

University of Nizhniy Novgorod, Wireless Lab



Expert control system of User Interface convenience

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Challenge



To create cheap automatic system for analysis of mobile device application usability

- Experts are subjective
- Existing methods are expensive



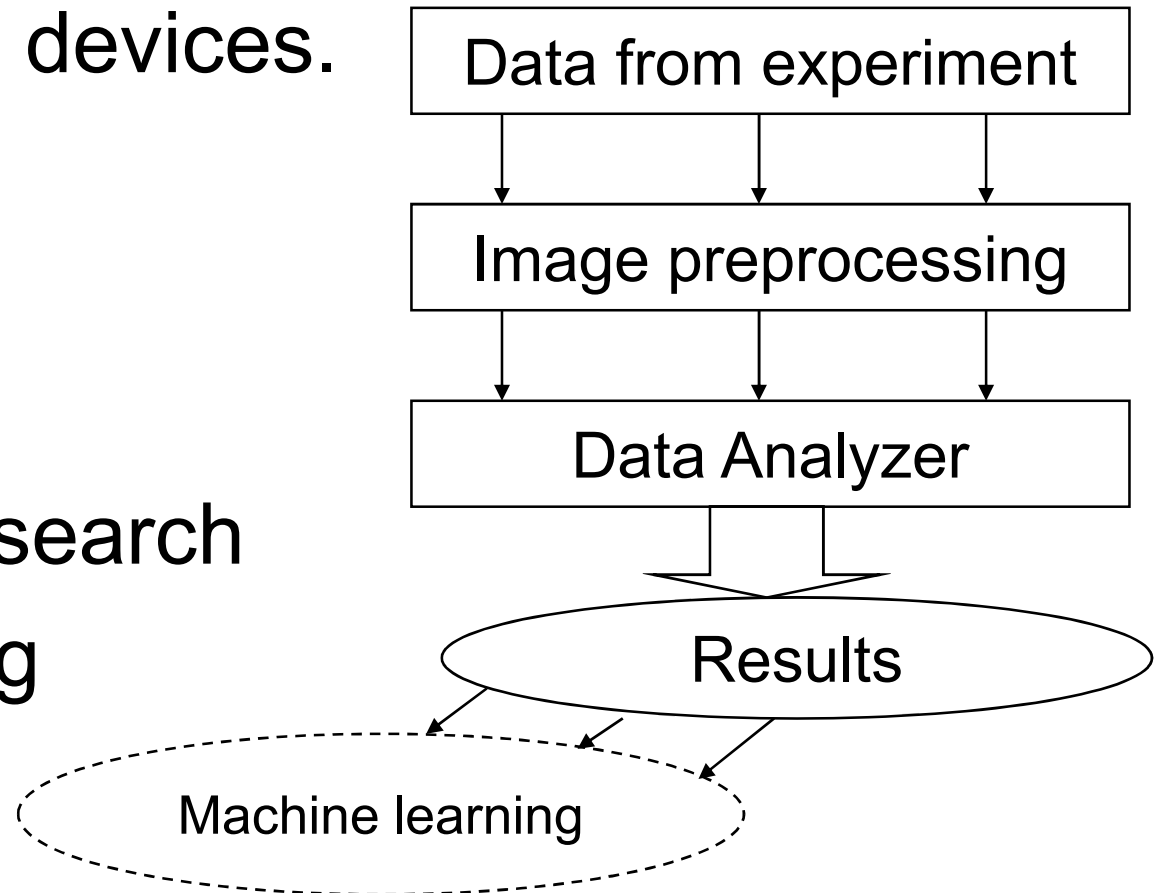
Difficulties

- Small monitor
- Need of quick access to information
- Limited functionality of keyboard
- Demand of medical knowledge

Conception

Automatic analysis of the usability for mobile devices.

