

# Applications of Wearable Technology in Healthcare

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**Abstract:** *Recently, wearable technology is utilized to observe and supervise a patient's health. These devices are in close contact with the patient. So, it may be used to acquire data in the form of time series data (i.e. minute-by-minute or second-by-second data) such as heart rate, blood pressure, body temperature and saturation of oxygen in the blood.*

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## 1. Introduction

The origins of new wearable technology are affected by the restraints to the discernment of ubiquitous computing. In the early 1980s, there was the first wearable device which was the hearing aid. A little while later, the calculator watch invaded the markets and it was vastly adopted [1, 2]. After its invention, wearable devices have gone through eighteen generations of improvements, with research going on at prestigious institutions such as MIT, Georgia Tech and Carnegie Mello University. In 1997, the first PhD was completed from MIT in wearable technology. Recent reports illustrate that the universal market for wearable technology in the medical field will accomplish more than twelve billion dollars. In fact, the United States of America is considered the most enormous market in the whole world [3, 4].

Researchers sometimes intended to call wearable devices as body-borne computers. This is because these devices can be worn by the user without punching keys or other manipulations. These devices have some important features such as it is always on, it is always working, perform calculations and process information. In fact, wearable devices consist of two main parts. The first part consists of sensors, glasses, watches and even wearable foot. The second part consists of information aggregator and analyzer [5].

Wearable technology offers multiple modern options like multimedia, Bluetooth, Wi-Fi, cameras and Samsung Galaxy Gear Watch. Besides, there are smart glasses which brings technology to our vision such as Google Glasses. Recently, a revolution has made on interactive clothing. These clothing can supply doctors and sports trainers with the real-time health status of the wearer such as Hexoskin [6].

## 2. Forces Driving the Growth of Wearable Technology

Indeed, there are some reasons that drive the excessive revolution of wearable devices like

- i. Cloud storage: cloud storage services exceeded 2 billion by 2014. Hence, this extensive storage capacity enables the wearable devices to get significant benefits from the cloud as well as sending time series signals and parameters to the cloud. The cloud storage also enables to present and perform reduced information technology (IT) costs. Also, the cloud enables the opportunities to get key advantages of the new technology named the Internet of Things (IoT) [7].
- ii. Faster, cheaper and smaller hardware: wearable technology gets advantages from the golden rule in electronics which illustrates that electronic chips are getting 100 times smaller each decade. Thus, devices based on this technology can be worn easily and held in pockets readily. These features qualify these devices to be used in military fields and in spy era. Recent studies report that by 2020, batteries are expected to be 2.2 times more powerful.
- iii. Location data: wearable devices can provide the medical team with its user's location implicitly. This technology has a device-based location service (i.e. GPS). Besides, it has some up-to-date operating systems (OSs) such as Android, Blackberry OS, Windows Mobile and Symbian S60 [8].

### 3. Fast-Evolving Gadgets in Fitness, Wellness and Healthcare

Wearable devices in healthcare can be used to measure different parameters such as calories burned, steps walked, issue of definite biochemicals, time spent exercising as well as time spent sleeping. The aforementioned parameters and other parameters can be composed in a particular unit such as activity tracker and smartwatch. Wearable devices can be utilized in some significant fields in healthcare such as determining the percentage of alcohol in blood especially for the drivers, determining the performance of athletics, measuring and supervising the degree of illness for a patient and monitoring of patients with heart diseases especially those with old ages and live alone in faraway places. Here are some applications of wearable devices in healthcare [9]. Figure (1) bellow illustrates the use of smart watch to monitor the heart rate. This application is very useful in fitness field as well as it has many benefits in training aerobically and understanding the heart rate vital sign.



**Fig 1: Fitness & Heart Rate Monitor**

Figure (2) below shows a new wearable device called fuel band. This device has the ability to track and measure everyday movements.



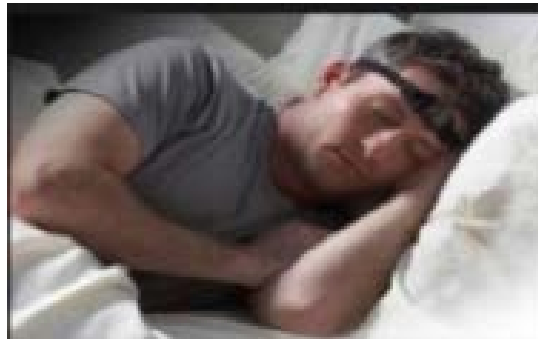
**Fig 2: Fuel Band**

Another fruitful application is the wearable device used for continuous glucose monitoring. This device is very helpful to patients who suffer from unbalanced levels of glucose in the blood [10]. Figure 3 below illustrates this technology which can monitor retrospectively review patients' glucose.



**Fig 3: Continuous Glucose Monitoring**

Some patients suffer from sleep apnea. It is considered impractical to connect the patient to a patient monitor while sleeping. Wearable technology provides a practical solution for these patients [11]. Figure (4) below shows this wearable technology.



**Fig 4: Sleep Sensor**

There are some significant modifications that transform the way we experience the world. In fact, one of these wearable devices that makes revolution in the medical field is the invention of sensory fitness socks. Some patients suffer from ischemia (i.e. a little blood supply to foot, hands and other organs). These wearable devices have sensors that can communicate with Bluetooth-powered anklet [12]. Then, feeding all data to the user's smartphone. Figure (5) illustrates sensory fitness socks



**Fig 5: Sensory Fitness Socks**

#### **4. The Future of Wearable Technology**

These revolutionary applications are not the end road of this technology. There are promising applications associated with this technology. Recently, Google announced that it released a Software Development Kit (SDK) which can be applied for Android-powered wearables. Moreover, another well-known trademark which is Looxcie. Looxcie has released a live streaming wearable headset with live-feed access from a proprietary tablet and smartphone. There are also devices invaded babies' world. Sensible baby is a wearable device that fits into a chest pocket and sends information and active alerts about temperature, baby orientation and breathing to a parent's mobile device.

Recently, MIT labs invented a wearable device that simulates science fiction. Sensory Fiction is the new wearable device in which the reader can soon experience physical sensation while reading the written words. Moreover, the medical field does not stop receiving modern technology in wearable devices. Smart Contact Lenses is a new wearable technology which can help measure glucose levels in tears [13].

The international theme parks receive a large number of visitors on a daily basis. Some of these visitors are not free of problems and attempts to sabotage. Disney's MyMagie+ is capable of monitoring visitors and collecting data about their behaviours in Disney World theme parks.

#### **5. A Few Hidden Limitations**

There are some limitations and restrictions associated with this technology such as

- i. Less versatile
- ii. Small in size

- iii. Ambient noise
- iv. Not as widely accepted
- v. Expensive
- vi. A lot of wirings at times
- vii. Heat emission may cause irritation
- viii. Some side effects such as headaches
- ix. Data security threats especially when the device is lost or stolen

## 6. Conclusions

Without a doubt, wearable technology will be the most prevailing topics in the upcoming years. Wearable devices will continue to reign in popularity. However, focuses needed on better designs for mass appeals. Moreover, future projections seem to be reaching to the highest level. This revolutionary technology will integrate more seamlessly into daily life.

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