COSC 345 Assignment 3

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1 Beta Release

Our app now contains three functioning games which can be opened via speech commands from the main menu and controlled either by speech commands or through touch. Two of the games (2048 and Frozen Bubble) are open source games we have manipulated to work with voice commands and Teragram is an original game, a maths practice game for children.

The application uses pocketSphinx to interpret speech commands: https://github.com/cmusphinx/pocketsphinx

1.1 Since the Alpha

We have made the following improvements and enhancements since our alpha release:

- The app no longer crashes on initial startup.
- We have added a help screen with a list of available voice commands, which can be opened from Teragram or 2048 by saying 'help'.
- Teragram is now able to be closed via speech command, at which point the main menu is reloaded.
- An open source implementation of the game 2048 has been added to the app and is now playable with speech commands.
- The open source game 'Frozen Bubble' has been added to the app and voice controls implemented, however some debugging still needs to happen with respect to the speed of the launcher (see known issues for more).
- We have implemented an on/off switch for the speech recognition, so the games can be played with either voice control or touch screen control, with voice control being the default. This is currently working with Teragram, 2048 and the main menu.
- We have implemented visual feedback for the speech recognition, currently working within Teragram. The user sees a 'what I heard' message at the bottom of the screen, showing how the voice commands are being interpreted by the voice recognition software.
- In Teragram, we have replaced random multiplication questions with times tables practice. The user can change which times tables they are working on with the 'too hard'/'too easy' buttons.
- In Teragram, we have added a powers of two multiple choice quiz. We chose to do this one as multiple choice rather than directly entering an answer so as to give the

child practice at recognising powers of two - all the options in the quiz are whole powers of two.

2 Known Issues and Intended improvements

Speech Recognition off-switch across all games

We have successfully implemented the on/off switch in the main menu, 2048 and Teragram but still have to implement it in FrozenBubble.

Visual feedback across all games

In Teragram, we have successfully implemented visual feedback which informs the user of how voice inputs are being interpreted, but are yet to implement it into the main menu, 2048 and FrozenBubble.

More robust number entry

The current way of inputing numbers using speech is finicky and prone to errors. We are unsure whether or not there is some easier way to do this, but we would like to try different methods.

Frozen Bubble Launcher Speed

Frozen Bubble is an open source game that is controlled strictly by touch. In order for a user to be hands-free, we have had to manipulate the code to have the launcher work with respect to time. This currently is working but not in a functional fashion as it travels far too fast. The issue is that the launcher moves with respect to int values, however, for it to be functional we need decimals values. When trying to manipulate this it throws a chain of bugs where the values are used elsewhere in the game.

Frozen Bubble first level bubbles

On two of our devices, the initial load of Frozen Bubble has two rows of bubbles that are generated directly in-front of the launcher therefore making the game impossible to play as they are blocking all angles of the launcher. Still have debugging to do but currently at a state where all the files have been compared with local, working states of the game and no differences are shown.

Help Screen

We intend to add a help menu on the main page, similar to the help menus within Teragram and 2048.

3 Testing

Voice control

Testing an application that is run by voice commands was not something we felt could be done through automated methods without devoting a large amount of time that could instead be spent implementing features. Instead, frequent testing was done manually either through emulators or by installing the apk on our own phones. We note that the microphone on a typical phone is significantly better than the microphone on a typical laptop or desktop computer, and so the app is significantly easier to play on a phone than on an emulator.

Teragram

For the Teragram game, we had extensive user testing performed by two children, seven and four years old. In the months since the alpha release, they have still been playing it frequently, so it has passed the fun test and is clearly suitable for children of those ages, with some room to grow, as some parts are too hard for them for now. However, they do prefer to play it without using the voice control. This is partly because they do not often find themselves in a quiet enough place for the voice control to work reliably, but also because they get frustrated that voice controls are a bit slower and less reliable than entering answers via the touch screen.

4 User Documentation

4.1 Teragram

The game starts up at level one, and the user can move to the easiest level by tapping the 'too hard' button or go up levels by tapping the 'too easy' button. When ten questions in a row are answered correctly, the game will automatically level up, otherwise if two questions are incorrect in a row, it'll automatically level down. The user is not aware of the actual level, it's just that questions get easier or harder - the bound on the random number generator used in setting new questions is related to the level.

The game launches in addition mode, and the user can chose to move to subtraction problems, or practice times tables or powers of two.

4.2 2048

2048 is a popular number name released on March 20, 2014. This game is very simple; you can choose to slide the tiles up, down, left or right by swipping the screen or saying 'left', 'right' 'up' or 'down'. Every slide, all the digital squares will move in the direction the screen was slid. This is a really neat game, and there are many open source implementations out there, but what makes it especially suitable for our app is the simplicity of its controls - it's an interesting and challenging game controlled with only four commands. Also there is no time pressure in this game, so if it takes half a second for the speech recogniser to work, this does not adversely affect the game play.

4.3 Frozen Bubble

The aim of this game is to clear the screen by shooting the current bubble from the launcher to its respective coloured bubbles on the level. Saying 'fire'/'now' or swiping up will shoot the bubble.

4.4 Voice Controls

You can control the game with the following voice commands:

4.4.1 Main menu

- **'Teragram' / 'game two'** - this will take you to the game Teragram.
- **'Twenty Fourty Eight' / 'game three'** - this will take you to the game 2048.
- **'Frozen Bubble' / 'game four'** - this will take you to the game Frozen Bubble.

4.4.2 Teragram

- **'help'** - Brings up help menu with available voice commands.
- **'harder'** - Provides a harder question.
- **'easier'** - Provides an easier question.
- **'new question'** - Provides a new question of the same type
- **'addition'** -Provides an addition question
- **'subtraction'** - Provides a subtraction question
- **'times tables'** - Starts times tables practice mode
- **'powers of two'** - Starts powers of two quiz
- When in powers of two quiz, say 'one', 'two', 'three' or 'four' to select from multiple choice answers.
- **'number'** - Starts Number Input mode, see below
- **'exit'** - Prompts a message confirming if they want to exit

4.4.3 2048

- **'help'** - Brings up help menu with available voice commands.
- **'left'** - All blocks will move to the left if possible.
- **'right'** - All blocks will move to the right if possible
- **'up'** - All blocks will move to up if possible.
- **'down'** - All blocks will move to down if possible
- **'exit'** - Prompts a message confirming if they want to exit
- **'back'** - Undoes the previous move, and sets the score to what it was before that move.

4.4.4 Frozen Bubble

- **'fire' or 'now'** - Will fire the bubble
- **'exit'** - Prompts a message confirming if they want to exit

4.4.5 Number Input

- **numbers 0 to 9 inclusive** Appends the spoken number to the end of your answer, ie. Speaking 'one', 'two' will give you 12. Note that 0 is to be spoken 'zero'
- **'okay'** - Submits the current answer and exits Number Input mode
- **'back'** - Removes the last number from your answer
- **'clear'** - Removes the entirety of your answer
- **'cancel'** - Exits Number Input mode

When entering numbers, please wait until the number you have just spoken appears in the box before trying to input the next one. Good Luck!

5 Open Source components

The code for the speech recognizer setup/permissions/asset copying is taken almost directly from the pocketSphinx demo application here: https://github.com/cmusphinx/pocketsphinx-android-demo

The phoneme definitions in our nktd.dic file are selectively taken from the cmudict-en-us.dict file in that same demo.

The acoustic model we use is provided by CMUSphinx at sourceforge.net

The game FrozenBubble taken from https://github.com/kthakore/frozen-bubble

The game 2048 taken from https://github.com/BuddyBuild/2048-Android