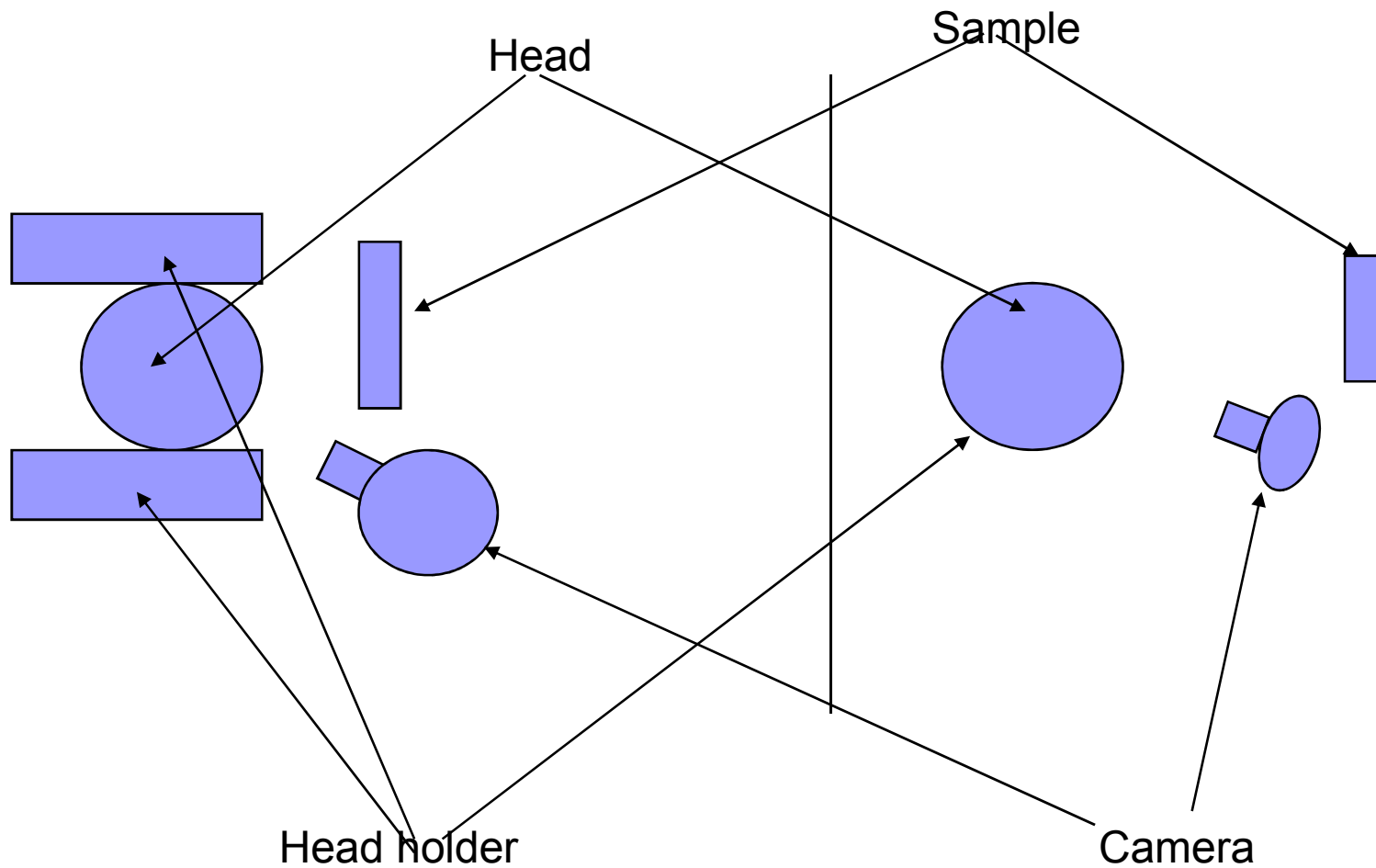
- Experiments
- Eye tracking
- Physiological research
- Machine learning



Experiments

Canon A590

Nokia N95



Experiments

- Camera of mobile device
 - 640*480
- Sample
 - Mobile device
or picture
- Head
 - Look at the Diana

Low cost!!!

