Alpha Release: Code Bread

20th of June 2020

Team *Callstack Overflow$_2$*

Maximilian Werhahn

Mark Pilgram

Min-Shan Luong

Felix Neumeyer

Additions since the Interim Report

UI Additions and Improvements

Main Menu & Pause Menu

We added a menu where players can change some basic settings like resolution and audio volume. It's also the entry point into our Game. The Steam overlay for *Steam Remote Play Together* (explained later) can be opened from the menu. When opened while playing, the menu pauses the game. The tutorial (see below) can also be accessed from the menus. The menu still lacks a nice background, but this will be added until the actual release.

Tutorial

The game now features tutorial slides that explain the basics of our game. The following topics are currently covered:

- Short introduction of the game's setting
- Controls (controller and keyboard)
- Picking up items and the inventory
- Baking Pizza
- Ingredients for baking
- Air System (Plants, breathing entities)
- Player revival
- Gravity and hull breaches
- The tractor beam and ice asteroids

Player Oxygen & Revive bars

When there isn't enough oxygen available nearby and a player is running out of breath or a player is being revived, we've added a circular bar next to the player to indicate the progress of them running out of breath or being revived.

Event Pointers

Objects can now trigger pointers with a custom color and icon towards their location. These pointers will then either hover over the object, or point in the direction of the object when it is not inside a player's view. These pointers smoothly transition to and from the out-of-view pointer circle when an object enters or leaves the camera's view.

Interaction Info Display

To make it easier for players to tell which object they are about to interact with and what options are available to them, we now display the currently relevant functions of the interact key in the bottom left corner.

Audio

Our game now has Audio! This might seem like something trivially easy to add, however the split-screen nature of our game did make this aspect a little more complex. Unity doesn't like it when there are multiple audio listeners active simultaneously, so to achieve correct 3D audio for all players, one needs to take a different approach. Rather than having audio listeners attached to multiple players or their cameras, 3D audio sources are duplicated on creation and moved around a static audio listener based on their position to their assigned player in each fixed update step.

Another thing to consider was sound balancing, certain sounds, like the ringing telephone, should be heard throughout the whole ship, whereas most other sounds can be more local. Our audio controller also supports applying volume adjustments to all active sound objects when making changes in the settings menu.

Ice Asteroid Gathering and Melting

Tractor Beam Mechanics

Players can now collect ice asteroids by using the ship's tractor beam. The beam doesn't reach its target instantly and is interrupted when other asteroids (regular or ice) pass through it, so it takes some skill to lead the beam to the ice asteroid you want to catch. Once successfully caught, navigate the asteroid back to the ship (the entrance is to the left of the tractor beam) without getting the beam cut off by other objects.

Ice Asteroids

Ice asteroids are a new type of pickup with the special feature that they will gradually melt when occupying either of the Spaceship's two engine rooms. Once melted, they transform into water bottles. This process even works when a player is holding an ice asteroid in their inventory.

Environment System Improvements and Expansion

Balance changes

Since the interim report, several changes were made to the setup of the simulation. Most importantly rooms now start off filled with air. Certain rooms also have CO2 inflow objects that allow them to refill with air. These inflow objects are disabled if the room gets connected to a room with a hull breach via open doors.

Additionally, air quantities now remain constant between simulation steps for more predictable behaviour, which should make it easier for us to balance resource consumption around these quantities.

Visualization Improvements

We now have GPU particles that move with the flow of air. For example, this picture shows **air being sucked out** of the ship from the hallway on the right and the room itself towards the **hull breach (green arrow)** in the top of the image.

Particles are colored blue for oxygen and red for carbon dioxide. The particle density corresponds to the concentration of oxygen and carbon dioxide respectively. The player can therefore get a better feeling for how much oxygen and carbon dioxide is around.

