IME-100

Interdisciplinary Design and Manufacturing

Examples of Current Technological Innovations Powered by ECE

Dr. Girma Tewolde

Wearable Technologies

Technology Cycles – Still Early Cycle on Smartphones + Tablets, Now Wearables Coming on Strong, Faster than Typical 10-Year Cycle

Technology Cycles Have Tended to Last Ten Years

Mainframe Computing 1960s	Mini Computing 1970s	Personal Computing 1980s	Desktop Internet Computing 1990s	Mobile Internet Computing 2000s	Wearable / Everywhere Computing 2014+

Others?

KPCB

Image Source: Computersciencelab.com, Wikipedia, IBM, Apple, Google, NTT docomo, Google, Jawbone, Pebble.

49

Wearable Technology Market to Exceed $6 Billion by 2016

http://www.mhealthtalk.com/wearable-technology-market-to-exceed-6-billion-by-2016/

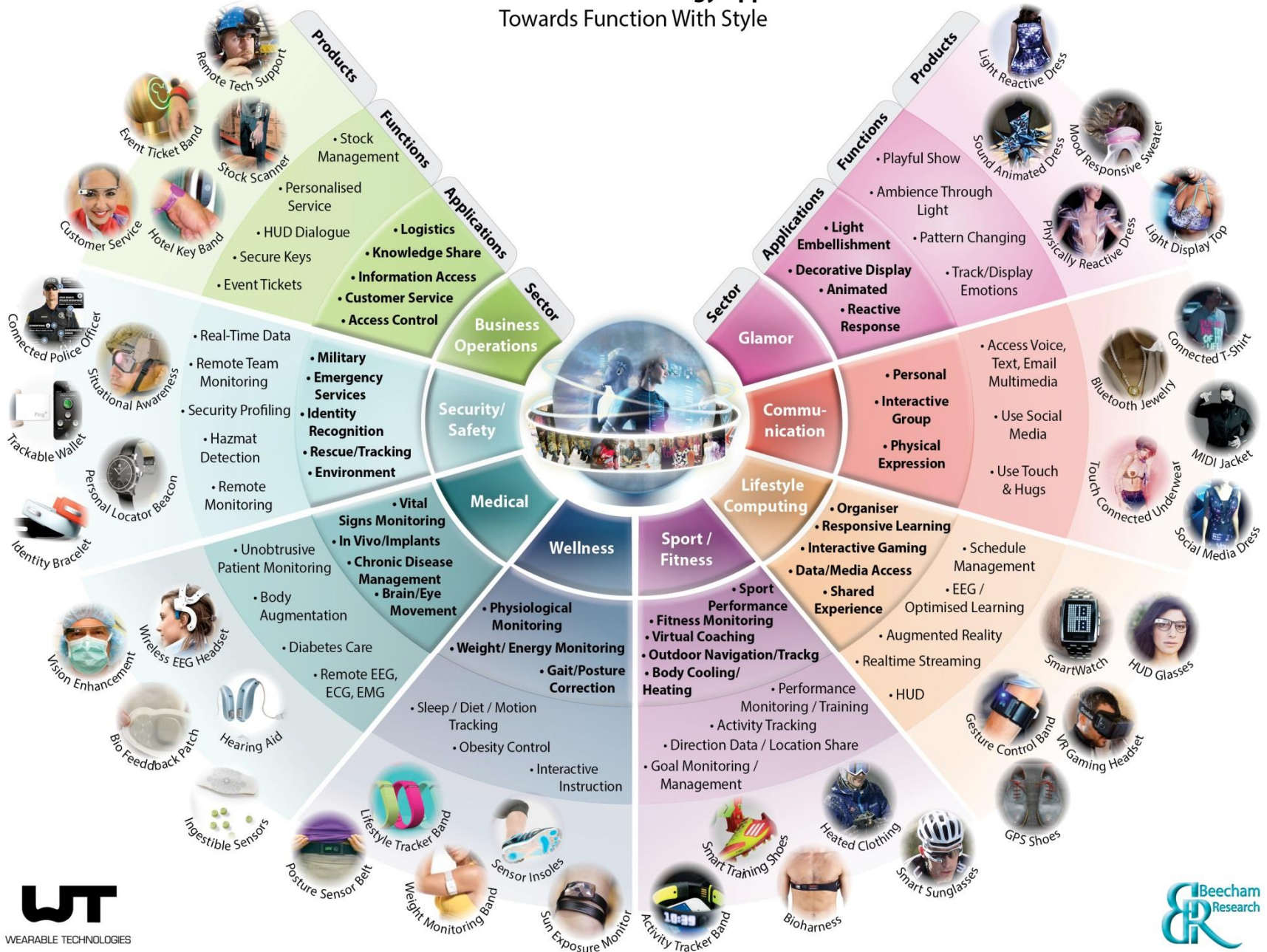# Wearable Technologies …

What is it?

