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ICAEIC-2019-0739

Selecting Facial Features for Machine Learning.....	13
(Jinho Han)	

ICAEIC-2019-0792

The Impact of Technologies in Management Education of Nepal.....	16
(Mithlesh Kumar Jha, Surendra Shrestha, Subarna Shakya)	

ICAEIC-2019-0731

Analysis of Privacy Disclosure Risk in CPS.....	19
(Min Kyoung Sung, Yong Sung Kim)	

ICAEIC-2019-0714

A Study of a Medical CPS Standard Evaluation Model: MCP SSE.....	22
(Ju-Yuck Han, Jung-Hwan Park, Ki-Won Song)	

ICAEIC-2019-0740

A Study on Development of Test Automation Framework for a Medical Software.....	25
(Kidu Kim, Kwanglak Jung, Gwanghun Kim)	

ICAEIC-2019-0782

Software Visualization Approach for Performance Measurement of Object-Oriented Code based on Cyber-Physical Systems (CPS) Software	28
(Bo Kyung Park, Geun-Hee Kang, R. Young Chul Kim)	

ICAEIC-2019-0795

On the Construction of Virtual Verification System Utilizing Unstructured Data for Reliability/Safety of Autonomous Driving Vehicles.....	31
(Kim Tong Hyun, Kim Young Min)	

ICAEIC-2019-0741

White-Box Testing of Convolutional Neural Network.....56
(Hyung-Ho Kim)

ICAEIC-2019-0725

An Analysis of Modified Fibonacci Backoff Algorithm for 802.11 DCF59
(Sangyeon Kim, Sungwook Ko, Kangwoo Lee, Younsoon Shin)

ICAEIC-2019-0786

Dwindling Stage of Postal Services in an Underdeveloped Country.....63
(Robert Khanal, Surendra Shrestha)

ICAEIC-2019-0768

A Study on Timing Issue Analysis of Cyber-Physical Systems.....66
(Joon-Ik Kong)

ICAEIC-2019-0775

Emergent Failure Effects on Dependability of Cyber-Physical Systems69
(Taihyong Yim)

ICAEIC-2019-0777

Requirements for Scalable CPS of Smart City.....72
(Joonho Kwak)

ICAEIC-2019-0783

Performance Measurement of Procedural Code for CPS Multiple-Joint Robotics Simulator75
(Bo Kyung Park, Geun-Hee Kang, R. Young Chul Kim)

A Study on Development of Test Automation Framework for a Medical Software

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Abstract

Medical CPS requires higher quality level than any other CPS domain because it can harm human health. However, it is difficult to conduct quality assurance activities because of frequent requirement change and not enough development periods. We suggest test automation framework for dental CAD software in Medical CPS.

Keywords: *Dental CAD Software; Test Automation Framework; CPS; DevOps.*

1. Introduction

A Cyber-Physical System (CPS) is a mechanism that is controlled or monitored by computer-based algorithms, tightly integrated with the Internet and its users. In CPS, physical and software components are deeply intertwined, each operating on different spatial and temporal scales, exhibiting multiple and distinct behavioral modalities, and interacting with each other in a lot of ways that change with context [1]. Medical CPS is used for diagnosis, monitoring and treatment of patients, and affects human life, therefore it requires higher quality level. However, it is difficult to conduct quality assurance activities because of frequent requirement change and not enough development periods.

We introduce related research in section 2, explain our build automation framework in section 3, and describe the implementation of test automation for dental CAD software in section 4.

2. Related Work

Industry 4.0 includes CPS, IoT (the Internet of things), cloud computing and cognitive computing. Industry 4.0 is commonly referred to as the fourth industrial revolution [2].

There are many build automation frameworks to build source code automatically when developers change source code [3]. We developed the DevOps-based build automation framework in this study. As DevOps is intended to be a cross-functional mode of working, those that practice the methodology use different sets of tools like continuous integration, and continuous delivery. These toolchains are expected to fit into one or more of the following categories, reflective of key aspects of the development and delivery process [4].

