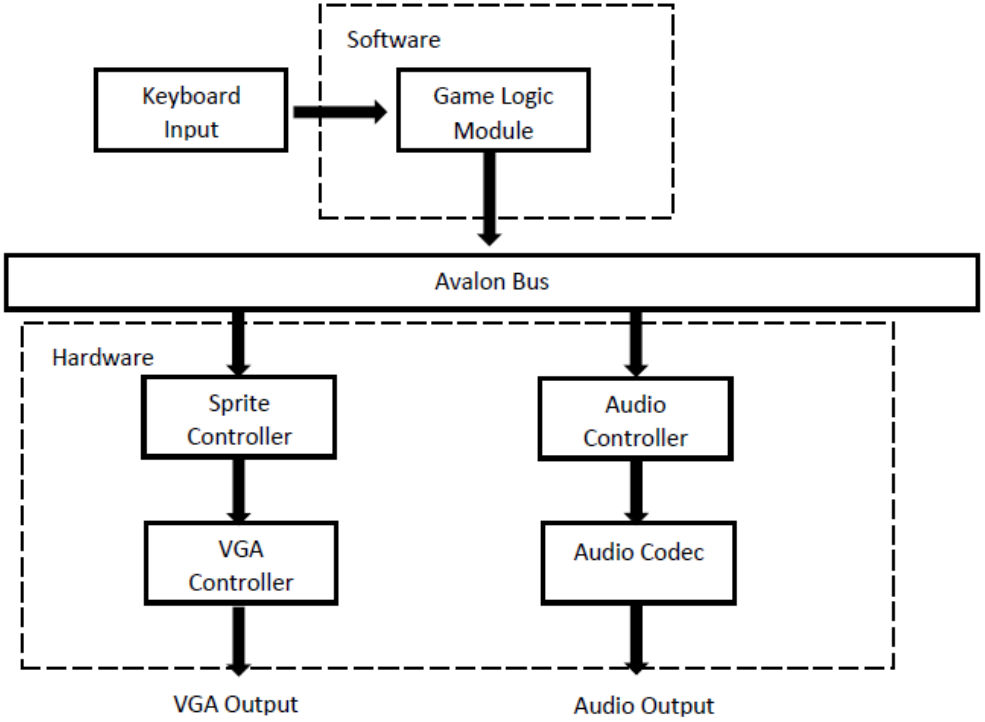
Car Racing Game

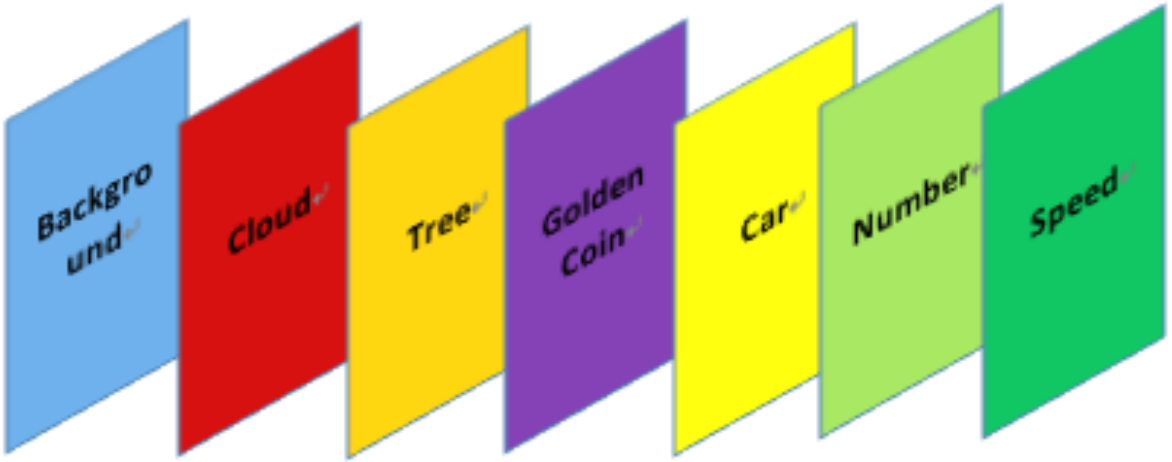
Jing Shi	Sprite Display Modules and Driver
Mingxin Huo	Audio Modules and Driver
Yifan Li	Software for game logic
Siwei Su	Software for game logic

