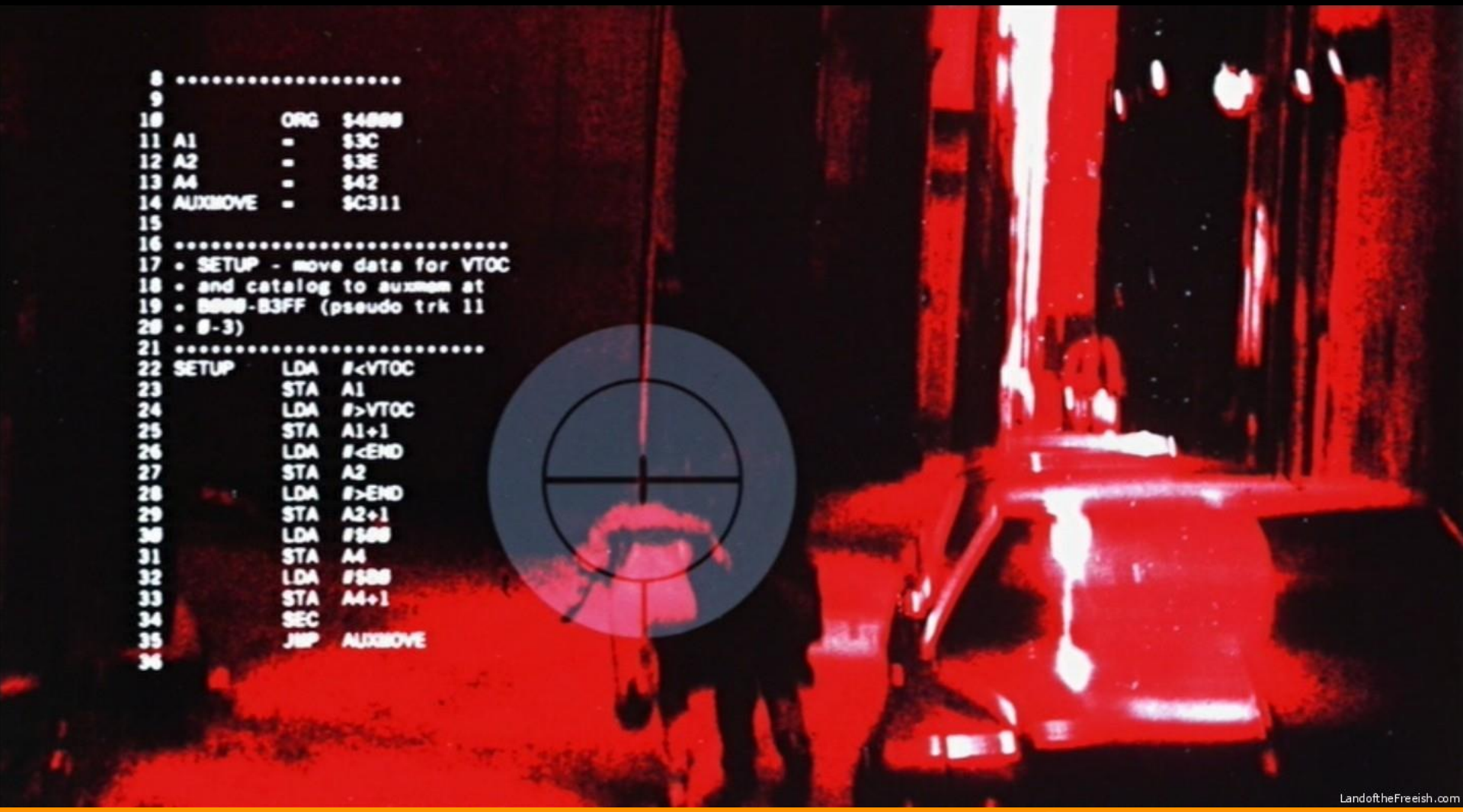
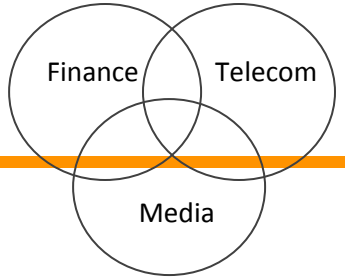
Wearable Computing Ecosystem





Amish Gandhi

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Wearable Technology Background

