

Put on the Future: Wearable Technology

White Paper

.....Press Contact.....

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1. Introduction

While jogging, your shoes can record your running speed, acceleration, path and distance. While taking a subway, the ring you wear can display how far your train is and how soon it will come; it also shows you at which stop you should take a transfer and when the next train will arrive. While putting on your mask in a city with poor air quality, your mask not only protects you, but it also detects and shares the air quality data to the cloud so that everybody can see air quality anywhere in the city on the display of his/her mobile phone. All of these are not just scenarios, but they have become real. Wearable technology has been widely adopted in various end-use segments and become a part of our daily life.

2. Market TAM, forecast, and trend

Even though wearable technology is in its early stage, it has reached 14 millions pieces of annual device shipment in 2011 according to IMS Research, and is forecasted to have a rapid growth to 171 millions by 2016. Other researches confirmed the same direction with even more optimistic forecast (Table 1). The market size will reach USD 5.8 billion in 2018 at CAGR of 40.8% from 2012 to 2018 predicted by Transparency Market Research. A large portion of shipment will be in the categories of healthcare, medical, wellness, and sport/fitness; the industrial and military usage will also occupy a certain portion. However, the emerging Infotainment products such as Smart Glasses and Smart Watches are projected to have a higher growth rate and will surpass the other products to become the major revenue contributor to the entire wearable industry in the future. Though some other subsidiary segments such as fashion, gaming, etc. are relatively smaller now, with more and more innovative products coming out they also have good potential to become big and deserve continuous attention.

Market research company	Forecast
BI Intelligence	300 millions in 2018
ABI Research	485 millions in 2018
IMS Research	171 millions by 2016

Table 1. Wearable devices forecast on annual unit shipment

Some key players in their respective segments have adopted wearable technology into their product lines to help growing the market. For example, the leading companies in sports goods such as Adidas and Nike have wearable products ready in the fields of health and wellness. The wearable market growth is also driven by some other factors. First, mobile

phones play the role of personal hubs to connect wearable devices through wireless technology like Bluetooth and provide the capability of online data access. This makes many products and applications in the field of mobile monitors/trackers feasible and successful. As a result, the demand is not only on devices but also on aggregators, cloud service, operators and the whole ecosystem gets major boost. Furthermore, the participation of big software companies such as Google, Apple, Microsoft, and Facebook provides platforms to integrate various services. It is definitely a driving engine to accelerate the entire industry toward maturity. Nevertheless, the advances in material science, power-efficient components, battery life, sensor technology, and SoC evolution can not be overlooked. They will make wearable devices thinner, lighter, more durable, portable and less power hungry, and these features are the keys to make them easily embedded into our daily life and accepted by the market. All these together drive the market growth in a tremendously rapid way.

3. Requirements

To ensure the success of a new wearable device, it has to meet at least two basic requirements from technology viewpoint: compactness and portability. In order to achieve compactness, each component of the device should be selected as small as possible, including the battery. Regarding to portability, power efficiency should be the most important consideration because it eliminates the need of frequent battery re-charging. Therefore, choosing small size and power efficient components will be the fundamental challenge for engineering.

4. AndesCore™ embedded body sensor network

Body sensor network plays very important role in wearable products, especially in medical and healthcare applications. Bluetooth is one of the best candidates for wireless body sensor network of wearable products because it has become a standard feature in mobile phones for short range communication. The Bluetooth protocol provides point to point and point to multi-point mechanisms that can be used for the mobile phone to efficiently communicate with individual sensor nodes worn on the human body. Sensor devices can gather the desired information and perform basic processing; then the results are sent to a mobile phone to undertake further calculation and statistics gathering (Figure 1). Users can install APPs to their mobile phones to display medical data in an easy-to-digest format. Furthermore, users can use the APPs to transmit the data to the server of remote medical care systems or cloud computing environments to have more accurate diagnosis.

