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UNITED STATES DEPARTMENT OF ENERGY
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(82010)
Responder Technology Alert
Monthly (Oct-Nov 2014)

JF Upton
SL Stein

January 2015

Prepared for the Department
of Homeland Security Science and
Technology Directorate under Contract
HSHQPM-14-X-00058.

Pacific Northwest National Laboratory
Richland, Washington 99352
### Acronyms and Abbreviations

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<tr>
<td>ACC</td>
<td>accelerometer</td>
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<tr>
<td>AR</td>
<td>augmented reality</td>
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<td>CC</td>
<td>carbon cotton</td>
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<td>DARPA</td>
<td>Defense Advanced Research Projects Agency</td>
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<td>DCRS</td>
<td>Dipole Coil Resonant System</td>
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<td>DHS</td>
<td>Department of Homeland Security</td>
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<tr>
<td>FCB</td>
<td>fabric circuit board</td>
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<tr>
<td>GPS</td>
<td>global positioning system</td>
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<td>HRV</td>
<td>heart rate and rate variability</td>
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<td>IoT</td>
<td>Internet of things</td>
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<tr>
<td>MA</td>
<td>motion artefact</td>
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<td>NPL</td>
<td>National Physical Laboratory</td>
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<td>PNNL</td>
<td>Pacific Northwest National Laboratory</td>
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<td>RTA</td>
<td>Responder Technology Alliance</td>
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<tr>
<td>WHMS</td>
<td>Wearable healthcare monitoring systems</td>
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Appendix A Technology Summary ........................................................ A.1
1.0 Introduction

The Pacific Northwest National Laboratory (PNNL) is supporting the Department of Homeland Security (DHS) to advance technologies to enhance responder health and address complex and changing threat environments. The DHS Science and Technologies First Responders Group established the Responder Technology Alliance (RTA) to accelerate the development of solutions to first responder needs and requirements by identifying, analyzing, and recommending solutions that improve responder safety, enhance their ability to save lives, and minimize property loss. The end goal is for RTA to develop and implement strategies that will make effective solutions available to first responders.

As part of technology foraging for the RTA, this report summarizes technologies that are relevant in the area of “wearables,” with the potential for use by first responders. The content was collected over the previous month(s) and reproduced from a general Internet search using the term wearables. Additional information is available at the websites provided. The content is organized by technology function including:

- Sensors – Devices that detect physiological, particle, and chemical activity
- Displays – Heads-up and body-worn visual displays
- Power – Wearable power systems including chargers, batteries, self-powering or harvesting technologies, and power supplies
- Integrated Communications – Voice and data communications systems utilizing Bluetooth, wireless, hands-free, ergonomically optimized systems, noise-filtering digital speakers or microphones, etc.
- Exoskeletons – Whole or partial body suit that enhances mobility and physical performance
- Wearable Computers – Body-worn data processing devices
- General – Miscellaneous technologies as well as emerging trends or recent advances in the field of wearables.

This report is not meant to be an exhaustive list nor an endorsement of any technology described herein. Rather, it is meant to provide useful information about current developments in the areas wearable technology.

A spreadsheet summarizing these technologies is available in Appendix A. For an electronic copy, contact Jaki Upton at jaki.upton@pnnl.gov.
2.0 Sensors

2.1 Physiological

2.1.1 3L Labs: Footlogger

Website: [http://www.footlogger.com/](http://www.footlogger.com/)

Technology name: Footlogger

Description: FootLogger is a Bluetooth-connected shoe insole activity tracker delivering wearable technology inside the shoe. The device is anticipated to have applications in healthcare, sports, and recreation.

Status: Soon to be released

Funding Source/Mechanism:

2.1.2 Adidas: MiCoach

Website: [http://micoach.adidas.com/](http://micoach.adidas.com/)

Technology name: MiCoach

Description: The MiCoach product line includes a heart rate monitoring shirt that pairs with an app that reports data as the wearer exercises. The "smart fabric" technology incorporates special sensing fiber electrodes knit directly into the garment.

Status: Available

Funding Source/Mechanism:

2.1.3 Athos: Core

Website: [http://www.liveathos.com/](http://www.liveathos.com/)

Technology name: Core exercise shirts and shorts with built in sensors

Description: The Core sensor contains the electronics and intelligence to collect and interpret biosignals, sending the information to a mobile device via Bluetooth. Measures muscle effort, muscle fatigue, heart rate, heart rate variability, recovery rates, and breathing patterns.

Status: Soon to be released

Funding Source/Mechanism:
2.1.4 BabyBe

Website: http://iq.intel.com/new-wearable-deepens-connection-mothers-premature-babies/

Technology Name: BabyBe

Description: BabyBe is a bionic mattress that brings haptic information from the mother to the baby. The sensor system pulls real-time information from a mother’s chest – breathing and heartbeat – and sends it wirelessly to the baby. The information can be recorded and retransmitted to the baby through a pneumatic pump embedded in the baby’s mattress, even when the parent is not there.

Status: Evolving

Funding Source/Mechanism:

2.1.5 BabyGuard

Website: http://thecreatorsproject.vice.com/blog/now-you-can-monitor-your-infants-vitals-with-wearable-technology

Technology name: BabyGuard

Description: BabyGuard gives parents real-time data on their infants through sensor units embedded in clothing. Using a core sensor to measure electrophysiological signals, and Intel Edison technology, BabyGuard puts vital data monitoring into parents' hands. Team BabyGuard will use Intel Edison technology in their prototype to transmit and process data such as EEG, FECG and EMG signals.

Status: Evolving

Funding Source/Mechanism: $50,000 from Make it Wearable campaign.

2.1.6 Backtrack

Website: https://www.kickstarter.com/projects/1606164085/backtrack-quantify-recovery?ref=kicktraq

Technology Name: Backtrack

Description: The device is worn alongside of your spine; it bends as you bend. The sensors track data points like pressure, angle of movement, etc. Technically, it uses inertial measurement unit sensors combined together to sense relative position and shape. The data is then sent to your phone over Bluetooth.

Status: Evolving

Funding Source/Mechanism: Crowdfunding
## 2.1.7 Bar-Ilan University


**Technology Name:** Glucose tester wristband

**Description:** This wearable biometric system utilizes lasers and a magnet to directly monitor glucose levels in the blood stream. Researchers developed a method of measuring glucose density with a wrist-worn device. The armband can analyze the “the speckle effect” produced as the glucose molecules pass by the magnet. The speckle refers to resulting noise on the image taken by the laser. The more noise, the higher the glucose density will be. The device will also determine relative dehydration of subjects, utilizing the laser to measure muscle weakness.

**Status:** Evolving

**Funding Source/Mechanism:**

## 2.1.8 Bebop Sensors, Inc.: Wearable Smart Fabric Sensor

Website: [http://www.bebopsensors.com/](http://www.bebopsensors.com/)

**Technology name:** Wearable Smart Fabric Sensor

**Description:** BeBop’s Monolithic Fabric Sensors integrate sensors, traces, and electronics into a single piece of fabric to provide greater sensitivity, resolution, range of deployment, and robustness -- all with a tiny size and able to integrate into new wearable products.

**Status:** Available

**Funding Source/Mechanism:**

## 2.1.9 BioSensive Technologies: Ear-o-Smart


**Technology Name:** Ear-o-Smart

**Description:** The earring uses Bluetooth 4.0 wireless technology to connect to a smartphone and monitors the user’s heart rate, activity level, and calorie burn. The Ear-o-Smart uses photoplethysmogram technology to measure blood flow through the skin. The ear-lobe sensors provide better contact with the skin than wrist-based monitors.
Status: Evolving
Funding Source/Mechanism: Crowdfunding

2.1.10 BITalino

Website: http://www.bitalino.com/

Technology Name: BITalino

Description: BITalino is a low-cost, purpose-built, all-in-one hardware and software toolkit designed for quick and easy creation of projects with body signals, development of quantified self-wearable devices or apps, and/or learning how to build medical devices. BITalino provides versatile, Arduino-compatible software and hardware blocks with sensors for Electrocardiography (ECG), Electromyography (EMG), Electrodermal Activity (EDA), Accelerometry (ACC), and Ambient Light (LUX), including Bluetooth low-energy wireless communication to a software toolkit to see the signals in real time or replay offline.

Status: Original version: available
Funding Source/Mechanism: Crowdfunding to reduce cost

2.1.11 BSXinsight

Website: http://www.bicycle.net/2014/product-review-bsxinsight-wearable-lactate-threshold-sensor

Technology Name: Wearable Lactate Threshold Sensor

Description: BSXinsight is a small wearable device able to analyze changes in an exercising muscle to immediately identify lactate threshold. It attaches around the user’s calf in a compression sleeve that comfortably slides on. The BSXinsight test was 99.9% accurate to the blood prick test that was done at the same time.

Status: Available
Funding Source/Mechanism: Crowdfunding

2.1.12 Catapult Sports

Website: http://www.catapultsports.com/united-states/

Technology name: Sporting wearables
Description: Catapult Sports’ sporting wearables fit under players’ sports gears, measure more than 100 points of data (i.e., heart rate, distance, velocity, acceleration and deceleration, speed, and shock), and link players to their coaches with technical and analytical performance data on athlete risk, readiness, and return to play.

Status: Some are available and some are soon to be released.

Funding Source/Mechanism:

### 2.1.13 CharmCare: H2

Website: [https://www.indiegogo.com/projects/h2-the-first-wearable-blood-pressure-monitor](https://www.indiegogo.com/projects/h2-the-first-wearable-blood-pressure-monitor)

Technology Name: H2 Wearable Blood Pressure Monitor

Description: The H2, proclaimed the world’s “smallest and lightest wearable blood pressure monitor,” tracks blood pressure in just 20 seconds and, compared to similar devices, does not require a smart phone or computer in order to operate.

Status: Evolving

Funding Source/Mechanism: Crowdfunding

### 2.1.14 Chinese PLA, General Hospital


Technology name: Wearable healthcare monitoring systems (WHMS) with GALL and Kalman filters

Description: Researchers are investigating the use of an adaptive filter to reduce motion artefact (MA) in physiological signals acquired by WHMSs. A WHMS is used to acquire ECG, respiration and triaxial accelerometer (ACC) signals during incremental treadmill and cycle ergometry exercises. The results show that for the respiratory signals, MA component can be reduced and signal quality can be improved effectively. Combination of the GALL and Kalman filters can achieve robust MA cancellation without supervised selection of the reference axis from the ACC. For ECG, the MA component can also be reduced by adaptive filtering. The signal quality, however, could not be improved substantially just by the adaptive filter with the ACC outputs as the reference signals.

Status: Evolving

Funding Source/Mechanism:

### 2.1.15 Code4Armour

Website: [https://www.code4armour.com/](https://www.code4armour.com/)

Technology name: Alert wristband
Description: Code4Armour is a shock-resistant, water-resistant, battery-free wearable device and mobile app that gives First Responders instant access to critical personal health information via a patent-pending VitalSpeak™ text-to-speech engine.

Status: Soon to be released

Funding Source/Mechanism: Crowdfunding

### 2.1.16 Electrozyme


Technology Name: Electrozyme

Description: Electrozyme is a biosensor strip that analyzes the chemical composition of the wearer’s sweat and delivers real-time feedback and tailored advice to avoid injury and optimize performance.

Status: Soon to be released

Funding Source/Mechanism:

### 2.1.17 embr Labs: Wristify

Website: [http://www.embrlabs.com/](http://www.embrlabs.com/)

Technology name: Wristify

Description: This thermoelectric bracelet regulates the user’s temperature by subjecting their skin to alternating pulses of hot or cold and is capable of changing that surface at a rate of 0.4 degrees Celsius per second.

Status: Evolving

Funding Source/Mechanism: The prototype recently won first place at this year’s MADMEC, an annual competition put on by the MIT’s Materials Science and Engineering program, netting the group a $10,000 prize, which will be used to continue development.

### 2.1.18 Empatica: Ebrace

Technology Name: Embrace wristbands

Description: These medical-quality wearables help measure stress, epileptic seizures, activity and sleep. The wristbands’ medical-grade internals include a sensor that measures electrodermal activity, which can help monitor stress and predict seizures. Embrace detects moisture — or sweat — on the skin to measure small changes in the “fight-or-flight response.”

Status: Evolving

Funding Source/Mechanism: Crowdfunding and private donors

2.1.19 Evoke Neuroscience

Website: http://www.evokeneuroscience.com/index.html

Technology name: Brain activity and heart rate variability (HRV) sensors

Description: The sensors gather data via high-end headphones and an arm band and pair with the Evoke app via Bluetooth to provide information about the user’s biometric activity.

Status: Soon to be available

Funding Source/Mechanism:

2.1.20 FitLinxx: AmpStrip

Website: http://www.wearabletechworld.com/topics/wearable-tech/articles/394220-fitlinxx-announces-ampstrip-wearable-heart-activity-monitor.htm

Technology Name: AmpStrip wearable heart and activity monitor

Description: The AmpStrip is a discrete sensor-filled device that attaches to a user’s torso and continuously tracks data such as heart rate, activity, respiration, body temperature and posture. The device tracks the user’s sleep-recovery cycle by monitoring data during rest, recovery and sleep in addition to workouts. The device is waterproof, comfortable, and hypoallergenic, with medical-grade adhesive rated to maintain attachment for 3-7 days and battery life of approximately 7 days of constant wear.

Status: Soon to be released
Funding Source/Mechanism:

### 2.1.21 Force Impact Technologies: FITGuard

Website: [http://inbusinessmag.com/technology-innovation/wearable-tech-small-big-data#.VIofQE0cSM8](http://inbusinessmag.com/technology-innovation/wearable-tech-small-big-data#.VIofQE0cSM8)

**Technology Name:** FITGuard mouthpiece

**Description:** FITGuard, the “brain’s check-engine light,” combines an accelerometer that measures how fast something starts and stops and a gyroscope that measures how fast it spins. The sensors can monitor the center of gravity of the brain and detect potential head injuries. The information is stored on the device and transferred via Bluetooth to a smartphone. LEDs visually display the force from the impact.

**Status:** Evolving

Funding Source/Mechanism: Crowdfunding

![FITGuard](http://inbusinessmag.com/wp-content/uploads/2014/10/FITGuard.jpg)

### 2.1.22 FuelWear: Flame Base Layer

Website: [http://www.fuelyouradventure.com/](http://www.fuelyouradventure.com/)

**Technology Name:** Flame Base Layer

**Description:** This wearable device warms itself to keep the wearer’s body temperature at the desired temperature. The clothing can be worn for 3-12 hours, depending on the amount of heat it must generate. An embedded sensor in the wearable technology registers the body’s heat in order to continually adjust.

**Status:** Soon to be released

Funding Source/Mechanism: Crowdfunding

### 2.1.23 HealthWatch: hWear™


**Technology Name:** hWear™ smart textile garment

**Description:** HealthWatch's hWear™ is a digital, heart-sensing garment with interwoven textile electrodes for detecting ECG signals at rest and in motion, without use of electrodes, gels, or shaving preparations. The garments are machine washable and integrate directly with most existing cardiac telemetry systems, with signal quality shown to be comparable to traditional methods.

**Status:** Evolving

Funding Source/Mechanism:
2.1.24 Hexoskin: Smart Tee

Website: http://www.hexoskin.com/

Technology name: Biometric Smart Tee

Description: The shirt is equipped with sensors capable of tracking over 3,000 data points every minute. The technology monitors heart rate, breathing rate, activity, and sleep.

Status: Available in US

Funding Source/Mechanism:

2.1.25 Imperial College of London: AcuPebble

Website: http://www.acupebble.com/

Technology name: AcuPebble

Description: AcuPebble is approximately the size of a coin and sticks onto a person’s neck or chest to wirelessly detect sounds emanating from the heart and respiratory system. AcuPebble monitors multiple breathing and cardiac parameters to determine those that may indicate deteriorating health or illness in patients, which could provide beneficial use to the diagnosis of respiratory and cardiac conditions, including sleep apnea, whooping cough, pneumonia, chronic obstructive pulmonary disease, and congestive heart failure.

Status: Evolving

Funding Source/Mechanism: AcuPebble is a finalist in the $US 2.25 million Nokia Sensing XCHALLENGE. Teams are competing for a $525,000 Grand Prize and up to five Distinguished Awards, each valued at $120,000. The lab leading the research receives funding from the European Research Council under the European Community's 7th Framework Program.

