

AI-GENERATED PHYSICS SIMULATIONS

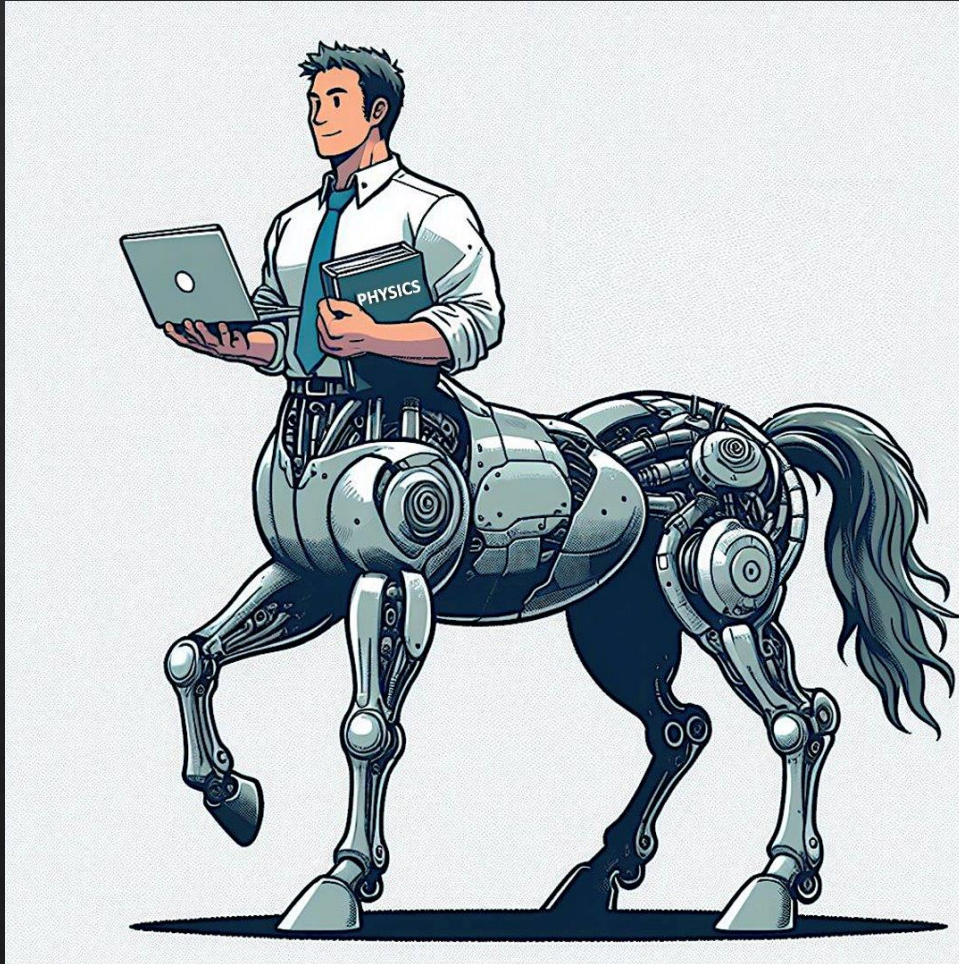
EAST ZONE PHYSICS CHAPTER EDTECH WORKSHOP

tan_seng_kwang@moe.edu.sg

PhysicsLens.com



BECOME A CENTAUR



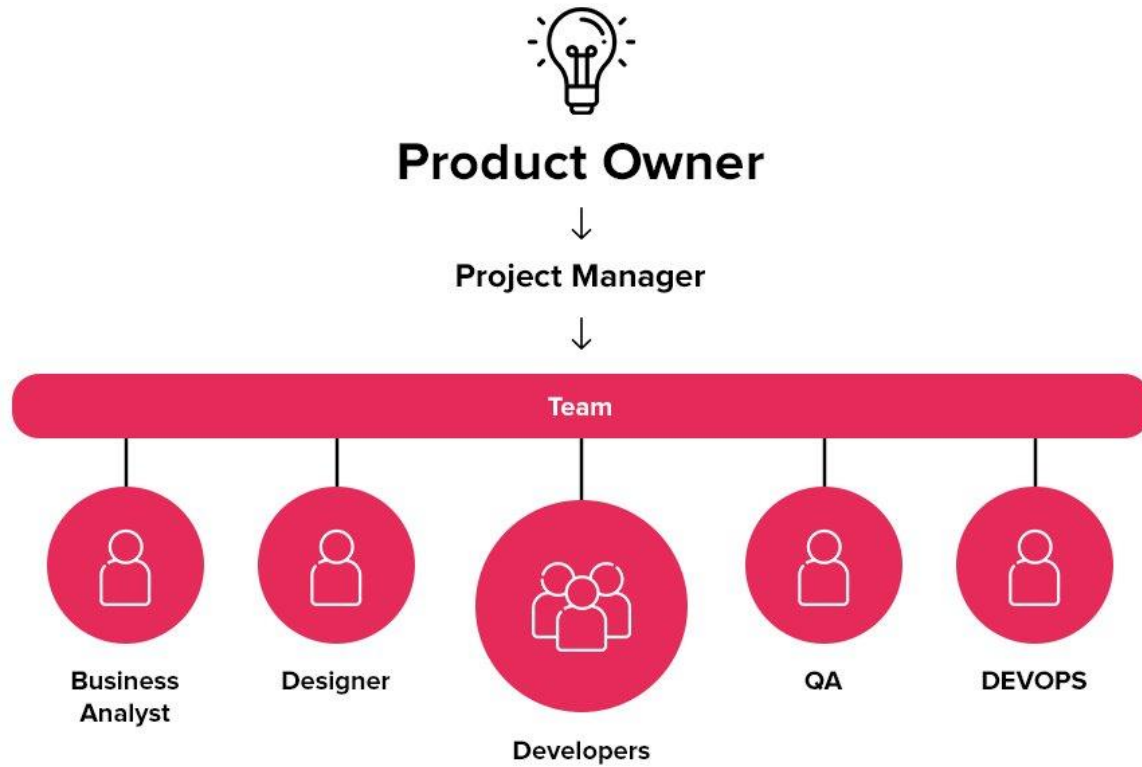
While experts will always be in demand, more intelligent machines are continually **lowering the bar** to creating with new technology.

Kasparov, 2017

Lower barrier of entry for app development; allow for **focus on higher levels of problem solving**

Bull and Kharrufa, 2023

Replacing the Programmer?



Nvidia's CEO, Jensen Huang:
AI will take over coding,
making learning optional

79 SOCIAL BUZZ

No more coding classes? Nvidia's CEO believes AI is enough (Source - Shutterstock)

AI-Generated Apps for Education

Repository:
for.edu.sg/apps



<https://for.edu.sg/apps>

Home General Tools Games Assessment Visualisation Sensors Blog

AI-Generated Apps for Student Learning Space

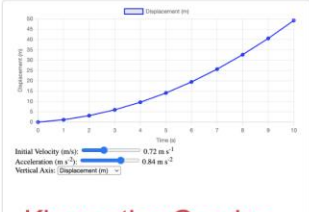
This is a series of apps that were produced using codes given by [ChatGPT 3.5 \(the free version\)](#). You can do so with other GAI like [Microsoft Copilot](#) too. The apps are usable directly from here or can be downloaded and included into an SLS package.

The prompts given to ChatGPT are provided for your reference. However, you may still have to refine the prompts as the output may not always be consistent. While it is possible to generate a working app without any changes to the code, you can customise the app much faster if you know a bit of html or javascript. You may even ask ChatGPT to teach you how to do so!

Check out the step-by-step guide to produce and deploy your app. This [html file generator](#) helps you to save the code into a html file and test it out.

How to: [Generate your own apps](#) | [Upload to SLS as Media Objects](#)

Visualisation Back to Top

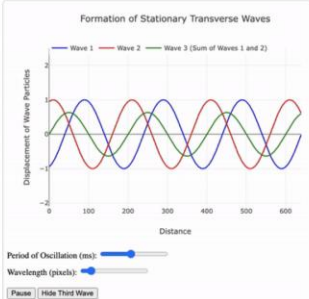


Kinematics Graphs

The user gets to explore the changes in the shape of a displacement or velocity graph by changing the values of initial velocity and acceleration.

