CANTATA

QA SYSTEMS
The Software Quality Company

SECTOR Automotive

STANDARD ISO 26262

Case Study

INNOVIZ™ TECHNOLOGIES

InnovizOne

ABOUT THE COMPANY

Innoviz Technologies is the leading provider of high-performance, solid-state LiDAR sensors and perception software used across the aerospace and defence, automotive, and industrial automation industries.

Headquartered in Israel, the company was founded in January 2016 by former members of the elite technological unit of the Israeli Defense Forces who have renowned expertise in the fields of electro-optics, computer vision, MEMS design and signal processing.

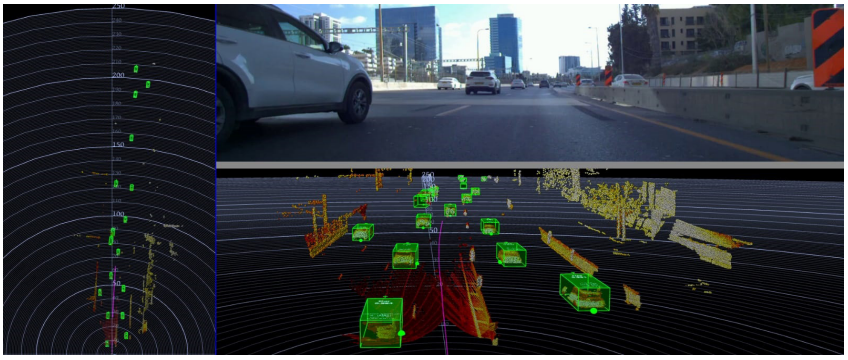
www.innoviz.tech

"Wrapping and custom code insertion capabilities in Cantata were a major benefit in achieving full code coverage of the harder to reach areas of defensive programming"

Project Background

Innoviz Technologies has designed and produced 3 products for autonomous vehicles: InnovizOne, InnovizTwo and Perception Software. InnovizOne was their first to market and is a LiDAR based sensor that when coupled with the Perception Software delivers high angular resolution and precise object detection. Together with the other products, they form part of an automotive grade package of software and hardware with unrivalled flexibility for use in applications outside of autonomous driving such as, industrial automation, commercial and consumer products. So that it was suitable for safety critical applications, InnovizOne was classified under ISO 26262 at the safety integrity level ASIL B.

The software was implemented in both C and C++, compiled with the ARM® Compiler (6.6.2) in the ARM® DS-5 Ultimate Edition IDE (v.5.29.1). The software was deployed on two chipsets, an ARM® v8 (Cortex-A) and an ARM® v7 (Cortex-R and Cortex-M) running ThreadX® RTOS (v5).



LiDAR Sensor onboard an Autonomous Vehicle

Toolchain Integration was Key

The team were looking for flexible solution for test automation and reporting suitable for ISO 26262 certification. As Cantata provides a high degree of automation for the generation, execution and analysis of unit & integration tests, where these can be edited in the GUI or directly as C/C++ code and run as executables on target, it was an obvious candidate tool.

However, the most important requirement for Innoviz Technologies, was a high level of integration with their complex toolchain. The chosen test tool had to integrate with: their ALM tool (Intland codeBeamer®), static analysis tool (Helix QA-C®), continuous integration tool (Jenkins), and their IDE (Arm Development Studio®).

Why Cantata was Chosen

Innoviz Technologies selected Cantata after evaluating a total of four commercial tools. Nir Erez, Director of LiDAR Software identified the main reasons for choosing Cantata. "**Firstly, we had a really good demonstration of the tool from QA Systems. There were no missing requirements with Cantata**". Beyond the tool requirements the capability to intercept as well as just simulate function calls, was seen as a clear technical advantage. "**Wrapping was also another interesting feature in Cantata. Other tools did not have the same functionality, nor was it explained clearly**". Finally, it was reassuring for them, as Nir added "**we had approval from our partner Magna Electronics, who were using it on another Automotive project",** and that **"the investment required was higher in the other tools than Cantata**".