The effect was created with Unity's *Visual Effect Graph* by randomly sampling the oxygen/carbon dioxide density and velocity textures of the fluid simulation and spawning particles in the corresponding world space coordinates. We are giving particles a lifetime larger than zero only at places where oxygen or carbon dioxide is. Even spawning 10,000 particles per second and simulating 100,000 particles in total is barely noticeable performance-wise.
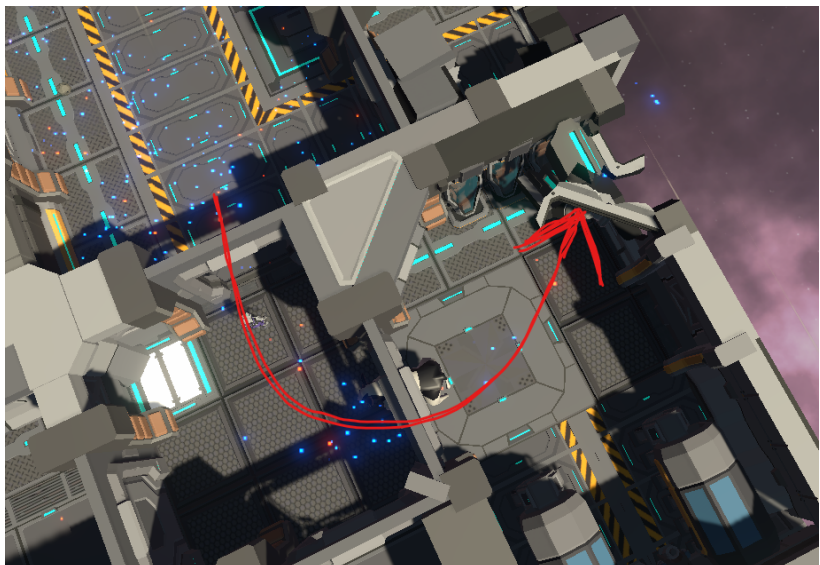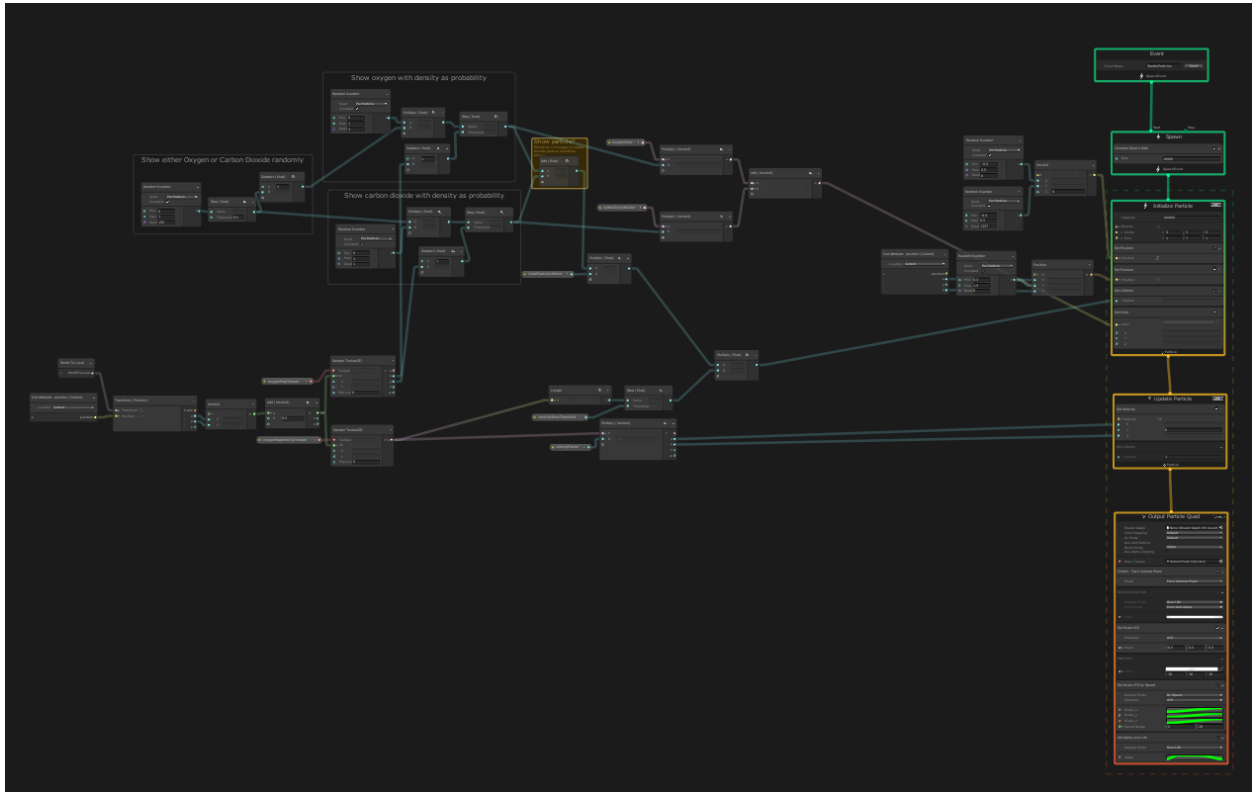
Fan Object

