EADLS: ELECTRONIC AIDS FOR DAILY LIVING

Mary Ellen Buning
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Learning Objectives

• Understand how a home Wi-Fi network along with other wireless computing technologies allows control of home devices and appliances
• The three transmission technologies and which works best for a type of device
• Have the courage to explore apps and hardware for iOS & Android devices for increased control of home devices
• Other types of AT devices that can send IR, RF and house wiring signals to enable control of the environment
• Locate online resources that will enable you to learn more
Why did I think this might be important?

• You are here because you are highly motivated to have a life with the best “quality of life” possible
• You like “being in control” and for you that means you most likely believe:
  • Knowledge is power
  • There must be another way
  • Maybe this wheel has already been invented

• I work with individuals who have spinal cord injuries and my goal has been to give them back some control over their daily lives and their environment
• I think you may have some issues in common
The back story

• In the past… EADLs have been very expensive
  • $10,000 for some devices
  • Required technical skill and extensive time for set up

• Now we have home Wi-Fi, tablets, smart phones and plug and play devices
  • Costs are lower because they were created for home automation
  • Expertise can be you local “technology geek” or even your grandkids

• It is now common for new power wheelchairs to be capable of sending IR or Bluetooth signals which will allow control of computers, smart phones and tablets

• Be prepared… even more innovations are coming
Let’s get some terminology

• Whether you call it:
  • Home Automation
  • Electronic Aids to Daily Living
  • Environmental Control

• The goal is to have an alternative way to control things in your everyday environment

• Society and technology progress are cooperating!

• We now have technologies and concepts like …
  • GPS, Wi-Fi, plug n’ play, streaming video, etc.
Transmission Modes

This is the electromagnetic energy spectrum. Electromagnetic energy travels in wave-like forms i.e., high frequency to low frequency with varying performance characteristics.
EADLs use various “Transmission Modes:”
Electromagnetic (EM) Radiation

- The FCC designates which part of the EM spectrum will be used for specific types of communication
- We use only a small part of the spectrum when we try to control home electronics:
  - InfraRed or IR – TV remote, boom box, DVD player, etc.
  - Radio Frequency – garage door opener
  - House wiring – the electrical supply for a home or apartment, electrons are moved through the house wiring
  - WiFi – a longer range wireless signal
  - Bluetooth – short range (30 ft.) wireless signal
  - Zigbee – a short range, (33 ft.) wireless signal
Match the control with the device

- Example: Controlling a TV
- The EADL device will need to send IR
- What are the most important features to control?
  - Just On/Off and 3 channels?
  - Or… All possible TV channels, plus volume up/down and mute?
  - Want to scroll through channels or input the numbers?
- The more options to be controlled; the more complex the device and the user interface need to be
- Another Example: Opening a garage door
The “Infrastructure” is now ready!

- Different from 10 years ago, home automation is now a “mass market” product for consumers
- The technologies are currently available and new ones arrive every day
- Products exist to manage
  - Lights on, off and dimmed – both plug in and house wiring
  - Thermostats
  - Entertainment devices
  - Security cameras
  - Irrigation
  - Control through small hand held devices or through computers, smart phones and tablets… Next? Smart wrist watches?
Lets see an example

A battery powered 360 degree infrared (IR) sender that communicates with a iPhone, Android or iPad app by Bluetooth using a free app for developing screens to interact with your specific TV, speakers, DVD, or music player

http://www.youtube.com/watch?v=Zwi1NkmP_6
Here is how you get started…

• What do you want to control & what is the current user interface?
• Why is control not possible?
• Observe and think about why:
  • Motor control?
  • Sensory?
  • Cognitive?
  • Or is it a combo?
• Given current skills and abilities, is the best solution a compensation or finding another way to do it?
• Begin a “needs list” and start to check out options!
What do you want to control?

- Something with a simple ON/OFF
  - Light
  - Fan
- Something with multiple or variable features
  - Volume
  - Channels
  - Tracks
- Something that uses a combination of functions
  - Satellite dishes
  - Downloaded Internet videos
Client Needs Evaluation

• What do you want to control?