Overview Design



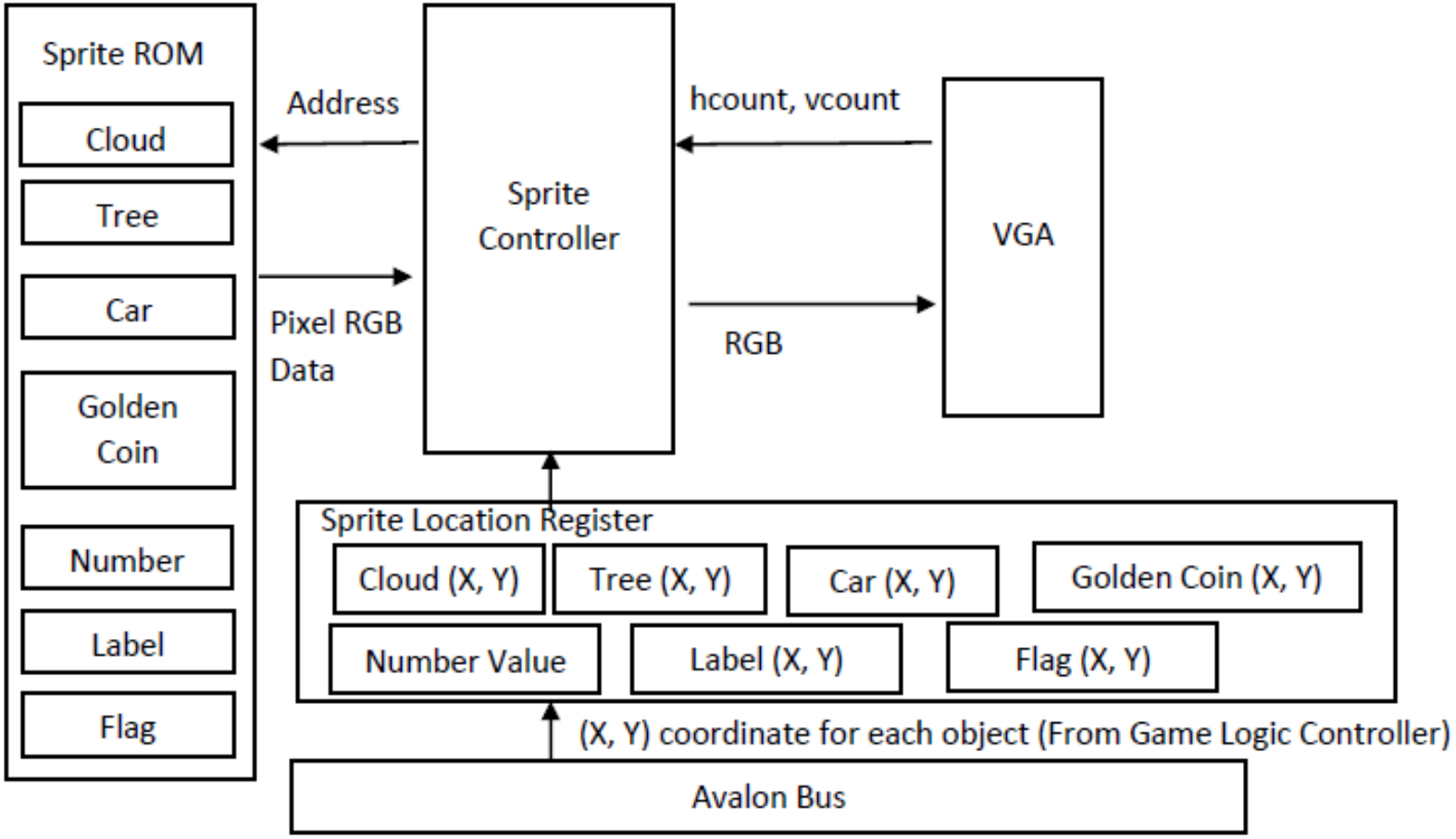
Sprite

7 Layers Merging Priority



1 mph

Sprite Module



Inside Sprite Controller

Submodule: ROM

Parameter: HEIGHT, WIDTH

Input: hc, vc, clk, (X, Y)

