Altimetrik

Transforming UI Automation Testing with GenAI, RAG, and Local LLMs

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White Paper

Executive **SUMMARY**

In today's competitive digital landscape, rapidly delivering high-quality web applications is critical to business success. However, sophisticated UI components and dynamic web frameworks often overwhelm traditional testing approaches, resulting in high maintenance costs, limited coverage, slow release cycles, and delayed innovation—ultimately impacting customer experience and market competitiveness.

To address these critical business challenges, this whitepaper introduces a transformative intelligent automation solution leveraging Generative AI (GenAI), Retrieval-Augmented Generation (RAG), and local Large Language Models (LLMs), including Mistral and Llama, seamlessly integrated with Playwright. This solution significantly reduces manual testing overhead, ensures higher reliability in test results, and accelerates product delivery. By enabling dynamic and context-aware test script generation, automated script maintenance, and incorporating human-in-the-loop validations, organizations can enhance software quality, achieve faster market response, and strengthen their competitive advantage.

BACKGROUND
Complexity in Modern UI Automation

Today's web applications utilize complex, dynamic UI components such as AG Grid, React Table, Vuetify Data Tables, Kendo UI Grid, Syncfusion DataGrid, and DevExtreme DataGrid. These components present significant challenges to traditional automation practices, such as frequent DOM changes, high maintenance costs, and limited dynamic behavior coverage.

LIMITATIONS
of Traditional Automation

Traditional automation scripts struggle to adapt dynamically, causing brittleness, high maintenance overhead, and limited coverage.

OUR SOLUTION
Intelligent, Context-Aware Automation

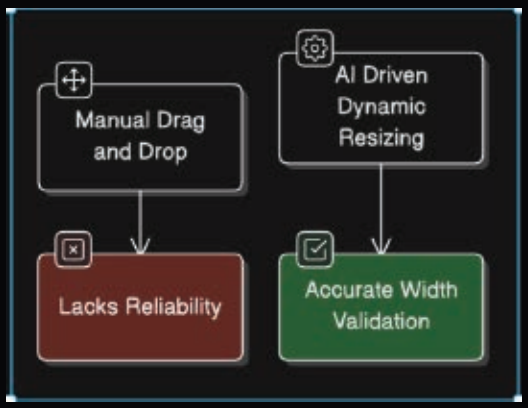
The framework leverages:

- **GenAI-driven Automation:** Dynamic script generation.
- **RAG:** Contextual accuracy via embedded documentation.
- **Local LLMs:** Rapid and secure local execution.
- **Human-in-the-Loop:** Expert validation and refinement.

ADDRESSING: Component -Specific Challenges (with and without Solution)

React Table – Column Resizing

AI scripts utilize RAG context to dynamically adapt to column resizing behaviors, ensuring consistent validations.



Without Solution:

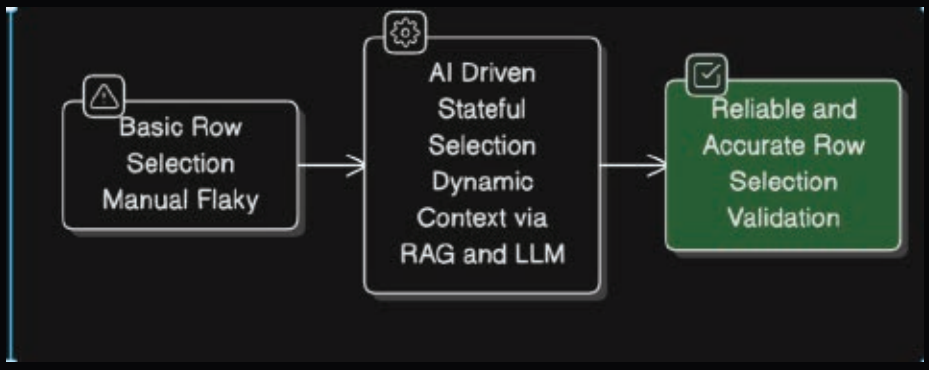
```
await page.mouse.move(100, 0);
await page.mouse.up();
```

With Solution:

```
await page.hover('.resizable-column-handle');
await page.mouse.down();
await page.mouse.move(100, 0);
await page.mouse.up();
await page.waitForFunction(() =>
document.querySelector('.column').offsetWidth >
100);
```

Vuetify Data Tables – Selectable Rows

RAG context enables scripts to reliably manage stateful row selection dynamically.