Once you have some ideas about this…. You are ready for the next step!
Client Needs Evaluation

- Think about your daily environments

- Locations of user?
- Are you mobile?
- Locations of devices?
- Mounting/positioning equipment
- Do you have technical supports?
- What’s your budget
Hierarchy of Access

- The objective? Use the least amount of technology necessary to do the job!
- First, look at task ergonomics:
- Then seating, positioning, and mounting
- Consider “universal design” or device accessibility options
- Use “performance enhancers” i.e., a stylus, a mouthstick, a splint or rubber “bumper”
- Use general purpose hardware or software: like iPhone and iPad apps and a “transmission technology”
- Special or “adaptive” hardware, software or devices (we will talk about some of these)
An example: “User Interface”

- Standard Controls: Think of a TV remote control or the dials, push buttons, and tuners on a stereo receiver
- If someone can manage these; no help is needed
- If they cannot, what is needed to make control possible?
  - Larger targets?
  - Smaller range of motion?
  - Better positioning to enable use of available motor skills?
  - More friction? More resistance to involuntary movement?
  - More contrast? More light?
  - A smaller set of choices or options for control or for simplicity?
Larger targets?
Better positioning?

Or more perhaps a more realistic solution: use Velcro® to attach typical TV and appliance remote controls to a “just the right size” pillow!

A Remote Control Pillow
A mounting arm?

An n-clamp for Phone

21st Century Scientific
A better way to accurately select

• Capacitive Touch Stylus

Replicates the small electrical field that is created by the touch of a finger tip on a capacitive touch screen
An Adaptive “User Interface” or the Assistive Technology

• A progression of “alternate” controls by Hierarchy of Access
  • Optimal positioning of the control device
    • An easel
    • A mounting arm
    • Attach a typical device remote to a pillow with Velcro®
  • A larger keypad – Large button remote
  • An existing device – AAC device or power wheelchair
  • Smartphone or tablet
    • A hand sock
    • Stylus
    • Modified stylus
    • Mouthstick
  • A dedicated device – Imperium
  • A “scanning” interface – Mini Relax
Match the user interface with user’s ability

- **Example:** Controlling a TV
- **Options:**
  - Placing a typical remote on an easel or AbleNet arm?
  - A large button universal remote?
  - An iPad with a Gear 4 Unity remote
  - A Relax or Mini Relax from AbleNet

More fine motor skill required, but can use adaptive stylus & positioning

Only gross motor skill required
Let's talk about some products… and why I like them!

- X-10 and Insteon lamp and appliance modules
- AbleNet Power Link4 with Jelly Beamer Switches
- AbleNet Mini Relax and Relax
- Gear4 Unity Remote paired with iPad or iPhone
- Belkin WeMo
- Capacitive Touch Stylus options
Transmission Technology: X-10

- **X-10**
  - Uses the current in the AC house wiring to send a coded signal to a module
  - Developed as a mass market so its low cost
  - Many controller options
  - Many module types
X-10 & Insteon Modules

- The signal pathway is the house wiring
- Can be slow, found to be less reliable as expectations for electronics increased; now being replaced with more robust signaling

Purchase at Smarthome.com and x10.com
Transmission Technology: Infra-Red

- Commonly used for entertainment appliances
  - Controller has code for many functions
  - Direct interface to commercial devices
- Line-of-sight
- Trainable
- Many signals available
Teachable Infrared (IR)

- Most older universal remotes
- Alternative Augmentative Communication Devices
- Power wheelchairs
  - You will need the original remote control
  - Put the EADL device in “learn mode”
  - Follow instructions to teach the IR code for each function
- Less common devices to be controlled with Unity Remote
- Not necessary with newer appliances as you can get access to a database of IR Codes, e.g., a Panasonic TV w. DVD
AbleNet Relax and Mini Relax

- Scanning interface
- Mini-Relax: Simple for control of one technology
- Relax: Complex for control of several
- Need the skills for scanning and literacy
  - Sequence or read options
  - Timing for switch hit
  - Adjustable scan rate
  - No auditory feedback only LED
Gear4 Unity Remote paired with iPad or iPhone or Android

