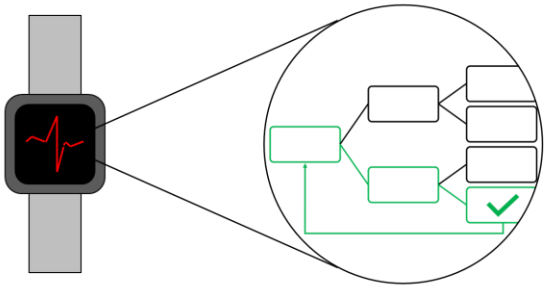
Intelligent Medical Devices

An Overview



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Introduction

The world is changing.

As recently as 2019, more than half of the world's population used the internet.

Advances in computer software and hardware have enabled technological advancement that would have been unpredictable even 10 years ago.

Though advances in the world of "information technology" have taken center stage, the progress made in the medical sphere has been equally impressive.

For an example, look no further than the COVID-19 mRNA vaccines which were developed, authorized, and distributed in under one year.

In this ebook, we discuss a trend we've seen accelerating in recent years: the rise of intelligent medical devices.

What is an intelligent medical device?

To understand what an intelligent medical device is, it's important to comprehend the basic concept behind the catch-all phrase "intelligent device."

Techopedia defines an "intelligent device" as, "a machine, instrument, piece of equipment or any other device with internal computing capability."

An example of an every day intelligent device would be a "smart" home thermostat that automatically adjusts room temperature based on factors like energy consumption and cost.

Taking the concept of intelligent devices further, we define "intelligent medical devices" as any medical device that makes self-adjustments based on a given input.

In other words, an intelligent medical device uses a data-driven feedback loop to perform a given task without human interaction.

A device that automatically administers medication when a patient's vitals hit a certain point would be considered an "intelligent" medical device.

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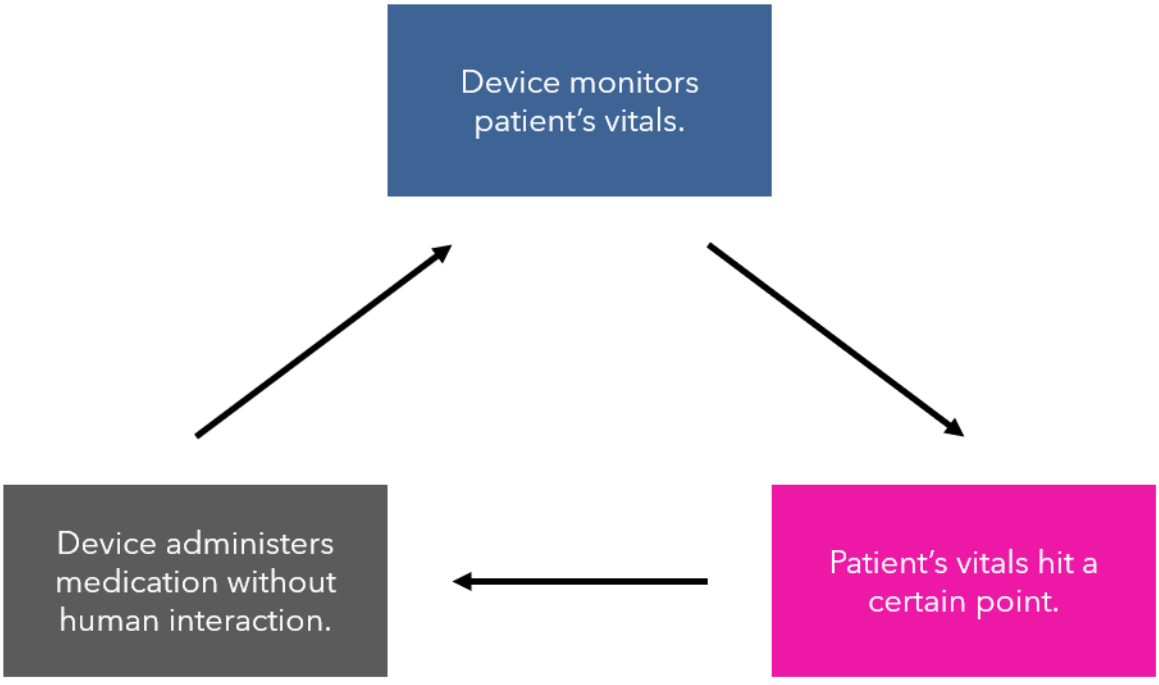
Example of an intelligent medical device feedback loop.



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Intelligent Medical Devices vs Smart Medical Devices

As we explained in our blog post about IoT-based patient monitoring systems, the term "smart" typically describes devices that are connected to the internet.

A watch that monitors your heart rate and uploads the data to the cloud for your physician to review would be considered "smart" medical device.

An intelligent device, on the other hand, is one capable of reading data and automatically performing a function based on that data—regardless of whether it is connected to the internet.

A watch that monitors your heart rate and alerts your physician if it detects an anomaly is an example of an "intelligent" medical device.

