

Utilising the Internet of Things (IoT) in Healthcare & Medical Devices



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At Mi3 we are often asked by clients to incorporate new technologies into their designs or products. One such 'new kid on the block' technology that is starting to disrupt the healthcare sector is the Internet of Things, or IoT. Collaborating with organisations that can develop applications in this sector strengthens our offering to our own customers. In this paper, Polymorph, custom software and application developers discuss the technology trends that are currently disrupting the healthcare sector, medical devices included.

The global delivery of healthcare has become increasingly focused on medical outcomes, achieving results for patients, and attaching industry incentives to those results. It is therefore not surprising that healthcare devices are one of the fastest-growing sectors in the Internet of Things (IoT) market. In fact, Fortune Business Insights predicts that the value of this sector – often referred to the Internet of Medical Things (IoMT) – will reach \$176 billion by 2026. Healthcare leaders are therefore well-advised to consider the following benefits of utilising the technology currently disrupting the healthcare industry:

Free up time to focus on patients.

Increasingly efficient processes and operations will ensure that highly trained healthcare professionals can operate more efficiently thus helping more patients in less time. Implementing effective, automated processes, through, for example, on-demand or immediate treatment healthcare services, can improve and/or do away with those time-consuming and often mundane tasks such as paperwork, the distance between theatres, waiting for test results and more.

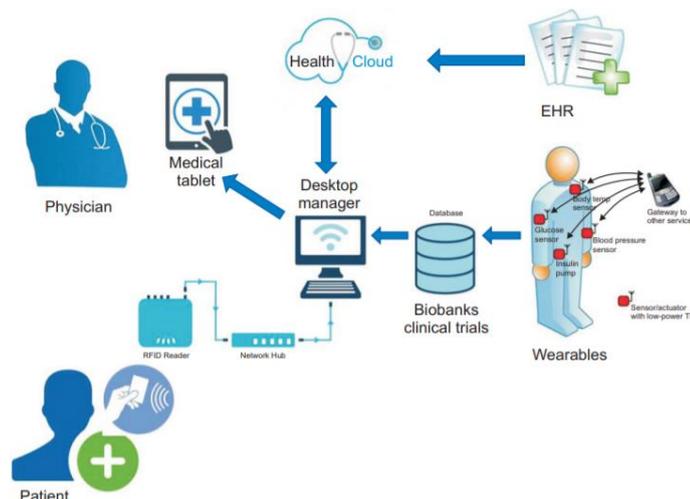
For example, the traditional way of booking a doctor's appointment has seen fierce competition from virtual-driven healthcare services and bookings. In addition to the pandemic-driven need, the convenience and flexibility of such services to both patients and service providers, support the use of on-demand medical devices and services. A primary example of transformation in the healthcare industry and the success that can be achieved can be seen by MyGP, Doctors on Demand and American Well. The latter two services connect patients with doctors, facilitate virtual patient consultations in the form of video chats and offer the option to easily share online prescriptions. This can dramatically reduce costs and the need for real-time assistance where it may not necessarily be required, especially during the current pandemic.

A further development, the digitisation of patient files and test results, also promises improved security and patient care. Digitising records means there is more time available to improve the patient experience as manual labour is reduced and your facility can also ultimately benefit from a paper-free environment.

Connecting medical devices that automatically save data in the cloud in a central database can improve patient safety and boost staff satisfaction, as well overall operational efficacy across the medical industry.

As an example, research by [Dimitrov](#) has shown that "in a typical IoT hospital, in practice, a patient with diabetes will have an ID card that, when scanned, links to a secure cloud which stores their electronic health record vitals and lab

results, medical and prescription histories. Doctors and nurses can easily access this record on a tablet or desktop computer."



An illustration of how this revolution in medicine will look in a typical Internet of Things (IoT) hospital. (Source: Dimitrov, D.V.: Medical Internet of Things & Big Data in Healthcare)

Overall, this could provide new opportunities to create smart MedTech devices not only to benefit patients but to develop apps to remotely monitor healthcare professionals' physical and mental condition, for example, are they well-rested, under stress, and so forth and process the information collected from multiple biometric indicators to provide health insights.

Your existing processes might be slowing you.

With the COVID-19 pandemic, the need for good healthcare has increased exponentially. The sudden global need for healthcare has forced hospitals, clinics, governments to adapt their policies and processes to accommodate change.