Initial Velocity (ms⁻¹): 0.72 m s⁻¹
Acceleration (m s⁻²): 0.84 m s⁻²
Vertical Axis: Displacement (m)

Test it out Download for SLS Prompts

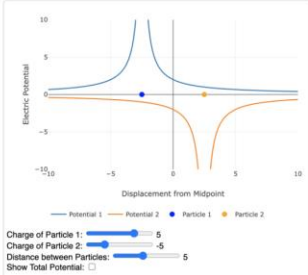


Formation of Stationary Transverse Waves

Meant for A-level Physics, students can observe how two waves moving in opposite directions can come together to produce a stationary wave.

Period of Oscillation (ms):
Wavelength (pixels):

Phase Hide Third Wave



Electric Potential of Two Charges

Meant for A-level Physics, the variation of electric potential due to two charge particles can be observed.

Sliders allow user to change the

Charge of Particle 1: 5
Charge of Particle 2: -5
Distance between Particles: 5
Show Total Potential:

About the Repository

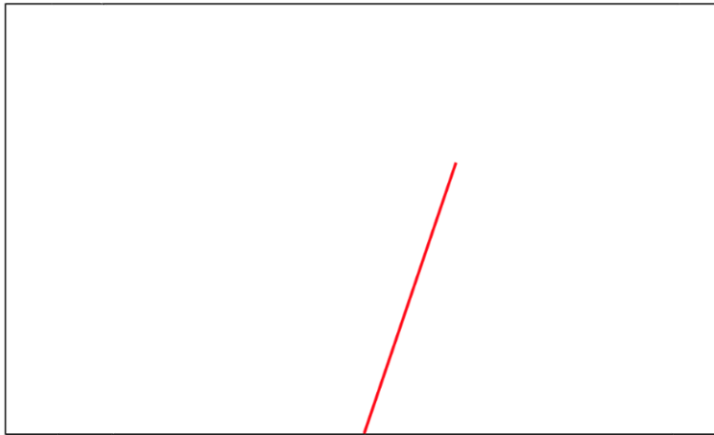
- Ready for Use
 - Can use directly on browser (online or offline) or
 - Upload the zipped file and embed into SLS:

<https://www.learning.moe.edu.sg/teacher-user-guide/author/html5-content-development/#uploading-a-html5-zip-file-in-sls>

- Prompts used are shown for each app

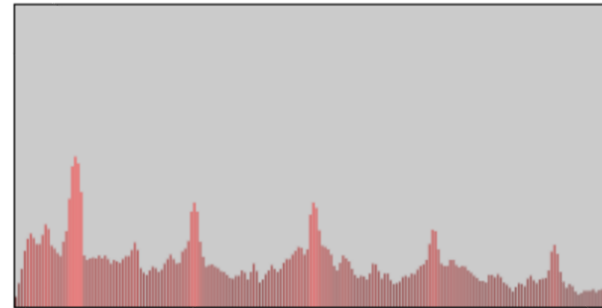
Examples: Use of Sensors for Experiments

Sound Level Meter



Range:

Sound Frequency Analyser



Dominant Frequency: 430.66 Hz



An example in the
SLS Community
Gallery
<https://vle.learning.moe.edu.sg/community-gallery/lesson/view/f9c45429-0261-4999-aaeb-f8ded90fe8eb/page/73124376>