3. Build automation framework based on the DevOps

We developed the build automation framework from 2018 to 2019 [5]. Figure 1 shows the architecture of the build automation framework that consists of configuration management machine, development automation machine, and build machine. Configuration management machine manages source code with GIT. Development automation machine automated review, issue management, dashboard, and messenger with Jenkins. Build machine builds source code, packages product, and deploys product on production environment automatically.

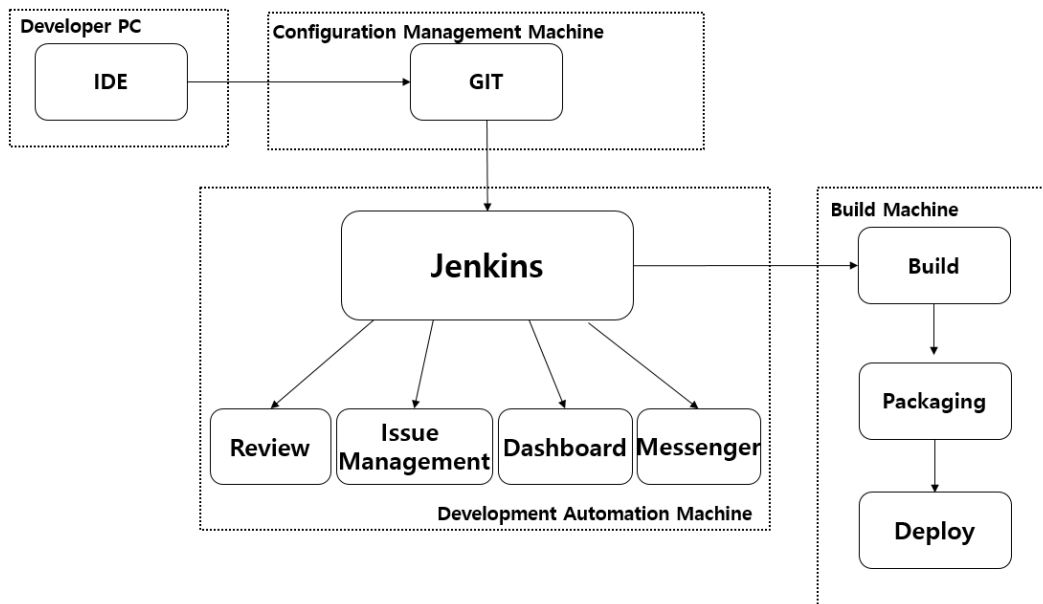


Figure 1. Architecture of the build automation framework

4. Test automation for dental CAD software

Based on build automation framework, we developed test automation for dental CAD software with four test modules. Figure 2 shows the execution of each test module.

Table 1. Test modules for dental CAD software

Module Name	Description
Static Analysis	Source Code Static Analysis using lizard ^[6]
Unit Test	Source Code Unit Test using GoogleTest ^[7]
User Acceptance Test	User Acceptance Test for dental CAD software using TestComplete ^[8]
Interoperability Test	Interoperability Test of dental CAD/CAM software based on ISO 18618:2018 ^[9]


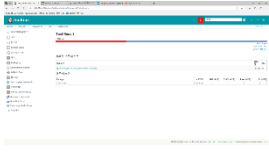
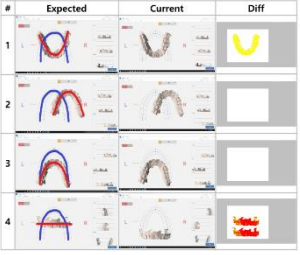
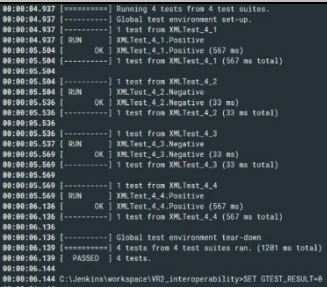
Static Analysis	Unit Test	User Acceptance Test	Interoperability Test
			

Figure 2. Execution of test modules

5. Conclusion

In this study, we implemented and applied the test automation for dental CAD software using the build automation framework. When application source code is changed, it executes automatically from build to deploy, and it was able to improve software development efficiency and improve quality level of product. In the future, we will generate test case and test data using artificial intelligence technique.

Acknowledgement

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