- Advanced miniature computer and electronic technology comfortably attached/worn on human body, clothing, or accessory

- Mostly has practical functions & features

- Has built-in wireless communication capability

- Enhances interaction with technology in our daily lives

Wearable Technologies …
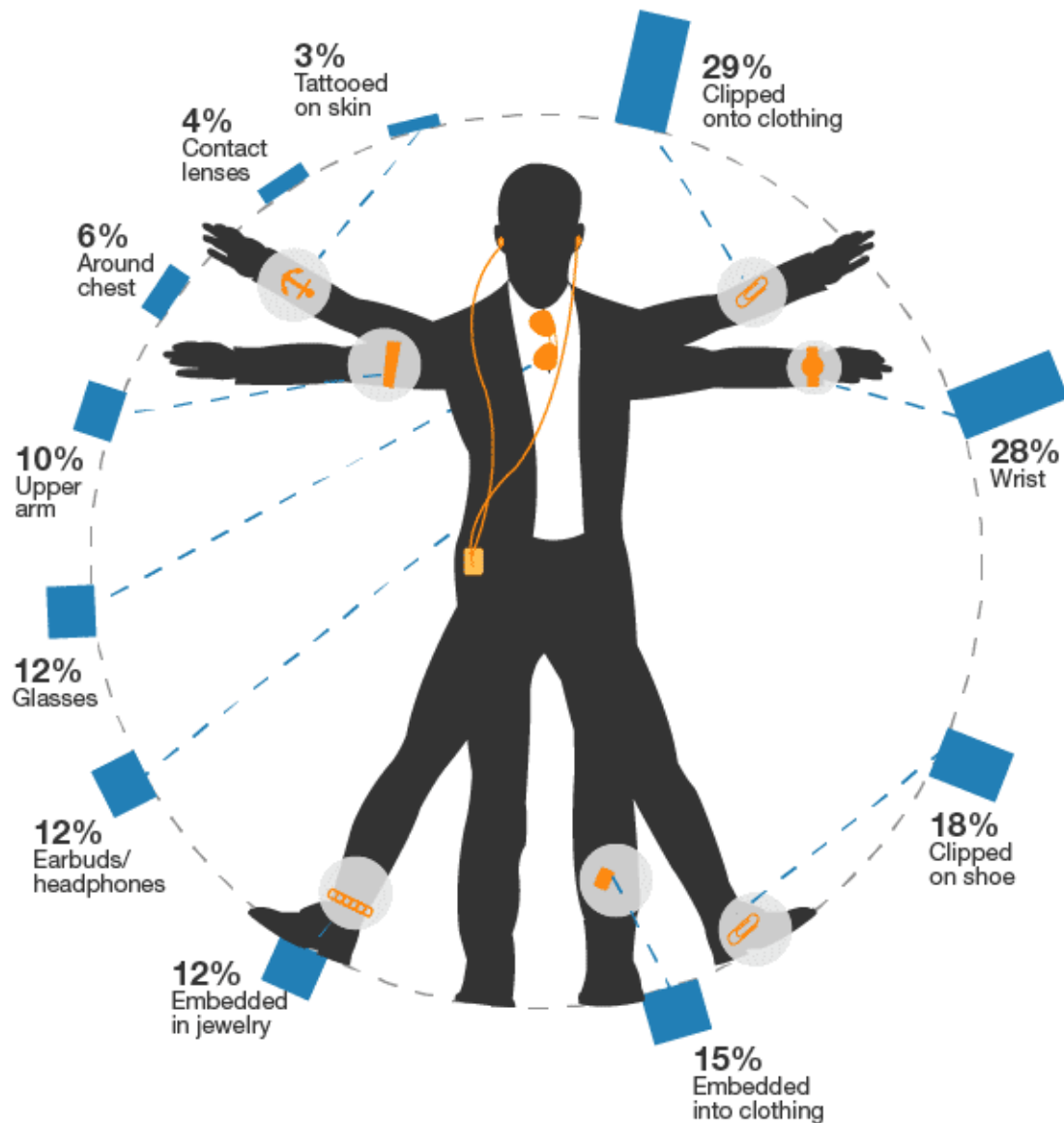
Why should we care?

