

웨어러블 스마트 디바이스 기술과 시장 전망 (Wearable Smart Device Technology and Markets)

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OUTLINE

- **overview**
- **wearable device technology**
- **wearable device applications**
- **wearable device markets**
- **wearable device issues**

OVERVIEW

- **Wearable smart device 특성**

- 안경, 시계, 의복 등과 같이 착용할 수 있는 형태로 된 장치
- 궁극적으로는 사용자가 거부감 없이 신체의 일부처럼 항상 착용하고 사용할 수 있으며, 인간의 능력을 보완하거나 배가시키는 것이 목표
- 언제 어디서나(항시성), 쉽게 사용할 수 있고(편의성), 착용하여 사용하기에 편하며(착용감), 안전하고 보기 좋은(안정성/사회성) 특성을 가짐

• Wearable smart device의 분류



[출처: 2011 IT전략기술로드맵 차세대컴퓨팅 분야]



구글의 프로젝트 글래스



페블의 스마트시계



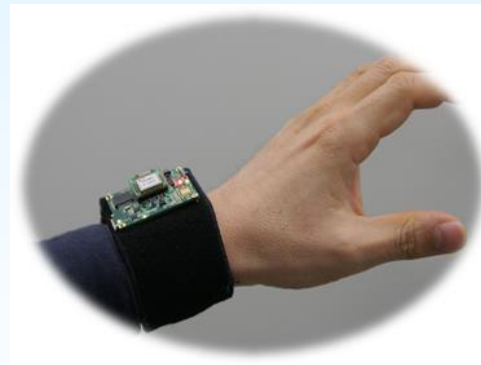
Galaxy Gear



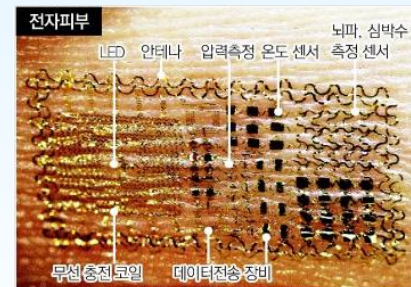
**아디다스
심박측정 브라**



**나이키
운동강도 기록
스마트 운동화**



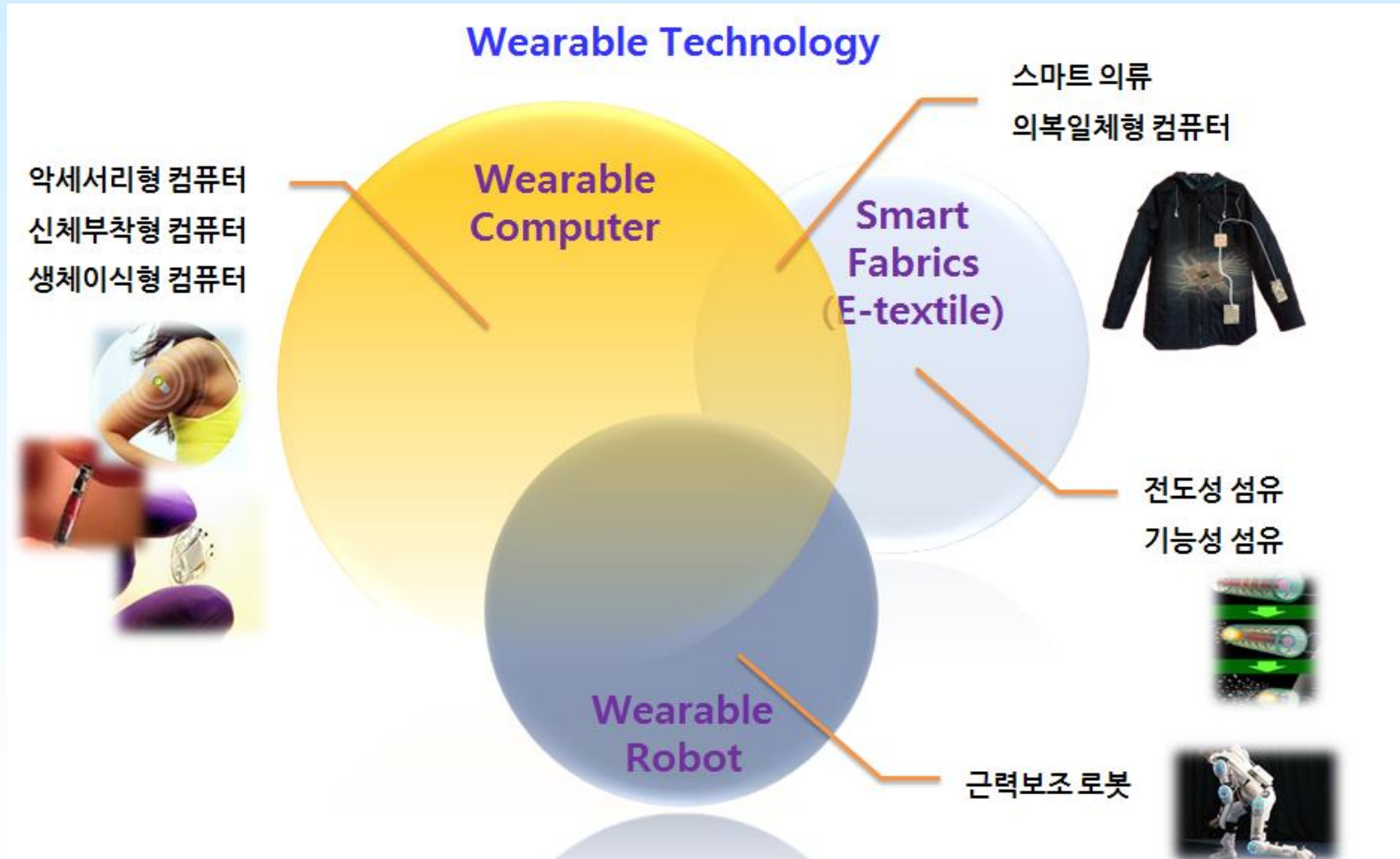
**ETRI
제스처 인식장치**



**일리노이대/서울대
전자피부**

WEARABLE DEVICE TECHNOLOGY

• 웨어러블 기술 분야



- 웨어러블 핵심 기술

- 전자부품/기기의 소형화, 저전력화 기술

- Battery life for wearables: Four factors contribute to increasing the use time of the product.
 - (1) increase the battery size (more cm^3)
 - (2) increase the energy density (more mAh/cm^3)
 - (3) reduce overall device energy consumption
 - (4) increase the conversion efficiency
 - Relative to the iPhone 5 analysis, by assuming a Wearable battery volume of 7.5cm^3 ($3.8\text{cm} \times 3.8\text{cm} \times 0.5\text{cm}$) and similar battery energy density (1.93MJ/liter), a Wearable could achieve battery life of 8hrs at 400mW assuming 80% efficiency.
 - Looking forward with a 2.2x increase in battery energy density (from 2010 to 2020), we see 16-20hr battery life possible at 80% efficiency for 350-450mW power consumption.

