The History and Incredible Potential Of Wearable Displays

Paul Travers
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A Little Background

• In 1991 I joined the fray and founded Forte Technologies
  - The first consumer virtual Reality HMD companies with the VFX1

• Reorganized Forte as Vuzix in 1997
  - Initial focus defense research and night vision
  - In 2004 Introduced first consumer wearable

• One of the World’s Leading suppliers of
  - Wearable display technology

• World Wide Operations

• Award Winning Technology and Designs
  - Immersive Viewing, Virtual Reality, Augmented Reality

• And after all those years we are just now on the brink of getting it right
The Evolution of Wearables

- Analog
- Digital
- Single Function
- Multi-Function, Unconnected
- Multi-Function, Sometimes Connected
- Always Connected, Smart/Analog

Take photos with your Google Glasses, iWatch??

Multifunction enthusiast devices from Suunto, Casio, Nike, Recon, introduced in 1990s. Multifunction, sometimes connected enthusiast devices begin to appear in early 2000s

- Peter Henlin’s "Taschenuhr", the earliest known watch
- Inspired by 2001: A Space Odyssey in 1968, the first digital LED watch from Hamilton/Pulsar was released in 1972
- Early calculator watch co-built by Hewlett Packard and Hamilton

1511 1972 1975 1990s 2000s Future???

- Courtesy: Credit Suisse
History of Wearable Display Technology

- It is arguable that the wearable display is the most intriguing
- The idea has been around for a while
- Wearable TV patent filed 1945
History of Wearable Display Technology

- 1960: Morton Heilig patents a head-mounted stereophonic television display.

- 1966: Ivan Sutherland creates first computer-based head-mounted display
History of Wearable Display Technology

- It's funny how some ideas just keep bouncing back…

- 1989: Leap Cyberface The predecessor to Oculus Rift
History of Wearable Technology

• The 90’s saw the introduction of numerous wearable computers

• 1997: Creapôle Ecole de Création and Alex Pentland (MIT) produce Smart Clothes Fashion Show
Just a Few Years Ago

ISMAR 2011 Eyewear
All hammers looking for a nail

Except for the occasional niche success story
So Why Does it Matter Now?
A Lot has Changed Since those Early Days

• Thanks to the wireless internet the world is connected 24/7

• The world has gone mobile

• Computer processing power has increased by orders of magnitude

• While silicon die size keeps shrinking and power consumption falls

• Display resolutions have multiplied to HD in a small panel

• These changes are so profound that the handheld computing devices coming out of them are killing the desktop computer

• And they are driving the wearable technology opportunity centered around the smartphone, connectivity and internet worlds connected through VR
Beside just information display
There are two basic concepts in wearable display today

VR & AR
I am going to focus on AR
AR
Wearable Display for mobility
Smart Phones are Growing Beyond Text-Voice-Internet
The possibilities are endless - A Day in the Life of Cloud Connected You...

Images: Siddharth Vanchinathan
http://sidv.co/author/sid/
Its Growing into Billion Dollar Markets

- Gartner Research estimates 714 million smart phones sold in 2014
- ABI Research forecasts the wearable computing device market will grow to 485 million annual device shipments by 2018
  - More than 75 million of these will be Smart Glasses

**Global Smart Glasses Shipments**

**Retail Market Value of Smart Wearable Devices (2014)**

Source: ABI Research

Source: Juniper Research
But the UI is not natural on a phone for these new apps so things are evolving yet again

Email – 1972
Text msg – 1992
Internet www – 1995
Cloud connected apps from AR to gaming

1983
1980s
1994 to now

1990
2000
2012

Smart Glasses
Wearable Displays are the Answer

• But it is very hard to do
• The Challenges for Mobility
  - Make them like fashion eyeglasses
  - Make them HD, smart, see-through, aware of the world
We are at the early cellphone days

- Market has been constrained by bulky appearance, poor ergonomics and technical limitations of optics
- There are some success coming in enterprise and home use!

Conventional Optics for Video Viewers & Gaming

- Carl Zeiss - Cinemizer
- Sony - HMZ
- Epson - Moverio
- Kopin - Golden-I
- Google - Glass

First Cell Phone

- Carl Zeiss - Cinemizer
- Sony - HMZ
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- Google - Glass
But wearable computers have come a long way
A Case in Point Vuzix M100 Smart Glasses – M Series for Enterprise/Prosumer

- M100 – first of smart glasses line
- Effectively a wearable smart phone
- AR can run realtime inside the glasses
- The display and camera are aligned for digital see through AR
- Feature
Thousands of developers for enterprise to prosumer

**Industrial - Warehousing**
- Peer to Peer Communications
- Hands Free - Safety
- Correct Pick, Place, Ship
- Warehouse Navigation
- Inventory Control

**Minimizes human error while reducing costs!**

**Off-Shore Heavy Equipment Operations**
- Real-Time Communications
- Over-The-Shoulder Coaching
- Spatial Awareness
- Emergency Evacuation Alerts
- Work Discrepancy Resolution

**Worker safety, less down time!**

**Medical Applications**
- Peer to Peer Communications
- Pre, Intra, Post OP Checklists
- Patient Medical History
- Patient’s Vital Data
- Invasive Procedural Checklist
- Symptom Identification & Documentation

**Improved quality of care while reducing costs!**

**Automotive**
- Peer to Peer Communications
- Production Line Checklists
- Assembly/Disassembly Assistance
- Dealer Technicians
- Remote Diagnostics
- Training

**Minimizing human error while reducing costs!**

**Airlines**
- Peer to Peer Communications
- Boarding Check-In
- Security
- Customer Data
- Aircraft Maintenance
- Flight Operations

**Increase passenger safety while reducing costs!**

**Customer Service**
- Peer to Peer Communications
- Product Stock Status
- Shelf Location
- Product Specifications
- Product Price
- Sales Associate Training

**Satisfied customers increased revenues!**

Real Time, Hands Free, Info on Tap, Image/Video streaming, Scan Code Reading and More...
SAP and Vuzix - The future of Field Service

http://www.youtube.com/watch?v=UlpGDrSmg38
But when does the AR display cross into the mainstream?
The technology needs to disappear
Fashion AR Glasses
So how do we get there?
Optics are the biggest hurdle

- When will these guys finally hire a fashion ID designer?
  - It's not that easy
- Conventional refractive and reflective optics have limits

Carl Zeiss - Cinemizer
Sony - HMZ
Epson - Moverio
Kopin - Golden-i
Google - Glass
New Approaches are needed like Waveguide Optics

• Waveguides are a revolutionary way of moving light
  - Image is injected into a 1.4mm thin waveguide like a fiber optic
  - Not bent through bulk material like conventional optics
• Provides a significant improvement in
  - Mass, cost, volume, simplicity and optical performance

Conventional Optics

Waveguide Optics
Purpose built for fashionable look and feel
Smart Glasses and Augmented Reality

The futures so bright you’ve gotta wear shades
Thank You