NaviTerier
Navigation system for visually impaired users

Jan Vystrčil

User Interfaces & Visualization

HTW Dresden 2008

Czech Technical University in Prague

Faculty of Electrical Engineering

Computer Graphics Group

Content

- Motivation use case

- Function of NaviTerier

- Position synchronization issue

NaviTerier - introduction

- ## System for independent interior navigation of visually impaired people

- ## Fits for universities, administrative buildings, libraries, etc.

- ## Step-by-step describing of route between two points in building

- ## No additional costs for user
  - mobile phone
  - navigation application

- ## Low implementation costs
  - description of building
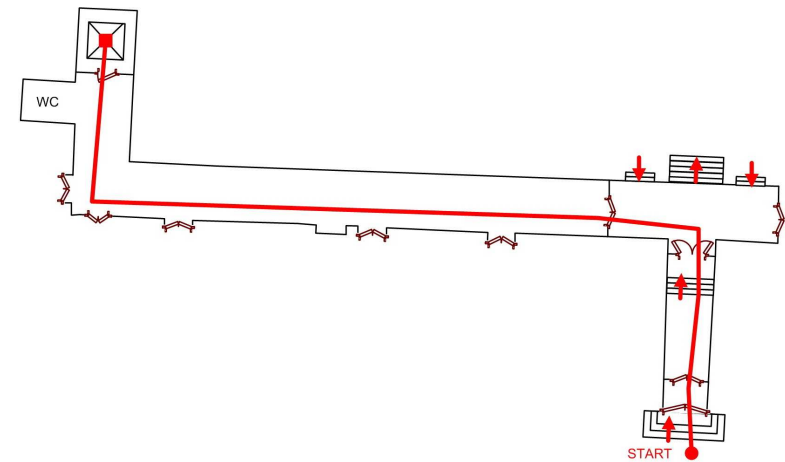
Independent mobility of visually impaired (1)

- Sight → source up to 90% information about environment
- Loss of sight…
  - Spatial orientation issue
  - Limited independent mobility
  - Necessity of using remaining senses
    - hearing / touch / olfaction
  - For standalone mobility should be used
    - white cane
    - guide dog
    - **human guide**
- Dependence on sighting people ➡ unwanted

Independent mobility of visually impaired (2)

EXAMPLE: Mr. Novak wants to create a new passport. He goes to the administrative building…

SIGHTING person

1. **Find appropriate office**

Looks on arrows around

2. **Go to the office**

Follows arrows to the office. If some problem occurs – he asks somebody

3. **Verify proper office**

Looks on sign on the door

VISUALLY IMPAIRED

Visually impaired are often dependent on help of sighting people.

→ incapability feelings, helplessness, decreased self-confidence

Goal is to simplify independent mobility of visually impaired in buildings

Other navigation systems

- ## Outdoor
  - GPS based (CTU FEE RDC - Navigating centre)
  - low accuracy of GPS
  - operator assistance necessary
  - not suitable for indoor

- ## Indoor
  - RFID based (RF-Guide)
  - special HW (modified white cane)
  - uncertain usability

NaviTerier – function

- **Consists of 3 main parts**

Navigation system

**Navigation device**   **Building description**   **Optional equipment**

- **Navigation device:**
  - Mobile phone (Symbian/Smartphone)
  - TTS system (voice output)
  - Navigating application
- „Passive" navigation
- System describes requested route in segments
- User gives feedback to system continuously

NaviTerier – function (2)

DESCRIPTION Corridor continues just about 20 meters. Windows are on the left side, office doors are on the right. Corridor turns left at the end of the corridor.

ACTION Go to turn at the end of corridor

NEXT

END

Computer Graphics Group
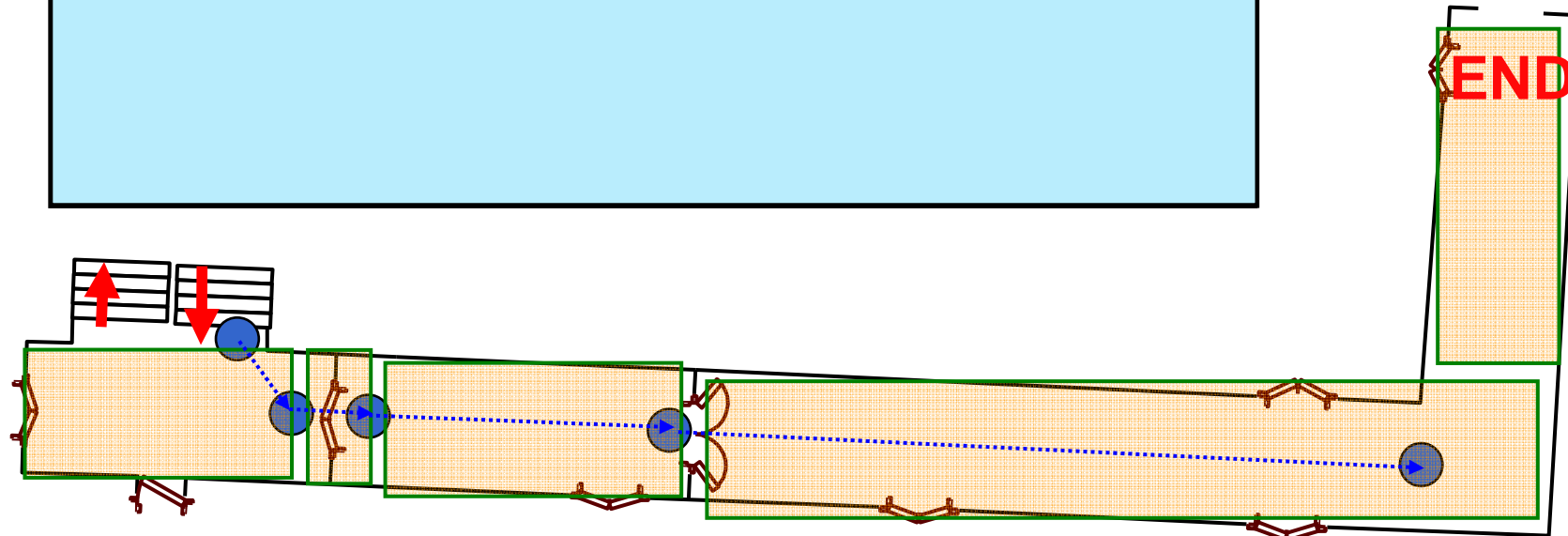
Design of navigation system with users