[출처: Credit Suisse, 17 May 2013]

Exhibit 12: Wearable Talk Time with Current Batt Density
Units in hours of use at 180mA

	Power Consumption (mW)						
	250	300	350	400	450	500	550
Efficiency	50%	8.1	6.8	5.8	5.1	4.5	4.1
	55%	8.9	7.4	6.4	5.6	5.0	4.5
	60%	9.7	8.1	7.0	6.1	5.4	4.9
	65%	10.6	8.8	7.5	6.6	5.9	5.3
	70%	11.4	9.5	8.1	7.1	6.3	5.7
	75%	12.2	10.2	8.7	7.6	6.8	6.1
	80%	13.0	10.8	9.3	8.1	7.2	6.5
	85%	13.8	11.5	9.9	8.6	7.7	6.9
	90%	14.6	12.2	10.4	9.1	8.1	7.3
	95%	15.4	12.9	11.0	9.6	8.6	7.7
	100%	16.2	13.5	11.6	10.2	9.0	8.1

Source: Company data, Credit Suisse estimates

Exhibit 13: Wearable Talk Time with 2.2x Battery Density
Units in hours of use at 180mA

	Power Consumption (mW)						
	250	300	350	400	450	500	550
Efficiency	50%	17.9	14.9	12.8	11.2	9.9	8.9
	55%	19.7	16.4	14.0	12.3	10.9	9.8
	60%	21.4	17.9	15.3	13.4	11.9	10.7
	65%	23.2	19.4	16.6	14.5	12.9	11.6
	70%	25.0	20.9	17.9	15.6	13.9	12.5
	75%	26.8	22.3	19.2	16.8	14.9	13.4
	80%	28.6	23.8	20.4	17.9	15.9	14.3
	85%	30.4	25.3	21.7	19.0	16.9	15.2
	90%	32.2	26.8	23.0	20.1	17.9	16.1
	95%	34.0	28.3	24.3	21.2	18.9	17.0
	100%	35.7	29.8	25.5	22.3	19.9	17.9

Source: Company data, Credit Suisse estimates

- 웨어러블 핵심 기술 (계속)

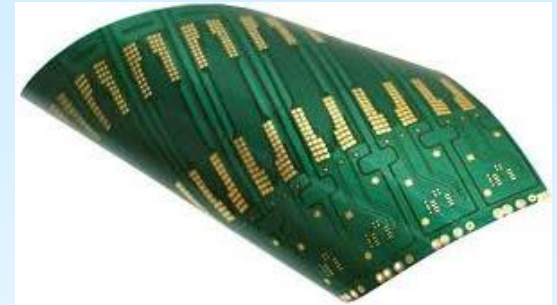
- 형태변형이 가능한 플렉서블, 종이형태화 기술



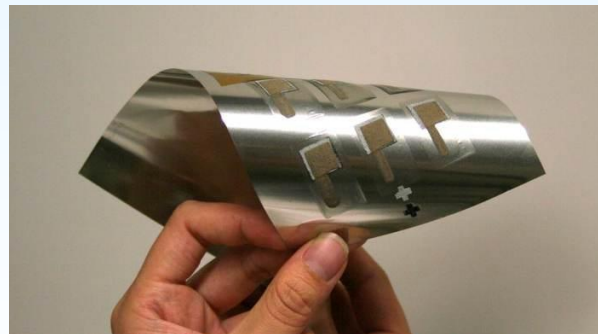
플렉서블 디스플레이



플렉서블 배터리



플렉서블 보드



**Zinc-based flexible battery
by Imprint Energy**

- 웨어러블 핵심 기술 (계속)
 - 입출력 인터페이스 및 인터랙션 기술



촉감 디스플레이



햅틱 피드백 장치



직물 인터페이스



프로젝션 기반 맨손 입력



3D 모션 동작 감지

• 웨어러블 핵심 기술 (계속)

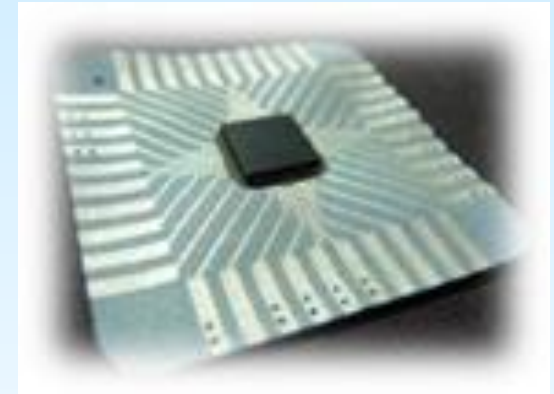
- 웨어러블 통신 기술
- 전자섬유(e-Textile) 기술



전도성 잉크, 자수



직물 회로보드



직물전자소자 패키징

- 신축회로 및 신소재 기술
- 다양한 웨어러블 센서 기술

- 의료용 센서: 심전도, 호흡, 체온, 심박수 등 측정
- 생화학 센서: 인체의 pH 농도, 염도 등을 측정
- 환경 센서: 온도, 습도, 오존지수, 자외선 지수 등 측정

- **Some of the more significant technology integration that will be used in wearable electronics 2014-2024.**
 - Smaller, thinner, lower power integrated circuits, LEDs and sensors
 - Conductive and active inks such as light emitting, sensing
 - Conductive and active thin film deposition that is not printing such as light emitting, sensing. Subtractive processes replacing additive ones. Substrate may be fibre or film or rigid
 - Advanced optics
 - Advances in conventional rigid or bendable electronics