2.1.26 Institute of Biomedical Engineering

Website: http://www.ibme.ox.ac.uk/research/biomedical-signal-processing-instrumentation/prof-m-de-vos/truly-wearable-brain-monitoring

Technology name: Wearable brain monitoring - mobile electroencephalogram (EEG)

Description: This prototype of a near-invisible high-quality brain monitoring device was developed in collaboration with CRITIAS (ETS, Montreal) and Sonomax. The around-the-ear device allows for continuous and reliable monitoring of brain activity and has the additional possibility to record vital signs in a convenient way.
Status: Evolving

Funding Source/Mechanism:

2.1.27 Intel and Anouk Wipprecht: Synapse


Technology name: Synapse dress

Description: Anouk Wipprecht created the “Synapse” smart dress based on biosensors that communicate changes in mood and enable better understanding of fluctuations in attention and stress levels. The dress is powered by Intel’s newly launched “Intel Edison” microcontroller and designed in collaboration with Niccolo Casas. The dress was 3D printed by i.materialise’s parent company Materialise, in the fully-flexible TPU 92A-1. Sensors in the headpiece track the wearer’s attention level and fluctuations; sensors embedded in the dress monitors proximity; and a camera on the front captures a picture whenever the wearer feels either most tense or most relaxed.

Status: Evolving

Funding Source/Mechanism: Intel

2.1.28 Khalifa University of Science, Technology, & Research

Website: [http://dx.doi.org/10.1039/C4TA05810K](http://dx.doi.org/10.1039/C4TA05810K)

Technology Name: Wearable Pressure Sensor made of carbon cottons (CC) with moderate electrical conductive

Description: In this wearable pressure sensor, CCs with moderate electrical conductive were combined with flexible and electrical conductive CC/polydimethylsiloxane composites, allowing for a simple yet highly sensitive pressure sensor. By integrating the pressure sensor with a sport shoe and waist belt, researchers demonstrated that the real-time monitoring of sport performance and health condition.

Status: Evolving

Funding Source/Mechanism:

2.1.29 LifeBeam

Website: [https://gigaom.com/2014/11/04/is-this-hat-the-future-of-the-wearables-market-i-hope-so/](https://gigaom.com/2014/11/04/is-this-hat-the-future-of-the-wearables-market-i-hope-so/)

Technology Name: LifeBeam hat and helmet
Description: This Bluetooth®- and ANT+™-equipped hat uses electro-optical sensors to monitor heart rate, cadence, and calories.

Status: Available

Funding Source/Mechanism: Venture funding - Raised $2.6 million in a seed round two years

2.1.30 MC10: Biostamp

Website: http://www.mc10inc.com/

Technology name: Biostamp flexiblesensor

Description: Biostamp adheres to the skin similar to a BAND-AID® or temporary tattoo with sensors that monitor temperature, movement, heart rate and more, and transmit this data wirelessly back to patients and their clinicians. The device has the potential to be used to track various conditions like heart failure, Parkinson’s, and seizures as well as infant health.

Status: Evolving

Funding Source/Mechanism:

2.1.31 Medtronic: Seeq

Website: http://www.medtronicdiagnostics.com/us/cardiac-monitors/seeq-mct-system/index.htm

Technology name: Seeq Mobile Cardiac Telemetry

Description: The Seeq is an adhesive, water-resistant, wireless wearable cardiac sensor that can be worn up to 30 days for continuous cardiac monitoring. The system records and stores every heartbeat and can transmit cardiac event data via Bluetooth and cellular connections to the Medtronic Monitoring Center.

Status: Available

Funding Source/Mechanism:

2.1.32 Moodmetric

Website: http://www.ibtimes.co.uk/moodmetric-smart-ring-unveiled-worlds-smallest-bio-sensor-wearable-1475809

Technology Name: Moodmetric Smart Ring - a small, wearable biometric sensor
Description: The Moodmetric ring uses bio-sensor technology to measure the "emotional voltage" of the wearer. Skin conductance sensors provide feedback through a Bluetooth connection to a smartphone app, which displays a "mood flower" that maps the various emotional states experienced throughout the day.

Status: Evolving

Funding Source/Mechanism: Crowdfunding

2.1.33 Myontec: Mbody Coach

Website: http://www.myontec.com/products/

Technology name: Mbody Coach

Description: Myontec’s "intelligent shorts" tell the wearer how hard they are working out, provide personal audio coaching designed to boost performance, and help avoid injury. The shorts use conductive textile sensors to collect the signals through the skin above muscles, called electromyography (EMG).

Status: Evolving

Funding Source/Mechanism: Crowdfunding

2.1.34 Netatmo

Website: https://www.netatmo.com/en-US/product/june

Technology name: Wrist device

Description: The wrist device records UV exposure and alerts the user if exposure is too great. The device tracks UV intensity in real-time and an app calculates the suggested maximum daily exposure.

Status: Available

Funding Source/Mechanism:

2.1.35 NewDealDesign: Project Underskin

Website: http://www.fastcodesign.com/3036175/from-the-designers-of-fitbit-a-digital-tattoo-implanted-under-your-skin#3

Technology name: Project Underskin

Description: The sub-dermal “digital tattoo” will interact and exchange information with a range of devices (doors, credit card readers, etc.).
Status: Evolving

Funding Source/Mechanism:

2.1.36 Northwestern University and University of Illinois at Urbana-Champaign


Technology name: Wearable skin monitor

Description: The small device, approximately 5 centimeters square, can be placed directly on the skin to monitor tracks skin and heart conditions. The wireless technology uses thousands of tiny liquid crystals on a flexible substrate to sense heat and turns colors to notify the wearer of a change in conditions.

Status: Evolving

Funding Source/Mechanism: The National Science Foundation supported the research.

2.1.37 Olive

Website: http://www.witholive.com/

Technology name: Olive bracelet

Description: This device is designed to help users manage stress by monitoring a user's heart rate, ambient light, and skin temperature to notifying users of rising stress. The bracelet uses either LED lights or haptic feedback to tell users that their stress is rising.

Status: Soon to be available - Design and engineering validation testing in Spring 2015 with a goal for the wearable to be available by November 2015

Funding Source/Mechanism: Crowdfunding

Photo source: https://www.indiegogo.com/projects/olive-a-wearable-to-manage-stress
2.1.38 Qardio, Inc.: QardioCore

Website: https://www.getqardio.com/

Technology Name: QardioCore wearable ECG monitor

Description: QardioCore is a wearable ECG monitor that collects and transmits biometric data to a smartphone or tablet then pushes automatically to the Qardio Cloud where it is made available to physicians and patients.

Status: Available

Funding Source/Mechanism:

2.1.39 Rijuven: Rejiva®

Website: https://rijuven.com/rejiva-science

Technology name: Rejiva®

Description: The water-resistant device analyzes vital signs and biofeedback metrics such as ECG, heart rate, heart rate variability, respiratory rate, sleep position, posture, sleep breathing index, and energy level, and analyzes the state of the Autonomic Nervous System.

Status: Soon to be released

Funding Source/Mechanism: Crowdfunding

2.1.40 Sensogram: SensoTRACK

Website: http://uk.prweb.com/releases/2014/10/prweb12215093.htm

Technology name: SensoTRACK wearable biometric earphones

Description: SensoTRACK is an ear-worn device that can monitor a range of health and fitness parameters including heart rate, respiration rate, oxygen saturation and blood pressure, as well as calories, step count, and geophysical location. SensoTRACK can run as a stand-alone device or pair with devices.

Status: Soon to be released - Plans call for limited availability by February 2015 and full-scale production in second quarter of 2015.

Funding Source/Mechanism: Crowdfunding

2.1.41 Sensoria

Website: http://www.sensoriafitness.com/

Technology name: Textile Sensors
**Description:** Sensoria integrates smart biometric monitoring capabilities with sports gear (i.e., socks, t-shirts, sports bra). Textile sensors embedded in the fabric provide information on heart rate, activity, running form, wellness, and fitness levels and allows for remote monitoring that could enable early detection to prevent, manage, and detect falls, foot injuries, or complications.

**Status:** Available - The fitness gear is available for purchase online. A software development kit is available.

**Funding Source/Mechanism:** Sensoria (previously known as Heapsylon) recently received an additional $5 million in investment from Reply SpA as it looks to expand its operations in the U.S. and Europe.

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### 2.1.42 Smartcadia: InnerYou (INYU)


**Technology Name:** Inner You (INYU)

**Description:** The hand-held device obtains a combination of physiological signals from the body like ECG, breathing, skin conductance and physical activity to infer the physical and emotional state of the user. Users’ biosignals like breathing or heart rate can also be used to controls games.

**Status:** Evolving

**Funding Source/Mechanism:**

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### 2.1.43 Spire

**Website:** [http://www.sys-con.com/node/3241433](http://www.sys-con.com/node/3241433)

**Technology Name:** Spire wearable health tracker

**Description:** Spire is a wearable that measures breathing patterns to make users aware of their focus, tension, and calm levels. The tracker can be worn on the hip or torso and is washer proof. The Spire app notifies the user of significant events and offers guided activities to shift state of mind, such as a breathing exercise or a relaxing walk. The Spire tracker can be worn on the hip or torso is washer proof, and its 7-day battery charges wirelessly on a cork charging pad.

**Status:** Available for purchase

**Funding Source/Mechanism:**

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### 2.1.44 Spree: Smartcap

**Website:** [http://spreewearables.com/](http://spreewearables.com/)

2.16
**Technology name:** Smartcap

**Description:** Smartcap uses Spree’s patented biosensor technology in a comfortable wearable cap that measures heart rate, temperature, movement and calories burned. Users pair the monitor with a Bluetooth Smart-enabled device running iOS Version 7 or Android Version 4.4 or higher. The technology is also available in a headband.

**Status:** Available

**Funding Source/Mechanism:**

### 2.1.45 Thync: Vibes

**Website:** [http://www.thync.com](http://www.thync.com)

**Technology name:** Thync Vibes neurosignaling wearable device

**Description:** The device is designed to use neurosignaling to shift a person’s state of mind; electronic or ultrasonic waveforms signal neural pathways in the brain to trigger a shift in the user’s state of mind or energy level.

**Status:** Soon to be available - Thync is currently working with the FDA for approval.

**Funding Source/Mechanism:** Thync has raised a total of $13 million since inception from top-tier investors, including lead investor Khosla Ventures.

### 2.1.46 University of Buffalo, Sentient Science


**Technology Name:** Wearable technology that fuses real-time medical and physiological data with computer models

**Description:** Researchers are developing wearable technology that fuses real-time medical and physiological data with computer models. The system sends personalized alerts when the individual’s level of stress, fatigue, and resilience may put them in danger. The wireless system will feature a series of electrodes that measure heart rate, brain activity, and other vital signs. The electrodes will relay information to a small sensor attached to the skin that will deliver that information to a remote computer network.

**Status:** Evolving

**Funding Source/Mechanism:** The work is funded by a $150,000 grant from the Office of Naval Research’s Small Business Technology Transfer program.
2.1.47 University of Cincinnati


Technology name: Sweat sensor skin patch

Description: This lightweight, wearable device features a sodium sensor, voltage meter, communications antenna, microfluidics, and a controller chip to analyze sweat via smartphone. The patches use paper microfluidics, “an inexpensive technology similar to that of a home pregnancy test,” to measure biomarkers (electrolytes, metabolites, proteins, small molecules, amino acids) in sweat that signal the physical state of the body.

Status: Evolving - Industry partners are expected to start more extensive human trials with the patch before the end of the year. Pilot program testing on college athletes could begin early next year. A second-generation patch using secure Bluetooth technology is nearly complete.

Funding Source/Mechanism:

2.1.48 University of Memphis

Website: [http://dl.acm.org/citation.cfm?id=2676433](http://dl.acm.org/citation.cfm?id=2676433)

Technology Name: Kinematic-based activity recognition systems

Description: Researchers are designing wearable sensors that use kinematic-based activity recognition systems to identify sedentary and light-intensity activities.
Status: Evolving

Funding Source/Mechanism:

2.1.49 V1bes

Website: https://www.indiegogo.com/projects/v1bes-a-ring-for-self-diagnostics-against-stress

Technology Name: V1bes activity monitor ring

Description: V1bes analyzes brainwaves, heart rate and molecular stress from surrounding electromagnetic pollution to measure stress. V1bes detects subtle voltage fluctuations between the sensors skin electrode (under the ring, touching the finger) and the antenna electrode (silver tube). The V1bes app provides real-time measuring of voltage fluctuations and frequency analysis.

Status: Evolving

Funding Source/Mechanism: Crowdfunding

2.1.50 Valencell: PerformTek

Website: http://www.valencell.com/performtek%C2%AE-sensor-technology

Technology name: PerformTek sensor technology

Description: PerformTek-powered sensors are wearable biometric sensors that continuously measure heart rate and activity, body temperature, respiratory rate, and blood pressure and are available in multiple sizes and form factors and comfortably fit into products of all types such as earbuds, sport watches, and armbands. PerformTek sensor technology can be seamlessly integrated into communication devices for first responders.

Status: Available

Funding Source/Mechanism: Since being founded in 2006, Valencell has raised more than $13 million in venture funding from WSJ Joshua Fund, Best Buy Capital, TDF Ventures and True Ventures. The company has also secured more than $3 million in grants.

2.1.51 Welch Allyn and Gentag

Website: http://gentag.com/nfc-skin-patches/

Technology name: Smart skin patches

Description: Ultra-lightweight, flexible and biosensor disposable skin patches, no thicker than ordinary adhesive bandages, are combined with Gentag near-field communication biosensors to simplify
diagnostics, fitness, diabetes monitoring, and drug delivery. These can be entirely battery-free, powered only by near-field communication and can provide precise geolocation even indoors.

**Status:**

**Funding Source/Mechanism:**

### 2.1.52 Zoll: Life Vest

**Website:** [http://lifevest.zoll.com/](http://lifevest.zoll.com/)

**Technology Name:** Zoll Life Vest

**Description:** The LifeVest wearable defibrillator is worn by patients at risk for sudden cardiac arrest, providing protection during their changing condition and while permanent sudden cardiac arrest risk has not been established.

**Status:** Available

**Funding Source/Mechanism:**

### 2.2 Chemical/Particle

#### 2.2.1 Borre Akkersdijk and Martijn ten Bhomer (individuals): BB.Suit 2.0


**Technology name:** BB.Suit 2.0

**Description:** BB.Suit 2.0 uses textiles with an “integrated air quality sensor” to analyze and map air pollution, including measuring the concentration of carbon monoxide, methane and liquid petroleum gas. The BB.Suit uses cold plasma technology to create a “bubble of clean air” around the wearer.

**Status:** Evolving

**Funding Source/Mechanism:**

#### 2.2.2 Chemisense

**Website:** [http://chemisense.co/](http://chemisense.co/)

**Technology Name:** Chemical sensor
Description: A chemical sensor that can detect chemicals present in the air around the user in real time. Chemisense initially plans to release the sensor embedded in a wristband.

Status: Evolving – aiming to have a working prototype within the next six months.

Funding Source/Mechanism:

### 2.2.3 Frog Shanghai: AirWaves

Website: [http://www.frogdesign.com/work/frog-wearables.html](http://www.frogdesign.com/work/frog-wearables.html)

Technology name: AirWaves pollution mask

Description: A pollution mask that filters air pollution and monitors the air quality, sharing the collected data with other mask users via a smartphone app.

Status: Evolving

Funding Source/Mechanism:

### 2.2.4 HabitatMaps: AirBeam

Website: [http://www.takingspace.org/](http://www.takingspace.org/)

Technology Name: AirBeam wearable air monitor

Description: The palm-sized monitor measures particulate pollution, temperature, and humidity. The AirBeam uses a light-scattering method to measure PM2.5. Air is drawn through a sensing chamber where light from an LED bulb scatters off particles in the airstream. This light scatter is registered by a detector and converted into a measurement that estimates the number of particles in the air and communicates these measurements via Bluetooth to the AirCasting Android app.

Status: Evolving

Funding Source/Mechanism: Crowdfunding

### 2.2.5 Morphix Technologies: Chameleon

Website: [http://www.morphtec.com/products/chameleon/overview/](http://www.morphtec.com/products/chameleon/overview/)

Technology name: Chameleon

Description: The wearable device allows hands-free detection of up to 10 different chemical hazards at one time. The product is approved by the US SAFETY Act of the DHS as an anti-terrorism technology.
This low-cost, reusable armband can hold up to 10 cassettes, each of which detect a particular toxic chemical and changes color upon detection. The product is anticipated to help military and first responders at the scenes of terrorist events and natural disasters to quickly and reliably detect any invisible toxic chemicals that may be present in the air.

