

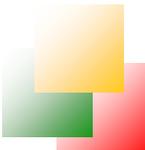
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Development of interactive applications with multi-modal interfaces for mobile devices

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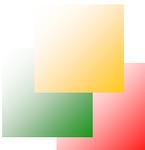


Presentation outline

- ◆ Brief description of multimodal interface and available modalities.
- ◆ Limitations of mobile devices.
- ◆ Approaches of realization of multimodal interfaces for mobile devices.
- ◆ Conclusion.

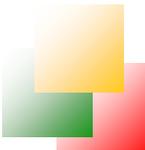
Kinds of modalities

Senses	Types of modalities	Examples of modalities	Examples of technologies
Vision	Visual	Hand gestures, body and lips movements, gaze direction, animated objects	Image analysis, virtual reality
Hearing	Sound	Speech, sounds, melodies	Speech synthesis and recognition
Touch	Tactile	Touch, vibration,	Touchpad and touchscreen
Smell	Olfactory	Odor	Methods of chemical analysis and synthesis
Taste	Taste	Taste	
Vestibular apparatus	Vestibular	Position of the body	Systems based on accelerometers and gyroscopes
Joints, nervous system	Proprioceptive	Relative position of body parts and their motion	Systems with exoskeleton



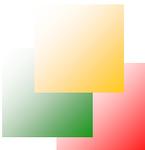
Combining of modalities

- ◆ Depending on the used input and output modalities several types of multi modal interfaces can be defined:
 - Speech + gestures
 - Speech + lip-reading
 - Line of sight + indication + speech.
- ◆ The most know multimodal concept is Bolt's (1980) original “**Put That There**” demonstration that combined speech and manual pointing during object manipulation.



Mobile devices hardware and software features

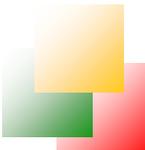
- ♦ **Mobile devices applications development should take into account the following limitations:**
 - **Size of mobile devices**
 - **Weight of mobile devices**
 - **Time of battery life**
 - **Performance of device**
 - **Internal memory size**



The main problems that arise when a user interacts with a mobile device

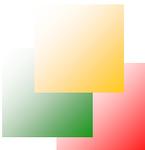
- ◆ **Failure to input data in motion.**
- ◆ **Failure to input data without having to look at the display device.**
- ◆ **Failure to use the device without direct contact.**

The use of multimodal interfaces will solve the problems above, or at least some of them.



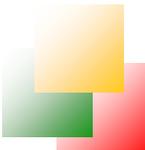
Bypass of restrictions

- ♦ **Many of the restrictions can be removed through the use of client-server architecture:**
 - **Mobile device serves primarily as the data collector.**
 - **All main processing, is executed on the server.**



Other new restrictions

- ♦ **Throughput.**
- ♦ **CPU clock.**
- ♦ **Time lag.**
- ♦ **The possibility of lack connection.**
- ♦ **Personal data protection.**



Conclusion

- ♦ **A lot of research was conducted in the past years on multimodal interface development with the use of different modalities. Unfortunately not so much work was done for the field of the mobile devices, where the multimodal interfaces so comfortable and needed. This situation is caused by the high demand of the multimodal interfaces for the computational, power and storage resources that are much lower in the mobile devices. The use of client-server architecture enables the implementation of complex models where the mobile device serves primarily as the data collector and all main processing is executed on the server.**