International Journal of Management, IT & Engineering
Vol. 15 Issue 4, April 2025
SSN: 2249-0558 Impact Factor: 7.119
Journal Homepage: http://www.ijmra.us, Email: editorijmie@gmail.com
Double-Blind Peer Reviewed Refereed Open Access International Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gate as well as in Cabell's Directories of Publishing Opportunities, U.S.A

PHYGITAL TRANSFORMATION
Collaborative Bots in Action

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Abstract

This whitepaper explores the application of robotic automation to overcome the limitations of traditional UI test automation in POS systems.

By leveraging robots such as IntelliQA, ABB Gofa, and EVA by Automata, which can mimic human interactions, the study demonstrates how robotic automation can achieve higher test coverage (75%-80%), significantly reduce regression cycle times to 2-3 business days, and provide a more comprehensive and effective testing solution for POS systems.

Through comparative analysis and case studies, the paper highlights the benefits of adopting robotic automation, including enhanced efficiency, accuracy, and cost-effectiveness.

The findings suggest that robotic automation offers a superior approach to POS test automation, ensuring more reliable and efficient testing outcomes.

Keywords:

Robotic automation.
POS systems.
Regression cycle.
Efficiency.
Cost-effectiveness.

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1. Introduction

The purpose of this whitepaper is to explore how robotic automation can address the limitations of traditional UI test automation in POS systems. By leveraging robots like IntelliQA, ABB Gofa, and EVA by Automata, which can mimic human interactions, we aim to demonstrate how robotic automation can:

1. Achieve higher test coverage (75%-80%).
2. Significantly reduce regression cycle times to 2-3 business days.
3. Provide a more comprehensive and effective testing solution for POS systems.

Figure 1. *Benefits of Robotic Automation*

A comparative analysis, case studies, and the benefits of adopting robotic automation for POS test automation, ultimately highlighting its potential to enhance efficiency, accuracy, and cost-effectiveness.

2. Research Method

Research Model

Robotic automation involves the use of robots to perform tasks that are typically carried out by humans. These robots are designed to mimic human actions with high precision and consistency. In the context of POS (Point of Sale) systems, robotic automation refers to the use of physical robots to simulate human interactions with the POS hardware and software.

Figure 2. *POS Context for Robotic Automation*

How Robotic Automation Works

Robotic automation works by programming robots to perform specific tasks that replicate human actions. These tasks can include swiping cards, entering PINs, pressing buttons, and handling receipts. The robots are equipped with sensors and actuators that allow them to interact with the POS system in a manner similar to a human user. Here's a step-by-step overview of how robotic automation works in POS testing:

Figure 3. *Steps for POS Robotic Automation*

1. **Programming**: Robots are programmed with scripts that define the sequence of actions they need to perform. These scripts are created based on the test scenarios and requirements of the POS system.
2. **Calibration**: The robots are calibrated to ensure they can accurately interact with the POS hardware. This involves adjusting the robot's movements to match the physical layout of the POS system.
3. **Execution**: The robots execute the programmed scripts, performing tasks such as swiping cards, entering PINs, and pressing buttons. They can also handle physical receipts and other outputs from the POS system.
4. **Monitoring and Reporting**: During the execution of the tests, the robots monitor the system's responses and record any discrepancies or errors. This data is then used to generate detailed test reports.

Simulating Human Interactions with POS Systems

The concept of using robots to simulate human interactions with POS systems is based on the need to replicate real-world usage scenarios.
Traditional UI test automation tools can simulate software interactions but often fall short when it comes to physical interactions.
Robotic automation bridges this gap by providing a way to test the entire POS system, including both hardware and software components.

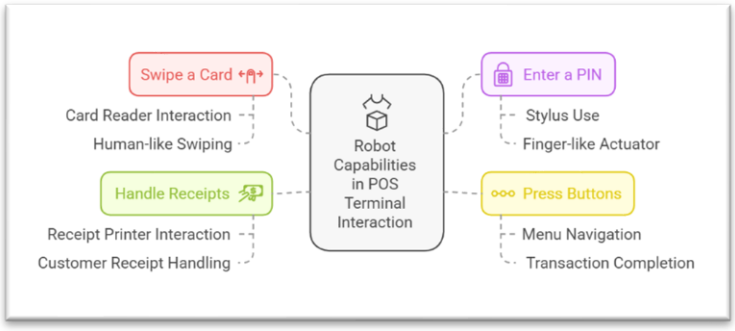

Figure 4. *Robot Capabilities for POS Automation*

By accurately simulating these human interactions, robotic automation provides a more comprehensive testing solution for POS systems. It ensures that all aspects of the system are tested, leading to higher test coverage and more reliable results

Technique of Collecting the Data
Data collection involves the use of robotic automation tools to perform various test scenarios on POS systems. The robots are programmed to execute specific tasks, such as swiping cards, entering PINs, and handling receipts. Data is collected on the performance of the POS system, including response times, error rates, and overall functionality.

