

Balloon Simulator

USER MANUAL

Acknowledgements

This project was designed with love and care by the following members of Team NoName

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Introduction

Thank you for downloading and using Balloon Simulator as part of your classroom's curriculum. We hope that you will find our software easy to use and reliable. This software was designed as part of a classroom project in CS4500 in the Fall of 2019, and released for public use by its developers.

What is Balloon Simulator?

Balloon Simulator is an open source project with the objective of providing a product to schools that is easily accessible and supports the advancement of S.T.E.M education in primary and secondary education. The goal of Balloon Simulator is to give students an insight into the physical properties of matter and physics by simulating a balloon filled with helium, whose properties can be tweaked and recorded to look for relationships between various properties of geometric shapes and physical forces.

How do I get started?

Getting started with balloon simulator is easy. Simply download one of our precompiled packages, extract it, and run it.

Balloon simulator comes preconfigured for various grade levels. These are as follow:

K – 2

- Color wheel that adjusts balloon color
- Radius slider that adjusts the balloon's radius when adjusted

3 – 5

- Everything from K – 2 EXCEPT color wheel PLUS
- Data boxes which display the metrics about the balloon

6 – 8

- Everything from 3 – 5 PLUS
- Graphing functions that allow plotting points on a graph
- Wind Slider which allows an additional force to be applied to the balloon

What if I want to customize what is available/visible?

Go to the location where you downloaded this package, go to the folder named BalloonSim_Data, then go to the folder named Config. Inside, there is a file named config.json. Inside, you can adjust which elements will be accessible to the users. Simply adjust the values inside to your desired values. Refer to configuration information for details about each value.

Full path:

%path_to_downloaded_package_folder/BalloonSim_Data/config/config.json

Operation Manual

In this section, there will be detailed information about each user-accessible component of this package.

Section 1: User Interface elements

Section 1.1: Color Wheel

The color wheel allows the user to drag their mouse across the color palate and immediately apply the color under their cursor to the balloon. This feature is generally aimed at younger students in the K-2 category.

Section 1.2: Radius / Wind Slider Switch Box

The Radius and Wind Slider Switch Box appears at the top right corner of the display. If only the wind slider is available or only the radius slider is available, this box will not appear. This switch box will allow the user to switch between seeing the radius slider and the wind slider respectively. The wind speed is in m/s.

Section 1.3: Radius Slider and Buttons

Section 1.3.1 Radius Slider

The radius slider is designed to change the radius of by moving the slider, move it up to increase the radius and down to decrease the radius. The slider displays the maximum radius value in meters at the top of the slider and the minimum value at the bottom of the slider. The current value the radius slider is at is displayed at the bottom box where it dynamically changes based on the sliders position. Refer to Radius Configuration for more information about the default values provided.

Section 1.3.2 Inflate and Deflate Buttons

The radius panel provides the user inflate and deflate buttons that will change the value of the balloon radius based on the provided default values in the configuration file. Refer to Radius Button Configuration for more information about these values. The buttons are provided for specific incremental increase or decrease of the radius in the situation of data change relative to exact radius changes.

Section 1.4: Data Box

The Data Box displays properties of the balloon, such as its radius, surface area, volume, and upwards force it can exert with the current amount of helium that is present inside of it. This value does NOT include the side wind forces that are applied to the balloon.

- Radius is in METERS
- Surface Area is in METERS SQUARED
- Volume is in METERS CUBED
- Force is in NEWTON METERS (only includes vertical force, I.E. Force exerted by helium)

Section 1.5: Wind Slider

The wind slider is used to adjust the amount of wind force applied to the balloon horizontally (right to left). This force is added to the total force exerted upon the weight. Move the slider up to increase the wind speed and move it down to decrease the wind speed. The currently selected wind speed value will be reflected on the bottom part of the wind speed panel.

