Chapter 34
The Security Constructions and Enhancements of Smart Wearable Devices in Modern Technologies and Health Monitoring System

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34.1 Introduction

With smart wearable devices, the concept of health management has become more focused on by the general public. According to a study from Stanford University, data collected by wearable devices can predict diseases, and people improving their health outside of fitness will become a new trend. In the global market, in the first half of 2020, in the wake of COVID-19, global total exports of smart wearables increased by another 20% per year. This shows that after experiencing an infection, people become more focused on their health and on the heart, drastically increasing the need for blood oxygen monitoring, exercise and fitness, and related equipment [1]. Counterpoint, a market research firm points out that the future growth of the smart wearable market will focus on fitness and healthcare applications.

Therefore, monitoring the blood oxygen concentration is seen in the production activities of many innards of smart intercepts this year. In medicine, blood oxygen concentration is an important indicator for diagnosing heart and lung health and overall health. Measurement data of blood oxygen concentration can be used to monitor the health status of patients' lung function. Smart health wearers play a significant role in COVID-19 infections. Koch has developed a "Coronet Data Donation" application that allows users to upload health data monitored by a sports band or smart wearable. Heart rate, sleep, amount of exercise, body temperature, and other physical symptoms monitored by sports innersoles and other devices can change significantly for those with severe respiratory illnesses [2]. The data can

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reflect the condition of the affected individuals and will assess the development of epidemics in Germany based on this data. As can be seen from the above, the value of health data collected by smart innersoles and other devices is starting to show. But the health data monitored by thousands of smart devices is huge and fragmented, and still worth more to cut. In the future, if smart wearables and other wearable devices offer only one health monitoring service, their competitiveness will not be enough. Only when they are integrated with health management, insurance, and medical ecology can they open up an increasing market for competitive flood health services.

Wearable devices or wearable technologies are accessories or clothing that have specific additional functionality. The main advantage of wearable computers, also called these electronic devices, is their complete integration into the user's daily life [3]. A person and a smart device are constantly communicating, but the gadget itself does not attract much attention and fits in harmoniously with reality. Typically, high-tech wearable devices are controlled by a specific operating system and fitted with several standard technologies that provide their functionality. Classic technologies used include Global positioning system (GPS), Bluetooth, Wi-Fi, Global system of mobile communication (GSM), 3G, accelerometer, compass, thermometer, chrono-graph, etc. Wearable devices will always multitask. For example, a smartwatch can not only show the time but also count the number of steps taken, announce incoming messages and calls, and track the user's location.

34.2   Literature Survey

In Liu et al. [4], they discussed the sensor-based activity recognition techniques in smart wearable devices. This means that the continuous operation of the sensor systems fitted on the smart devices will constantly monitor the wearer. So, even small changes that occur there will be recorded. Even the small things that are created on a daily basis can be factors that affect their efficiency [5] designed a chemical-based sensor unit for monitoring biofluids and Bandodkar et al. [7] discussed wearable chemical sensors. Different chemicals were identified and dif-ferent performance matrices were analysed. Here, the chemical reactions are keenly monitored by the given methods. Fang et al. [6] discussed wearable devices for elderly people. It is also important to measure its ability to design and perform radiation functions for adults. This allows adults to wear these devices without fear. Park et al. [8] discussed the heart rate monitoring sensor and wearable devices. Doctors generally advise people with heart disease to be careful not to damage their hearts. These wearable devices can constantly monitor their heart rate by monitoring their heart rate and other cardiac functions. Al Hemairy et al. [9] discussed the health monitoring systems in the smart health care industry. Furthermore, these technolo-gies combine with IoT technology to enable their applications to monitor the patient's activities as if they were a physician.

The key factor here is that wearable devices are commonly worn devices because of their sensors. While their enhanced capability is a combination of all types of inputs and enhances its experiments, small changes in it can have a large impact on the coda. The use of some centres that are highly sensitive to these wearable devices fitted into the body can have some kind of impact on the human body. Thus, it is necessary to meticulously weave some of the tips that occur in its design.

