CSEE 4840 Embedded System Galaxian

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Introduction

Control with ps2 keyboard

Star background is implemented

Audio block is enabled

Game play

Player has 5 spaceships

Ship can only move left and right at the bottom

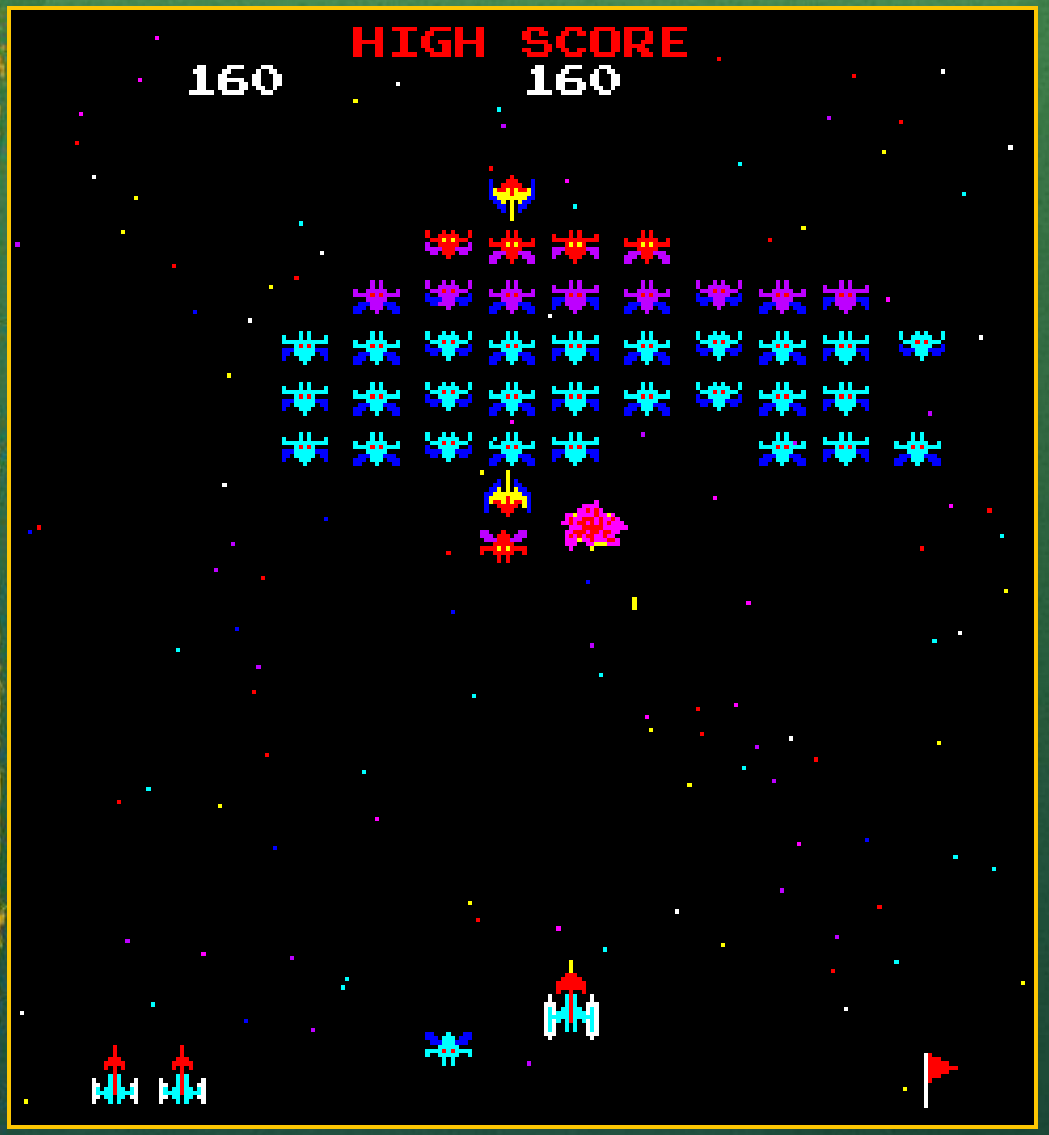
A matrix of swarm fluctuate back and forth on the top

Swarm can fire bullet

Goal: Shoot the swarm until all the enemies destroyed.