Without Solution:

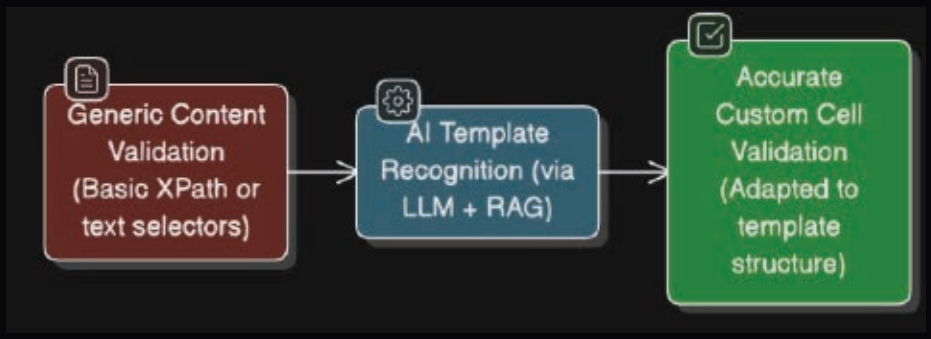
```
await page.click('input[type="checkbox"]');
await page.waitForTimeout(1000);
```

With Solution:

```
await page.click('input[type="checkbox"][aria-label="Select Row"]');
await page.waitForFunction(() =>
document.querySelector('.v-data-table__selected'));
```

Kendo UI Grid – Custom Cell Templates

Local LLM dynamically generates scripts capable of identifying custom cell templates.



Without Solution:

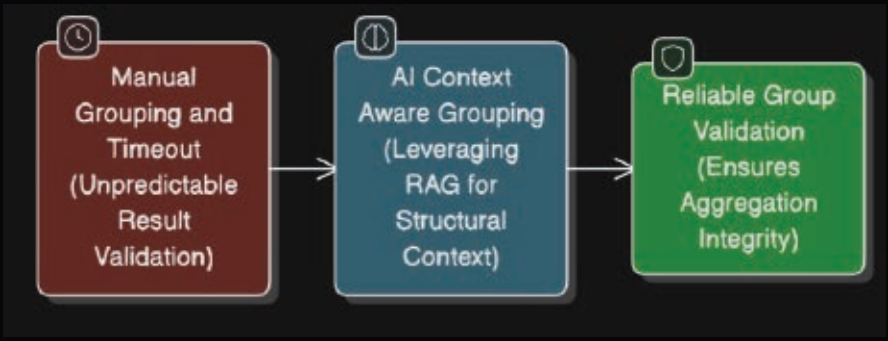
```
const content = await page.$eval('.k-grid-content', el =>
el.innerText);
```

With Solution:

```
const cellContent = await page.textContent('.k-grid-content
.custom-cell-template:first-child');
expect(cellContent).toContain('Special Format');
```

Syncfusion DataGrid – Grouping and Aggregation

AI-driven context-aware scripts reliably handle complex grouping and aggregation interactions.



Without Solution:

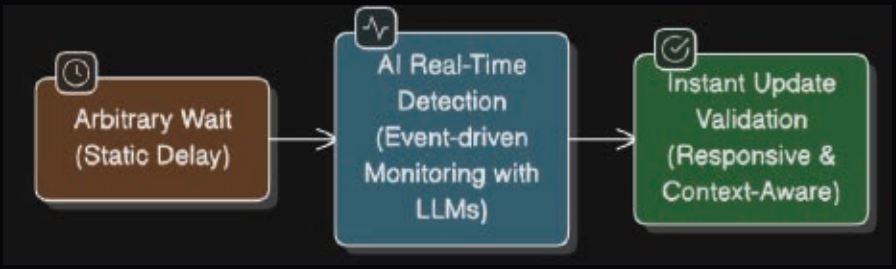
```
await page.dragAndDrop('.e-headercell', '.e-groupdroparea');
await page.waitForTimeout(2000);
```

With Solution:

```
await page.dragAndDrop('.e-headercell', '.e-groupdroparea');
await page.waitForFunction(() =>
document.querySelector('.e-groupcaption'));
```

DevExtreme DataGrid – Real-Time Data Updates

Dynamic adaptation via LLMs ensures scripts validate real-time data updates seamlessly.



