

Stanford University EE 402A “Can You Feel Me Calling?”



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Goals of this presentation

- Introduction to (programmable) haptics
- Introduction to Immersion
- Technical overview
- Demonstrations
 - TouchSense® Programmable Rotary Controller
 - TouchSense® Tactile Touchscreen
 - VibeTonz™ System

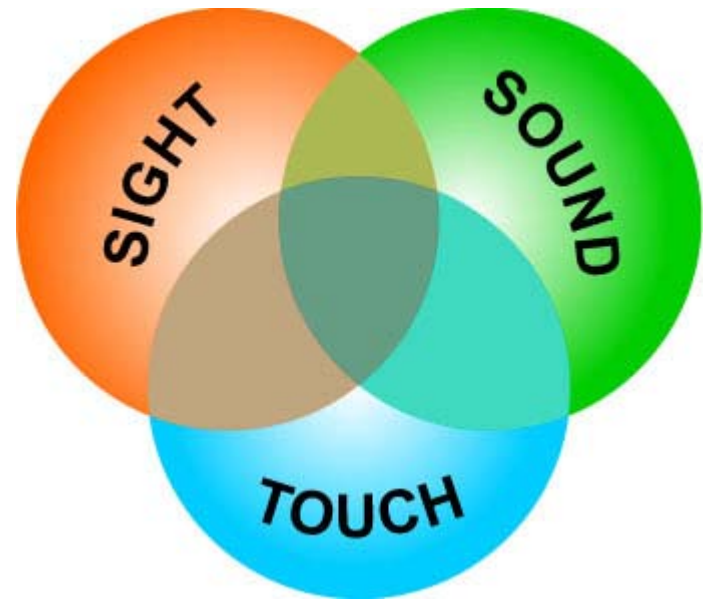


What is Haptics?

Haptic technology enables digital systems to engage the sense of touch for greater realism, accuracy, and performance

A multimodal experience combines one or more senses to:

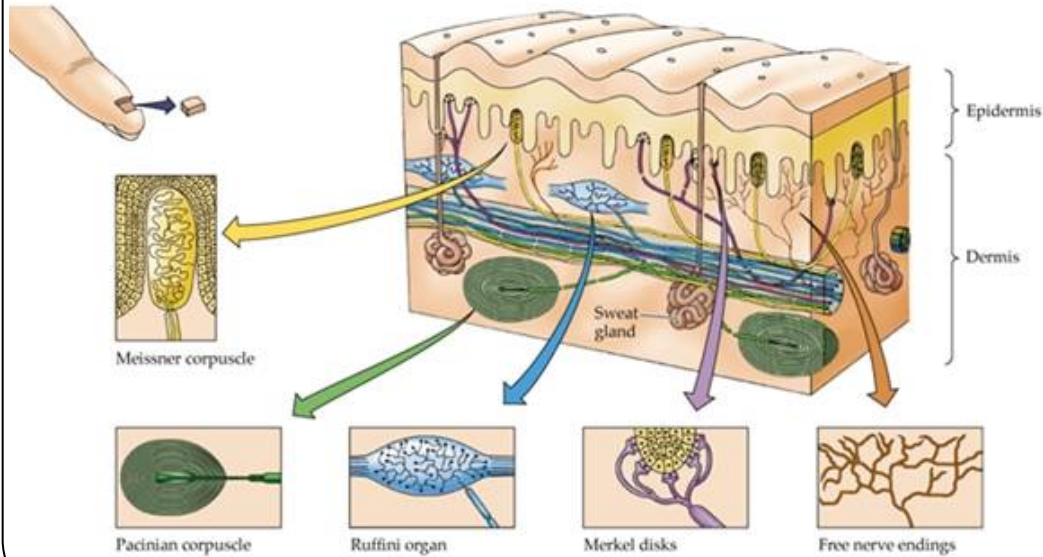
- **Provide greater realism**
- **Support intuitive operation**
- **Make the interface more fun and engaging**
- **Allow faster recognition and response**
- **Mitigate environmental distractions (e.g., noise, glare)**



