MINISTRY OF SCIENCE AND HIGHER EDUCATION OF THE RUSSIAN FEDERATION

FEDERAL STATE AUTONOMOUS EDUCATIONAL INSTITUTION OF HIGHER EDUCATION

"NOVOSIBIRSK NATIONAL RESEARCH UNIVERSITY

STATE UNIVERSITY"   
(NOVOSIBIRSK STATE UNIVERSITY, NSU)

15.03.06 - Mechatronics and Robotics

Focus (profile): Artificial Intelligence

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| Job topic: | **SPECIFICATION**  **‘SPACE INVADERS’** |

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2024

# **Introduction**

Computer games in the form in which we have seen them over the past 20 years have come to the form we are familiar with after many years of evolution. Since the middle of the last century, people began to use computers to create various types of entertainment programs, and later, based on them, arcade machines began to appear. The arcade games of that time were the reason that piqued our interest, and we decided to recreate one of them as part of this group project.

Created in 1978, Space Invaders has become a true classic over the decades of its existence. Released in Japan, the arcade game managed to win fans all over the world and, having become one of the founders of the Shoot’em up genre, has not lost its popularity to this day, being reborn in various kinds of remakes. Our team was interested in repeating the experience of creating this game, as well as understanding its internal structure and principles of its operation.

The essence of the game is to prevent alien ships from reaching the earth, destroying them as they approach. To do this, the player controls of a turret, which, when a key is pressed, fires a projectile that destroys the alien spaceship when hit. However, the aliens also drop bombs in an attempt to destroy the player's turret. The goal of the game, as you might guess, is to destroy waves of enemy ships, and defeat is considered either when at least one of these ships reaches the surface of the earth, or when the player’s turret is destroyed.

# **Purpose and area of application**

The purpose of creating this program is to obtain a working copy of the above-mentioned game, while maintaining the main part of its functionality. The scope of application lies not only in the obvious opportunity to use a ready-made program for its intended purpose (i.e., to play), but also in the ability for an outsider to clearly understand what the circuitry is.

**DEVELOPMENT REQUIREMENTS**

For a better understanding of how to implement the project, we decided to break the goal down into several tasks that need to be fully implemented for the final product to work at the level we planned

**Main goals:**  
1) Create a game with full functionality of the original based in the Logisim (name of program)

2) Use CDM-8 processor to implement at least one of the aspects and connect it to the circuit

**Subgoals:**

1. Use hardware and software to implement game mechanics
2. Combine circuits created with hardware and mechanics created with software
3. Check the correct operation of the final program

**FUNCTIONAL REQUIREMENTS**

Using hardware:

1) Implement a player turret that can move along the X axis and shoot.

2) Implement enemy ships that will move towards the player.

3) Implement collision of projectiles between enemy ships and the player's turret/collision of projectiles between the player's turret and enemy ships

4) Implementation of victory and defeat conditions

5) Implement a points counter

Using software:

1) Using the DM-8, implement the mechanics of dropping bombs on enemy ships.

**STAGES OF DEVELOPMENT**

First of all, we decided to draw up a work plan. Further explanation of the principles of operation of various aspects of the program will be built according to the above-mentioned plan.

Player Turret

Because Since the turret moves only along one axis, only one register is responsible for storing the coordinates of the turret in memory. Movement is implemented by sending a signal from the keyboard to the decoder, which, depending on the key pressed, moves the ship one pixel to the right or one pixel to the left.

(there should be a picture with a diagram here)

(Following is an explanation of the circuit responsible for firing the turret and a picture showing this circuit)

Enemy spaceships

In the original Space Invaders, alien spaceships move with some periodicity in one direction along the x-axis, after which, upon reaching one of the screen boundaries, they move down a pixel towards the player. We decided to transfer this idea to our program, implementing it as follows:

(Explanation of the circuit and picture)

Implementation of a collision

In order for alien ships to be destroyed, it is necessary to implement collision tracking between the projectile and the ship. In order for the bullet to “find” alien spaceships, we designed the circuit.