1. **Background:** We plan to implement the 1980s space-themed, fixed shooter arcade game Phoenix originally developed by Taito and Amstar Electronics. In this game, the player controls a spaceship that moves horizontally at the bottom of the screen and fires upwards to kill its enemies (birds). The player loses a life, whenever the ship is hit by an enemy or projectile.

![Figure 1. Phoenix game graphics display](image)

2. **Hardware and software description**

   a. **Hardware Components:**
   - DE1 SOC board
   - VGA monitor (must support different colors)
   - Joystick (alternatively, a keyboard input to control the videogame)
   - Speakers
   - Accelerometer

   b. **Software Components:**
○ Enemy movement: Enemies move randomly horizontally and vertically. They never disappear off screen. They automatically shoot downwards to the player’s spaceship whenever the spaceship is directly underneath.
○ Player’s spaceship movement: May only move horizontally throughout the lowest row of the screen. May not go off screen.
○ Player’s shooting and shielding: The player may shoot once vertically upwards at every press of a button. A shield that protects the spaceship from enemy shots activates simultaneously when the player shoots.

- Joystick input: One-dimension, horizontal input.
- Monitor output: Must support color and graphics similar to [2].
- Audio output.
- Accelerometer input.

3. Milestones

Milestone 1: Static display of background, spaceship and enemies (one theme). Recognize joystick input.

Milestone 2: Audio output not dependent on game action. Scrolling background, moving bullets and moving players and enemies.

Milestone 3: Final implementation of game logic:
- Start screen
- Shooting destroys and corresponding graphics for enemy/player dies and disappears. Shielding logic.
- Improved graphics throughout the game.
- Keeping track of score and highest score between rounds.
- Audio output varies with game action.
- Different themes, backgrounds.
- Different levels of difficulty

Extra milestones if time permits: Accelerometer substitutes joystick to move player’s spaceship horizontally and to shoot.

Menu? Milestone 3 too large? Memory? Graphics?
References:
[2] https://www.youtube.com/watch?v=vT4-0eJfsto