Pipe Connection

Team members: Chanyu Han & Izabella Yu

1. Game explanation

Welcome to Pipe Connection, a captivating puzzle game where players manipulate pipe blocks using a PS2 keyboard to irrigate a thirsty plant displayed on a VGA screen.

The objective of Pipe Connection is simple: players must strategically connect all randomized pipe blocks to connect them from the starting point to the endpoint.
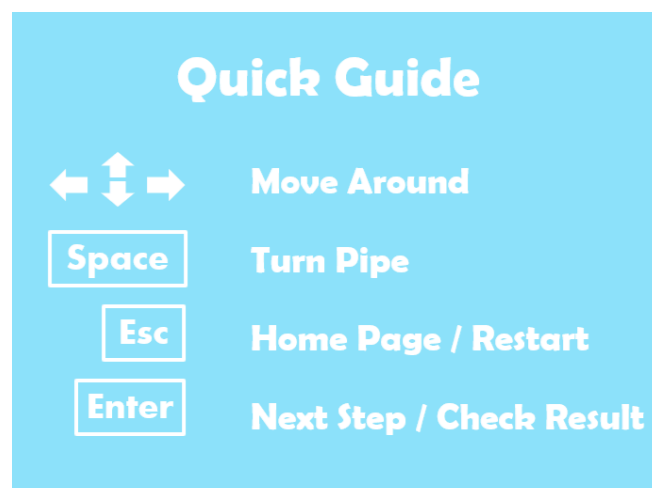
The game features two levels of increasing difficulty. In the first level, a single predetermined solution is hardcoded in the program and randomized before being presented on the VGA screen. Players should navigate the pipes to achieve the correct connection and success.

Level two presents a greater challenge. In addition to randomizing the blocks according to one of the hardcoded solutions, the game introduces randomly placed pipe blocks of various shapes around the standard solution. This creates multiple possible solutions, testing players' problem-solving skills even further. To ensure connectivity from start to finish, we implemented a robust algorithm treating each pipe as a block with four connectable or un-connectable edges.

To enhance the gaming experience, audio elements are added to immerse players further into the game.

Use the PS2 keyboard to maneuver the pipes and conquer each level. Are you ready to take on the challenge and help the plant thrive?

Keyboard Guide:

2. Work Distribution

Partial Task	Done By	Short Description
Keyboard	Izabella	Control to choose block(move around), turn pipes, go to next step, restart, etc.
VGA display - highlight	Izabella	Draw the highlighted pipe at its current position and redraw to un-highlight the previous pipe block
VGA display - draw blocks	Holly	The block images are encoded with numbers 0-6, 0 represents empty, 1-2 represents straight pipes and 3-6 represents corner pipes. The numbers are stored in a 2D array so that the program can easily read the type of block and draw it on VGA
VGA display - Water Flow	Izabella	Water flowed through the connected pipes from the "input pipe" when the player asked to check the result and stopped at the not-connected block
VGA display - HomePage/ Guide/Level/ EndPage	Izabella	A simple interface to guide the player and make sure they know how to play the game
Audio	Holly	Two short audio segments (pipe turning and water flowing sounds) are converted into integer samples. These samples are read using a pointer pointing to the Audio base location, which then writes the audio samples to the output FIFO
Algorithm	Izabella & Holly	**Original algorithm:** Store the randomized game board from one of the solutions into another global 2D array, update it after every pipe turn, at the same time, compare the 2D array with the solution 2D array. If they are equal, the player wins the game. **A more general algorithm is developed for the second level:** A model of different pipes is created, containing information about which edges are connectable. Pressing "Enter" initiates the process of checking the connection of each pipe block from the previous block until it successfully connects from start to end.
Switch between levels	Holly	A finite state machine that controls the order of displaying images on the VGA
Improve Aesthetics	Izabella &	- A light blue background for all the images

	Holly	that need to be displayed - A small "thirsty" plant at the end of the pipes, players can "water" the plant by successfully connecting all the pipes.