- Experimenting with several wearable devices and APIs
- Built and launched world's first Google Glass magazine applications
- Device development experience in telecom

MS Computer Science from Univ of Texas, Austin

BS Computer Science from Bombay University

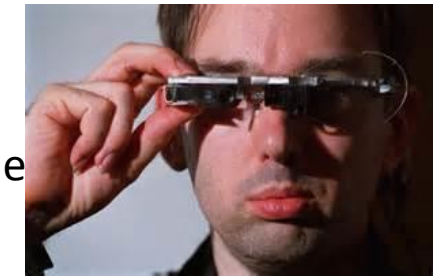
Wearable Computing

- Overview
- Technology Ecosystem
- Product Ecosystem
  - Sports
  - Healthcare
  - Childcare
  - Public Safety
  - Consumer
    - Demo

A brief history of wearable computers

Experiments | Early Vertical Adoption | Mainstream Consumer

1977: HP releases the HP 01 algebraic calculator watch [Hewlett-Packard]



1999: Steve Mann's Eyetap device

2012: Google Glass announced at Google I/O

2012: Pebble Kickstarter record

2013: Samsung Galaxy Gear launches

1989: Private Eye head-mounted display sold by Reflection Technology

2004: Microsoft launches SPOT Smartwatch

Killer App: FITNESS

2012: Nike Fuelband launch

2013: Google Glass launches to limited audience

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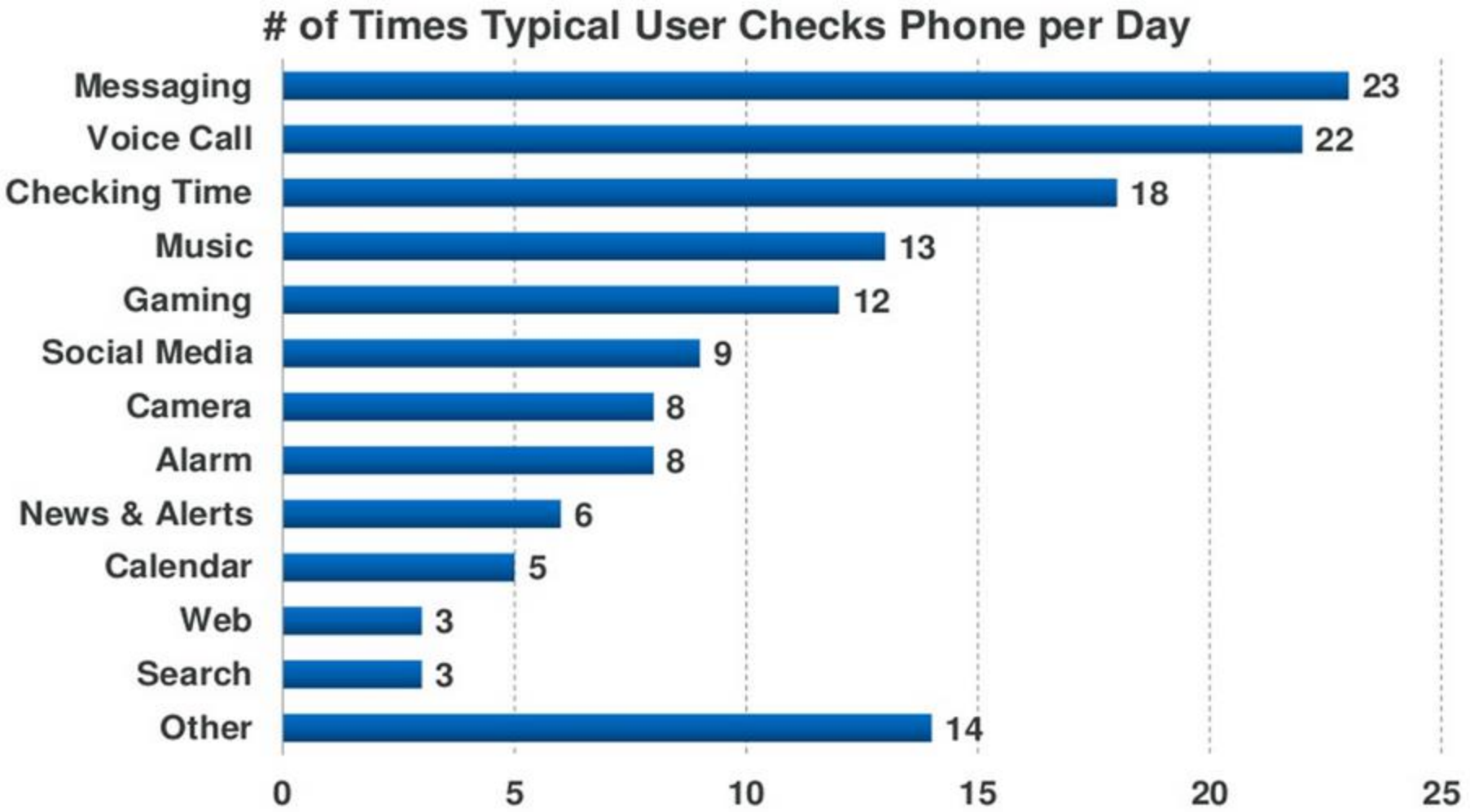
Attributes of Wearable Computers

