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College of Computing

Computer Science Department

CS3141 Team Software Project

Spring 2022

**Realistic Cave Generation Simulation**

Section: R02

Team #: 10

| Roll # | Name | Role |
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# **Abstract**

In this project we will be developing a cave simulation for users that are interested in learning more about the makeup of caves, based on real caves in the Upper Peninsula of Michigan. The aim of this project is to give an accurate representation of the makeup and structures of caves so users can be educated through a simulation. This eliminates the need for travelling, and expensive cave exploring gear, as well as giving an accommodating experience to users who can not or should not explore wild caves. Interested cave enthusiasts would be able to generate a cave and view 2D cross-sections of the generated cave. There will be information about the cave’s makeup as well as highlighting of the cross section to determine where certain features or minerals are located within the cave. The user would be able to cycle through the 2D cross sections of the cave at will, and if they find an interesting pattern or fact, they would have the ability to save the cave to their device to share with others. We are using an incremental process model and the development of the software will be within Unity or another suitable 2d engine.

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Chapter1

Specification

# **1.1 Introduction**

We plan on making a program that allows the user to create a procedurally generated cave system by inputting a desired length, depth, location, and other possible features and seeing the result. When the cave system is finished generating, the user will be able to view it in two cross-sections, one vertically and another horizontally. We thought of this idea after figuring that a simulation based on caves/mining would be especially fitting for where we live in the Upper Peninsula, where mining is prevalent throughout the area’s history.

# **1.2 Problem Statement**

Many people have an interest in geological features such as caves. However many of these features are in remote areas and are hard to access. Due to this, people have limited access to education on these topics and are not able to accurately visualise these features.

# **1.3 Aim and Objectives**

We plan to create a program that will simulate cave generation based on given parameters. This simulation will act as a means for education. The program will be created with a 2D view that will show the user different layers of the generated cave. This user will then be able to explore a cave that replicates what would be found in the upper peninsula. Allowing the user to explore this accurate representation of a cave will provide both a form of entertainment, and education when learning about the upper peninsula.

Objectives:

* Allow the user to create a map that simulates the real world
* Allow the user to generate a cave that models a real world cave
* Show the user the composition of the current cave they are viewing
* Allow the user the view the cave they have generated
* Allow the user to save the cave they have generated for viewing later or sharing

# **1.4 Stakeholders**

The stakeholders are any potential user who is interested in how caves form. This could be MTU students who either major in geology or have an interest in geology. This is meant as an learning tool.

# **1.5** Methodology

We will be using the incremental approach as our software process.

1. Outline Description- Created in this document and will be reviewed at the beginning of the first Sprint.
2. Specification- Defining and dividing tasks among team members for sprint entirety.
3. Development- completing the tasks as assigned.
4. Validation - Testing, implementing, and team feedback at weekly intervals.
5. We will repeat numbers 2 through 4 at the beginning of each sprint.

# **1.6 Tools**

1. Our software should be able to be run on an average laptop.
2. We plan on writing the program in a language that is best suited for user interfaces and has the performance to run small scale simulations.
3. We’ll be using Jira to organise our requirements and goals and Discord for our communications (text, video, and audio)
4. We will host the code on Github.

# **1.7 High-Level Business Requirements**

## **Functional Requirements**

* User interface to allow a user to create a map, which will be the starting point
* Using that map and user-specified starting conditions, a cave will be generated
* Show the user the geological breakdown of the cave they are viewing
* Allow the user to view the map after the cave has been generated
* Allow the user to view a 2d cross section of the cave
* Allow the user to adjust the view through different depths of the cave
* Allow the user to save a file of the cave, both before and after the simulation

## **Non-functional requirements**

* The simulation should not take more than a minute or two to complete
* The user interface should be responsive and easy to use
* The UI should be user friendly and self explanatory
* The map file should not be too large
* There should not be too much ram usage