Technique of Analyzing the Data
Data analysis is conducted using statistical methods to compare the performance of robotic automation with traditional UI test automation and manual testing. Key metrics include test coverage, regression cycle times, and cost efficiency. The analysis aims to identify the benefits and limitations of robotic automation in POS testing.

Hypothesis
The hypothesis of this research is that robotic automation can significantly enhance test coverage, reduce regression cycle times, and improve the overall efficiency and accuracy of POS system testing compared to traditional UI test automation and manual testing.
Research Chronological

Research Design:
Architecture Overview
We developed a sophisticated test automation solution for a retailer, integrating key technologies to enhance efficiency and coverage. This solution significantly improved test coverage, reduced regression cycle times, and provided robust reporting capabilities.

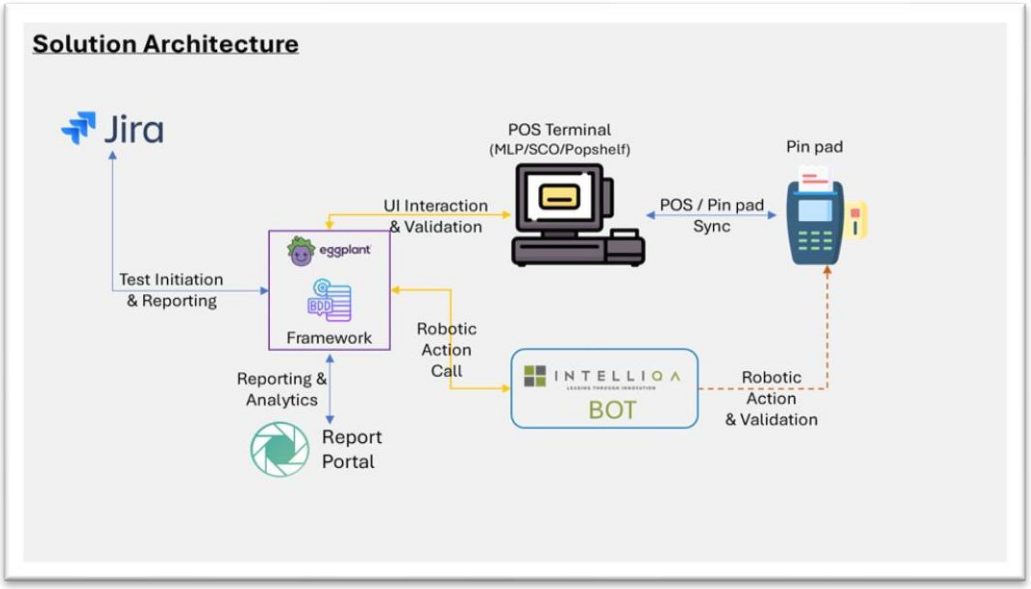

Figure 5. *POS Robotic Automation Framework Architecture*

Key Tenants of the Solution and Their Importance

JIRA Integration for Test Management:
Ensures streamlined test management and collaboration by providing a centralized platform for managing and tracking test cases. This integration enhances visibility, accountability, and efficiency in the testing process.

BDD Framework with Eggplant:
Implements a Behaviour-Driven Development (BDD) framework that interacts with both the POS system and robots via Eggplant, serving as the System Under Test (SUT). This approach promotes clear communication among stakeholders and ensures that tests are aligned with business requirements.

IntelliQA API for Robotic Actions:
Utilizes IntelliQA' s API, exposed over HTTP, to control all robotic actions, enabling precise and automated physical interactions with the POS system. This capability is crucial for accurately simulating human interactions and achieving higher test coverage.

UI Interactions and Validations:
Conducts UI interactions and validations through the POS terminal UI using Eggplant as the SUT, ensuring comprehensive testing of the user interface. This step is essential for verifying that the POS system functions correctly from an end-user perspective.

Reporting and Analytics:
Syncs additional reporting and analytics data with a report portal via Spring Boot Integration, providing detailed insights and enhancing decision-making. This integration allows for real-time monitoring and analysis of test results, facilitating continuous improvement.

These key tenants collectively enhance test coverage, reduce regression cycle times, and provide robust reporting capabilities, ensuring a more efficient and effective POS test automation solution.

Research Procedure:
The procedure involves programming the robots with test scripts, calibrating the robots to interact accurately with the POS hardware, and executing the tests.

