Game Design Document for unnamed City Builder Game

Overview:
This is a top down isometric voxel styled city builder game, where the user starts on an empty piece of land and gets to build buildings. The player gathers natural resources and constructs new buildings over time, expanding their city.

The goal of the game is to increase the city's population. The user can do so by building housing and providing utilities to the houses by building utility buildings such as power generators and water towers. Houses have a base population, which increases based on its satisfied utilities.

Additionally, the user is able to interact with the real world by scanning objects in the real world to unlock certain buildings. This feature is not implemented in this version of the project, but will be a major feature for future groups.

Buildings currently in the game:

Object name	Category	Building Effect	Building Materials	Requirements	how to collect item in real world	Special Notes
Single House	Housing	Population + 5-10	n/a	1000 coins Player level 1	n/a	In game
Coal plant	Energy	Energy Capacity +50 Air Pollution +10	n/a	3000 coins Player level 1	n/a	In game
Wind Turbine Generator	Energy	Energy capacity +20	n/a	3000 coins Player level 10	n/a	In game
Solar Energy Plant	Energy	Energy capacity +30	n/a	5000 coins Player level 10	n/a	In game
Hydro Power Plant	Energy	Energy capacity +30	n/a	5000 coins Player level 10	n/a	In game
Water Tower	Water	Water+50	n/a	3000 coins Player level 5	n/a	In game
Sewage Treatment Facility	Sewage	Sewage+100	n/a	5000 coins Player level 5	n/a	In game

		Water Pollution + 20				
Radio Data Center	Internet	Internet+100	n/a	5000 coins Player level 5	n/a	In game
Town Hall	Government	Tax collection	n/a	10,000 coins Player level 1	n/a	In game
Lumber Yard	Harvesting	Allows users to harvest trees.	n/a	5000 coins Player level 1	n/a	In game
Stone Quarry	Harvesting	Allows users to mine stone	n/a	5000 coins Player level 1	n/a	In game

Buildings to be added:

Object name	Category	Building Effect	Building Materials	Requirements	how to collect item in real world	Special Notes
Nuclear Power Plant	Energy	Energy capacity +100	n/a	20,000 coins Player level 20	n/a	To be added
Oil Power Plant	Energy	Energy capacity +100 Air Pollution + 20	n/a	5000 coins Player level 10	n/a	To be added
Water Pumping Facility	Water	Water+200	n/a	10,000 coins Player level 20	n/a	To be added
Gas Reservoir	Natural Gas	Gas+100	n/a	5000 coins Player level 5	n/a	To be added
School	Education	Education coverage for all buildings in range	n/a	10,000 coins Player level 10	scan 10 different books	To be added

Police Station	Security	Security coverage for all buildings in range	n/a	20,000 coins Player level 10	n/a	To be added
Fire Station	Fire	Fire coverage for all buildings in range	n/a	20,000 coins Player level 10	n/a	To be added
Hospital	Health	Health coverage for all buildings	n/a	30,000 coins Player level 10	n/a	To be added
Park	Recreation	Recreation +20 Air Pollution-20	n/a	5,000 coins Player level 10	scan 5 different park signs	To be added
Recreation center	Recreation	Recreation +50	n/a	10,000 coins Player level 15	visit 3 different community centres irl	To be added
Mall	Recreation	Recreation +100	n/a	30,000 coins Player level 20	visit a mall in real life	To be added
Court House	Security	Security+100	n/a	20,000 coins Player level 20	n/a	To be added
Lumber Refinement Facility	Manufacturing	Given wood, produces lumber for building	n/a	5000 coins Player level 5	scan 50 unique trees	To be added
Steel Production Facility	Manufacturing	Given ores, produces steel	n/a	5000 coins Player level 5	n/a	To be added
Concrete Production Facility	Manufacturing		n/a	5000 coins Player level 5	n/a	*note: IRL, concrete requires cement which requires various materials,

						so might need to break this down into various steps To be added
Stone Cutting Facility	Manufacturing	Given stone, produces refined stones for building	n/a	5000 coins Player level 5		To be added
Glass Production Facility	Manufacturing	Given sand, produces glass	n/a	5000 coins Player level 5	scan glass bottles / find a way to track recycling	might be hard for users to get sand, need to think of ways to give them sand To be added
Brick Blaster	Manufacturing	Given clay, produces bricks	n/a	5000 coins Player level 5	scan paper waste?	Hard for users to get clay, how to give To be added
Plastic Factory	Manufacturing	Given Ethylene and Propylene, produces plastic	n/a	5000 coins Player level 5	scan plastic waste	These materials can be generated as a byproduct from oil power plants. To be added

