An approach to improve User Acceptance Testing with Generative AI and RSL based techniques – Assessment Guide

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1. Introduction

The work of a software testing professional involves performing time-consuming activities, including analysis of business requirements, designing test cases and test automation.

With the development of Generative Artificial Intelligence tools, the potential to improve the development of these activities has emerged. Additionally, with rigorous languages, such as the Requirements Specification Language (RSL), it is possible to reduce the ambiguity of business requirements and facilitate consistency and traceability between different requirements and test work products.

This study is oriented toward acceptance tests, by its importance to the end user and proximity to deployment for production.

An OpenAI GPT-4 based conversational assistant named “Software Testing Guide” (STG) was customized and trained to support fast and efficient generation of test work products. It is important to highlight that the use of Generative AI involves several risks of inaccuracy and, therefore, the role of the software tester is essential to verify and validate the assistant's results.

Based on the initial interaction experience with this agent, the ATI (Acceptance Test Improvement) approach was developed to facilitate the application of RSL and AI Generative in the acceptance testing process.

2. Objective

This survey intends to evaluate the performance of the STG assistant and the ATI approach, in the generation of test work products, namely the RSL requirements and test cases specifications and automation test scripts.

For this, I would appreciate your collaboration in performing the following assignments described below.

3. Background

3.1. What is Generative AI?

Generative AI is a branch of AI focused on models that create new content. It´s possible to synthesize the answers to the questions posed, through existing data.

A subset of Generative AI is the Pre-trained large language models (LLMs) that have recently emerged as a breakthrough technology in natural language processing and artificial intelligence.

LLMs can handle large-scale datasets and exhibit remarkable performance across a wide range of tasks. It typically refers to language models that have hundreds of billions (or more) of parameters and are trained on massive text data. One example is GPT-4, used in this study to create a customized test assistant. The prompts are the questions or statements you use as input to guide the AI in generating responses.

3.2. What is RSL language?

Controlled natural languages (CNLs) define a restricted use of a natural language's grammar (syntax) and a set of terms (including the semantics of these terms) to be used in the restricted grammar. The ITLingo RSL (Requirements Specification Language) is a controlled natural language that helps the production of both requirement and test specifications in a systematic, rigorous, and consistent way. RSL includes a large set of constructs logically arranged into views according to specific concerns. The constructs contribute to produce requirements specifications at different level of abstraction, writing styles and types of requirements and tests. By applying RSL in the testing process, it is possible to clarify and objectify requirements, reducing ambiguity and improving traceability throughout the Software Testing Life Cycle.

For more details see the scientific article: Rigorous Specification of Use Cases with the RSL Language.

3.3. What is ATI approach?

The ATI (Acceptance Test Improvement) approach was developed in the scope of this research to combine the application of RSL and AI Generative improving the acceptance testing process. It includes a Process Diagram, Technological Architecture Diagram and a Good Practices Guide.

4. Tools and support

Where will tasks occur?

Tasks will be completed online.

What equipment is needed?

• Smartphone, tablet or computer (preferable).
• Web navigator: Chrome or Edge.
• Internet connection to access the site to be tested (SUT).

5. Glossary

- AI: Artificial Intelligence
- ATI: Acceptance Test Improvement
- GenAI: Generative Artificial Intelligence
- NL: Natural Language
- RSL: Requirements Specification Language

- STG: Software Testing Guide
- STLC: Software Testing Life Cycle
- SUT: System Under Test

6. Instructions

What are the tasks to perform?

It is necessary to complete the following steps in this order:

- Complete the subtasks indicated to generate test work products.
- Fill please the assessment survey.

A - Accesses required

Objective: Follow the steps in order to access the site under test and the test assistant.

1) Access the SUT by URL: https://www.qatesthub.info/ .
2) Access to “STG-Software Testing Guide” assistant.
   a) Go to https://chatgpt.com/g/g-girJvbOJl-stg-software-testing-guide
   b) Click on the button “Aderir ao chat”.
   c) Create an account or log in as appropriate.
   d) Go to “STG-Software Testing Guide” assistant.

B – Generate Test work products - basic scenario

Objective: giving the SUT description in Natural Language (NL), the test goal and instructions, ask the assistant to generate the test work products (RSL requirements, test cases, automation script and traceability matrix).

Task:

Read and copy the text included in the rectangle displayed on the next page and paste it into the STG assistant's input box, providing the GenAI assistant with the website description, test goal, and instructions.