CANTATA

QA SYSTEMS
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ISO 26262:2018 Certified

Starting with Cantata

A major initial challenge for Innoviz Technologies was deploying Cantata for their target environment, which they opted to do themselves with support from QA Systems. According to Alan Winkovski, Embedded Software Team Leader, they "**had to ask for support from QA Systems a lot, but now we have the knowledge to do it ourselves, so it was worth doing**". In response to growing demand for users deploying Cantata to target platforms themselves, QA Systems have created a dedicated deployment training course.

Innoviz Technologies faced a quite common tool adoption challenge with their developers. As Alan said "**it took us a while to understand how to best use the stub and wrapping functions, but the QA Systems help documentation was useful and has everything**". In addition, they used the built in Cantata tutorials to quickly explore the tool GUI and it's capabilities. Successful tool roll-out was further accelerated when Innoviz Technologies arranged an online Cantata training course. Alan recalled that "**it cleared up a lot of the issues we had, and people came out of the training with a good understanding of how to use Cantata in the ARM Development Studio GUI**". When asked how they would rank the tutorials against the training course, Alan said "**the training course was very helpful, we waited for training so that our engineers could use Cantata first. In hindsight, we should have had training earlier**".

Regarding their experiences working with QA Systems technical support Alan added "**they answered questions on time and the issues that we had were solved very fast. They invested a lot of hours to help us**".

Most Useful Features

Innoviz Technologies found the "**wrapping and custom code insertion capabilities in Cantata were a major benefit in achieving full code coverage of the harder to reach areas of defensive programming**". Injecting errors into the application at the function call boundary with wrappers, and more flexibly before or after any statement in the code with custom insertions, allowed them to exercise these error handling conditions.

Cantata stubs were used primarily for isolation unit testing. Stub default instances provided a starting point for the extension of function return parameters and addition of further checks on accessible data. The integration with Jenkins enabled Innoviz Technologies to automate regression testing via Cantata Makefiles to ensure tests re-run without errors.

Conclusion and Future Plans

Looking back on their decision, Nir Erez recognised a positive return on investment, reporting that "**we understand the benefits of a tool like Cantata and it will help us improve our methodologies**". Following success with Cantata on the InnovizOne and InnovizTwo programs, the team plan to extend its use to further variants and the Perception Software. In addition they are looking forward to using the Cantata Trace integration with their requirements tool Intland codeBeamer to enhance the productivity of their requirements based tests. Summarising, Nir Erez explained they plan to "**focus on improving the efficiency of our integration testing and streamline our methodologies to improve productivity with Cantata**".

All case study text has been approved by the relevant customer.

CERTIFICATION

Cantata has been classified as usable in development of safety related software up to **ASIL D** as defined by the **ISO 26262** standard.
TCL1 can be reached.


SGS TÜV SAAR

CERTIFICATE NO FS/71/220/20/0626 PAGE 1/1

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PROJECT NO-ID: K3UX-AU10
LICENSED TEST MARK
CERT. REPORT NO.: K3UX0017

Tested according to: IEC 61508:2010; ISO 26262-6:2018; clause 11.4.9; EN 50128:2011; IEC 60880:2006; IEC 62304:2015; EN 50657:2017

Certified product(s): Cantata, Core product

Model(s): Version: 9.1; Build_id: RELEASE_9_1_3

Technical Data and Parameter: Suitable for verification of safety-related software acc. to:
- ISO 26262 up to ASIL D,
- IEC 61508 up to SIL 4, class T2 tool
- EN 50128 up to SIL 4, class T2 tool
- IEC 62304 up to SW safety Class C
- IEC 60880 for category A functions
- EN 50657 up to SIL 4, class T2 tool

The certificate is based on voluntarily tests. Any changes to the design, components or processing may require repetition of some parts of the pre-qualification in order to retain the certification. This certificate report is an integral part of this certificate. The safety related application guidelines shall be maintained.

Specific Requirements

Certification Body for Functional Safety SGS-TÜV Saar GmbH

Munich, 03.12.2020

Gudrun Neumann

CERTIFICATE

For information on tool certification, please visit:
www.qa-systems.com/tools/cantata

MORE ON AUTOMOTIVE SECTOR:

Our Automotive Sector Brief provides more information on how Cantata was successfully used by relevant customers in various projects worldwide.

All Sector Briefs can be found on the QA Systems website.

"QA Systems invested alot of hours to help us"