OK-Net: An Oxygen Kiosk

OK-Net on 1st floor
“Under-the-hood”

Kiosk Specs

- Touch Screen Monitor
  - no stylus, yes finger
  - 3M 17” Monitor with built-in speakers
  - microphone array on top

- Small Computer (contained within kiosk)
  - Slimpro 300, Pentium 3, 1.4 GHz, 30 GB 2.5 disk

- Minimal Infrastructure
  - WiFi card, bluetooth USB dongle
  - Must be near WiFi base station & power outlet

- Hacker-Hardened
  - Linux, no console, reboots at any time

- Nothing Exposed except power cord
Computer behind monitor

All fits except power cord
Interaction Modes

- **General Public**
  - Information harvested automatically from web, email
  - Similar to browser: point-and-click

- **CSAIL Demonstration Platform**
  - Provides ability to highlight research demonstrations
  - Add peripheries as needed
  - Open to others via VNC on Kiosk (revert to Skinny when idle)

- **Adapt to user**
  - Kiosk is an extension of user’s digital world
  - Kiosk is an extension of user’s mobile devices
Finger as mouse

Bluetooth device as mouse
Interaction

• User input
  • touch & speech
  • phone and pda as remote finger
    • supports multiple users at once

• Information Transfer
  • sms and email (requires user id)
  • bluetooth connection-less (OBEX push)
  • bluetooth connection (requires authentication & authorization)

Why bluetooth?

• Short range, wireless communication
• Stable, inexpensive, mature
• Other choices:
  • IrDA: directional, line of sight
  • 802.11: too coarse grained
  • RFID: expensive readers
  • RF/US: more precise, too expensive
Device Groups

- **User must authenticate device with kiosk**
  - usually done via pin

- **One authentication should suffice**
  - pairing with one kiosk should enable pairing with any OK-Net kiosk

- **Want all my BT devs to belong to a group**
  - pairing with any one device, should allow pairing with any other

- **Group is a key pair (public/private)**
  - all group devices in group share the private key
  - device initial pairing returns BT address signed by this private key
  - this is used by device to pair with other group members

Device Groups

- **Group G**
  - private key: used to join members
  - public key: used to verify members
  - proof of group membership: BlueTooth Address signed by G

- **How to join a group**
  - device A joins; it gets (A signed by G), (Public G)
  - device A wants to prove to B that it is a member:
    - B has public G, can decode A
Guidance though building

- Stata is hard for a visitor to navigate
- Kiosk provides several guide modes
- Passive:
  - show & push map to bluetooth-enabled device
- Active:
  - guide user along the way
  - user must be identified along the way (face, rfid, cricket, bluetooth)

Phone or PDA gets applet
Create graph for each floor
Nodes: junctions or destinations

Compute path
Not always easy to follow the map (especially in Stata) Stata can follow you!

- **Bluetooth phone can be tracked**
  - kiosks and embedded microprocessors communicate and all scan for user's device
  - when found, they send update to device

- **Bluetooth phones in discover mode can be hacked**
  - “spamming” and “toothing”

- **Cricket has taught that**
  “It is better to receive than to give”

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**Trivial Deployment**

- **Identified 30 neighborhoods in Stata Center**
- **Every neighborhood contains computers**
  - does not matter if Windows, Linux, or Mac
- **Place bluetooth in a machine/neighborhood**
- **Name according to location, eg. “OKN-G868”**
- **Database learns name for each BT#**
  - Devices discover new BT#’s and update DB
Trivial Deployment

- Dongle is discoverable
  - no connection need actually be made
  - very simple deployment issues
- Device scans and updates location
  - first device heard is location, additional ones ignored.
  - after first device is silent for 15 seconds, start over

When hear BT dongle, update map loc
When hear BT dongle, update map loc

When hear BT dongle, update map loc
When hear BT dongle, update map loc
Some people cannot

- A “human-centric” navigation guide
  - without sound
  - without abstraction

- Picture reality
  - use graph
  - at each junction node, record pictures of path
  - user looks for the reality that matches image
Conclusion

• **Kiosks: new interaction model?**
  - are they just glorified web browsers?
  - interaction with hand-held devices
  - proximity provides simple, everyday protection

One month of usage, even on weekends

**Daily Pane Usage**

- Interaction Sessions
- Days (T W R F S S M T)
One day of usage,

Pane Usage Hourly

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Kimono: Kiosk-Mobile Phone Knowledge Sharing System

Albert Huang
Kari Pulli
Larry Rudolph
SIGGRAPH is confusing

- Big conferences are difficult to navigate
- especially SIGGRAPH (just too much going on)
- even the web page is huge
- not convenient to navigate from laptop or mobile phone while at conference
- do you really get connection always?
- fold-up printed programs work better
- but still don’t remind me where I should be when

What could I do with a smartphone?

