design-climate-action-proposal

team members:

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innovations:

1. Plants need accommodation 2. Social ducts.

our major:

We are master's students of renewable energy engineering.

name of our proposed idea:

SustainCity: The lively nexus of green living and social engagement

a brief explanation:

greenhouse buildings:

the metropolises are far away from nature and the supply chains, so designing a system that can provide the city's needs for agricultural products locally, would make the cities and metropolises more reliable and sustainable, as the land use is always a challenge so vertical greenhouses are the solution, as the citizens live in the apartments, use water, energy, pay the taxes and rent of the residential buildings, it can be considered that the plants are the citizens of the city, living in the tall buildings, need water, energy, and space but the difference is that they can have profit for the city and one important point is that it can avoid water wastes in this agricultural floors. there are many important features of these buildings:

a. the use of solar energy called BIPVs (building integrated photovoltaic systems) for the energy needs of plants and also the light needs because of the transparency of BIPVs

b. use the controlled water usage with a water circulation system with required treatment.

c. to cut the need for product transportation.

d. eliminate the use of cold storage systems which cause 5% of global warming.

e. vertical greenhouse (hydroponics as an alternative).

f. the green look in the city.

g. sell the products locally.

figure1. BIPV and transparent PV cells

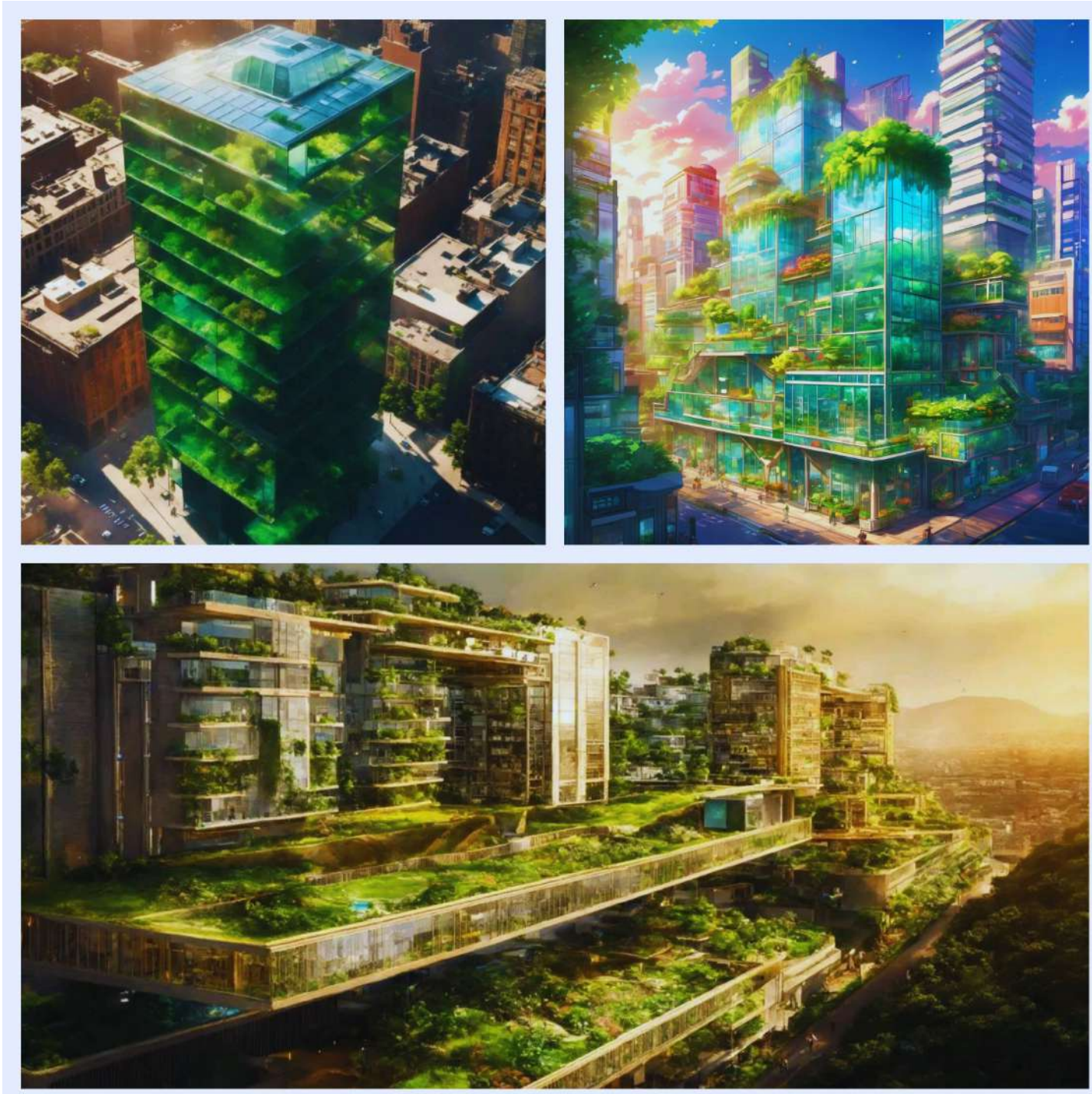

figure2. greenhouse buildings with transparent PV cells

ref: pixlr image generator

