BUILD 112 - Daniel Lin (dlin3)

TP3 Update:
Randomized Terrain Generation based off of the Perlin noise algorithm:
- https://pvigier.github.io/2018/10/08/terrain-generation-simulopolis.html
- https://gamedev.stackexchange.com/questions/29044/how-can-i-generate-random-lakes-and-rivers-in-my-game

Recursive road network identification:
- https://devforum.roblox.com/t/looping-through-a-2d-array-to-check-grid-connections/1726141/3

TP2 Update:
Functional Game Buttons
Menu Screen Functionality and Load New Game
Multiple Building Types
Game Implementation:
- Money
- Population
- Taxation
- Days
Zoning
- Assigns grids for auto-building
- Increases auto-build possibility next to roads
Screen Manipulation:
- Zooming
    - Keys are K and L
    - Building moves with grid
    - Zoomed grid recognition
    - Zoom centered around screen center
- Panning
    - Shifts grid and buildings.
    - Works with zooming
- Key hold zooming and panning

TP1 Update:
Game Implementation will be based on managing the popularity of the mayor (player) as the city grows.
Currently available features:
    Buttons that toggle other buttons
    Multiple Screens (Splash, Instructions, Menu, Game)

Togglable Grid
Road and Residence Building
Upgrading Residences

Description

BUILD 112 is a city builder game emulating the progression and development of a city. Starting with limited resources, your goal is to slowly progress your city by building infrastructure that facilitates your economy. The goal of the player is to serve as the mayor, building infrastructure and zone areas to satisfy the citizen's demands.

Similar Projects

Simstainable City by Annabelle Swain from the 112 class of spring '17 demonstrates a 2d grid based city builder game. My game will aim to have the same technical functionality as Simstainable City, most notably the grid based system, building placing functions and economy. While it's not exactly clear how the game progresses with time in Simstainable City, I will be using a more simplified approach to the game with a button allowing the player to move on to the next month. Other differences for Cities 112 include functions for building residential houses being a zoning tool instead of building individual buildings.

Features

1. Static 2.5D isometric background,
   a. increase complexity allowing zoom
   b. max complexity allowing rotation.
   c. https://clintbellanger.net/articles/isometric_math/
2. Terrain Generation
   - Basic Level: Includes water(rivers, ponds) and terrain details(stones and trees) on a flat grid based plane
   - Noise based elevation displayed rgb gradients
3. Grid based building placement:
   a. Buildings with preset shapes
   b. Roads built by click and drag. Can support building curves
4. Game Functionality:
   a. Services(Building Classes):
      i. Police
      ii. School
      iii. Hospital
      iv. Energy
      v. Parks
   b. Roads(Building Classes):
      i. Click and drag across grids to draw roads.

        ii.   Complex: incorporates curved road building and complex road types such as roundabouts and other intersections.
- c. Zoning(Grid Parameter) :
  - i. Zone areas to automatically build buildings of a certain type over time.
  - ii. Zones include: Commercial, Industrial, Low/High Density Residency.
- d. Money(Game Parameter) :
  - i. Consumed to build things
- e. Land Values/Happiness(Grid parameter):
  - i. Land values are calculated based on the proximity of the location to essential services and density of housing.
5. Camera zooming, panning
6. UI:
   - a. Gamestart Screen
   - b. Instructions Screen
   - c. Game Interface with buttons.

Game Class:
- Parameters
  - Money
  - Population
  - Energy
  - Time

Board Class:
- Parameters:
  - Rows, Cols
  - Tiles
- States:
  - Water, Water Adjacent, Empty Tile(Cleared/Uncleared), Occupied Tile
- Functions:
  - Building services
  - Building roads
  - Zoning
    - automatically generates Residency and Industrial buildings

Object/Buildings Class:
- Services:
  - Police
  - School
  - Hospital
  - Park
  - Energy
- Roads:
- Residency and Industrial

Buttons Class:
- To be determined

Algorithmic Plan:

1. Orthogonal Grid (Medium)
    a. Found article explaining principles for an isometric tile map
    b. https://clintbellanger.net/articles/isometric_math/
2. Placing Buildings onto Grid (Hardish)
    a. Road building (Hard)
3. Adding Buildings restrictions (Easy)
4. Adding game parameters. (Easy)
   – likely cutoff for MVP –
5. Zoning and automatic building development (Hard)

Will ask a mentor for recommendations on finding information on developing these algorithms.

