Modern approaches to human-computer interaction based on observation of a software developer

Student: Lukáš Galko
Supervisor: doc. Ing. Jaroslav Porubán, PhD.

1. Motivation: Multi-monitor work environment

- Multiple monitors in workplace result in performance benefit of 20-30%
- Working with multiple monitors requires executing actions on both of these monitors
- When switching focus between the monitors, the developer uses computer tools to switch the program windows and rotates the head for viewing the second monitor
- The developer's behavior determines his intentions

2. Observation of the developer

**Tools for observation:**
- Camera
- Kinect device

**Observation methods:**
- Scanning the developer's eyes and calculation of the developer's point of regard on the monitor
- Identifying the developer's nasal tip and its position
- Estimating the developer's point of regard on the monitor with the help of his face map

3. Midas Touch problem - Uses of gaze

**Tools for observation of workplace**
The developer identifies the objects in his workplace by gaze and thus gathers information he needs for working with them

**Tools for execution of commands**
The gaze initializes execution of reactions in a system that executes reactions on the observed actions of the developer

4. Addressing Midas Touch problem

The system that executes reaction on the developer's action needs to differentiate between the look used to observe workplace and the look for execution of actions. Three main ways to address the Midas Touch problem are to:

1. Use dwell time of focused look to execute reaction
2. Execute reaction on a specific amount of action occurrence
3. Execute reaction when the developer performs a specific gesture

5. Identification of developer’s actions with Kinect device

Kinect detects the face map of a developer. This map indicates the direction of the developer's look and can be used to decide towards which monitor the developer is currently looking.

The change of look from one monitor to another can be used to indicate the need to switch the active window, in which the developer is currently working. The computer system can use information about the currently used monitor to show alerts on this monitor and to open new windows on it, since the developer is looking at it. The rotation of the developer's head is calculated with points from the side of his face map. The difference between these points indicates whether the user is looking towards the kinect device or sideways from it.

6. Solution - Face Of useR Command Executioner (FORCE)

- Works in two-monitor environments
- Uses a kinect device for observation of the developer
- Estimates the point of regard of the developer on the main monitor
- Identifies the monitor the developer is currently looking at
- Needs one calibration in a stable environment

The developer defines the commands for the human-computer interaction

- Definition of commands:
  1. Key sequence that defines the behavior of commands
  2. Developer action on which the command is executed
  3. Numeric indicator for alteration of command execution
  4. Assignment of the program window for the execution of a command

- Creating a system that performs a human-computer interaction based on observation of the developer
- This system can perform:
  1. Execution of key shortcuts
  2. Activation of window with look
  3. Edition of text
  4. Document manipulation

- The system is fully adjustable to match the developer's needs.
- The system runs in real time
- Reuse of the system is improved through saving created commands

7. Results