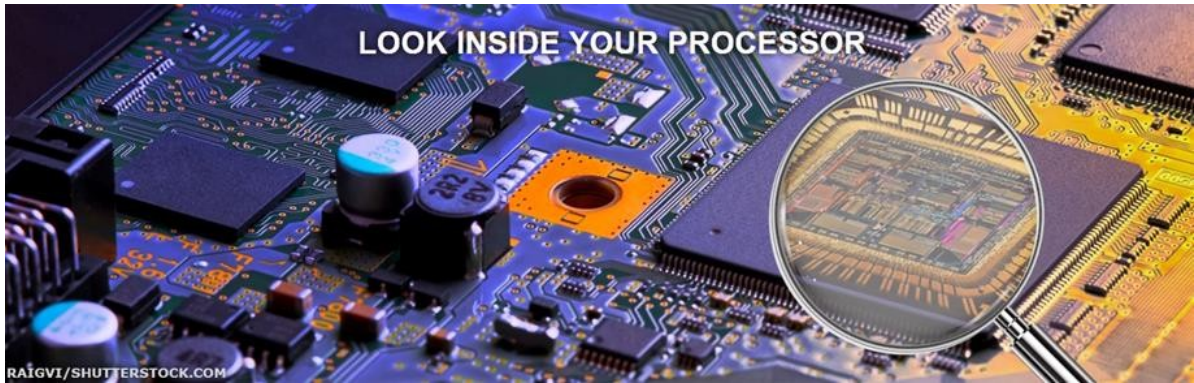**Embedded4You e.V.**

Joint project and cooperation between E4You member companies and partners

Research project CoCoSi

Measurement of code coverage at system and integration level
- Within KMU-Innovativ -

Participating companies from E4You and cooperation partners

HEICON Global Engineering

Accemic Technologies GmbH

Further partners: Intel Deutschland GmbH and the Fraunhofer Institute for Experimental Engineering (IESE)

Motivation

Embedded systems must increasingly fulfill safety-critical requirements. This usually requires structured development in accordance with specified standards. It is therefore necessary to precisely specify the necessary requirements, which are then translated into functions in the project. These results must be verified by functional and structural tests.

These structural tests are important and mandatory in order to be able to check the completeness of the functional tests and thus the safety of the system. They require a deep insight into the running software and are usually only carried out at low level for technical reasons

The CoCoSI project is developing and evaluating a solution that can also carry out structural tests when performing functional high-level tests.

Embedded4You e.V.

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Project description

The KMU-Innovativ research project "CoCoSI - Code Coverage in System and Integration Tests" with the project number 01IS19044 was carried out from January 2020 to April 2022 was carried out.
The project developed and evaluated new methods for automated structural test completeness measurement (code coverage) at higher test levels (integration and system testing).

Project implementation

The requirements specification on which the project was based was developed under the leadership of HEICON. The technical basis of the project, the CEDARtools® based
online measurement of structural overlap, was provided and adapted by accemic.
The support of Intel was essential in order to utilize the observation possibilities of modern microprocessors.

The detailed analysis of the machine code and source code coverage data obtained was carried out jointly, with a particular focus on the coverage measurement with optimized compilation, the detection of MC/DC situations and the analysis of coverage gaps.

HEICON and IESE successfully evaluated the methods developed.

Technology and innovation

The core of the project was the application of the method developed by accemic for the non-intrusive and continuous observation of an embedded system. This makes it possible to go beyond the usual unit tests to work at higher test levels and identify superfluous program code, missing integration and system tests and missing requirements. In addition, the number of test cases and the duration of test runs can be reduced through greater automation and the utilization of synergy effects at different test levels.

Conclusion and goals achieved

The functioning of the method was impressively demonstrated on the basis of practical examples developed in the project.

Two articles published in the IEEE Computer Magazine in connection with the project and winning the prestigious "embedded award" in the tools category, which is presented by the "embedded world Exhibition & Conference" in six categories and honors the most innovative products from the embedded system industry every year, are worthy of special mention.

About accemic and HEICON

accemic

With CEDARtools®, the company has developed a new type of dynamic analysis technology and implemented it in a product.

This makes software tests for embedded systems more effective and efficient.

The tools simplify the debugging process and make it possible to find the causes of sporadic, non-deterministic errors.

www.accemic.com

HEICON

System security - competent & sustainable

As a technological consulting company whose strengths lie in its knowledge of methods and processes for safety-critical systems and embedded solutions, it offers its expertise in a binding and sustainable manner for the added value of its customers.

https://www.heicon-ulm.de

Are you more interested in the topic of software quality assurance for embedded systems?

You are welcome to contact Mr. Martin Heininger (martin.heininger@heicon-ulm.de) and Dr. Alexander Weiß (aweiss@accemic.com). They look forward to exchanging ideas with you.

Embedded4You e.V.

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