Acoustic Stopwatch

Threshold: 150

Minimum Delay (ms): 1000

Time: 1.502 seconds

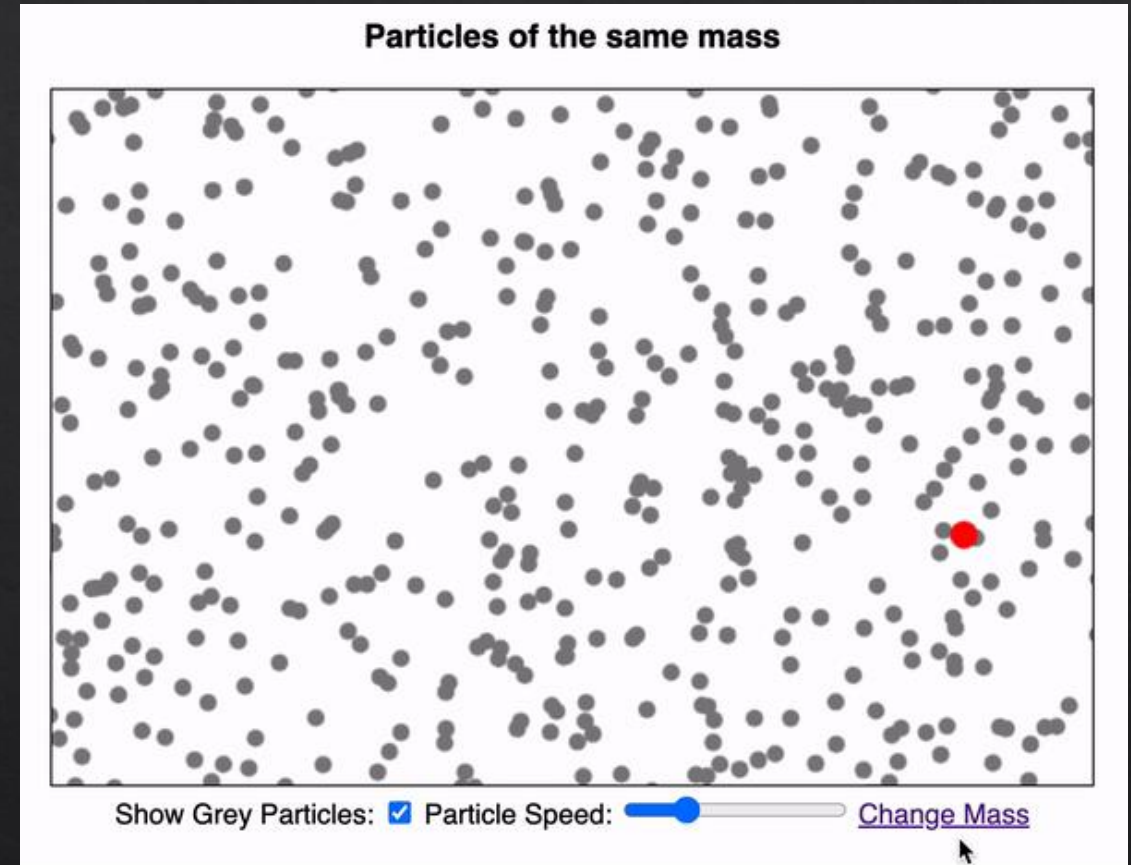
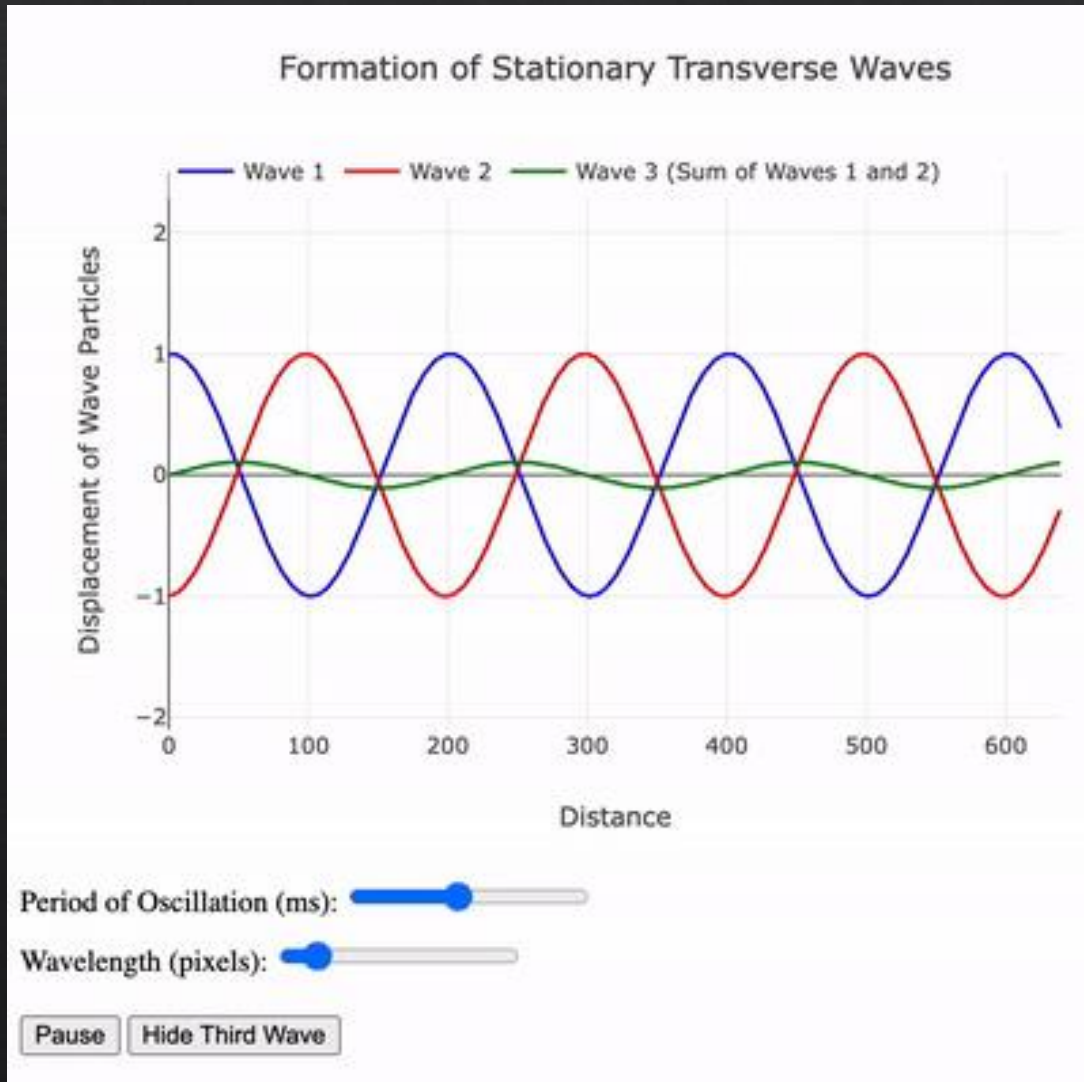
Camera Brightness Recorder