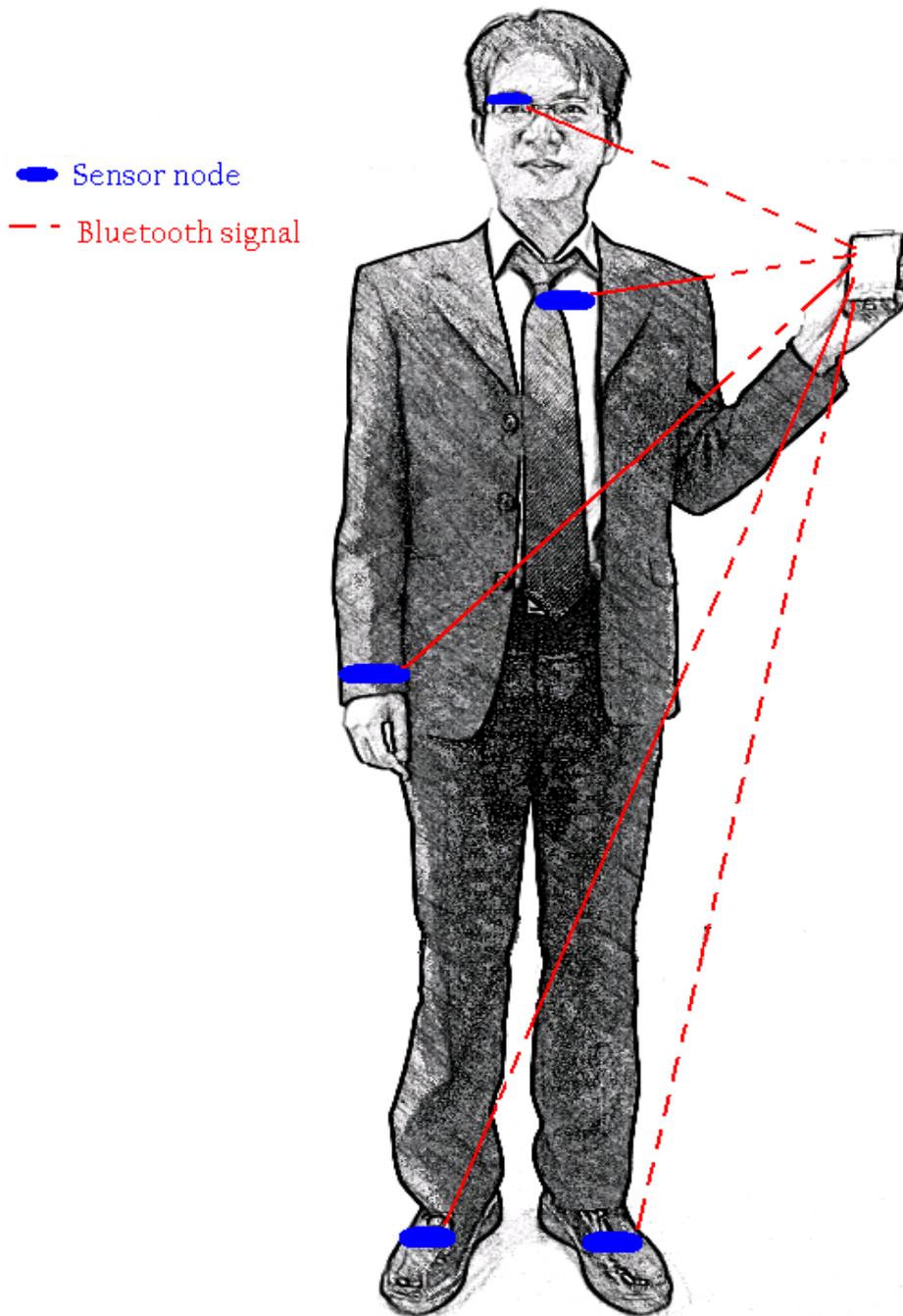


Figure 1. Body sensor network connecting to mobile phone device

Andes Technology Corporation, a dedicated vendor of 32-bit CPU IP and associated SoC platforms, provides the innovated performance-efficient processor solution for SoC. To serve the requirements of Bluetooth based sensor nodes with competitive low power and small size, Andes architects a solution implementing the AndesCore™ configurable 32-bit

CPU IP N705 with TSMC 90nm Low Power process and its related IP.

The AndesCore™ N705 is an ultra power-efficient compact synthesizable softcore of a general-purpose 32-bit embedded processor. For ease of integration in SoC design, the N705 is delivered with a complete softcore development package as well as reference design flow to fit customer's requirements in all aspects of performance, power consumption, and die area. In addition, it supports All-C Embedded Programming, C libraries optimized for MCUs and low-cost ICE debugger through Serial Debug Port (SDP). With TSMC's world-class technology in processes and supporting infrastructure, the N705 demonstrates the industry-leading power efficiency at 90LP for a 32-bit CPU core using TSMC standard library. It achieves over 100 DMIPS/mWatt, or 115 to be exact. The N705 uses as little as 12K gates logic and can deliver up to 1.51 DMIPS/MHz and 2.62 CoreMark/MHz. Both are the industry leading scores for CPUs at this level.

