Robot Simulation Creation Toolkit using Functional Concise Script for Education

Yong-Ho Seo[1]

[1] Department of Intelligent Robot Engineering, Mokwon University,
Mokwon Gil 21, Seo-gu, Daejeon, Republic of Korea
yhseo@mokwon.ac.kr

Abstract. This paper proposes a robot simulation creation toolkit using functional concise script for education. We adopted functional concise script in building simulation environment, and this concise script composes of simplified service commands and minimum options. In experiment, we verified that user can build robotics simulation environment and control simulated robots easily in two-day training course.

Keywords: Robotics Simulation, 3D Toolkit for Education, Functional Concise Script, Mobile Robot

1   Introduction

Robot simulation is going to be popular among the public and the robotics researchers as well; education materials for enhancing learner's creativity, learning tools for the majors who want to develop a robot and experience practical exercises [1].

Though the use of robot simulation is everywhere, there is no tailored simulation program because of the difficulty of refactorying the program for public users. For this reason, robot simulation has not been disseminated widely. The robot simulation is considered as the field that is hard for robotics researchers, requiring not only the knowledge of robotics but many other professional knowledge such as 3D rendering and physical engine, etc [2].

In this research, to resolve this problem, we propose a script-based execution environment which can produce the diverse simulation environment and robot simulation without training. Only two days are expected to design their own robot even for the beginners who do not have a prior knowledge about robotics.

There are various types of robot simulation programs including MSRDS (MicroSoft Robotics Developer Studio [3]. Being skillful in general programming languages such as C, C++, C# and Java, at least three months are needed for the beginner. And this can be a barrier for them to use robot simulation freely.

Therefore, in this research, we propose a Functional concise script for constructing the simulation environment and controlling the simulation robot. This script can be used easily even by the beginner and layman. We will show the effectiveness of our script through a result of an experiment conducted in a high school class.

2   Functional Concise Script for Robot Simulation Creation Toolkit

In general, robotics simulation is composed of many commands, components and complex options. If these commands and options are made of general programming languages, there would be too many codes to learn. And it makes users confused.

Functional concise script reduces a number of commands and minimizes the use of command options by applying Off-The-Shelf service. Each service is simplified by its own commands and other options.

The key point of the functional concise is that frequent options are configured as default and not revealed to outside. For novices, they don't need to know the detailed options and only simplified commands are required because all detailed parameters can be set with default values.

In this research, the proposed script is used for flow control while the iteration structure and definition of functions for providing functionalities are similar to a general programming language designed to follow JavaScript grammar and it also has a graphical diagram for functional concise script. Because functional concise script is composed of simple commands, it can be converted graphical diagram easily as show in Fig 1.
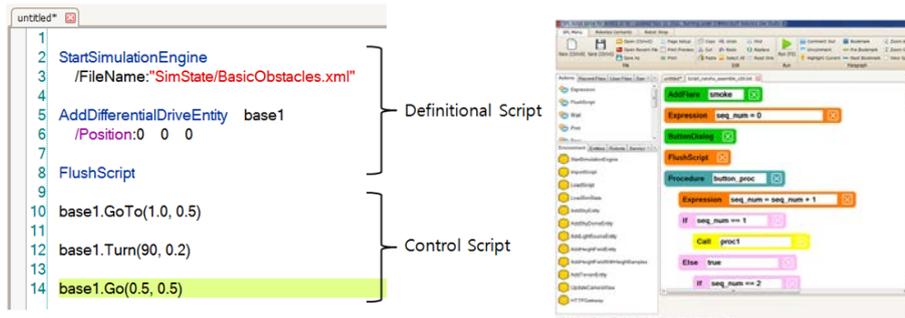

Fig. 1. Script parts for defining mobile robot (left) and Graphical diagram of functional concise script (right)

3   Experimental Result

We implement functional concise script based on MSRDS R4 version simulation environment. Various elements such as a floor, sky and sun are located properly in window form. And two long boxes are added as obstacles. Mobile robot equips with two wheels, bumper and a laser ranger finder.

In order to verify the performance of functional concise script, four days course training was carried out with 50 High-school students. These students are trained two days for functional concise script and additional two days were provided for their team project. Fig 2 shows examples of their implementation results.
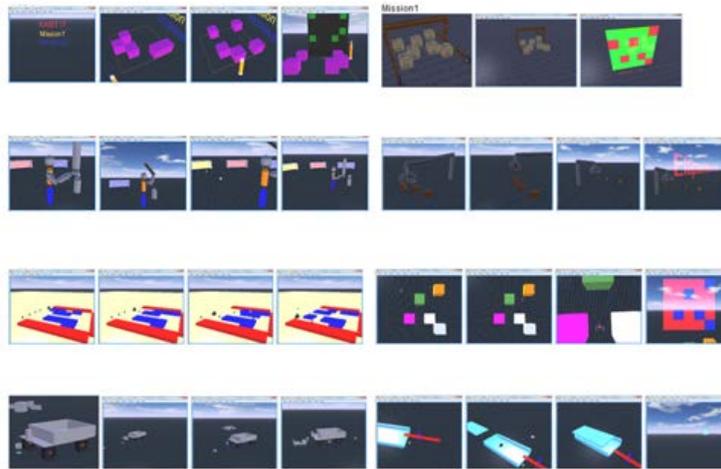
Fig. 2. Examples of Implementation Results for Test Groups

4   Conclusion

We propose Functional concise script for robot simulation that is handy for the beginners. And we believe that it can contribute to propagating the robot simulation program. Beginners who do not know the prior knowledge about robotics can handle this program after a short training. And this is verified by the experiment. They can produce a simulation robot only after two day training.

References

1. Railsback Steven F, Lytinen Steven L and Jackson Stephen K. Agent-based simulation platforms: Review and development recommendations. Simulation 2006;82(9): 609–623.
2. Young Joon Kim, "MSRDS Simulation Environment and External Interface", Korea Robotics Society, Spring Edition, pp.16-21, 2010.
3. Microsoft Robotics Developer Center, http://msdn.microsoft.com/robotics