Sampling Rate (seconds): 1 seconds

Relative Brightness: 0.30

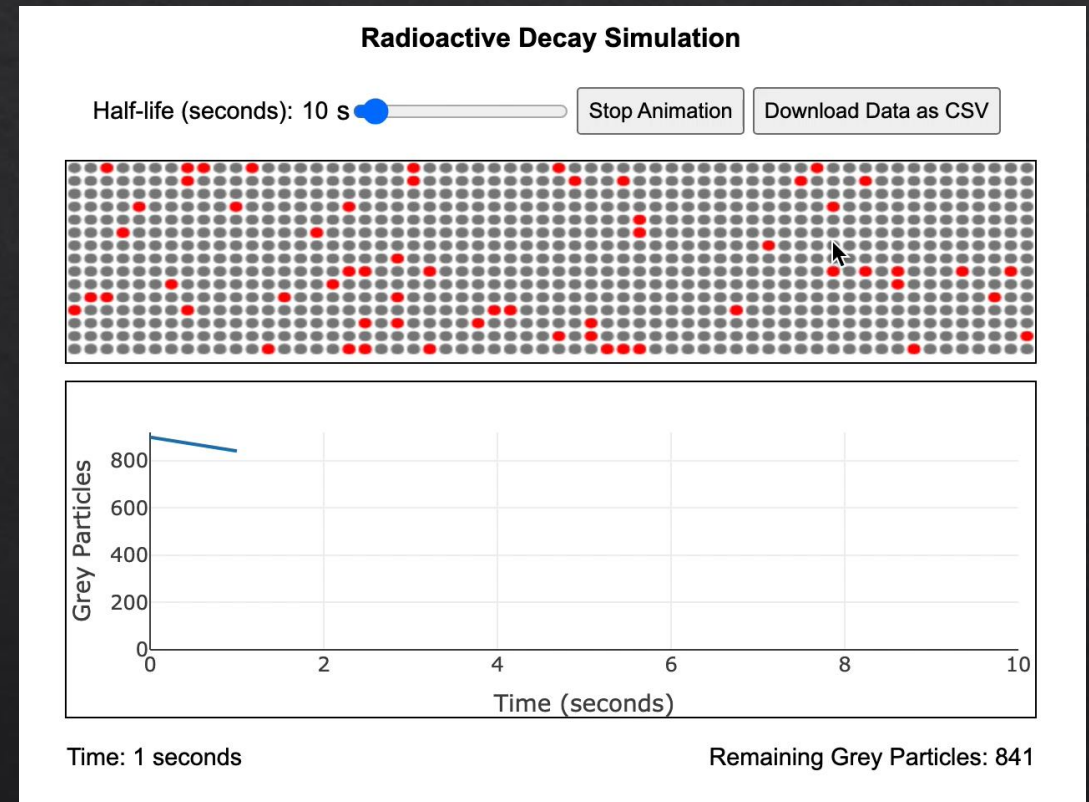
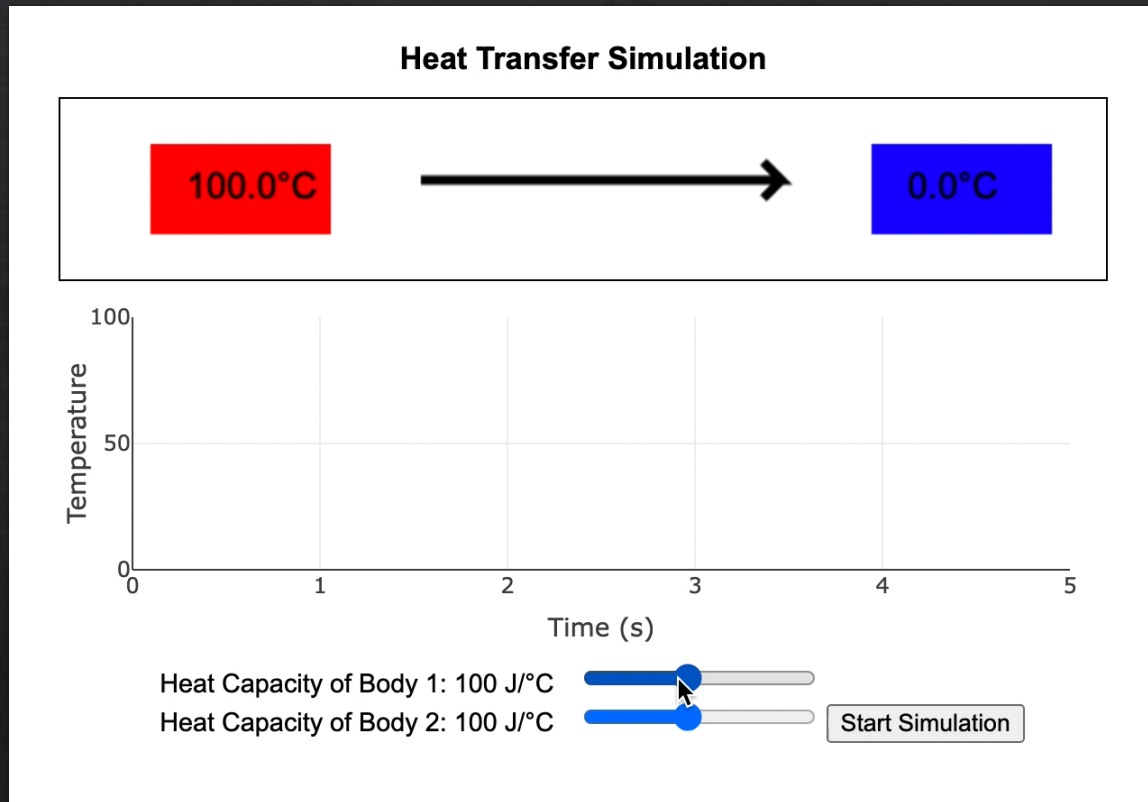
- 21:29:16: 87.00
- 21:29:17: 94.40
- 21:29:18: 75.52
- 21:29:19: 89.34

