Wireless Health

• The convergence of wireless, microsensor technologies with medical sciences
  • Fundamental advance in healthcare quality and accessibility

• Deliver healthcare:
  • Adapted to each individual
  • Continuous and global

• Wireless Health Institute
  • Leadership at UCLA
  • Campus-wide collaboration
  • Industry and community partners
Wireless Health Institute (WHI)

- **Campus Community**
  - School of Medicine
  - Medical Center
  - School of Engineering
  - School of Nursing
  - School of Public Health
  - College of Letters & Science
  - Anderson School of Management

- **Unique approach**
  - End-to-end integration from sensing to medical informatics to call center
  - Develop and verify new healthcare methods and services
  - Establish standards for efficacy, reliability, interoperability, and security
Example Area

- Health and Wellness Promotion
  - Nutrition and activity guidance for obesity intervention
  - UCLA HMO program
- Geriatric Health and Wellness
  - Fall risk reduction
  - Activity promotion
- Community Health
  - Substance abuse intervention
  - Contraceptive management
  - Stroke rehabilitation in underserved communities
- Disease Management
  - Neurological disorder detection and treatment management and control
  - Clinical trial support for advanced capability and efficiency
- Pharmaceutical Management
  - Development of anticoagulant and hypertension management dosage guidance systems

About 30 faculty across UCLA, 50 Graduate students, 10 clinical trials, advising about ten companies, ...
EHSR: Electronic Health Signal Record
Signal Search Engine for Every User

Subject Wears PAM

Guidance (Physician, Subject Guardian) via Web, email, SMS, voice call, others.

Subject or Guardian: USB or Local Wireless

Data Transport

Signal Search Engine Archiving, Classification, Analysis
All WHI Platforms Supported

- PAM
- SmartCane
- SmartShoe
- Smart Wheel Chair
- User Platforms
- WHI PAM Connection Server and Database
- UCLA Medical Informatics Gateway
Project: No-pain-no-game
Facts about Child Obesity

• Children aging 8-18 spend more time (44.5 hr/week) in front of computer game screens than any other activity except sleeping.

• 30.3% of children (age 6-11) are overweight and 15.3% are obese.

• A study shows that the group that lessen their time watching TV and playing video games (7 hr/week) had a significant reduction in body fat compared to other groups (21 hr/week).
Obesity in China

• The rate of obesity in China has increased by 97% in 10 years, according to a government report.

• Altogether, around 200 million people are thought to be overweight, 22.8% of the population, and 60 million (7.1%) obese.

• Health officials have been blaming diets too high in fat and a decrease in physical exercise.

Wang Longde
Chinese vice health minister

The Chinese population does not have enough awareness and lacks knowledge of what is a reasonable nutrition and diet
Our Goal

• Encourage children to engage in exercise in exchange for home entertainment.
• Solution: PAM + automatic TV /PC controller
Gaming for Health
Gaming for Health:

- Eight prototypes, 4 patents
- (Soccer) Ball of Fire, I am Mario, Penguin, Stage Presence: Guitar Hero, DDR, FPS
Gaming for Health: DDR
A Maryo State of Being
by: Jonathan Garcia (jgarcia@cs.ucla.edu)

Problem
• To promote more active lifestyles through video games.

Solution

Marketability
• 195 million Mario games sold
• 40.24 million copies of Super Mario Bros. (NES) sold
• Over 56 million Nintendo Wii units shipped worldwide
• Over 20 million WiiFit units sold

Experiments
• Normal Game Play
  • Reached Level 3
  • 100% Sedentary
• Active Game Play
  • Reached Level 3
  • 90% Fast Walk
  • 273 Jumps Registered
  • Jumping rope: ~11 cal/min.

Challenges
• Signals lack “history”
• Signal analysis & pattern recognition
• Cheating prevention

Intellectual Property
• Finite state machine model for interpreting and reproducing realistic movements as video game actions.
Project: WANDA B.
(Weight and Activity w/BP Monitoring System)
WANDA B. Weight/BP/Glucose Monitoring System

• Weight, Blood Pressure, and Blood Glucose can be monitored by Ideal life Manager™ at home.
• Ideal Life Pod™ receives data from Ideal life Manager™ systems via Bluetooth.
Smat Insole: MediSens Wireless
Platform technology

- Sensors
  - Flex, pressure, pulse
  - Temperature, heart rate
  - Galvanic skin response
  - Accelerometer, oximetry, etc.
- Medical motherboard
- Communications and processing in a small package
  - Station software (PDA, cell phone, iPod)
  - PC software (caregiver’s office)
A pressure sensing Orthotic to alert patients and/or their caregivers when blood flow may have been compromised to the point where serious injury may occur.
PressureAlert™ Orthotic System

- Detect conditions that cause diabetic ulcers
- Designed for 21M diabetic sufferers in US
- Addresses neuropathy – loss of sensation
- Already covered by insurance and Medicare
- 90,000 amputations* of diabetic patient’s toes/feet/legs were required last year
Assistive Devices in Geriatrics

- Health promotion and disability prevention measures are critical for aging population
  - UCLA Geriatrics national leadership along with HSSEAS research
- Wireless Health application thrusts
  - Fall prevention
  - Falls are leading cause of death due to injury above age 65
- Activity management for health promotion
  - Proper exercise has been shown to be an intervention for Alzheimer’s disease
- Assistive technology needed
  - Enable monitoring and promote proper guidance for patients, caregivers, medical professionals
Assistive Devices in Geriatrics

- **Smart Cane System**
  - Detect proper and improper (potentially hazardous) motion

- **Sensing**
  - Acceleration, rotation, forces (handle, tip, shear forces)

- **Computing**
  - Classify proper and unsafe usage regimes
  - Detect events including encounters with obstacles, slip events
  - Classify individualized activity level

- **Communication**
  - Provide notification
  - Enable guidance
Smart Textile Surface
Smart Glove
Smart Textile Surface: capable of object recognition

- Objects placed on this surface would produce variable resistances at different elements of this sensor array.
- In the learning phase, the surface learns about various objects, placed on it.
- In the recognition phase, image processing algorithms are applied on the resulting grayscale image from resistances at each pixel.
Smart Textile Glove

- Bend sensors using textile technology is placed on fingers.
- Finger shape and movement can be detected.
- Data transmitted wirelessly to access point for analysis.

Applications: object recognition for blind, remote control applications (e.g. mouse), medical therapy, ...
Summary: Wireless Health at UCLA

- Wireless Health Institute at UCLA is recognized leader
  - End – to – end research
  - Multidisciplinary teams
- Dedicated to establishing a Wireless Health research and business community founded at UCLA and growing in Los Angeles