The Turn-key Test Automation Solution for Futuristic Automotive Infotainment HMIs

Quest global

Executive Summary

In the age of smart, connected, and autonomous vehicles, infotainment systems and Human Machine Interfaces are rapidly emerging as one of the most critical features. Today, one of the major challenges faced by most automotive Original Equipment Manufacturers (OEM) is to ensure and enhance product quality and test the complex functions handled by infotainment HMIs before the onset of actual production. Test automation has emerged as a proven method to shorten test cycles, enhance quality, accelerate go-to-market strategies, while saving upon critical resources. Although there is a wide variety of free resources and paid test automation software in the market, these have some limitations while automating complex HMI and embedded systems. This article introduces Quest Global's HMI Test Automation framework that provides a superior experience for sampling, analyzing, and manipulating a constructive mechanism to test an intuitive HMI system using Artificial Intelligence.

Introduction

In 2022, while buying a new car, apart from checking its safety rating, build quality, engine reliability, and maintenance cost, what could be one of the other top priorities?

GFK Automotive research reports that five out of the top ten car purchase decisions are based on infotainment features. An In-Vehicle Infotainment (IVI) system that informs the driver and entertains the passengers is a critical decision making factor for today's car buyers. Futuristic automotive design with connected or self-driving cars would only increase the In-Vehicle Infotainment system's complexity in the race for unique selling points.

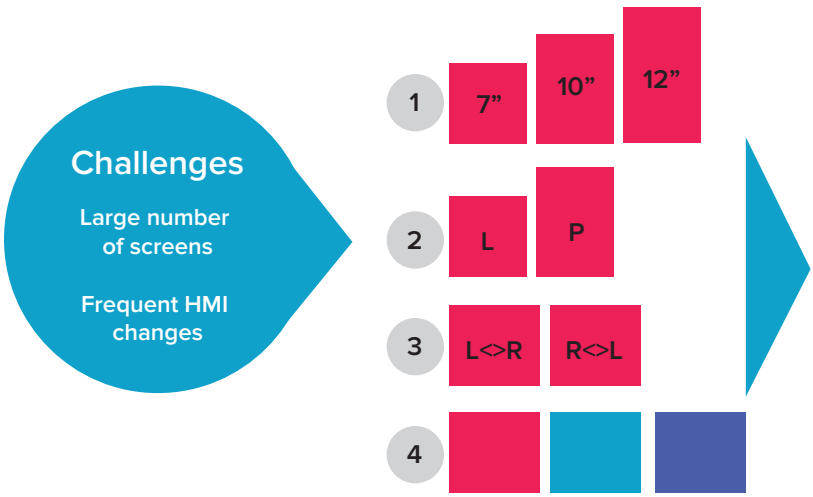
IVI Design Challenges

Media	Phone	Radio	Navigation	Projection	Vehicle/HVAC	Internet Apps

OEMs or TIER 1 suppliers have multiple infotainment systems with the same platform. However, with screen sizes and orientations (portrait and landscape) differing based on the actual IVI system design, test automation becomes more complex as many screens are involved. Moreover, based on the left-hand and right-hand drive, icon designs need to change position, and multiple user interface themes create even more complexities for screen verification.

Production Program ; 200-250 engineers. 2 years. 50-70 Test engineers

Conventional Way



- **High Manual Testing Effort**
- **Not - efficient - Automation**
  - No direct solutions in the market
  - Test rework is high

Test Automation Challenges

Target Systems

UI Controls	API, Protocols	Image based HMI
Windows Desktop Win32, MFC, .Net C#	Web service	HMI • Automotive HMI • Consumer Electronics-Set topbox, HD Player, AVR
Web page - Browser	Protocol / Shell	
Mobile App- Android, iOS	Test & Measurment	Remote Desktop UI
Linux Desktop	Embedded Systems	Camera

Advanced HMI + Embedded Systems

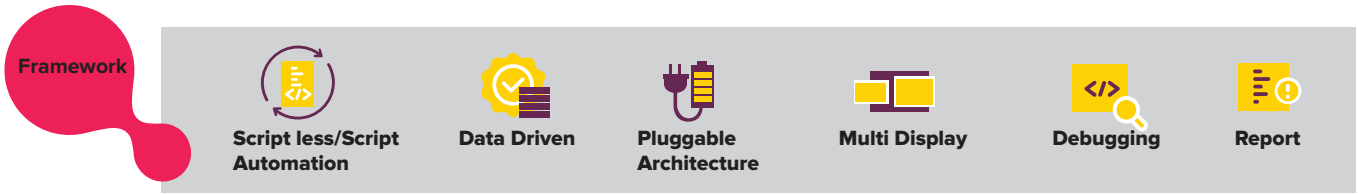
For automotive OEMs, there is an ever-challenging mandate to ensure and enhance product quality while testing these complex functions before production. With shrinking product refresh cycles, test cycles have also been halved. Short on time and the expertise of skilled engineers, automotive leaders have tried automating these tests to maintain this industry-wide impetus for accelerating go-to-market strategies. Such practices to make the impossible possible have steadily increased the need for test automation frameworks and solutions. Many open-source and commercial test automation software are available in the market. However, there is no silver bullet for automating the testing of advanced HMI and embedded systems.