Game Mechanics:

The map:

The map consists of individual 1x1 tile objects, which are just colored and scaled cubes. These tiles have a script attached to them that tracks if it is currently occupied, and what is currently occupying it. This is the basis for the placement system.

The map is generated to be 100x100, using perlin noise to also generate bodies of water, trees, and rocks.The map is generated randomly per user.

The user can pan around the map using WASD to control the camera.

The building system:

The building system takes place on the tiles. All existing buildings can only be placed on top of free tiles. Roads can be placed by clicking and dragging, and other buildings must be connected to some road. The building system utilises two main classes, an input manager and a placement system. The input manager finds the cursor's position on the tile via raycast, and returns a position snapped to the center of the tile the cursor is on. The placement system uses that position to select, place, move, and delete objects.

UI:

The main UI provides the user a way to place and move objects. To place an object, the user can find the different categories of objects on the right, and clicking on any of the categories will bring up either a sub category, or a list of available buildings in their inventory. Each building will have a count, and when the user has 0 of a certain building, they are given the option to build a new one (this feature is currently under development).

If the user clicks on a building that is already on the map, a menu will show up that allows them to move, delete, or rotate the building. If the building is housing, it will also display its current population and the parameters for each utility; power, water, sewage, gas, internet.

Pollution:

Pollution is one of the key mechanics to be implemented and expanded upon. As the player builds their city, and as the population grows, the city's pollution index will increase. A higher pollution index means less happy citizens, which affects the population of the city. Thus, the user must invest in cleaner buildings such as solar panels instead of coal factories. Trees also contribute to reducing air pollution, so when users cut down more trees, the less their pollution will be offset.

The partner has suggested different types of pollution, such as air pollution, water pollution, land pollution etc. We only plan on implementing air pollution.

Building Materials:

There are two kinds of materials, ones that you directly harvest, and ones that you need to manufacture. Currently, only two materials have been implemented. That is, wood and stone, which you harvest from trees and rocks.

Here is a more detailed summary of the different materials planned:

Harvestable: wood from trees, stone from rocks, ores from rocks (with a drop rate), sand from the beach (area not implemented), clay from the beach.
Manufacturable: lumber from processing wood, steel from smelting ores, concrete from mixing stone and sand, glass from smelting sand, brick from smelting clay, plastic from manufacturing using ethanol as a byproduct of oil plants.

Early-game (low player level) buildings will require the more primitive materials such as wood and stone, whereas higher level buildings will require materials that need to be manufactured.

What's next:
We have built the infrastructure required for the game to work, so the next steps would be to implement more gameplay features. Here are some ideas

- More buildings and more building categories
- Different kinds of pollution, how you can balance pollution caused from buildings and population with pro-environmental buildings
- Transportation: introducing different types of transportation solutions such as buses, subways, etc. Making transportation another parameter that housing objects need to function.
- More natural resources and manufactured materials. From the list of buildings above that have yet to be implemented, some buildings are manufacturers that produce building materials which higher tier buildings may require
- Player level: a mechanic that locks and unlocks what buildings a player should be able to build. This is a way to gate and streamline player progression.
- Real world interaction: This is a large feature that changes how the game can be played. People can gather resources for the game by scanning objects in the real world. This is mostly an idea proposed by James but has not been concretely planned out.
- Game flow and tutorial: Hone in on the design of what buildings are available at what stage of the game. For example, the buildings that the player starts with should be buildable with the materials they have access to at the time.