[출처: Wearable Technology 2014-2024, IDTechEx]

- 웨어러블 기술 개발 사례: 시촉각 융합 UI/UX
 - 시촉각 융합 디스플레이 기술 및 렌더링 엔진 개발



- 상용 스마트폰용 햅틱 범퍼케이스
 - 최신 안드로이드폰(갤럭시S2) 연동
 - 햅틱 서버 개발 및 실시간 전송
 - 실시간 연속/중단/중첩 재생 기능
 - 사용자 정의 촉각 패턴 재생/저장/수정



[출처: 차세대컴퓨팅워크샵 2012, ETRI]

• 웨어러블 기술 개발 사례: SKIN PATCH

- 신축성(30%이상 인장)이 있고 피부에 탈부착 가능한 Smart Skin Patch 시스템 기술 개발



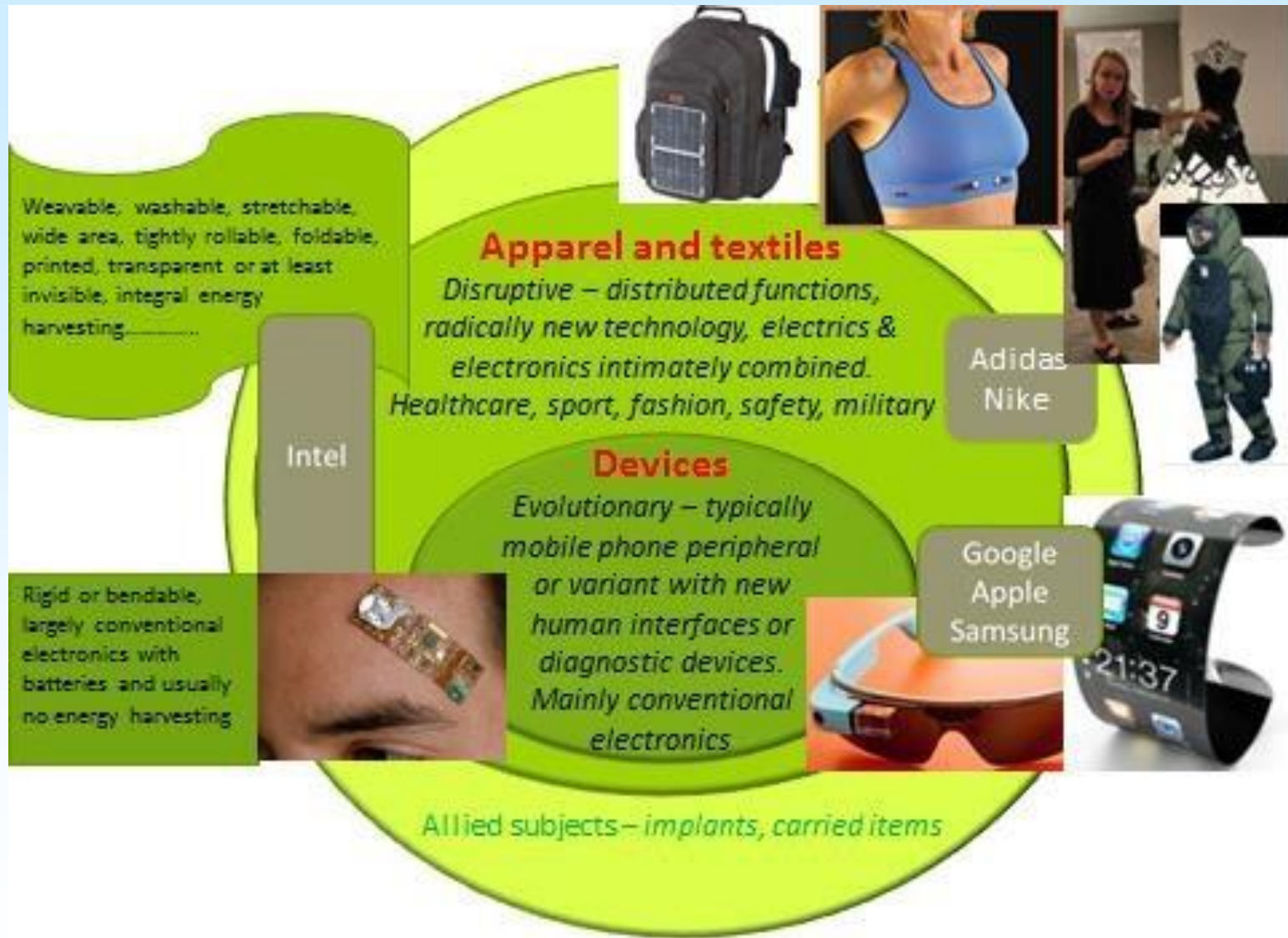
[출처: 차세대컴퓨팅 신규R&D과제 워크샵 2012, ETRI]

WEARABLE DEVICE APPLICATIONS

• 응용 분야

Application	Product Categories
Fitness and Wellness	<ul style="list-style-type: none">- Sports and Activity Monitors- Fitness and Heart Rate Monitor- Smart Sports Glasses- Smart Clothing- Sleep Sensors- Emotional Measurement
Healthcare and Medical	<ul style="list-style-type: none">- Continuous Glucose Monitoring- ECG Monitoring- Pulse Oximetry- Blood Pressure Monitors- Drug Delivery- Hearing Aids- Wearable Patches- Defibrillators
Industrial & Military	<ul style="list-style-type: none">- Hand-worn Terminals- Augmented Reality Headsets- Smart Clothing
Infotainment	<ul style="list-style-type: none">- Smart Watches- Augmented Reality Headsets- Smart Glasses- Wearable Imaging Devices

The two main types of wearable technology, their typical characteristics (though not all are exhibited by any one realisation) with examples and allied subjects.