Several wave is designed

High score will be recorded.



Star background

- **Phase bias: 4 different phases of stars**

  implement: counter based

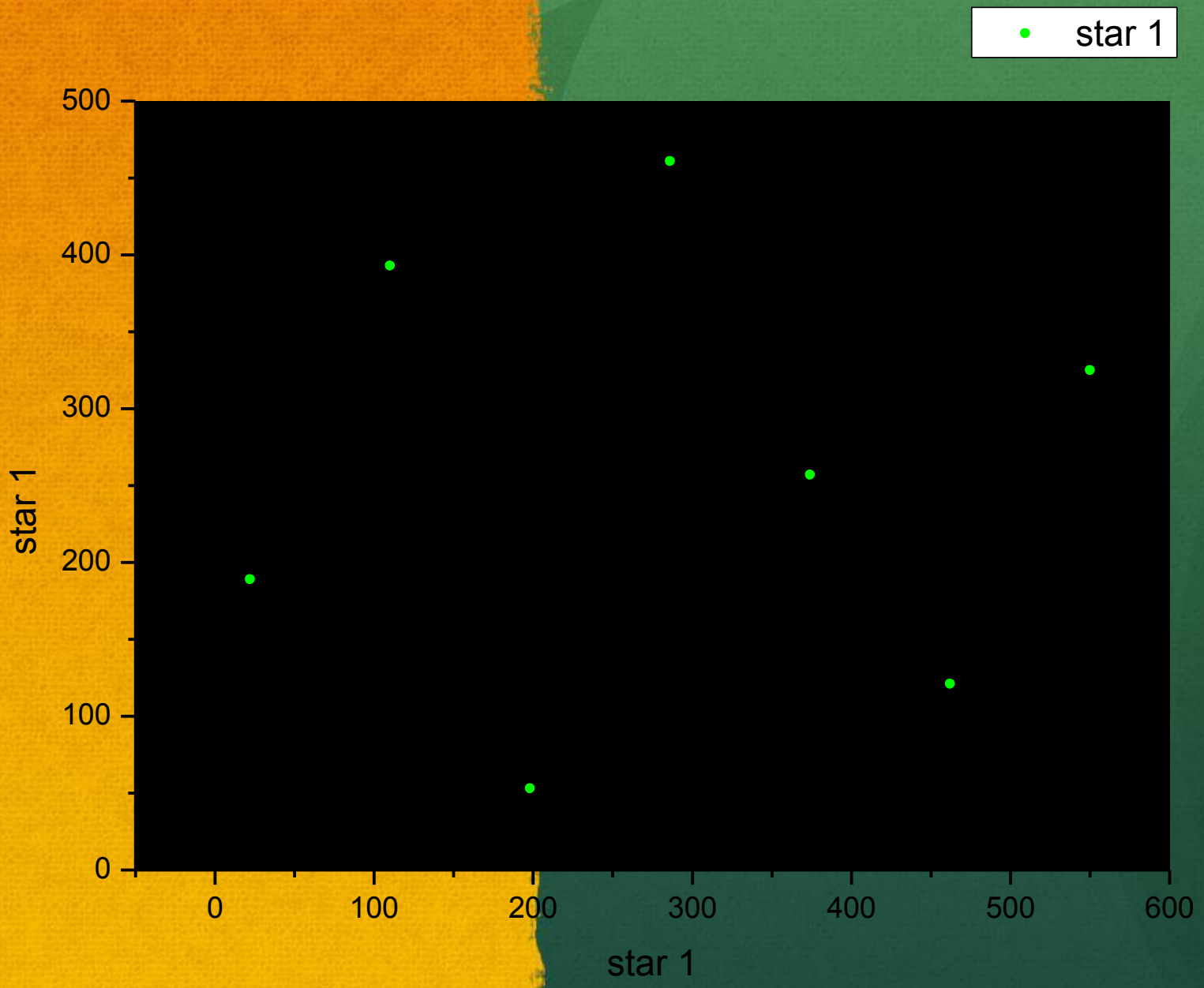
- **Color: changing every time star flash**