Video
demonstration

Eye-tracking

Drawbacks of many eye-tracking systems:

- High resolution multiple cameras
- High cost (5000\$ - 40000\$)
- Head movement restriction
- Inaccuracy

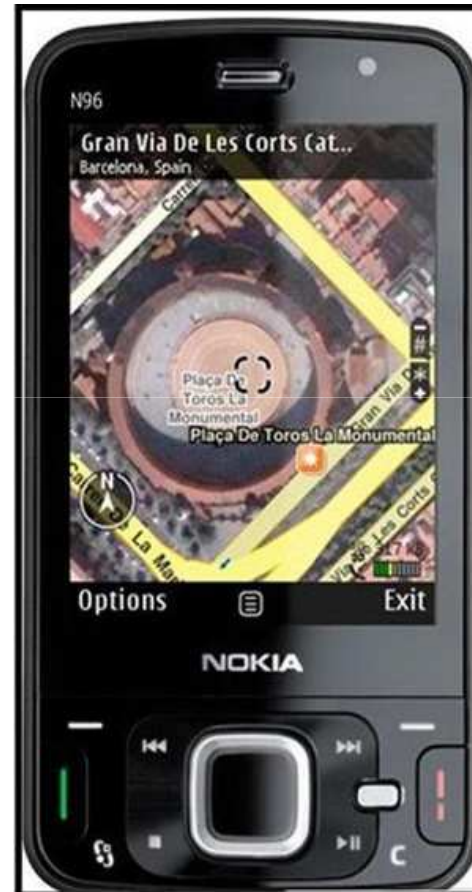


The Problem is hard

- Difficulty of computer vision
- Light and shades
- Demand of high accuracy
- Head movement
- Camera noise and distortions
- Blinks
- Lights in eyes
- Eyelids and eyelashes

Demonstration (good quality)

VIDEO



- Working version of eye-tracking program

Demonstration (poor quality)



Problems in the working version of eye-tracking program (mobile device video)



Further work

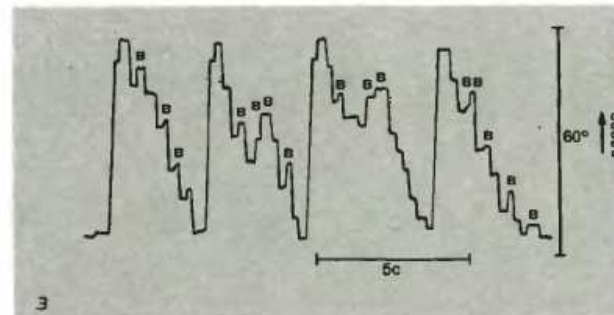
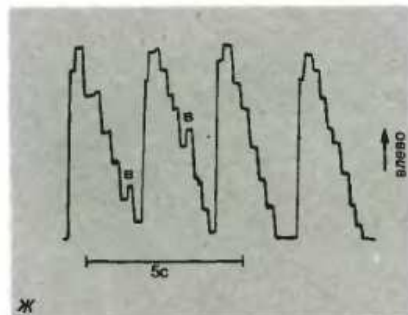
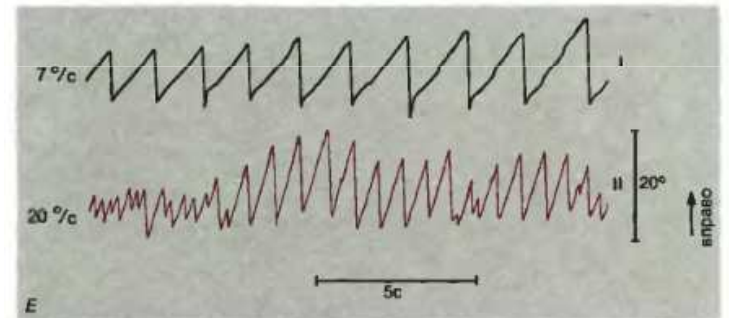
- Free head
- Testing new algorithm
 - Allow blinks
 - Head movement
 - Eyelids and eyelashes
- Increase accuracy using new math model
- Reduce camera resolution
- Optimization for mobile device

