2022 Design and Prototype Finalists

Asteroid VR/AR Simulator

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Teacher: Louis Reyes
School: Space Coast Jr./Sr, Florida

Students: Jayden Campbell, Joshua Barnes, Jacob Lewis
Teacher: Melissa Goodall
School: Miami Valley Career Technology Center, Ohio

Students: Matthew Floyd, Joseph Leavy, Alisa Vinogradova, Srichandra Kodavali
Teacher: Fred Bauer
School: Council Rock South, Pennsylvania


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Asteroid VR Simulator

Space Coast Jr./Sr. High School
Ava Robinson
Mr. Reyes

Problem I am trying to solve: Asteroids in space can prove to be very big obstacles due to the difficulty of handling them and lack of knowledge. It leads to astronauts having to work around them instead of being able to take care of the asteroids so they can continue on their mission without too many threatening obstacles. In order to understand asteroids better and give the astronauts a chance at removing them safely, building a VR program will help simulate the asteroids accurately so that astronauts can settle on them, move them, or break them apart without huge dust clouds and particles obstructing their work.

Solutions I have brainstormed:

In order to appropriately simulate asteroids, there is a feature in the simulation that enables the asteroid to break apart differently depending on where it is struck at. Which side, which angle, etc. This allows for the best possible realism when it comes to different approaches to breaking the asteroid.

Due to the vast range of asteroid sizes, weights, materials, and overall differences from asteroid to asteroid, creating a range of a few asteroid to simulate a large majority of each type would be the most effective approach. Ex: An example asteroid with an iron base will be the average size of a real asteroid with an iron base, that way I can cover the most ground without spending too much time making several ranging sizes of the same asteroid. If needed, however, I can do that by using the average as a base for building onto.

Problems I have encountered:

Largely due to the size and complexity of this project, a lot of research is needed both to accurately simulate the asteroids and to use the programs features to the highest advantage, a lot of my time is dedicated to research. This has caused my actual simulator to come along rather slowly, as I'm getting a grasp for how I'm going to be able to make this project the best that I can. I'm afraid the project may need to be extended to another year, as I don't have the resources necessary to work on the project outside of class, and instead are limited to only doing research. On the other hand, a lot of sites are blocked by the school so I have to do my research and actual programming separately, which can be a hassle.

Simulating the large size of asteroids has also become an issue, as school computers only have so much capability and can lag very harshly when met with high criteria and a lot of particles when the asteroid is broken apart.

Team Leader and Programmer:
Jayden Campbell

Particle Effects and Collision Physics:
Joshua Barnes

Research and Version Control Manager:
Jacob Lewis

Instructor:
Melissa Goodall
at Mgoodall@Mvctc.com

School:
Miami Valley Career Technology Center

MIAMI VALLEY CAREER TECHNOLOGY CENTER

Asteroid Dust Dispersion Simulation

NASA HUNCH
High school students United with NASA to Create Hardware

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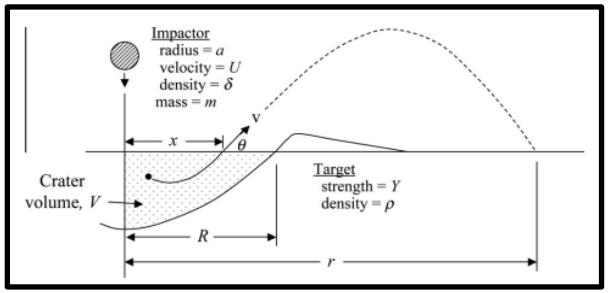
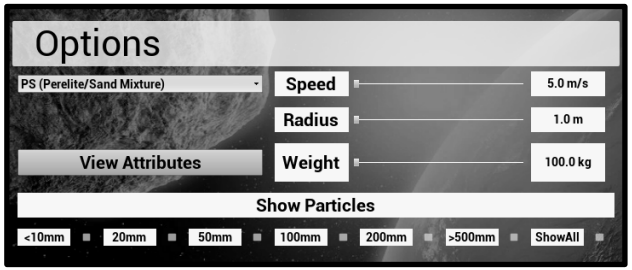
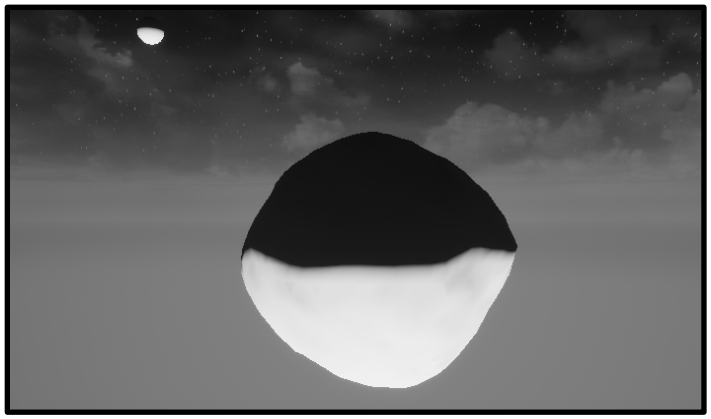