**Status:** Available

**Funding Source/Mechanism:**

### 2.2.6 Nanozen

**Website:** [http://nanozen.ca/](http://nanozen.ca/)

**Technology name:** Wearable particle sensor

**Description:** The wearable particle sensor was designed for use in mines, mills, and other industrial locations where dust and other particles can lead to respiratory diseases. The monitor can detect particles as small as one micron and attach to protective equipment such as a helmet.

**Status:** Soon to be released - Currently field testing with hopes to launch the product in 2015.

**Funding Source/Mechanism:** The startup has been financed through government grants and private angel funding.

### 2.2.7 NTT Docomo: Docotch

**Website:** [https://www.nttdocomo.co.jp/english/](https://www.nttdocomo.co.jp/english/)

**Technology Name:** Docotch

**Description:** A safety-conscious children's smartwatch designed by Japanese mobile phone operator NTT Docomo, the Docotch has the ability to measure air quality in the home. The device is equipped with humidity and temperature sensors, which may aid in preventing heat-related ailments such as heatstroke. Key features also include air monitoring, GPS tracking, 3G communications, and a panic button that sends an alert with a location tag by email to up to six stored numbers.

**Status:** Soon to be released - due to be released in May 2015

**Funding Source/Mechanism:**

### 2.2.8 TZOA: Enviro Tracker


**Technology Name:** TZOA Enviro-Tracker
**Description:** TZOA measures harmful air pollution metrics and builds street-level maps of community air quality. TZOA uses an optical air quality sensor to detect UV rays and particle matter in the air. The sensor counts individual particles, displays concentrations, and distinguishes between PM10, which tends to be allergens, and PM2.5, which is more harmful to human health. TZOA’s data will stream onto the TZOA Smartphone App and then further processed in the cloud.

**Status:** Evolving

**Funding Source/Mechanism:** Crowdfunding

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**2.2.9 UC Berkeley: Clarity**

**Website:** [http://clairity.io/](http://clairity.io/)

**Technology Name:** Clarity wearable air quality monitor

**Description:** Clarity is a small wearable device that measures air pollutants including particulate matter 2.5, volatile organic compounds, nitrogen dioxide, and ammonia. The device also measures temperature and humidity. Clarity uses sensors that operate as pollution detectors. Users receive real-time alerts of pollution levels and notifications of the optimal times to be outdoors or engage in strenuous physical activities.

**Status:** Evolving

**Funding Source/Mechanism:**

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**2.2.10 WindSix**


**Technology Name:** Intelligent Wearable Air Purifier

**Description:** Wind Six developed a wearable air purifier that uses a powerful, high-precision filter that purifies the air around it by up to 99.9%, even in strong winds. It looks similar to a headset and uses non-ozone electrostatic dust removal technology. The battery runs for around 6 to 8 hours on a single charge.

**Status:** Evolving

**Funding Source/Mechanism:**
2.3 Other

2.3.1 Bionym: Nymi

Website: http://www.getnymi.com/

Technology name: Nymi

Description: The wristband uses an electrocardiogram (ECG) sensor to recognize a user’s heart rhythm and automatically unlock a device. Nymi’s ECG sensor measures the electrical activity the heart generates, which is “as unique as a finger print.”

Status: Soon to be released

Funding Source/Mechanism: The company announced a $14 million Series A led by Ignition Partners and Relay Ventures.

2.3.2 Captiks: Movit

Website: http://www.captiks.com/en/

Technology name: Movit – miniature unit for motion capture

Description: The Italian start-up Captiks develops wearable, wireless devices that measure body motions for kinematic and functional analysis. Its modular devices are equipped with several sensors, such as accelerometer, gyroscope, magnetometer, and barometer.

Status: Evolving

Funding Source/Mechanism:

2.3.3 Sail Research: Pathfinder

Website: http://www.sailresearch.com/pathfinder.html

Technology name: Pathfinder

Description: A small, light wristband translates sight into touch, allowing blind and visually impaired users to rapidly scan and identify any environment. Gentle taps encode highly accurate environmental detail, indicating any object up to 10 feet away. Pathfinder offers long ranges (up to 10 feet), contact-free sensing, and full control of both hands.

Status: Evolving

Funding Source/Mechanism: Crowdfunding
2.3.4 Samsung: Simband

Website: http://blog.phonebloks.com/post/102863040618/samsung-simband-a-modular-wearable-platform-for

Technology Name: Simband modular smartband

Description: Simband is an open developer platform comprising a smartwatch unit and a wristband connector that holds custom sensor modules. Developers can modify, build, and integrate their own custom modular health sensors. The smartband is based on the Samsung Architecture Multimodal Interactions (Sami) health platform, an open cloud network that shares data from wearable devices or online sources to other gadgets or applications in real time. Simband is not currently a consumer product; it is a reference design for developers to use to start creating their own modules and apps.

Status: Available

Funding Source/Mechanism:
3.0 Displays

3.1 Heads-Up

3.1.1 Ashkelon Enterprises

Website: http://www.ashkelon-visor.com/

Technology Name: Ashkelon Visor

Description: The Ashkelon Visor prototype features a front compartment for a smartphone and a Focusing Relay unit. Touching the Smartphone and other movements control the menu selection process. The functions appear in the Focusing Relay via smartphone.

Status: Evolving

Funding Source/Mechanism: Crowdfunding

3.1.2 Atheer Labs

Website: https://www.atheerlabs.com/

Technology Name: Augmented reality glasses

Description: Atheer’s glasses overlay information over the real world and allow the user to manipulate digital fields or content with hand gestures. A sensor built into the pair of glasses picks up the shape of the user’s hands, swiping, or clicking on an augmented reality button.

Status: Soon to be released - Atheer has a development kit shipping to early partners, with a broader release planned for next year.

Funding Source/Mechanism: Crowdfunding

3.1.3 DAQRI

Website: http://www.coolwearable.com/daqri-smart-helmet/

Technology Name: DAQRI Smart Helmet

Description: The smart helmet is fitted with augmented reality. It utilizes a 4D interface to allow users to see content and touch/control using third-party devices like a smartwatch. The device features an industrial-grade inertial measurement unit, a high resolution 3D depth camera, and 360° navigation

Photo source: http://www.ashkelon.me/
Photo source: http://hardware.daqri.com/smarthelmet/
cameras. It supports HD video recording, mapping, and more. The device uses a technology called Intellitrack capable of recognizing specific objects and environments and even reconstructing a facility or building based on plans.

**Status:** Soon to be released

**Funding Source/Mechanism:**

### 3.1.4 Elbit Systems: Skylens™


**Technology name:** Skylens Wearable heads-up display

**Description:** The Skylens wearable heads-up display was designed for commercial pilots to provide a better view through augmented vision that can help them navigate through fog and darkness. Skylens is a lightweight wearable device with a visor large enough to fit easily over the pilot’s glasses and display high-resolution data, symbols, and video. It reduces dependency on airport equipment, enhances day and night operation in all weather conditions and provides exceptional situational awareness.

**Status:** Evolving

**Funding Source/Mechanism:**

### 3.1.5 Fusar Technologies: Guardian


**Technology Name:** Guardian GA-1 augmented reality motorcycle helmet

**Description:** The Guardian is a U.S. Department of Transportation approved device with an Android board, two wide-angle cameras, and parts of the Epson Moverio Glasses. Bikers receive speed, fuel and navigation data as well as information about their surroundings, side and rear included. The prototypes may also include additional alerts and voice control.

**Status:** Evolving

**Funding Source/Mechanism:** Crowdfunding

### 3.1.6 Google


**Technology name:** Google Glass with customized software
Description: Software developed by Dubai police for use with Google Glass will allow for facial recognition. The software will establish a connection between devices disseminated amongst its detectives and a database of wanted people. Google Glass will be able to match suspects to any existing profiles based on their face print.

Status: Soon to be released. The device, which is expected to cost £1000 when it goes on wide release next year.

Funding Source/Mechanism:

### 3.1.7 I2i: iPal

Website: [http://meetipal.com](http://meetipal.com)

Technology name: iPAL glasses

Description: iPal glasses have four cameras embedded in the frame. Two eye-tracking cameras see what the user sees, and two HD cameras view the scene in front of the eyes and can also zoom. iPal uses eye gestures as a control mechanism, allowing a hands-free, attention-free experience. iPal works with Android, iOS or Windows smartphones with apps that can deliver telepresence, driver assistance, and image recognition and retail searches.

Status: Evolving

Funding Source/Mechanism: Crowdfunding

### 3.1.8 Magic Leap: Dynamic Digitized Lightfield Signal™

Website: [http://www.magicleap.com/#/home](http://www.magicleap.com/#/home)

Technology name: Dynamic Digitized Lightfield Signal™

Description: Magic Leap’s augmented-reality technology is alleged to generate images indistinguishable from real objects and place those images seamlessly into the real world, essentially creating realistic 3D light sculptures before the user's eyes. Patent and trademark filings describe sophisticated display technology that can trick the human visual system better than existing virtual reality displays into perceiving virtual objects as real.

Status: Evolving – patents filed

Funding Source/Mechanism: Magic Leap received $542 million Series B financing from Google Inc., with participation from Qualcomm Incorporated, through its venture investment group, Qualcomm Ventures, Legendary Entertainment, including a personal investment from CEO Thomas Tull, KKR, Vulcan Capital, Kleiner Perkins Caufield & Byers, Andreessen Horowitz, Obvious Ventures, and other
investors. Magic Leap also raised more than $50 million in its series seed and A rounds to develop its proprietary technology platform.

### 3.1.9 Mitumi

**Website:** [http://www.ubergizmo.com/2014/10/mitumi-delivers-focus-free-wearable-display/](http://www.ubergizmo.com/2014/10/mitumi-delivers-focus-free-wearable-display/)

**Technology name:** Laser eyewear

**Description:** This prototype laser eyewear with a focus-free display is a retina-scanning display that relies on RGB laser and MEMS mirror. These transparent wearable glasses deliver a wide viewing angle, a high level of brightness, and decent color reproducibility.

**Status:** Evolving

**Funding Source/Mechanism:**

### 3.1.10 NUVIZ


**Technology Name:** NUVIZ

**Description:** NUVIZ is a heads-up display system for motorcycle helmets that attaches to the chin bar of the user’s helmet and uses Liquid Crystal on Silicone Microdisplay to offer a clear experience. NUVIZ provides navigation, weather, telemetry, and other useful information and allows the user to capture photos, stay connected, and listen to music.

**Status:** Evolving

**Funding Source/Mechanism:** Crowdfunding

### 3.1.11 Optinvent: Ora

**Website:** [http://optinvent.com/](http://optinvent.com/)

**Technology name:** Ora

**Description:** Ora X features a front-facing 1080p 5MP camera, a 9-axis motion sensor, wireless connectivity with Bluetooth, Wi-Fi and GPS as well as a trackpad for tactile interactions. Compared to Google Glass, Ora provides a Flip-Vu mode that allows the image to be either directly in the wearer's field of view or just below.


**Photo source:** [https://www.kickstarter.com/projects/nuviz/the-first-head-up-display-for-motorcycle-helmets/?ref=kicktraq](https://www.kickstarter.com/projects/nuviz/the-first-head-up-display-for-motorcycle-helmets/?ref=kicktraq)

Status: Soon to be released. Preorders are being taken. It is not an FCC, UL, CSA, or CE approved product for general consumers.

Funding Source/Mechanism: Crowdfunding

### 3.1.12 Recon Instruments: Snow2


Technology name: Snow2 heads-up display

Description: Goggles that display detailed information including speed, jump analytics, altitude, map, compass, messaging capabilities and markers showing the location of others on the slopes. The Snow 2 holds a dual-core CPU, GPS, and on-board gyroscope, accelerometer, magnetometer, altimeter, and thermometer.

Status: Available

Funding Source/Mechanism:

### 3.1.13 SAP and Vuzix


Technology name: Video eyewear

Description: The smart glasses combine SAP’s augmented reality (AR) apps with Vuzix’s M100 glasses. The new AR applications, SAP® AR Warehouse Picker and the SAP® AR Service Technician, simplify and improve the user experience and work processes by offering a hands-free working experience. The wearer interacts with the device using voice commands. In a warehouse for example, the device frees warehouse workers from handheld scanners and other devices.

Status:

Funding Source/Mechanism:

### 3.1.14 Skully

Website: [http://store.skullysystems.com/](http://store.skullysystems.com/)


Technology Name: Augmented reality motorcycle helmet
Displays

Description: The Skully AR-1 helmet is a light, high-quality, and full-faced motorcycle helmet equipped with a wide-angle rearview camera and transparent heads-up display. The helmet provides riders with navigation, blind spot information, 180-degree rear-view camera.

Status: Soon to be released

Funding Source/Mechanism: Crowdfunding

3.1.15 Sony: SmartEyeglass

Website: https://developer.sony.com/devices/mobile-accessories/smarteyeglass/

Technology name: SmartEyeglass

Description: SmartEyeglass is equipped with a range of different sensors, electronic compass, gyroscope, accelerometer, ambient light censor, and 3-megapixel camera. It is wired to an external battery pack equipped with a microphone and added touch sensor.

Status: Soon to be released - Sony released the software development kit for this wearable technology and stated that by the end of March 2015 the hardware kits will also be ready for developers to purchase.

Funding Source/Mechanism:

3.1.16 TrackingPoint: ShotGlass™

Website: http://tracking-point.com/how-it-works/shotglass

Technology name: ShotGlass

Description: TrackingPoint’s ShotGlass™ app on the Recon Jet™ smartglass allows the wearer to see and record what their compatible Tracking Point scope sees. ShotGlass features a high-definition video display, an HD camera that can record audio and video, and optical controls that allow the user to control the glasses even when wearing thick gloves. ShotGlass only works with TrackingPoint’s Precision Guided Firearms, which can tag, track and automatically fire at targets more than 1,000 yards away.

Status: Soon to be released

Funding Source/Mechanism:

3.1.17 University of Fukui

Website: http://spie.org/x110607.xml

Technology name: Laser beam combiner
Displays

Description: This technology could offer immediate, hands-free access to information via gadgets such as smart glasses, which overlay computer-generated visual data on the user’s field of vision. The small laser beam combiner enables laser-scanning displays in wearable computer systems. The beam combiner comprises three optical waveguides for RGB light inputs, as well as three directional couplers. The couplers can switch and exchange the light beams from one to the other.

Status: Evolving

Funding Source/Mechanism:

3.2 Body-worn

3.2.1 Arubixs: Portal

Website: http://www.arubixs.com/

Technology name: Portal, flexible screen phablet

Description: Portal is a flexible screen phablet that slides into a dual-strap arm cradle that extends about halfway up the forearm from the wrist. The device’s 6-inch TFT display is scratch-resistant and reinforced by a flexible Kevlar exterior. It has 2GB RAM, a total of four cameras, 64GB of storage, a full suite of sensors, NFC, Bluetooth, LTE, wireless charging and a proprietary 3,200mAh flexible battery. Portal will run a skinned version of Android and respond to touch, gesture, and motion-based commands.

Status: Evolving

Funding Source/Mechanism: Crowdfunding

3.2.2 Cicret


Technology Name: Cicret bracelet and on-skin display

Description: The Cicret (pronounced secret) app connects to a bracelet, a wearable technology, that projects your smartphone on your forearm. You can control and move through the app by touching your skin as you would the screen of the device.

Status: Evolving.

Funding Source/Mechanism: Crowdfunding
3.2.3 Kyocera: Proteus

Website: http://www.igyaan.in/88518/kyocera-proteus/

Technology Name: Proteus collapsible, wearable smartphone

Description: This flexible device collapses to become a wearable. The device can transform from a flat, bar-shaped phone into a bracelet that can be draped or wrapped around. The Proteus is expected to have AMOLED display.

Status: Evolving

Funding Source/Mechanism:

3.2.4 Proglove

Website: http://www.proglove.de/

Technology name: Proglove

Description: This professional-grade wearable tool targeted at professional production processes features Intel-Edison sensors in the fingers, a computing core and display. ProGlove enables its wearer to work faster, more accurately and more efficiently, plus it is easy to use and unlocks a new level of control and business intelligence for production management.

Status: Evolving

Funding Source/Mechanism: $100,000 award from Intel Make it Wearable campaign.
4.0 Power

4.1 Chargers/Batteries

4.1.1 BAE Systems: Broadsword

Website: http://www.baesystems.com/product/BAES_176721/broadsword

Technology name: Broadsword

Description: Broadsword product line features interconnecting components such as inductive charging equipment pouches that provide power to equipment batteries without wiring/connections.