[출처: Wearable Technology 2014-2024, IDTechEx]

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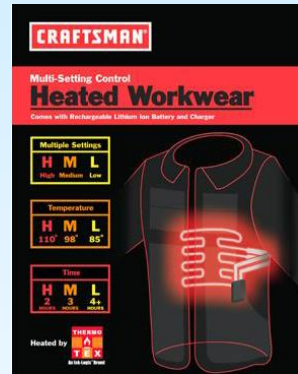
Merging of Applications: Examples of wearable products that merge the functions medical, healthcare, fitness, wellness

	Medical/Health care	Fitness	Wellness	Infotainment
Heated apparel	Therapy	Athlete assistance	Mountain climbers	
Brainwave monitoring	Communication with Alzheimer’s patients Rehabilitating brain injured	Controlling a motorized skateboard by thought has been demonstrated	Meditation aid	Video games headsets Moving ears toy
Diagnostic wristwatch with satnav	Non-invasive blood glucose test for diabetes	Heart rate, distance calories burned etc	Warning of overstress	Time, position, navigation etc
Bionic man and woman using exoskeletons, prosthetics and patches such as artificial pancreas	Replacement parts	Improved performance	Reduced pain	
Self-cooling shirt	Therapy and cooling surgeons working under hot lights	Athlete cooling	Comfort for anyone	



• Product examples

- Smart watches, internet enabled Timex, Sony, Samsung, Apple, Google
- Google Glass, Android Wearable, Qualcomm collaboration USA
 - Google announced Android Wear, an extension of the Android operating system for smart watches and other wearable devices, which will be powered by Qualcomm Snapdragon processors
- HID laundry buttons Switzerland
 - Radio Frequency Identification RFID buttons and stitched labels
- Neurowear Necomimi Japan, 4D Force Germany – brainwave monitoring and control
- T-Ink heated and smart apparel USA
- Nike, Adidas smart shoes, wristwear etc USA



Lockheed
Martin
FORTIS



• 웨어러블 제품 사례: Fitness/Wellness

– Nike Plus

- 2006 introduction of the Nike+iPod Sports Kit, which consisted of a pedometer and small transmitter device that communicated with various iPod products to store elapsed time, distance, pace and calories burned during a workout.
- The product line has since expanded to include iOS and Android apps, a multi-functional GPS watch, and the Nike FuelBand, an accelerometer-based activity monitoring tool.

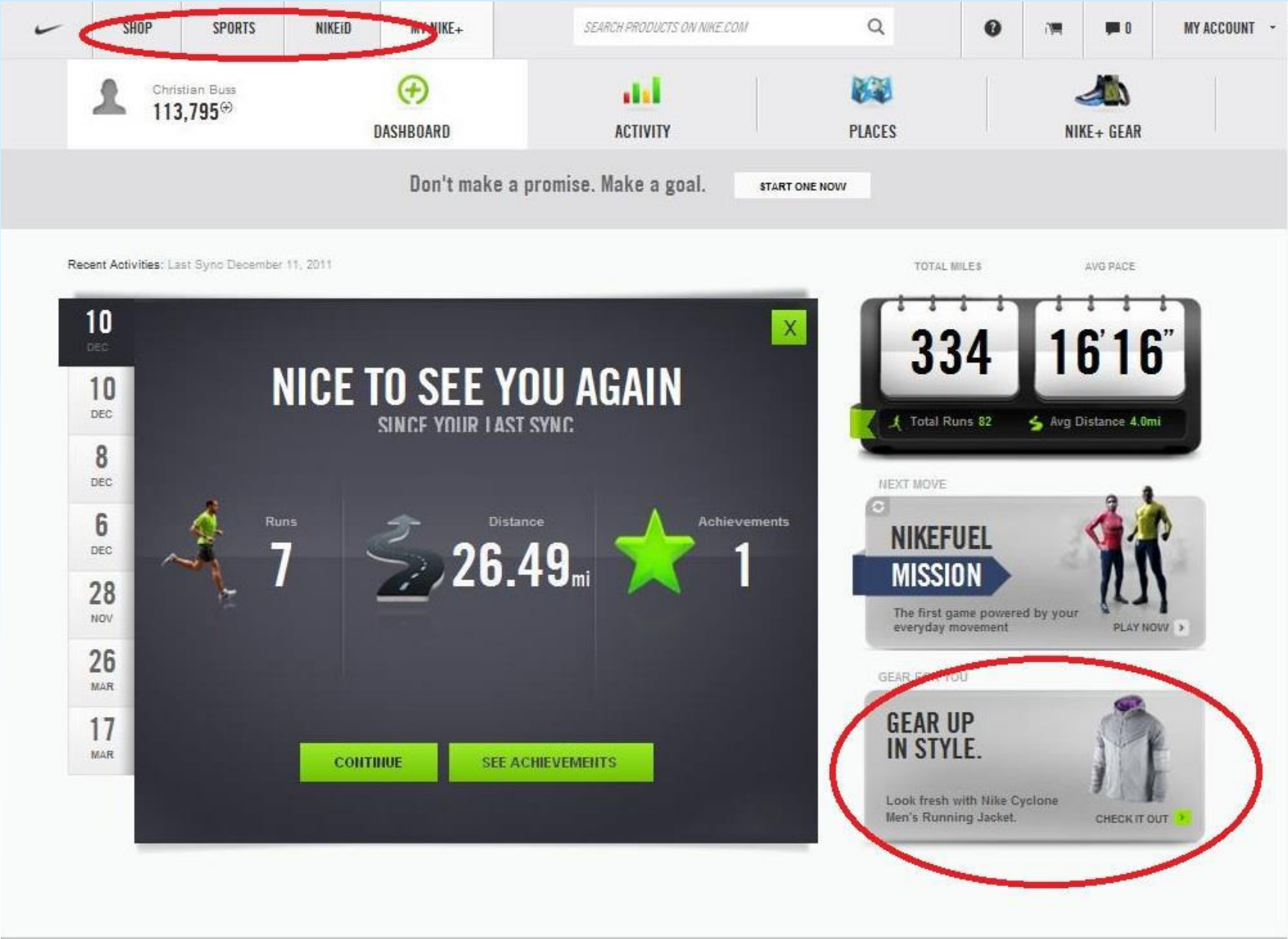


Original Nike+ System



Nike+ FuelBand

Nike+ Integrated Into Nike eCommerce Platform



• 웨어러블 제품 실패 사례

- Solar bags: Cost. Limited life: PV 2-3 years, solar cells 5 years. Ugly – no designer bags.
- Solar swimsuits: Uncomfortable, ugly, produced little power.
- Sewn in iPod controls in men's suits: Circuit had to be removed for cleaning.
- Most of the advanced wristwatches: Too big and expensive. Awkward to use.
- Most electrically heated apparel: Did not heat for long enough, expense of dry batteries (needed replacing every time of use). Weight of battery.

