Ubiquitous Computing for the public

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Introduction

• Ubiquitous Computing
  – Aid daily tasks
  – Reduce complexity
  – Exist in background

• Progress
  – Experience gained
  – Technological advances

• Benefits mainly
  – Restricted to research community
Mobile devices

• Pervasive mobile information devices
  – Daily interaction
  – Widespread use
  \{ Mobile phones, PDAs, ...

• Benefits from using off-the-shelf devices
  – Large scale distribution
  – Growing market
  – Familiarity
The BlueReminder

- Objectives
  - Introduce ubiquitous computing
  - Target the widest audience
  - Use available consumer products
  - Focus on the interaction *between* people
  - Aid people in their daily tasks
The BlueReminder

• Background
  – People tend to forget things
  – Traditional technologies
    • Calendar
    • Notepad
    • Post-It note
  – ... are not always suitable!
The BlueReminder

• Scenario:
  – You need to remember something when you meet someone
  – Then
    - Calendar
    - Notepad
    - Post-It Note
The BlueReminder

• Virtual Post-it notes
  – Can be attached to anything identifiable
    • People, Places, Things
  – Conditional Triggering
    • Upon meeting someone / group of people
    • At particular time or place
  – Multimedia
    • Text, Sound, Vibration, …
  – Proven Concept
    • Stick-e Notes, FieldNote
The BlueReminder

• How does it work?
  – Preparing
    • Note is written
    • Triggering conditions are set (identifier, date, …)
  – Searching
    • Device searches for identifiers
  – Acting
    • Evaluate found identifier(s)
    • Issue reminder?
Architecture

• Chosen Technologies:
  – Mobile Phone
  – Bluetooth
  – J2ME (CLDC 1.0, MIDP 2.0)
  – Java APIs for Bluetooth (JSR-82)
Architecture

- Device discovery
  - JSR-82 API
    - DiscoveryAgent
    - Listener
  - Periodic discovery
    - Background thread
    - Inquiry → match → action
  - Manual discovery
    - Useful to add new contacts
Architecture

- Data storage
  - Persistent
    - Notes, contacts, settings
    - Separate record stores
    - Common access mechanism
  - Non-persistent
    - Device buffer (first in, first out)
    - Runtime variables
Architecture

• Graphical user interface
  – High-level API
  • Layout device specific
  • Optimised
  – Screen-based
Preliminary findings

- Tests performed on two popular types of mobile phones
  - A) High-end device
    - Large-touch screen
    - Symbian OS
  - B) Medium-range
    - Small screen (output only)
    - Vendor specific OS
Preliminary findings

• Concept
  – Works well overall
    • Write notes
    • Issue reminders
    • Everyday situations
  – Extends usefulness
    • New functionality
  – Easy to use
    • Appearance consistent with device
Preliminary findings

• Energy consumption
  – Measured for 8 hours use
  – Three states
    • State 1: Bluetooth off
    • State 2: Bluetooth on
    • State 3: Bluetooth on, BlueReminder running
  – Results
    • State 3 consumes twice the energy as state 2
    • Approximately 90-95% of a full battery left (state 3)
Preliminary findings

• Stability
  – A measure of predictable behaviour
  – Results for high-end device
    • Bluetooth service stalls unexpectedly
      – Detectable by measuring inquiry time
      – Recovery requires manual Bluetooth restart
      – Frequency dependant on device and sleep time between inquiries (>180s significant reduction)
    • Infrequent VM errors
      – Minimised by optimising memory usage
Preliminary findings

– Results for medium-end device
  • No stability problems found
  • But application times-out

– Alternative High-end test application
  • Personal Java (using JNI)
  • Stability issues remain

– Overall outcome
  • Need to look at underlying OS and JVM
  • BlueReminder appears to be stable
Further work

• Verify preliminary findings
  – More tests
  – Wider range of devices

• Improve system
  – Additional functionality
  – Minor changes
  – Optimisation

• Perform a case study
  – General public
Conclusion

• Concept
  – Works well overall

• Energy consumption
  – Significant increase
  – But does not hinder everyday operation

• Stability
  – Stability problems occur with one device
  – Need to look at underlying OS and JVM
More information

• For more information contact

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