IntelliQA: IntelliQA provides advanced robotic solutions for end-to-end POS test automation, featuring bespoke engineering to perform mechanical interactions and reduce reliance on manual testing

ABB Gofa: ABB Gofa is a collaborative robot (cobot) known for its superior precision, safety features, and ease of use, designed to work alongside humans without the need for protective barriers

EVA by Automata: EVA is a compact, affordable desktop cobot that mimics human interactions with intuitive programming, making it ideal for automating small, repetitive tasks in POS testing

Feature/Capability	IntelliQA	ABB Gofa	EVA by Automata
Description	Advanced robotic solutions for end-to-end POS test automation	Collaborative robot (cobot) with high precision and safety features	Compact, affordable desktop cobot for small, repetitive tasks
Key Features	Customizable solutions, physical receipt validation, fuel dispenser testing	Integrated torque sensors, handles up to 5kg, designed for collaborative work	Easy setup, flexible, user-friendly programming interface
Strengths	Tailored engineering solutions, seamless integration, enhanced test coverage	Class-leading speed and safety, high-precision tasks, direct human collaboration	Affordable, accessible, versatile applications
Unique Functionalities	Full system test automation, reduces manual testing reliance	Superior precision, safety features, no need for protective barriers	Intuitive programming, ideal for small-scale automation tasks

Selection Criteria

Choosing the right robotic automation solution for your organization involves evaluating several factors to ensure the selected robot meets your specific needs and requirements. Here are some key considerations to help you make an informed decision:

1. **Identify Your Testing Requirements**

Test Coverage: Determine the level of test coverage you need. If you require comprehensive coverage, a solution like IntelliQA might be suitable due to its customizable and full-system automation capabilities.

Types of Interactions: Consider the types of human interactions you need to simulate (e.g., swiping cards, entering PINs, handling receipts). Ensure the robot can accurately perform these tasks.

2. Evaluate Technical Capabilities
Precision and Accuracy: Assess the precision and accuracy required for your testing. High precision and integrated torque sensors might be ideal for tasks requiring meticulous accuracy.
Payload Capacity: Check the payload capacity needed for your testing scenarios. Load handling up to 3-4Kg, which might be necessary for certain POS components.

3. Consider Ease of Use and Integration
Setup and Programming: Evaluate how easy it is to set up and program the robot. EVA by Automata is known for its user-friendly programming interface, making it accessible for organizations with limited technical expertise.
Integration with Existing Systems: Ensure the robot can integrate seamlessly with your existing POS systems and testing frameworks. IntelliQA offers tailored engineering solutions for seamless integration.

4. Assess Cost and Budget
Initial Investment: Consider the initial cost of the robot and any additional expenses for setup and training. EVA by Automata is an affordable option for organizations with budget constraints.
Long-term Costs: Evaluate the long-term costs, including maintenance, scalability, and potential upgrades. Choose a solution that offers a good balance between cost and functionality.

6. Scalability and Future Needs
Scalability: Ensure the robot can scale with your organization's growing needs. ABB Gofa's collaborative nature makes it suitable for scaling up operations.
Futureproofing: Choose a robot that can adapt to future technological advancements and evolving testing requirements.
Vendor Support: Consider the level of support and service provided by the vendor. Reliable support can be crucial for troubleshooting and optimizing the robot's performance.

Data Acquisition:
Data is acquired through the execution of test scenarios, with robots performing tasks and recording the system's responses. This data is then used for analysis.

Supporting References for Benefits of Robotic Automation
The research is supported by references to existing studies on robotic automation, POS system testing, and the benefits of using robots for repetitive and precise tasks. These references provide a scientific basis for the research methodology and help validate the findings.

Increased Test Coverage

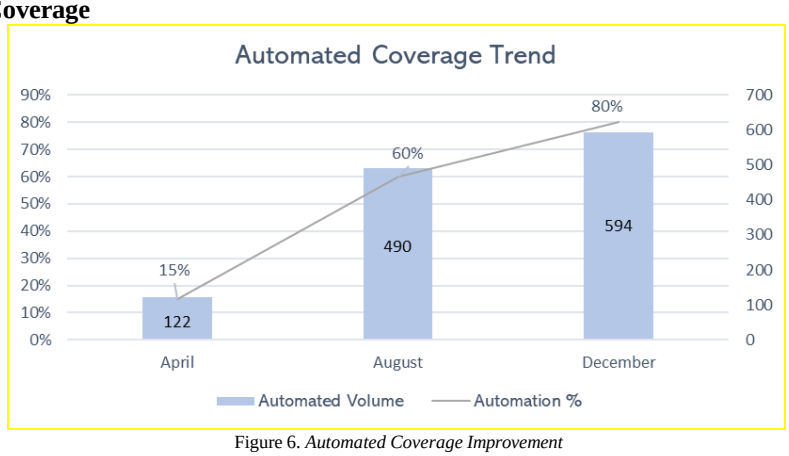

Figure 6. *Automated Coverage Improvement*

Robotic automation enhances test coverage by accurately simulating human interactions, such as swiping cards and entering PINs. This allows for comprehensive testing of both software and hardware components, achieving 75%-80% coverage compared to 45%-60% with traditional UI automation.