[출처: Wearable Technology 2014-2024, IDTechEx]

- Nintendo Virtual Boy:
Required you to wear special goggles that projected 3-D images. It caused huge eyestrain, was too cumbersome to carry around and cost \$180 in 1995 dollars.
- Xybernaut Poma **wearable computer**: Ugly, clunky

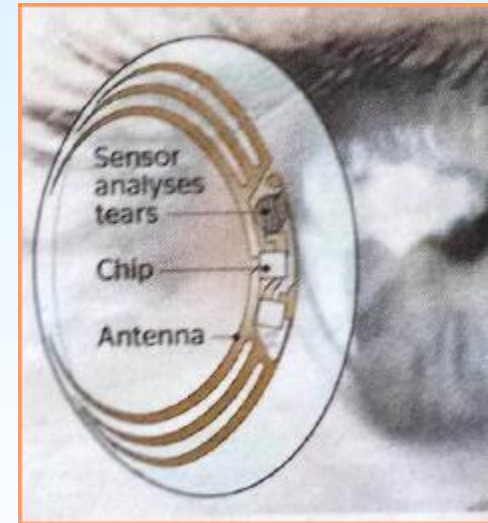


[출처: Wearable Technology 2014-2024, IDTechEx]

- **Examples of wearable electronics ideas, products and enabling materials with potential identified as over \$5 billion**

- **Eyewear:** Google contact lens
- **Wristwear:** Much improved versions of Samsung, Qualcomm, Metawatch, Apple iWatch
- **Sports apparel:** Adidas smart sports bra
- **Footwear:** 3L Labs Footlogger
- **Earpieces:** New multi-functional earpiece
- **Neckwear**

Google contact lens enables diabetes patients to read glucose level every second

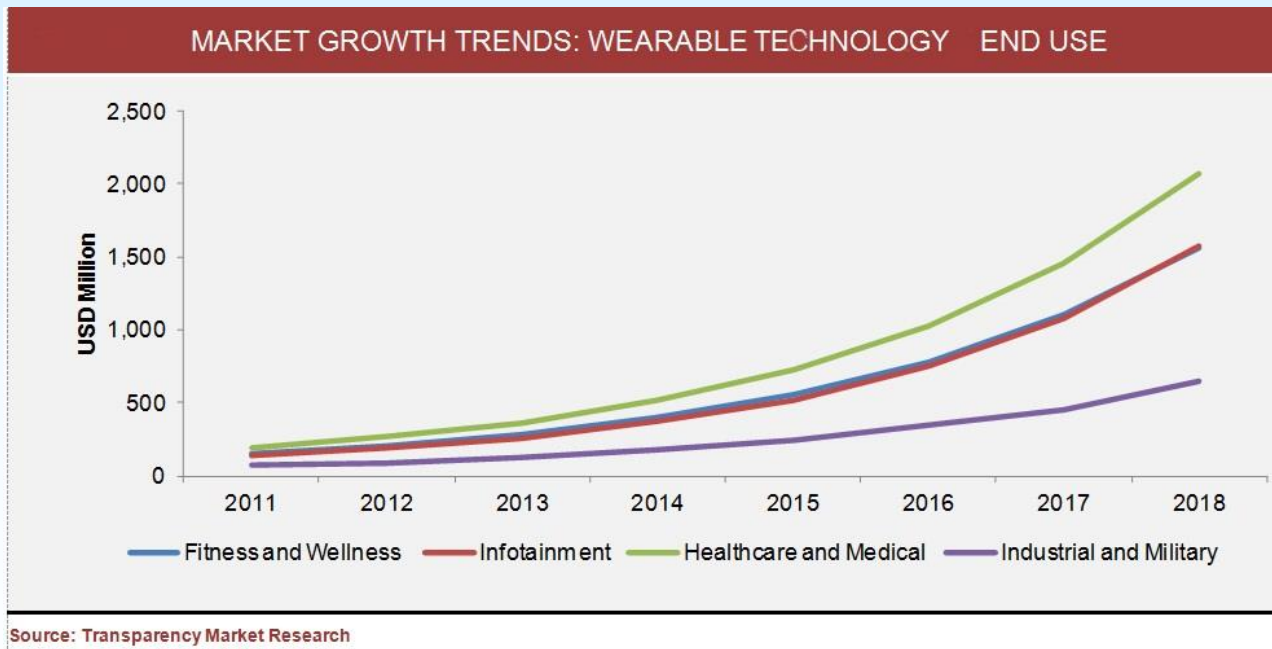


[출처: Wearable Technology 2014-2024, IDTechEx]

