
Climate Change Computer Model

High Level Design (HLD) Document

1. Introduction

This document describes the High Level Design (HLD) for a computer model of the effects of carbon dioxide on different environments. It lists the personnel involved in the project, the requirements of the end product, a timeline for completion of the project, and a detailed description of the desired behavior and components of the end product.

This model shows two examples of the effects of an increase of carbon dioxide in the atmosphere.

The first example is in a Glacier setting, where ships pass by. When a ship is next to the glacier, the carbon dioxide levels increase in the atmosphere. Once the carbon dioxide levels reach a certain point, the glacier starts to melt.

The second example is in a City setting, where cars drive. When a car is driving, the carbon dioxide levels slowly increase in the atmosphere. If the car is next to the house, the carbon dioxide does not increase for a certain number of timesteps. Once the carbon dioxide levels reach a certain point, the skies start to be filled with smog.

2. Personnel

The following table lists the personnel who will be involved with this project. Approval must be acquired, as needed, before proceeding to develop the product described in this HLD.

Name	Role	Needed Approval? (Y/N)	Approval
Ameya Rao	Designer, Developer	N	
Caroline Cunningham	Proofreader (Apprentice)	Y	Y
Ishaan Rao	Proofreader (Intern)	Y	Y

Aaron/Ernie	Proofreader/Manager	Y	
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3. Requirements

The following is a description of the requirements for this project.

System model

A system model of climate change written in Vensim, Excel, or Javascript. The developer must have a personal copy that is accessible from the developer's web portfolios on the client's website (<http://shodor.org>). Must conform to the desired behavior/components as described in section 5 of this document.

Agent Model

An agent model of climate change using either Agent Cubes Online or Javascript. The developer must have a personal copy that is accessible from the developer's web portfolios on the client's website (<http://shodor.org>). Must conform to the desired behavior/components as described in section 5 of this document.

Website

The Website must contain the following:

1. A description of the climate change model
2. A link to this HLD
3. Links to both the System and Agents Models
4. System Model:
 - a. Detailed description of how to use your model
 - b. What software you need to run your model
 - c. If Vensim or Excel: screenshots of the model. If Javascript: it should run in the browser
 - d. Your observations about the behavior of the model.
5. Agent Model:
 - a. Detailed description of how to use your model
 - b. Link to Design/Edit page of AgentCubes
 - c. Screenshots of your model
 - d. What software is needed to run the model
 - e. Your observations about the behavior of the model.

Presentation

A presentation of the end product must be given to the clients on the agreed-upon date.

4. Timeline

Complete this HLD

Designer must make an HLD for the Modeling Project.

Fill out section 5 (Desired Behavior/Components) and get approval

In section 5, the designer must describe the agents in their model and the behaviors of those agents, as well as any additional user interaction components.

The manager and client must give approval for the document.

Publish model on website

The developer must have a copy of the code in his/her public_html folder on the client's file server.

There must be a link to the code's index.html file on the developer's web portfolio on the client's website (<http://shodor.org>) along with a description of the project. **This is due before the presentation starts and must be approved by the manager.**

Give presentation

The developers must give a demonstration of the end product to the client at an agreed-upon time.

5. Desired Behavior/Components

Agents

- Worlds; Glacier, City
- Cars
- Ships
- Glaciers
- Skies
- Smog
- House
- Counter for CO₂ levels in each environment

Behaviors

Agent Model

1. Ships move randomly in Glacier world.

2. Cars move randomly in the City world.
3. If a ship is next to the glacier, the carbon dioxide counter increases.
4. Once the carbon dioxide reaches a certain level, the area of the glacier begins to decrease.
5. As the cars move throughout the city, the carbon dioxide increases each timestep.
6. If a car is next to the house agent, the counter does not increase for that timestep.
7. Once the carbon dioxide reaches a certain level, the sky begins to be filled with smog.

System Model

- Variable for cars and ships
- Box variable for glaciers, smog, and carbon dioxide
- Arrow between cars and co2, % chance of increasing
- Arrow between ships and co2, % chance of increasing
- Arrow between co2 and glacier, rate of decreasing
- Arrow between co2 and smog, rate of increasing

User interaction

A visualization of the model will be shown, indicating the positions of each of the agents in the world at each time step.

A graph will show the count of each agent (as a percent of the world's capacity for agents) at each time step.

Buttons will allow the user to start, stop, step, and reset the model.

A model description will be provided on the web page, below the user controls.

6. Conclusion

This project will provide a computer model of Climate change that will allow the clients to see the effects of carbon dioxide on different environments.

Furthermore, the project will allow the developer to further refine their programming, planning, and presentation skills.