



# Evaluation of ITSWAP-HMI using Occlusion

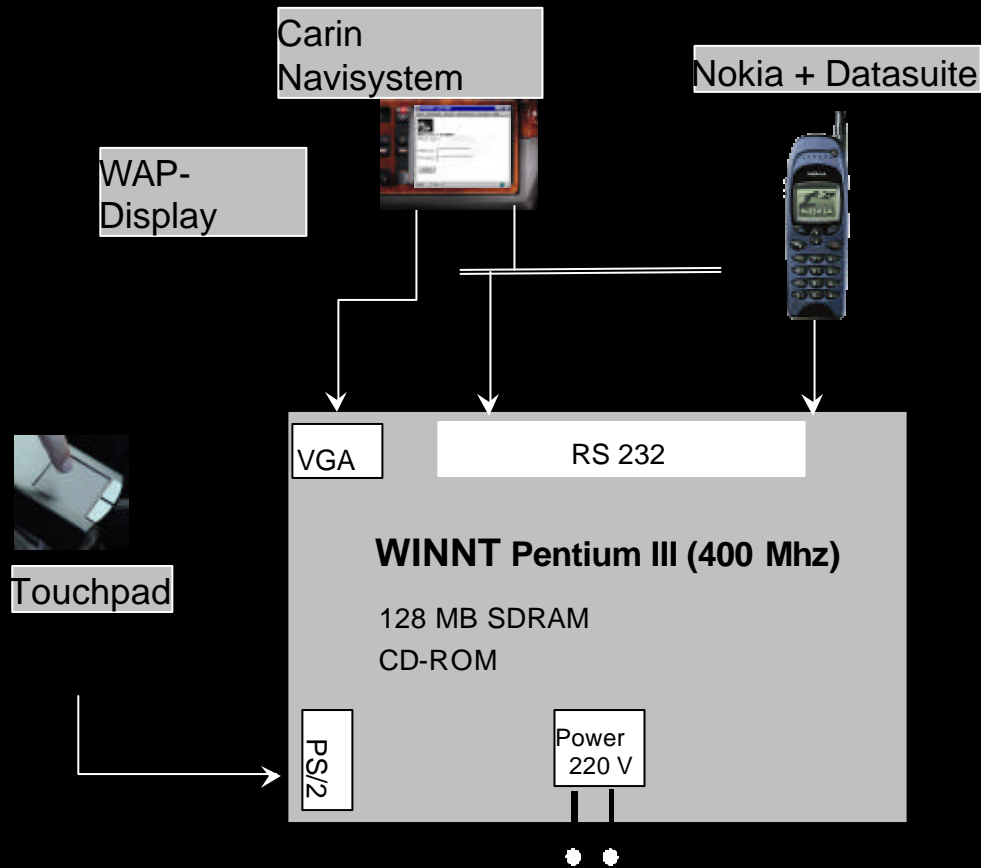
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# The ITSWAP Project



- WAP services for various on-board and off-board ITS applications in different field trial sites
- Human-machine interface (HMI) prototypes
- Implementation and evaluation of platform and protocol solutions for different environments/platforms
- [www.ertico.com/activiti/projects/itswap/itswap.htm](http://www.ertico.com/activiti/projects/itswap/itswap.htm)

# Itswap Architecture



# Motivation

- Implementation of UI for service operation
- Occlusion evaluation of handwriting input  
Blindoperation ratio  
Chunkability of different task types

# Setting



# Handwriting Input



# Study Details



- 11 subjects
- Within subjects design  
(occlusion vs. non occlusion)
- 2 hours per session
- Occlusion parameters:  
1300-1700 msec presentation intervall  
2800-3200 msec occlusion intervall
- Questionnaire:  
QUIS (Generic User Interface Questionnaire)  
SUS (System Usability Scale)



# Results

# Relative Frequencies

Error type	Relative frequencies of Errors	
	Without occl.	With occlusion
1. Error within function frame	,19	,196 (+3,16%)
2. Error within input area	,14	,16 (+13,06%)
3. Input during wrong mode	,02	,019 (+20,41%)
4. Wrong input by subject	,018	,004 (+6,82%)
5. Input out of touchpad	,007	,005 (-35,29%)
6. Function key operated to quick	,006	,01 (-14,29%)
7. System crash (no reaction longer than 10 sec.)	,005	,008 (+84,62%)
8. No system reaction on input	,002	,004 (+100,00%)
9. Input into wrong input field	,004	,00 (+27,27%)
10. Subject does not know how to proceed	,002	,436 (+40,00%)

Table 1: Error types and relative frequencies

Estimated total number of input actions without occlusion: 2500

ITSWAP Evaluation

# Subtasks



- 1: Menueselection „German railways“
- 4: Input: „Start“, „Destination“  
(Cities, Zip)
- 6: Menueselection: „Back to main menu“
- 10: Route guidance input:  
„Destination“ (city, street)

# Task solution time



	Mean duration of task solution (StdDev)		N
Subtask	Without occlusion	With occlusion	
Subtasks 1 and 6 Menueselection	44,97 sec (31,24)	52,75 sec (41,84) + 17%	57
Subtask 4 String input	54,11 sec (11,33)	59,06 sec (14,24) + 9%	36
Subtask 10 String input	76,02 sec (32,57)	90,03 sec (43,64) + 18%	79

Tabelle 2: Mean duration for selected subtasks by conditions [without vs. With occlusion]

# Occlusion Methodology



- Effect of occlusion goggles on task operation and task times
- Unsystematic occlusion influence on task solution times
- Increased variances on total task time by individual interruption strategies
- Stable and efficient laboratory methodology
- Goggles proved to be very uncomfortable for longtime sessions

# Discussion

- Highly efficient handwriting input
- Several input actions/sequences can be done without visual contact
- Operation/input sequences are interruptable and interrupted
- UI for selection of functions has to be improved

# Outlook



- Testing alternatives for occlusion goggles
- Field trials for validation
- Refinement of itswap UI