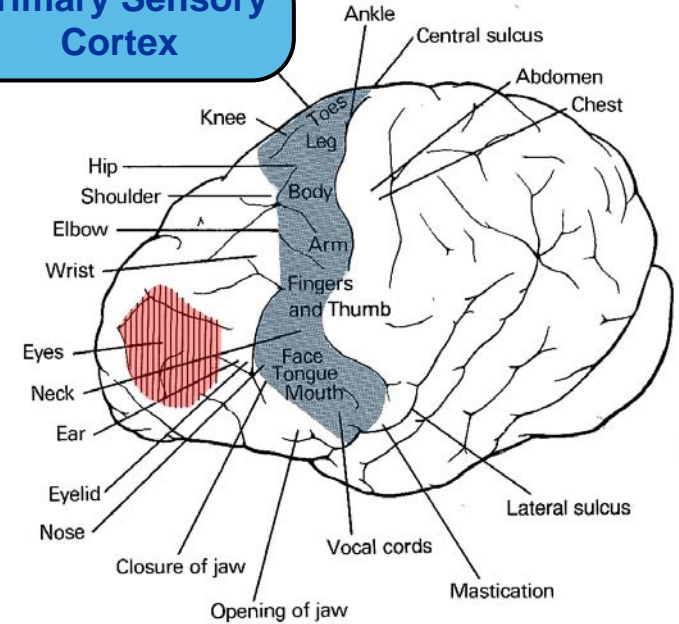


The Physiology of Touch

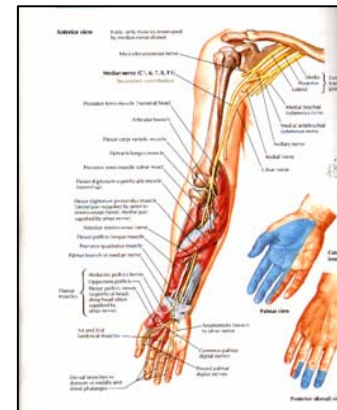
Mechanoreceptors



Primary Sensory Cortex

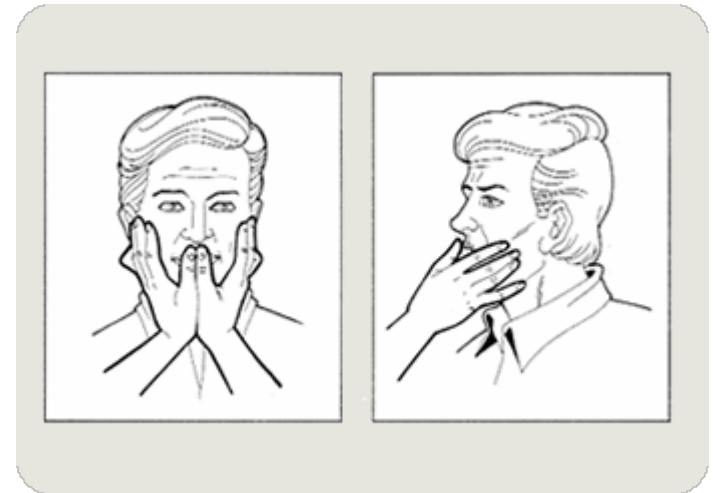


- Work together to inform us about pressure, texture, stretch, motion, vibration



The Sense of Touch

- **Everyday Tasks**
 - Dialing a phone
 - Playing a guitar or piano
 - Finding a light switch
 - Feeling your cardiac pulse
- **Touch is complex:
Tadoma, Tying a shoelace**
- **Only bi-directional
communication channel –
both input & output**



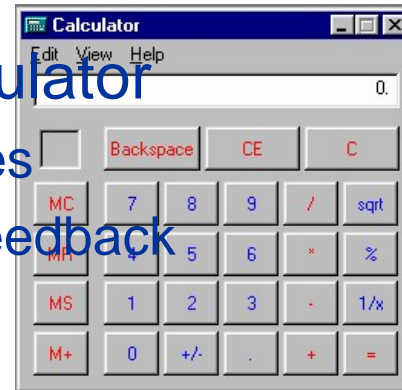
Why is Touch Important?

- Touch-tone phone
 - Rich tactile cues
 - Can be done without looking
 - Effortless



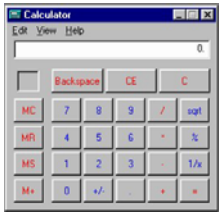
■ Windows calculator

- No tactile cues
- Only visual feedback
- Painstaking



New HMIs are putting the primary sensory cortex to sleep!
Haptics reverses this trend and restores real-world comprehension

Why is Touch Important in Learning?



Surgery 1997

We learn and comprehend through seeing, hearing, and **feeling**, so ...

Haptics is an essential but often missing component of today's computer-aided training and learning



Touching is Believing

- Haptics is an input channel – tactile and kinesthetic
- Haptics intrinsically related to motor skills. You feel when you reach.
- Programmable haptics requires real-time rendering calculations, motors and often sensors.
- Programmable haptics is a new media, complementary to audio and graphics.

- Touching is believing
 - Circulate the PR-1000 handheld device.
 - Click to change the effect (see the LEDs changing), then rotate to feel.