- Pros
  - programmable information appliance
  - could have all the data there
  - it’s always with me
  - one-hand operation
  - it can remind me where and when to be
  - I can input data to it
    - text
    - speech
    - photos, video
  - might even know its location
    - from beacons (BT, WiFi)

- Cons
  - small screen
  - difficult text entry
  - no mouse for easy navigation
**How to get data into handset?**

- Two main options, really the same
  - get the information from the web
    - either directly to handset
    - or first to laptop, then to handset
- Still problems
  - the content has been designed to be accessed through a WIMP device
  - there’s too much information, much of it I just don’t care (and won’t have space for it all)
  - the potential capabilities of my smartphone don’t interoperate well with that data

**Kimono:** Kiosk-MObile phone kNOwledge sharing system

- Use information kiosk to access and mark information you are interested in
  - easy browsing and selection from a large touch-panel display
- Transfer the data to your handset
  - get a kiosk proxy that travels with you
  - phone is aware of the data, knows when and where events take place, can remind
- Bonus
  - use other phone capabilities to add and annotate the data, and share it
    - text, speech, photo, video
Key concepts for simple UI

Associations

- Associations are the key to information organization
  - avoids the tedium of selecting all the individual items, allows selection as a group
  - synchronization protocols can move closely related data together

- Two kinds of associations
  - topics, e.g., “MUM 2005”
  - individual objects (each object has a unique ID)
Association examples

- Associations enable automating decisions
  - Policies tell what is actually done

- Example policies
  - Fundamental object type
    - Gives precedence to a specific object type, e.g., events are more important than sound clips
  - Default associations at object generation
    - E.g., associate photo with the current event, or previously viewed event
  - Interested in
    - Items selected as interesting get precedence over others for display and transfer
  - Public / Private
    - Different rules to handle objects associated with special “private” or “public” objects
Kimono system

- OK-net rewritten fully in Python
  - since S60 now supports Python on handsets, the same core engine can run both on device and kiosk
  - different backends for databases on PC vs. phone
  - different GUIs for the Kiosk, phone, or laptop
  - anything that supports Python and Bluetooth can be a device

Kimono architecture
**Kimono data exchange**

- Information may flow
  - from kiosk to device
  - from device to kiosk
  - directly between devices
- Short-range connectivity via Bluetooth

**Data exchange**

- Steps
  - handshake
    - set up Bluetooth connection
  - offering
    - what is available (new since last exchange)
  - request
    - what the device wants from the offering
  - object upload
    - (wait...)
  - disconnect
  - done
Triage of data

- Not all data on kiosks is necessarily of interest, and
  - handset has limited memory
  - transmission of data takes time
- Mark items on the kiosk as interesting or not interesting
  - interesting ones get sent to handset
  - not interesting ones are ignored
  - the rest depending on policy

Getting information

- Operator input
  - the default way
  - does not scale
- Data harvesting
  - the system consults databases in the background
    - department event db
    - university general event db
    - weather forecasts
  - set up once, automatic after that
  - scales
- Contributions from mobiles (users)
  - users may contribute blogs, opinions, voting results, ...
Security considerations

- Security through physical access
  - websites are much more likely to be defaced because anybody can attack them from anywhere
  - bulletin boards are seldom defaced because access requires physical proximity

- Moderating kiosk content
  - can borrow concepts from wiki pages
    - some entries can be defined to be system / operator changeable only, others could be edited, others only added but not edited, ...

- Man-in-the-middle attacks
  - somebody could pretend to be the kiosk and hijack data
  - solutions exist: can display number sequences that work as keys, ...

Future work
Conference kiosk

• The basic system architecture implemented
• Conference information kiosk is an ideal application for Kimono
  • data of conference web site
  • program: schedule and rooms
    • may be updated during the event
  • handset reminds of interesting talks
  • associate notes, images, etc., with events
  • exchange virtual business cards
  • download the information to own laptop, create a personal “travel report”

Multimodal input

• Vision and speech groups at MIT have experimented with OK-net
  • e.g., video tracking can help the system to figure out when a user is talking to the system vs. a friend
  • perhaps port some of those capabilities to Kimono
Two messages

- A smartphone and an information kiosk together are more than either one alone
  - Kiosk is location-dependent beacon and storage of information with good browsing and data selection capabilities
  - Phone works as a smart mobile proxy for the kiosk, it’s with you, knows what you want to be reminded of, allows adding notes and data

- Key for simple UI on the phone
  - separate the policies (how to automate selections, etc.) from the framework (associations)