Version Control Plan:

Github Repository
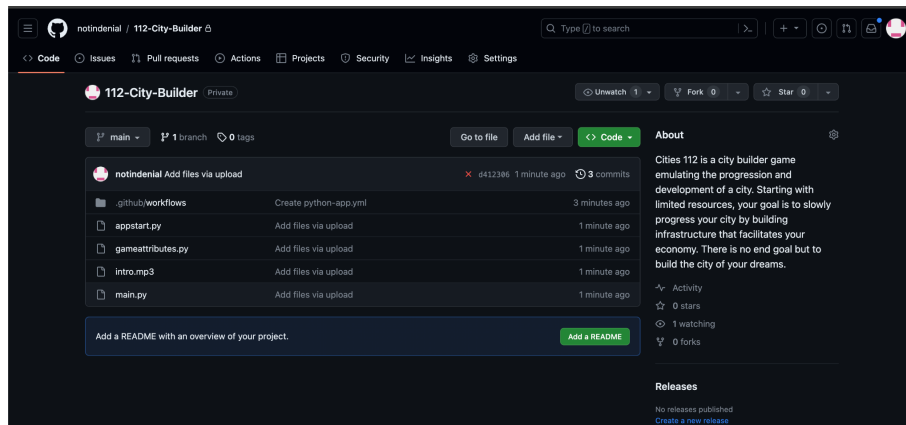
Timeline Plan:

- 11/20 TP0 Due
- 11/27 TP1 Due
    - Complete Isometric Grid Layout and Sevices Placement
- 12/04 TP2 Due
    - Complete Road and Zoning Features
    - Complete UI and Game Running
- 12/11 TP3 Due
    - Complete Final Features

Module List:

1. from cmu_graphics import *

   CMU Graphics Package

2. from math import floor

   floor function to round numbers

3. from noise import pnoise2,pnoise3

   noise algorithm used to generate terrain elevation

4. PIL import Image, import os, pathlib

   Image, os, pathlib used to interpret images in directory to be displayed

   using the CMU Graphics Package

5. import random

   used for random terrain generation with the noise algorithm and zoning(autobuilding)

   feature

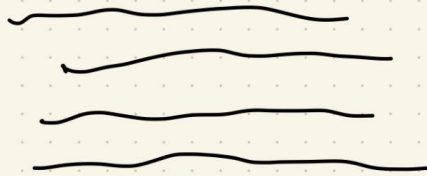StoryBoard:

Start screen

BUILD 112

press space or click to begin

Instructions

Welcome to BUILD 112

_____
_____
_____
_____

press space or click to continue.