Players can now influence the flow of air by picking up portable fans. These fans are only active when carried by a player, so performing this action may reduce a player's capability to perform other actions at the same time, as the fan can only be stored in a large inventory slot. It gives the player more control over the air flow around the ship and the possibility to quickly move air around if he needs to. For example after a hull breach, when there's not too much air around, it would normally take some time until carbon dioxide and oxygen spread throughout the room. The player could speed this process up alot by turning on the fan for just a moment.
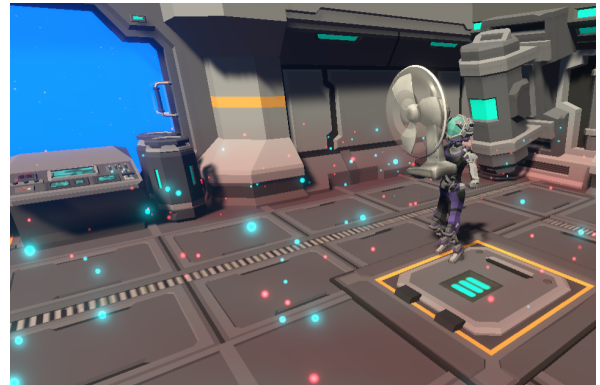
Hull Breaches & Gravity

Hull breaches now interact with the fluid simulation, sucking air out into space. Additionally, rooms with at least one hull breach lose artificial gravity, which doesn't have too much of an impact on gameplay right now, but does cause items and debris to float around the room, making them potentially harder to access. Objects in a zero gravity environment have their movement affected by the flow of air around them.

Fire & Fire Extinguisher Object

Certain objects can now catch fire, and spread their fire to other nearby burnable objects. We don't have all that many objects on our ship just yet, so the gameplay impact is rather minimal, but players should take care not to store too many items around the oven if they bake a pizza for too long...

Fires can be extinguished using a fire extinguisher. When the fire extinguisher has been picked up, a player can spray out water by holding the interact key.

Steam Remote Play Together Integration

We integrated Steam's Steamworks API to use the Steam Overlay and functionality in our game. The main reason for this was to use Steam's *Remote Play Together* functionality. We can therefore invite friends on Steam to play our local multiplayer game with us by streaming the screen in real-time and pass input of our friend's controls to our local game. This makes it possible to play the game as a "online-multiplayer", given that both players have a stable internet connection at around 10 Mbit/s bandwidth. We will use this for playtesting as well by inviting two testers to play on our PCs, making it possible to observe their experience in real time.

Telephone & Pizza Teleporter System

Rather than having pizza orders appear out of nowhere, the space ship's telephone will occasionally ring, requiring a player to answer it in order to either accept or decline an order. When taking the order, the phone will display a random animated NPC with a speech bubble showing the type of Pizza they want.
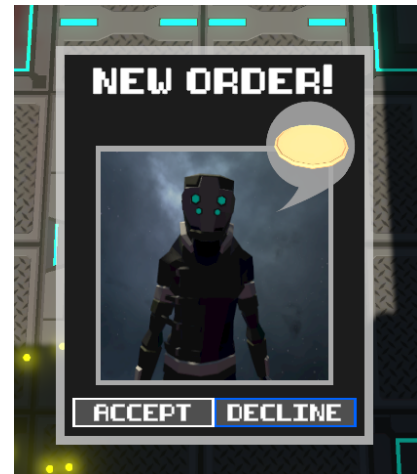

Petty Officer Mooington VII

The space ship is now home to a new member of the crew! This cow will roam around the ship independently, producing cheese. Make sure to keep her fed if you don't want her to start eating your most valued plants and pizzas that are left in her way.

As a living being, Mooington naturally also consumes oxygen. If none is available, cheese production will pause while she tries to find a room where she can breathe in.

Since communication with cows hasn't advanced too much by this point, evaluating the cow's hunger status and food preferences isn't as straightforward as checking on a plant's growth.
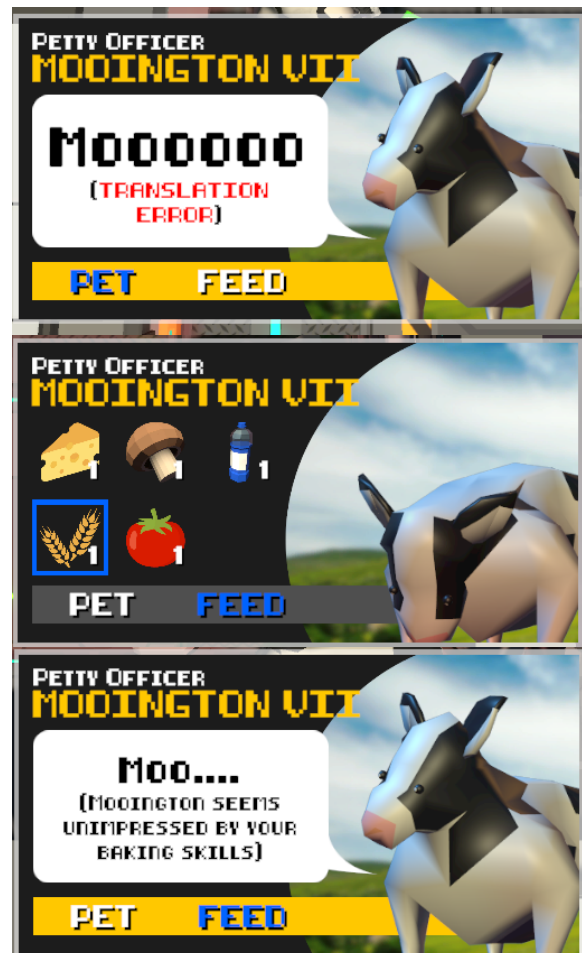
Overview of the game's current state