34.3 Wearable Devices

Wearable devices are accessories or clothing with a built-in microcomputer and interfaces and sensors that provide specific functions [10]. The main advantage of such a solution is its full integration into the daily life of the user. One person and wearable devices are in constant contact, but the latter does not attract unnecessary attention and complements reality harmoniously [11]. High-tech wearable devices operate under special operating systems and are equipped with a set of built-in sensors and interfaces. The latter includes a cellular module and wireless adapters for Bluetooth, Near field communication (NFC), and Wi-Fi. Depending on the purpose, the gadget can be equipped with a GPS receiver, accelerometer, electronic compass, thermometer, barometer, heart rate monitor, chronometer, etc. Modern wearable devices are multi-functional [12]. For example, a "smart" watch can not only show the time and date but also calculate the number of steps taken by the user, announce incoming messages and calls to the connected smartphone via Bluetooth, and track the user's location.

34.3.1 SmartWatch

Since the appearance of smartphones, to make them easier to manage, they have a kind of assistant device, an additional device for the smartphone: the SmartWatch. People wanted to make watches rather than toy watches to show time and date. Now "smartwatches" are integrated into mobile devices based on features and software, a notable example of which is the watch. However, the definition of a "smartwatch" is highly controversial [13]. A proper smartwatch is not defined by any international standards. In Japan, the first true "smartwatch" has been released, and it was created by Sony. The Sony SmartWatch acts like a traditional watch and, when linked to a compatible smartphone, offers a plethora of features, including access to real-time information like news and text messages, as well as alerts and reminders [14]. Of course, numerous smaller companies had already come up with their own versions of such devices before Sony unveiled its SmartWatch. Even before the Japanese electronics review [15], Chinese manufacturers had created timepieces that could make phone calls and connect to the Internet. Despite their high quality and dependability standards, these gadgets have already implemented the notion of

"smartwatches" [8] that can make and receive phone calls, send and receive text messages, process information, perform computations, and connect to the Internet. In addition, several makers of consumer electronics are wrapping up production on their own versions of this kind of smartwatch. Apple, for instance, has filed for a patent on an "iWatch" in Japan and other countries. In September, Qualcomm plans to release the Zola SmartWatch. Rumour has it that Intel is testing a comparable product. Samsung has revealed they are working on a smartwatch right now. Similarly, Google is rumoured to be working on an Android-powered clock [16].

However, the Android OS–powered smartwatch that can receive calls and take images is reported to be the first of its kind to be introduced to a group of Indian students [17]. The Androiduli is a $150 Indian smartphone that supports Bluetooth. GPS and Wi-Fi are all supported. The Pebble, MotoActv, and WIMM One watches are a few others worth mentioning. The Pebble Watch is a popular Kickstarter project [18]. The 1.26-inch LCD display can provide 144 by 168 pixels. With a 600 MHz OMAP3 ARMv7 processor, 256 MB of RAM, 8 GB of memory, and Bluetooth connectivity, the MotoActv is Motorola's take on the smartwatch. The FM Tuner and Android power this wristwatch. WIMM One has a 220 × 176 pixel [13] display with a screen size of 1.6 inches. They are powered by an altered version of Android and have a see-through display, a magnetometer, an accelerometer, and Bluetooth, Wi-Fi, and USB connectivity [19].

34.3.2   Computer Glasses

Google Glasses introduced a new era of wearable technology. Yes, before "good review", similar devices were offered many times, but none of them. Google Glass seems to have installed a new type of consumer electronics [20]. Glass differs from other similar devices by its small size and many features, such as "augmented reality", a camera, Internet access, and voice-based communication. Google Glass is not only a wearable computer but also an "ubiquitous" computer, meaning that it may be used in both an active and passive capacity. The device has a 5-megapixel camera with a bone transducer sensor, Wi-Fi, Bluetooth, a gyroscope, an accelerometer, a magnetometer, and a touchscreen control panel. Android powers Google Glass, which is powered by a dual-core OMAP 4430 processor. It is believed that more companies, inspired by Google Glass, will soon introduce similar products to the market. Scope Technologies, which has collaborated with Epson on the development of computer glasses, the Spark of Cypriot, whose glasses make it possible to see and study tiny objects, and Innova, which creates breakthrough computer lenses, are all involved in the Vuzix project. Despite claims that it is a major rival to Google Glass, not much is known about this product at this time.

