Eye Tracking Technologies to Analyze and Visualize the Behavior of Secure Coders

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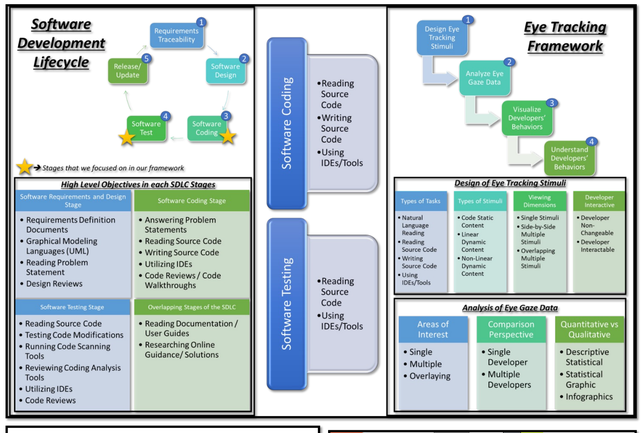
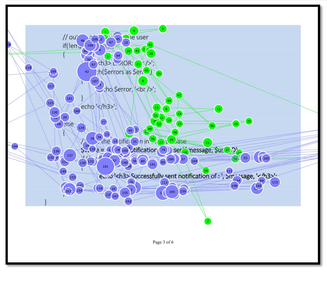
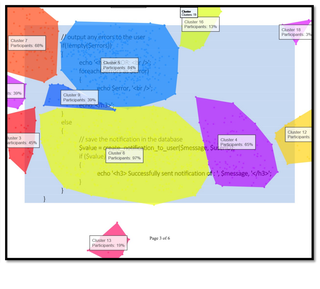
RESEARCH CONTRIBUTIONS

- Classification of the goals, objectives, participant tasks, and visualization techniques in distinct stages of the SDLC (specifically secure coding) for eye-tracking
- Understanding of secure coders' behaviors with multiple types of visualizations of distinct aspects in secure coding and over a timeline
- At the low level, we process eye movements, the speed of movement, the duration of eye fixation, and changes in pupil sizes
- At the medium level, we examine participants' eye gaze at the application and source code files or function level
- At the high level, we present participants' secure coding patterns and strategies
- We propose swimlane diagrams, state transition diagrams, and pupil size fluctuation diagrams
- Developed our Eye Tracking Design and Analysis Framework for software development with a focus on secure coding
- A decision matrix for mapping objectives/tasks in the SDLC to specific aspects of eye-tracking design, analysis, and comparison
- Guide on the type of software tasks and eye-tracking stimuli to present to participants

