Software Development Method Using Cradle Considering the Software Development Life Cycle

Dongil Lee [a*], Kyeong wan Kim [a], Myunghyuk Yim [b]
[a]*KHNP, Central Research Institute, 70, 1312-gil, Yuseong-daero, Yuseong-gu, Daejeon, 34101, South Korea*
[b]*SNS ENG Co., Ltd., #1110, Kolon Science Valley2, 55, Digital-ro 34-gil, Guro-gu, Seoul, Korea*
[*]*Corresponding author: diturtle@khnp.co.kr*

1. Introduction

As the digitization of Nuclear Power Plants (NPPs) accelerates, the importance of software is increasing.

Verification & Validation (V&V) is being conducted based on IEEE 1012-2004 to verify software for NPP [1,2]. Automation of software V&V is difficult, but many organizations are implementing V&V systems in various ways.

In some cases, a self-developed system is used, or a person directly uses Excel or various document formats.

In this paper, for the systematic development and verification of software, Cradle, which is used in space, aviation, and national defense, was used to establish a software development and verification system in the nuclear field. Using Cradle suitable for building a complete software system excluding engineering and business feasibility, We will explain the design of the structure for systematically performing software development, configuration management, and verification.

2. What is Cradle

It is a software developed by 3SL (Structured Software Systems Ltd) and is a system and software engineering tool. The Exploration Systems Mission Directorate (ESMD) of the National Aeronautics and Space Administration (NASA) has been adopted and is in use as a requirements management Systems Engineering (SE) standard tool for an integrated collaborative environment [3].

2.1 Configuration Management System

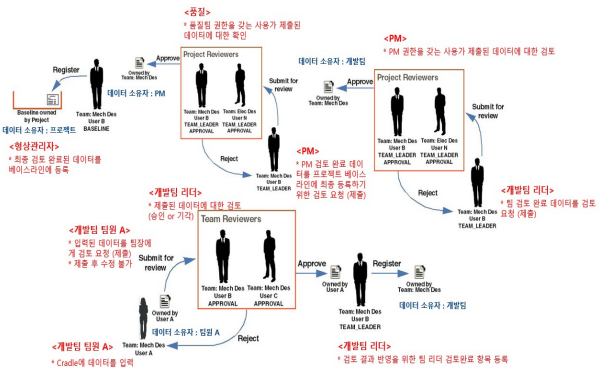

Fig 1. Configuration Management System

Configuration management is divided into configuration planning, configuration identification, configuration change management, configuration status accounting, and the process is shown in Fig. 1 [4].

2.2 Traceability System

It is possible to inquire the traceability matrix between the requirements of each stage by using the Requirements Traceability Matrix (RTM) based on the entire requirements of each phase and all the upper requirements.

2.3 Document Conversion

Cradle provides a total of 3 input methods. There are 1) direct input method from Work Bench (Fig. 2), 2) Word source document input method, and 3) Excel source document input method.

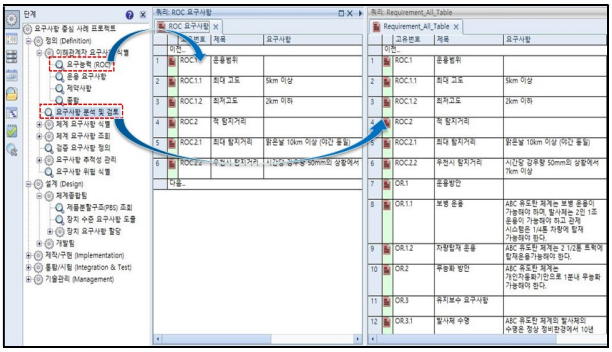

Fig 2. Direct input method using work bench

Word is useful for document unit input, and it is easy to input as individual items for each paragraph in a document, enter a hierarchical structure between items in a document, and automatically enter links between pictures and items.

Excel is useful for entering individual items without a hierarchy, and each row is entered as a separate item.

Each has its pros and cons, and when outputting after input, it is output in word format.

3. Application of Cradle

A V-model was built using Cradle for software development that scans drawings in use and operation in NPPSs, makes them into vector-type regular drawings, and verifies them.

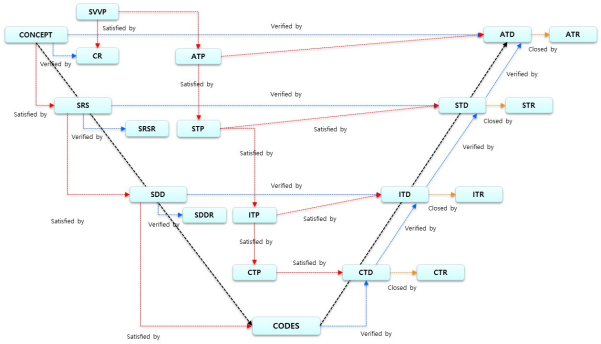

Fig. 3. Designing V-model using Cradle

Fig. 3 is the model definition for designing V-model using Cradle. The defined model is composed of Cradle as shown in Fig. 4.

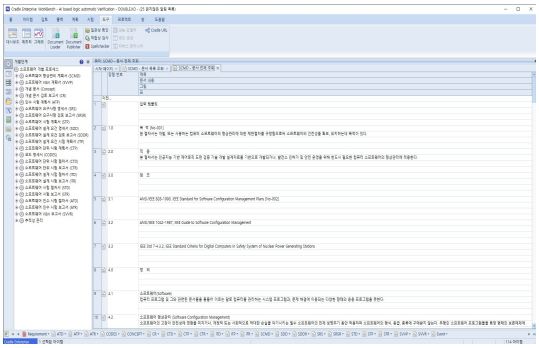

Fig. 4. Software lifecycle built with Cradle

As shown in Fig. 5, the degree of achievement of coverage or requirements is expressed, and the requirements can also be traced.

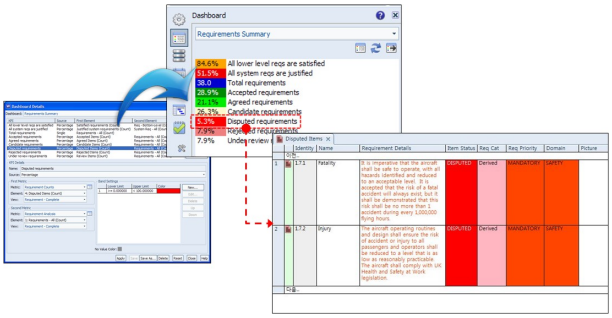

Fig 5. Dashboard screen

4. Conclusions

It is very important to establish a document system for development suitable for the software development life cycle. In particular, in order to perform V&V suitable for software, requirements tracking, coverage, and configuration management are very important.

When software is developed by introducing Cradle, configuration management is easy, and the reliability of the software development system can be improved by systematically and quantitatively expressing software development documents.

REFERENCES

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[4] IEEE Computer Society 828 for Software Configuration Management