MINIMA
Vigilance and attention as trigger for adaptive automation

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Project Objectives

Motivation
• Increase of efficiency, capacity, safety in ATC: Automation
• Role of Air Traffic Controllers (ATCos) will change
  • Supervisory Control
  • Mainly monitoring, less actions
→ Risk: ATCos are Out-Of-The-Loop

MINIMA Objectives
• Measure state of ATCos
• Detect Out-Of-The-Loop occurrences
• Adapt automation and tasks
Problem addressed

Out-Of-The-Loop (OOTL): Reasons

• Lack of involvement in control
• Lack of system predictability

Consequences on operator performance

• Human vigilance decrements
• Over-trust / Automation misuse
• Loss of situation awareness
• Direct/manual control skill decay
Solution and Example Task

Vigilance and attention controller

Task and support activation

Task environment

Air Traffic Controller

Traffic situation

Actions

Operator state

Adaptation trigger

Traffic situation

Bio signals

MINIMA - Project Overview
Solution: Adaptations

Highlighting information
• Loss of separation and close aircraft
• Deviations from route
• Predicted deviations from target time
• Conflicting trajectories
• Not monitored aircraft

Additional information
• Centerline Separation Range
• Advisories

Additional tasks
• Manual vs. automatic hand-overs
• Earlier Hand-overs from adjacent sectors
• Sequence optimization according to customer demand
• Provision of addition information to aircraft

Artificial tasks
• Answer automatically generated questions
Assessment of Vigilance and Attention

Balance intrusiveness, effort and data quantity / quality
Eliminate noise caused by body or eye movements
Reduce data by spectrum analysis
Compute vigilance index by using machine learning

EEG Acquisition → Signal Preprocessing → Feature Extraction → Pattern Classification

Balance intrusiveness, effort and data quantity / quality
Calculate fixations and saccades

Task environment
Vigilance
Attention

Eye Tracker → Interpretation
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Thank you very much for your attention!