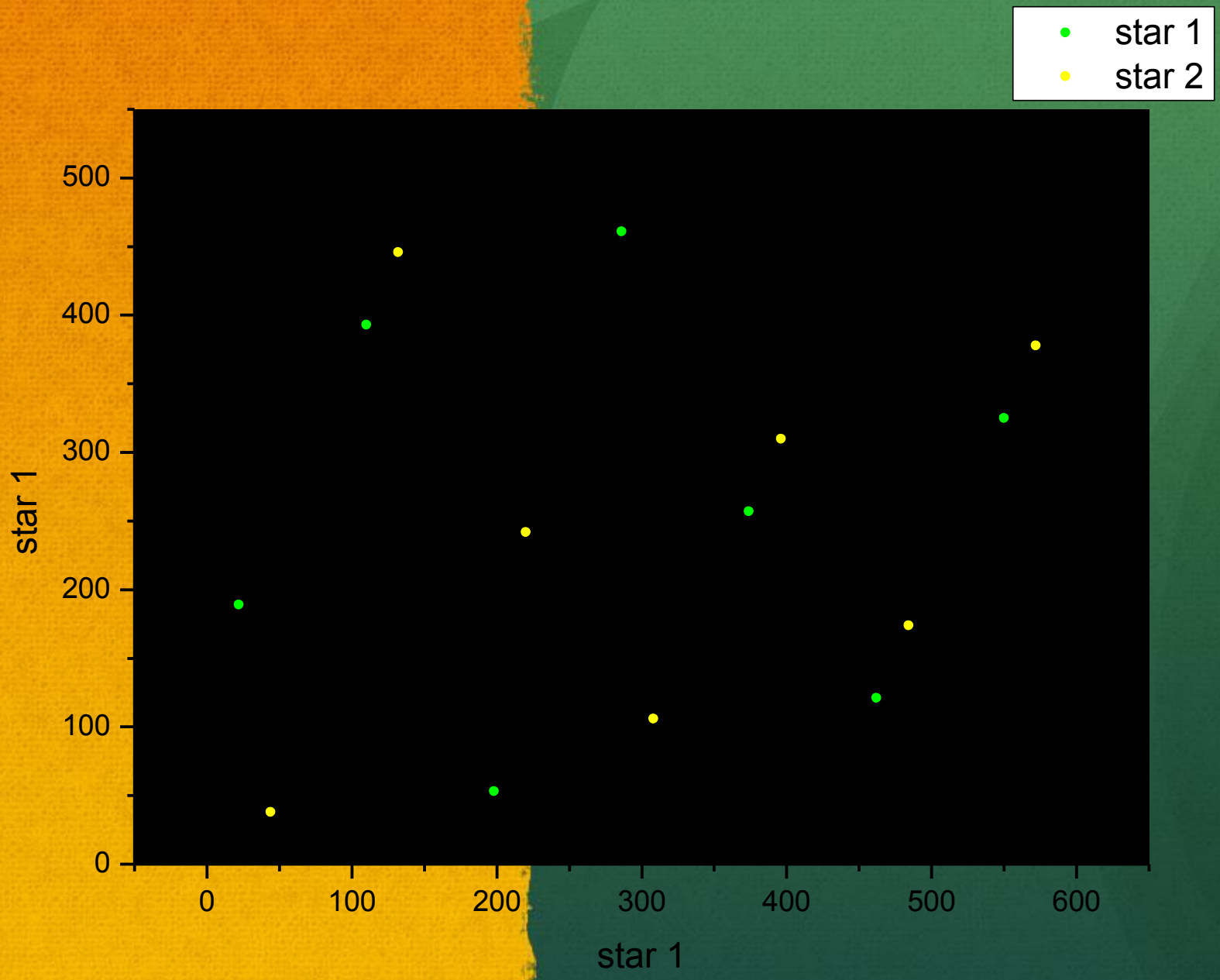
  Color is assigned as an register rather than a constant