PR-1000





Immersion

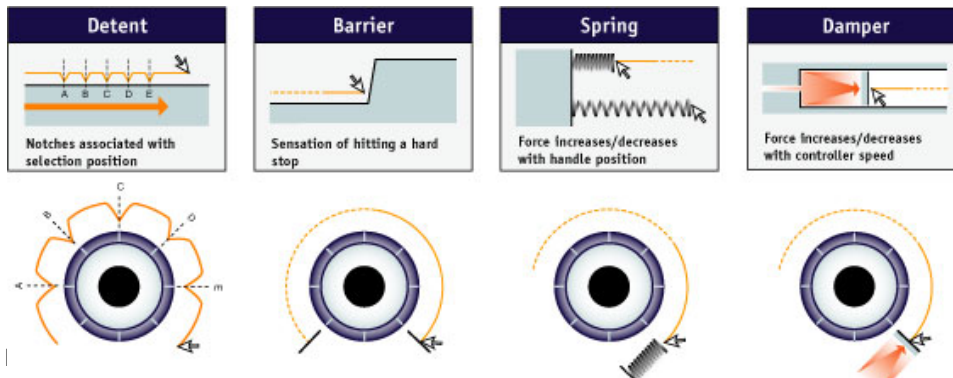
Rotary Controls

■ Breakthrough TouchSense® rotary controls technology for industrial interfaces

- Programmability allows context sensitive control, user configuration
- Many types of controls in one space-saving device
- Simplification of inventory and installation, field configurable
- Control actions not possible with mechanical devices

■ Applications in

- Military
- Aerospace
- Test and measurement equipment
- Sound and video editing equipment
- Industrial machines





PR-1000 Demonstration Unit TouchSense® Programmable Rotary Module

- Push the knob to cycle through effects
- Turn the knob to feel the effect
- Program with Immersion Studio® for PR-1000



Continuous



Continous



Barriers



Barriers with small detents
and large center detent



Barriers with small
and large detents



Immersion Profile

Immersion engages the sense of touch in the digital world to communicate, control, navigate, train, or just for fun

- **Diverse product and technology portfolio**
- **Core expertise in haptics, the human-machine interface (HMI) design, simulation, and medical training**

Founded	1993
Employees	125+
NASDAQ	IMMR
2004 Revenue	\$23.8M
12/31/04 Cash Balance	\$25.5M
Locations	San Jose, CA Gaithersburg, MD Montreal, Canada