The core of our game is of course its environment simulation. Right now, the major aspects that we had originally planned for the simulation are in place, though not all elements are all that relevant to gameplay. We have the air simulation with its mix of oxygen and CO_2, as well as air velocity. Objects such as players, animals and plants or the portable fan can interact with the simulation, converting and providing resources, or accelerating their flow.

Fires can spread between burnable objects and be put out with a fire extinguisher. These also interact with the air simulation, consuming oxygen, though with few movable objects on the ship, this system is still rather irrelevant to gameplay. Rooms with a hull breach lose gravity, which can occasionally make pickups harder to access, but mostly just looks pretty.

From a gameplay perspective, the core gameplay we had planned is basically all there, even if most systems still leave room for expansion. Players can take orders from the telephone, grow plants with water collected from passing ice asteroids, and bake the collected resources into pizzas that are delivered via the pizza teleporter. Resource collection comes in various forms, namely the aforementioned plant growth, searching for randomly spawning mushrooms or collecting cheese from the cow that roams the ship and also needs to be fed.

While players try to accomplish the task of making pizza, they need to maintain and control the environment around them, fixing hull breaches and managing plant positions and door states to stay alive. Should a player spend too long in an environment without oxygen, they fall unconscious and need to be revived by the other player. All of this relies on the player having clear information about the environment around them, which we've achieved by visualizing the simulation through particles and colors.

Even though some of the more optional ideas from our original list of targets may have been too ambitious for this project's time frame, many of them could easily be added with the foundation we have built if given more time. In this project we chose to focus more on building this foundation, as it is the key to making the gameplay we had planned stand out.

Development Schedule and Tasks

The color **green** stands for tasks which we thought of before and which we completed until the alpha release, whereas **red** denotes the tasks we didn't have time to implement. Additionally, **yellow** marks tasks which we added during development. Tasks which were greyed out below we deemed unnecessary. In the brackets "**[...]**" behind the tasks we explain our design decisions.

Layered Task Breakdown

Functional Minimum

- **Basic environment simulation (O2/CO2, air flow)**
  - **Plants/life system as producers**
  - **Players as consumers**
- **Spaceship hull breaches and repair mechanics => air pressure**

Low Target

- **Co-Op of any kind**
  - **Examples:**
    - ammunition needs to be carried to the gunner [not needed anymore]
    - **repair task distribution**
    - **the players maintain the ship**
  - **Revive other players when they fall unconscious due to a lack of oxygen**
- *The Telephone*
  - **Do missions, get paid (e.g. in order to buy a better spaceship)**
- **Asteroid shooting minigame [in form of a tractor beam minigame]**
- **Resource gathering from asteroids and plants**
- **Crafting**
  - ammo
  - repair equipment
  - **pizza ingredients**
- **Oven for baking pizza**

Desired Target

- **Online Co-Op [Steam Remote Play Together]**
- Med-bay or cloning room to replace revival system [Did not make sense]
- **Fire, Fire propagation & interaction with the environment, fire suppression mechanics**

- **Advanced environment simulation: electricity, artificial gravity (that can get disabled)**
- **Ultimate environment simulation: temperature**
- **Explaining ship AI (tutorial, ship status updates, story?) [ship status shown by indicators on the edge of the screen]**

High Target

- **Captain's chair (advanced ship overview) [split up into different features (e.g. fluid visualization)]**
- **End-game statistics**
- **Environment based audio mixing (having things sound different when in a pressurized room compared to an unpressurized room).**
- **Hunger system [for Cow instead of Players]**
- Attacks from other ships if their orders via *the telephone* aren't completed/are completed poorly [Might be too harsh on the player to have to focus on additional penalties]

Extras

- **Needy ship AI**
  - **Enforces players to keep the ship tidy, otherwise it will temporarily disable random systems**
  - **Comments on the current situation**
  - **Defend the ship from hacking attacks**
  - **AI temporarily takes control of the spaceship**
- **Multiple levels**
- **Balancing for different numbers of players [limited to 2 players currently]**
- **Trading**

Novel tasks

- **Cow AI for additional resources, random behaviour**
- **Fan Object to interact with the simulation directly**
- **Tutorial in the Menu**
- **Audio in general (for most events/player interactions)**