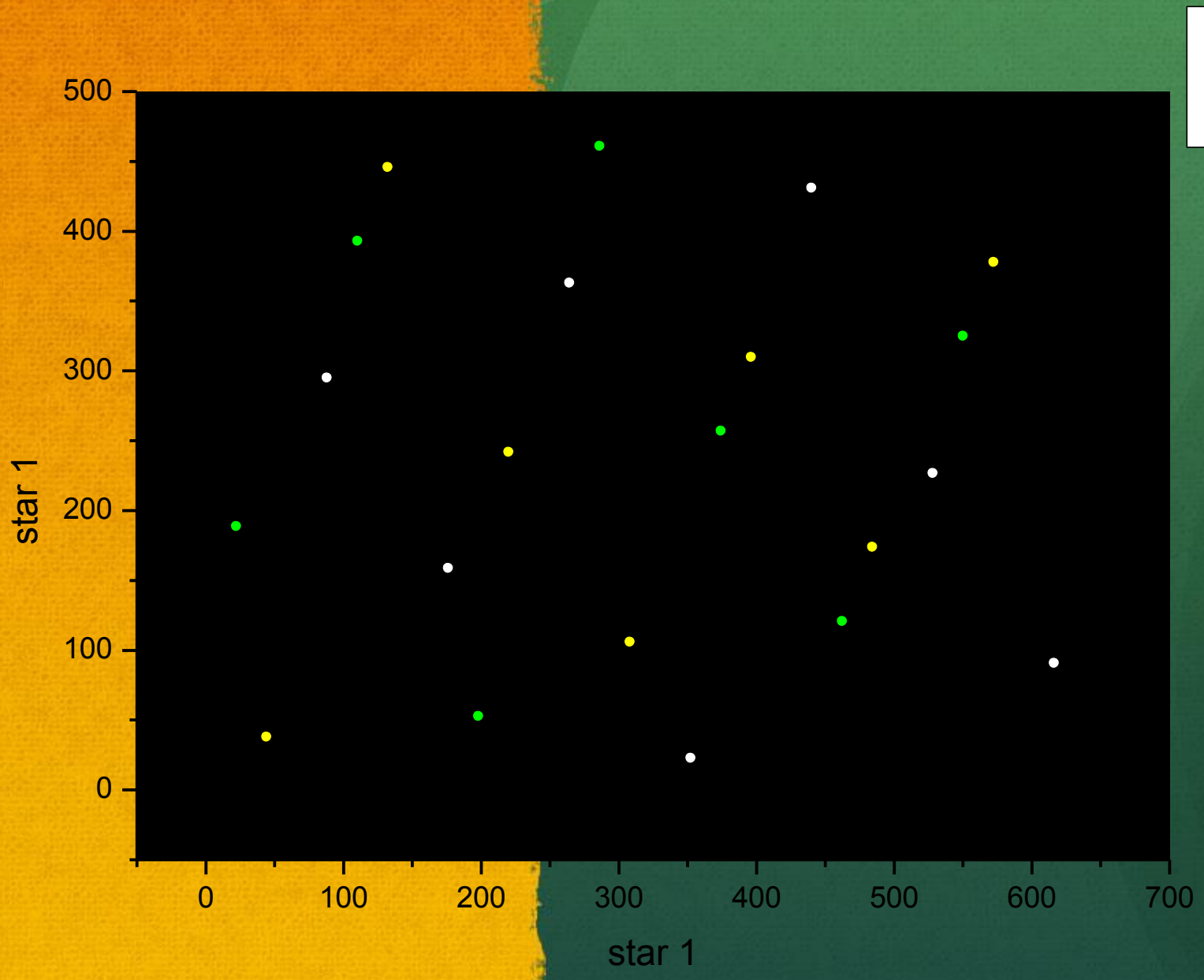
- **Position distribution: Biases on one base address**