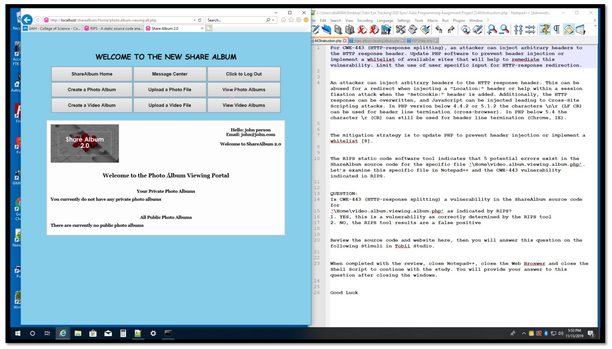
INTRODUCTION

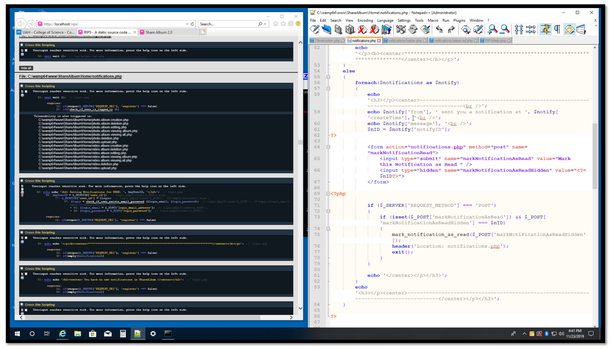


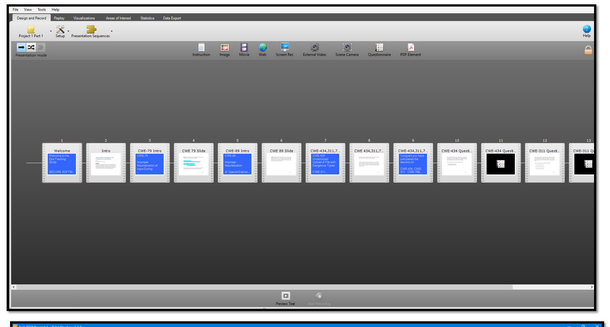


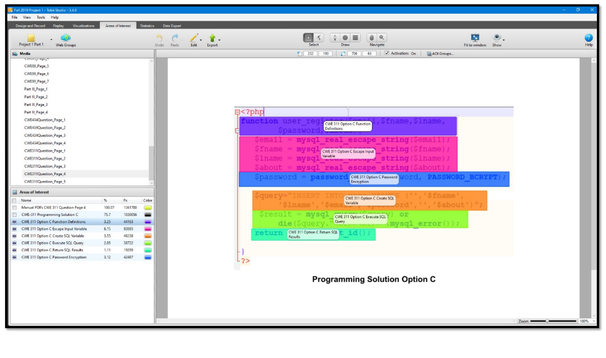


METHODOLOGY

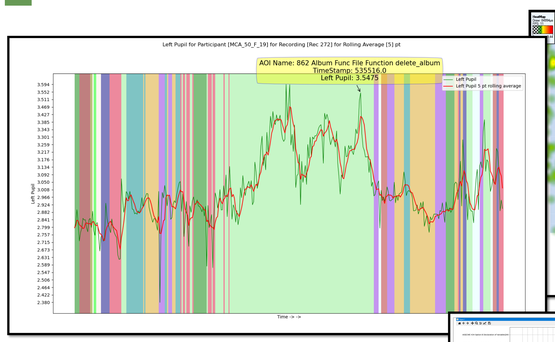


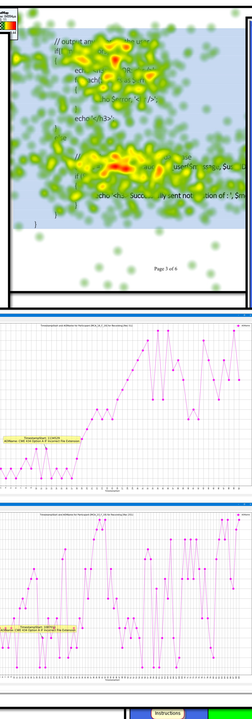


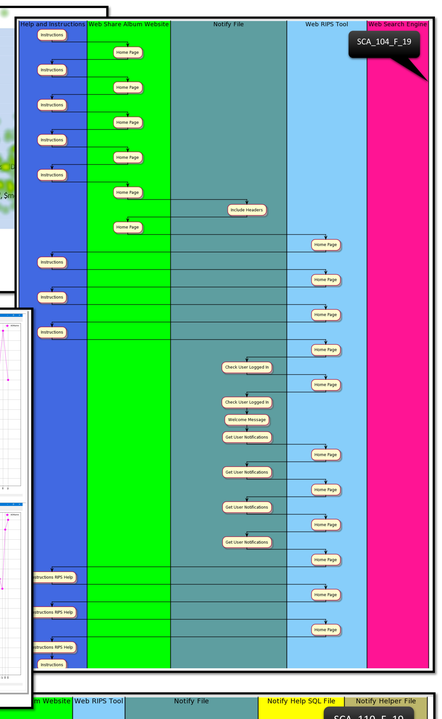


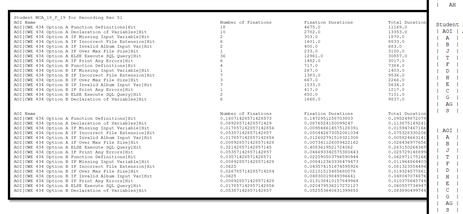


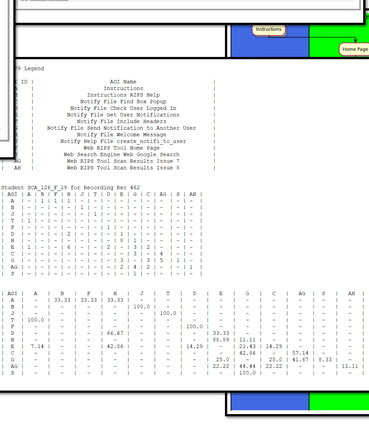
RESULTS & RECOMMENDATIONS











CONCLUSION

Software developer tasks and individual actions create complexity in designing eye-tracking experiments and analyzing the collected eye gazes. Our approach allows us to explore behaviors across a range of tasks for a single secure coder and among different coders. New visualization techniques were developed to investigate behaviors during secure coding tasks including methods to present transitions among components within and between applications, as well as present coders' attention levels during secure coding. Our contributions include a literature survey, framework design, secure coding learning modules, scrollable and modifiable eye-tracking stimuli analysis, pupil diameter changes analysis, and stimuli presented in different sequences based on individual participants' behavior. Our contributions focus on comparing and contrasting multiple visualization methods for eye-tracking stimuli.

ACKNOWLEDGEMENTS

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