The MedTech industry undoubtedly understands the value of the data generated from connected medical devices to improve clinical performance and outcomes. The next step is to monetise this data through new business models, revenue streams and product lines. As the healthcare industry focuses increasingly on improving quality and reducing the costs of providing healthcare services, MedTech companies need to demonstrate the added value of new business models and product lines such as subscription software-based medical care. Further reducing costs, increasing revenue streams, and ensuring improved patient compliance and outcomes are fundamentally changing how MedTech companies commercialise products which, in turn, leads to companies developing new funding and business models for their connected medical devices and software which not only improve patient outcomes but also create added value for key health care stakeholders.

Connected medical devices must furthermore be designed to allow remote software or security updates to ensure optimal performance. However, suppliers of connected medical devices must assess security updates, patches and possible virus signatures and confirm these as safe before they can be implemented on the medical device.

Increasingly efficient processes and operations will ensure that highly trained healthcare professionals can operate more efficiently.

Proper risk management in healthcare is saving more human lives.

An increase in infections and highly contagious diseases require ancillary care and hygiene to manage and mitigate the risk of spreading viruses. In healthcare, managing risk equals saving human lives. Remote patient monitoring and advanced technology can therefore facilitate faster diagnoses and quicker responses.

In addition, real-time data to automate patient alarms and notifications can ensure that healthcare professionals are able to either pre-empt or avoid adverse events.

By making use of analytics from various sources of data, healthcare providers are now in a position to take stock across the entire system of alarms, evaluate their existing algorithms and decide where real-time data can be used to improve sensitivity and specificity to reduce false positives. These algorithms lay the foundation for predictive alerts and alarms. For example, predictive alerts and alarms can change living with diabetes from reactive to proactive.

Reliable connectivity and proper training for medical staff are furthermore crucial for connected medical devices in a healthcare facility. These devices could include air filters in theatres and sanitation devices. Since these devices record and send critical data, it should be capable of staying connected for extended periods of time. This means that your connection should not fluctuate as your medical devices, systems and sensors will be ineffective and patient health and safety will be put at risk.

In healthcare, managing risk equals saving human lives.

Data can't predict the future but can help you travel back in time.

Combining connectivity with artificial intelligence and machine learning in a healthcare environment can potentially save the lives of current and future patients when considering, for example, diagnostics. There have been large scale developments in rapid image recognition, symptom checking and risk stratification. Further, research conducted at John Hopkins University School of Medicine notes the capability of digital therapeutics to dramatically increase long-term medication adherence. You can't foresee the future, but data can certainly provide you with a clear view of the past. This, in turn, can aid healthcare facilities to benefit from trends to make quick and efficient decisions which will save lives.

On-demand healthcare services have disrupted the healthcare landscape in the past few years. The current pandemic has further emphasised the need for on-demand healthcare. For example, the traditional way of booking a doctor's appointment has seen fierce competition from virtual-driven healthcare services and bookings. In addition to the pandemic-driven need, the convenience and flexibility of such services to both patients and service providers, support the use of on-demand medical devices and services.

A primary example of transformation in the healthcare industry and the success that can be achieved can be seen by Doctors on Demand and American Well. These services connect patients with doctors, facilitate virtual patient consultations in the form of video chats and offer the option to easily share online prescriptions. This can dramatically reduce costs and the need for real-time assistance where it may not necessarily be required, especially during the current pandemic.



Two key features of connected medical devices are the ability to predict potential device failures before it becomes life-threatening and to minimise errors and control waste. For example, if a heart pump manufacturer changed the type of lubricant used in the pump bearings, even though the product is the same, it may still cause an issue. However, with a connected medical device, both the physician and the manufacturer receive a notification should a problem occur and can then replace the pump before it fails. This would save the lives of patients who are using the pumps with the new lubricant.

Using healthcare IoT solutions to collect data and automate workflows is a superb way to cut down on unnecessary tests and expensive imaging, reduce system costs, and minimise human errors. To treat patients efficiently, guide diagnosis and consider treatment options, it is vital to have access to up-to-date patient information to ensure accurate data insight and analytics. Nevertheless, even the most thorough patient assessments are of little help to clinicians if they are not documented correctly or in a timely way. This, in turn, creates inconsistencies in the documentation process and hinders data quality and integrity. Medical device connectivity can help eliminate these issues and provide healthcare professionals with complete, precise and current / real-time patient assessments on demand.