Ref:

KPCB

Avg. Mobile Phone User Reach 150 X Daily



Ref:

KPCB

Source: TomiAhonen Almanac 2013, LINK. 'Other' includes voicemail, charging and miscellaneous activities. We cross-checked Tomi's analysis to gain context. Our references include: 1) Motorola Mobility / Google (consumers interact with their phones more than 100x per day, mid-2012); 2) Leading 3G Carrier with Operations in Europe & Asia (smartphone users interact with mobiles ~150x per day); 3) IDC (51 blended average of social sessions per smartphone user per day in USA, 3/13...excluded services like checking time, alarm and calendar events, web browsing, gaming, using camera, listening to music, searching, using maps, charging and other activities that require checking the phone) and 4) other third parties, including app providers.

Number of times users reach for their device daily=150

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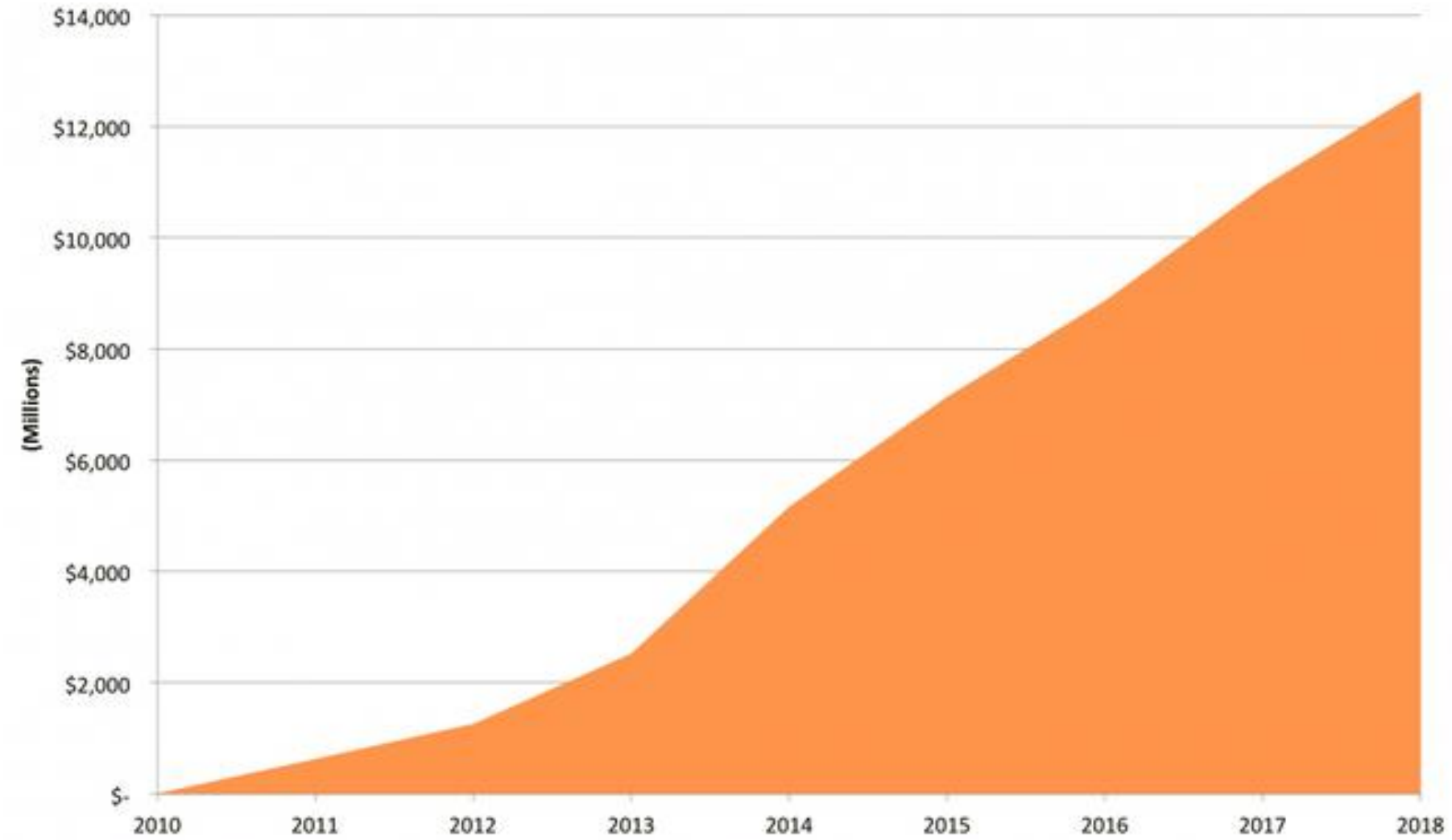
Wearables Market Forecast



