GAIO TECHNOLOGY
Embedded Software and Model-based Development Solution Provider

Development tool, test tool and engineering service supplier for embedded software development

GAIO TECHNOLOGY was founded in 1990 as an original cross compiler developer for embedded systems. At present we provide embedded development and test tools based on our own microprocessor, mode analysis and simulation technologies. In addition, our solutions have expanded to include engineering services such as model-based development, test process construction and tool installation support for automobile manufacturers and parts suppliers.

The standard software test tools in the automotive industry in Japan

GAIO’s embedded software unit test tool, CoverageMaster has become one of the standard tools in the automotive industry in Japan. CoverageMaster includes a built-in microprocessor simulator to perform unit tests on actual target code. CoverageMaster has many users, particularly in the automotive industry, that require high-mouldly high-quality tests. CoverageMaster and our code analysis tool, CodeInspect have both been certified as automotive safety ISO 26262 compliant tools in order to provide advanced assurance to our customers in meeting functional safety requirements.

Corporate Profile

Company Name: GAIO TECHNOLOGY CO., LTD.
Established: March 31, 1990
Capital: 240 million Japanese Yen
Board of Directors: Chairman & CEO: Takashi Tanakashi
President & CDO: Yoshiko Nakamura
Director: Toshiyuki Yagi
Director: Yoji Iori
Director: Keiichi Watanabe
Director: Yoshitaka Tanaka
Auditor: Akira Okitsu
Employees: 95 (As of April 2019)
Affiliates: INNOFEO Corporation
Location: Headquarters (Yamaguchi Office) Tsurumi, 2nd Floor 35F

Company Organization

GAIO develops original embedded development and test tools based on GAIO's own code analysis and microprocessor simulation technologies including:
- Test tool product development
- Code analysis product development
- Microprocessor simulator module development
- Simulator debugger tool development
- MPU object code analysis and conversion tool development
- Cross compiler
- Documentation

GAIO provides the following engineering services primarily for Japanese automotive companies such as:
- Model-based development installation support
- Model-based development technology research
- Software quality improvement support
- Unit test installation support
- Functional safety test process creation
- Test process consulting
- Unit test services

GAIO conducts its own sales activities including product sales, marketing, shipment, user support, maintenance, exhibition show participation and training seminars.

GAIO's financial and human resources management team.
GAIO began as an original cross compiler developer in 1980. Now GAIO develops embedded development and test tools based on our own core microprocessor code generation, code analysis and simulation technologies.

Global tool Interlink Solution (GiS) is GAIO’s new comprehensive development and verification solution for embedded developers. GiS allows for GAIO’s original tools and services to be linked with other tools in order to create custom tool chains for comprehensive testing solutions.

**MC-Verifier : integrated Model / Code Back-to-Back Test Tool**

“MC-Verifier” is an integrated test tool for performing model-based development Back-to-Back testing.

**Model, Software & Target Code B2B Testing, Evaluation & Reporting**
MC-Verifier can perform B2B testing with models (MIL), software (SIL), & target code (PIL). Evaluate B2B test results to detect and report error locations. Import test cases created from other MBD tools for B2B testing.

- **Note**: GAIO’s own MPU simulator is built-in for target code testing.

**MATLAB/Simulink Integration**
MC-Verifier is integrated with MATLAB/Simulink. MC-Verifier features such as model, software, target-code B2B testing and report generation can be executed from the MATLAB/Simulink GUI, command-line or MATLAB scripts.

**Code Debugging Features**
Code debugging features included with the MPU simulator can be used to analyze errors for model-to-target-code tests. Set breakpoints in the code, verifying changes in variable values, register values, memory values, etc.

**Error Location Analysis**
The output values of signal lines and code variables for the selected subsystem are recorded during testing. After testing, signal line and code variable values can be analyzed over time in order to locate errors. This feature for locating errors even works with breakpoints in the code, verifying changes in variable values, register values, memory values, etc.

**Model-Based Development - B2B Test Use Cases**

**High-Abstraction Level & Low-Abstraction Level**
- Specification Model & Implementation Model

**Software Developers (MIL to SIL)**
- Verify MATLAB/Simulink algorithm design
- Evaluate behavior consistency between models

**Control System Designers (MIL to MIL)**
- Verify floating-point to fixed-point conversion
- Evaluate model equivalence to code generation

**Implementation Model & Target Code**
- Identify errors (SIL, SIL to PIL)
- Validate model to target code testing

**Code Coverage**
Code coverage (statement, Branch, MC/DC) can be measured for model-to-target-code tests. In this way, detect code structure issues through code coverage testing and fulfill ISO 26262 code coverage requirements.

Block highlighted colors indicate the degree of error
From small to large: BLUE - GREEN - RED

Use to locate the cause of errors when they first occur.
CoverageMaster winAMS/General: Unit Test Tool

Embedded C/C++ software unit test tool
Performs MPU target code based unit testing
CoverageMaster winAMS is an automated embedded software unit testing tool that executes the target MPU (*) device’s code. It is recognized as a standard unit test tool for automotive software that requires high-reliability high-quality tests.

(*) - The MPU support list can be viewed at GAIO’s web page.

Code coverage
The code coverage modes for unit testing, CD (Statement Coverage), C1 (Branch Coverage) and M/C/CC are fully supported. In addition, function/call coverage required by ISO 26262 for integration testing can also be measured.

Specification-based and Structure-based Test Case Design Features
Test cases can be efficiently created from the function’s specifications to perform Requirement-based testing by using CoverageMaster’s dedicated Data Analysis Editor. Test Cases can also be auto-generated through source code static analysis for Structure-based testing.

