



The Development and Integration of Voice Controlled Software with AgentSheets for Children with Motor Disabilities

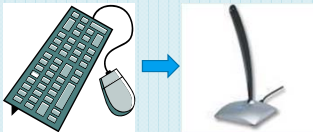


Abstract

As technology constantly advances, the need for computer programmers is increasing. Teachers are trying to encourage students to become interested in programming through software like AgentSheets, a programming environment that allows students to make interactive games using simple programming concepts by dragging and dropping the building blocks of a program into a compiling window. However, there is one major limitation to environments based on graphical user interfaces; anyone with a disability who does not have the fine motor control needed to use a mouse and keyboard is unable to take advantage of this environment. In order for mobility impaired children to use software like AgentSheets and begin their education in computer programming, they need an alternative method for controlling the mouse and keyboard. This project is related to the idea of "Programming by Voice" and is focused on computer accessibility. The result of the work is a software tool that was developed in Java that makes the programming of software AgentSheets usable through voice commands. For speech recognition, the tool the CloudGarden – TalkingJava SDK, a voice-to-Java group of classes that was used to parse the verbal phrases uttered as program commands. The TalkingJava SDK works with the Java Robot Class (a standard Java class), which can control the mouse and keyboard programmatically. The result of the project demonstrates the potential for assisting children or adults who have an interest in learning the basics of computer programming, but would traditionally be restricted due to impairment in their mobility.

Objective

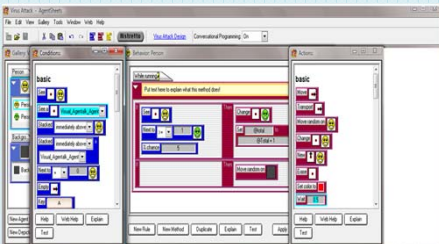
The goal of this project was to develop Java code to make the programming software, AgentSheets, usable through voice commands. The application of this objective will allow disabled children to learn the basics of computer programming despite being unable to use a mouse or keyboard.



Challenges

- Without fine motor skills, needed to use a mouse and keyboard, "drag and drop" programmable software like AgentSheets is nearly impossible to use.
- Most existing voice recognition software are designed to either be extremely broad (i.e., only applicable to the mouse) or only specified for standard operating system requirements and the internet.

AgentSheets Screenshot:



Background

AgentSheets

AgentSheets is a programming environment that allows students to make interactive games using simple programming concepts. This software allows the user to create agents that perform behaviors, specified when the user drags and drops the building blocks of a program into a compiling window to modify.

CloudGarden

The CloudGarden TalkingJava SDK is a voice-to-Java group of classes that was used to parse the verbal phrases uttered as program commands. This package must be downloaded from the CloudGarden website along with the Java Speech Application Programming Interface from the Java.Sun website.

Methods and Procedures

In order to develop a tool that integrates the Cloud Garden TalkingJava SDK with the Java Robot class and AgentSheets, a series of new classes were made that call upon one another's methods. The classes made are Commands, ControlMouse, AgentSheets, and various small classes that implement the Runnable interface to make threads and allow the classes' methods to be run more than one at a time. A grammar file was also made that provides a key for translating the spoken commands.

Commands

- Driver class that is run to begin the voice recognition program.
- Contains the primary code for the integration of the Cloud Garden TalkingJava SDK.
- Tells the computer to "listen" for commands by parsing all of the sounds from the microphone into strings and then comparing them to the list of commands in the grammar file.
- Once a command is heard, the associated method is called from either the AgentSheets or ControlMouse classes.

Examples of Code:

```
public void resultAccepted(ResultEvent re){
    ExecutorService runListener = Executors.newCachedThreadPool();
    Result r = (Result)re.getSource();
    ResultToken tokens[] = r.getBestTokens();
    String temp;
    for (int i = 0; i < tokens.length; i++)
    {
        command = tokens[i].getSpokenText();

        //Mouse movements
        if(command.equals("up"))
            mouse.moveUp();
        else if(command.equals("scroll up"))
            runListener.execute( new ScrollUpThread() );
        //continued
    }
}
```

ControlMouse

- This class contains methods that control the mouse and keyboard through the Java Robot class.
- Methods important to the execution of AgentSheets; includes mouse scrolling, dragging and dropping, and clicking.