Reduced Regression Cycle Time

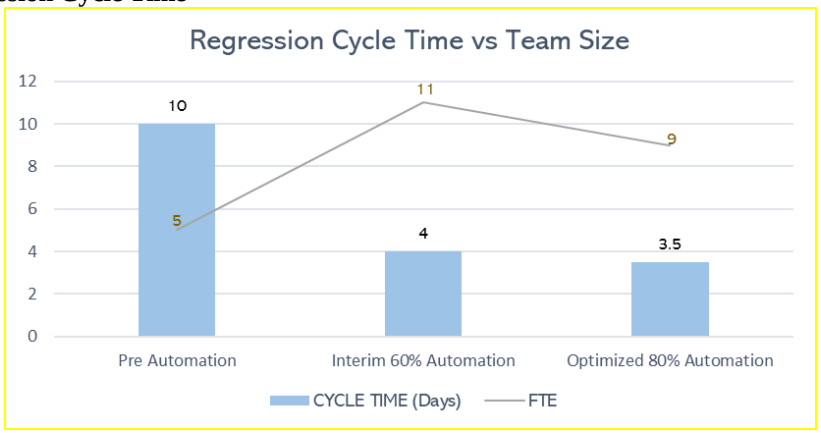

Figure 7. *Regression Cycle Time vs FTE reduction*

Robotic automation significantly shortens regression cycle times to 2-3 business days, compared to 5-7 days with traditional UI automation and approximately 10 days with manual testing. This faster turnaround enables quicker identification and resolution of issues.

Cost Efficiency

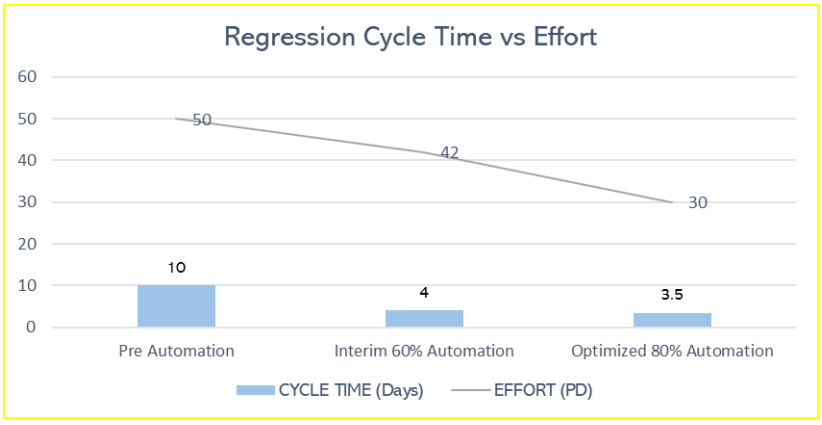

Figure 8. *Regression Cycle Time vs Effort reduction*

3. Results and Analysis

Robotic automation reduces testing time and manual interventions, leading to substantial cost savings. By automating complex interactions, it minimizes costs and accelerates time-to-market. The precision of robotic testing also reduces the need for rework, further lowering costs.

Overall, robotic automation offers superior test coverage, faster regression cycles, and cost efficiencies, making it a valuable investment for POS test automation.

4. Conclusion

Robotic automation offers superior test coverage, faster regression cycles, and cost efficiencies, making it a valuable investment for POS test automation. By leveraging advanced robotic solutions, organizations can achieve more reliable and efficient testing, enhancing the performance and reliability of their POS systems.

Robotics and Digital Twin Creation

Robotics Advancements:

- **Enhanced Precision and Flexibility**: Future robots will provide greater precision and flexibility, enabling more accurate simulation of human interactions with POS systems, thereby improving test coverage and reliability.
- **Collaborative Robots (Cobots)**: The increased use of cobots, like ABB Gofa, will facilitate safer and more efficient collaboration between humans and robots in testing environments.

Digital Twin Creation:

- **Real-Time Simulation**: Digital twins will create virtual replicas of POS systems, allowing for real-time simulation and testing of various scenarios without physical hardware. This will enable continuous testing and quicker identification of issues.
- **Predictive Maintenance**: Integrating digital twins will help predict potential failures and maintenance needs, ensuring robots remain effective over time.
- **Data-Driven Insights**: Digital twins will provide detailed analytics and insights, optimizing testing processes and improving decision-making.

Combining robotic automation with digital twin technology will further enhance POS test automation, achieving greater accuracy, efficiency, and reliability.

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