Section 1.6: Record/Graph/Export Module

The graph section will appear on the bottom left side of the display and has the following components:

1.6.1 Magnify Button

The magnify button opens the magnify UI element which allows a closer look at the graph, export of recorded data, and selection of graph axis values.

1.6.2 Graph

The main purpose of this module is to allow the user to graphically represent different values that they have recorded using the record button on the bottom left of the screen. Values that have been recorded can be viewed using the graph. In addition, the graph can be exported to an image.

1.6.3 Record Button

The record button takes a snapshot of the current values that are in the data box, the radius and other internal values. These values can be represented graphically on the graph module or be exported as a .csv.

Configuration Information

In this section, there will be information provided on each value of the configuration file. The configuration file can be located at:

%path_to_downloaded_package_folder/BalloonSim_Data/config/config.json

Section 2: User Interface Elements Configuration

Section 1.1: Color Area Configuration

“colorWheel” Possible Values:

true - Enables the color area

false - Disables the color area

Section 1.2: Radius Slider and Buttons Configuration

Section 1.2.1 Radius Slider Configuration

“radiusSlider” Possible Values:

true - Enables the radius slider

false - Disables the radius slider

“minRadius” Possible Values:

Whole number values 50 – 399

Constraint:

Must be less than maxRadius

“maxRadius” Possible Values:

Whole number values 51 – 400

Constraint:

Must be greater than minRadius

The configuration file contains values that reference the radius sliders properties named minRadius, maxRadius, and radiusSlider. Starting with the radiusSlider, the value can be true or false. A true value will provide the radius slider UI in the simulation and is set to true for every configuration. A false value will remove the radius slider from the UI and disable any change in radius of the balloon. The minRadius value is set to a minimum of 50 meters for a realistic visual when comparing the balloon to the rope. The minRadius value can be changed to anything greater than 50 and less than 400 with regard that the minRadius value is less than the maxRadius value. The maxRadius value has similar constraints, the maxRadius can be anywhere greater than 50 and less than 400 with regard that the maxRadius is greater than the minRadius. In the case that the minRadius value is greater than the maxRadius value or, the maxRadius value is less than the minRadius value, the default values will override the changes and set minRadius to 50 and maxRadius to 400.

Section 1.2.2 Inflate and Deflate Buttons Configuration

“inflateDeflateButton” Possible Values:

true - Enables the inflate / deflate buttons

false - Disables the inflate / deflate buttons

“inflateIncrement” Possible Values:

Whole number

Constraint:

≥ 1 AND $< \text{maxRadius}$

“deflateIncrement” Possible Values:

Whole number

Constraint:

≥ 1 AND $< \text{maxRadius}$

The configuration file contains the values inflateIncrement and deflateIncrement, which refer to the change in meters of the radius. Each time either button is pressed it will change the value of the radius to the set values of inflateIncrement or deflateIncrement. The default value provided is 10 which corresponds to 10 meters. These values can be customized however the user likes with a few constraints. The value of inflateIncrement and deflateIncrement must be greater equal to 1 and less than the maxRadius value.

Section 1.3: Data Box Configuration

“dataBox” Possible Values:

true - Enables the data box

false - Disables the data box

Section 1.4: Wind Slider Configuration

“windSlider” Possible Values:

true - Enables the wind slider

false - Disables the wind slider

“minWindSpeed” Possible Values:

Whole number values 0 – 4

Constraint:

Must be less than maxWindSpeed

“maxWindSpeed” Possible Values:

Whole number values 1 – 5

Constraint:

Must be greater than minWindSpeed

Section 1.5: Graph Configuration

“graph” Possible Values:

true - Enables the data collection/display area

false - Disables the data collection/display area

“recordButton” Possible Values:

true - Enables the data collection button

false - Disables the data collection button

Constraint:

graph must be true to be visible

“csvExportPath” Possible Values:

Export path string starting at the base of the program’s installation

“imageExportPath” Possible Values:

Export path string starting at the base of the program’s installation