Status: Evolving
Funding Source/Mechanism: U.S. Army

4.1.2 Korea Advanced Institute of Science and Technology: Dipole Coil Resonant System

Website: http://www.eurekalert.org/pub_releases/2014-04/tkai-wpt041714.php
http://www.businesskorea.co.kr/article/6829/wireless-power-commercialization-wireless-power-charging-wearable-implanted-devices-be

Technology name: Wireless charging system using Dipole Coil Resonant System (DCRS)

Description: KAIST is developing a wireless power transmission technology called DCRS that reduces the required number of coils to a single transmitter and single receiver coil (only 10 percent of the size of the originals) by using dipole-structured high-frequency magnetic substances. Due to less fluctuation in the low frequency used, DCSR is 20 times sturdier against changes in the environment and much more efficient at the same time. Researchers developed a wireless charging system using the technology that can charge around 40 smart phones at a time, from a distance of 5 meters.

Status: Evolving
Funding Source/Mechanism: Ministry of Science, ICT & Future Planning

4.1.3 Nifty: XOO

Website: http://en.kioskea.net/news/25565-xoo-belt-phone-charging-wearable

Technology Name: XOO

Description: The XOO belt includes 2,100 mAh of power to allow...
users to charge up on the go. Devices can plug into the belt to charge. The belt features a Lithium Ceramic Polymer flexible battery and is weather-resistant. The charging wire is magnetically nestled against the inside of the belt when not in use.

Status: Evolving

Funding Source/Mechanism: Crowdfunding

4.1.4 Panasonic


Technology name: Pin-shaped Lithium ion battery

Description: This small cylindrical-shaped rechargeable Lithium ion battery (a diameter of 3.5mm and a weight of 0.6g) features the high reliability and high output required for near-field communications and may be a fit power source for small devices such as spectacles-shaped, pen-shaped and other slim devices.

Status: Soon to be released - February 2015

Funding Source/Mechanism:

4.1.5 Samsung

Website: http://www.digitaltrends.com/wearables/samsung-flexible-battery/

Technology name: Bendable battery and pill-sized battery

Description: Samsung’s thin, rollable, bendable battery can wrap around a person's wrist or bend into a U shape and still operate normally. Samsung also announced a tiny pill battery with the capacity up to 5 times higher than any batteries mounted to the smart bands rolled out to the markets until now.

Status: Evolving

Funding Source/Mechanism:

4.1.6 UBeam

Website: http://ubeam.com/

Technology name: Ultrasound charger

Description: This device converts electricity into sound that is transmitted via ultrasound. A receiver attached to a portable electronic device catches the sound and converts it back into electricity. Charging stations will be thin, measuring no more than 5 millimeters thick, and smartphones and laptops could be equipped with thin receivers able to convert audio and charge the devices.
Status: Soon to be release – within next two years

Funding Source/Mechanism: Closing a Series A round of financing, in addition to an earlier $1.7 million seed round from Marissa Mayer, Yahoo’s chief executive; Founders Fund; and Andreessen Horowitz.

4.2 Self-powering/Harvesting

4.2.1 A*STAR Institute of Microelectronics (IME)


Technology name: Implantable energy harvester

Description: This technology uses low-frequency vibrations to power small-scale electronic devices. MEMS microfluidics and piezoelectric micro-belts convert changes in pressure (from random real-world vibrational sources) into electricity indefinitely. The technology could efficiently harness low frequency vibrations as infinite power source for miniature electronic devices. As an inexorable power supply, the remarkable power density feature translates into massive savings.

Status: Evolving

4.2.2 AMPY

Website: [http://www.getampy.com/](http://www.getampy.com/)

Technology name: AMPY wearable kinetic device

Description: The AMPY wearable kinetic device lets users capture and convert physical activity into charging power for smartphones. The compact device straps to a user’s arm, leg, or hip, or is carried inside a personal bag or purse, where it charges when movement is detected. It features Proto Lab’s proprietary architecture for the internal conductor.

Status: Soon to be released

Funding Source/Mechanism: Crowdfunding, two accelerator programs

4.2.3 Columbia Engineering and the Georgia Institute of Technology

Website: [http://engineering.columbia.edu/researchers-develop-world%E2%80%99s-thinnest-electric-generator](http://engineering.columbia.edu/researchers-develop-world%E2%80%99s-thinnest-electric-generator)

Technology name: Piezoelectric nanogenerators
**Description:** Researchers discovered a way to create electricity using an atom-thin generator that produces electricity when bent or stretched and could potentially be sewn into clothing and even used in medical implants. Potential uses include integrated into wearable devices and clothing, converting energy from body movement to electricity, and powering wearable sensors, medical devices, or smartphones.

**Status:** Evolving

**Funding Source/Mechanism:**

### 4.2.4 Fudan University, China

**Website:** [http://www.polymer.fudan.edu.cn/polymer/research/Penghs/data/publications/101.pdf](http://www.polymer.fudan.edu.cn/polymer/research/Penghs/data/publications/101.pdf)

doi: 10.1002/aenm.201401438

**Technology Name:** Wearable supercapacitor textile

**Description:** Scientists at the Fudan University in Shanghai, China, developed a high-performance Li-ion battery made of carbon nanotube fiber yarns. The novel wearable supercapacitor textile is thin, lightweight, transparent, and flexible and developed by stacking two aligned carbon nanotube fiber-based textile electrodes. The supercapacitor textile is further integrated to create a new energy textile that can convert solar energy to electric energy, in addition to storing it with a high entire photoelectric conversion and storage efficiency.

**Status:** Evolving

**Funding Source/Mechanism:**

### 4.2.5 Georgia Institute of Technology

**Website:** [http://pubs.acs.org/doi/abs/10.1021/nl5029182](http://pubs.acs.org/doi/abs/10.1021/nl5029182)

**Technology Name:** Self-powered nanosystem

**Description:** According to this research by Pradel, Wu, Ding, and Wang (2014), self-powered nanosystems that harvest operating energy from a host (i.e., the human body) may be feasible due to their extremely low power consumption. Researchers report materials and designs for wearable-on-skin piezoelectric devices. According to this research, the p–n structure can be further grown on polymeric substrates conformable to a human wrist and used to convert movement of the flexor tendons into distinguishable electrical signals for gesture recognition. The devices may have applications in powering nanodevices, bioprobes, and self-powered human–machine interfacing.

**Status:** Evolving

**Funding Source/Mechanism:**

### 4.2.6 Korea Advanced Institute of Science and Technology
Technology name: Glass fabric-based flexible thermoelectric (TE) generator

Description: The light-weight, flexible glass fabric-based thermoelectric (TE) generator is light-weight, extremely flexible, and produces electricity from the heat of the human body. This will be useful for wearable self-powered mobile electronic systems such as medical sensors or smart watches.

Status: Evolving

Funding Source/Mechanism:

4.2.7 Pauline Van Dongen: Wearable Solar

Website: http://dutchdesigndaily.com/new/wearable-solar/?cat=4

Technology Name: Wearable solar

Description: Wearable Solar comprises two designs that produce sustainable energy through integrated solar cells. When worn in full sun for 2 hours, the garments can generate enough energy to charge a typical smartphone. The solar cell compartments can be opened and revealed to the sun when needed and folded back when they are not being used.

Status:

Funding Source/Mechanism:

4.2.8 Rajesh Adhikari (Individual)


Technology name: Power-generating footwear

Description: These functional shoes contain a small dynamo that charges up and produces 5 volts of electricity as the wearer walks or runs; this can lights up an LED bulb when the power runs out or charges a mobile phone.

Status: Evolving

Funding Source/Mechanism:
4.2.9  Sungkyunkwan University: Perovskite Solar Cells


Technology name: Perovskite Solar Cells

Description: According to this research, perovskite solar cells may provide an efficient, flexible, and lightweight energy supply system for wearable devices. The cells may provide high power conversion efficiency while using a low-temperature technology for the fabrication of a compact charge collection layer.

Status: Evolving

Funding Source/Mechanism:

4.2.10 Tommy Hilfiger


Technology Name: Solar-powered jacket

Description: The clothing charges electronic devices by converting energy from solar panels attached to the user’s backs. A subtle cord in the lining connects the removable solar panels on the jacket’s backside to a removable battery pack in the front right pocket. The solar panel unit is made from a flexible amorphous silicon technology, developed by Pvilion – a specialist in designing and manufacturing lightweight, portable solar products. When exposed to full sunlight, the cells charge up the battery pack which, in turn, can fully charge a standard 1500mAh mobile device up to four times. There are two USB ports on the pack to connect multiple devices at once.

Status: Available

Funding Source/Mechanism:

4.2.11 U.S. Marine Corps Expeditionary Energy Office (E2O): Marine Austere Patrolling System


Technology name: Marine Austere Patrolling System, or MAPS
Description: MAPS is a wearable solar-energy system can reduce up to 50% of the weight that U.S. Marines normally bears above the waist. The unit comprises a solar energy harvesting and storage system and water-purification unit. MAPS uses a photovoltaic panel and rechargeable battery that weighs less than 3 pounds. The panel works in a transparent sleeve on the vest or can be taken out for maximum exposure to the sun.

Status: Field testing. Over the next 2 years, MAPS will undergo bulletproofing and joint Army–Marine testing to prepare it for use in battle.

Funding Source/Mechanism:

### 4.3 Power Supply

#### 4.3.1 Acticheck Assure


Technology Name: Assure

Description: The device provides is a battery life of two years without recharging.

Status: Soon to be released

Funding Source/Mechanism:

#### 4.3.2 Drexel University, Dalian University of Technology: Mxenes

Website: [http://drexel.edu/now/archive/2014/November/flexible-MXenes/](http://drexel.edu/now/archive/2014/November/flexible-MXenes/)

Technology Name: Mxenes, electrically conductive, flexible nanomaterial

Description: According to this research, engineers chemically engineered a new, electrically conductive nanomaterial that is flexible enough to fold but strong enough to support many times its own weight. Researchers believe it can be used to improve electrical energy storage, water filtration, and radiofrequency shielding in technology from portable electronics to coaxial cables. This flexible new material is a conductive polymer nanocomposite that can be rolled into a tube, which early tests indicate only serves to increase its mechanical strength.

Status: Evolving

Funding Source/Mechanism:
4.3.3 Massachusetts Institute of Technology (MIT)

Website: http://hdl.handle.net/1721.1/90565

Technology name: Stretchable supercapacitors with graphene paper

Description: Stretchable supercapacitors can store energy for flexible electronic devices. Crumpled-graphene papers present a simple and low-cost method for extremely stretchable and high-performance electrodes for supercapacitors. Researchers demonstrated that by crumpling a sheet of graphene paper, they can make a supercapacitor that can easily be bent, folded, or stretched to as much as 800 of its original size. The crumpled graphene material might be used as one electrode in a flexible battery, or to make a stretchable sensor for specific chemical or biological molecules.

Status: Evolving

Funding Source/Mechanism: The work was supported by the Office of Naval Research, the National Science Foundation, and the National 1000 Talents Program of China.

4.3.4 Mixel


Technology name: Controller

Description: Mixel's high-performance, low-power Rx D-PHYSM and Northwest Logic's full-featured, small-size CSI-2 Rx Controller Core. The device minimizes power and area.

Status: Available

Funding Source/Mechanism:

4.3.5 Samsung

Website: http://www.patentlymobile.com/2014/10/samsung-invents-wearable-devices-for-energy-sharing-network.html

Technology name: Wearable energy sharing devices

Description: Samsung's invention shares energy between wearable devices. The device wirelessly transmits and receives power to enable energy sharing between the plurality of wearable devices. The wearable device may perform wireless energy transmission using a magnetic near field channel in a near field at high efficiency without being affected by a body medium.

Status: Evolving – patent application filed

Funding Source/Mechanism:
4.3.6 Taiwan Semiconductor Manufacturing Company Limited


Technology name: Ultra low-power technology platform

Description: Taiwan Semiconductor Manufacturing Company Limited’s ultra-low power processes can reduce operating voltages by 20% to 30% to lower both active power and standby power consumption and enable significant increases in battery life (by 2 to 10 times). Low-power radio frequency and embedded Flash memory capabilities enable system-level integration for smaller form factors as well as facilitating wireless connections among IoT products.

Status: Soon to be released

Funding Source/Mechanism:

4.3.7 TE Wearables Lab

Website: http://www.hmgaerospace.com/news/show/7973

Technology Name: Wireless power development kit

Description: The kit will include a small 2.5W charger with integrated magnet for attachment to a wearable device, as well as a complete RX coil and electronics for integration. TE engineers miniaturized the electronic system and the coil to make it possible for wearable designers to prototype their products quickly.

Status: Available

Funding Source/Mechanism:
5.0 Integrated Communications

5.1 Bluetooth

5.1.1 OnBeep: Onyx


**Technology Name:** Onyx wearable communicator badge

**Description:** The Onyx is a small, round clip-on wearable equipped with speakers, an LED light, and an activation button that allows users to communicate with other Onyx owners via Bluetooth. Onyx wearers can manage the groups they want to communicate with through the companion smartphone app, and the actual communication occurs through the smartphone’s data connection.


**Status:** Soon to be released.

**Funding Source/Mechanism:** Venture funding - The company raised $6.8 million across two rounds of angel and venture capital.

5.1.2 Yak Hat

Website: [https://www.indiegogo.com/projects/yak-hats-wearable-bluetooth-technology](https://www.indiegogo.com/projects/yak-hats-wearable-bluetooth-technology)

**Technology Name:** Yak Hat

**Description:** Yak Hat has controls, ear buds, and controls as well as Bluetooth 4.0 integrated into the hat to provide wireless connectivity to the user’s Smartphone. The Yak Hat's design also eliminates wind noise during phone conversations in wind speeds up to 40 mph.

**Status:** Evolving

**Funding Source/Mechanism:** Crowdfunding
5.2 Hands-free operation

5.2.1 16Lab: OZON™

Website: [http://16lab.net/](http://16lab.net/)

Technology name: OZON™ Smart ring

Description: A titanium ring with dual touch surfaces that can pair with devices via Bluetooth and can interpret gestures, provide alerts, and serve as an e-wallet. The ring features a Sensor Network Module from Alps Electric, a 6mm square chip that integrates Bluetooth 4.0, accelerometer, and compass.

Status: Soon to be released - 2015

Funding Source/Mechanism:

5.2.2 Easier to Use LLC: GoGlove


Technology Name: GoGlove wireless remote

Description: GoGlove is a wearable wireless devices that allows the user to control their smartphone via a Bluetooth module in the glove connected to sensors in the fingertips.

Status: Soon to be released

Funding Source/Mechanism: Crowdfunding
5.2.3 **Elliptic Labs**

Website: [http://www.ellipticlabs.com/](http://www.ellipticlabs.com/)

Technology name: Touchless gesturing with ultrasonic technology

Description: The device uses ultrasonic technology that recognizes gestures and allows for touchless interaction. Without touching the device, as the user’s hand moves toward their smartphone for example, the screen lights up and information is displayed. As the hand moves closer, different information is revealed.

Status: Evolving

Funding Source/Mechanism:

5.2.4 **Murata**


Technology name: Crystal unit

Description: Murata’s high-tolerance small crystal units are optimal for wearable and data communications applications. With an overall frequency precision of +/-20ppm, these miniature crystal units can support the stringent frequency tolerances required for wireless communications such as LTE/3G, Wi-Fi, Bluetooth, Bluetooth Low Energy, ZigBee and NFC. They are also suitable for wired data communications applications such as Ethernet, USB3 in addition to hard disk, and solid-state disk computing systems.

Status: Available

Funding Source/Mechanism:

5.2.5 **Mycestro**


Technology Name: Wearable wireless mouse

Description: This wearable, wireless 3D mouse worn on the finger delivers the same functionality as a traditional mouse with increased mobility. The Mycestro will work up to 30 feet from its dongle, plugged into the USB port of the device under control, and a full battery charge will last about 8 hours of normal use.

Status: Available

Funding Source/Mechanism: Crowdfunding
6.0 Exoskeletons

6.1.1 Defense Advanced Research Projects Agency (DARPA): Airlegs


Technology Name: Airlegs

Description: The power pack provides power to movement (like running) from a tank of compressed air connected by pulleys and electronic sensors to braces on the knees. The goal is to reduce the load by 25 percent, which developers said will allow the average soldier or Marine to run a mile in four minutes.

Status: Evolving

Funding Source/Mechanism: DARPA

6.1.2 Ekso

Website: http://www.eksobionics.com/

Technology name: Body suit

Description: This exoskeleton body suit powers steps when the wearer shifts his or her weight, then motors push the legs forward. The device is designed for people with traumatic injuries, including victims of strokes, spinal cord injuries or disease and brain injuries.