Without Solution:

```
await page.waitForTimeout(3000);
```

With Solution:

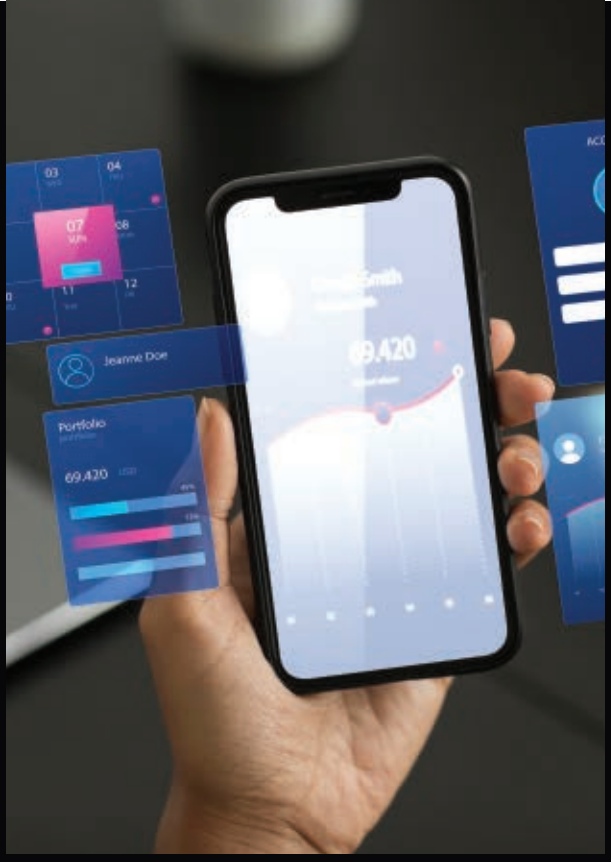
```
await page.waitForFunction(() =>
document.querySelector('.dx-row').textContent.includes('Updated
Value'));
```

Technical
ARCHITECTURE

- **Local GenAI & LLM Layer:** Secure local script generation.
- **Contextual RAG Layer:** Precise documentation -driven retrieval.
- **Playwright Integration Layer:** Script translation and execution.
- **Execution & Reporting Layer:** Actionable insights and comprehensive reporting.
- **Human Validation Layer:** Expert-driven refinements and validation.

Quantifiable **BENEFITS**

- **Reduced Effort:** ~70% decrease in manual scripting
- **Enhanced Coverage:** ~80% improvement in test coverage
- **Accelerated Testing:** Feedback loops reduced by ~50%
- **Increased Reliability:** Human validation enhances accuracy



Revolutionizing **UI AUTOMATION**

The integration of GenAI, RAG, and local LLMs provides a robust and intelligent solution capable of addressing the complexities of modern UI automation. Supported by human expertise, this approach offers substantial improvements in testing efficiency, coverage, reliability, and agility.

About Us

Altimetrik is a pure-play digital business services company focused on delivering measurable business outcomes through an agile, product-oriented approach. Our industry-first, proven digital business methodology serves as a blueprint to develop, scale, and launch new products to market faster. With a team of over 6,500+ practitioners skilled in software, data, and cloud technologies, we foster an agile engineering culture that drives collaboration, innovation, and modernization. By delivering results in incremental, bite-sized phases, Altimetrik helps businesses build new models and achieve transformation without disruption, serving as a strategic partner and catalyst for growth. The company has recently been recognized as a Product Challenger in ISG's prestigious Provider Lens™ 2024 study on Advanced Analytics and AI Services in the U.S. region.