34.3.3   Wearable Computers

Wearable computers are less cumbersome and difficult to operate presently. Small, high-capacity batteries perform well enough to power wearable electronics. Modern devices with high-quality displays make using them much more straightforward. We have greatly improved the system's touch input, so it is much more sensitive to your touches. The CPUs also perform better without getting too hot. They are currently impregnated with dust and even water-proof tiles. The sensors themselves are compact. Who would have guessed that something as thin as 7.9 mm could house an infrared camera, accelerometer, barometer, thermometer, proximity sensor, pedometer, and gyroscope? As battery manufacturers compete to produce the most energy-efficient products, things are looking brighter. For example, the Koreans claim to have created a flexible battery similar to flexible displays. File Sharing can easily be shared outside network via removable media. Offering access to digital information or resources. In addition, hydrophobic technology is so advanced that devices no longer need to be sealed to be waterproof.

34.3.4   Medical Gadgets

A smartphone-sized device that detects cancer and infections within 20 minutes. This gadget is based on the research of the British review Quantum. The Q-Poc Alpha is now in the testing phase, and the finished product will not appear until 2018, as promised by the developers. Drug abuse causes 125,000 deaths a year in the United States. To rectify the situation, US review AdhereTech has developed a tablet box with sensors that read the number of container openings [21]. The smart system reminds you to take medications with sounds, LEDs, phone calls, and text messages sent to the patient's phone. The lipstick level test microscope allows you to independently determine the amount of ovulation by the concentration of salt in the saliva sample. To do this, apply a drop of saliva on the lens, let it dry for 5–-10 minutes, and then evaluate the result on the eyelids. To accurately determine the phase of the cycle, you need to compare what you see with the checklist. An inexpensive miniature device, such as a USB flash drive, connects to the human body using four Velcro electrodes, reads data about the work of the heart, and sends it to a cardiologist via the Android app. Most likely, everything will come to this. Technologies are evolving towards smart clothing. But there are several important technical limitations here. First, direct skin contact is required to accurately capture heart rate and other data. That is, the sensors must fit snugly against the body, which means smart clothing must be tight. It may not be very comfortable to wear such clothes every day. Some techniques will help, which will allow taking data at a distance of 2–3 cm from the body.

On the other hand, even if a person measures his parameters only 2–3 times a day for 5–10 minutes, the data obtained is sufficient to establish a diagnosis and make recommendations. You can take a cardiogram in a relaxed state, and based on this,

doctors will tell you whether or not to change your lifestyle. Who is it for? For example, those who have a heart attack, as a rule, have a risk of recurrence. Therefore, they should regularly take a cardiogram and send information to doctors. There are already devices that pierce the fingers in a non-invasive way (laser). In general, insulin pumps are now widespread abroad; they are a box in the body that holds an automatic insulin injection device depending on the blood sugar level. This is a very important device for patients with type 1 diabetes. They are forced to take a basic dose (called long insulin) in the morning and the right dose (short insulin) during the meal. Long-acting insulin is more harmful than short-acting insulin because it raises blood sugar. These pumps allow the short-lived insulin to dispense automatically as the sugar level changes. In Russia, such devices are not made: they are very expensive. Instead, they use insulin injections, which are provided free of charge by the Ministry of Health. All automatic injectors must be imported.

34.4   Modern Technology

It has become customary to see people wearing smart devices that can be worn. Typically, these smartwatches or electronic straps are used to monitor fitness. Due to the advanced technology of sensors, wearable devices are starting to encourage more people to be more active. They help people set and achieve goals, as well as provide a sense of motivation and reward when achieving these goals. As technology has advanced so much, new limitations on wearable devices are helping people improve their fitness. Here is a range of wearable accessories that can get you started on a healthy lifestyle.

