
High Level Design (HLD) Document

1. Introduction

This document describes the High Level Design (HLD) for an AgentCubes and Vensim model of the illegal elephant poaching issue in Africa due to the demand for ivory for the creation of ornaments and jewelry. It lists the personnel involved in the project, the requirements of the end product, and a detailed description of the desired behavior and components of the end product.

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
Leanne	Designer, Developer	Y	Y
Ameya	Apprentice	Y	Y
Anagha	Intern	Y	Y
Ernie	Staff	Y	Y

3. Requirements

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

System Model

A Vensim model of the elephant hunting within Africa and the illegal ivory trade globally.

- Description of how to use model

Agent Model

An AgentCubes model of elephant hunting within a certain area of Africa.

- Description of how to use model
- Basic Story

Website

A website for the two models to add to my portfolio.

- Basic HTML and CSS
- Description of models
- HLD
- Links to models

4. Desired Behavior/Components

System Model

- **Variables**

- Elephant population
- Average birth rate
- land/resource availability
- Average lifetime
- Ivory demand
- Hunting kills
- protection/ranger

- **Behavior**

- Box variable for elephant population
 - Rate going into it of elephant births
 - Arrow going into from population box variable
 - Arrow going into from average birth rate variable
 - Arrow going into from land/resource availability variable
 - Rate going out of elephant deaths
 - Arrow going into from population box variable
 - Arrow going into from average lifetime variable
 - Arrow going into from land/resource availability variable
 - Arrow going into from hunting kills variable
 - Arrow going into from ivory demand variable
 - Arrow going into of protection/ranger variable

- **User interaction**

- A graph will show the elephant population.
- Buttons will allow the user to start and stop the model.
- A slider bar will allow the user to control all of the different variables.

Agent Model

- **Agents**

- Elephants
 - Adult elephants
 - Pregnant elephants
 - Baby elephants
- Humans
 - Poachers
 - Poacher w/ elephant
 - Rangers
- Ground
 - Land
 - Water
- Jail
- Counter

- **Behaviors (Story)**

- 1 time step represents approximately 1 month
- Adult elephants move randomly on the land
- If two adult elephants are next to each other, there is an $x\%$ chance that they will create a baby elephant after x amount of time
- Baby elephants will follow their mothers
- After x amount of time, a baby elephant will turn into an adult elephant.
- Poaches move randomly on the land
- If a poacher is next to an elephant, there is an $x\%$ chance that the poacher will kill the elephant
- If a poacher kills an elephant, the poacher turns into a poacher w/ elephant
- A poacher w/ elephant moves slowly to the scent of water
- If a poacher w/ elephant makes it to the water, the poacher disappears (sails away)
- After x amount of time steps after the poacher w/ elephant disappears, a new poacher will appear
- There is a set number of rangers
- Rangers move randomly in the world

- If a ranger is next to a poacher w/ elephant, the ranger will catch the poacher, making the poacher w/ elephant disappear for x amount of time steps (sent to jail)
- After an adult elephant reaches x age, the elephant will have an x% chance of dying naturally
- The counter will count the number of adult elephants, the number of baby elephants, the number of poachers, the number of rangers, the number of elephants killed, the age of elephants
- **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 at each time step.
 - Buttons will allow the user to start, stop, step, and reset the model.
 - A slider bar will allow the user to control the number of simulation steps per second.

5. Conclusion

This project will provide both an agent and system model of elephant poaching and the illegal ivory trade that will allow the clients to study these issues without necessarily needing to go to the location of the poaching and view it firsthand.

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