Physiological research

saccade – abrupt eye movement (10-80ms) between long periods of view fixation (200-600 ms)

Eye – tracking Main flow:

- Attention
- Device control
- Medical application



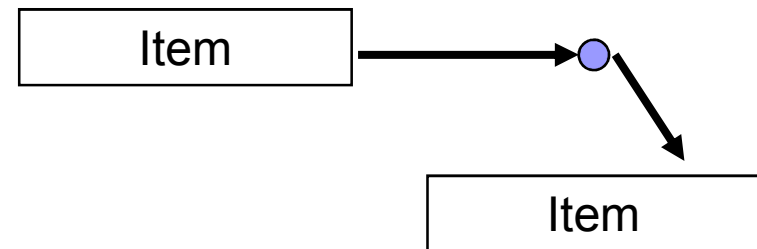


Physiological research

Goal: to determine laws of movement of eye that defined inconvenient elements

Physiological research

- Multi – parametric analyze of the eyes behaviors
 - Attention
 - Saccads
 - Return saccades
 - Multi-hops saccades
 - Tracer for saccades
 - Saccads distribution
 - in length
 - in directions



Form1



Tracet

CurrentStep

1

NextStep

GetMultiHops

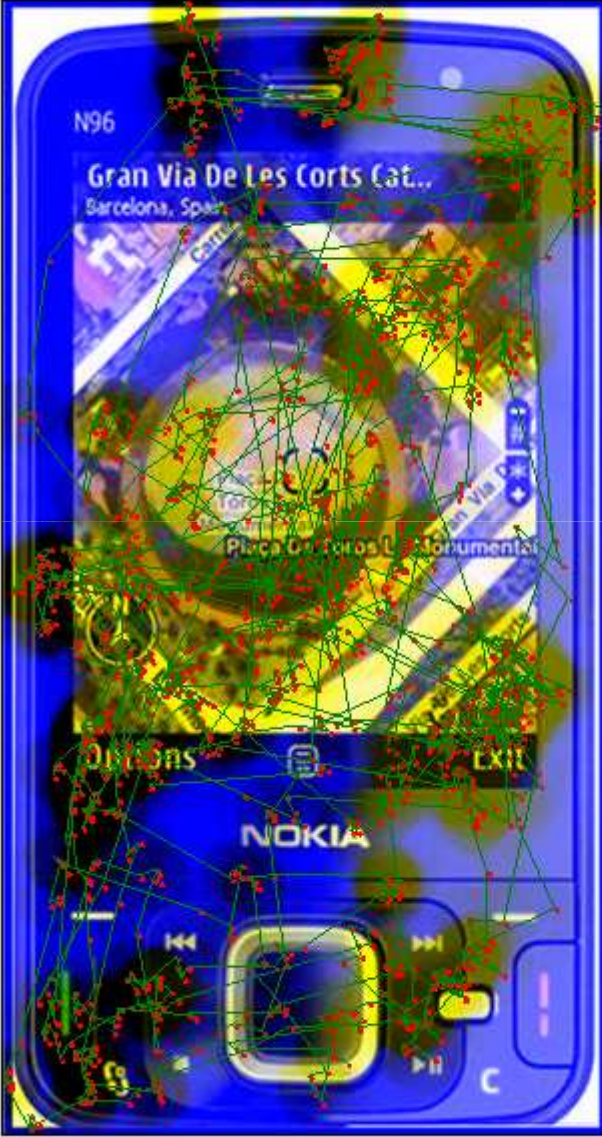
GetHops

GetAttention

GenPoint

Form1

Form1



Tracert

CurrentStep

1