- Get exposed to the next big market wave of new technology gadgets

- Big player in business and economics

- Opportunity to become an entrepreneur by catching on this wave:
  - New product/service development
  - New application scenarios that were never thought before
  - … think outside the box

- Be a smart consumer – to adopt the right product for the right application

World of Wearable Technology Applications:
Towards Function With Style

Left wing — Products / Functions / Applications / Sector

Remote Tech Support · Event Ticket Band · Stock Scanner · Customer Service · Hotel Key Band · Connected Police Officer · Situational Awareness · Trackable Wallet · Personal Locator Beacon · Identity Bracelet · Vision Enhancement · Wireless EEG Headset · Bio Feedback Patch · Hearing Aid · Ingestible Sensors · Posture Sensor Belt · Lifestyle Tracker Band · Weight Monitoring Band · Sensor Insoles · Sun Exposure Monitor

Products

Functions
- Stock Management
- Personalised Service
- HUD Dialogue
- Secure Keys
- Event Tickets

Applications
- **Logistics**
- **Knowledge Share**
- **Information Access**
- **Customer Service**
- **Access Control**

Sector: Business Operations

- Real-Time Data
- Remote Team Monitoring
- Security Profiling
- Hazmat Detection
- Remote Monitoring

- **Military**
- **Emergency Services**
- **Identity Recognition**
- **Rescue/Tracking**
- **Environment**

Sector: Security/Safety

- Unobtrusive Patient Monitoring
- Body Augmentation
- Diabetes Care
- Remote EEG, ECG, EMG

- **Vital Signs Monitoring**
- **In Vivo/Implants**
- **Chronic Disease Management**
- **Brain/Eye Movement**

Sector: Medical

Wellness
- **Physiological Monitoring**
- **Weight/ Energy Monitoring**
- **Gait/Posture Correction**
- Sleep / Diet / Motion Tracking
- Obesity Control
- Interactive Instruction

Sport / Fitness
- **Sport Performance**
- **Fitness Monitoring**
- **Virtual Coaching**
- **Outdoor Navigation/Trackg**
- **Body Cooling/ Heating**
- Performance Monitoring / Training
- Activity Tracking
- Direction Data / Location Share
- Goal Monitoring / Management

Lifestyle Computing
- **Organiser**
- **Responsive Learning**
- **Interactive Gaming**
- **Data/Media Access**
- **Shared Experience**
- Schedule Management
- EEG / Optimised Learning
- Augmented Reality
- Realtime Streaming
- HUD

Communication
- **Personal**
- **Interactive Group**
- **Physical Expression**
- Access Voice, Text, Email Multimedia
- Use Social Media
- Use Touch & Hugs

Sector: Glamor

Applications
- **Light Embellishment**
- **Decorative Display**
- **Animated**
- **Reactive Response**

Functions
- Playful Show
- Ambience Through Light
- Pattern Changing
- Track/Display Emotions

Products (right wing): Light Reactive Dress · Sound Animated Dress · Mood Responsive Sweater · Physically Reactive Dress · Light Display Top · Connected T-Shirt · Bluetooth Jewelry · MIDI Jacket · Touch Connected Underwear · Social Media Dress · SmartWatch · HUD Glasses · Gesture Control Band · VR Gaming Headset · GPS Shoes · Smart Sunglasses · Bioharness · Heated Clothing · Activity Tracker Band · Smart Training Shoes

WT — WEARABLE TECHNOLOGIES

Beecham Research

How would you
be interested in
wearing/using it?

"How would you be interested in wearing/using a sensor device, assuming it was from a brand you trust, offering a service that interests you?"

3%
Tattooed
on skin

4%
Contact
lenses

29%
Clipped
onto clothing

6%
Around
chest

28%
Wrist

10%
Upper
arm

12%
Glasses

18%
Clipped
on shoe

12%
Earbuds/
headphones

12%
Embedded
in jewelry

15%
Embedded
into clothing

Base: 4,657 US online adults (18+)
(multiple responses accepted)

Source: North American Technographics® Consumer Technology Survey, 2013

97141

Source: Forrester Research, Inc.