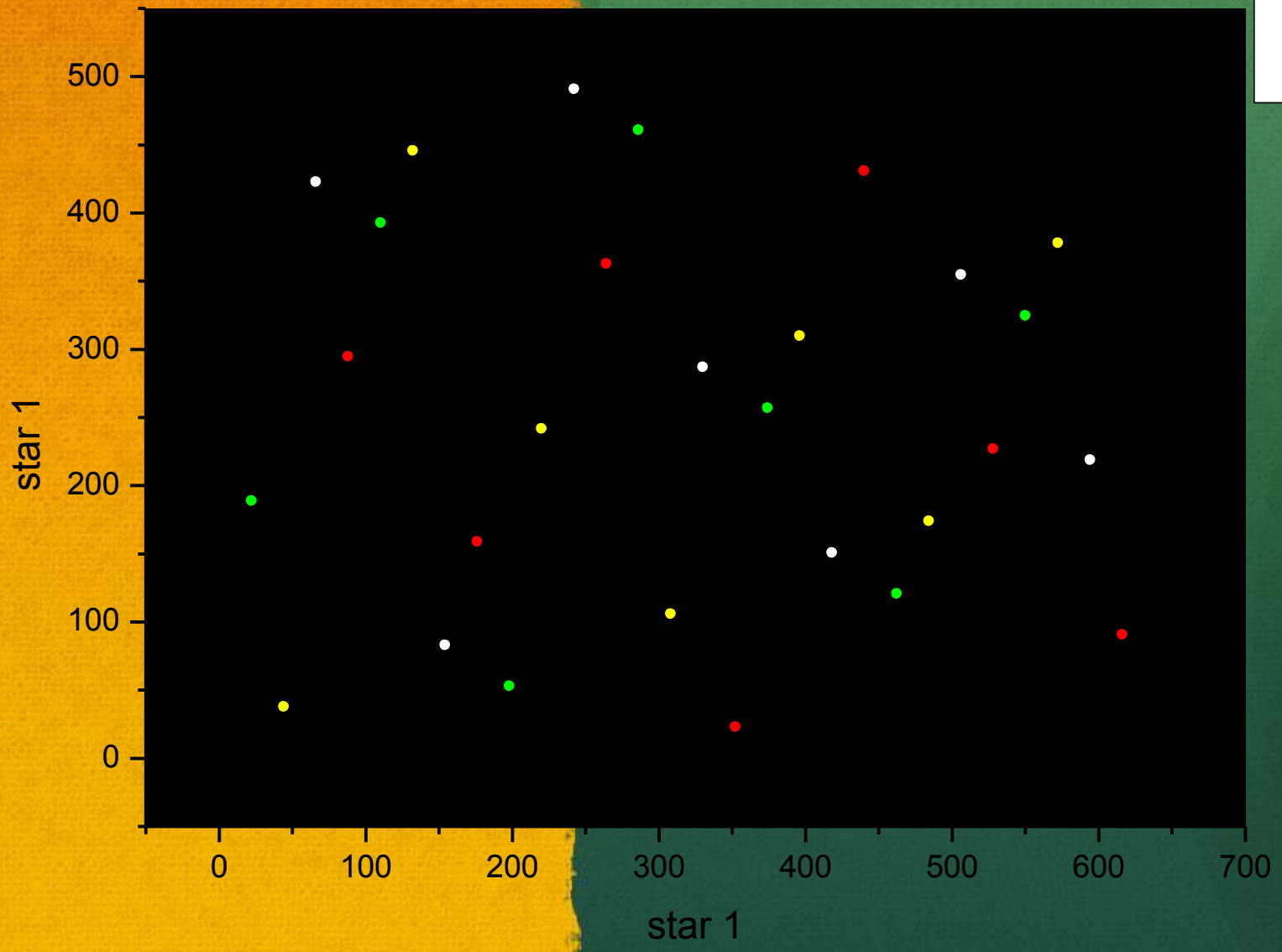
  (1)Horizontal: uniform distributed

  (2)Vertical: nearly randomly distributed


star 1
500
400
300
200
100
0
star 1
0
100
200
300
400
500
600
star 1

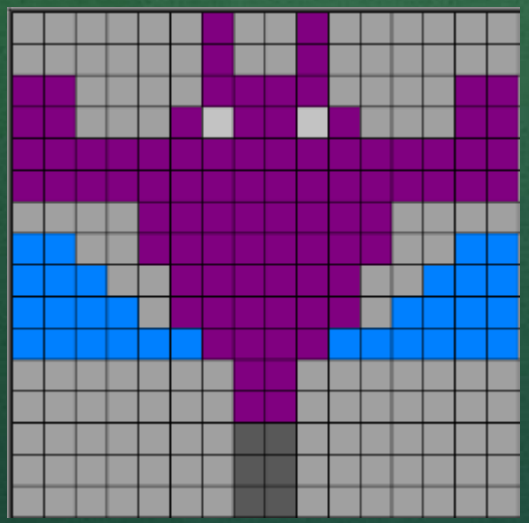

star 1
star 2
500
400
300
200
100
0
star 1
0
100
200