WEARABLE DEVICE MARKETS

• 시장 전망

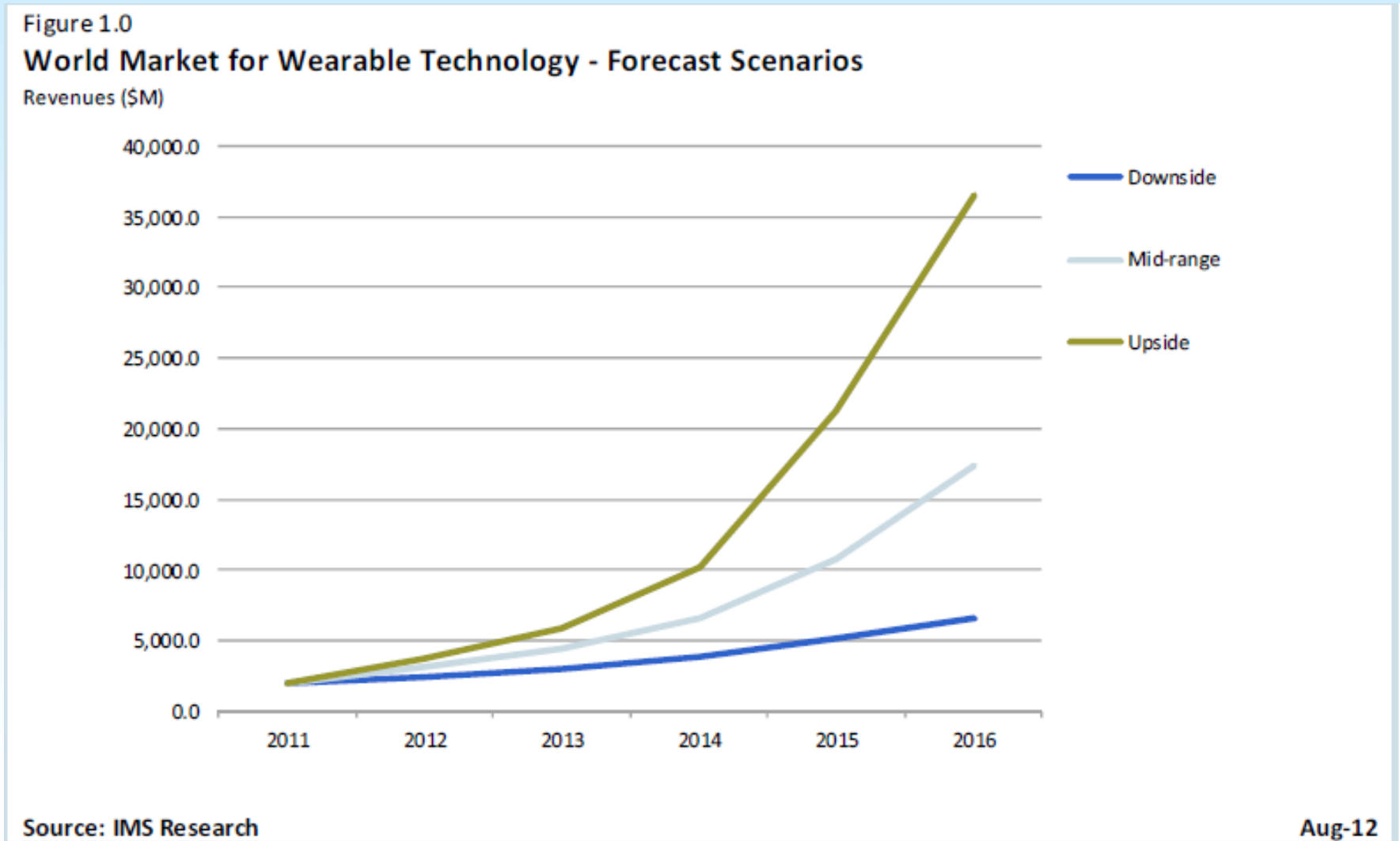
- 세계 웨어러블 디바이스 시장은 2012년에 약 7.5억불이며, 연평균 40%이상 성장하여 2018년에는 약 58억불에 이를 것으로 전망



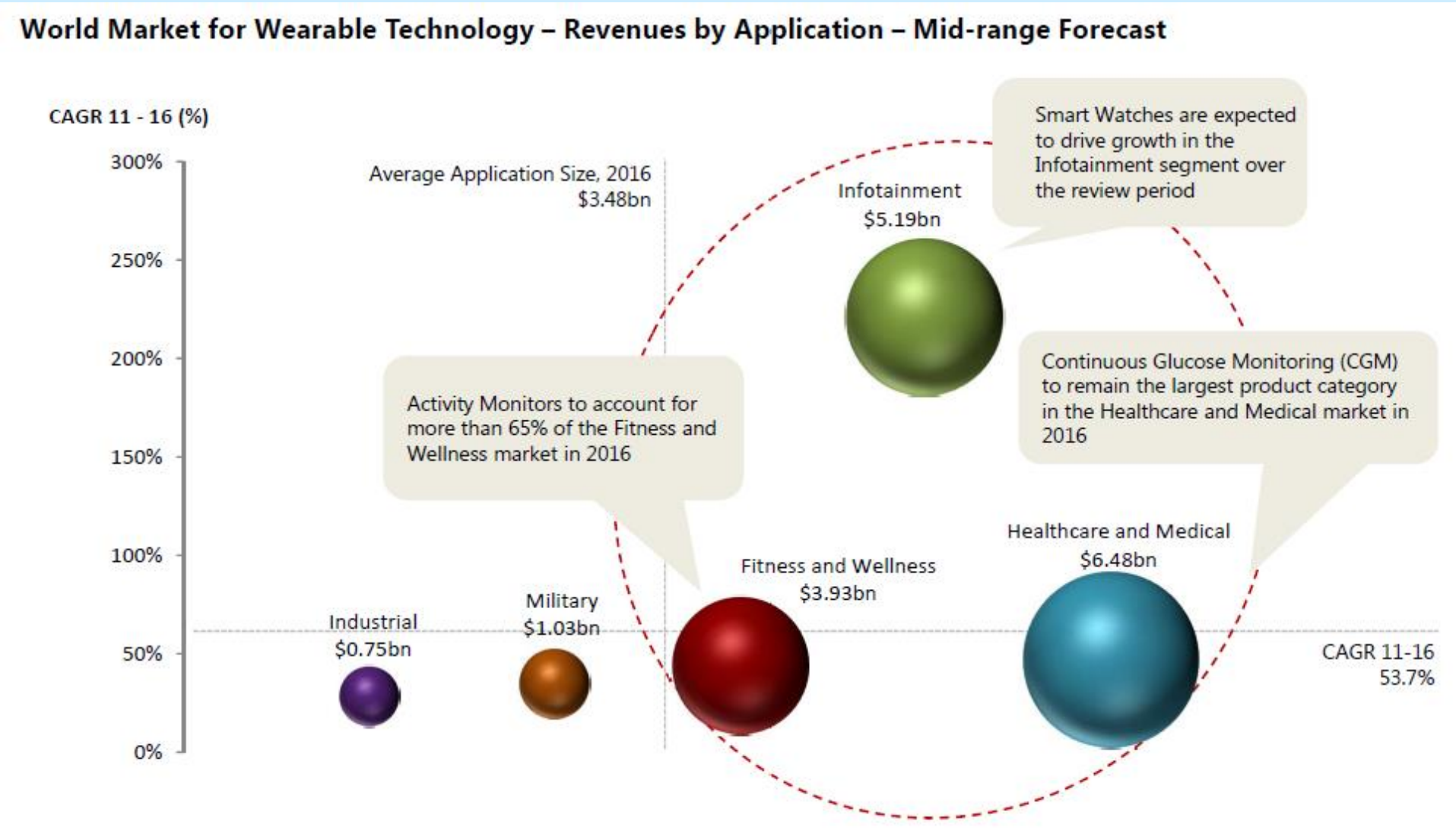
[출처: “Wearable Technology Market - Global Scenario, Trends, Industry Analysis, Size, Share And Forecast, 2012 – 2018”, Transparency Market Research]