*Source: BI Intelligence estimates, ABI Research, IMS, Juniper, *Assumes 42$ average selling price for wearable devices*

Wearable Technology Ecosystem

Hardware	Software	API/SDK	Data	Visualization
Large cellularphone manufacturers Manufacturers of non-connected wearables Brand new entrants (crowdfunded)	Android Respective device firmware Misc. device capability drivers (accelerometer, sensor etc)	JSON/REST Java/.NET Event driven programming Unity 3D	No standard Application specific	No standard -On device -Synced to mobile app -Available online

Technologies

- Sensors
  - Event driven
  - Websockets vs. http
  - Bluetooth and other near-field communications
  - Sensor
- Material science
- Electromyography-sensors
- Accelerometers
- Speech recognition
- Intertial sensors
- In-air gesture control
- Power consumption
- Natural Language Processing

Wearable Product Ecosystem

	Sports/ Fitness	Consumer/ Infotaimnent	Public Safety	Healthcare	Other
Watches		X			
Bracelets	X				X
Eyewear		X	X		
Headgear		X	X	X	
Clothing	X	X		X	X
Accessories (ring, necklace..)	x	X		X	

Upcoming Devices and Development

- Sports
- Healthcare
- Public Safety
- Other eg Childcare
- Consumer

Sports

Nike Fuelband

Fitbit

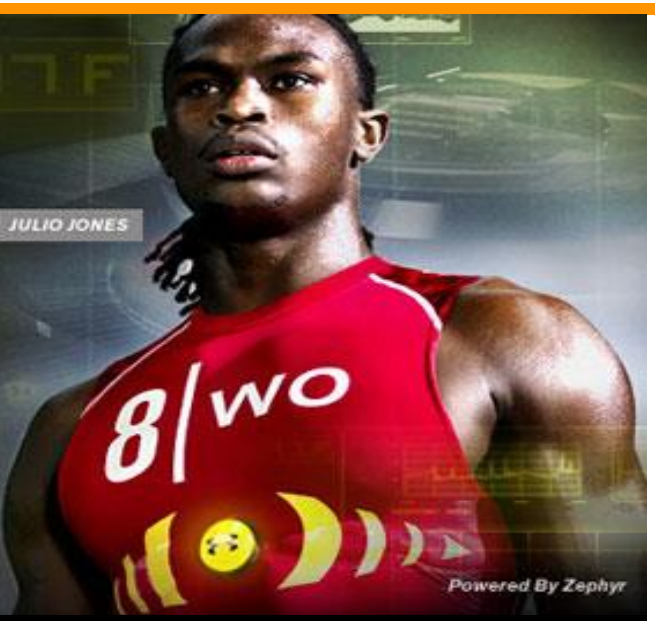
Adidas MiCoach

Garmin Tactix

Fitbug Orb

Under Armor E-39

Sports



Removable "bug" sensor equipped with
-Triaxial accelerometer
-CPU
-2GB of storage
-Additional monitors that measure heart rate & breathing