34.4.1   Fitbit Smart Wearable

Fitbit dominates the wearable device market. Its simple design, usability, and affordability make it an impressive wearable device. Continuous heart monitoring means that your activity is constantly being recorded. Keep track of how many calories you are burning, as well as make sure you are working at the right intensity.

34.4.2   Jawbone Smart Wearable

The Jawbone is a device for fashion-conscious fitness enthusiasts. If you do not want to wear a bold smartwatch and want something that looks beautiful, Jawbone offers a wide variety of stylish and elegant accessories. Jawbone UP2 monitors your activity, sleep, and food intake. The smart trainer provides you with customised insights to help you achieve your fitness goals.

34.4.3   Microsoft Smart Wearable

Microsoft has jumped on the bandwagon of wearable devices and has developed a device that can detect heart rate, exercise, calorie-burning, and sleep quality. Microsoft, as a device, connects the user to email, text, and calendar. The band has 11 sensors, such as a barometer, an ultraviolet monitor, and GPS.

34.4.4   Activated Steel Smart Wearable

The Activated Steel looks pretty cool on this list. If you have always moved but want a sophisticated wearable device, the Activated Steel is the device to buy. It monitors daily activities such as running, walking, sleeping, and how many calories you burn. It is water-resistant up to 50 metres, which means you can use it to monitor your light swimming. This device requires charging as the replaceable battery lasts up to 8 months.

34.4.5   Apple Smart Wearable

Apple has acquired smartwatches for those who want to get a piece of wearable functionality. Apple Watch has released the Sport for fitness enthusiasts. With the silicone band, the Apple Watch Sport is lightweight and comfortable on the wrist while in operation. The clock includes a heart rate monitor and an accelerometer that monitors activity throughout the day. If you are an avid Apple user and want to sync everything with your iPhone, this is the device.

34.4.6   Samsung Smart Wearable

The Samsung Gear S2 is similar to the Apple Watch. It can perform the functions of a regular smartwatch, but this device emphasises fitness within the design. The straps are made of a silicone-like material, which is dustproof and water-resistant up to 3 metres. The application monitors your activity throughout the day and changes the application accordingly. The quick access to information from the gear screen. There is a built-in heart rate monitor to monitor your heart rate before and after the procedure. You can buy the Samsung Gear S2 with leather straps, which will look like a regular watch if not the one that catches your attention. Samsung is proud to be one of the first wearable devices to be compatible with most Android phones.

34.4.7 Moto Smart Wearable

With the success of the first generation of the Moto 360, Motorola has acquired the Moto 360 Sport. It has IP67 dust and water resistance, making it durable for heavy workouts. The Moto 360 Sport has seven sensors, including a heart rate monitor, an accelerometer, and an ambient light sensor. Lightweight silicone pads are available in black, white, and flame orange. Even with high usage, the battery will last for a whole day. You can add your Moto 360 Sport with a wireless charging dock.

34.5 Security Measurements

The increase in the number of smartphones in 2007 is being monitored by various businesses. Security arrangements that began to enter inside in some way have now reached the prime location. Devices that monitor physiological fitness changes, such as the Fitbit and Jawbone UP, are currently in high demand. These are designed to store your health data on smartphones and thereby provide information about your health. In particular, the smartwatches of companies like Apple have the most sophisticated improvements. Its GPS module is capable of tracking anyone from wherever you are. There are security flaws in such sophisticated achievements.

Usually, these wearable devices are connected to your mobile phones. Hence, activities like attacks or hacking on them can also affect the exposure of your wearable devices. The process by which these functions affect the functionality of your wearable devices is called a "weak connection problem". Its problems are going to be left to you alone. Your wearable devices can also affect the product company.

A skilled hacker can even access that company's server settings via your wearable devices. Most wearable devices have a very small design. Also, these can be easily stolen if their data is connected to a smartphone or computer. Hence, start using it only after you know how to handle it before you use the wearable device. Companies are constantly updating data to escape from these problems and often store the data securely on the cloud server and erase the data and temp information on the local server.