[출처: IMSresearch, 2012.8]

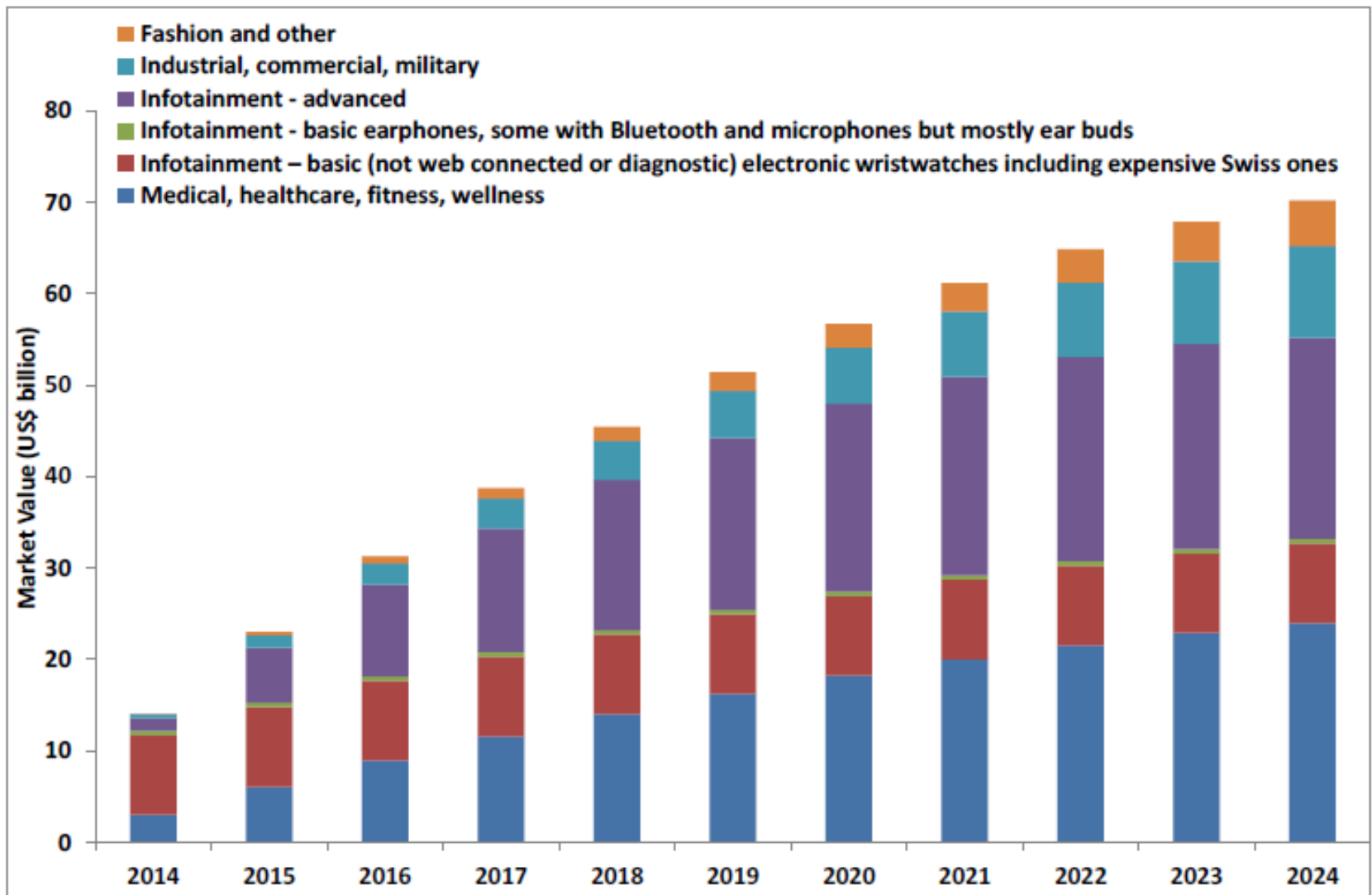
The downside forecast is a conservative forecast which assumes that the adoption of Wearable Technology will be limited by factors including lack of Technology, poor user compliance and lack of an overall enhanced experience from devices that are wearable as compared to non-wearable products.