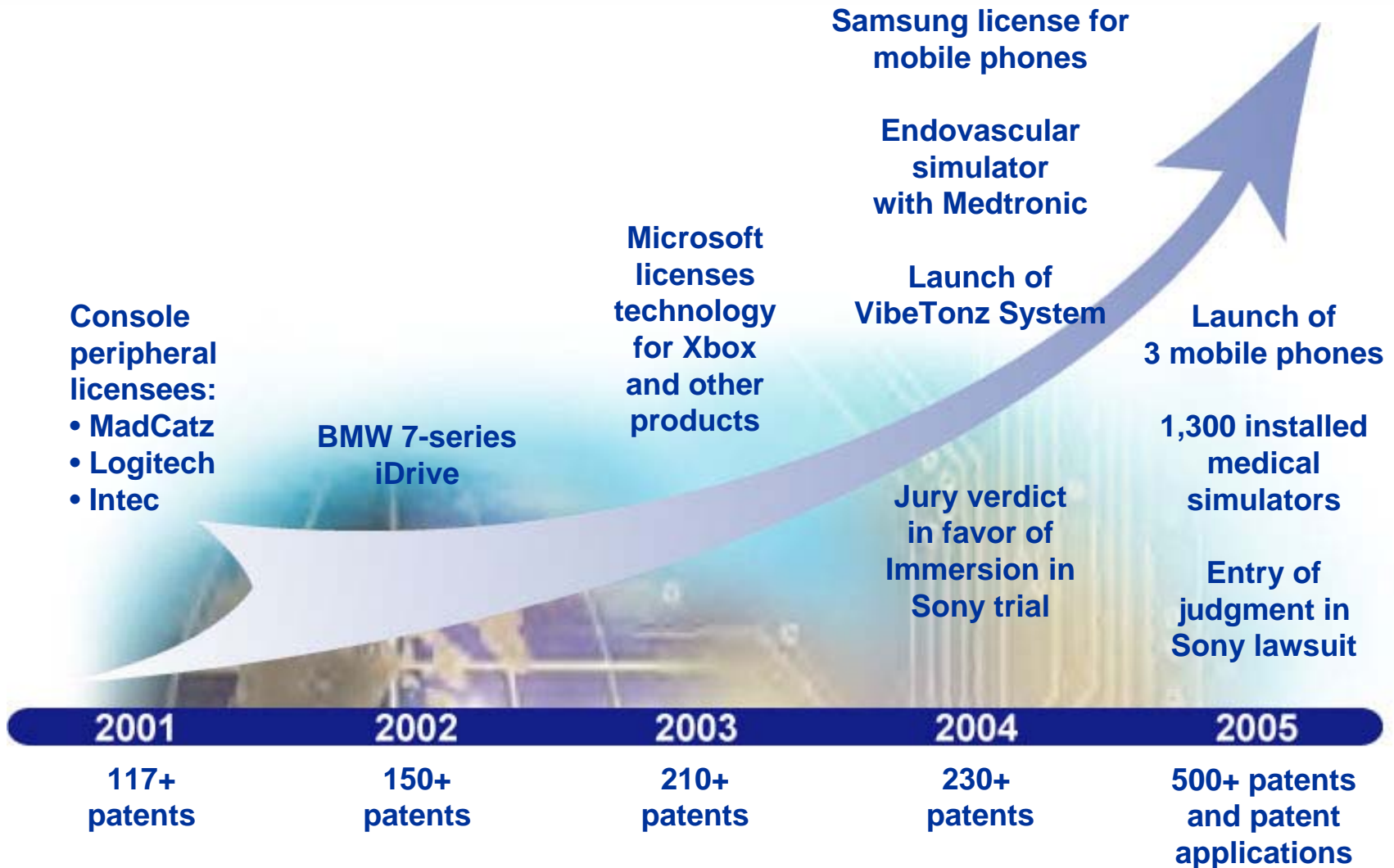


Key Business Relationships





Immersion Milestones



Solution Benefits

COOL FACTOR

VALUE FACTOR

CONSUMER

ENTERTAINMENT

- More engaging
- Added realism
- “Aim better, drive faster, fly farther”



Logitech MOMO Racing Force Feedback Wheel

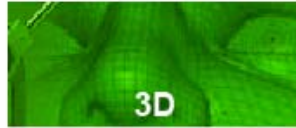


MOBILITY

- Improved interactivity
- Increased personalization
- More realistic and fun
- Intuitive user interface



Mobile phone with VibeTonz™ System



3D

- Affordable, portable digitizing
- Efficient, cost-effective measurement and inspection
- High-resolution simulation
- Virtual prototyping



CyberGlove® device and VirtualHand® for CATIA software



AUTOMOTIVE

- Reduced driver distraction
- Sleek interior design
- Reduced inventory costs with control consolidation
- Flexible and upgradeable



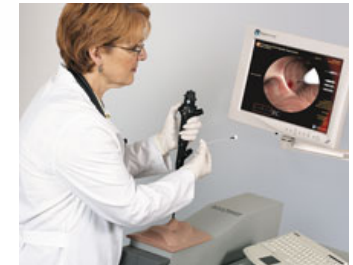
BMW iDrive



MEDICAL

MEDICAL

- Realistic training experience
- Effective skill maintenance and assessment
- Reduced OR time, costs, and medical complications



Endoscopy AccuTouch® System



Trends Driving Adoption

TREND	PROBLEM	SOLUTION
■ Cool, compelling entertainment	Provide enjoyable, immersive experience	Engaging touch sensations are new, cool
■ Entertainment going mobile	High expectations for experience on numerous smaller platforms	Full-fidelity haptics adapted for mobile platforms
■ More electronics, more features	Complex user interfaces	Intuitive haptics enhance usability
■ All digital controls	“Human touch sense” lost	Recreate/enhance “mechanical” feel
■ Computer-based training	No realistic or hands-on experience	Medical training simulators supply hands-on realism

Haptic System Components

■ Actuators

- Selection of actuator type
- Design of customized specialty actuators
- Actuator testing and certification
- Transmission design

■ Sensors

- Design and integration

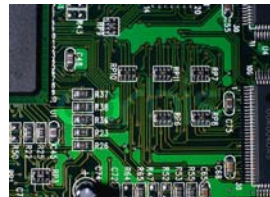


■ Control Software

- Embedded software
- Real-time haptic algorithms
- API (Application Programming Interface)
- Device drivers
- Closed-loop and open-loop controls
- Multiplatform support
- Communications software

■ Electronics

- Microprocessor
- Power electronics
- Communication interface



■ Haptic Effect Authoring Tools

- Windows-based, easy-to-use GUI developer tools
- Libraries of haptic effects
- Tutorials and documentation



■ Expertise in Physiology of Touch

■ Expertise in Multimodal User Experience

- Integration of touch with sound and graphics
- Synchronization
- System architecture



Gaming Products





Gaming Product Examples



- Numerous force feedback gaming products are Immersion licensed
- Haptics provides a more engaging and immersive experience
- More than 750 game titles



Immersion

Arcade and Amusement Force Feedback Controller

- Microprocessor based controller for advanced force feedback steering wheels and joysticks, resulting in **better, more exciting games**
- Microsoft Windows DirectX compatible
- Complex force feedback processing is offloaded from the main processor
- 1 axis (wheel) and 2 axes (stick) devices supported through on-board amplifier, up to 5A per channel
- USB host communications
- 4 axis of analog (potentiometer) input;
2 axis of quadrature (encoder) input;
12 programmable digital I/O (switches)
- **Many 1000's of controllers already sold!**





Space Flight Simulation Disney Epcot Center's Mission Space



Medical Simulator





Immersion

Immersion Medical Products

Needle Base

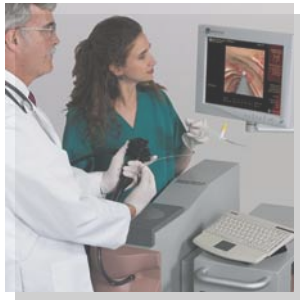
- Large user group: Nurses, MDs, EMTs, phlebotomists, aides & techs
- Variety of patient types: adult, pediatric, geriatric
- Immersive: case history, feel of needle stick, patient response, performance metrics