-Track individual movements and biometric
-Identify performance issues
-when the body is moving out of sync thereby slowing down an athlete's linear speed

Scouts, coaches, and trainers can collect data over Bluetooth from
-Smartphones
-Tablets
-PCs

Fitbit API

REST API with oAuth

BODY	ACTIVITIES	FOODS	SLEEP	HEART	BP	GLUCOSE
Get Body Fat						
Get Body Fat Goal	Get Activity Weekly Goals					
Get Body Measurements	Get Activities	Get Foods	Get Sleep	Get Heart Rate	Get Blood Pressure	Get Glucose
Get Body Weight		Get Water				
Get Body Weight Goal	Get Activity Daily Goals	Get Food Goals				

Upcoming Devices and Development

- Sports
- Healthcare
- Public Safety
- Other eg Childcare
- Consumer

Body Guardian

$36 BILLION
SAVINGS IN HEALTHCARE COSTS THROUGH THE USE OF REMOTE PATIENT MONITORING BY 2018

25%
REDUCTION IN THE NUMBER OF BED DAYS BECAUSE OF REMOTE MONITORING

20%
REDUCTION IN HOSPITAL ADMISSIONS BECAUSE OF REMOTE MONITORING

$9.3 BILLION
SIZE OF GLOBAL PATIENT MONITORING MARKET

Upcoming Devices and Development

- Sports
- Healthcare
- Public Safety
- Other eg Childcare
- Consumer

Public Safety: Golden I

Hardware

- 15-inch display
- 9-axis head-tracking technology
- Digital compass
- GPS
- Speech recognition with noise-cancelling mic
- 38 languages supported
- Bluetooth/Wi-Fi USB
- 3D graphics accelerators
- 8+ hours battery life
- 14MP camera

Software

- Media Player
- E-mail Center
- File Explorer
- Web Browser
- Camera Viewer
- Telephone Dialer

Public Safety: Golden I: First Person View

Upcoming Devices and Development

- Sports
- Healthcare
- Public Safety
- Other eg Childcare
- Consumer

Other eg Childcare

Mimi Onesie

Guardian

ATT Flip

Upcoming Devices and Development

- Sports
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- Other eg Childcare
- Consumer

Consumer (Infotainment)

- Pebble/Kreyos
- Samsung Galaxy Gear
- Space Glasses
- Muse Brain Sensor
- Google Glass

Consumer

pebble

-SMS
-Apps (Sports, music, games)
-Extensive API

KICKSTARTER

$10M Raised

kreyos

-SMS
-Phone
-Activity Tracker
-Voice + Gesture Control

indiegogo

$100K Raised

Consumer: Samsung Galaxy Gear

- Android 4.2.2
- 800 Mhz Processor
- ½ gig of RAM

COOLHACK

- Settings→Gear Info→USB Debug=true
  - Connect to computer over USB
  - Android apps can be side-loaded