ducted sharing space:

in very hot or cold climates around the world, people don't have quality interactions outside, which causes a lot of mental problems, the designed pedestrian-level structure below, is a good place for people to meet up, cycle, or walk. this is a showcase to see how it works and can be modified for different applications. the use of BIPVs here again, would help to supply the energy needs of electrical systems inside. the hot climate can take advantage of the flow acceleration, better wind comfort, and the sunlight besides energy. though, for very hot days, the first door of the duct can be closed and the air conditioners can be used at the beginning of the duct and it automatically would lead the flow forward because of the opening at the end. On very cold days again there is a warm place to hang out another innovation is the use of piezoelectric footstep energy generation. based on human footstep frequency and equivalent energy generation,155 Hz frequency and with a resistive load of 11 kΩ can generate the output power of 25mW for a single plate based on [1]. it almost takes 20 minutes to fully charge a smartphone with these tiles.

the features of these structures are:

a. people’s interaction.

b. avoidance of depression.

c. the use of BIPV for the heating and cooling system inside.

d. based on continuity law (A1V1=A2V2); the ducted form accelerates the flow and cools the transparent colorful PV cells, improving their efficiency.

e. low entrance fee.

f. greenery inside.

g. fighting with extreme climate situations like heat waves and cold flows which we might face more and more in the future.

h. pedestrian wind comfort.

i. The city looks good with colorful structures.

j. Use the footsteps energy generation to charge small devices such as smartphones.