**CathSim®
AccuTouch® System**

Endoscopy

- Single platform for bronchoscopy & upper and lower GI
- Ten modules, 62 diagnostic and therapeutic cases
- Strong clinical validation
- Extensive didactics, virtual attending, patient responses



**Endoscopy
AccuTouch® System**

Endovascular

- Realistic training for life-saving procedures – angioplasty, pacing
- Real tools, supplies, and equipment
- Many pathologies extend user experience
- Suitable for team training



**Endovascular
AccuTouch® System**

Hysteroscopy

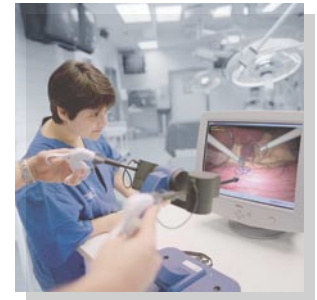
- First in the industry
- Trains existing physicians on new medical procedures
- Supportive training for possible alternative to hysterectomy



**Hysteroscopy
AccuTouch® System**

Laparoscopy

- Training for minimally invasive procedures: gynecological, surgical
- Realistic force feedback interface
- Proficiency and skills assessment exercises supported



**Laparoscopy
AccuTouch® System**

Haptics in Medical Simulation

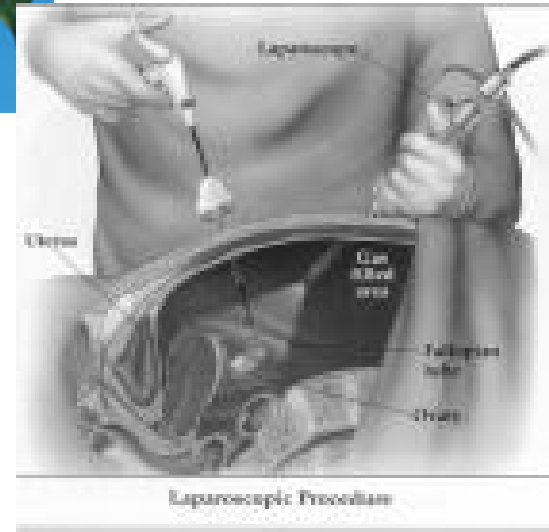
■ Simulators before Haptics

- Fruit
- Animals
- Cadavers
- No Touch



■ Trends Towards More Reliance on Touch

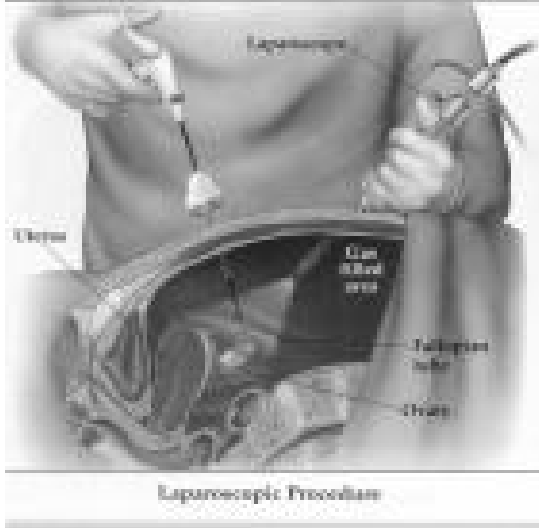
- Laparoscopy
- Endoscopy





Haptics in Laparoscopy

Immersion



Automotive Products





Immersion – Automotive Business BMW iDrive

Immersion



Control Display

BMW ASSIST Communication OB data PARIS

Climate



Navigation

Change menu:
Push

Disable display:
Press

Settings Entertainment Help 05.09.2001 15:05

Controller



BMW Assist Communication On-board data

Climate Navigation

Settings Entertainment Help

- Shipping in
 - 2002 in BMW 7 Series and VW Phaeton
 - 2003 in Rolls Royce
 - 2004 BMW 5 & 6 Series