Sediment dispersion and crater diagram found with the help of Dr. Julie Brisset.

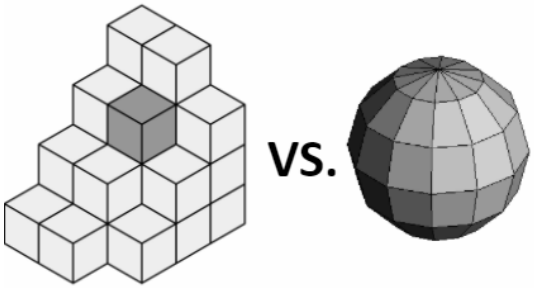


Our options page for choosing different values related to speed, size, and mass of an impactor, as well as a few other quality of life options.



More alternative choices:

- Complex vs simple collision for asteroid
- Voxels vs Polygons for destruction?
- Camera perspective and zoom?

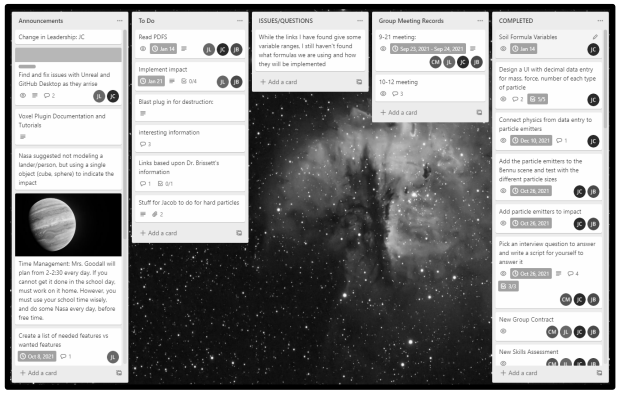


Platform	Pros	Cons
Unity:	- More free community resources - More support and documentation - Beginner Friendly	- Unfamiliar coding language(C#) - Would need to build or find physics system ourselves
Unreal:	- Built-in physics system - Uses C++ and blueprints(familiar and easy to use) - Open-source	- Less free community resources - Less support and documentation
Blender:	- Built-in physics and destruction systems - Uses Python(familiar) - Open-source	- Very different from anything else - Would be more difficult to implement both user input and output - Not really meant for what we are doing, would take more effort to make use of

Our simple prototype for testing collision, with a 3d model of Bennu and the impactor.

Description Of Risk	Probability of Occurance	Relevance of Occurance	Currently Active Mitigation Plans	Possible Mitigation Plans
School Closure	1	8	Discord, Trello	Github, Scheduled Meetings (Physical or Virtual)
Instructor is Housebound	1	7	Trello, Classroom	Zoom
Loss of Project	2	9	USB Backups, Google Drive	Github
Loss of Code	2	7	USB Backups, Google Drive	Github
Loss of Assets	2	2	USB Backups, Google Drive	Github, Downloads Cache
Sickness prevents project Work	3	7.5		
Formulas Aquired are Irrelevant	4	4	Careful research, validate with Physics instructor	Documentation Review, Testing formulas immediately
Unreal Physics are Inacurate	5	6		Hand-Code Physics, Aquiring External Physics Packages
Schoolwork prevents Project Work	6	5	Warning in Advance, Make-Up Work	
Early Dismissals prevent Project Work	8	3	Warning in Advance, Make-Up Work	
Distractions prevent Project Work	9	2	Redirection By Instructor, Make-Up Work	