Automation by using Batch Execution and CLI
Using Windows Batch files, it's possible to easily manage, configure and run tests automatically through CoverageMaster’s Command Line Interface (CLI).

Functional safety certified
CoverageMaster winAMS complies with the ISO 26262 automotive functional safety standard and the IEC 61508 functional safety meta-standard. Tool certification was granted by third-party certification organization TÜV SÜD Germany.

Safilia: A Safety Concept Design Tool supporting SCDL
A modeling tool for Safety Concept Design using the Safety Concept Design Language (SCDL)
Safilia is a tool to assist Safety Concept Design using the Safety Concept Design Language (SCDL). It follows the specifications and standards decided by the Safety Concept Notation Study Group, which oversees the development of SCDL and promotes its diffusion.
Facilitate the sharing of Safety Concept Designs through a Block Diagram interface
Safilia includes a graphical editor to display Safety Concepts with block diagrams.
By making the Safety Concepts and their inter-relations easier to visualize, it facilitates the expression and communication of critical Safety Designs to other Design or Development teams.

Shared Variable Checker: Visualize Variable Conflicts
An Integrated Browser to visualize Variable Access and detect conflicts
Using data from CasePlayer2’s static analysis, SVC reports the race conditions on Global Variables accessed by multiple functions, tasks or interrupts.
Easily confirm which function accesses a selected variable with the built-in "Function Graph" viewer.
Save the Analysis data for each variable to CSV files and export "Function Graphs" to PDF files.

Notes: Feature names are subject to change. CasePlayer2 sold separately.

CasePlayer2: Program Analysis and MISRA-C Check Tool
Functional safety certified
Program analysis and document creation tool
CasePlayer2 is an integrated reverse CASE tool that can create program documents such as flowcharts and MISRA-C reports from the source code. CasePlayer2 complies with the ISO 26262 automotive functional safety standard and the IEC 61508 functional safety meta-standard.

< Created Document Types >

< MISRA-C Rule Check Function >
MISRA-C 1998 & 2004 rule sets for C code checking are supported with configurable options.

< MISRA-C checking & source metrics >
MISRA-C checking & source metrics supported:
Cyclomatic Complexity, Myer’s Interval, Nesting, Code Size, Number of lines (excluding comment), Comment Rate (%), Static Path Count

Garo’s Simulator Based Family SBF-SLV: Virtual Verification Tools
Easily reproduce fault conditions
GAO’s Simulator Based Family consists of microprocessor simulator based virtual verification environment solutions. System level verification can be performed by connecting HW simulation models with a microprocessor simulator. In this way software reliability testing can be performed by reproducing exceptional conditions and fault conditions in the virtual system.

Execute actual target code
Actual target code generated by a cross compiler is executed in GAO’s microprocessor simulator for the system simulation. Embedded software that includes address mapped i/o port definitions and MPU dependent interrupts can be executed as is.

Connectivity library to link with external HW simulation models
The microprocessor simulator can be connected with external HW simulation models such as MATLAB/Simulink, mechanical models, C/C++ and SystemC ASIC models through the connectivity libraries provided by GAO. Various types of system simulations can be built by creating a test management model for performing input/output functions.
We contribute to improving customer development and engineering ability

We provide engineering services to support customer development based on our over 30 years of experience in embedded tool development. As an experienced tool vendor we have access to extensive embedded industry information valuable to our customers. At present we primarily provide a wide variety of services for model-based development related support and embedded software quality improvement.

In addition, based on our close relations with our customers we can develop and improve useful test tools solutions. We are truly grateful for your consideration in using our engineering services.
We make sure to reach our customers’ mid and long-term objectives during Product Design and Development with our expertise and multiple specialized teams.

Assess the customer’s needs and efficiently develop and provide tools to optimize performance

From Safety Concept Design support to the completion of the Software Testing Process, experienced professionals assist you

On-site Support for AUTOSAR development processes: ahead of the market, a team already experienced with the AUTOSAR architecture assists your transition

A team with global experience with the complete Model-Based Development process

Let us handle the Quality improvement of your Automotive Software

Starting Test in the early design phases with virtual ECU Testing Environments. Setup MATLAB/Simulink or Hardware-in-the-Loop Simulation Environments.

There are many challenges to face in order to create and develop a product that is safe and reliable but also manufacturable and competitive. To tackle these issues, our specialized teams combine their knowledge of Quality Assurance, Functional Safety, Model-based Development, Process Improvement, Tool Optimization, AUTOSAR, Virtual ECU Testing, and Test Services, and help you reach your mid-term objectives (Safety, Reliability, Completeness). We also provide services to customers already in the mass-production phase, who face issues with time-consuming iterative processes.

Model-based Development is now widely adopted in the Automotive Industry. We help you setup an efficient toolchain to boost the efficiency and quality of your Development and Testing processes.

We can quickly create test items especially adapted to the customer’s needs and quality standards (as a tool vendor, this is GAIO’s specialty after all)

We provide management tools (ALM, BT/RTS, ClearCase, ...), MATLAB/Simulink based MDB automation, automatic report generation in Excel/PowerPoint, user-friendly GUIs, etc...

We level up the development and testing process to the end of the ISO Certification. Our Test experts can support you on all phases of the MDB process with our extensive knowledge based on several years of experience in the Embedded Software Industry.

With the industry’s shift toward MDB, the old ways of thinking and methods for designing and testing Software "by hand" become obsolete.

We have a lot of feedback from Software Testing teams worrying about the transition to MDB.

"How to efficiently test complex models?"

"How to efficiently use Automatic Test data Generators?"

GAIO can help you plan and optimize your Quality Assurance and Testing Procedures for the MDB Age in conformity with the ISO26262 standard and no less in product quality or time schedules.