- Nissan Concept Car
- Haptic Touch Panel

Tactile Touchscreen



The device
The specifications



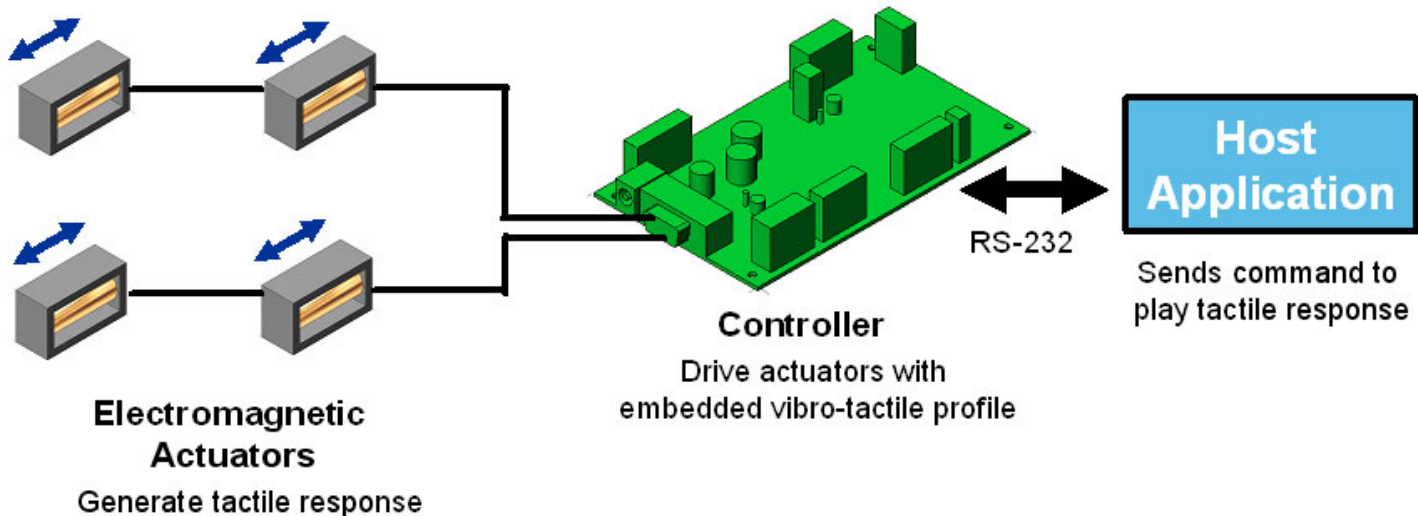
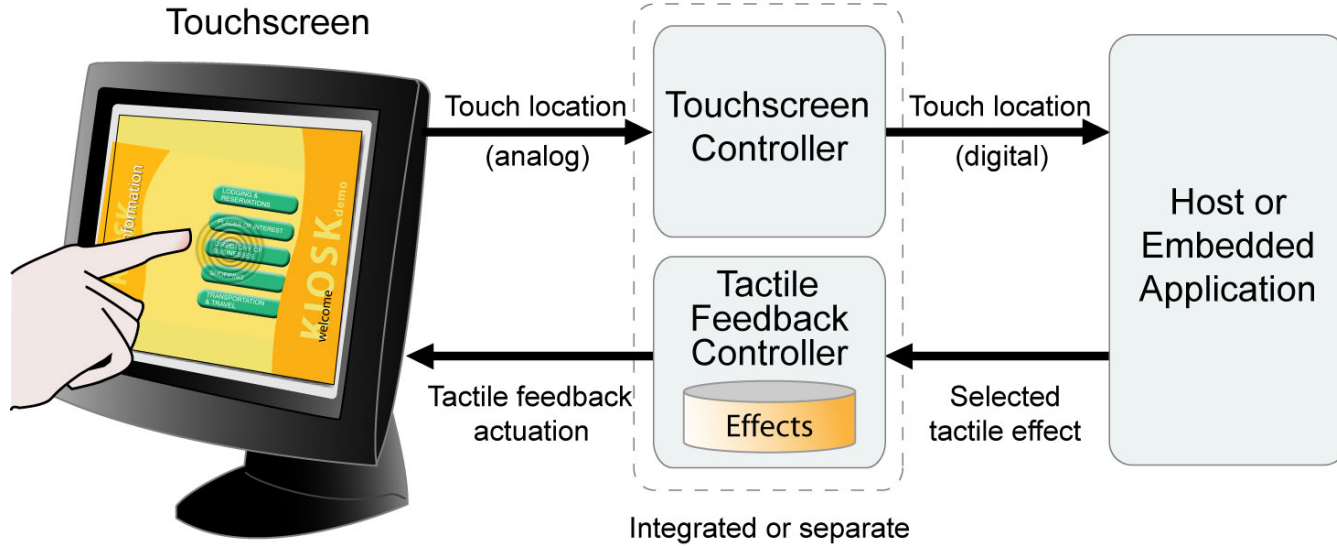
Tactile TouchScreen



Target Markets:
Kiosk, ATM, Point of Sale, Gaming,
Automotive, Machine Control

- Creates the perception of pressing physical buttons
- Provides fast, tactile response that can be synchronized with sound and graphics for a more intuitive, multisensory experience
- Enhances usability in noisy and distracting environments
- Works with a wide range of touchscreen sizes and technologies

Tactile TouchScreen Technology





TouchSense® Specifications

Monitor Specifications

Construction

- Heavy duty steel chassis

Bezel

- Plastic

Mounting

- Panel mount

Input Signal

- HDB-15 video connector

Control

- Rear access OSD buttons

Power Supply

- External power adapter, 12V/5A

Dimension (WxHxD)

- 9.6"x7.8"x1.4"

LCD Specifications

Display Type

- 8.4" color TFT LCD display

Resolution Capabilities

- VGA, SVGA, XGA

Pixel Pitch (mm)

- 0.167 x 0.167

Max. Color

- 256K

Luminance (cd/m²)