300
400
500
600
star 1

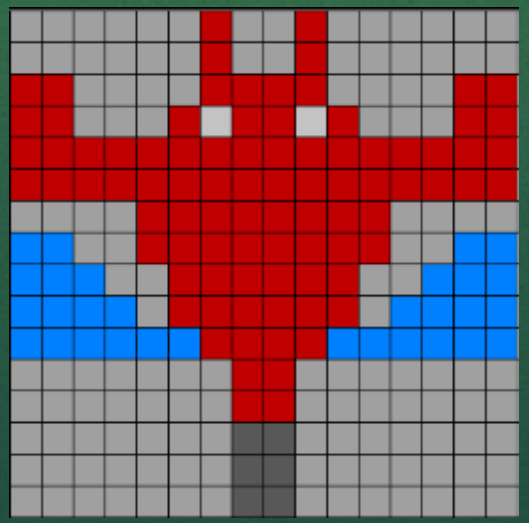

star 1
star 4
star 2
500
400
300
200
100
0
star 1
0
100
200
300
400
500
600
700
star 1

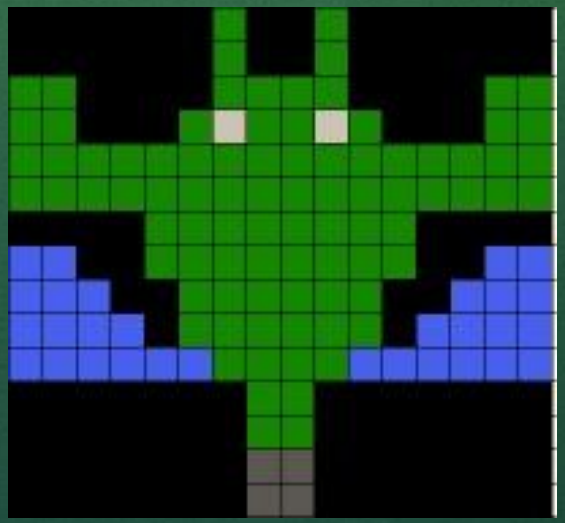

star 1
star 2
star 3
star 4
500
400
300
200
100
0
star 1
0
100
200
300
400
500
600
700
star 1

