Blue eye technology

( blue eyes – Human operator monitoring system )
Agenda

- Motivation
- What is BlueEye technology?
- What is BlueEyes?
- System designing
- System overview
- DAU
- CSU
- Data security
- IBM research
- Conclusion
Motivation

- Human error - a frequent reason of catastrophes and ecological disasters
  - temporary indisposition
  - weariness
  - oversight
What is blue eye technology?

- The BLUE EYES technology aims at creating computational machines that have perceptual and sensory ability like those of human beings.
How can we make computers “see” and “feel”?  

- Blue eyes uses sensing technology to identify a user’s actions and to extract key information.
- Information is then analyzed to determine the user’s physical, emotional, or informational state.
What is Blue Eyes?

- The complex solution for human-operator monitoring:
  - Visual attention monitoring
  - Physiological condition
  - Operator’s position detection
  - Wireless data acquisition using bluetooth
  - Real time user defined alarm triggering
  - Recorded data playback
What is BlueEyes not?

- Doesn’t predict nor interfere with operator’s thoughts
- Cannot force directly the operator to work
Applications of Blue Eyes

- Generic control rooms
  (System can be applied in every working environment requiring permanent operator’s attention)
  - Power station
  - Captain bridge
  - Flight control centers
  - Operating theatres – anesthesiologists
BlueEyes - benefits

- Prevention from dangerous incidents
- Minimization of
  - ecological consequences
  - financial loss
  - a threat to a human life
- The reconstruction of the course of operator’s work
Implementation and engineering considerations

- THREE groups of users
  - OPERATOR - a person whose physiological parameters are supervised
    - authorization in the system
    - receiving alerts
  - SUPERVISOR – a person responsible for analyzing operator’s condition and performance.
  - SYSTEM ADMINISTRATORS- maintains the system deliver tools for adding
    - new operator’s to the database
    - defining alarm conditions
    - configuring logging tools
    - creating new analyzer modules
Designing

- A personal area network for linking all the operators and the supervising system
- Two major units
  - DAU (data acquisition unit)
  - CSU (central system unit)
**System overview**

Bluetooth technology provides means for creating a Personal Area Network linking the operators and the central system.
The eye movement sensor

- Off-shelf eye movement sensor – Jazz multisensor
- Supplies raw digital data regarding
  - Eye position
  - Level of blood oxygenation
  - Acceleration along horizontal and vertical axes
  - Ambient light intensity
Jazz multisensor

Jazz Multisensor
Jazz
The DAU consists of the following components:

- ATMEL 8952 microcontroller
- BLUE TOOTH MODULE – supports synchronous voice data transmission
- PCM CODEC – used to transmit operator’s voice and central system sound feedback
- UART – communication between bluetooth module and microcontroller (115200 bps)
- MAX232 – level shifter
- ALPHAUNUMERIC LCD display
- LED indicators
- ID CARD interface
BlueEyes

Data Acquisition Unit (DAU) - components

- MC 145483 PCM codec
- Jazz Multisensor
- Beeper
- LCD display
- LED indicators
- Atmel 89C52 microcontroller
- UART
- MAX232
- Bluetooth module
- UART
- Simple keyboard
- ID card interface
- ID card
- Earphone
- Microphone

BlueEyes
Data Acquisition Unit
Microcontroller & blue tooth module
EEPROMS & the PCB
Implementation - DAU

• Motivation
• What is BlueEyes?
• Physiological foundations
• System design
• System implementation

• DAU
• CSU
• Future improvements
• Project work summary
• System demonstration

- PCM codec board
- Microcontroller board
- Batteries and voltage level monitor
DAU - features

- Lightweight
- Runs on batteries - low power consumption
- Easy to use - does not disturb the operator working
- ID cards for operator authorization
- Voice transmission
CSU - features

- Connection management
- Data processing
- Visualization
- Data recording
- Access verification
- System maintenance
CSU – components

- CONNECTION MANAGER – main task to perform low-level blue tooth communication
- DATA ANALYSIS MODULE – performs the analysis of the raw sensor data in order to obtain information about operator’s physiological condition
- DATA LOGGER MODULE – provides support for storing the monitored data.
- VISUALIZATION MODULE – provides user interface for the supervisors
CSU - Visualization Module

- Raw and processed data visualization using:
  - VU-meters
  - pie-charts
  - time series

- audio and video data playback
Data security

- Only registered mobile devices can connect to the system
- Bluetooth connection authentication
- Bluetooth connection encryption
- Access rights restrictions
- Personal and physiological data encryption
IBM research

- BLUE EYE – EMOTIONAL MOUSE
  sensors in the mouse, sense the physiological attributes which are correlated to emotions using correlation model
  - by simply touching the mouse, the computer will be able to determine a person’s emotional state.

- BLUE EYE enabled TELEVISION – could become active when the user makes an eye contact.
Conclusion

- In the near future, ordinary household devices such as television, refrigerators, ovens may be able to do their jobs when we look at them and speak to them.

- Future applications of blue eye technology is limitless
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Thank you

BlueEyes
Human-Operator Monitoring System