NextStep

GetMultiHops

GetHops

GetAttention

GenPoint

Form1

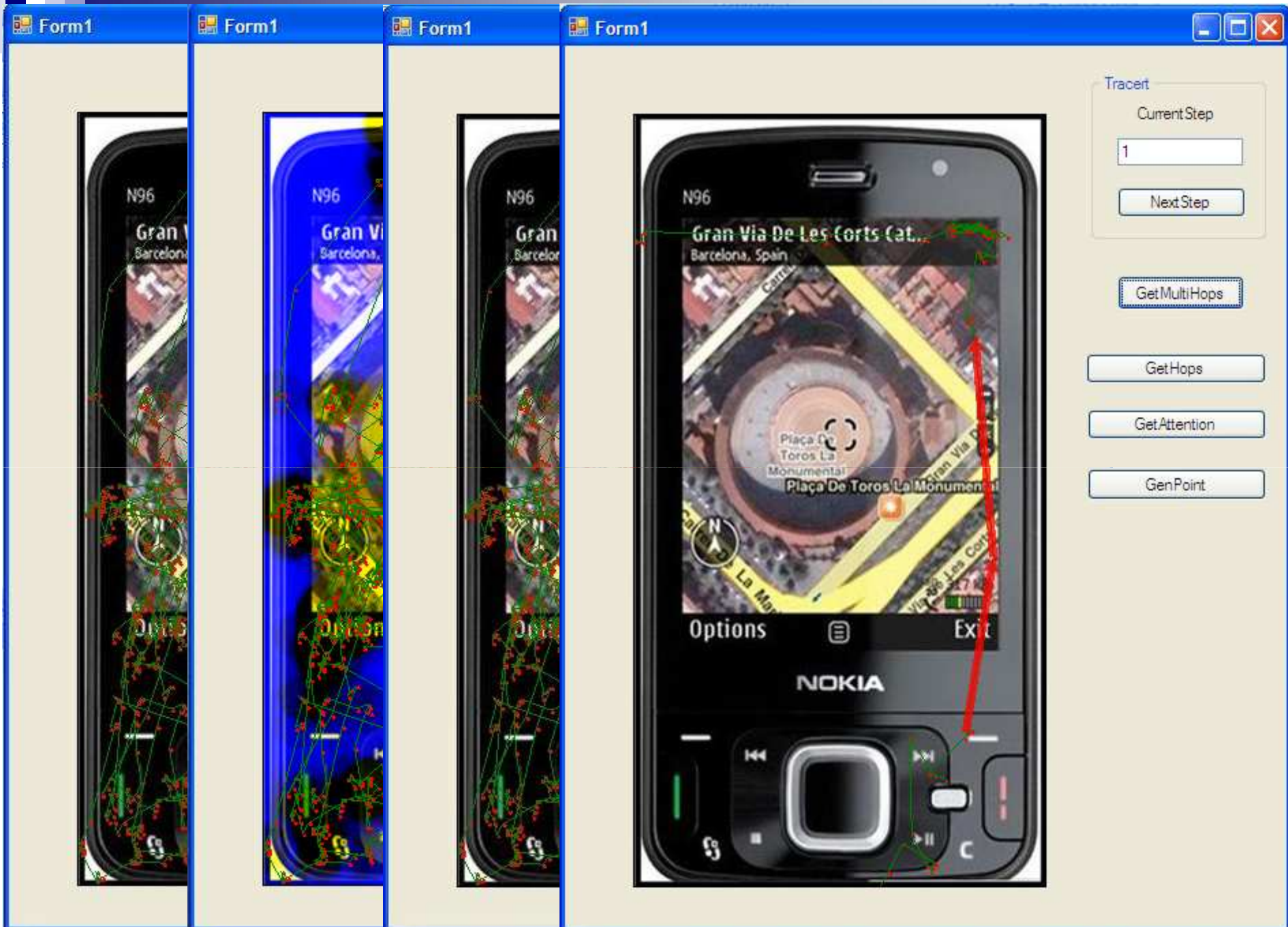
Form1

Form1



Tracert

Current Step





Future options

- Saccades analysis on the mobile device
- Saccades analysis with main interface items
- Use cases search – defined main succession moving between items
- Dependency of eye coordinates from time

Need additional research. Advisor for research is prof. Mukhina I. V. from NSMA



Summary

- Performed experiment for mobile devices
- Adaptation eye – tracking system for mobile devices
- New algorithms for eye – tracking (in process)
- Research of physiological parameters
 - Saccads distribution



Thank you for attention

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