Status: Available - Ekso suits are available for use with certified trainers at centers around the country.

Funding Source/Mechanism:

6.1.3 Harvard Wyss Institute for Biologically Inspired Engineering: Soft Exosuit

Website: http://wyss.harvard.edu/viewpage/456

Technology name: Soft Exosuit

Description: The Soft Exosuit can be worn comfortably under clothing and could enable soldiers to walk longer distances, keep fatigue at bay, and minimize the risk of injury when carrying heavy loads. The lightweight Soft Exosuit is designed to overcome the challenges of traditional heavier exoskeleton systems, such as power-hungry battery packs and rigid components that can interfere with natural joint movement. It is made of soft, functional textiles woven together into a piece of smart clothing.

Status: Evolving
Funding Source/Mechanism: Awarded a first-phase $2.9 million follow-on contract from DARPA to further develop a biologically inspired smart suit.

### 6.1.4 Purdue University


Technology name: Robotic fabric

**Description:** Robotic fabric moves and contracts and is embedded with sensors. The cotton material contains sensors made of a flexible polymer and threadlike strands of a shape-memory alloy that return to a coiled shape when heated, causing the fabric to move. According to the researchers, such an elastic technology could make possible robots that have sensory skin, stretchable robotic garments, suits pilots or astronauts to counteract the effects of acceleration, and lightweight, versatile robots to roam during space missions.

**Status:** Evolving

**Funding Source/Mechanism:** NASA Early Career Faculty Award

### 6.1.5 StretchSense: I Measure U


Technology Name: Bionic limbs and sensors

**Description:** Researchers are exploring numerous commercial applications for bionic limbs (robotics attached to the outside of the body) including stroke rehabilitation, helping patients with compromised strength, and in manufacturing. StretchSense manufactures "rubber bands with Bluetooth" that measure body motion while attached to a limb. I Measure U is focused on the consumer market, manufacturing inertial measurement units that provide movement analysis for athletes.

**Status:** Evolving

**Funding Source/Mechanism:** Venture funding - StretchSense recently completed a $500,000 seed funding round with the newly-formed Flying Kiwi Angels investors group and the New Zealand Venture Investment Fund.

### 6.1.6 Tokyo University of Science and Innophys Co.: Muscle Suit


Technology Name: Muscle Suit wearable power-assist device
**Description:** The Muscle Suit, which weighs 5.5 kilograms (12 pounds), can be worn “knapsack-style” and uses a mouthpiece as its control. It uses specially designed rubber tubes and compressed air as the source of its power. The Muscle Suit can help users pick up everyday loads with about a third of the usual effort.

**Status:** Soon to be released

**Funding Source/Mechanism:**

7.0 Wearable Computers

7.1.1 Raytheon


Technology name: Wearable computer

Description: This device merges proven, wearable computer system with situational awareness capabilities to create an enhanced real-time view of the battlefield for commanders and their troops. Raytheon's innovative solution leverages investments already made in its deployed Air Warrior wearable computing technologies and couples that with the DCGS-A Lite capability that enables troops to receive intelligence and generate new intelligence as they perform missions in bandwidth-challenged areas.

Status: Evolving

Funding Source/Mechanism:

7.1.2 Tufts University


Technology name: Passive physiological input

Description: The proposed interface uses passive physiological input as additional communication channels between wearable devices and wearers. This research utilizes three principles (Subscription, Accumulation and Interpretation) and introduces a core framework to enable continuous streams of input data, accumulate the data in a buffer, and attempt to recognize patterns in the accumulated data upon request from the application, rather than directly in response to the input events.

Status: Evolving

Funding Source/Mechanism: National Science Foundation and Google supported this research.

7.1.3 University of Canterbury


Technology Name: Wearable computer interface design

Description: Researchers are exploring how models of human cognition can be adapted for wearable computer interface design, particularly how to use models of human attention to create wearable interfaces that do not distract the user. The team aims to use cognitive psychology techniques to model the user and the wearable computer as a single system. This model can then be used to reduce the demand on the brain’s working memory while the user performs activities such as walking while searching through icons on the display. The overall outcome will be wearable applications that can be used without distracting the user from real-world tasks.
Status: Evolving

Funding Source/Mechanism: Received $870,000 of Marsden funding over three years.
8.0 General

8.1.1 Actuate: BIRT iHub and Analytics


Technology Name: BIRT iHub 3.1 and BIRT Analytics 5.0

Description: The applications help users turn wearable-generated data into usable information. The BIRT Analytics backend allows customers to set up a system-as-a-server to analyze data and offer it up to an open API. The BIRT iHub optional frontend turns that data into information with value-added visual representations in the form of charts and spreadsheets viewable across desktop, tablet, mobile, and wearable devices.

Status: Soon to be released

Funding Source/Mechanism:

8.1.2 Allied Minds: Seamless Devices, Inc.


Technology Name: Seamless Devices analog signal processing

Description: Seamless Devices is developing applications for analog signal processing to produce high-performance signals even as transistors are scaled down in size. The company expects to be able to offer analog-to-digital converters for telecom applications, to address the demand for analog-to-digital converters that can operate at high bandwidth and high resolution with low power consumption.

Status: Evolving

Funding Source/Mechanism:

8.1.3 Alpinestar: Tech-Air


Technology Name: Tech-Air street system – garments fitted with airbags

Description: Alpinestars’ Tech-Air street system is essentially a portable lining for bike jackets. When the system detects an impact, a built-in canister and ‘bladder’ inflates to protect the rider.

Photo source: [http://www.alpinestars.com/tech-air](http://www.alpinestars.com/tech-air)
wearer’s body. Sensors inside the Airbag Control unit monitor the impact, and the whole system is powered by a lithium-ion battery.

**Status:** Soon to be released

**Funding Source/Mechanism:**

### 8.1.4 Arco: Smart Reactor

**Website:** [http://meworksco.com/arco.html](http://meworksco.com/arco.html)

**Technology name:** Smart Reactor

**Description:** The Smart Reactor uses white and RGB LEDs to handle different types of notifications. It connects to your phone using Bluetooth to receive notifications from your phone – including e-mail messages, calendar events, incoming calls, and social media updates.

**Status:** Evolving

**Funding Source/Mechanism:** Crowdfunding

### 8.1.5 ARM Holdings: MBED OS

**Website:** [https://mbed.org/](https://mbed.org/)

**Technology name:** MBED OS

**Description:** The operating system designed of IoT devices is designed to resolve productivity problems associated with running a mix of devices using different protocols. ARM aims consolidate devices into a single software layer.

**Status:** Soon to be released - 2015

**Funding Source/Mechanism:**

### 8.1.6 Betatrac: eBodyGuard


**Technology name:** eBodyGuard

**Description:** The eBodyGuard interactive composite jacket equipped with GSM/GPRS/GPS and a miniature camera. The jacket comfortably holds all the technology while hiding the cables connecting everything to the battery and modem. The device combines hardware (eGuard, eGuard-K9 and eBodyGuard) and software called AIMSS (Analytical Intelligent Mobile Security Systems) with communications technologies, and controls it all from a central management console. The technology can track people and assets in real time and monitor voltage, speed, movement, temperature and location – which is overlaid on a map.
8.4

8.1.7 Body Biolytics

Website: [http://bodybiolytics.com](http://bodybiolytics.com)

http://www.zdnet.com/article/wearables-solution-startup-prototypes-predictive-analytics/

**Technology name:** Predictive analytics software

**Description:** Body Biolytics provides Activity Recognition Engines that are easily used by data aggregators and application developers to bring useful machine learning technology and AI features into their software or app.

**Status:** Evolving

8.1.8 Clone: Algo


**Technology Name:** Artificial intelligence chip-embedded clothing

**Description:** Niraj Goel's group of companies under Clone Algo is designing wearable devices that will use artificial intelligence in chip-embedded clothes to reduce the usage of hand-held tools. The designer is set to create wearable devices with chips embedded into body wears such as clothing, belts, shoes, and rings, among others.

**Status:** Evolving

**Funding Source/Mechanism:** Internal - Clone Algo is raising $ 250 million by selling 20 million shares at $ 12.50 per piece through a share placement which would value the tech company at $11 billion.

8.1.9 DOCTO


**Technology Name:** DOCTO

**Description:** The DOCTO app complements medical sensors and fitness wearables by applying biometric analysis to provide diagnostics to the user. The app recognizes particular combinations of high and low readings that indicate a significant health development. The device integrates multiple biometrics from various devices such as glucose, heart rate, and blood pressure monitors. The technology may be
applicable to wearables like smart fabrics and sweat analyzers. DOCTO can monitor vitals and inform at-risk individuals of irregularities in their general well-being.

Status: Evolving

Funding Source/Mechanism: Crowdfunding

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**8.1.10 Ducere Technologies: Lechal**

Website: [http://lechal.com/](http://lechal.com/)

**Technology name:** Lechal Bluetooth-enabled haptic shoe

**Description:** The Lechal shoe uses haptic technology and digital mapping to signal the wearer through vibrations, the intensity and duration of which vary to correlate with the distance to an upcoming turn. The insoles are embedded with removable sensors powered by two rechargeable lithium polymer batteries which sync with mobile apps like Google maps. Directions are relayed through haptic feedback through vibrations either in the left or the right shoe.

Status: Soon to be released

Funding Source/Mechanism: Cofounders raised more than $2 million seed capital, have over 40,000 online preorders ($6 million).

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**8.1.11 Eidos**

Website: [http://www.timbouckley.com/eidos.html](http://www.timbouckley.com/eidos.html)

**Technology name:** Eidos Vision and Audio

**Description:** Eidos products allow users to have better control over their senses. The visual device overlays what the user is seeing with images recorded just a few milliseconds ago. The effect is similar to time-lapse video, only in real time. The user can see moving objects more clearly and determine patterns in them. The audio device allows users to isolate sounds, screening out background noise similar to Soundhawk.

Status: Evolving
Funding Source/Mechanism:

8.1.12 FacialNetwork Inc.: Orbit

Website: [http://www.nametag.ws/](http://www.nametag.ws/)

Technology name: Orbit cloud-based facial recognition

Description: Orbit is a cloud-based facial recognition app designed for facial recognition authentication on mobile devices, facial recognition for smartphones and facial recognition applications for Google Glass

Status: Evolving

Funding Source/Mechanism:

8.1.13 Google

Website: [http://googleblog.blogspot.com/2014/01/introducing-our-smart-contact-lens.html](http://googleblog.blogspot.com/2014/01/introducing-our-smart-contact-lens.html)

Technology name: Smart contact lenses

Description: These specially designed contact lenses are fitted with wireless chips and glucose sensors that are able to measure blood sugar levels in a diabetic’s tears.

Status: Evolving

Funding Source/Mechanism:

8.1.14 Imagination


Technology Name: PowerVR Series7 graphics processor unit

Description: Imagination’s power-efficient PowerVR Series7XE and Series7XT graphics processors are targeted at wearables, mobile devices, gaming consoles, PCs, and servers and could be used for image recognition and object detection in smartglasses and headsets.

Status: Soon to be released

Funding Source/Mechanism:

8.1.15 Ineda Systems

Website: [http://www.inedasystems.com/](http://www.inedasystems.com/)
Technology Name: Low-power system-on-chip

Description: Ineda’s architecture is optimized for long battery life and scalable performance required to run applications in the wearable and IoT space.

Status: Evolving

Funding Source/Mechanism: Venture funding - $19 million in Series B funding. Investors include Cisco, Samsung Catalyst Fund, Qualcomm Ventures, and Imagination Technologies.

8.1.16 Institute of Textiles and Clothing


Technology name: Fabric circuit board

Description: This fabric circuit board (FCB) is made of pre-stretched elastic yarn and polyurethane-coated copper fibers. With novel computerized textile technology, the FCBs are made by knitting a combination of conductive and conventional fibers. The textile with knit-in electrical wiring that can be worn, washed, folded and even shot through with bullets. This research provides the example that the fabric can be built into a soldier's bulletproof Kevlar vest; if the wearer is shot, the material can sense the bullet's impact and send radio a message back to a base.

Status: Evolving

8.1.17 Invensense®: MotionTracking™

Website: http://www.invensense.com/mems/gyro/catalog.html

Technology name: Single-chip MotionTracking™
Description: System-on-chip solutions are developments in microelectronics that have enabled researchers to create miniature circuits that combine sensing, front-end amplification, MCU functions, and RF transmission. Wearable sensors have applications in monitoring biochemical sensors monitoring chemical compounds in the atmosphere or people working in hazardous environments. InvenSense® single-chip MotionTracking™ solutions combine micro-electromechanical system, or MEMS, based motion sensors, such as accelerometers and gyroscopes, with mixed-signal integrated circuits to improve performance, accuracy, and intuitive motion- and gesture-based interfaces.

Status: Available

Funding Source/Mechanism:

8.1.18 iStrategyLabs: Dorothy

Website: http://istrategylabs.com/

Technology name: Dorothy

Description: Dorothy is powered by the LightBlue Bean, an Arduino micro-controller with a built-in Bluetooth chip, accelerometer, and coin cell battery. Dorothy’s “ruby” sensor is placed inside a shoe and when tapped three times it sends a fake call to the user and can also send custom texts to contacts, notifying them of the user’s location.

Status: Evolving

Funding Source/Mechanism:

8.1.19 Karen Janssen: HERE for Gear


Technology Name: HERE for Gear navigation app

Description: The navigation app offers turn-by-turn pedestrian navigation and public transit routing fit for display on smaller screens or smartwatches.

Status: Available

Funding Source/Mechanism:

8.1.20 Korean Agency for Technology


Technology Name: Standards
Description: The Korean Agency for Technology and Standards suggested the establishment of a standard-setting committee for wearable smart devices. The agency suggested a total of 18 international standards in the areas of semiconductor (9 standards), display (5), and electronic printing (4).

Status:

Funding Source/Mechanism:

8.1.21 Lineable

Website: http://www.lineable.net/

Technology name: Lineable wearable beacon

Description: The Lineable tracking bracelet syncs with users’ smartphones through Beacon and Bluetooth 4.0 technology. Parents or guardians can use mobile devices to track their children in a given area.

Status: Soon to be released - February 2015.

Funding Source/Mechanism: Crowdfunding

8.1.22 MEU

Website: http://www.themeu.net/hardware/meu-square/

Technology name: MEU square wearable LED display

Description: The MeU Square, a full-color LED matrix display with a microcontroller and a Bluetooth radio, allows wireless communication with other devices. The product allows users to display any text, image, or pattern.

Status: Evolving

Funding Source/Mechanism: Crowdfunding

8.1.23 Microsoft

Website: http://www.wearable.com/wearable-tech/microsoft-bone-conduction-headset-for-the-blind-448

Technology Name: Bone-conduction headset

Description: This bone-conducting headset could help guide blind and visually impaired people. Users wearing the headset receive audio guidance without having their ears covered. Bone conduction delivers sound to the inner ear, using the skull as a delivery method. Bone conduction transmission works with people with regular or impaired hearing.

Status: Evolving
**Funding Source/Mechanism:**

### 8.1.24 Myo-systems: PurePhones

**Website:** [http://www.thenewadhd.com/](http://www.thenewadhd.com/)

**Technology name:** PurePhones

**Description:** Pure Phones helps users optimize their cognitive abilities. The device uses sound to “trick” the brain into hearing something that is not actually there by intentionally calibrating your brainwaves to a situation. This “phantom noise” causes the brain to elevate its operating speed to maintain homeostasis.

**Status:** Evolving

**Funding Source/Mechanism:** Pursuing their first major round of funding

### 8.1.25 Nanyang Technological University


**Technology Name:** Flexible wearable electronic circuits via T-shirt printer

**Description:** Using the T-shirt printing equipment, scientists successfully printed transistors, capacitors, and resistors onto materials such as paper, fabric, plastic, and aluminum foil. Instead of ink the printer used printing materials containing silver nanoparticles, non/conductive plastics, and carbon. This included printing 4bit D/A (digital to analogue converters) and RFID tags onto wearable component materials.