# **1.8 Product backlog**

| **Priority** | **User Story** | **Tasks** | **Estimated effort** | **Sprint** |
| --- | --- | --- | --- | --- |
| 5 | **As a geologist I want to visualise the surroundings of a cave in a specific area. So that I can prepare for surveying a real cave with similar conditions.**  User interface to allow a user to create a map, which will be the starting point | **Create a map interface** | **7-14 Days** | **1** |
| **Decide on visual style** | **2 Days** |
| **Develop map renderer** | **7-14 Days** |
| 5 | **As a parent I want to educate my children on geology in a visuale setting so that they stay engaged with the educational material.**  As a user, I want to be able to view a cave that will be generated realistically. | **Using math, generate the path of the cave** | **7 Days** | **1** |
| **Calculate the geometry of the cave** | **3-5 Days** |
|  |  |
| 3 | **As a geology student I want to interact with geological software so that I can supplement my existing studying.**  Show the user the geological breakdown of the cave they are viewing | **Implement interactive feature that shows mineral breakdown** | **5 days** | **4** |
|  |  |
|  |  |
| 3 | **As a user with an old laptop, a 3d render might be too difficult for my computer to handle.**  Allow the user to view a 2d cross section of the cave, and to adjust the view through different depths of the cave | **Render single layer of map** | **5 Days** | **2** |
| **Add scroll bar to move between layers** | **5 Days** |
|
| 1 | **As a geology student I would like to save my results if I want to share it with colleagues.**  Allow the user to save a file of the cave, both before and after the simulation | **Develop map data structure** | **5 Days** | **4** |
| **Save Map file** | **3 Days** |
| **Load Map file** | **4 Days** |

Chapter 2

Analysis and Design

Chapter 3

Implementation

The following [report](http://people.uncw.edu/simmondsd/documents/450_Implementation%20and%20Testing%20Report.pdf) is a good example that you can follow for implementation please refer to pages 25 - 30, and here is another [example](http://api.uofk.edu:8080/api/core/bitstreams/13308397-e07c-47ef-83e5-3bbb2e9f0a81/content) for your reference.

Chapter 4

## Validation

**For Chapter 4 (Validation)**: here you need to write about the process of checking that your software system meets specifications and requirements so that it fulfils its intended purpose, and to confirm or to prove the accuracy of your project.

Write about your testing and validation; **level of testing** you had, unit testing, integration testing, validation testing and acceptance testing.   Did you have **manual or automated** testing or both? specify the part(s) that have automated testing and part(s) that have manual testing, and **What is your oracle?**

**Write the** **test cases** for valid and invalid **input** (please see Week3 Automated Testing/ slide 11),

then confirm that no errors in the code and the application is able to operate in required condition (OS, web browsers) and you have created the code correctly.

For validation and acceptance testing write who tested your system? MTU students? computer science student? other department students? your group only? other college students? public users? How many students/users? How many times? could they use it easily or did they make mistakes?

Chapter 5

## Limitations and Future Work

**For Chapter 5**

Limitations: address everything that the project left,  if some project backlog items/ features/ requirements have not been implemented then mention them in this part with an explanation/justification why you couldn't implement them (Time constraints the time was not enough, some developers were unavailable, because of COVID19, or  tool limitation ....etc.). Many students tend to feel that presenting the limits of their work makes work weaker. on the contrary, approaching this section shows maturity for the academic universe, and writing about them actually strengthens your work by identifying any problems before reviewers/readers find them.

Future work : if the limitations can be addressed in the future then add this in here in future work, moreover, if you believe this project can be extendable (add more features/ more parts) that the project is worth extending to a Final Year Project (FYP) by you or other students or can be adopted and extended by industry as a product so you can give directions for that in future work.

Chapter 6

Conclusion

**For  Chapter 6 (Conclusion),**: write what you have concluded.

Examples:

I solved many problems in the project…

This application/project/system was applied to improve the learning process.

The results of this project showed that system significantly facilitated the students' learning process.

The system is useless, acceptable, usable, beneficial or maybe enjoyable and why do you believe that.

References

(Include any references to external documents or materials (for example, tutorials the team will be using, literature , web references or links to documentation of third-party tools you will use) here.

The references should be properly numbered and correctly used in the text.

The Reference section should be in the following fashion:

# References

Journal, Magazine/ Newspaper Article

| [1] | Author, "Title," *Journal name,* p. pages, year.  Book |
| --- | --- |
| [2] | Author, Book Title, publisher, year.  Internet Web page: |
| [3] | Author, "Name of the Web Page," [Online]. Available: URL. [Accessed Date]. |