Output: R, G, B, Valid

Signals: ROM address,

Name	Function
HEIGHT, WIDTH	Define the height and width of this Sprite Picture
hc, vc	Horizontal Count and Vertical Count, define current pixel location
(X, Y)	The coordinate of the Sprite, determines where to put the Sprite
R, G, B	The RGB value of the Sprite
Valid	Whether the VGA scan location (hv, cv) is within the Sprite region
ROM Address	Calculate the address of current pixel RGB value in ROM

Background Module

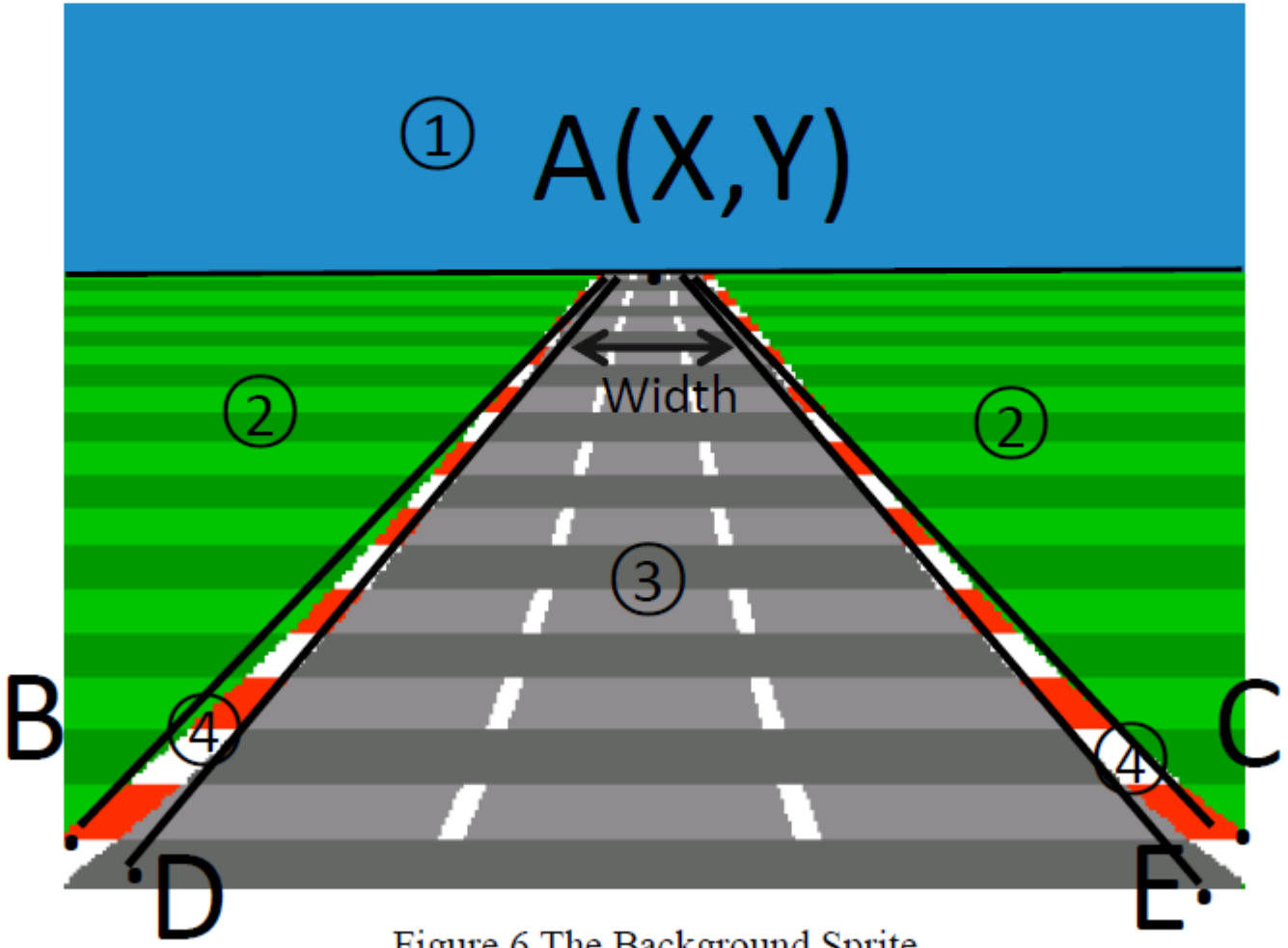


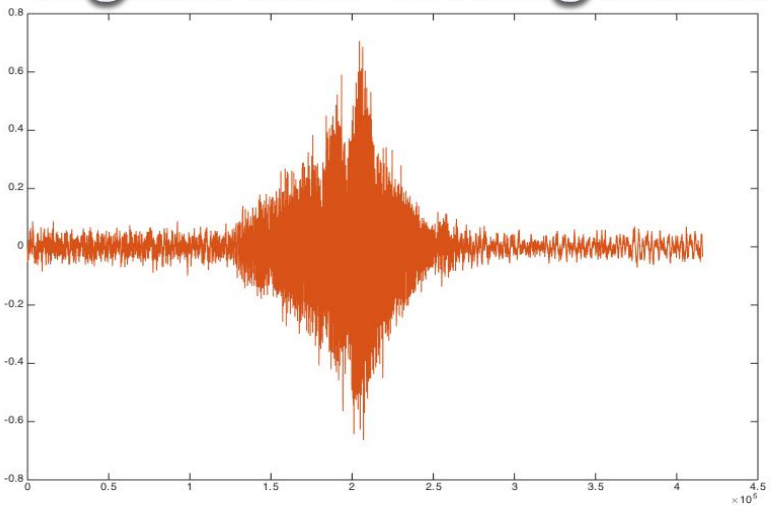
Figure 6 The Background Sprite

Lesson Learned

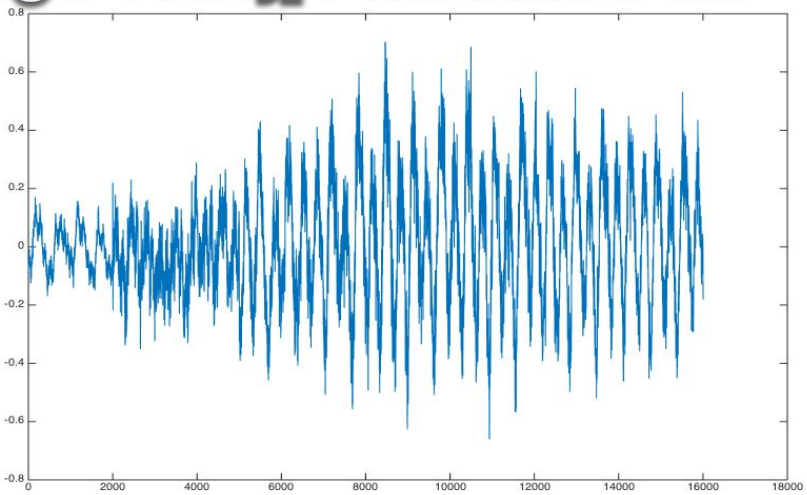
1. How to debug in hardware
2. Need to handle the positive or negative signed of calculation
3. Top-to-Down Design Methodology
4. The importance of team work especially when design the interface of different modules (like the input/output ports, and timing), otherwise it would become a nightmare when try to assemble all the modules