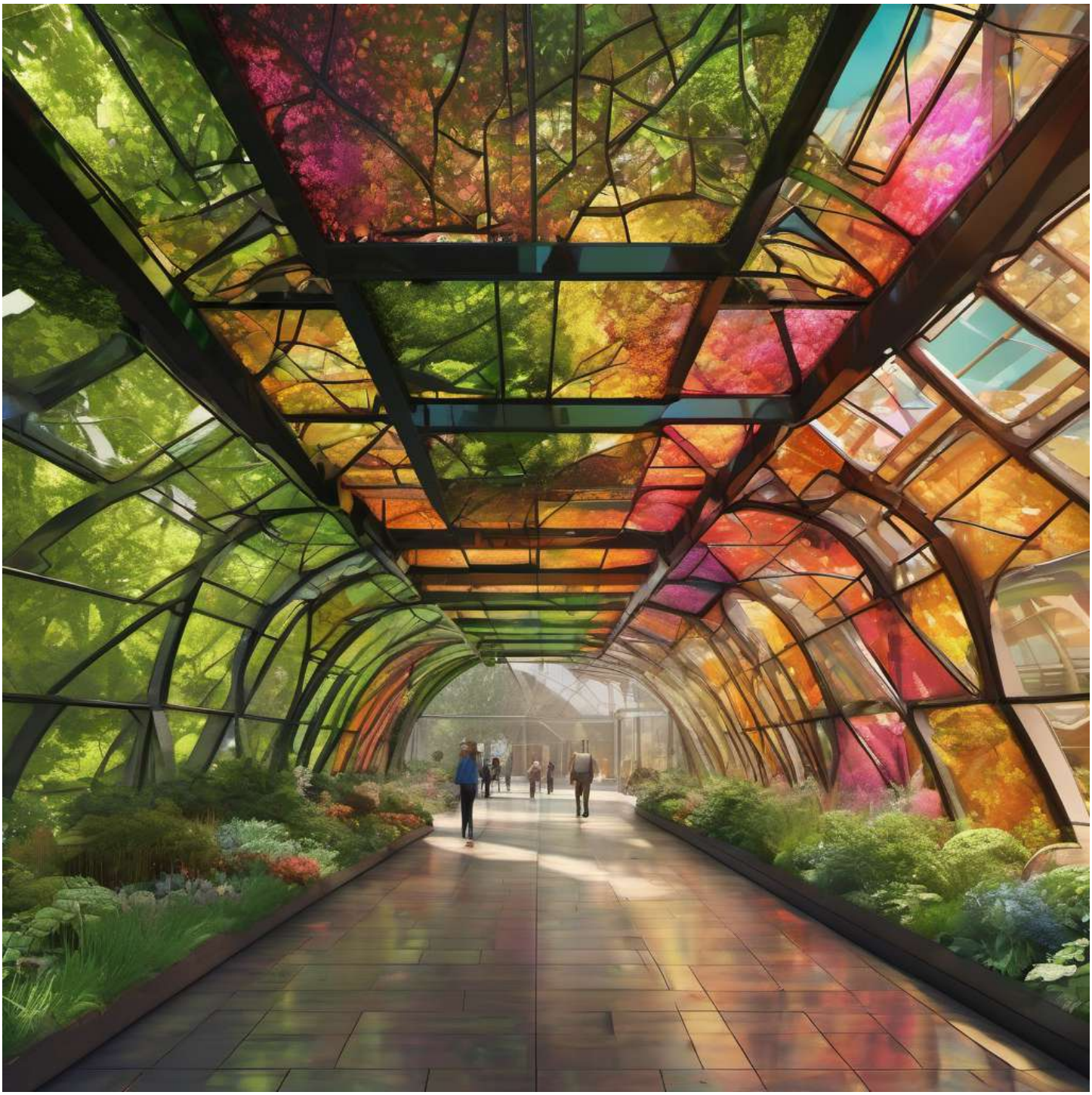

figure3. using AI image generation to create the inside of the duct view

ref: pixlr image generator

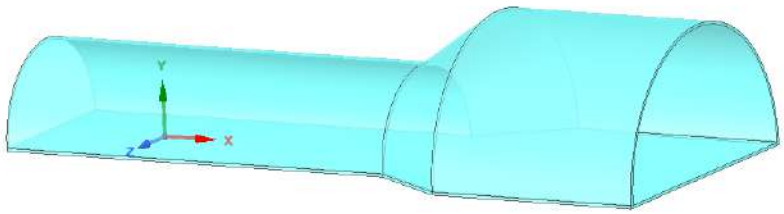

figure4. the ducted geometry in simulation(with ansys fluent)