- Multiple options for set up from simple to complex
- Enables control of two part sequences
- Has a database of common appliances
- Can learn novel IR code
- Cost about $70.00
  - Free app
Gear4 Unity Remote paired with iPad or iPhone or Android

- The Unity remote sends IR signal in 360 degrees
- Set up is easy
- Communicates with iPhone/iPad and Android via bluetooth
- About $80.00
Belkin WeMo

- Each WeMo has its own IP or Internet address
- Can be integrated into a home Wi-Fi network
- Plug in a device and control it remotely with an app
  - Coffee pot
  - Curling Iron
  - Fan
  - Lamp
  - Humidifier
  - Space heater
- About $50.00
Capacitive Touch Stylus options

- Enables or improves fine motor control
- Improves accuracy
Mounting Wi-Fi Devices

- Loc-Line Modular Hose
  - Commonly used in manufacturing processes
- AT kits
  - Very inexpensive placement of AT device
Mounting Wi-Fi Devices

An n-clamp for Phone

21st Century Scientific
Mounting Wi-Fi Devices

- iPhone and iPad mounts by Stealth Products
- Highly adjustable but static device mounts
- http://www.stealthproducts.com/
Mounting Wi-Fi Devices

- **Mount ‘n Mover** by Blue Sky Designs
- User controlled placement of AT device
- [http://www.youtube.com/watch?v=ZZiPj9LhNz4](http://www.youtube.com/watch?v=ZZiPj9LhNz4)
Wheelchair Control of EADLs

- Currently possible with Quantum, Permobil, and Invacare power wheelchairs
- For extra cost or with an upgraded controller:
  - The joystick is capable of sending IR signals for control of IR-controlled devices like TV, DVD & music
  - The joystick on all new Quantum power wheelchairs with Q-Logic2 controllers can send Bluetooth for mouse control on a computer or to select language on an AAC device
- The consumer uses the same user-interface technology that they use for driving (joystick, head array, or sip ‘n puff)
Bed Control

- No bed manufacturer makes it easy!
- Each bed/company requires its own solutions: Hill-Rom (AbleNet) or Invacare Adaptive Switch Laboratory (ASL)
  - Modify the circuits that are behind each function in a typical bed control touch pad, e.g., head up, head down, foot up, foot down.
  - Solder a connection to an IR receiver into the circuit for each bed function
  - Place the IR receiver in line of sight and use a device that can send an IR signal.
- Cost for EADL purchase = about $1000 to $1500
Paying for EADLs

• Cost versus Funding
  • Home automation is very exciting…
    • The cost is way down & availability up
    • More usable devices, easier to install and set up; easier to use

• Funding Sources
  • Health insurance - rarely
  • Auto insurance
  • Worker’s compensation
  • Medicaid waivers
  • Benevolent organizations
  • Vocational Rehabilitation
Remember to Think about Safety

- **Electrical**
  - Isolate the user from electrical circuits
  - What *not* to connect to an EADL
  - Be respectful of house wiring and circuit loads
  - Avoid power strip multiplication
  - Pay attention to device power ratings

- **Security or emergency back up system**
  - If safety depends on EADLs, be sure to use an Uninterruptible Power Supply (UPS)
Resources

- SmartHome
  - http://www.smarthome.com/
  - Learning Center: http://www.smarthome.com/learningcenter.html
- X-10.com – if you are not yet a Wi-Fi home
  - http://www.x10.com/
- Michelle Lange, OTR at Access to Independence has created an EADL comparison grid
  - http://www.atilange.com
- For more: search Google: using “Electronic Aids to Daily Living” and/or “Environmental Control Units”
Review of the Learning Objectives

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Questions?

Mary Ellen Buning, PhD, OTR/L, ATP/SMS
Frazier Rehab Institute
Assistive Technology Resource Center
220 Abraham Flexner Way
Louisville, KY 40202

• Phone: 502.407.3272
• Email: MaryBuning@KentuckyOneHealth.org
• For Appointments: 502.582.7660