N705 can be connected to the slow and power-hungry embedded flash memory directly. Thanks to the FlashFetch™ technology, the N705 can not only run in its full speed, but also help reduce flash power consumption significantly by avoiding over 50% flash instruction memory accesses in EEMBC's CoreMark® benchmark. Both together ensure ultra power efficiency in the real world environment. Under 2:1 CPU vs Flash speed ratio, the N705 demonstrates 37% higher power efficiency (DMIPS/mWatt) and still maintains 11% better area efficiency (DMIPS/mm²) over the leading supplier's smallest and lowest power CPU core. The N705 supports flexible power management mechanism through software, but it can also relinquish the control to the SoC through a standby request input signal. This allows SoCs to fulfill the requirements of versatile power management modes. The following block diagram (Figure 2) shows an example of an AndesCore™ N705 based Bluetooth SoC supporting sensor network. This SoC combines Andes CPU IP, TSMC standard cell and libraries, TSMC or the third party IP including embedded flash, SRAM macro and ADC. The sensor would get the analog signals from the human body and ADC would convert the analog signals to their digital counterparts that can be handled by the CPU for basic analysis. The analysis results will be transmitted through the Bluetooth protocol logic and transceiver to the mobile phone, where the application program would present the data in an easy-to-understand format.

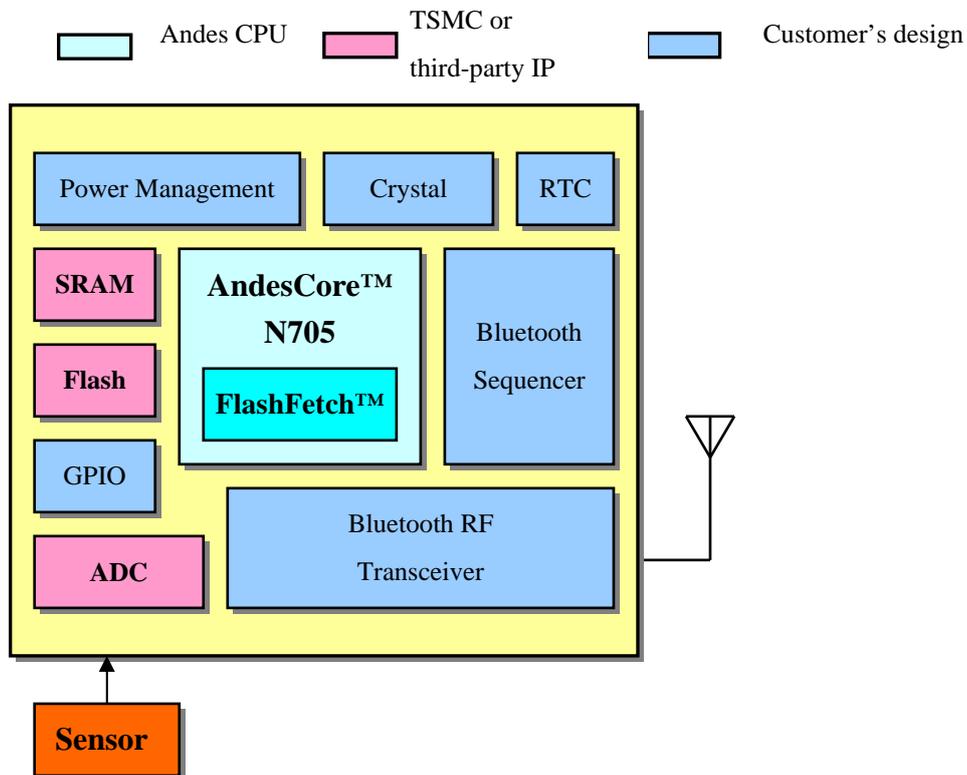


Figure 2. An Andes embedded sensor node for Bluetooth™ based body sensor network

5. Conclusion

Wearable technology and products intimately bind our lives to healthcare, medical, wellness, sports and fitness, and lead us to better, healthier and more convenient life. It forms an industry with a high growth potential. The wearable products will have an annual growth of over 40% for the next 6 years to reach the total revenue of over USD 5 billion in 2018. Part of their success depends on its mean time between battery charges. Andes Technology would like to contribute to the industry by offering AndesCore™ N705 together with TSMC's advanced processes and libraries to serve the demanding SoCs with the best power consumption, efficiency and small die size.

Note: FlashFetch™, AndeStar™, and AndesCore™ are trademarks of Andes Technology Corporation. CoreMark® is the CPU core benchmark developed by EEMBC organization.

.....About Andes.....



Andes Technology Corporation was founded in Hsinchu Science Park in 2005 to develop innovative high-performance/low-power 32-bit processor cores and its associated development environment to serve worldwide rapidly-growing embedded system applications. It delivers the best super low power CPU cores with integrated development environment and associated software and hardware solutions for SoC development.

In order to meet demanding requirements of today's electronic devices, Andes delivers configurable software/hardware IP and scalable platforms to respond to customers' needs for quality products and faster time-to-market. Andes' comprehensive CPU families, including newly launched N7 family, budget N8 family, entry-level N9 family, mid-range N10 family, high-end N12, N13 family and secure SN series, are available to address full range of embedded electronics products, especially for smart and green applications.

For more details about Andes 32-bit CPU IP and ESL development tools, please contact sales@andestech.com.