**Status:** Evolving

**Funding Source/Mechanism:**

### 8.1.26 National Physical Laboratory

**Website:** [http://www.npl.co.uk/science-technology/electronics-interconnection/technical-areas/smart-textiles](http://www.npl.co.uk/science-technology/electronics-interconnection/technical-areas/smart-textiles)

**Technology name:** Smart textiles

**Description:** The National Physical Laboratory (NPL) developed a technique to produce conductive textiles that may make integrating electronics into clothing simple and practical by enabling lightweight circuits to be printed directly onto complete garments. This could have applications in the sports, health, medicine, consumer electronics and fashion industries.
Status: Evolving

Funding Source/Mechanism: NPL won a Knowledge Transfer Partnership award from Innovate UK and will be partnering with Coventry University to work in the area of smart textiles.

8.1.27  Ohio State University

Website: https://electroscience.osu.edu/research-publications/textile-and-wearable-antennas

Technology name: Textile wearable antenna

Description: In this research project, textile antennas are made from embroidered conductive fibers, referred to as E-fibers, that offer high surface conductivity (nearly equivalent to copper), are flexible and mechanically strong, and can be integrated into garments. According to researchers, the technology offers improved mechanical and radiofrequency performance compared to traditional rigid antennas and circuits and may have a range of applications including body-worn communications.

Status: Evolving

Funding Source/Mechanism:

8.1.28  OriginGPS: NanoSpider

Website: http://www.origingps.com/

Technology Name: Nano Spider

Description: Nano Spider is a GPS module (4x4x2.1mm in size) designed for use in small smart devices. The Nano Spider tracks GPS satellites to provide real-time positioning data. The company's Noise Free Zone system gives the device a strong signal even in urban canyons, under dense foliage, or a rapidly-changing receiver position.

Status: Evolving

Funding Source/Mechanism:

8.1.29  Ramco

Website: http://www.thehindubusinessline.com/features/smartbuy/tech-news/ramco-offers-erp-for-wearables/article6571416.ece

Technology Name: Enterprise resource planning (business management) software
Description: The enterprise resource planning business management software provider is adapting its system for use with wearable devices. The applications will add value for businesses that depend on a continuous flow of information, including aviation, particularly in maintenance, e-commerce, and health care.

Status:

Funding Source/Mechanism:

8.1.30 Re-Timer

Website: [http://www.virgin.com/travel/wearable-technology-that-combats-jetlag](http://www.virgin.com/travel/wearable-technology-that-combats-jetlag)

Technology Name: Re-Timer glasses to combat jetlag

Description: The Re-Timer glasses shine UV-free green light into the user’s eyes to help adjust circadian rhythms, which is proposed to reduce the effects of jetlag. Wearing Re-Timer sleep glasses for 30–50 minutes a day is suggested to provide the bright light necessary for a user to maintain a healthy sleep–wake rhythm.

Status: Available

Funding Source/Mechanism:

8.1.31 Soundhawk

Website: [http://www.soundhawk.com/](http://www.soundhawk.com/)

Technology Name: Soundhawk

Description: Soundhawk is a hearing device that cuts through background noise, focusing on the speech of the person the user wants to hear. An app lets the user tune the device to listen for specific sounds to make louder while reducing other sounds.

Status:

Funding Source/Mechanism:

8.1.32 Tech Museum of Innovation: Body Metrics Exhibit


Technology Name: Integrated full-body kit

Description: The Body Metrics Exhibit provides users with off-the-shelf hardware and custom software to measures social, physical, and emotional aspects of museum visitors in real-time. Visitors’ full-body kit
includes a Somaxis Cricket shoulder sensor that picks up muscle tension and heart rate, the MindWave Mobile NeuroSky electrocardiogram headset receiver for measuring brain activity, and a custom iPod touch that gathers motion data and takes pictures. The technology transmits the data to an on-site server where it is analyzed using custom software by Local Projects.

Status: Available

Funding Source/Mechanism:

8.1.33 Toshiba: AppLite™


Technology Name: TZ1021MBG App Lite™ application processor for wearable devices

Description: TZ1021MBG integrates a low-power consumption processor and Flash memory, without the Bluetooth Low Energy and accelerometer that Toshiba integrated into the previous “TZ1001MBG”. The processor integrates highly sensitive analog-to-digital converters well-suited for measuring weak biomedical signals such as the pulse and the heart’s electrical activity (like an electro-cardiogram).

Status: Soon to be released

Funding Source/Mechanism:

8.1.34 Tsinghua University: iGaze


Technology name: iGaze headset

Description: This wearable, head-mounted computer tracks the user’s gaze using an eye-tracking camera that calculates where the wearer is looking and transmits it to all the nearby internet-connected devices, such as stereos and TVS, via Wi-Fi. The devices reply with a beep played through the headset and the wearer nods to confirm a desire to connect.

Status: Evolving

Funding Source/Mechanism:

8.1.35 University of Adelaide


Technology Name: Wearable antenna
Description: The antennas can be incorporated into clothing using computerized embroidery into conductive fabric. The wearable antennas have potential application in biomedical monitoring, sports analysis, military and emergency communications. The solution being developed is a t-shirt made of conductive metallized fabric that is low-cost, flexible, and lightweight. It is reported to not deteriorate easily and is washable, with the antenna embroidered onto the textile.

Status: Evolving

Funding Source/Mechanism:

8.1.36 University of California: Hush

Website: http://mashable.com/2014/11/29/smart-earplugs/

Technology Name: Hush smart earplugs

Description: The smart earplugs use noise-masking to block outside sounds while working in conjunction with a smartphone via an associated app, allowing users to receive alerts from their mobile device. Sound-eliminating foam, combined with noise-masking sounds (including white, pink, and brown noise, ocean waves, a waterfall and even raindrops) emitted by the in-ear plug (at up to 30 to 40 decibels) for up to 10 hours, results in what the creators claim is a noise reduction of up to 70 decibels.

Status: Soon to be released

Funding Source/Mechanism: Crowdfunding

8.1.37 University of Texas

Website: 10.1109/DCAS.2014.6965331

Technology Name: Memory nap controller

Description: Researchers propose a technique that reduces the static power consumption in caches with no side effect on processor performance. The proposed architecture achieves this power saving by deterministically lowering the power state of cache lines that are guaranteed not to be accessed in immediate future cycles. Simulation of the architecture across different cache configurations, using widely known CAD tools, demonstrated up to 92% reduction in static power consumption on SPEC2006 benchmarks with no performance penalties and minimal hardware overhead.

Status: Evolving

Funding Source/Mechanism:

8.1.38 University of Tokyo


Technology Name: Ultraflexible circuits
Description: Researchers are creating printed circuitry on thin (1-micron thick), flexible plastic substrates. According to the researchers, the low-power components and thin film batteries or energy harvesting power could lead to sensors that are as easy to apply and that communicate wirelessly to a controller for processing and forwarding.

Status: Evolving

Funding Source/Mechanism:

8.1.39 Viametrica and SensorUp

Website: http://venturebeat.com/2014/09/16/viametrica-launches-health-data-aggregation-platform-for-fitness-trackers-apple-watch-google-fit/

Technology name: Industry Standards

Description: The exponential growth in the number of people tracking their health through activity monitors and biosensor devices is driving the need for industry standards. Vivametrica and SensorUp have formed a partnership to collect, standardize, and integrate data from wearable devices for application in healthcare environments.

Status: Evolving

Funding Source/Mechanism:

8.1.40 Visual Intelligence: iOne


Technology name: iOne sensor technology

Description: Miniaturized imaging technology that provides ultra-high resolution and multi-sensor functionality may allow for powerful multi-function imaging system with features such as infrared, night vision, ultra-high resolution, engineering-grade metric imaging, image fusion—all through a very small aperture and with a form factor that uses very little real estate in the device.

Status: Evolving - Visual Intelligence was granted the patent and is initiated a licensing program for manufacturers seeking miniature imaging technology.

Funding Source/Mechanism:

8.1.41 Wearable Experiments: Navigate

Technology Name: Navigate GPS jacket

Description: The jacket directs the wearer with subtle vibrations, indicating when they need to turn right to get to their desired destination. The hardware is embedded in the jacket, and once synced with the Navigate App, and the destination is entered in, it will guide you through to your final destination.

Status:

Funding Source/Mechanism:

8.1.42 Zikto: Arki

Website: http://www.planetbiometrics.com/article-details/i/2442/

Technology Name: Arki wristband

Description: The wearable device aims to improve users’ walking posture also features biometric qualities, with people’s “unique” walking patterns used to authenticate their identity. The device measures a user’s walking pattern so that it can become a password.

Status: Evolving

Funding Source/Mechanism: Crowdfunding
Appendix A

Technology Summary
Appendix A

Technology Summary

The following spreadsheet provides a summary of the technologies compiled in this report. For an electronic copy, please contact Jaki Upton at jaki.upton@pnnl.gov. This information is not meant to be an exhaustive list nor an endorsement of any technology described herein.
<table>
<thead>
<tr>
<th>Company</th>
<th>Technology</th>
<th>Description</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>3L Labs</td>
<td>Footlogger</td>
<td>Bluetooth-connected shoe insole activity tracker</td>
<td>Soon to be released</td>
</tr>
<tr>
<td>Adidas</td>
<td>MiCoach</td>
<td>Smart fabric measure heart rate</td>
<td>Available</td>
</tr>
<tr>
<td>Athos</td>
<td>Core exercise shirts and shorts with built in sensors</td>
<td>The Core sensor contains the electronics and intelligence to collect and interpret your biosignals, such as muscle effort and fatigue, heart rate and variability, breathing patterns, etc.</td>
<td>Soon to be released</td>
</tr>
<tr>
<td>BabyBe</td>
<td>BabyBe</td>
<td>Bionic mattress that brings haptic information from the mother (like her breathing and heartbeat) to the baby.</td>
<td>Evolving</td>
</tr>
<tr>
<td>BabyGuard</td>
<td>BabyGuard</td>
<td>Sensor units embedded in clothing to monitor babies vital data.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Backtrack</td>
<td>Backtrack</td>
<td>Bendable sensor worn near the spine to track data points like pressure and angle of movement.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Bar-Ilan University</td>
<td>Glucose tester wristband</td>
<td>Wearable biometric system that utilizes lasers and a magnet to directly monitor glucose levels in the blood stream and dehydration.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Bebop</td>
<td>Wearable Smart Fabric Sensor</td>
<td>Smart fabric sensor for real-time monitoring on force, x/y location, bend, twist, size, stretch and motion.</td>
<td>Available</td>
</tr>
<tr>
<td>BioSensive Technologies</td>
<td>Ear-o-Smart</td>
<td>Earring that uses photoplethymogram (PPG) technology to measure blood flow to monitor the user’s heart rate, activity level, and number of calories burnt.</td>
<td>Evolving</td>
</tr>
<tr>
<td>BITalino</td>
<td>Bitalino</td>
<td>Monitors and responds to human biosignals.</td>
<td>Available</td>
</tr>
<tr>
<td>BSXinsight</td>
<td>Wearable Lactate Threshold Sensor</td>
<td>BSXinsight is a compression sleeve worn on the calf that is able to analyze changes in your exercising muscle to immediately identify lactate threshold.</td>
<td>Available</td>
</tr>
<tr>
<td>Catapult Sports</td>
<td>Sporting Wearables</td>
<td>Measures more than 100 fields of data, including heart rate, distance, velocity, acceleration and deceleration, speed, and shock to monitor wearer movement and fatigue.</td>
<td>Soon to be released</td>
</tr>
<tr>
<td>CharmCare</td>
<td>H2 wearable blood pressure monitor</td>
<td>Small, lightweight wearable blood pressure monitor.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Chinese PLA, General Hospital</td>
<td>Wearable healthcare monitoring systems (WHMS) with GALL and Kalman filters</td>
<td>Use of an adaptive filter to reduce motion artefact (MA) in physiological signals acquired by WHMSs.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Code4Armour</td>
<td>Alert wristband</td>
<td>Delivers vital personal health information to first responders in seconds in the event of an emergency.</td>
<td>Soon to be released</td>
</tr>
<tr>
<td>Company</td>
<td>Technology</td>
<td>Description</td>
<td>Status</td>
</tr>
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<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>Electrozyme</td>
<td>Electrozyme</td>
<td>Wristband with a biosensor strip that analyzes chemical composition of user's sweat and sends notifications.</td>
<td>Evolving</td>
</tr>
<tr>
<td>embr Labs</td>
<td>Wristify</td>
<td>The wristband harnesses thermoelectrics to both heat and cool a patch of skin and is capable of changing that surface at a rate of 0.4 degrees Celsius per second.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Empatica</td>
<td>Embrace wristbands</td>
<td>Medical-quality wearables to help measure stress, epileptic seizures, activity, and sleep through electrodermal activity.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Evoke Neuroscience</td>
<td>Brain activity, heart rate and rate variability sensors</td>
<td>The sensors gather data via a set of high-end headphones and an arm band to increase biofeedback control over biometrics.</td>
<td>Soon to be released</td>
</tr>
<tr>
<td>FitLinxx</td>
<td>AmpStrip wearable heart and activity monitor</td>
<td>Continuously wearable activity monitor for heart rate, activity, respiration, body temperature, and posture.</td>
<td>Soon to be released</td>
</tr>
<tr>
<td>Force Impact Technologies</td>
<td>FITGuard mouthpiece</td>
<td>Mouthguard equipped with LED and sensors to monitor the center of gravity of the brain and detect potential head injuries.</td>
<td>Evolving</td>
</tr>
<tr>
<td>FuelWear</td>
<td>Flame Base Layer</td>
<td>An embedded sensor in the wearable technology registers the body's heat in order to continually adjust.</td>
<td>Soon to be released</td>
</tr>
<tr>
<td>Healthwatch</td>
<td>hWear™ smart textile garment</td>
<td>Digital, heart-sensing garment incorporating interwoven textile for detecting ECG signals.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Hexoskin</td>
<td>Biometric Smart Tee</td>
<td>The shirt is equipped with sensors capable of tracking over 3,000 data points every minute. The technology monitors heart rate, breathing rate, activity, and sleep.</td>
<td>Available</td>
</tr>
<tr>
<td>Imperial College of London</td>
<td>AcuPebble</td>
<td>Detects sounds emanating from the heart and respiratory system to indicate deteriorating health or illness.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Institute of Biomedical Engineering</td>
<td>Wearable brain monitoring - mobile electroencephalogram (EEG)</td>
<td>This around-the-ear device allows for continuous and reliable monitoring of brain activity and has the additional possibility to record vital signs.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Intel and Anouk Wipprecht</td>
<td>Synapse Dress</td>
<td>Sensor tracks attention level and focus fluctuations and sensor monitors proximity; includes camera.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Khalifa University of Science, Technology, &amp; Research</td>
<td>Wearable pressure sensor</td>
<td>Wearable pressure sensor made of carbon cottons with moderate electrical conductivity.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Lifebeam</td>
<td>Lifebeam hat and helmet</td>
<td>Bluetooth®- and ANT+™-equipped hat uses electro-optical sensors to monitor heart rate, cadence, and calories.</td>
<td>Available</td>
</tr>
<tr>
<td>MC10</td>
<td>Biostamp flexible sensor</td>
<td>Patch with sensors that monitor temperature, movement, heart rate and more, and transmit this data wirelessly back to patients and their clinicians.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Company</td>
<td>Technology</td>
<td>Description</td>
<td>Status</td>
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</tr>
<tr>
<td>Medtronic</td>
<td>Seeq Mobile Cardiac Telemetry (MCT)</td>
<td>Adhesive, water-resistant, wireless wearable cardiac sensor.</td>
<td>Available</td>
</tr>
<tr>
<td>Moodmetric</td>
<td>Moodmetric Smart ring</td>
<td>Small, wearable ring with biometric skin conductance sensors that provides feedback through a Bluetooth connection to a smartphone.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Myontec</td>
<td>Mbody Coach</td>
<td>Textile sensors to collect EMG signals to tell how hard the wearer is working.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Netatmo</td>
<td>Wrist device</td>
<td>Records UV exposure and alerts the user if exposure is too great.</td>
<td>Available</td>
</tr>
<tr>
<td>NewDealDesign</td>
<td>Project Underskin</td>
<td>Sub-dermal tattoo that will run off of the body's electro-chemical energy and will have the ability to monitor blood sugar, exchange information through a simple handshake, unlock front doors, etc.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Northwestern University, University of Illinois at Urbana-Champaign</td>
<td>Wearable skin monitor</td>
<td>This wearable health monitor can track skin and heart conditions while being worn discretely on the skin.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Olive</td>
<td>Olive bracelet</td>
<td>Manage stress by monitoring a user's heart rate, ambient light, and skin temperature.</td>
<td>Soon to be released</td>
</tr>
<tr>
<td>Qardio, Inc.</td>
<td>Qardiocore wearable ECG monitor</td>
<td>Wearable ECG monitor that collects biometric data and transmits to patients and physicians.</td>
<td>Available</td>
</tr>
<tr>
<td>Rijuven</td>
<td>Rejiva</td>
<td>Wireless ECG-based patch that captures overall health, manages stress, appraises the aging process, and tracks sleep and energy level.</td>
<td>Soon to be released</td>
</tr>
<tr>
<td>Sensogram</td>
<td>SensoTRACK</td>
<td>Ear-worn fitness device that can simultaneously measure and monitor heart rate, respiration rate, oxygen saturation, and blood pressure in real time, along with a range of other parameters.</td>
<td>Soon to be released</td>
</tr>
<tr>
<td>Sensoria</td>
<td>Textile Sensors</td>
<td>Textile sensors embedded in the fabric of these garments give information on heart rate, activity, running form, wellness, and fitness levels.</td>
<td>Available</td>
</tr>
<tr>
<td>Smartcadia</td>
<td>Inner You (INYU)</td>
<td>Handheld sensor that monitors breathing, skin conductance, and physical activity.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Spire</td>
<td>Spire wearable health tracker</td>
<td>Tracker measures breathing patterns to make users aware of their focus, tension, and calm levels.</td>
<td>Available</td>
</tr>
<tr>
<td>Spree</td>
<td>Smartcap</td>
<td>Measures heart rate, temperature, movement, and calories burned</td>
<td>Available</td>
</tr>
<tr>
<td>Thync</td>
<td>Thync Vibes neurosignaling wearable device</td>
<td>The device is intended to use neurosignaling to shift a person’s state of mind.</td>
<td>Soon to be released</td>
</tr>
<tr>
<td>University of Buffalo, Sentient Science</td>
<td>Wearable technology</td>
<td>Wearable technology that fuses real-time medical and physiological data with computer models.</td>
<td>Evolving</td>
</tr>
<tr>
<td>University of Cincinnati</td>
<td>Sweat sensor skin patch</td>
<td>A patch to measure biomarkers in sweat, sodium sensor, voltage meter, communication antenna, microfluidics, and controller chip</td>
<td>Evolving</td>
</tr>
<tr>
<td>Company</td>
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</tr>
<tr>
<td>University of Memphis</td>
<td>Kinematic-based activity</td>
<td>Wearable sensors that use kinematic-based activity recognition systems to identify sedentary and light-intensity activities.</td>
<td>Evolving</td>
</tr>
<tr>
<td></td>
<td>recognition systems</td>
<td>V1bes looks at stress both in the body and from the environment. To detect, it looks at brainwaves, heart rate, and molecular stress from surrounding electromagnetic pollution.</td>
<td>Evolving</td>
</tr>
<tr>
<td>V1bes</td>
<td>V1bes activity monitor ring</td>
<td>V1bes activity monitor ring</td>
<td>Evolving</td>
</tr>
<tr>
<td>Valencell</td>
<td>PerformTek sensor technology</td>
<td>Biometric sensors that continuously measure heart rate and activity and physiological data.</td>
<td>Available</td>
</tr>
<tr>
<td>Welch Allyn and Gentag</td>
<td>Skin patches</td>
<td>Lightweight, flexible patches for glucose monitoring, diagnostics, drug delivery, and geolocation.</td>
<td></td>
</tr>
<tr>
<td>Zoll</td>
<td>Zoll LifeVest</td>
<td>Wearable defibrillator</td>
<td>Available</td>
</tr>
<tr>
<td>Borre Akkersdijk and Martijn</td>
<td>BB.Suit 2.0</td>
<td>The material has an “integrated air quality sensor” that can analyze air pollution.</td>
<td>Evolving</td>
</tr>
<tr>
<td>ten Bhomer</td>
<td>Chemical sensor</td>
<td>Chemical sensor that can detect chemicals present in the air around you in real time.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Frog Shanghai</td>
<td>AirWaves pollution mask</td>
<td>A pollution mask that filters air pollution and monitors the air quality.</td>
<td>Evolving</td>
</tr>
<tr>
<td>HabitatMaps</td>
<td>AirBeam wearable air monitor</td>
<td>AirBeam uses a light-scattering method to measure particle matter 2.5.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Morphix Technologies</td>
<td>Chameleon</td>
<td>The wearable device allows hands-free detection of up to 10 different hazards at one time in a variety of operating environments.</td>
<td>Available</td>
</tr>
<tr>
<td>Nanozen</td>
<td>Wearable particle sensor</td>
<td>The monitor can detect particles as small as one micron and even less.</td>
<td>Soon to be released</td>
</tr>
<tr>
<td>NTT Docomo</td>
<td>Docotch</td>
<td>Measure air quality in the home. The device is equipped with humidity and temperature sensors.</td>
<td>Soon to be released</td>
</tr>
<tr>
<td>TZOA</td>
<td>TZOA Enviro-Tracker</td>
<td>Measures air pollution (particle matter) and UV exposure.</td>
<td>Evolving</td>
</tr>
<tr>
<td>UC Berkeley</td>
<td>Clarity wearable air quality</td>
<td>Wearable air quality monitor that measures air pollutants including particulate matter 2.5, volatile organic compounds, nitrogen dioxide, and ammonia.</td>
<td>Evolving</td>
</tr>
<tr>
<td></td>
<td>monitor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WindSix</td>
<td>Intelligent Wearable Air Purifier</td>
<td>The headset's powerful, high-precision filter purifies the air around it by up to 99.9 percent and uses non-ozone electrostatic dust removal technology.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Bionym</td>
<td>Nymi</td>
<td>Recognizes your individual heart rhythm and automatically unlocks a device.</td>
<td>Soon to be released</td>
</tr>
<tr>
<td>Captiks</td>
<td>Movit – miniature unit for</td>
<td>Measure body motions for kinematic and functional analysis.</td>
<td>Evolving</td>
</tr>
<tr>
<td></td>
<td>motion capture</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Company</td>
<td>Technology</td>
<td>Description</td>
<td>Status</td>
</tr>
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</tr>
<tr>
<td>Sail Research</td>
<td>Pathfinder</td>
<td>Translates sight into touch, allowing blind and visually impaired users to rapidly scan and identify any environment.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Samsung</td>
<td>Simband modular smartband</td>
<td>Smartwatch and a wristband connector that holds custom sensor modules.</td>
<td>Available</td>
</tr>
</tbody>
</table>

