Chapter 1 **Wearables: Introduction**

1.1 Wearable Computing

In general, a computer or computing device is characterized by the presence of a central processing unit (CPU) within it. The CPU is the crucial hardware that carries out the instructions of computer programs. **Wearable Computing** is the paradigm that entails lightweight, miniature computers that can be worn on the body such that the user and the computer can interact at any time as needed, with minimal overhead and impact on the user's real-world physical activities. Examples of such real-world physical activities are gardening, jogging, rafting, carrying a child, walking a dog, and so on. It can be harder and inconvenient to engage in many such real-world physical activities while also holding a phone or having to bring it out of the pocket or handbag frequently.

1.2 Wearable Computers and Technology

A **Wearable Computer** is a body-borne, miniature computing device, which the user has opportunity for constant access to and interaction with—with minimal impact to the user's real-world activities. Wearable Computers have historically been used for the last few decades in niche and specialized segments such as space, military, academic, medical, industrial, and so on. Wearables have also been the subject of academic research since decades. Many of the technological innovations from the academic and niche arenas are starting to be seen today in the nascent consumer Wearable segment.

Wearable Android™: Android Wear & Google Fit App Development, First Edition. Sanjay M. Mishra.

1.3 "Wearables"

Wearable Computers or simply "***wearables***" are today no longer limited to the abovementioned niche segments; they have commenced to make their way into the mass consumer market. Wearables are available to consumers in various shapes and forms including smart watches, clothing, belts, shoes, jewelry, athletic and fitness sensors, and so on.

The calculator watch and similar products introduced in the 1980s may be considered to be instances of simple wearables. Wearables in today's world can be quite sophisticated due to the synergistic integration of various information such as the user's current contextual information or context with the Internet cloud-based intelligent agents. Mobile devices and wearables to a greater extent can provide valuable signals from which the user's "context" can be inferred. This real-world "context" refers to where the user is currently located, what the user is currently engaged in, and so on.

Wearable technology and modern human–computer interaction trends aim to make computing less intrusive on the user's real-world experience. Today, value can be derived, not from computing devices in isolation but rather from the synergistic combination and collaboration between devices and sensors in a networked and "ubiquitous" computing ecosystem. Ubiquitous computing is the concept wherein computing is accessible everywhere and at all times, via any device.

Much like Bluetooth headsets reduced the intrusiveness of smartphones while having phone conversations and simultaneously engaging in various activities, wearables such as smart watches aim to make it easier for users to engage in their diverse real-world activities while simultaneously maintaining "light," "glanceable" interactions with the online digital world.

Wearables have commenced to make an entry into the mass consumer market, due to the convergence of numerous factors. The modern human has now commenced to wear one or more computing devices on their person that are always on and ready and close at hand. This is a trend that is unlikely to go the way of some outdated fashion, anytime soon. The implications are huge, and the applications of Wearable technology have tremendous potential. Much like the motor car of long ago, and the smartphone in more recent memory, many innovations start out as being "unnecessary" but convenient; but before long, some catch on and even reach that tipping point after which they are perceived as a "necessity."

Wearable technology lies at this interesting intersection of fashion, fitness, home automation, efficiency, productivity, and more. Some of the limitations of the smartphone in terms of their intrusiveness toward the user's real-world activities make the case for wearable devices such as smart watches.

1.4 The word: "Wearables"

The word "wearables"—short for Wearable computer and technology—has been used for several decades mostly in academic and technical publications. Today, the arrival of devices to the consumer market has started to make it a commonly used word. Currently, the dictionary word "wearable" is an adjective meaning "capable of being worn." In this book, we will use the term "wearable" as a noun to denote a wearable computing device. The chances are that once this word gathers adequate mass usage—sooner or later and likely

sooner than later—the major dictionaries of the English language will begin to acknowledge the use of this word "wearable" as a noun to denote the concept of "a wearable computer or device." "Wearables" are thus computing devices that are intended to be convenient to wear and comfortable to interact with, while we go about our choice of real-world activities.

1.5 Wearables and Smartphones

Wearables are typically not a replacement for smartphones or tablets—rather wearables typically complement and augment smartphones and tablets. Wearables are somewhat of a natural progression and extension of the smartphones and the useful smart "Apps" that reside and run on them, which have become an indispensable part of our daily lives. Some smartphone Apps have adequately demonstrated their usefulness and ability to serve as our own intelligent personal agent, always ready and available to help us in the many dimensions of our daily toil and strife of work and family, fitness and health, entertainment, education, and more.

Wearables as do smartphones often have sensors, which can help in determination of the user's current context. However, wearables—by virtue of being worn on the person—have more intimate sensor access including biological parameters such as heart rate, skin conductivity, body temperature, and so on, thereby making them useful for fitness and productivity applications and so on.

1.6 Wearable Light, Glanceable Interactions

Wearables support the ideal that users can more easily continue to pay adequate attention to their physical activities and environment, while also keeping up to date with the online world via lightweight, minimally intrusive interactions. Wearables are intended to help us engage better with our real-world activities that tend to change from moment to moment, in free and full flow. Wearables aim to make it easy for you to keep in touch with the physical world and environment and also be on top of those important, informational electronic updates, acknowledgments, and lightweight actions that need to be performed in real time.