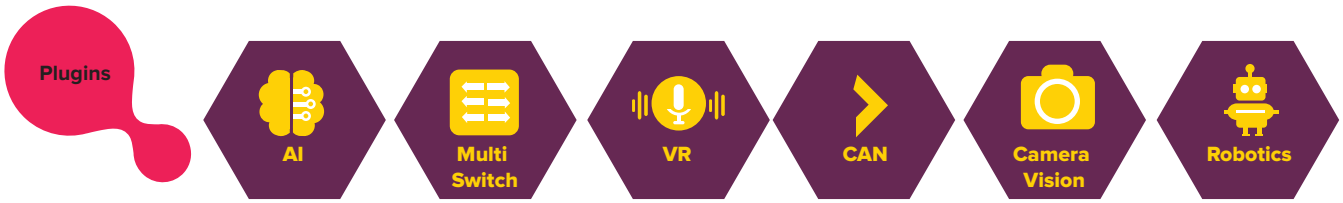
Why an AI-driven Test Automation Framework by Quest Global?

While partnering with the leading automotive brands worldwide, engineering teams at Quest Global noticed a common trend. Our customers were worried about the high failure rate of the image processing library in their existing test automation systems. These were the needs for which Quest Global's test automation solution was created. It's a highly advanced AI-based test automation framework for infotainment HMIs that neither depends on the operating system nor the screen size.

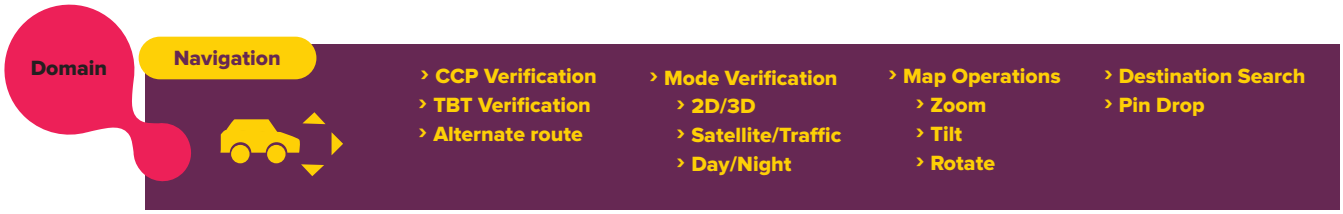
Most problems in HMI development arise due to the enormous effort required to test every aspect of the HMI before every release. This calls for the need to automate the complete HMI regression testing. The Quest Global AI-driven test automation solution focuses on establishing a systematic procedure by leveraging existing test automation tools and custom modules to match the type of testing needed. From representing the HMI screens to test case generation and execution with the AI technology used for verifying and identifying the screens – the framework does it all.

Key Features





1. **Hybrid screen recognition module:** Capable of comparing screens using both AI and image processing techniques
2. **Multi-capturing mode of screens:** Screens can be grabbed directly from the device as screenshots or camera images can be used for identifying controls
3. Any robotic arm can be integrated into the system. **Modular architecture** helps plug in any robotic solutions for touch operations.
4. All other features are essentially required for the test automation of automotive systems
   - Audio verification
   - CAN message verification
   - Voice recognition with single and multi-level
   - Optical Character Reading (OCR)
5. Contains an inbuilt library for verifying the functionalities of navigations screens



The Automation Workflow

The solution includes online and offline processes. The offline process generates test cases from test scenarios. In contrast, the online process uses these test case definitions to generate test scripts and executes them on the actual device. Verification is done either by image comparison or with AI analysis.

Applications

This framework can handle Sanity Testing, Functionality Testing, and Performance evaluation.

Customer Benefits

Quest Global's test automation solution provides critical benefits such as:

1. Accelerating testing cycles
2. Enhancing testing efficiency and test coverage
3. Cost efficiency
4. AI reduces the rework effort if there is any change in the screen
5. AI improves the efficiency of control recognition

Accelerating digital transformation for automotive OEMs

Quest Global has been at the forefront of accelerating digital transformation for OEMs and car manufacturers by designing solutions like these. Such partnerships have enabled world-leading OEMs to create a passenger experience that is intuitive, appealing, and desirable. Our experienced teams of automotive engineers with proven expertise understand the broader ecosystem of automotive components and how they work. It is solely based on the innovation and collaboration of such extraordinary engineers that Quest Global has consistently delivered superior and reliable solutions in critical areas such as infotainment, embedded software design, chip design, virtualization of testing, and much more with the help of our Centres of Excellence (COE) in India and Germany.

For more than 25 years, Quest Global has emerged as the most trusted partner for some of the leading OEMs and Tier 1s to solve the hardest automotive engineering and design challenges. We help develop the software-defined cars of today and tomorrow by integrating new technologies and processes on both the hardware and the software side. Our quality systems and processes meet the highest standards and ensure the efficacy, reliability, and safety of the systems and solutions we develop for our customers.

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