

TASK # HF003. CHARACTERIZATION AND APPLICATION OF AIR TRAFFIC CONTROLLERS VISUAL SEARCH PATTERNS AND CONTROL STRATEGIES FOR EFFICIENT AND EFFECTIVE TRAINING

PROJECT AT-A-GLANCE

- UNIVERSITY: University of Oklahoma
- PRINCIPAL INVESTIGATOR: Dr. Zihong Kang
- STUDENT: Saptarshi Mandal
- INDUSTRY PARTNER: Adacel

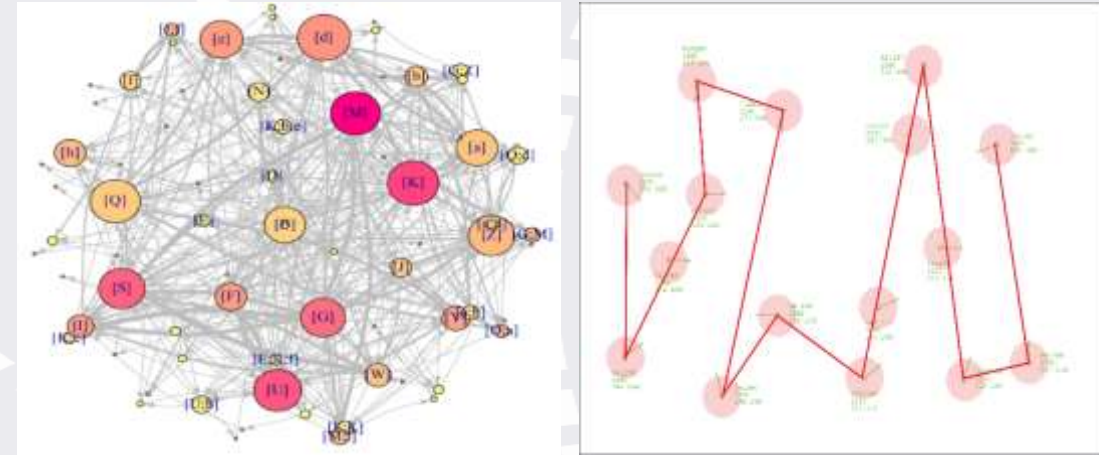
RELEVANCE TO TECHNICAL TRAINING AND HUMAN PERFORMANCE

- This proposed project aims to characterize and classify the visual scanning patterns and control strategies of expert air traffic control operators (ATCOs) in order to support the efficient and effective training of air traffic control candidates.
- We will collect eye movement data and aircraft control commands from multiple expert ATCOs, and develop designs to better provide the characterized and classified visual search and control strategies. The research focus is on enroute air traffic control.

STATEMENT OF WORK

- Conduct requirement analysis for collecting ATCO's eye movements, retrospective verbal inputs, and mitigation commands.
- Perform experiments on retired expert ATCOs: Record eye movements and verbal commands. Analyze visual scanning patterns and conduct retrospective verbal protocol analysis..
- Characterize and classify expert ATCO's visual search patterns and control strategies.
- Develop designs to provide visualization and classification results.

Analysis examples of visual scanning characteristics



STATUS

- We have been juggling around the milestones to accommodate the delay of the union review process. We should be able to accomplish our goals within the duration; however, we will request no-cost extension if needed.

FUTURE WORK

- Analyze situation awareness, visual scanning, and aircraft control strategies of tower controllers.
- Develop an automated eye movement analysis software in enroute and tower control environments.

Publications, Presentations & Awards

- Publications

Kang et. al (2017). Data visualization approaches in eye tracking to support the learning of air traffic control operations, In *proceedings of the 2017 National Training Aircraft Symposium*, Daytona Beach, FL.

Kang (2017). Real time eye movement analysis framework: Objective-based systematic approach, In *proceedings of the IEEE BioSmart 2017: 2nd International Conference on Bio-engineering for Smart Technologies*, Paris, France.

Additional journal papers are under preparation.

- Presentations

Data visualization approaches in eye tracking to support the learning of air traffic control operations, In *proceedings of the 2017 National Training Aircraft Symposium*, August 14 – August 17, 2017, Daytona Beach, FL.

Presenter: Kang.

Real time eye movement analysis framework: Objective-based systematic approach, In *proceedings of the IEEE BioSmart 2017: 2nd International Conference on Bio-engineering for Smart Technologies*, September 28 – October 1, 2017, Paris, France.

Presenter: Kang.

Kang will be a keynote speaker for the IEEE BioSmart 2017 conference.

- Awards

Kang received the Andrew P. Sage Best Transactions Paper Award in October, 2016.

Mandal received the Best Student Paper Award (first place) from the Aerospace TG within the Human Factors and Ergonomics Society in October, 2016.

Continued on next page

Publications, Presentations & Awards

- Publications (continued)

Kang et. al (2017). Data visualization approaches in eye tracking to support the learning of air traffic control operations, submitted August 1st to the joint publication of the Journal of Aviation/Aerospace Education & Research and International Journal of Aviation, Aeronautics, and Aerospace.

Preparing a conference or journal paper for the experts' visual scanning patterns and aircraft control strategies (experiments are currently underway)

- Presentations (continued)

FAA SOAR Q2 presentation (Nov. 2016). Characterization of visual scanning patterns and aircraft control strategies for training Q1 progress presentation, November 30-December 1, 2016, Norman, OK.

Presenter: Kang.

FAA SOAR Q3 presentation (Mar. 2017). Characterization of visual scanning patterns and aircraft control strategies for training Q2 progress presentation, February 28-March 1, 2017, Daytona Beach, FL.

Presenter: Kang.

FAA SOAR Q4 presentation (Jun. 2017) . "Characterization of visual scanning patterns and aircraft control strategies for training Q3 progress presentation, June 13-15, 2017, FAA Headquarters, Washington D.C.

Presenter: Kang.

FAA SOAR Q4 poster session (Jun. 2017). Universal Design for Learning and Multimodal Training poster presentation, June 13-15, 2017, FAA Headquarters, Washington D.C.

Presenter: Kang.

Publications, Presentations & Awards

- Publications (continued)

Mandal, S. and Kang, Z (2017, under review). *A Robust Framework of Data Visualization in Eye Tracking Analysis for a Tracking Task of Multi-Element Moving Targets: A Directed Network Approach*. Submitted to the *Journal of Eye Movement Research*.

- Presentations (continued)

Kang, Z. (May, 2017). *Data visualization in eye tracking research. Tobii Pro Research Spotlight Seminar Series. Tobii Pro North America. (webinar attendees: 108)*

Presenter: Kang.

- Other appointments

Kang was invited as a keynote speaker at the *Proceedings of the 2nd International Conference on Bio-engineering for Smart Technologies*, Paris, France.

Kang was elected as Chair Elect (3 year term) of the Education Technical Group within the Human Factors and Ergonomics Society.