Prompt:

Hi. Your task will be to generate test work products (RSL requirements, test cases, automation script and traceability matrix) for testing a website. The site description is: The QA Testing Hub website (https://www.qatesthub.info/) is a website intended for use by professional testers, in order to help them stay up to date in the area of software testing and develop their career. The website allows you to consult blog posts, news, events, purchase e-books and even contact the author. The goal of this test is: Testing the navigation between the menu options: Home, News, E-books, Blog, Events, Contact, generating the respective test work products (RSL requirements, test cases, automation script and traceability matrix). The test should validate the access to each menu link from the home page and confirm that a text is displayed in the menu page. Pay attention to these notes: *For converting site description in NL to RSL specify the following element types: package, system, actors, actions definitions, events, use cases, data, data entities, state machines, and their respective relationships. *Give the response for an RSL file. *Automation tests will run on edge (it´s not necessary to include in the script the path to the drive). *Maximize browser window. *Page text to be checked is: Home page text: "QA Testing Hub"; News page text: "QA News"; E-books page text: "E-books"; Blog page text: "Blog"; Events page text: "Events"; Contact page text: "Contact Information".

C – Review - basic scenario

Objective: review, extend and adjust the response if necessary.

Task:

1 – Analyze the assistant response and ask for any adjustments if necessary.

If the STG assistant generates the test work products one by one, for example, generates only RSL requirements, please review it and ask to proceed with the test case generation, then with automation script and traceability matrix.

Examples of adjustment or extension prompts:

Prompt 1:

Generate the respective test case excel file.

Prompt 2:

In the generated test cases excel file, adjust the column widths so that the included text is readable.

Prompt 3:

In the generated automation script, include comments explaining the script to the user.

2 – After adjustments, ask for a final version.

Prompt:

Regenerate all the test work products with the adjustments introduced.

D – Result comparison – basic scenario

Objective: Compare your results with the validated results available at the following link regarding the validations requiring tool support (RSL requirements and Robotframework Automation script).

Link: https://github.com/s2mcunha/ATIapproach/blob/main/Basic%20scenario_results.pdf .

(If you think it would be interesting to test an advanced scenario, go to section E, otherwise go to section H to complete the assessment survey).

E – Generate Test work products - advanced scenario (optional)

Objective: giving the SUT description in NL, test goal and instructions, ask the assistant to generate the test work products for an advanced scenario.

Task:

Read and copy the text included in the rectangle below and paste it into the STG assistant's input box, providing the GenAI assistant with the website description, test goal, and instructions.

Prompt:

Hi. Your task will be to generate test work products (RSL requirements, test cases, automation script and traceability matrix) for testing a website.

The site description is: The QA Testing Hub website (https://www.qatesthub.info/) is a website intended for use by professional testers, in order to help them stay up to date in the area of software testing and develop their career. The website allows you to consult blog posts, news, events, purchase e-books and even contact the author by email.

The goal of this test is: Generate the test work products (RSL requirements, test cases, automation script and traceability matrix) for navigating to e-books page, test the action of adding e-books to the cart and confirm final price.

Pay attention to these notes: *For converting site description in NL to RSL specify the following element types: package, system, actors, actions definition, events, use cases, data, data entities and state machines. Give the response for an RSL file. *Automation tests will run on edge (it´s not necessary to include in the script the path to the drive). *The browser must be opened at the start of the first test and closed only when the last test is closed. *Maximize browser window. *After adding each e-book to the cart, need to handle alert message. *Each price should be converted to numbers. *Locators for Robotframework: Quantity of ebook 1: //input[@id='quantity-ebook-1']; Add to cart button of ebook 1: //button[@onclick='addToCart(1)']; Quantity of ebook 2: //input[@id='quantity-ebook-2']; Add to cart button of ebook 2: //button[@onclick='addToCart(2)']; Ebook 1 price: //div[@data-id='1']//span[@class='total-price']; Ebook 2 price: //div[@data-id='2']//span[@class='total-price']; Final price: //span[@id='final-price'].

F – Review - advanced scenario (optional)

Objective: review and adjust the response if necessary.

Task:

1 – Analyze the assistant response and ask for any adjustments if necessary.

2 – After adjustments, ask for a final version.

Prompt:

Regenerate all the test work products with the adjustments introduced.

G – Result comparison – advanced scenario (optional)

Objective: Compare your results with the validated results available at the following link regarding the validations requiring tool support (RSL requirements and Robotframework Automation script).

Link:

https://github.com/s2mcunha/ATIapproach/blob/main/Advanced%20scenario_results.pdf

H - Assessment survey

Objective: This survey will collect feedback from Software Testing professionals who applied the ATI approach to test a website and generated test work products using a Customized Generative AI Assistant, the "STG-Software Testing Guide".

Link: https://forms.gle/giijqg3drjcVhNAq9 .

7. Conclusion

Thank you for your time and feedback!

Your contribution is vital to improving ATI approach and making it more effective for the benefit of Software Testing professionals, like you!