1. Introduction

Current recognition capability of speaker independent voice recognition technology is not adequate to realize general purpose applications. Therefore, by applying to restricted applications, recognition ratio is improved up to adequate level to practical use. For example, there are voice recognition applications in the field of a seat reservation system, an inquiring system for banking services and a shopping guidance system using voice input. In their applications, sentence styles and vocabularies to be utilized are restricted to some areas. As a result, in their applications, high recognition ratio is attained.

In programming language C, usable statement syntaxes and vocabularies are specified based on the language specification. Since sentences and vocabularies are specified, recognition ratio is improved up to applicable level. Thought users defined vocabularies are feasible to use in the programming language, it is possible to restrict the utilization so that users declare them during programming. Using this characteristic, program C editor is realized.

2. Language Specification of Input Sentences

In programming language C, statements are specified by syntax rules the same as other conventional high level programming languages. In a program, sentences and syntaxes to be described are decided. The language, C is a functional language. The overall syntax structure is main (  ) {

#include <stdio.h>
/* "HelloWorld" を出力するプログラ

main (void)
{
 printf("HelloWorld");
 return(0);
}

Fig. 1   C Program example

de start character of a C language program

Each statement is represented by the end of semicolon ;. Statements block is surrounded by  { and }. Delimiters, function names and reserved words are inputted by their pronunciations in order to easily read and memorize them.

2.1 Delimiter, Function Name and Reserved Word

The corresponding pronunciations to delimiters, function names and reserved words are predefined. In the following definition, Japanese words show pronunciations to them.

Delimiter

(function name or reserved word)
In program input, delimiters, function names, reserved words, and users defined words which are variables names, array names and function names are recognized and translated to the corresponding word based on the defined dictionary word by word. Updating and editing are performed using the editing command when input errors have occurred during inputting a program.

2.2 Users Defined Name

In a programming language, users can use freely variable names, array names and user defined function names. Usually the number of them is indefinite and they can not be predefined before programming. In addition, it is not convenient and it takes long time to input a word character by character. Users defined data and their corresponding pronunciations are declared and stored in the dictionary during the programming. After that, it is possible to input them by their pronunciations. Examples are as follow;

After inputting the following two C statements,
```
int declare hosei;
scanf(%d, &hosei);
```
we get the following statements.
```
int hosei;
scanf(%d, &hosei);
```
In this case, hosei is the corresponding pronunciation to the variable name, hosei.

2.3 Editing Command

Commands for editing programs, updating defaults caused by voice input and for defining users defined words are prepared.
speech recognition. Delimiters, function names and reserved words are defined based on the specification of input sentence at the beginning. Dictionary definition is CFG style. In the current version of the system, each vocabulary is stored serially. In addition, users defined words are also stored in the same dictionary during programming as shown in Fig.2.

5. System Implementation

Voice input C program editor is described with Visual Basic. Speech recognition system is NEC Speech recognition system[1]. Figure 3 shows an input view.

6. Evaluation

We measured input times to compare the voice input with the keyboard input. The voice input for elementary and middle level students is comparable to the keyboard input. But for higher level students the voice input is lower than the keyboard input. Table 1 shows the comparison result indicating the ratio of the keyboard input time by the voice input time.

Table 1  Input Speed Comparison

<table>
<thead>
<tr>
<th>Program No</th>
<th>Elementary level</th>
<th>Middle Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.05</td>
<td>0.91</td>
</tr>
<tr>
<td>2</td>
<td>1.11</td>
<td>0.93</td>
</tr>
<tr>
<td>3</td>
<td>1.14</td>
<td>0.95</td>
</tr>
</tbody>
</table>

7. Conclusion

Elementary level people to C programming, for example, elementary level students, have happened input mistakes of statements, vocabularies and reserved words by the keyboard input. But voice input C editor can reduce mistakes depending on vocabulary check at the voice input phase. In addition, using the both voice input and the conventional keyboard input, we can attain higher input speed.

In future, upgrading the the definition dictionary, it is possible to much more improve the voice recognition ratio.

Reference

[1] NEC Voice SDK