Audio Files Preparation

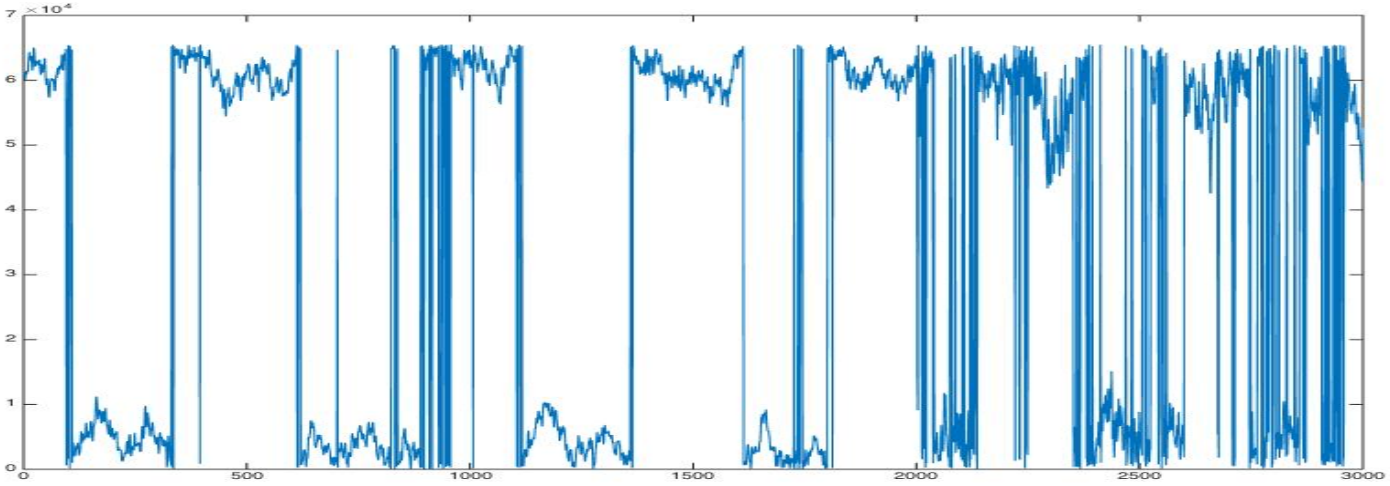
Original Data → Breaking and Reassembling → Data Type Conversion → MIF



Original acceleration sample data plot



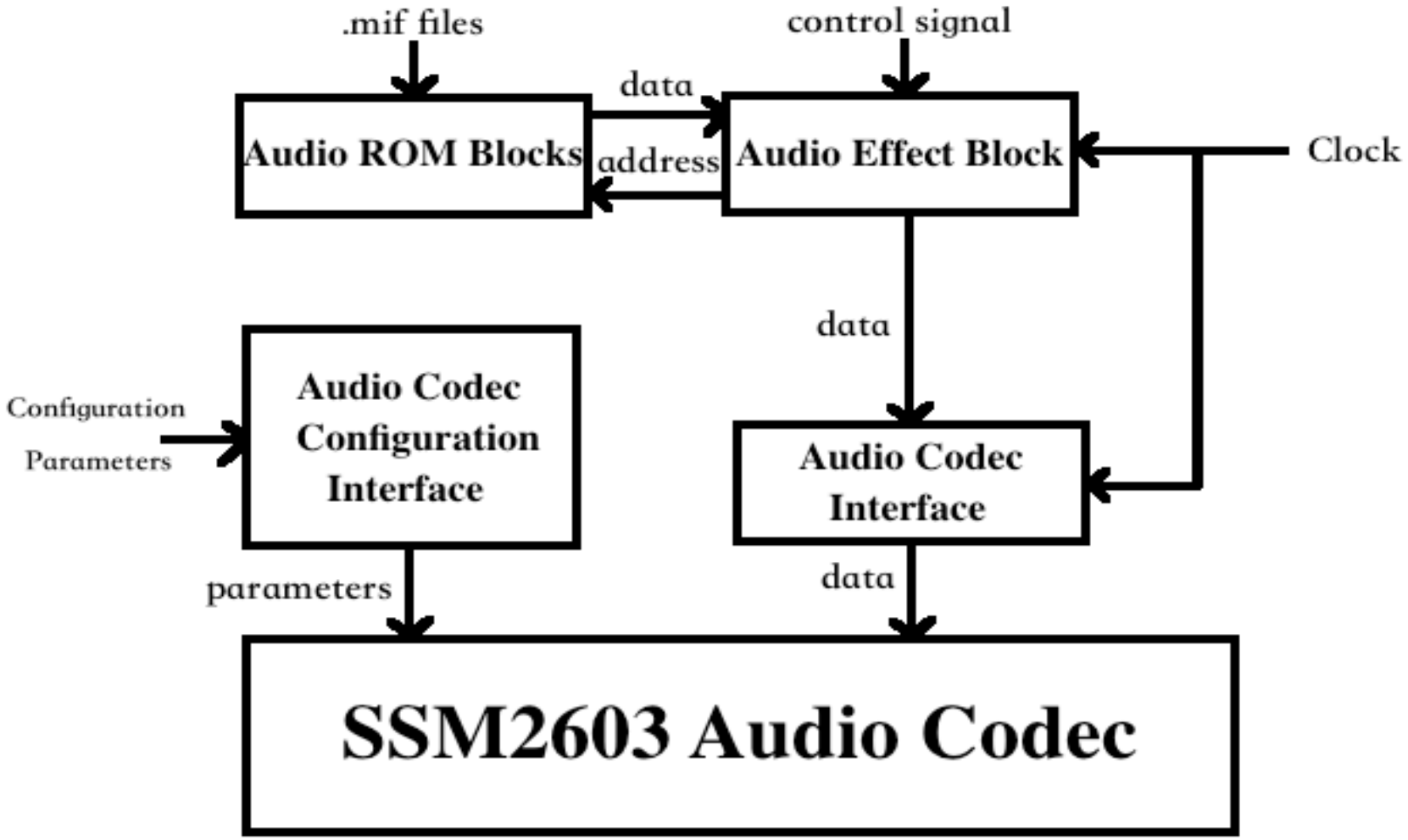
Reassembled acceleration sample data plot