Consumer: META: Space Glasses

Augmented reality vs. Heads-up display

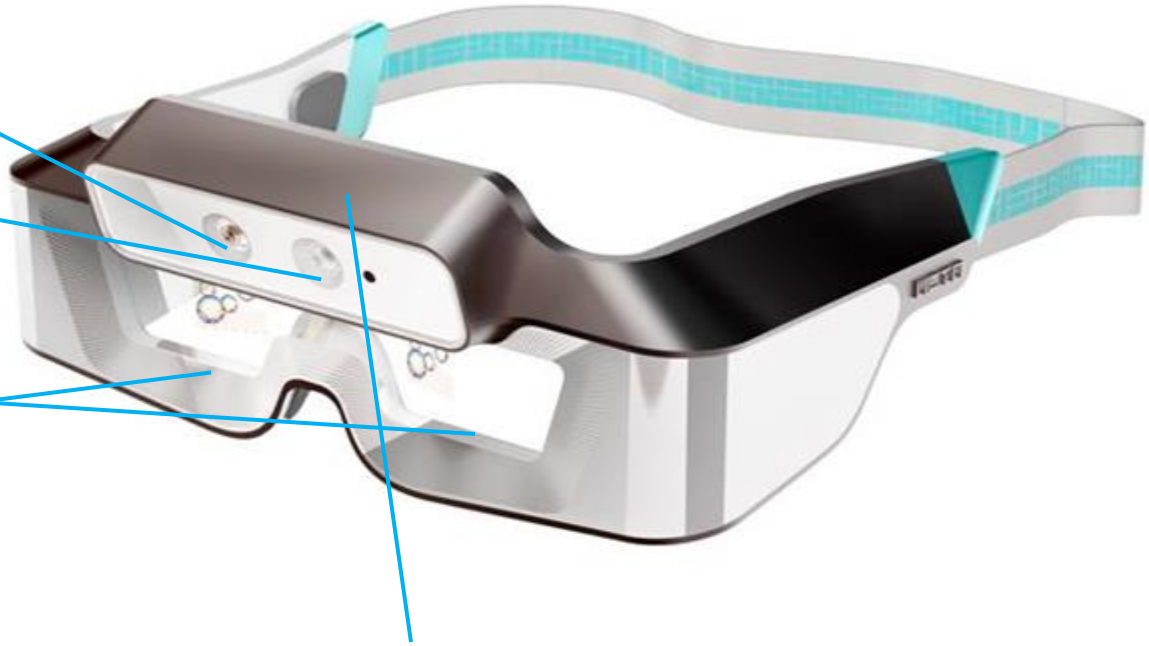
META: Space Glasses

Hardware

720p RGB camera via USB

320x240 Infra-Red Depth Camera via USB

Twin 960x540 see through TFT LCD displays at 23 degrees Field of View, via HDMI



9 degree of freedom sensor (3-axis accelerometer, 3-axis gyroscope, 3-axis compass) via USB

Developing for Space AR Glasses

- Dev: Javascript friendly Game Engine Unity 3D
  - Built-in physics engine
  - Full editor for 3d scene
  - Physics, sound controls
- Glasses available for pre-order for US$650.00.
- SDK launching Dec 2013

http://docs.unity3d.com

Muse: Brain Sensing Headgear

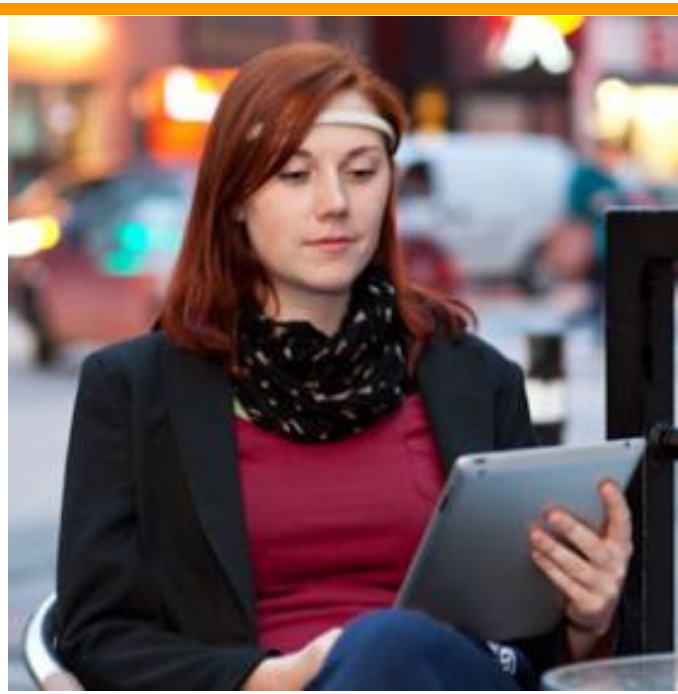
Six sensor headband
-Control games
-Reduce stress
-Improve memory and concentration
-Eventually to control devices directly with your mind

How it works

Detects electrical frequencies from neuron's in your brain using electroencephalography (EEG) sensors

- -Delta, Theta, Alpha waves: Sleep
- -Beta waves: active thinking
- -Gamma waves: high mental activity, consolidation of info

Muse: Brain Sensing Headgear



- Muse Device+ Brain Health System App = plug and play experience.

  Muse →Bluetooth→Device

  View brainwaves in real time

- SDK + API to access:

  - Raw EEG and Accelerometer data
  - Processed brain features

Google Glass

Google Glass 2

Google Glass Timeline

Google Glass

General Architecture + Development Model