Home page

BUILD 112

New Game

Load Game

Instructions

Exit

Start

$ 500000 8 0
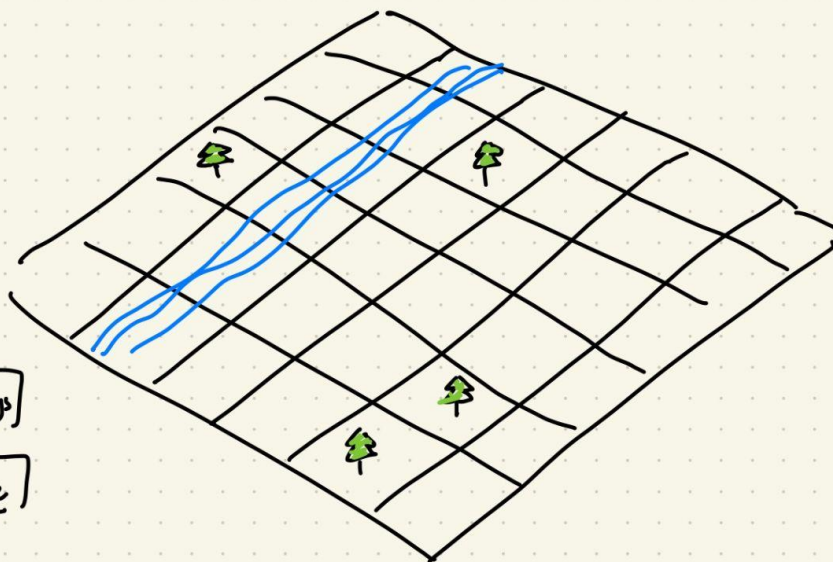
Buildings

Delete

$100000 💰 500
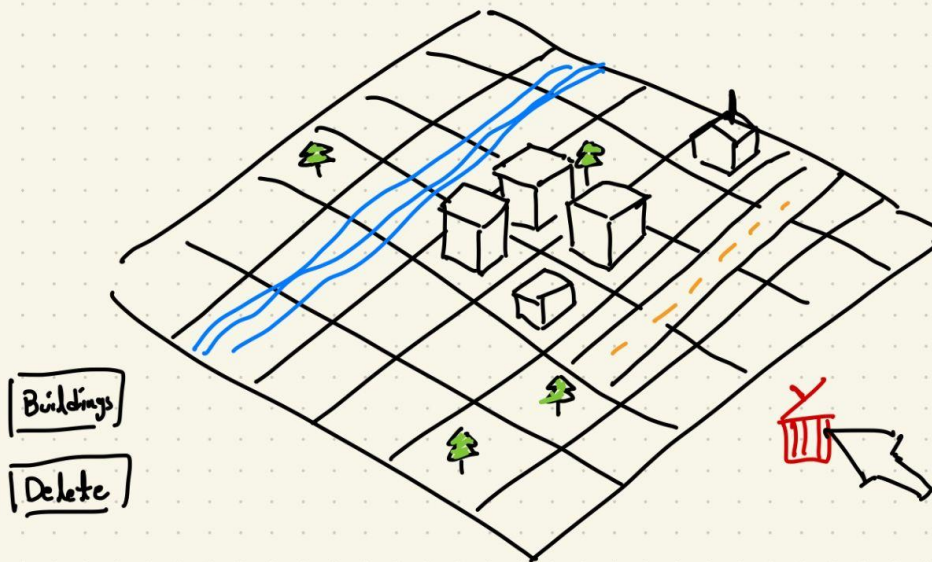

Buildings

Delete

$ 500000 💰 0

Buildings

Delete
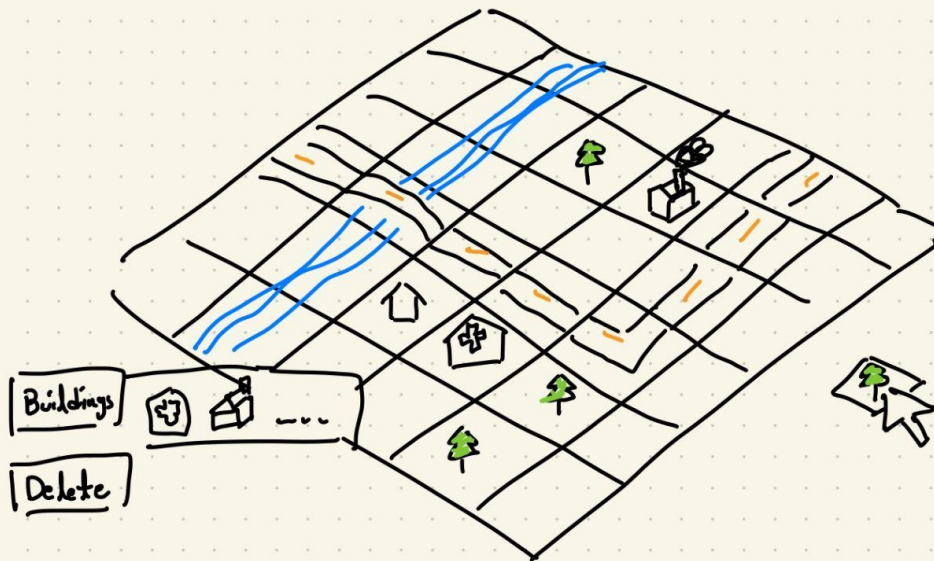
Image Documentation:
- Monopoly house: https://www.monopolylifesized.com/
- Monopoly hotel: https://www.renderhub.com/dcbittorf/monopoly-houses-and-hotels
- City Background: https://clipart-library.com/clipart/260115.htm
- PowerPlant:
  https://pngtree.com/element/down?id=MzU2NTQ5Nw==&type=1&time=1701398886&token=YjhjYjAwNDkxYWNhZWY1ZTc3M2MzY2I2YmQ3ZTlmZDI=&t=0
- Hospital:
  https://www.rawpixel.com/image/6482917/vector-sticker-public-domain-illustrations
- Police Station:
  https://www.cleanpng.com/png-police-station-clip-art-cartoon-image-sample-csss-6942213/download-png.html
- Road:
  https://www.vecteezy.com/vector-art/1975472-isometric-road-on-white-background
- Factory: <a
  href="https://www.freepik.com/free-vector/isometric-industrial-building-white-background_24467222.htm#query=manufacturing%20clipart&position=21&from_view=keyword&track=ais&uuid=7e4382f2-d45c-466b-a0b3-5020dd537b06">Image by brgfx on Freepik
- Tree: <a
  href="https://www.freepik.com/free-vector/tree-with-green-leaves-transparent-background_18555253.htm#query=tree%20clipart&position=22&from_view=keyword&track=ais&uuid=4115cabf-4561-4a79-ad3a-5fb1e2b40597">Image by brgfx on Freepik
- Button Symbols:
  - Lightning: https://clipart-library.com/clipart/lightning-bolt-clipart-9.htm
  - Siren: https://clipart-library.com/clipart/siren-cliparts-7.htm
  - Money: https://clipart-library.com/clipart/rTnGgekxc.htm

Timesheet Tracking:
- Monday: 2 hours
- Tuesday: 2 hours
- Friday: 3 hours
- Sunday: 4 hours
- Monday: 3 hours