Using Scenarios to Validate Requirements through the use of Eye-Tracking in Prototyping

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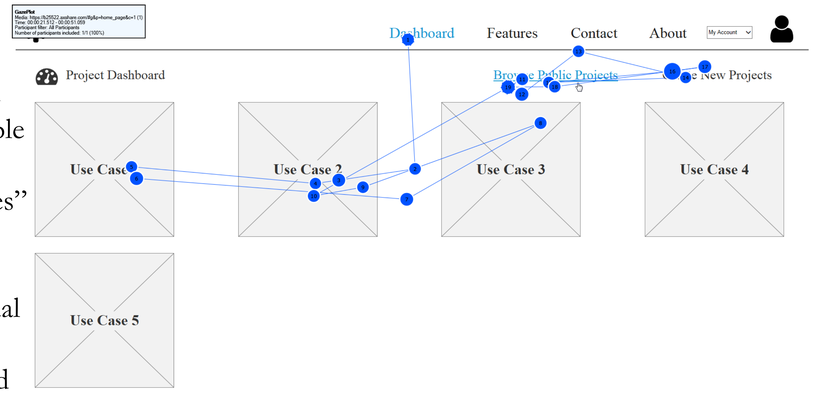
Abstract
Research has shown that eliciting and capturing the correct behavior of systems reduces the number of defects that a system contains. A requirements engineer will model the functions of the system to gain a comprehensive understanding of the system in question. Engineers must verify the model for correctness by either having another engineer review it or build a prototype and validate with a stakeholder. However, research has shown that this form of verification can be ineffective because looking at an existing model can be suggestive and stump the development of new ideas. This paper provides an automated technique that can be used as an unbiased review of use case scenarios. Using the prototype and a scenario, a stakeholder can be guided through the use case scenario demonstrating where they expect to find the next step while their eye movements are tracked. Analysis of the eye tracking data can be used to identify missing requirements such as interaction steps that should have alternative sequences or determining problems with the flow of actions.

Requirement
Use case diagrams are a specific type of UML model that maps out the different actors and their interactions with the system. The visualization of these interactions contributes to the development of the use case scenarios by defining functionality that needs to be accessible for a user to be satisfied with the use. Use case scenarios are what drives the development of a prototype especially in a computer system and are what the design team goes through when demonstrating a prototype to a stake-holder. For this study, the scenario and prototype are based off a system that was defined and designed for a graduate-level requirements analysis and modeling class named Sharing and Discovering Semantic Use Case Scenarios (SADSUCS); "SADSUCS is a research project that requires a web-based interface that will allow teammates to efficiently share and discover use case diagrams and scenarios. SADSUCS must be a user-friendly tool to encourage its adoption. Users should be able to create models of systems following a common use case diagram syntax. The system should generate "scenario templates" to be populated with missing information by the user. It is envisioned that the creation of the models will be done by the users' dragging and dropping components in and out of a virtual workspace. The system must store projects in the cloud, along with each project's history of most recent snapshots, each saved every time the user clicks 'save' or every 5 minutes if the model has changed. The app will allow users to undo their actions."

The use case scenario for the SADSUCS system for the specific use case, view public use case diagram is drawn out below. For the results that are explained, use cases 4 and 5 are the focus.
Use Case: View Public Use Case Diagram
Description: A user wishes to find and view a public use case diagram. The user is not part of the project.
Actors: User, Cloud Management Database
Precondition: The user has an account with the system. The use case diagram is not private and can be viewed.
Trigger Condition: The user has launched the application.
Steps:
1. The system displays the login page prompting the user for a username and a password.
2. The user enters a username and a password and selects to login.
3. The system successfully verifies the entered password for the given username by comparing it with the password stored in the Cloud Management Database (ALT 1).
4. The system displays popular diagrams and an option to search for use cases.
5. The user enters use case keyword information in the search field and selects the search option.
6. The system queries the Cloud Management Database using the keywords provided.
7. The Cloud Management Database returns a list of matching use cases (ALT 2).
8. The system displays the list of matching use cases.
9. The user selects a use case diagram to view from the list.
10. The system displays the selected use case diagram.
11. The user views and navigates the use case diagram.
12. End of use case.



Results
The dashboard page focuses on steps 4 and 5 from the use case scenario and stated above. The screen captor includes the protoype screen for the dashboard along with an overlay of gazeplot data that was gathered. Only one participant was ran through the prototype to provide sample data.

Using the gazeplot data, more steps were added to the use case scenario as stated below.
ALT 1: Step 5: User selects a use case.
Step 5.1: Continue with step 10.
ALT 2: Step 5: User selects the create a new project op-tion.
Step 5.1: The system displays a prompt for the user to enter information relevant to a new project.
Step 5.2: The user enters information in the prompt.
Step 5.3: The user selects a submit option.
Step 5.4: Continue with step 10.

Future Work
The purpose of this study was to provide a description of a new approach to validate requirements via scenarios and conduct a pilot study. It is important to note that only one participant was guided through the prototype and issues can be found with the data that was collected.
Mouse tracking is another usability testing method that can be used both independently and supplementary to eye tracking. Research indicates that a participant's gaze leads the movement of their mouse movements [1], and it is a common practice to use mouse tracking when eye tracking is not a viable option. These methods are most useful when used in combination, as in usability the click and clickstream of a user's navigation through an interface [2]. The incorporation of mouse tracking into the proposed approach could provide more accurate information, however it might provide an average user with too much information and thus possibly making it more difficult to analyze.

References
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