- Designed navigation system passed usability testing
    - 13 visually impaired users
    - 3 iterations of tests
    - Results of each iteration integrated in next research
    - Consultation of testing with psychologist
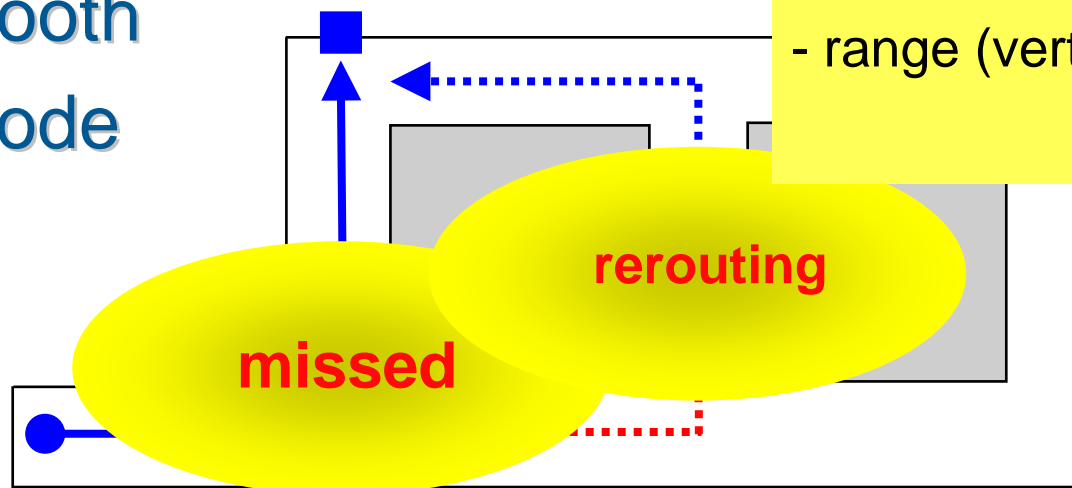- Created personas

Martin

Hanka

Position synchronization issue

- User missed junction…

- Issue: expected position ≠ real position

- Solution: synchronization of real and expected position

- Add synchronization points
  - Bluetooth
  - QR code

Problems with Bluetooth:

- detection delay

- range (vertical axis)

rerouting

missed

CGG
Computer Graphics Group

Usage of QR codes

"Usabilty Lab"

- QR code – 2D graphical code
  - alphanumeric strings binary encoded
  - application for decoding tags (Kaywa Reader, Quick Mark – Symbian based)

- Usability tested with visually impaired

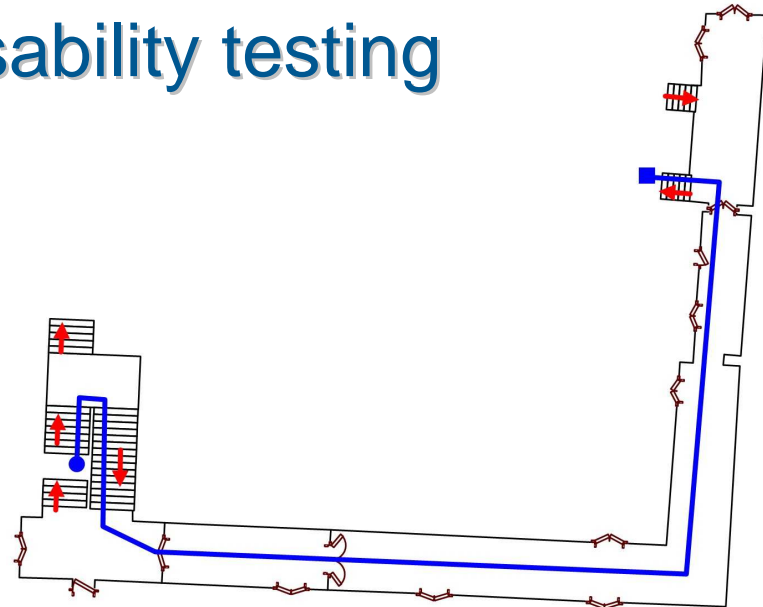- Can be used for synchronization of real and expected position

CGG
Computer Graphics Group

Conclusion

- **Designed user interface for independent navigation of visually impaired**

- **Implemented prototype of navigation application**
  - (Java ME)

- **System prototype passed usability testing**

Future of the project

- **Implementation of Symbian based version of NaviTerier**
  - remove implementation limits
  - better cooperation with TTS system

- **Remote usability testing (headcam setup)**
  - avoid moderator's disturbing
  - more realistic conditions

- **Embedding QR code reader**

Thank you for attention

Jan Vystrčil

vystrj1@fel.cvut.cz