How to Teach AI Programming for Elementary Students? – A Case Study of AI Conversation Robot Programming at UEC Programming School

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Abstract

In order to increase the number of human resources with programming thinking, programming education has become indispensable from elementary school students in Japan as well.

To utilize communication robots for programming education Developed a scripting language for communication robots that even beginners can program I actually used it in a programming class.

Basic syntax

The script language developed this time supports speech recognition and speech synthesis. If you want to say something, write it in natural language without any special grammar. Listing 1 is a example.

Listing 1: Utterance example

```
1  Hello.
2  I am a robot. Nice to meet you.
```

Code written in natural language is spoken in order from the top. Since it can be written in natural language, anyone who can input using the keyboard can write it. No special programming knowledge is required.

Listing 2 is an example of conditional branching. This script says "Hello" when the robot recognizes "Greeting" by voice. When he recognizes other words, he says, "I see." Lines with "/" at the beginning of the line are command lines. The line with ":" at the beginning becomes a label and can be specified as the transition destination of the goto or if command. Lines beginning with "//" are comment lines.

Listing 2: Conditional branching example

```
1  :LOOP
2  /speech-to-text
3  /if/greeting/:GREETING
4  I see.
5  /goto/:LOOP
6
7  :GREETING
8  hello
9  /goto/:LOOP
```

Comparison with AIML

When you execute the following code, if the result of voice recognition is "Hello", you will say "Nice to meet you!" If "Goodbye", say "See you again!"

Listing 3: Description example

```
1  /speech-to-text
2  /if/Hello/Nice to meet you!
3  /if/Goodbye/See you again!
```

The code below describes the same process in AIML (2001). AIML was developed by Carnegie Mellon University. It is a world-renowned rule-based language for chatbots.

Listing 4: AIML

```
1  <aiml>
2    <category>
3      <pattern>Hello</pattern>
4      <template>Nice to meet you!</
         template>
5    </category>
6    <category>
7      <pattern>Goodbye</pattern>
8      <template>See you again!</template>
9    </category>
10 </aiml>
```

Comparing the two in Listing 3 and Listing 4 It can be seen that the script language devised this time can easily describe the same contents.

XML is a difficult grammar for beginners and elementary school students, and it is difficult to notice grammar mistakes. The script language used this time can be spoken in natural language, Since the control syntax is also the minimum number of characters, I thought that it could be used as a language for programming education.

Evaluation robot configuration

Figure 1 shows a robot developed to evaluate this script language. The robot has a built-in Linux-based single board computer and A speaker, a microphone, a motor, a button with LED, and a monitor are connected.
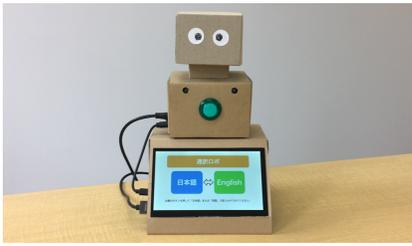
Figure 1: Evaluation robot

The single board computer has a built-in web server and The image specified in the script language can be displayed via a web browser. Because the script language can also be edited via a web browser No special development environment is required.

Example of use in programming classroom

Used as a teaching material in the summer course of the University of Electro-Communications programming class held in August 2018. The target students were 50 students from the 5th grade of elementary school to the 2nd grade of high school, and each class was held for 2 days, for a total of 4 days.

Understanding the network

The main theme of the first day was network learning. The evaluation robot has built-in WiFi and can connect to the Internet. Have students understand how TCP / IP, IP addresses and ports work They learned to operate their robot remotely from their PC.

Because all the robots are connected to the same WiFi router Students who understand how IP addresses and ports work Noticed that other people's robots can also be operated remotely they started to operate another student's robot remotely. The student noticed that his robot was being operated remotely with others and changed a password on his robot.

From this experience, students learned the importance of security in networks.

Understanding control syntax

On the second day, they developed a script that gives a theme and makes the presentation a robot.

First of all, We told the students that the robot would speak when you typed Japanese characters into the editor. Students who understand that the robot speaks when entering a Japanese document. Then start trying what happens when you enter a random sentence. They understood that you can make the robot talk while having fun.

Next, I gave some simple control syntax that are label and goto command. Listing 5 shows the sample code.

When this scenario is executed, the robot repeatedly says "Hello". Students enjoyed the behavior of a broken robot and understood loop control.

Listing 5: Loop example

```
1  :LOOP
2  Hello
3  /goto/:LOOP
```

Creating a presentation

Finally, the students actually developed a thematic presentation program. You can make a robot give a presentation by creating a program. The theme of the presentation was "Thanks to my family, which I can't usually say." Listing 6 shows an example presentation script.

Listing 6: Presentation example

```
1  /image/title.png
2  Gratitude.
3  I'm Taro Yamada,
4  5th grade at Tokyo Elementary School.
5  /image/slide1.png
6  Dad, mom, thank you for your hard work
      every day.
```

A presentation is made by arranging the combinations of slide images and utterances in order. The image command is a command to display a slide image on the screen.

summary

Some students in the programming class started touching the keyboard a few months ago, As a result, everyone was able to complete the presentation script.

Understanding the network and basic control of programming The students enjoyed learning.

Visual programming languages are often used in programming classes for beginners and you think Text-based programming languages aren't for beginners. It was shown that it can be used for elementary school students by devising a script language.

Future tasks

The reason for creating the script developed this time is the sense of incongruity with the watching robot for the elderly. A watching robot developed by your grandson is better than being watched by an off-the-shelf robot. I think it will be a robot that is loved like a treasure.

It is still difficult in reality for AI to automatically learn and perform various tasks. At present, it takes time and effort to create a rule-based mechanism. An easy-to-write scripting language will be needed to gain the power of many non-engineers.

Elementary school students develop a communication robot for their summer vacation homework and you can see a service using robots in the town. We would like to expand the range of activities to build a richer and more enjoyable world.

References

AIML Foundation. 2001. http://www.aiml.foundation/. Accessed: 2022-01-24.