DESIGNING USER INTERFACE OF MOBILE APPLICATION FOR WHEELCHAIR USERS

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Wheelchair users
Wheelchair users

- **Mechanical wheelchair users**
  - Manual power – controlled by both hands
  - Shorter, less physically challenging routes
  - Only disability is that they cannot walk

- **Electric wheelchair users**
  - Powered by electric motor – controlled by one hand only
  - Longer routes
  - Might have higher level of disability
Wheelchairs

Mechanical wheelchair

Electric wheelchair

Joystick controller
Using mobile phone on wheelchair

- Mobile phone mount
Motivation – routes without barriers

- Wheelchair users can come across many obstacles while moving around the city.
Motivation – accessible POIs

- Wheelchair users want to know what places of interest are accessible
  - No stairs
  - Elevator
  - Platform
Motivation – other type of interaction

- Mechanical wheelchair users can interact with the mobile phone without any problems
- Some of the electric wheelchair users cannot interact with mobile phone in the standard way
- Need of other type of interaction – joystick controller
Joystick controller
Requirements

- Application should find accessible routes without barriers
- Application informs users about accessible places nearby
- Users should be able to interact with the application by joystick controller only
Existing solutions
Existing solutions – wheelmap.org

- Display all POIs
  - Green – accessible
  - Orange – partly accessible
  - Red – not accessible
  - Grey - unknown

- For routing and navigation uses third party applications
  - Waze, Google Maps
Existing solutions – vozejkmap.cz

- Displays only accessible POIs
  - Data collected from users of the application
  - Data is verified and licenced under Creative Commons CC BY-NC-SA 4.0

- POIs divided into groups
  - Food and drink, culture, institutions...

- Every POI has
  - Accessibility type (without stairs, elevator)
  - Indication of accessible restroom
  - Indication of accessible parking

- For routing and navigation it uses Google Maps
Why new application

- We want to find routes that try to avoid obstacles or places that could be difficult to overcome for wheelchair users
- Mainly we want to design an interface that could be controlled by joystick controller only
User interface design
Abstract version of joystick controller

- 4 basic directions + 2 buttons (Enter, Back)
Base screen

Quick access actions

Fixed menu
Place search
Map mode

Moving around the map

Choosing place

Enter
Specifying precise location

- In case of street name search it is important to set the destination precisely.
- Navigation instructions might completely differ even if we set the destination on one side of the street or on the other side.
Specifying precise location

We show some suggestions and let the user decide.

If we did not meet the preferences, we let the user choose custom place in map mode.
Route search

From  

Your location

To

Plan

Na Zbořenci  ➔  Štěpánská

3 routes found

Route 2

Previous

Route 2

Distance: 669 m

Navigate

Next

2 %
Navigation

Continue straight on Odborů street. Have buildings on your right.

Cannot finish step
Exit navigation

Cannot finish step
Exit navigation
Obstacle on the route

Cannot finish Step 2/7

Select cause

Bad surface

Cancel Re-plan

Cancel Re-plan
Notifications

Notification at the top

Minimized fixed menu
Conclusion

- We have designed a prototype of mobile navigation application
- It is targeted at electric wheelchair users, but it can be used by anyone
- We have designed a system in a way so that the application can be operated by joystick controller only
- We have designed a system of quick access actions and a fixed menu
Future work

- Test the prototype with real users
- Find a way how to integrate our abstract controller with the real joystick controller on the wheelchair
- Integrate the application with existing routing system, that can find routes without barriers
- Design a system that could store information about obstacles on the route
Thank you for your attention!