**Displays**

<table>
<thead>
<tr>
<th>Company</th>
<th>Technology</th>
<th>Description</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ashkelon</td>
<td>Ashkelon Visor</td>
<td>Touching the Smartphone, as well as other kinds of movements, controls the menu selection process. A free application will adapt the various functions of the Smartphone so they can appear in the Focusing Relay.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Atheer Labs</td>
<td>Augmented reality glasses</td>
<td>A sensor built into the pair of glasses can pick up the shape of your hands and whether you're swiping left or right, or clicking on an augmented reality button.</td>
<td>Soon to be released</td>
</tr>
<tr>
<td>DAQRI</td>
<td>Smart helmet</td>
<td>Helmet outfitted with augmented reality and 4D interface to allow users to see content and touch/control using third party devices like a smartwatch.</td>
<td>Soon to be released</td>
</tr>
<tr>
<td>Elbit Systems</td>
<td>Skylens wearable heads-up display</td>
<td>The Skylens wearable heads-up display was designed for commercial pilots to give a better view of proceedings, through augmented vision that can help them navigate through fog and darkness and improves situational awareness.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Fusar Technologies</td>
<td>Guardian GA-1 augmented reality motorcycle helmet</td>
<td>DOT-approved, Android-based augmented reality motorcycle helmet with heads-up display.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Google</td>
<td>Google Glass with customized software</td>
<td>Google Glass will be able to use facial recognition to match suspects to any existing profiles based on their face print.</td>
<td>Soon to be released</td>
</tr>
<tr>
<td>i2i</td>
<td>iPAL glasses</td>
<td>iPal uses your eye gestures as a control mechanism, allowing a hands-free, attention-free experience.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Magic Leap</td>
<td>Dynamic Digitized Lightfield Signal™</td>
<td>Magic Leap’s augmented-reality technology is alleged to generate images indistinguishable from real objects and then being able to place those images seamlessly into the real world.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Mitsumi</td>
<td>Laser eyewear</td>
<td>These wearable glasses deliver a wide viewing angle, a high level of brightness, and decent color reproducibility.</td>
<td>Evolving</td>
</tr>
<tr>
<td>NUVIZ</td>
<td>NUVIZ</td>
<td>NUVIZ provides navigation, weather, telemetry, and other useful information and allows the user to capture photos, stay connected on the road, and listen to music.</td>
<td>Evolving</td>
</tr>
</tbody>
</table>
## Appendix A: Technology Summary

<table>
<thead>
<tr>
<th>Company</th>
<th>Technology</th>
<th>Description</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optinvent</td>
<td>Ora</td>
<td>Features a front-facing, 1080p, 5MP camera; a 9-axis motion sensor; wireless connectivity with Bluetooth; Wi-Fi; and GPS as well as a trackpad for tactile interactions.</td>
<td>Soon to be released</td>
</tr>
<tr>
<td>Recon Instruments</td>
<td>Snow2 heads-up display</td>
<td>Goggles that provide a display of detailed information including: speed, jump analytics, altitude, map, compass, messaging capabilities, and markers showing the location of others on the slopes.</td>
<td>Available</td>
</tr>
<tr>
<td>SAP and Vuzix</td>
<td>Video eyewear</td>
<td>Improve the user experience and work processes by offering a hands-free working experience. The wearer interacts with the device using voice commands.</td>
<td></td>
</tr>
<tr>
<td>Skully</td>
<td>Skully augmented reality motorcycle helmet</td>
<td>Motorcycle helmet fitted with augmented reality technology to provide wide-angle rearview camera and transparent heads-up display.</td>
<td>Soon to be released</td>
</tr>
<tr>
<td>Sony</td>
<td>SmartEyeglass</td>
<td>SmartEyeglass is equipped with a range of different sensors, such as an electronic compass, a gyroscope, an accelerometer, an ambient light sensor, and a 3 megapixel camera.</td>
<td>Soon to be released</td>
</tr>
<tr>
<td>TrackingPoint</td>
<td>ShotGlass</td>
<td>Features a high-definition video display, an HD camera that can record audio and video, and optical controls that allow the user to control the glasses even when wearing thick gloves.</td>
<td>Soon to be released</td>
</tr>
<tr>
<td>University of Fukui</td>
<td>Laser beam combiner</td>
<td>This technology could offer immediate, hands-free access to information via gadgets such as smart glasses, which overlay computer-generated visual data on the user’s field of vision.</td>
<td>Evolving</td>
</tr>
</tbody>
</table>

### Body-worn

<table>
<thead>
<tr>
<th>Company</th>
<th>Technology</th>
<th>Description</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arubixs</td>
<td>Portal, flexible screen phablet</td>
<td>This flexible screen phablet slides into a dual-strap arm cradle that extends about halfway up the forearm from the wrist.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Cricet</td>
<td>Cicret bracelet and on-skin display</td>
<td>A bracelet that projects smartphone on the user's forearm. It is controlled and moved by touching your skin.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Kyocera</td>
<td>Proteus collapsible, wearable smartphone</td>
<td>A flexible smartphone that can collapse and become a wearable, likely with an AMOLED display.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Proglove</td>
<td>Proglove</td>
<td>The devices features Intel-Edison sensors in the fingers, a computing core and display.</td>
<td>Evolving</td>
</tr>
</tbody>
</table>

### Power

#### Chargers/Batteries

<table>
<thead>
<tr>
<th>Company</th>
<th>Technology</th>
<th>Description</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAE Systems</td>
<td>Broadsword</td>
<td>The suit includes woven fabric that conducts electricity and transmits data without cords. The suit is powered by a flexible battery along its wearer’s spine that recharges each time the user sits down on a charging pad.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Company</td>
<td>Technology</td>
<td>Description</td>
<td>Status</td>
</tr>
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<td>-------------------------------------------------------</td>
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</tr>
<tr>
<td>KAIST</td>
<td>Wireless charging system using Dipole Coil Resonant System (DCRS)</td>
<td>Wireless power transmission technology called the Dipole Coil Resonant System (DCRS) allows you to recharge devices in range of a &quot;Wi-Po Zone.&quot;</td>
<td>Evolving</td>
</tr>
<tr>
<td>Nifty</td>
<td>XOO</td>
<td>Belt features Lithium Ceramic Polymer flexible battery, can carry 2,100 mAh of power, and includes USB ports.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Panasonic</td>
<td>Pin-Shaped Lithion Battery</td>
<td>As the industry’s smallest cylindrical-shaped rechargeable Lithium ion battery (a diameter of 3.5mm and a weight of 0.6g), this product features the high reliability and high output required for near-field communications.</td>
<td>Soon to be released</td>
</tr>
<tr>
<td>Samsung</td>
<td>Bendable battery and pill-sized battery</td>
<td>Samsung’s thin, rollable, bendable battery can wrap around a person’s wrist or bend into a U shape and still operate normally. Samsung also announced a tiny pill battery with the capacity up to 5 times higher than any batteries mounted to the smart bands.</td>
<td>Evolving</td>
</tr>
<tr>
<td>UBeam</td>
<td>Ultrasound charger</td>
<td>This technology can take electricity, convert it into sound, and send that audio through the air over ultrasound. A receiver attached to a portable electronic device catches the sound and converts it back into electricity.</td>
<td>Soon to be released</td>
</tr>
<tr>
<td>A*Star Institute of Microelectronics (IME)</td>
<td>Implantable energy harvester</td>
<td>This technology uses low frequency vibrations to power small-scale electronic devices.</td>
<td>Evolving</td>
</tr>
<tr>
<td>AMPY</td>
<td>AMPY wearable kinetic device</td>
<td>The AMPY wearable kinetic device lets users discreetly capture and convert their daily physical activity into charging power for their smartphones.</td>
<td>Soon to be released</td>
</tr>
<tr>
<td>Columbia Engineering and the Georgia Institute of Technology</td>
<td>Piezoelectric nanogenerators</td>
<td>Researchers discovered a radical new way to create electricity using an atom-thin generator. It produces electricity when bent or stretched, and researchers say it could be sewn into clothing and even used in medical implants</td>
<td>Evolving</td>
</tr>
<tr>
<td>Fudan University, China</td>
<td>Wearable supercapacitor textile</td>
<td>A high-performance Li-ion battery made of carbon nanotube fiber yarns. A novel wearable supercapacitor textile that is thin, lightweight, transparent, and flexible. The supercapacitor textile is further integrated to create a new energy textile that can convert solar energy to electric energy.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Georgia Institute of Technology</td>
<td>Self-powered nanosystem</td>
<td>Materials that harvest operating energy from a host (i.e., the human body) may be feasible.</td>
<td>Evolving</td>
</tr>
</tbody>
</table>
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<tr>
<td>KAIST</td>
<td>Glass fabric-based flexible thermoelectric (TE) generator</td>
<td>The glass fabric-based thermoelectric (TE) generator is light-weight, extremely flexible, and produces electricity from the heat of the human body.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Pauline Van Dongen</td>
<td>Wearable solar</td>
<td>Garments produce sustainable energy through integrated solar cells.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Rajesh Adhikari</td>
<td>Power-generating footwear</td>
<td>These functional shoes contain a small dynamo that charges up and produces 5 volts of electricity as the wearer walks or runs.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Sungkyunkwan University</td>
<td>Perovskite solar cells</td>
<td>Perovskite solar cells are candidates for realizing an efficient, flexible, and lightweight energy supply system for wearable electronic devices.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Tommy Hilfiger</td>
<td>Solar-powered jacket</td>
<td>Jacket with solar panels and chargeable battery that can fully charge a standard 1500mAh mobile device up to four times.</td>
<td>Available</td>
</tr>
<tr>
<td>U.S. Marine Corps Expeditionary Energy Office (E2O)</td>
<td>Marine Austere Patrolling System, or MAPS</td>
<td>A vest that consists mainly of a solar-energy harvesting and storage system and water-purification unit.</td>
<td>Evolving</td>
</tr>
</tbody>
</table>