- 300

Viewing Angle

- H: -60°, +60°
- V: -40°, +50°

Touchscreen Specifications

Type

- 4-wire, analog resistive

Transparency

- >79%

Lifetime

- More than 1 million touches

Operating Pressure

- <40g average for finger

Integrated haptic/touch controller

- RS-232 interface

Environmental

Operating Temperature

- 0°C to 45°C

Storage Temperature

- -20°C to 60°C

Shock

- 100G



Tactile Touchscreen Demonstration

VibeTonz™ System





Immersion

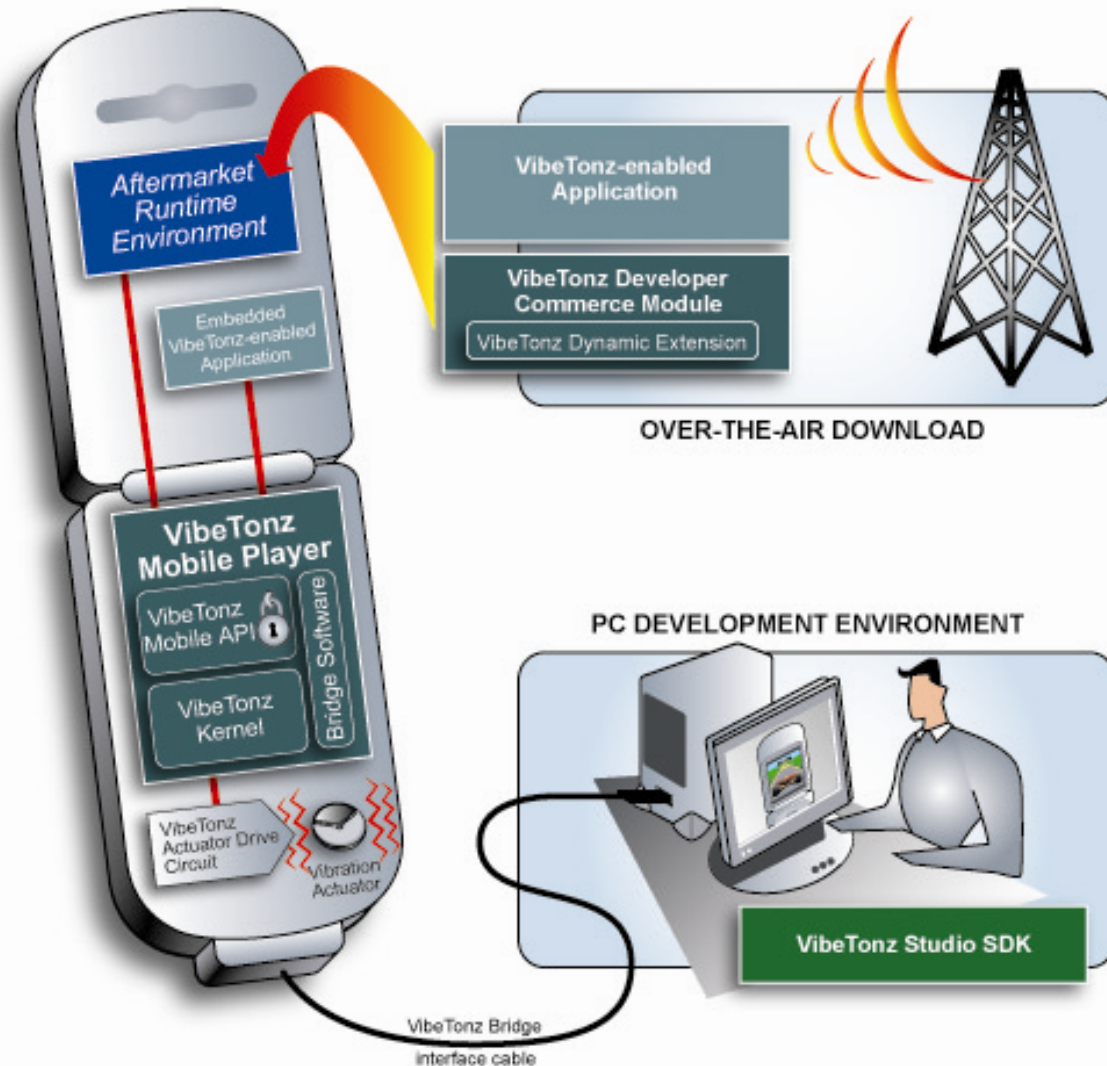
History of Success

Enhancing Mobile Games From Game Peripherals to Cell Phones



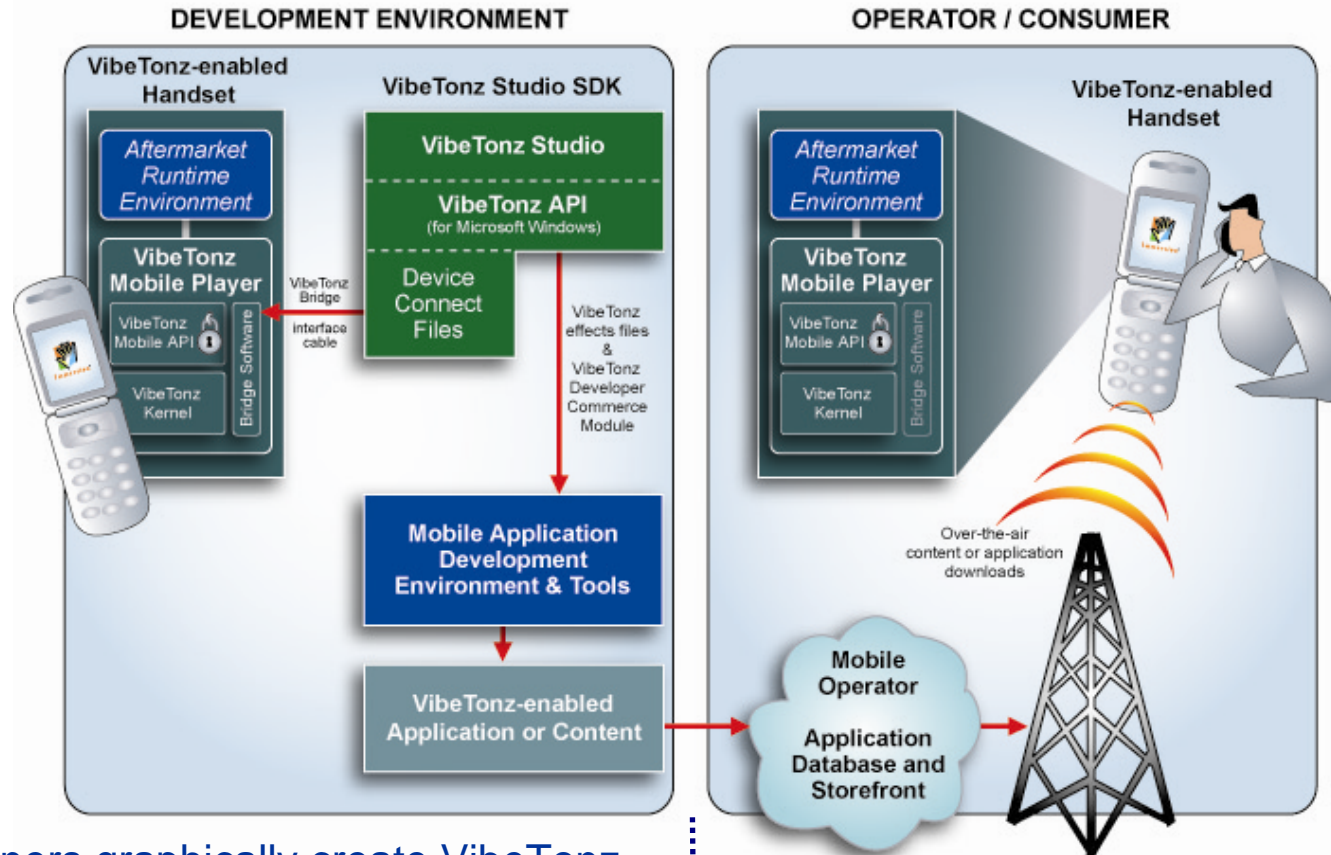
Immersion VibeTonz™ System

VibeTonz™ System Components



Immersion VibeTonz™ System

VibeTonz™ System Deployment



- Designers graphically create VibeTonz effects
- Embed VibeTonz effects in applications
- Rich tools for sound import & synchronization

- VibeTonz Mobile Player in phone
- Developer access through existing infrastructure

