Template Design of Automatic Source Code Generation based on Script Language used in Cloud Robot Compiling Environment

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Abstract. The existing robot programming education consumes a lot of time in the process of building compile environment. Therefore, a robot developer should study many languages for development of firmware. To solve this problem, we proposed the script language to compile in cloud environment. The proposed script language reduces time for building development environment, and easily & quickly develops a robot action without learning many languages. In this paper, we design some templates for automatic code generation of robot firmware based on the existing script language designed by analyzing some common functions of the robot. This code generation method consists of three steps. First step, it transfers Platform Independent Model (PIM) from the script language. Second step, it transfers Platform Specific Model (PSM) from the PIM. Two models (PIM and PSM) are expressed by XML. Third step, it generates real source code from PSM based on a template matching XML generated at the second step.

Keywords: Cloud Service, Robot Firmware, Embedded Software, MDA

1   Introduction

The current robot programming education increases the cost to buy the development of PC, Operating System, and compiler for building development environment. Also it occurs time and cost for handling exceptions when building development environment [1]. The robot firmware developer should learn many languages with their compliers. In the education environment for the robot development, if applying script language on cloud services easily builds the development environment, saves learning time of language, and easily studies how to operate the robot [2, 3].

In this paper, we design the template to automatically generate source code of robot firmware based on the existing script language through compiling in cloud service. The code generation method consists of three steps. First step, it transfers Platform Independent Model (PIM) from the script language. Second step, it transfers Platform Specific Model (PSM) from the PIM. Two models (PIM and PSM) are

expressed by XML. Third step, it generate real source code from PSM applying a template matching the generated XML at second step. This method automatically execute to process source code generation in cloud environment.

This paper consists of the following chapters: Chapter 2 explains a related study about MD and HBE-RoboCAR. Chapter 3 mentions a process method from the script language into source code. Chapter 4 shows a case study of code generation of HBE-RoboCAR . Chapter 5 provides conclusion and future works.

2   Related Work

Model Driven Architecture (MDA) is able to transfer platform specific model from platform independent model using specification and design model of systems. These two modes in MDA call Platform Independent Model (PIM) and Platform Specific Model (PSM). The models of both PIM and PSM describe Unified Modeling Language (UML). To describe PIM and PSM of a system is able to integrate the system and to enhance productivity and flexibility [4]. HBE-RoboCAR is 4-wheel robot developed by Hanback Electronics as shown figure 1. This machine writes a firmware of programing robot using ATMega128.

Fig. 1. HBE-RoboCAR

3   The template Design for Automatic Source Code Generation

The structure to automatically generate source code as shown figure 2 consists of three step. First step, it transfers Platform Independent Model (PIM) from the script language. Second step, it transfers Platform Specific Model (PSM) from the PIM. Two models (PIM and PSM) are expressed by XML. Third step, it generate real source code from PSM applying a template matching the generated XML at second step.
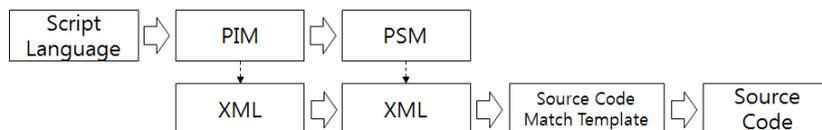

Fig. 2. The template to automatically generate source code

4   Case Study

4.1   Script Code to Models

In transformation into script code from models, the proposed method transfers forward of PIM from the function named "forward" in script code and transforming PSM from PIM. Figure 3 shows the detailed process of transformation.
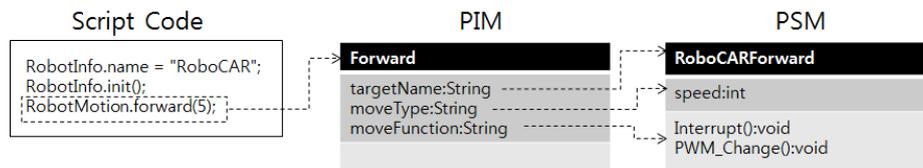

Fig. 3. A Procedure for Automatic Model Transformation

4.2   Models to XML

In transformation into XML from models, the proposed method transfers XML from PIM and PSM. Figure 4 shows the detailed process of transformation.
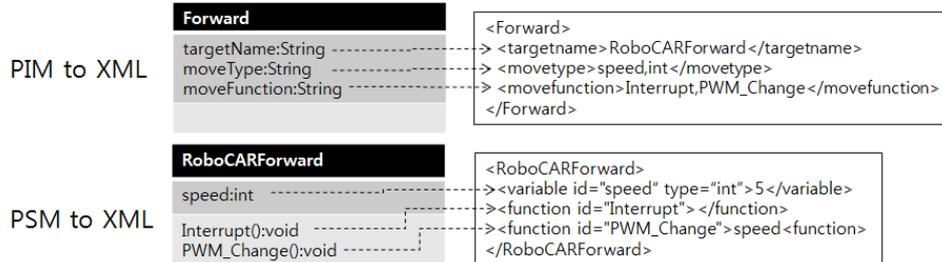

Fig. 4. A Procedure of Automatic XML Code Transformation

4.3   PSM's XML to Source Code

In transformation XML into source code, the proposed method generates source code from XML of PSM if the function is matching when XML compares to the template stored in the list of functions. Figure 5 shows the detailed process of transformation.
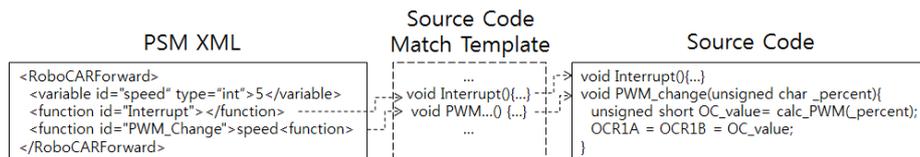

Fig. 5. A Procedure of Automatic Source Code Generation

5   Conclusion

In this paper, we suggest the template design to automatically generate source code of robot firmware based on the existing script language with compiling in cloud service. We show a case study to automatically generate firmware code of HBE-RoboCAR from script code. New learners with a proposed script language are to easily compile various robot firmwares of without robot programing language such as C, C++, and Java. Also the learner can be easily to understand principle of operation of robot and to compile source code in cloud environment.

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