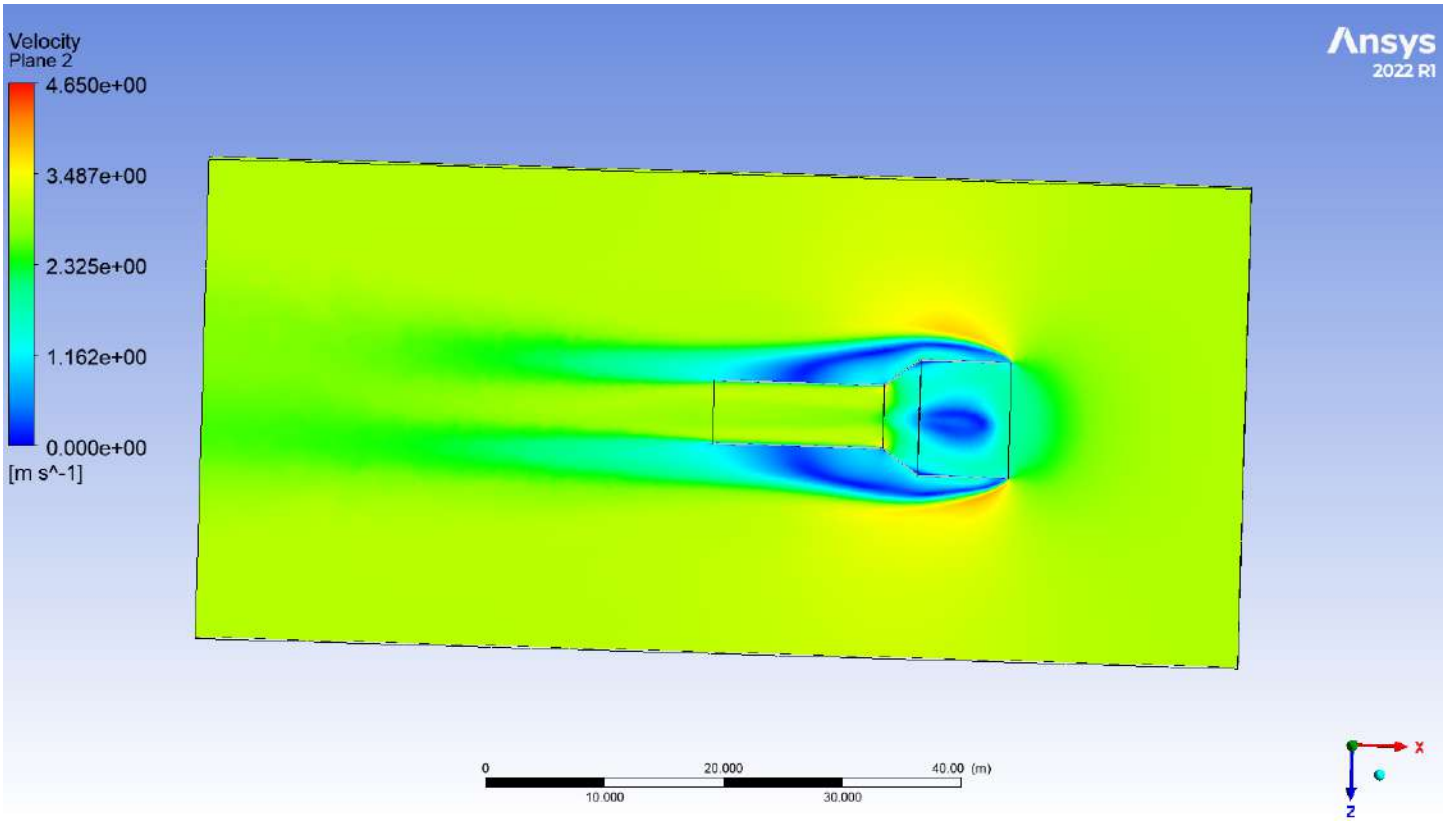

figure5. the simulation results show an increase in velocity in the second duct and a decrease in velocity in the entrance duct(with ansys fluent)

reference:

[1] Wang, Wei & Yang, T Q & Chen, Xurui & Yao, Xi. (2012). Vibration Energy Harvesting Using a Piezoelectric Circular Diaphragm Array. IEEE transactions on ultrasonics, ferroelectrics, and

frequency control. 59. 2022-6. 10.1109/TUFFC.2012.2422.