■ User Value

- Enhanced communications experience
- More realism and fun
- Increased personalization
- Greater functionality and productivity



Current Applications

- Downloadable content
 - Ringers
 - Games
- User Interface
 - Dialing and operational cues
 - Alerts
 - Menu navigation cues

Future Applications

- Data services
 - Messaging (SMS to MMS)
 - Location-based transactions
- Other
 - Music
 - Streaming video



VibeTonz™ Mobile Handsets



Samsung
SCH-G100
SPH-G1000

Samsung SCH-N330





VibeTonz™ Studio SDK

Immersion VibeTonz Studio - [Untitled1]

File Edit View Playback Window Help

Generic Virtual Device

Component Time Repeat

RingerSample1_Signals

Overrides

Start Time ms

Magnitude

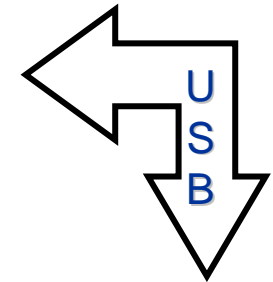
Duration ms

Speed

Period

Zoom In Zoom Out

Ready CAP NUM



VibeTonz™ System Demonstration



Q&A



Touch for Gaming



Touch for Mobility



Immersion®



Touch for Medical



Touch for Industrial



Touch for Automotive