1.7 Smartphone Dependency, Inconveniences

Fundamentally, we as consumers use personal computing devices because we derive some value from them. At the same time, using any computing device tends to distract and detract from our real-world activities. The more we recognize and appreciate the benefits of our smartphones and Apps that run on them, the more they become an integral part of our daily lives; and the more we tend to experience the inconvenience, overhead, and inelegance of having to frequently dig our phones out of our pockets and handbags or holding our phones in our hands for extended periods of time and under inconvenient circumstances—such that our almost perceptual use of our phones can tend to interfere with our various real-world activities.

The greater our need to keep connected with the networked world, for reasons of family, work, entertainment, and more, the more we are likely to benefit from a more elegant and less intrusive "wearable" model of the human–computer interaction. The wearable model aims to reduce the distractive and constraining effect on the user in "the here and now."

1.8 Wearable Interaction

The more trivial the nature of an electronic interaction, the more likely that the wearable will suffice. The more complex your electronic activity or task (say, something substantial such as writing a marketing plan, preparing a report, watching a movie, etc.), the more likely that you will benefit from a larger computing device such as a smartphone, a tablet, a *Chromebook*™, or a netbook computer. Smart watches typically support simple "outbound" communication using voice and simple touch menus and simple "inbound" context-based suggestions and cards.

1.9 User's Real-world Context

The user context is a broad term that includes location awareness and real-world activity recognition. It is about where a user is and what activity a user is engaged in, at any given time. Smartphones often come with various sensors such as accelerometers, gyroscope, and so on, which Apps can access and leverage in order to make an intelligent determination of the user's real-world context such as driving, running, hiking, at work, at home, and so on. Apps have recently been trending and evolving toward a more user context aware, proactive, predictive, participatory paradigm of interaction with the user. The user's real-time context awareness is one of the foundations for intelligent agent-based applications. Wearables are uniquely qualified to provide accurate and useful insight into the users' real-world context due to their various sensors and direct contact with the human body.

1.10 Variety of Wearable Devices

A wide variety of wearables such as smart watches, fitness sensor cuffs and straps, smart contact lenses, athletic goggles, eye glasses and displays, smart headphones, helmets, smart clothing, shoes and belts, smart jewelry, and so on have become available in the consumer market. A few of the most common wearable categories are listed below.

1.10.1 Smart Watches

Smart watches are one of the predominant wearable devices in the consumer market today. Initially, the rise of the smartphone tended to make the wrist watch practically redundant. But today, the success and proliferation of the smartphone and our deepening dependence on them paves the way for smart watches, which offer a less intrusive interface. Smart watches mostly serve in the role of an extension of the smartphone. Smart watches typically have one or more mechanisms for interconnectivity such as Bluetooth LE, Wi-Fi,

USB, and so on. Bluetooth LE is the predominant mechanism for connectivity. Once paired with a phone, the smart watch can access the network.

1.10.2 Fitness Sensors

Fitness sensors are available in various configurations—some are stand-alone sensors mounted on chest straps, wrist bands, and so on. Others are integrated or embedded into other body-worn items such as watches, headphones, belts, shoes, goggles, and so on. Fitness sensors typically provide connectivity via technologies such as Bluetooth LE, Bluetooth (classic), Wi-Fi, etc.

1.10.3 Smart Jewelry

Smart jewelry is less of a separate category of wearables and more of a special case of smart watches and fitness sensors that are encased in elegant and/or expensive metal. There are a variety of smart jewelry such as bracelets, rings, necklaces, and so on that perform the function of jewelry in conjunction with the computing functions as in smart watches, fitness sensors, and activity trackers.

1.11 Android Wear and Google Fit

Android Wear and *Google Fit* are distinct and collaborative efforts by Google and numerous partners to bring smart watches and fitness sensors into the mass consumer market in a user-centric ecosystem. *Android Wear* and *Google Fit* aim to make it easier for App developers to write Apps that are portable across devices from diverse manufacturers.

Android Wear and *Google Fit* are separate but closely related platforms. A typical *Android Wear* device is the smart watch—which augments the smartphone and provides a simpler and lighter user interface that allows the user to receive notifications and address trivial online interactions, in a less intrusive manner. *Android Wear* devices typically have a simple screen and can accept voice and touch inputs. The *Android Wear* watch is conceptually an extension of the smartphone. Most *Android Wear*/smart watch devices have fitness sensors such as heart rate, step counters, and so on.

Google Fit currently works with Bluetooth LE devices such as heart rate monitor or step counter worn on the body that provides sensor data that their smartphone can access.

While the general subject of Wearable Computing certainly includes medical devices, particularly *Google Fit* is a fitness platform and explicitly excludes medical devices and medical applications. Medical devices and applications are typically regulated by the country-specific governmental agencies.

1.11.1 Device / Hardware Purchases

The subject of procurement of an *Android Wear* device has been covered in Section 6.7.2. Similarly, the subject of procuring devices for *Google Fit* development has been covered in Section 8.8. You may refer to these mentioned sections in advance, in case you would like to order suitable devices now or at any point.

References and Further Reading

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