Trello allows us to keep track of tasks, see what has already been completed, and leave notes and memos for other team

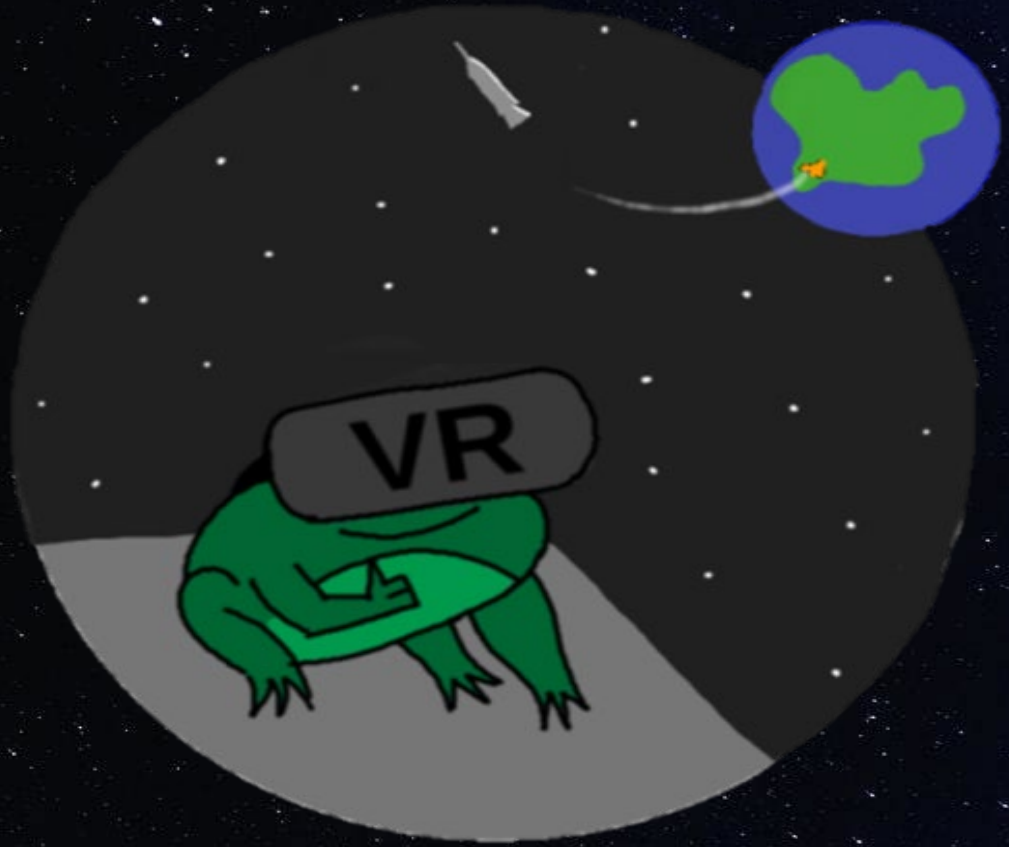


members.

This risk assessment diagram allowed us to discuss possible risks to the project and find ways to mitigate them based on relevance and severity.

P.H.R.O.G.S

Personal
Headset for
Rock
Observation
and
Globule
Simulation



The AR/VR Simulation Project

School(s): Council Rock South + Council Rock North
Teacher: Mr. Bauer

What do we have so far?:

So far the simulation has been implemented in VR through the use of unreal engine and has the basic Bennu model, basic movement, orientation control, and will be improved to perfection in the near future. The first finished prototype will create a real feeling basic experience of which to build the final most realistic implementation of the simulation.

The Team working on AR/VR

- At the top is Matthew Floyd our project leader
- To the left is the well known Sabrina filling in for Joseph Leavy
- To the right is Alisa Vinogradova
- And last but not least Srichandra Kodavali, who we call Chandu for short.