Wearable Technologies …

What they do:

- Perform functions on their own or sync with smartphones (eg. Smart watches -- alert user when receiving messages)

- Provide sensory and scanning functions – biological and environmental sensing capability

- Tracking of physiological functions

- Wireless communication capabilities with other sensors and smart devices

- Provide real-time information to the user

- Have capability to send alerts to remote locations

Wearable Technologies …

Examples:

- **Smart watches** (FitBit, Gear Fit, Gear S, Fit 2, Moto 360, Pebble, Nike+)
    - Most have activity tracking for workouts, heart rate, calories, distance, GPS tracking, sleep tracking, etc.
- **Glasses** (Google Glass, Microsoft HoloLens)
    - Screen, camera, voice and touch commands
    - Virtual reality, gaming, information access
- **Health trackers** (iHealth, Basis, Trimmer, Fitbit–Zip, Fitbit-Flex, Misfit)
    - Monitor vital signs, activity, sleep, etc.
- **Military applications** (soldier monitoring, etc.)
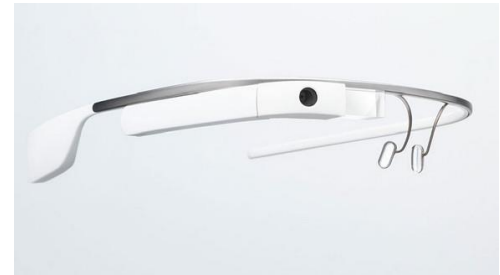
Quantified Self (QS)

What is it?

- *It is a movement to incorporate self-tracking technology to get detailed personalized data.*

- The movement includes both the users/consumers and makers of such technology

http://qs4eml.ltu.edu/?page_id=10
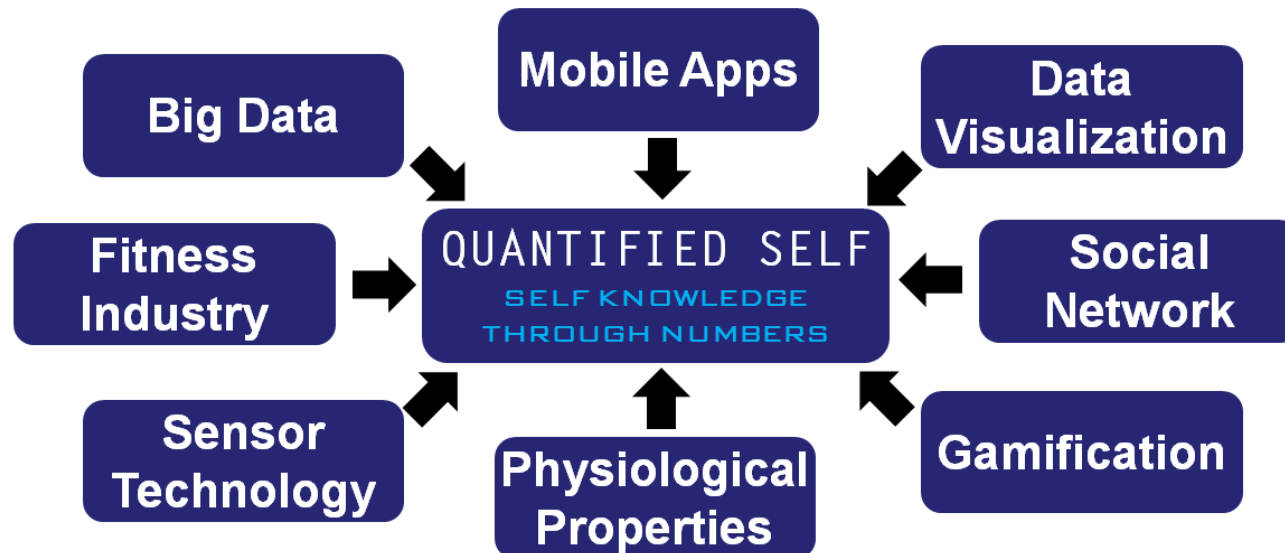
Quantified Self (QS)

What & why?

- Self knowledge through numbers
- Rapid advances in sensors and data logging systems to allow individuals understand their health and wellness through quantification and tracking.
- Social networks and the fitness industry are embracing new opportunities created by the QS social movement.
- Entrepreneur opportunities through QS
  - Accelerator/developer program
  - "Digital Health" venture capital funding: $2B in 2013 up from $1B in 2011
    - Analytics and Big Data
    - Digital Medical Devices
    - Wearables and Biosensing

Internet of Things (IoT)

What & why?

