

Software Design Document

For Frogger

University at Buffalo, The State University at New York
EE379 Spring 2019

The information enclosed in this document and the source code generated for this laboratory assignment were generated by the named students on this cover page. Detection of plagiarism in a submitted lab or project design document will result in an automatic failing grade in the course by all parties involved.

Written By	Chen Chen, Chushan Ru		Revision History			
Engineer	Chushan Ru		Rev	Date	Session	Approved/Grade
Engineer	Chen Chen		Orig	05/07/19	Tues. 5PM	T.A.
Teaching Assistant						
						EE379S19 FINAL PROJECT

Table of Contents.....	1
1. Introduction.....	2
1. Overview.....	2
2. Document Scope.....	2
3. Intended Audience.....	2
4. Revision History.....	2
2. Code Design	
1. Embedded System Overview.....	2
2. Application Programming Interface.....	3
1. Function main().....	3
2. Function drawRect().....	3
3. Function drawhome().....	3
4. Function drawtop2().....	3
5. Function drawtop3().....	3
6. Function drawtop4().....	3
7. Function drawtop5().....	3
8. Function drawtop6().....	3
9. Function drawtop7().....	4
10. Function drawtop8().....	4
11. Function drawtop9().....	4
12. Function drawtop10().....	4
13. Function drawtop11().....	5
14. Function drawtop12().....	5
15. Function drawtop13().....	5
16. Function drawFrog().....	5
3. Testing and Verification	
1. Objective Verification.....	6
4. Glossary	
1. List of Abbreviation.....	7
Hardware References.....	7

1.Introduction

1.1 Overview

The overall goal for this lab is to create a Frogger game on the development board, and we display the interface and game on LCD, and play game with joysticks. Also the designed game should be meet the requirements in instructions.

1.2 Document Scope

The scope of this document is to provide the understanding in how to control LCD display on LandTiger development board and learn how to use joystick to control the movement of frog and how to determine state of the game.

1.3 Intended Audience

The intended audience for this document is the teaching assistant in Tuesday lab session.

1.4 Revision History

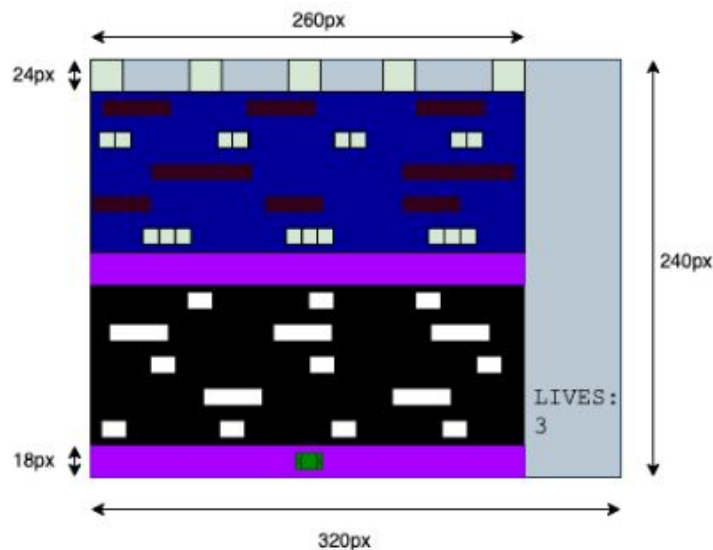
Date	Revision	Modified Sections	Description of Changes
5/7/19	Original	All	Original

2. Software Design

2.1 Embedded System Overview

We use a microcontroller, 32-bit RISC Arm processor core, combined with the Keil μ Vision program to compile and debug the C code to process to our system. Plugging a usb cord into the co computer monitor and Powering the LandTiger LPC17XX board with 5V power supply from another USB port. Also the LCD screen was used in this lab.

The diagram shown below is a sample game interface, showing the dimensions of the screen of the LandTiger LPC17XX board we will used to design the game.



2.2 Application Programming Interface

2.2.1 Function main()

Return Type	int
Parameters	int
Description	<p>This function set up logics of how state of the game is determined.</p> <ol style="list-style-type: none">1.joystick control the center position of the frog2.if center of the frog falls in range of top 0 lane, frog move with the object if center of the frog matches pixel position of the object. If the frog touches edge or not match pixel position of the object, frog dies.3. Number 2 logic applies for all traffics similarly.4. Each traffic lane has its own array. We divide x-axis into 13 portion on pixel map.5. Lane 2,4,6,9,11 move right, lane 3,5,8,10,12 move left. As k controls the movement of objects.6. Top0 array include 5 homes, which is safe area, when the center of the frog is within the range of pixel of homes, arrive ++;7. Display string when five frogs arrive home.8. Display remaining life at bottom right corner of the LCD screen.

