# Realising Physical Selection for Mobile Devices

VTT Technical Research Centre of Finland
Heikki Ailisto, Ilkka Korhonen, Johan Plomp, Lauri Pohjanheimo and Esko Strömmer

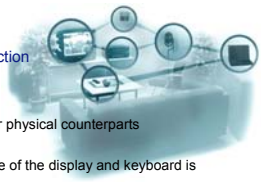
## Introduction

- HCI paradigms for desktop computers are clumsy with handheld devices
- In dynamic environment use of multilevel menus is inconvenient.
- Using display and keyboard or pointer usually need user's full attention

- We suggest that physical selection by pointing or touching could be employed to make use of the handheld devices more convenient
- Physical selection could be employded for example in Smart Phones and PDA:s

- In this presentation we focus on different technologies which could be used to implement physical selection concept

## Physical Selection



- Method for tying available services to their physical counterparts
- Intented to ease use of devices where size of the display and keyboard is restricted
- Actions are initiated by pointing or bringing the handheld device near the target object
- This way object can be selected without browsing though multi-level menus.

## Requirements for physical selection

- Several parameters are important when evaluating technologies suitable for physical selection concept
  - Selection type: pointing or proximity.
  - Data transfer characteristics:
    - uni- or bidirectional transfer
    - data rate
    - range
    - latency.
  - Information storage and processing capabilities
  - Stand-alone and front-end systems
  - Manufacturing costs
  - Power economy
  - Standard compatibility

## Physical selection technology: 1. Visual codes

- Visual codes:
  - Barcode
  - Optical Character Recognition
  - Two dimensional matrix code
- Properties:
  - Suitable for unidirectional communication
  - Information density varies between the types of codes
  - Image recognition is processing power critical
  - Long lifetime
  - Inexpensive
- Embedded digital cameras may be feasible solution for reading the codes in physical selection applications

## Physical Selection technology: 2. Electromagnetic technologies

- Technologies:
  - RFID
    - Magnetic induction
    - Capacitive coupling
  - Reader generates magnetic field that powers the tag, field is also used for communication
- Properties:
  - Low price
  - Small size
  - Very low power consumption.
- Suitable for proximity type of selection

## Physical Selection Technologies: 3. Infrared technologies

- Widely supported data transfer method
- IrDA standard has high penetration in PC, mobile phone and PDA environments
- Properties:
  - Data storage capabilities not limited
  - Bidirectional
  - High data rate
  - Wide variety of commercial components available
  - Operating range can be several meters
- Potential implementation method for pointing concept
- High power consumption possible problem

## Comparison of the technologies

| | Visual code | IrDA | RFID, inductive | Bluetooth |
|---|---|---|---|---|
| **Selection concept** | Proximity/ pointing | pointing | proximity | none |
| **Data transfer type** | unidirectional | bidirectional | unidirectional (bidirect.) | bidirect. |
| **Data rate** | medium | high | medium | high |
| **Latency** | very short | medium | short | long |
| **Operating range** | short-long | medium (long) | short (medium) | medium (long) |
| **Data storage type** | fixed | dynamic | fixed (dynamic) | dynamic |
| **Data storage capacity** | limited | not limited | limited (not limited) | not limited |
| **Data processing** | none | yes | yes, limited | yes |
| **Unit costs** | very small | medium | low | medium-high |
| **Power consumption** | no | medium | no (low) | medium-high |
| **Interference hazard** | no | medium | low-medium | medium-high |

## Selection example: Sensor reading

- Macroprototype demonstration where temperature sensor was integrated to IR tag.
- System has properties similar in IrDA Data and IrDA Control standards
- Demonstration target:
  - To test point to point bidirectional ad hoc communication
  - To test physical selection
  - IrDA like communication range and data rate
  - Ultra low power consumption of the tag
  - Small size of the tag
  - Low prize of the tag

## Conclusions

- Physical selection is a potential paradigm for HCI in ubiquitous domain
- Visual codes, electromagnetic means and infrared technology offer suitable characteristics for different applications
- Smart mobile devices with suitable communication capabilities such as IrDA, Bluetooth and camera for visual codes are becoming more common
- Low cost tags and readers in RFID domain are emerging on the market