Examples of Code:

```
public void buildBot()throws AWTException
{
    bot = new Robot();
}

public static ControlMouse getInstance()
{
    if(instance == null)
    {
        instance = new ControlMouse();
    }
    return instance;
}

public static void main(String[] args)
{
    public void scrollUp()
    {
        this.stop = false;
        boolean tempStop = this.getStop();
        while(tempStop == false)
        {
            moveUp();
            try
            {
                Thread.currentThread().sleep(500);
            }
            catch (InterruptedException e)
            {
                e.printStackTrace();
            }
            tempStop = this.getStop();
        }
    }
}
```

AgentSheets (Class)

- This is the class containing the methods for accessing the majority of AgentSheets' commands.
- Most of the methods correspond to an AgentSheets command by sending the mouse to their location on the screen and then making the mouse click.
- Methods lessen the number of "clicks" normally required by automatically taking the required steps. (e.g., Rather than pressing "File->New Project", the user would only need to say "new project").

Examples of Code:

```
public void standardProject()
{
    //set size
    mouse.moveX(700);
    mouse.moveY(365);
    robot.delay(500);
    mouse.singleClick();
    //select customize
    mouse.moveY(495);
    robot.delay(500);
    mouse.singleClick();
    robot.delay(500);
    //type 24 in both slots
    robot.keyPress(KeyEvent.VK_2);
    robot.keyRelease(KeyEvent.VK_2);
    robot.delay(100);
    robot.keyPress(KeyEvent.VK_4);
    robot.keyRelease(KeyEvent.VK_4);
}

//continued
mouse.moveX(650);
mouse.moveY(415);
robot.delay(500);
mouse.doubleClick();
robot.delay(500);
robot.keyPress(KeyEvent.VK_2);
robot.keyRelease(KeyEvent.VK_2);
robot.delay(100);
robot.keyPress(KeyEvent.VK_4);
robot.keyRelease(KeyEvent.VK_4);
mouse.moveY(455);
robot.delay(500);
mouse.singleClick();
}
```

voiceCommands

- Grammar file made on Notepad
- List of variables set equal to specified combinations of spoken words, letters, or numbers.

Examples of Code:

```
#JSGF V1.0;
grammar grammars.voiceCommands;

//mouse commands
public <up> = up;
public <down> = down;
public <left> = left;
public <right> = right;
public <click> = click;
public <doubleClick> = "double click";
public <drag> = "drag";
public <drop> = "drop";
public <scrollUp> = "scroll up";
public <scrollDown> = "scroll down";
public <scrollLeft> = "scroll left";
public <scrollRight> = "scroll right";
public <stop> = stop;
public <exitProgram> = "exit program";

//Agentsheets specific
public <file> = "file";
public <edit> = "edit";
public <view> = "view";
public <gallery> = "gallery";
public <tools> = "tools";
public <windows> = "window";
public <web> = "web";
public <help> = "help";
public <ok> = "enter";
public <windowgallery> = "window gallery";
public <windowworksheet> = "window worksheet";
public <newproject> = "new project";
public <standardsize> = "standard size";
public <newagent> = "new agent";
public <gotoagent1> = "agent one";
public <gotoagent2> = "agent two";
public <gotoagent3> = "agent three";
public <editdepicion> = "edit depiction";
public <newdepicions> = "new depiction";
public <newworksheets> = "new worksheet";
//continued
}
```

Terms & Abbreviations

- CloudGarden TalkingJava SDK:** Free downloadable Java package containing voice-to-Java classes.
- JSAPI:** Java Speech Application Programming Interface
- Robot Class:** Java class already in the standard Java package that takes control of the mouse and keyboard.
- Standard Java Package:** Standard set of classes used in almost all Java programs, downloadable online for free.

Results and Conclusion

The objective of this project has been met to the extent that a simple AgentSheets program can be developed through voice commands. This was tested by creating a functional program from beginning to end. Testing was done by a small group of volunteers given a list of available commands and the order in which to call them to complete an example program. The program that was used in testing is based from the AgentSheets online tutorial provided on their website. A recurring error found was that the Microsoft Speech voice recognition software often confused commands, especially individual letters.

Limitations

- Because the program cannot be trained, an accent or slur may cause some commands not to be recognized and for the program to recognize other commands that were not given.
- The screen resolution must be the same in every computer that uses the program in order for the mouse to locate certain commands.
- This program is not abstract enough to be easily adaptable to other voice command projects.

Future Work

- Apply a better voice recognition software than the standard Microsoft Speech that can be trained to the user's voice and lead to better accuracy.
- Make the program more robust so that it can be applied to more screen resolutions, platforms, and become even simpler to use.
- Make the program more abstract so that it can be applied to other educational software.

AgentSheets Screenshot:

