CYIENT

PERFORMING SYSTEM AND SUBSYSYTEM SAFETY HAZARD ANALYSIS, AND FAULT TREE ANALYSIS FOR GE TRANSPORTATION DIGITAL SOLUTIONS

The Challenge

The Remote Control Locomotive (RCL) is a complex product that interfaces with multiple systems. It includes ruggedized boxes held by train operators on the ground to enable remotely controlling the operations of locomotives in a train yard. Safe communications between the boxes and a variety of locomotive services are critical. This evaluation was necessary to ensure that the system worked effectively and did not create hazards for the operator and other personnel working around the remotely-controlled trains.

The Verification and Validation team at Cyient was selected to support the customer on their Remote Control Locomotive (RCL) product to perform a Systems Safety Hazard Analysis (SSHA) and Fault Tree Analysis (FTA).

GE Transportation Digital Solutions requested the use of Isograph to be the tool of choice for the SSHA and FTA assessment. We undertook an analysis to determine that if there were any component failures, they would not adversely affect the safety of the system. The RCL product includes dual CPUs and several modules, which present significant challenges during safety assessments. To deliver this project, our Verification and Validation team had to understand all the standards involved, the operations of the application, and acquire an in-depth knowledge of the hardware and software components of the system. This included the mean time between failures (MTBFs) of individual electronic component used in the schematics for quantitatively assessing the risks analyzed.

Our Solution

The Verification and Validation team at Cyient carefully considered the various operational aspects of LOCOTROL™ RCL related to this specific application. We then automated the process of reading the Bill of Materials (BOMs) for all schematics and determined acceptable MTBFs for all hardware components. The automation enabled a semi-automated import of the data to Isograph, which then generated MTBF aggregates by the topological layout of the components. This allowed MTBFs at both system and subsystem levels to be visually linked to component level. The process helped determine which component and subsystem were the largest contributors to failure and if other parts of the system could potentially be affected.

Our team subsequently simulated the communication protocols in use and made determinations about the probabilities of messages not delivered and/or delivered in error. An in-depth study of the Cyclical Redundancy Checks (CRCs) in use enabled us to make a quantitative assessment of the possibility that a message could be delivered in error without being discarded by CRC mismatch, including the consequences of such events.

Our Verification and Validation team was able to perform a Safety Hazard Analysis for the system and a Subsystem Hazard Analysis for the two parts of the system. Such analyses met CENELEC standards EN50126 and EN50129. The analysis included quantitative assessments employing FTA by Isograph. All deliverables complied with GE Transportation Digital Solutions formats.

Key Business Benefits

The Verification and Validation team at Cyient was able to apply proven tools and technology for GE Transporation Digital Solutions by providing independent qualitative and quantitative System and Subsystem Hazard Analysis for a critical component, whilst adhering to customer guidelines and tools in use.

Our Verification and Validation team has become familiar with the customer's internal processes and procedures through the four-year collaboration. We had the capabilities to perform various system/safety analyses as per EN50128 and EN50129 standards, and utilized our dedicated knowledge in using Isograph as a tool for computing reliability predictions and FTAs.

The customer benefited from having qualified resources available at the critical time, thus being able to deliver on time to their customers. The studies carried out were independent and unbiased with the purpose of predicting the reliability and safety of GE Transporation Digital Solutions' system,

illustrating that they can provide unbiased opinions about their products for their customers. The system has also benefited from improvements as a result of the assignment because the customer adopted recommendations and suggestions from us, namely because our Verification and Validation team provided proof that a better balance of message length and CRC was required.

We contributed to the customer's operation and business processes by identifying, predicting, and eventually eliminating multiple hazards and failures. Consequently, the customer is now benefiting from improved efficiency of components and services, and reduced possibility of errors leading to cost savings.

A number of customer products that our Verification and Validation team has contributed to are items of longevity. They are configurable for different target locomotives, which allows modification of design to suit the needs of the end goal/platform.

The Verification and Validation Team at Cyient

Over the last decade, the Verification and Validation team at Cyient has established an identity of unparalleled safety-critical certification solutions in the aerospace, medical device, and transportation industries. Our Verification and Validation team has internally developed tools and exclusive technology designed to streamline approvals of safety-critical systems, software, and complex hardware. These competitive advantages allow our Verification and Validation team to minimize the time-to-market of customer products while providing a Firm Fixed Cost to its customers. The Verification and Validation team provides expertise in all phases of systems, software, and complex hardware product design lifecycles to support rapid approval of safety-critical customer products.

About Cyient

Cyient (Estd: 1991, NSE: CYIENT) provides engineering, manufacturing, geospatial, networks, and operations management services to global industry leaders. We leverage the power of digital technology and advanced analytics capabilities, along with domain knowledge and technical expertise, to solve complex business problems. As a Design, Build, and Maintain partner, we take solution ownership across the value chain to help our clients focus on their core, innovate, and stay ahead of the curve.

Relationships lie at the heart of how we work. With more than 15,000 employees in 22 countries, we partner with clients to operate as part of their extended team, in ways that best suit their organization's culture and requirements. Our industry focus spans aerospace and defense, medical, telecommunications, rail transportation, semiconductor, utilities, industrial, energy and natural resources.

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