### Power Supply

<table>
<thead>
<tr>
<th>Company</th>
<th>Technology</th>
<th>Description</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acticheck</td>
<td>Assure</td>
<td>The standout feature of the new device is a battery life that provides power for 2 years without recharging.</td>
<td>Soon to be released</td>
</tr>
<tr>
<td>Drexel University, Dalian University of Technology</td>
<td>Mxenes, Electrically conductive, flexible nanomaterial</td>
<td>Electrically conductive nanomaterial, flexible enough to fold but strong enough to support many times its own weight. Believed to be used to improve electrical energy storage.</td>
<td>Evolving</td>
</tr>
<tr>
<td>MIT</td>
<td>Stretchable supercapacitors with graphene paper</td>
<td>Stretchable supercapacitors can store energy for flexible electronic devices. Crumpled-graphene papers present a simple and low-cost method for extremely stretchable and high-performance electrodes for supercapacitors.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Mixel</td>
<td>Controller</td>
<td>Mixel's high-performance, low-power Rx D-PHYSM and Northwest Logic’s full-featured, small-size CSI-2 Rx Controller Core minimizes power and area.</td>
<td>Available</td>
</tr>
<tr>
<td>Samsung</td>
<td>Wearable energy sharing devices</td>
<td>Samsung’s invention shares energy between wearable devices.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Taiwan Semiconductor Manufacturing Company Limited (TSMC)</td>
<td>Ultra low-power technology platform</td>
<td>TSMC’s ultra-low power processes can reduce operating voltages by 20% to 30% to lower both active power and standby power consumption.</td>
<td>Soon to be released</td>
</tr>
<tr>
<td>TE Wearables Lab</td>
<td>Wireless power development kit</td>
<td>2.5W charger with integrated magnet for attachment to a wearable device.</td>
<td>Available</td>
</tr>
</tbody>
</table>

### Integrated Communications
<table>
<thead>
<tr>
<th>Company</th>
<th>Technology</th>
<th>Description</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bluetooth</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OnBeep</td>
<td>Onyx wearable communicator badge</td>
<td>Round clip-on wearable equipped with speakers, an LED light, and an activation button that allows users to communicate via Bluetooth and over smartphone’s data connection.</td>
<td>Soon to be released</td>
</tr>
<tr>
<td>Yak Hat</td>
<td>Yak Hat</td>
<td>Bluetooth 4.0 integrated into the hat offers wireless connectivity to the user’s smartphone.</td>
<td>Evolving</td>
</tr>
<tr>
<td><strong>Hands-free Operations</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16Lab</td>
<td>Smart ring</td>
<td>A titanium ring with a somewhat pointy protrusion made up of dual touch surfaces. To activate the ring, you simply hold your thumb on either one. The ring vibrates subtly and is now awaiting your command. You can wave it up and down, twist your hand left or right, or basically move the ring freely in 3D space.</td>
<td>Soon to be released</td>
</tr>
<tr>
<td>Easier to Use</td>
<td>GoGlove wireless remote control</td>
<td>A Bluetooth module in the glove is connected to sensors in the fingertips. Used to control your phone.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Elliptic Labs</td>
<td>Touchless gesturing with ultrasonic technology</td>
<td>The device uses ultrasonic technology that recognizes gestures and allows for touchless interaction.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Murata</td>
<td>Crystal unit</td>
<td>With an overall frequency precision of +/-20ppm, these miniature crystal units are can support the stringent frequency tolerances required for wireless communications such as LTE/3G, Wi-Fi, Bluetooth, Bluetooth Low Energy, ZigBee, and NFC.</td>
<td>Available</td>
</tr>
<tr>
<td>Mycestro</td>
<td>Wearable wireless mouse</td>
<td>A wearable, wireless 3D mouse worn on the finger delivers all of the same functionality as a traditional mouse with increased mobility.</td>
<td>Available</td>
</tr>
<tr>
<td><strong>Exoskeletons</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Defense Advanced Research Projects Agency (DARPA)</td>
<td>Airlegs</td>
<td>The power pack provides power to movement (like running) from a tank of compressed air connected by pulleys and electronic sensors to braces on the knees.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Ekso</td>
<td>Body suit</td>
<td>The suit works by powering steps when the wearer shifts his or her weight.</td>
<td>Available</td>
</tr>
<tr>
<td>Harvard Wyss Institute for Biologically Inspired Engineering</td>
<td>Soft Exosuit</td>
<td>The Soft Exosuit can be worn comfortably under clothing and could enable soldiers to walk longer distances, keep fatigue at bay, and minimize the risk of injury when carrying heavy loads.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Company</td>
<td>Technology</td>
<td>Description</td>
<td>Status</td>
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</tr>
<tr>
<td>Purdue University</td>
<td>Robotic fabric</td>
<td>The robotic fabric is a cotton material containing sensors made of a flexible polymer and threadlike strands of a shape-memory alloy that return to a coiled shape when heated, causing the fabric to move. Such an elastic technology could make possible robots that have sensory skin, stretchable robotic garments that people might wear for added strength and endurance, etc.</td>
<td>Evolving</td>
</tr>
<tr>
<td>StretchSense, I Measure U</td>
<td>Bionic limbs and sensors</td>
<td>Bionic limbs to give people more capability than they were born with.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Tokyo University of Science and Innophys Co.</td>
<td>Muscle Suit wearable power-assist device</td>
<td>The Muscle Suit, weighing 5.5 kilograms (12 pounds), can be worn knapsack-style and uses a mouthpiece as its control. The Muscle Suit can help users pick up everyday loads with about a third of the usual effort.</td>
<td>Soon to be released</td>
</tr>
</tbody>
</table>

### Wearable Computers

<table>
<thead>
<tr>
<th>Company</th>
<th>Technology</th>
<th>Description</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raytheon</td>
<td>Wearable computer</td>
<td>The new technology merges proven, wearable computer systems with situational awareness capabilities to create an enhanced real-time view of the battlefield for commanders and their troops.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Tufts University</td>
<td>Passive physiological input</td>
<td>The proposed interface uses passive physiological input as additional communication channels between wearable devices and wearers.</td>
<td>Evolving</td>
</tr>
<tr>
<td>University of Canterbury</td>
<td>Wearable computer interface design</td>
<td>Researchers are exploring how models of human cognition can be adapted for wearable computer interface design, particularly how to use models of human attention to create wearable interfaces that do not distract the user.</td>
<td>Evolving</td>
</tr>
</tbody>
</table>

### General

<table>
<thead>
<tr>
<th>Company</th>
<th>Technology</th>
<th>Description</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actuate</td>
<td>BIRT iHub 3.1 and BIRT Analytics 5.0</td>
<td>The applications help users turn wearable-generated data into usable information and value-added visual representations.</td>
<td>Soon to be released</td>
</tr>
<tr>
<td>Allied Minds Seamless Devices, Inc.</td>
<td>Seamless Devices analog signal processing</td>
<td>Applications for a novel technique in analog signal processing that will make it possible to produce high-performance signals even as transistors are scaled down in size deep into the nanoscale.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Alpinestar</td>
<td>Tech-Air street system</td>
<td>Tech-Air street system works like a lining for bike jackets. When the system detects an impact, a built-in canister and ‘bladder’ inflates to protect the wearer’s body.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Arco</td>
<td>Smart Reactor</td>
<td>The Smart Reactor uses white and RGB LEDs to handle different types of notifications.</td>
<td>Evolving</td>
</tr>
<tr>
<td>ARM Holdings</td>
<td>MBED OS</td>
<td>The operating system is meant to resolve productivity problems that arise from fragmentation—where different devices in the so-called “Internet of things” (IoT) market run on a mix of different protocols. ARM aims to consolidate those devices under a single software layer that’s simple, secure, and free for all manufacturers to use.</td>
<td>Soon to be released</td>
</tr>
<tr>
<td>Company</td>
<td>Technology</td>
<td>Description</td>
<td>Status</td>
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</tr>
<tr>
<td>Betatrac</td>
<td>eBodyGuard</td>
<td>The eBodyGuard interactive composite jacket equipped with GSM/GPRS/GPS and a miniature camera. The technology can track people and assets in real time and monitor voltage, speed, movement, temperature and location – which is overlaid on a map.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Body Biolytics</td>
<td>Predictive analytics software</td>
<td>Software to correlate the information gathered by wearables.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Clone Algo</td>
<td>Artificial intelligence chip-embedded clothing</td>
<td>Wearable devices that will use artificial intelligence in chip-embedded clothes to reduce the usage of hand-held tools.</td>
<td>Evolving</td>
</tr>
<tr>
<td>DOCTO</td>
<td>DOCTO</td>
<td>DOCTO is an app that complements medical sensors and fitness wearables by applying biometric analysis to provide diagnostics to the user.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Ducere Technologies</td>
<td>Lechal Bluetooth-enabled haptic shoe</td>
<td>The Lechal shoe uses haptic technology and digital mapping to signal the wearer through vibrations, the intensity and duration of which vary to correlate with the distance to an upcoming turn.</td>
<td>Soon to be released</td>
</tr>
<tr>
<td>Eidos</td>
<td>Eidos Vision and Audio</td>
<td>The visual device overlays what the user is seeing with images recorded just a few milliseconds ago. The effect is similar to time-lapse video, only in real time. The user can see moving objects more clearly and determine patterns in them. The audio device allows users to isolate sounds, screening out background noise</td>
<td>Evolving</td>
</tr>
<tr>
<td>FacialNetwork Inc.</td>
<td>Orbit cloud-based facial recognition</td>
<td>Orbit is a cloud-based facial recognition app designed for facial recognition authentication on mobile devices.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Google</td>
<td>Smart contact lenses</td>
<td>These specially designed contact lenses measure the glucose levels in diabetics' tears and send that data to a mobile device. The contacts are fitted with wireless chips and glucose sensors that are able to measure blood sugar levels once per second.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Imagination</td>
<td>PowerVR Series 7 graphics processor unit</td>
<td>The XT provides more graphics processing power than its predecessors while using lesser or the same amount of power.</td>
<td>Soon to be released</td>
</tr>
<tr>
<td>Ineda Systems</td>
<td>Low-power system-on-chip</td>
<td>Ineda's ground-up architecture is optimized for long battery life, along with the scalable performance that is required to run the various applications in the wearable and IoT space.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Institute of Textiles and Clothing</td>
<td>Fabric circuit board</td>
<td>This fabric circuit board is made of pre-stretched elastic yarn and polyurethane-coated copper fibers.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Invensense</td>
<td>Single-chip MotionTracking</td>
<td>InvenSense® single-chip MotionTracking™ solutions combine micro-electromechanical system, or MEMS, based motion sensors, such as accelerometers and gyroscopes, with mixed-signal integrated circuits to improve performance, accuracy, and intuitive motion- and gesture-based interfaces.</td>
<td>Available</td>
</tr>
<tr>
<td>iStrategyLabs</td>
<td>Dorothy with a ‘ruby’ sensor</td>
<td>Dorothy’s “ruby” sensor is placed inside a shoe and when tapped three times it sends a fake call to the user and can also send custom texts to contacts, notifying them of the user’s location.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Company</td>
<td>Technology</td>
<td>Description</td>
<td>Status</td>
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</tr>
<tr>
<td>Karen Janssen</td>
<td>HERE for Gear navigation app for smartwatches</td>
<td>Navigation app offers turn-by-turn pedestrian navigation and public transit routing fit for display on smaller (2-inch) screens or smartwatches.</td>
<td>Available</td>
</tr>
<tr>
<td>Korean Agency for Technology Standards</td>
<td>Standards</td>
<td>Establishing a standard-setting committee for wearable smart devices. The agency suggested a total of 18 international standards in the areas of semiconductor (9 standards), display (5), and electronic printing (4).</td>
<td></td>
</tr>
<tr>
<td>Lineable</td>
<td>Lineable wearable beacon</td>
<td>Lineable is an iOS-compatible tracking bracelet that allows parents to keep track of children. Parents or guardians can use mobile devices to monitor children within that area; if children leave the area, users are immediately notified.</td>
<td>Soon to be released</td>
</tr>
<tr>
<td>MEU</td>
<td>MEU square wearable LED display</td>
<td>The product brings the ability for users to display any text, image, or pattern in order to communicate a message with people around them.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Microsoft</td>
<td>Bone-conduction headset</td>
<td>Bone conduction delivers sound to the inner ear, using your skull as a delivery method.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Myo-systems</td>
<td>PurePhones</td>
<td>The device uses sound to &quot;trick&quot; the brain into hearing something that is not actually there. This “phantom noise” causes the brain to elevate its operating speed to maintain homeostasis.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Nanyang Technological University</td>
<td>Flexible wearable electronic circuits</td>
<td>T-shirt printing equipment prints transistors, capacitors, and resistors onto materials such as paper, fabric, plastic, and aluminum foil.</td>
<td>Evolving</td>
</tr>
<tr>
<td>National Physical Laboratory</td>
<td>Smart textiles</td>
<td>Integrating electronics into all types of clothing made simple and practical by enabling lightweight circuits to be printed directly onto complete garments.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Ohio State University</td>
<td>Textile wearable antenna</td>
<td>The textile antennas are made from embroidered conductive fibers, referred to as E-fibers, that offer high surface conductivity (nearly equivalent to copper), are flexible and mechanically strong, and can be inconspicuously integrated into the garments.</td>
<td>Evolving</td>
</tr>
<tr>
<td>OrginGPS</td>
<td>Nano Spider</td>
<td>The Nano Spider tracks GPS satellites to provide real-time positioning data.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Ramco</td>
<td>Enterprise resource planning (business management) software</td>
<td>Enterprise resource planning (business management) software fit for use with wearable such devices.</td>
<td></td>
</tr>
<tr>
<td>Re-Time</td>
<td>Re-Timer glasses to combat jetlag</td>
<td>Re-Timer sits on your face like a pair of glasses and blasts UV-free green light into your eyes to help adjust circadian rhythms, or ‘body clock’, helping to reduce the effects of jetlag.</td>
<td>Available</td>
</tr>
<tr>
<td>Soundhawk</td>
<td>Soundhawk</td>
<td>Hearing device that cuts through background noise, focusing on the speech of the person the user wants to hear.</td>
<td>Available</td>
</tr>
<tr>
<td>Tech Museum of Innovation Body Metric Exhibit</td>
<td>Integrated full-body kit</td>
<td>The Body Metrics Exhibit measures social, physical, and emotional aspects of museum visitors in real-time.</td>
<td>Available</td>
</tr>
<tr>
<td>Company</td>
<td>Technology</td>
<td>Description</td>
<td>Status</td>
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</tr>
<tr>
<td>Toshiba</td>
<td>TZ1021MBG App Lite™ application processor for wearable devices</td>
<td>Integrates a processor, Flash memory, low-power consumption, and highly sensitive analog to digital converters (ADCs) well-suited for measuring weak biomedical signals such as the pulse and the heart's electrical activity (like an electro-cardiogram).</td>
<td>Soon to be released</td>
</tr>
<tr>
<td>Tsinghua University</td>
<td>iGaze headset</td>
<td>This wearable, head-mounted computer tracks your gaze and connects to devices just by looking at them.</td>
<td>Evolving</td>
</tr>
<tr>
<td>University of Adelaide</td>
<td>Wearable antenna</td>
<td>Antennas that be incorporated into clothing using computerized embroidery into conductive fabric.</td>
<td>Evolving</td>
</tr>
<tr>
<td>University of California</td>
<td>Hush smart earplugs</td>
<td>The earplugs use noise-masking to block outside sounds and integrate with a smartphone via an associated app. Users achieve complete silence, without missing important updates and alarms on mobile devices.</td>
<td>Soon to be released</td>
</tr>
<tr>
<td>University of Texas</td>
<td>Memory nap controller</td>
<td>Researchers propose a technique that reduces the static power consumption in caches with no side effect on processor performance.</td>
<td>Evolving</td>
</tr>
<tr>
<td>University of Tokyo</td>
<td>Ultraflexible circuits</td>
<td>Circuitry printed on ultraflexible plastic substrates that can withstand bending and crumpling.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Viametrica and SensorUp</td>
<td>Aggregation platform for fitness trackers</td>
<td>Vivametrica and SensorUp have formed a partnership to collect, standardize, and integrate data from wearable devices for application in healthcare environments.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Visual Intelligence</td>
<td>iOne sensor technology</td>
<td>Miniaturized imaging technology that provides ultra-high resolution and multi-sensor functionality may allow for powerful multi-function imaging system with features such as infrared, night vision, ultra-high resolution, engineering-grade metric imaging, and image fusion.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Wearable Experiments</td>
<td>Navigate GPS jacket</td>
<td>The jacket directs the wearer with subtle vibrations, indicating when they need to turn right to get to their desired destination.</td>
<td>Evolving</td>
</tr>
<tr>
<td>Zikto</td>
<td>Arki wristband</td>
<td>Measures gait biometrics, a person's walking patterns, to authenticate identity.</td>
<td>Evolving</td>
</tr>
</tbody>
</table>