Projectile Motion Project

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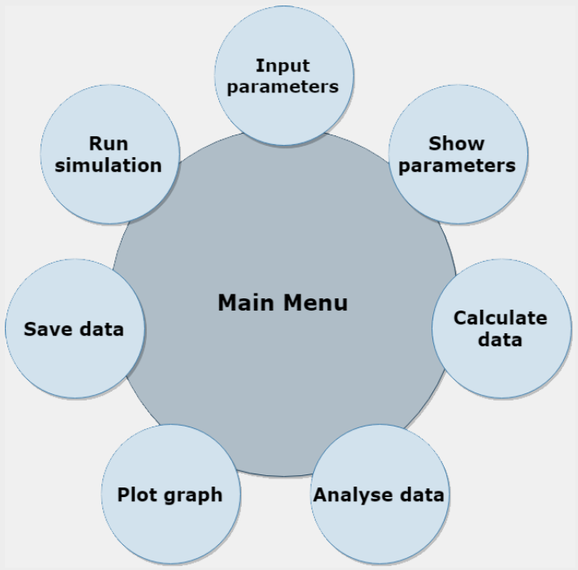
Functions and their features

This program focuses on projectile motion of cannons and is written using Python programming language. The program is designed around the main menu which allows the user to run functions by inputting commands. The 7 functions that are accessible from the main menu as include:



Change parameters

This allows the user to input parameters :

1. Mass of the projectile (Kilograms)
2. Height of initial projection (Meters)
3. The initial speed of projectile (Meter per second)
4. The surface area of projectile (Meters^2)
5. Step size (Seconds)
6. Initial angle (Degrees)

Although the user is given the ability to input any values, the program eliminates any unrealistic inputs, the program checks if the input value meets the three requirements: smaller than maximum value, larger than minimum value and value input is a float. If all three requirement are meet, the value input is recorded. However, if one of the requirements are not met, the pre-set default value will be recorded instead. The default parameters are chosen to be similar to real-life examples. (5.5kg cannonball has a frontal area of 0.0154m^2). [1]

Show current parameters

This function displays the parameters that will be used in calculations and allows the user to confirm the parameters and choose between changing the parameters or proceeding to calculate the function.

Calculate and show current data set

This function uses equations and the parameters to model how the object will act during time of flight. The equations used in this program include:

1. $F_g =$ Mass x Gravity on Earth
2. $F_d = \frac{\text{Drag coefficeint} \times \text{Air density} \times Frontal\ \text{area} \times (\text{Current velocity})2}{2}$
3. $a = \frac{\text{Force of gravity} - \text{Air resitance}}{Mass}$
4. $\frac{dv}{dt} = a$
5. $\frac{dx}{dt} = v$

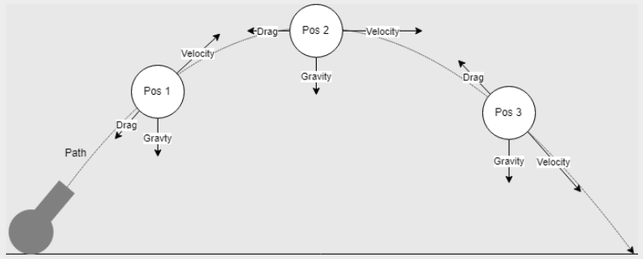


Figure 1

Analyse data

This function finds the highest point and the furthest distance achieved in the data set and display it to provide more depth information for the user. It also provides time and velocity during the highest and furthest point. Figure 1 shows the console output when the user choose to display analysis.

```
DUISC
Projectile Motion Simulator
Jia Xiu Sai-2427165
16:51 20/5/2019
Function: Analyse data
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Data analysis:

Furthest distance achieved at:
X-coordinate - 696.817 meters
Y-coordinate - -0.862 meters
Speed - 72.045 meter per seconds
Time - 13.22 seconds

Highest distance achieved at:
X-coordinate - 386.405 meters
Y-coordinate - 213.772 meters
Speed - 51.783 meter per seconds
Time - 6.41 seconds
```

Figure 2

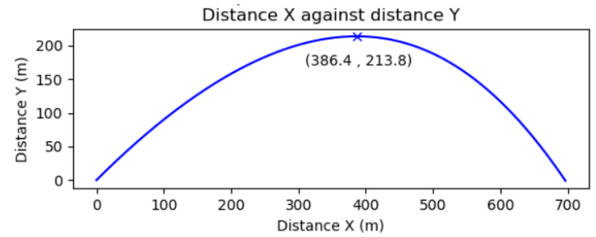
Save csv

This function allows the user to save data set calculated in a csv file format which allows the user to have a more in depth analysis.

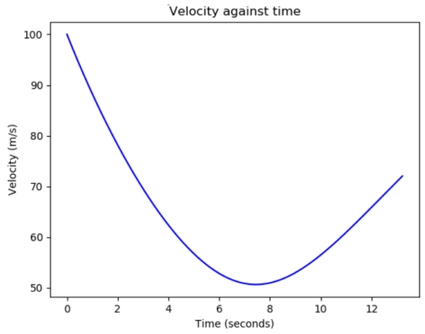
Plot graph

This function display graphs, the graphs available for the user to choose from are:

1.



2.



Run simulation

This function uses the data set calculated and runs a simulation in real time to help the user visualise how the projectile will react to different parameters.

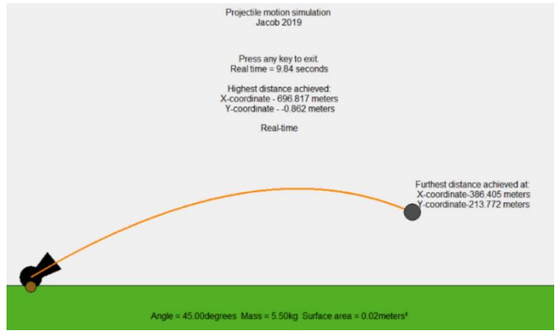


Figure 3

References

1.DR A. Collins, (n.d). “British Cannonball Size”. Available at: https://www.arc.id.au/Cannonballs.html [Accessed: 21 May 2019].