VGA

- 3 Different kinds of bees





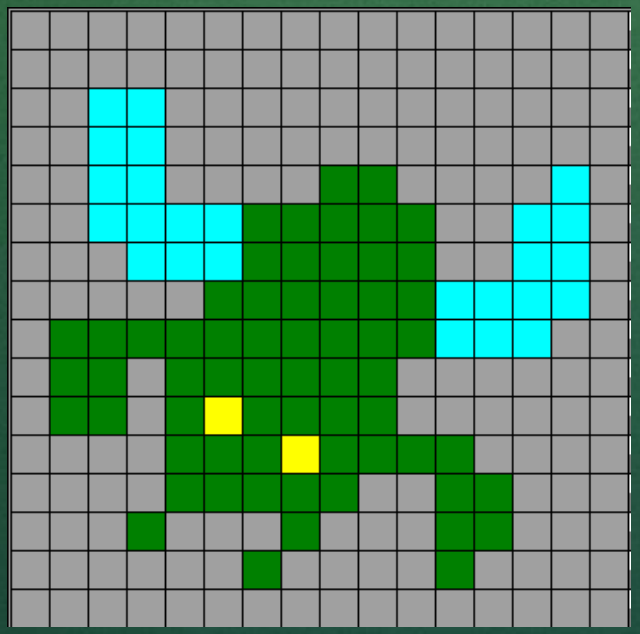


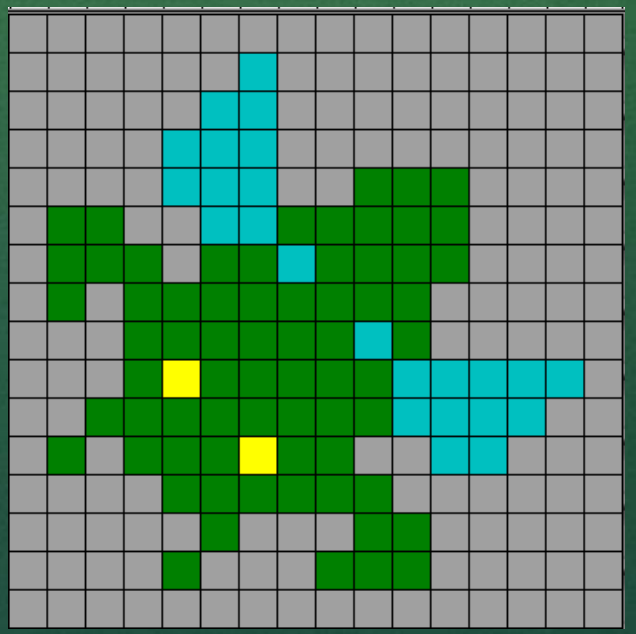
VGA

- Bee Matrix

VGA

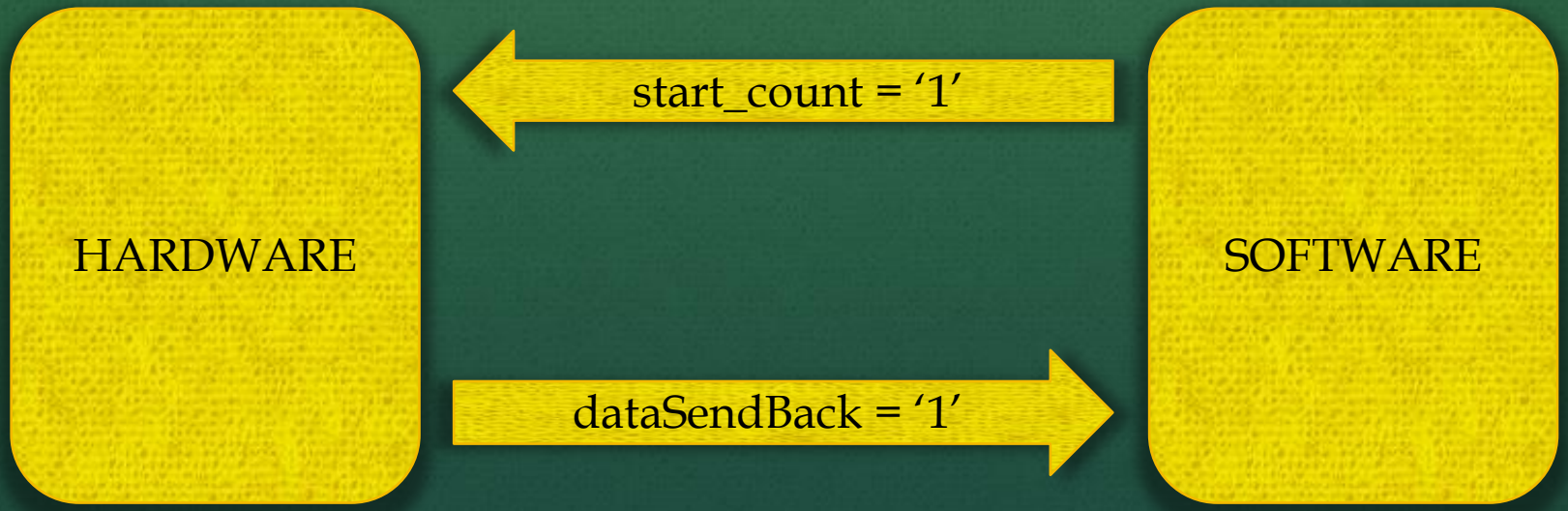
- 360 Degrees Bee Direction





Connection with Software

- Fast Moving Objects Synchronization
  - vga_vsync = ‘1’ and vga_hsync = ‘1’
- Time Synchronization



Keyboard

-Use the de_ps2 vhdl file in Lab 3 audio part

-Only implement the read interface

-Use the data read from keyboard with logic condition to eliminate subtle stuck when moving

Audio

-Modified version from Lab 3 audio part

-Use ROM to store music files

-Audio_driver implement the connection interface

Audio(Cont.)

-wm8371 implement the main funtion

-Involve discussion with Team Battle City

Software

- IOWR_32DIRECT(base, address, data)
  - IOWR_32DIRECT(VGA_BASE, address, data) to write data to VGA
  - IOWR_32DIRECT(AUDIO_BASE, address, data) to write data to AUDIO
- IODR_32DIRECT(base, offset)
  - IODR_32(VGA_BASE, 0) to read data from VGA
- IODR_8DIRECT(base, offset)
  - IODR_8DIRECT(PS2_BASE, 0)
  - IODR_8DIRECT(PS2_BASE, 4)

Software

- Main Moving Objects:
  - 36 Alien Enemies
    - 20 Green (slowest)
    - 8 Purple (fastest)
    - 6 Red (median)
    - 2 Command (median)
  - Spaceship
  - Bullet from Spaceship
  - Bullet from Enemy

Software

- Other Objects
  - Explosion
  - Start Screen
  - Game Over
  - High Score
  - Current Score
  - Level
  - Player Life
  - Ready
  - Pause

Enemy Movement

- Enemy randomly flying down
- Enemy flying down in a circle
- Enemy turning around when flying back
- Enemy tracing the position of the spaceship
- Enemy facing to the spaceship while flying
- Command enemy with two guards flying together
- Formation moving left and right
- Bullet from the enemy
- Bullet from the spaceship

Collision

- Enemy hits the spaceship
- Bullet from the enemy hits the spaceship
- Bullet from the spaceship hits the flying enemy
- Bullet from the spaceship hits the enemy in formation

Conclusion

- Communication between Hardware and Software
- Timing
- Team Collaboration
- Have Fun!