34.6 Inference and Discussions

Highly sensitive sensors fitted to enhance your daily life will not only amaze you but also ensure your safety. Scientists have even begun to design clothes made with smart devices. These dresses, which were initially seen as a big deal, are now becoming more commonly available on the market. Its rise is to be loved and worn by everyone, from children to adults. Rather than simply replacing digitally made jewellery, smart sensors are integrated into your body and monitor your entire

body. And with the advanced technology in them, you can easily find yourself wherever you go and save yourself in times of danger. Communication will be easier for you if you have wearable clothes instead of jewellery. Wearable devices that are usually traditionally made are upgraded based on certain health benefits. Using it for a short period and throwing it away is a simple process, but jewellery is not like that. You may always be compelled to wear it. Its special feature is that the smart clothes designed in this manner are comfortable to wear and easy to wash. And for some, as a baby gets older, he or she will outgrow this. The needs of elegant fabric designers and technicians will be very important in designing this. This technology is considered feasible in terms of fabric smart sensors and biometric smart sensor speeds.

The detection of certain significant health conditions in most smart clothing technologies is considered to be the key factor in improving their design. Diabetes is considered to be the most important problem at present. Smart devices are designed to constantly monitor this and help keep patients constantly monitored. It also constantly monitors the patient's body changes and conditions of injuries and constantly raises the appropriate conditions to perform medical first aid accordingly. In this process, it is important to test the physical well-being of the diabetic patient in advance. The cause of skin allergies is a rise in elemental temperature. Thus, the increase in the temperature of the feet indicates a large number of ulcers occurring in that area. Smart wearable socks are designed with this in mind. High-pressure sensor devices are attached to these socks. Thus, there is no need to connect any other devices to monitor body temperature and diabetes. The use of these socks alone is sufficient.

The Wearable-Socks are only available for a limited time; in freezing temperatures, they leave you wanting to snooze in style. Intelligent socks would assist wearable electronics to move toward digital human for diversified applications. The submission gives foot cleanliness marks and warns the client to correct the occupation and/or consult a health-care expert if desired. Clients who are equipped with this novel knowledge can change their utility by self-surviving their skin warmth. This procedure can be included in the daily routine to make sure glucose stage.

34.7   Future Work

We discovered how to build Wearable 2.0 to be good-looking and functional. For example, OM-signal from Canada has designed a game spinner for women that can detect heartbeat and inhalation and provide personalised flow recommendations. Consumer bio-sensors embedded in the inner lining of clothing collect consumer information at the foundation of movement (rather than wrist measurements) to provide more precise advice. These smart devices are put together with an iPhone application, which over time becomes accustomed to the user's body and allows them to supply more reliable preparation. AIQ-Smart Clothing is considered to be

another thing that combines wearable clothes with technological devices. Its sensitivity is further enhanced by the fact that it is sewn directly into fabrics with stainless steel threads. As a result, it does not require plating with copper or silver materials also developing into an advanced technology that further enhances the production of gloves on devices that operate in touch panel mode. In this, a special thread of light-penetrating nature is attached to the fingertips. Its sensitivity is high, so its use in the fashion sector is enhanced. This type of clothing for kids can be designed and styled more elegantly. Some specialised sensor systems can be set up to detect the baby's body temperature and oxygen levels. The baby's heart rate can also be accurately monitored. Thus, the sensor systems will immediately report any discomfort from the child's grief and its safety deficiencies. Based on these measurements, the team plans to make appropriate arrangements for the user to easily use or carry the smart devices we plan to build.

34.8   Conclusion

Generally, the smart wearable device technologies with advanced technology currently being designed should be helpful to most humans. Users will trust and buy those wearable devices only if their functionality is fast and of high quality. In many of the leading companies, these types of wearable device technologies are automatically developed and implemented to the extent that they are given artificial intelligence to collect the data for the given jobs and check and make their own decisions. The only real problems are when it comes to security management. These wearable devices cannot do the right amount of work if data is altered or stolen. And the accuracy of the results makes it difficult for users to choose. Therefore, the size and strength of its security improvements measure not only the buyers but also the value of the companies that make them.

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