It's important to note that the two categories, "smart" and "intelligent," are not mutually exclusive—a medical device can be either or both.

“Smart” vs “Intelligent” Medical Devices

“Smart” Medical Device

Uploading heartrate data to the cloud.

“Intelligent” Medical Device

Alerting physician of heartrate anomaly.

Intelligent Medical Devices and the Internet of Medical Things

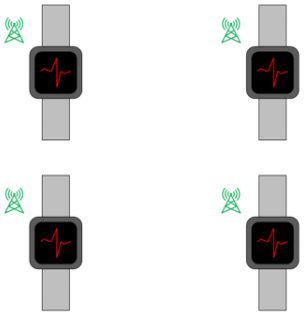
The term “Internet of Medical Things” (“IoMT”) is often used to refer to the infrastructure of connected medical devices and healthcare systems.

“Smart” medical devices, by definition, play the central role in the IoMT.

“Intelligent” devices, however, still contribute to and benefit from the IoMT.

For example, a watch that monitors a patient’s heartbeat and alerts the doctor of an anomaly could upload its data to a cloud of similar watches to improve its algorithm/feedback loop—leading to better functionality for all of the watches “in the network.”

Intelligent watch notices pattern in heartrate data that improves anomaly detection and uploads information to the network.



Intelligent watches connected to the network receive and implement the anomaly-detection improvement.

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Artificial Intelligence and Intelligent Medical Devices

Much has been written about artificial intelligence ("AI") being used in the world of healthcare.

It is at the crossroads of AI and medical technology that intelligent medical devices can be found.

As we mentioned earlier, intelligent medical devices function via a feedback loop in which data is collected and a decision is made by the device without any human interaction.

For now, we'll use a smart watch that alerts the physician when an anomaly in a patient's heartrate is detected as an example.

However, it is only one step removed from a branch of AI known as machine learning ("ML").

AI pioneer Nils J. Nilsson describes ML as follows:

"As regards machines, we might say, very broadly, that a machine learns whenever it changes its structure, program, or data (based on its inputs or in response to external information) in such a manner that its expected future performance improves."

For an intelligent medical device to fall under the umbrella of ML (an transitively, AI), it must have a mechanism for learning—it must be able to improve itself based on data it (or connected devices like it) collects.

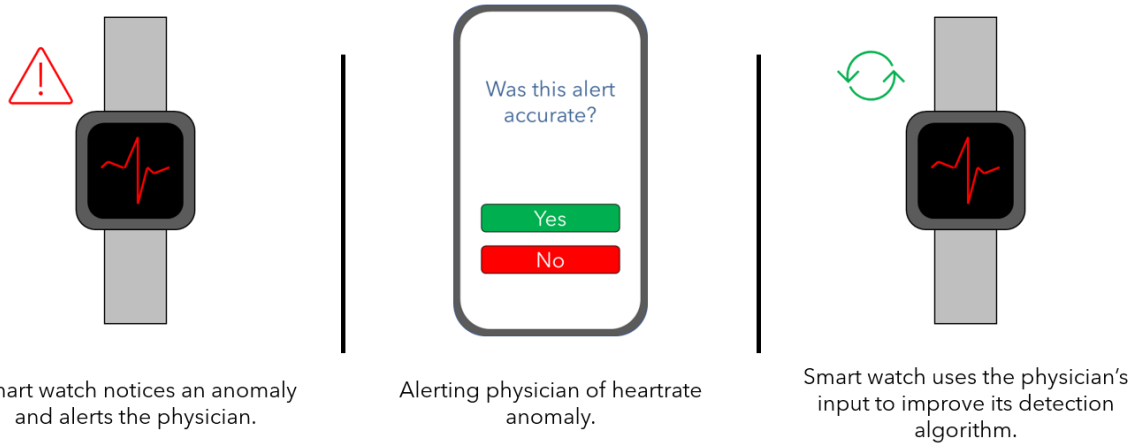
So, if an intelligent medical device were to use the data it collects to improve its algorithm—its feedback loop—it could be considered an ML device.

Let's return to the hypothetical smart watch mentioned earlier.

Assume the watch is initially programmed to alert the physician when a patient's heartrate increases or decreases by a certain amount.

Next, imagine that whenever the physician receives an alert she/he can log into an app and click a button to let the device know if the alert was warranted.

Now, picture the device using the physician's input to improve its algorithm so that it is more or less likely to alert the physician next time a similar event occurs.



Smart watch notices an anomaly and alerts the physician.

Alerting physician of heartrate anomaly.

Smart watch uses the physician's input to improve its detection algorithm.

The device has now learned.

Though it is still early in the age of AI, medical devices and technology companies alike are working to improve patient outcomes with the use of ML and "intelligent" feedback loops.

Conclusion

As you can see, the story of the intelligent medical device is just beginning.

With advances in medical technology, data mining, and software capabilities, the intelligent medical device market is poised to grow into something promising.

Developing an intelligent device, however, can be a tough task—especially if you've never done it before.

We recommend working with a partner who has experience bringing intelligent devices to market.

To learn more about developing next-generation devices, download our free ebook.

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