already embraced blockchain technology. The growth of 5G, IoT and blockchain will shape the future of the internet wherein algorithms would play a decisive factor in change. There are even thoughts of a possible merger of these three technologies which could open a new door ahead in the realm of tech-policy and governance.





Manufacturing

The manufacturing industry has been a leader in adopting IoT technologies. This change leans towards industrial automation and has an impact on- production planning, compliance, supply chain management and logistics. Over 40 % of all manufacturing processes are automated and IoT plays a crucial role in this change.

According to a study by Deloitte, by 2025, predictive maintenance solutions which are based on the Industrial IoT are expected to reduce factory maintenance costs of equipment by 40% and generate an economic value of \$630 billion annually.

IoT technologies reduce inefficiency in tracking inventory and in checking manufacturing operations. It also addresses safety issues in any hazardous manufacturing environment. The manufacturing sector is also witnessing transformation through 3D printing.

Conclusion

The role of IoT in transforming the industry and its processes cannot be undermined or undone. The nature of technology and its advancement by disrupting old systems and processes are but the natural order of science, innovation and progress. This has impacted society at every stage of progress. Industry 4.0 and its route through IoT enabled technologies will create new avenues and make an impact on a global scale.

Futurologist Ray Kurzweil goes a step further and predicts the reality of AI and IoT to go beyond the phase of the current industry wherein self-driving cars, space tourism and nanobots become the new norm. While foreseeing the challenges and flaws of new technologies, governments and industry can plan ahead in time to make sure the transition is successful. The government and the industry both could benefit from this change creating a paradigm shift in the new technological era.

About

Zerone Consulting is a leading agile software development company that delivers innovative technology and business solutions to customers across the world. Our focus is to accelerate our customers' journey towards digital transformation by ensuring them rapid delivery, transparency, and cost advantages in the best possible way. We help forward-thinking businesses to leverage transformation through Artificial Intelligence, Cognitive Computing, Internet of Things (IoT), Robotic Process Automation, Data Analytics, Face Detection and Recognition, Natural Language Processing, and Blockchain Technology. Zerone Consulting started its operations way back in 2003 and is located in Kochi, India. We have a success rate of 99+%. We are ISO 27001 certified with an exceptional track record of completing and delivering 500+ successful projects.