2.2.2 Function drawRect()

Return Type	void
Parameters	Int, int, int, int, unsigned short
Description	This function draws a rectangle on the LCD screen with color.

2.2.3 Function drawhome()

Return Type	void
Parameters	char
Description	This function draws rectangles on the LCD screen with color accordingly to its array.

2.2.4 Function drawtop2()

Return Type	void
Parameters	char
Description	This function draws rectangles on the LCD screen with color accordingly to its array.

2.2.5 Function drawtop3()

Return Type	void
-------------	------

Parameters	char
Description	This function draws rectangles on the LCD screen with color accordingly to its array.

2.2.6 Function drawtop4()

Return Type	void
Parameters	char
Description	This function draws rectangles on the LCD screen with color accordingly to its array.

2.2.7 Function drawtop5()

Return Type	void
Parameters	char
Description	This function draws rectangles on the LCD screen with color accordingly to its array.

2.2.8 Function drawtop6()

Return Type	void
Parameters	char
Description	This function draws rectangles on the LCD screen with color accordingly to its array.

2.2.9 Function drawtop7()

Return Type	void
Parameters	char
Description	This function draws rectangles on the LCD screen with color accordingly to its array.

2.2.9 Function drawtop8()

Return Type	void
Parameters	char
Description	This function draws rectangles on the LCD screen with color accordingly to its array.

2.2.9 Function drawtop9()

Return Type	void
Parameters	char
Description	This function draws rectangles on the LCD screen with color accordingly to its array.

2.2.9 Function drawtop10()

Return Type	void
Parameters	char
Description	This function draws rectangles on the LCD screen with color accordingly to its array.

2.2.9 Function drawtop11()

Return Type	void
Parameters	char
Description	This function draws rectangles on the LCD screen with color accordingly to its array.

2.2.9 Function drawtop12()

Return Type	void
Parameters	char
Description	This function draws rectangles on the LCD screen with color accordingly to its array.

2.2.9 Function drawtop13()

Return Type	void
Parameters	char
Description	This function draws rectangles on the LCD screen with color accordingly to its array.

2.2.9 Function drawFrog()

Return Type	void
Parameters	char
Description	This function draws a frog on the LCD screen with color accordingly to its array with center being cx, and cy as pixel on the LCD.

3. Testing and Verification

3.1 Objective Verification

The functionality of the program was verified in loading the code into LandTiger LPC1768 development board with Keil ulink device.

1. The Frogs should be designed to display with a sprite rather than a simple square or rectangle on the screen. The designed Frog successfully display on the screen meets the verification.
2. The movement of frog displayed on screen should be controlled with joystick on the board and able to move left, right,, up and down. Once the frog can move up, down, left and right with the joystick, the verification is successful.
3. The frog starts on a safe area on the bottom of the screen instead of starting on the area beyond the safe area which programed by the designers, the verification passed.
4. Five rows of cars/ trucks should appear on a road occupying the bottom part of the display instead of on the river. Two rows of trucks and three rows of cars were required to draw on the screen. The trucks should be bigger than the cars and also they should be move in alternating directions. Once trucks and cars displayed and move properly on the screen on certains positions, the verification is good.
5. The basic patterns of cars/trucks may be drawn as rectangles, and be simple and repeating. They all may move at the same speed but in alternating directions. The designers may change the patterns or moving speed. But the simple one is fine.
6. A safe zone, or second safe zone, should be displayed half way up the screen. Frogs can land anywhere on the safe zone. Once the safe zone displays on the middle of screen and Frogs can land, the verification passed.
7. Five rows of turtles/logs should be displayed on a river that occupies the top part of display. Two rows of logs and three rows of turtles were required. The requirements of movement and patterns are same as the car/truck's.
8. Five homes should be shown at the top of the screen, with reasonable distance between each other. The frogs should only able to land in these five home. Frog is not dead while missing home. Once a frog lands in the home, a new frog should appear at the bottom of the screen. If the frog can land beyond the square areas of these five home and if there is no new frog appears at safe area of the bottom screen. The verification failed.
9. In the game, when the frogs getting hit by cars/trucks, jumping into the water, or riding a log/turtle off screen should result in a loss of life and frog should be returned at the bottom of the screen. Any situations that frog goes through cars/truck or float above the river fails to meet the requirement.
10. The number of lives must be displayed on the screen, starting with four. Once the player loses all lives, the text "You Lose" should appear. Or the text "You win" should appear if five frogs are navigated to the five homes. The verification succeeds one meets all the requirements above.

4. Glossary

4.1 List of Abbreviation

GLCD: Graphical Liquid Crystal Display

4.2 Hardware References

https://ublearns.buffalo.edu/bbcswebdav/pid-4965885-dt-content-rid-23435535_1/courses/2191_17918/E379S19_FinalProject%282%29.pdf