Managing and maintaining medical devices used to be a laborious, routine task. With connected medical devices, stakeholders can now complete and collect device diagnostics remotely. It could also potentially help predict device failures. This boosts assurance that devices are working safely in the field. The access to real-time data puts CTOs and MedTech developers in a better position to optimise their workforce and so deploy staff to sites that need immediate assistance.

Consistent and effective data analytics is also of paramount importance. Connected medical devices must be capable of handling large volumes of data hence reliable and scalable data platforms should be used to aggregate and process the data.

Internet-connected devices and objects (or the Internet of Things (IoT)) are undoubtedly transforming the world and no industry is immune. The medical and health sectors, however, seems to be in a position to gain the most from this transformation.

If you're not already innovating, you're lagging and should get on it.

Healthcare innovation is multifaceted with myriad benefits to both healthcare professional and healthcare facilities. There are, for example, pocket-size ultrasound devices at half the price of the normal machines in hospitals (and can connect to a user's phone). Virtual reality is being used to speed up rehab, artificial intelligence is fast surpassing medical experts at spotting lung tumours and the Parker Institute for Cancer Immunotherapy is disrupting the traditional approach to cancer research. Can you really afford to miss the innovation bus?

The real value of healthcare IoT solutions reaches far beyond the connected device itself – cloud connected and wireless medical devices are just the foundation. The business value and subsequent business growth come from the ability of these devices to collect and analyse massive amounts of data, often in real time, resulting in improved decision making and customer experience.

Innovation in healthcare offers several benefits and advantages such as automated emergency notifications, remote monitoring, early diagnosis, virtual consultations, lowered healthcare costs, compliant authorisations processes, intelligent data collection and most importantly improved patient outcomes. Implemented to improve patient health and more often than not, the benefits outweigh the risks.

According to the IBM Institute for Business Value, the estimated number of connected medical devices – that is, medical devices connected to the Internet – is expected to increase from 10 billion to 50 billion over the next decade. This presents several advantages from both a clinical and data perspective of which remote patient monitoring is just one.

Medical device connectivity allows for the remote monitoring of chronic diseases such as diabetes and high blood pressure. These devices (such as wearable medical devices) can transmit data from the patient's home to the caregiver or clinician, providing a bird's eye view of the patient's condition and improving treatment effectiveness. In the current pandemic, it can even be utilised to monitor hand hygiene. IoMT connects people (patients, technicians and clinicians), data, processes such as care delivery and patient support and devices to deliver improved patient outcomes efficiently.



Conclusion

Connected devices, cloud computing, and the internet allow for a larger exchange of data than ever before combined with convenience, and automation. IoMT is substantially changing how healthcare professionals and healthcare facilities can manage patient records, oversee operations, control inventory and monitor and provide preventative care. This disruptive technology is certainly significant considering that other tech advancements have been made possible through this.

About Polymorph:



Polymorph's experienced team of developers, product managers and user experience (UX) designers enjoy solving problems. And they go out of their way to build products that people actually use. The types of products they build range from Mobile app development, Internet of things (IoT) solutions, Backend development, Web platforms and Dashboards.

Polymorph understands the unique conditions that medical devices must meet so you can focus on the bigger picture. They think about all the ways in which connected devices can support patients, MedTech providers and clinicians can then evaluate the system holistically. This ensures end-to-end solutions that are focused on patient outcomes and results while simultaneously enabling visibility and security of all of your connected medical devices. Polymorph's goal is to develop quality scalable healthcare at sustainable costs through operational efficiency. To discuss your IoT requirements contact them on www.polymorph.co.za

About Mi3:

Mi3 are the experts in designing, developing and manufacturing end-to-end advanced medical and surgical solutions – providing specialist knowledge in injection moulding, device assembly & packaging, thermoplastic engineering, tubing systems, and regulatory compliance. We take your product ideas from consultation to concept to production, and work alongside you and our collaborators to bring your medical innovations to life.

Visit our website at www.mi-3.co.uk to learn more about our contract manufacturing services or contact us directly by clicking [here](#) to discuss your requirements.