- The interconnection of uniquely identifiable embedded computing devices to the Internet.
- *Things* in IoT can refer to a wide variety of devices/systems:
  - Smart home automation (energy management, smart thermostats with learning algorithm, security cameras, garage door controls, burglar alarms)
  - Biochip transponders on farm animals
  - Health monitoring implants
  - Smart grid
  - Industrial automation
  - Warehouse automation
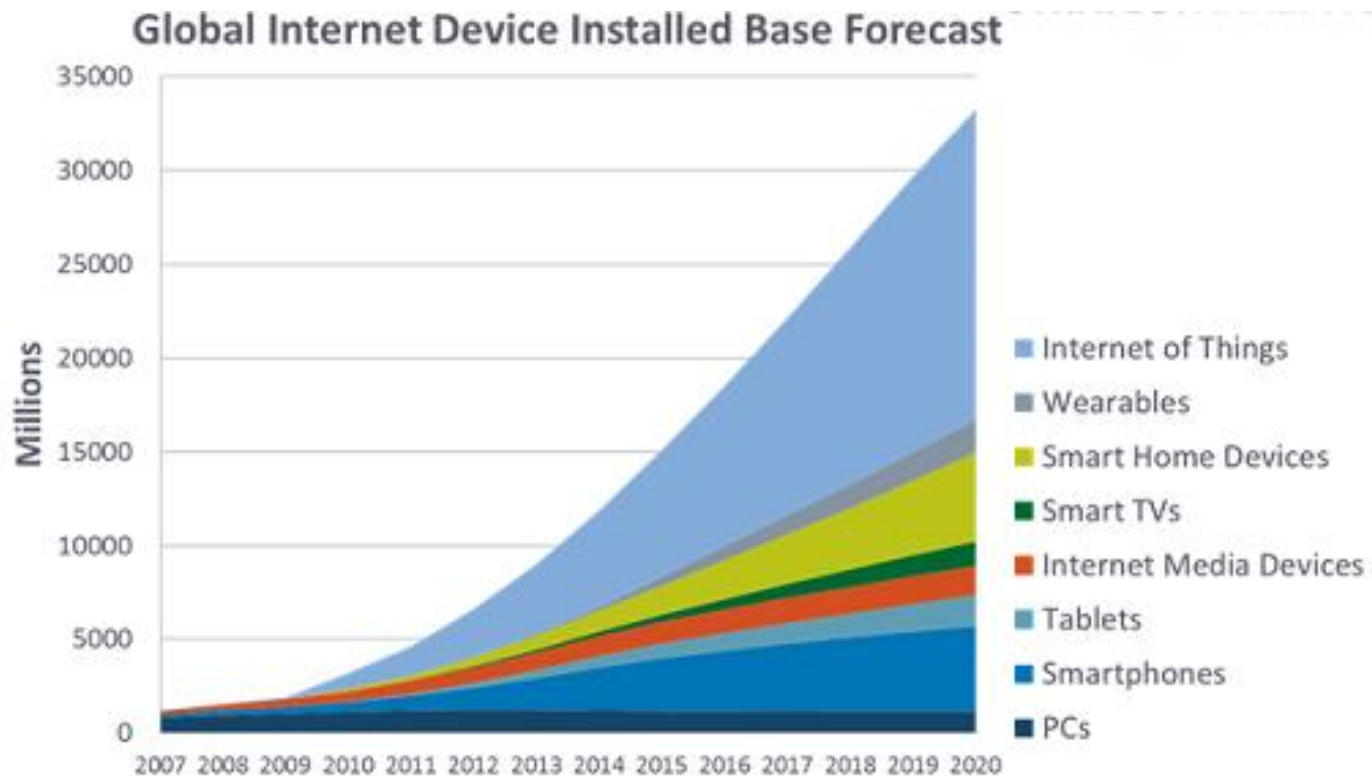 - Intelligent transportation system
  - Agricultural automation

Internet of Things (IoT)

The possibilities are endless … get inspired!

Internet of Things (IoT)

- Sharp growth expected in connected devices & applications, hence great opportunity for entrepreneurs…

Global Internet Device Installed Base Forecast

Source: Strategy Analytics, October 2014