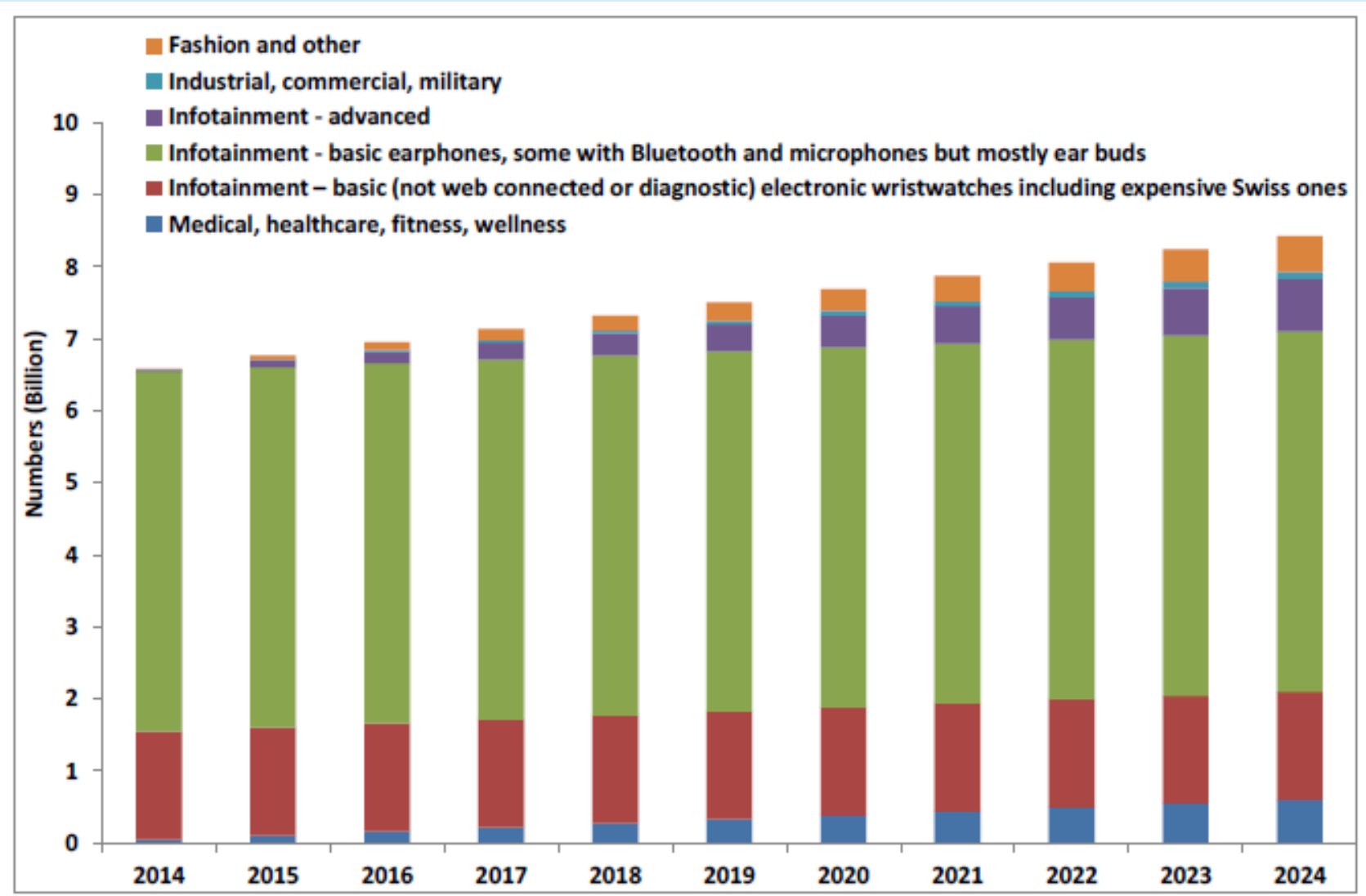
Mid-range forecast. Note that the size of bubble indicates the projected size of the application market in 2016



Global market value of wearable electronic devices in US\$ billions 2014-2024



Global number of wearable electronic devices in billions 2014-2024



[출처: Wearable Technology 2014-2024, IDTechEx]

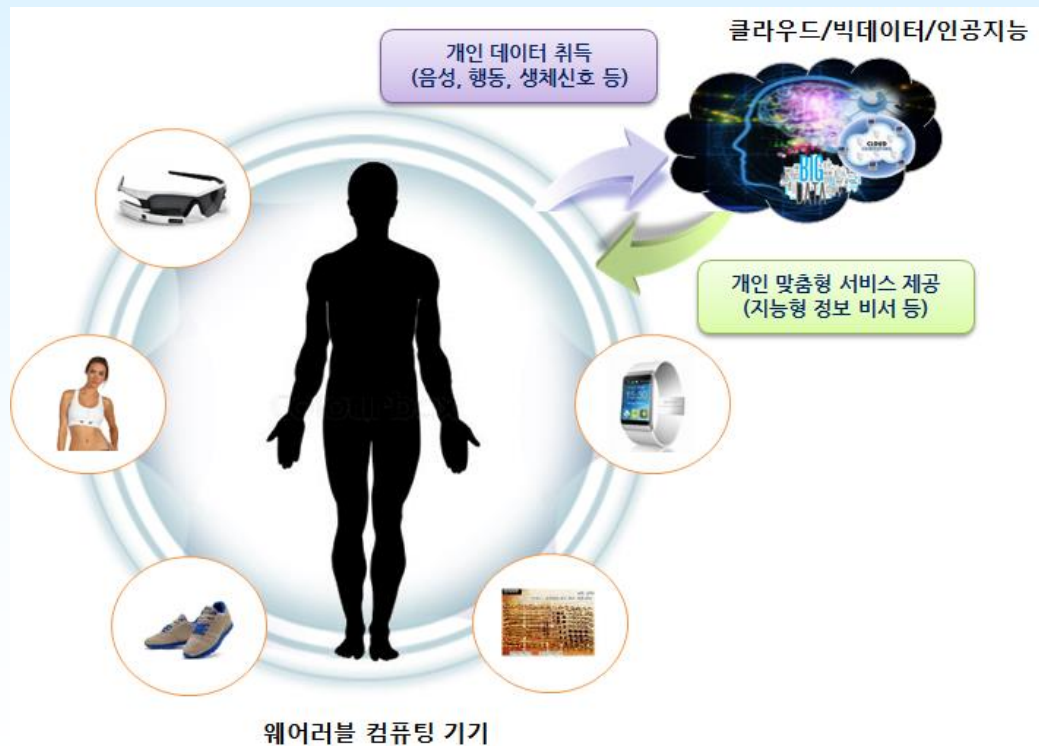
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WEARABLE DEVICE ISSUES

• 산업 전망

- 빅데이터 처리, 클라우드 컴퓨팅 기술과 결합하여 미래 인류에게 필수적인 스마트 정보 디바이스를 제공
- 스마트 라이프 실현, 국민 안전과 편의 증진에 기여



SAP has released two new applications for Vuzix' M100 Smart Glasses for the enterprise markets. The new augmented reality (AR) applications, SAP® AR Warehouse Picker and the SAP® AR Service Technician, help simplify and improve the user experience and work processes by offering a hands-free working experience.

Wearable + AR + Cloud/BigData Platform



[출처:

http://article.wn.com/view/2014/10/17/SAP_Launches_Two_Enterprise_Applications_Supporting_Vuzix_M1_6/]

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- **필요 작업**

- 관련 법제도 정비, FDA 인증 등

- **대책 마련 필요 부분**

- 전자파로 인한 인체 부작용
 - IT기기에 대한 상시 의존성 심화
 - 사생활 침해 및 개인정보보호 문제
 - 해킹으로 인한 오작동시 인체에 대한 부작용

Thank You !