Modified acceleration unsigned integer type sample data (partial) plot

Audio Controller

Control Signal → Fetch Audio Data → SSM2603 Audio Codec → Sound

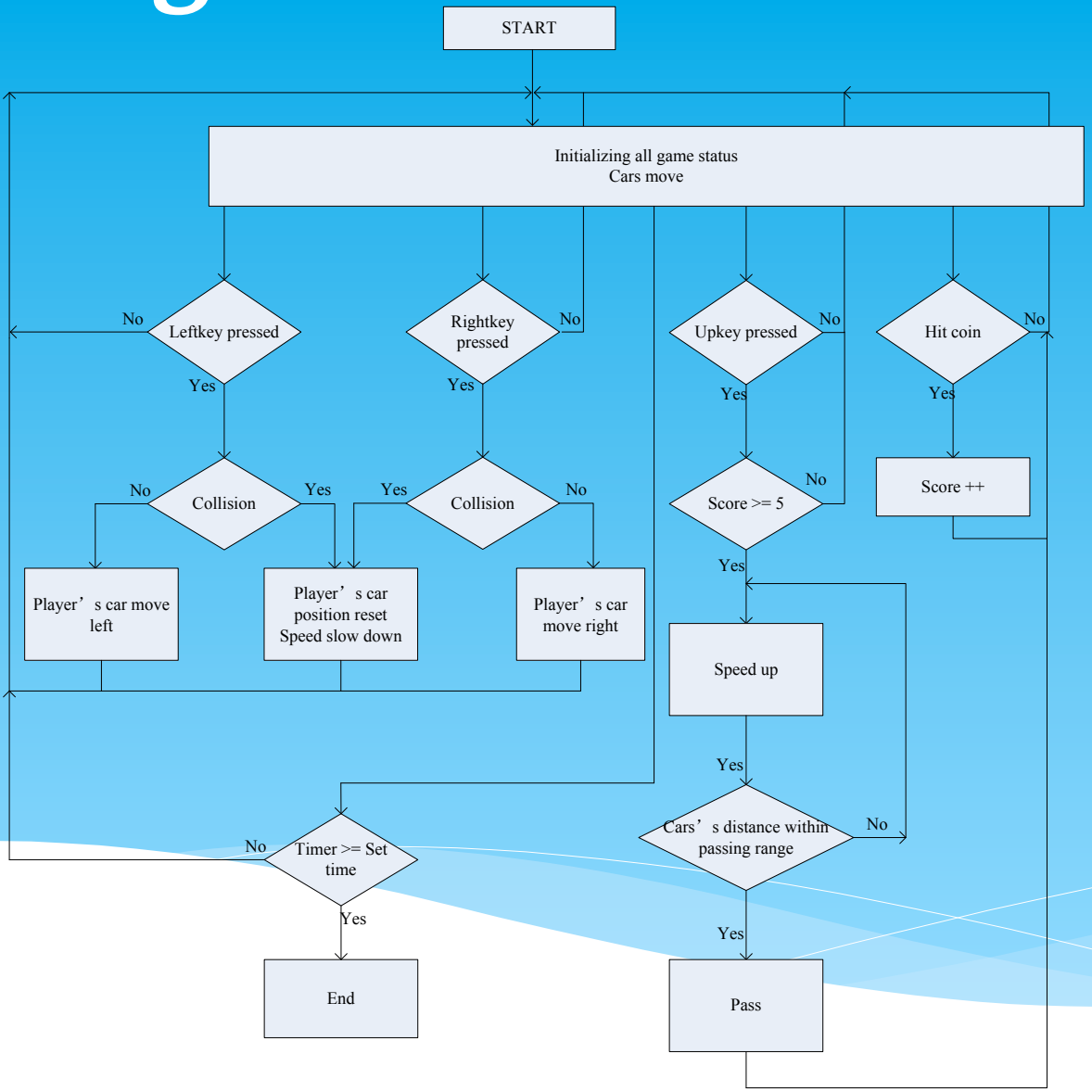


Overview

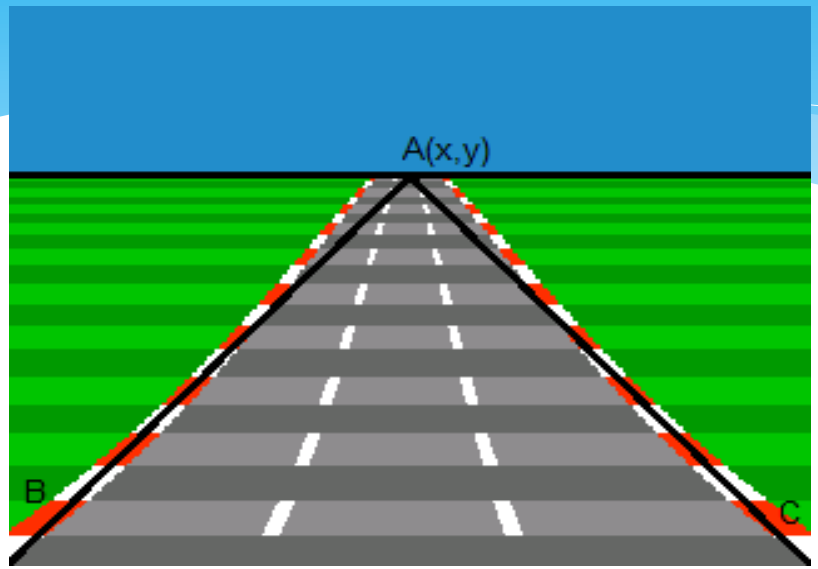
* Motivated by car racing video games
* Using keyboard to control your car and trying your best to get first place in the game
* Play issues:

1. Be careful not to hit other cars and road margin, otherwise you'll get penalty
2. Try your best to eat more coins as much as possible to get a speedup reward.

Game Logic Flowchart



Movement issues



- By calculating vector AB and AC, we could easily control the location and movement of trees and clouds.

$$ab(x,y) = \left(\frac{A(x) - B(x)}{\sqrt{(A(x) - B(x))^2 + (A(y) - B(y))^2}}, \frac{A(y) - B(y)}{\sqrt{(A(x) - B(x))^2 + (A(y) - B(y))^2}}\right)$$

$$ac(x,y) = \left(\frac{A(x) - C(x)}{\sqrt{(A(x) - C(x))^2 + (A(y) - C(y))^2}}, \frac{A(y) - C(y)}{\sqrt{(A(x) - C(x))^2 + (A(y) - C(y))^2}}\right)$$

Pass Event

* Three variables to track how far each car travelled: car1_dist (player), car2_dist, car3_dist
* car1_dist =+ car1_speed

  car2_dist =+ car2_speed

  car3_dist =+ car3_speed
* Compare |car1_dist-car2_dist| and |car1_dist-car3_dist| with a set passing range
* If within passing range, there could be a pass event
* If the player's car is falling behind and speeding up,it will pass the opponent car; if it is ahead and not speeding up, it will be passed by the opponent car.

Problems Encountered

* Unable to move the trees with road
* Missing libusb
* Keyboard function not working in main()
* Unable to make the car move continuously
* Unable to define reasonable pass range due to high frame rate

Solutions

* Set two vectors that are controlled by one point's coordinates
* Move everything from lab3 to lab2
* Create a thread and put the whole keyboard function in it
* Change timeout variable in libusb_interrupt_transfer
* Divide the distance variables by an integer

Lessons Learned

* Software and hardware design
* Time management
* Teamwork
* Keyboard control