Examples: Interactive Simulations

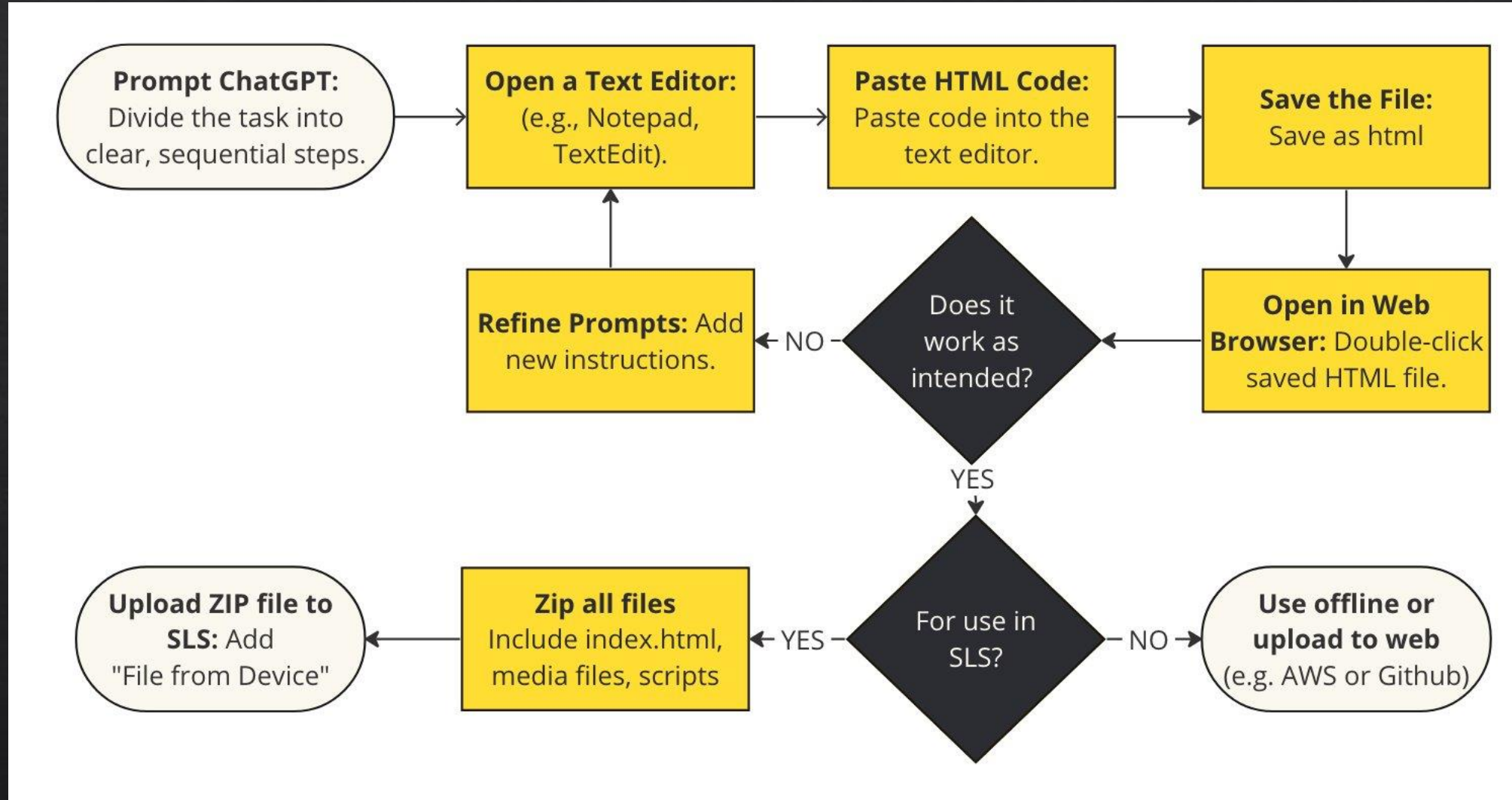


An example in the SLS Community Gallery
<https://vle.learning.moe.edu.sg/community-gallery/lesson/view/b582192d-1d30-488a-a846-93c34d69da85/cover>

Examples: Interactive Simulations

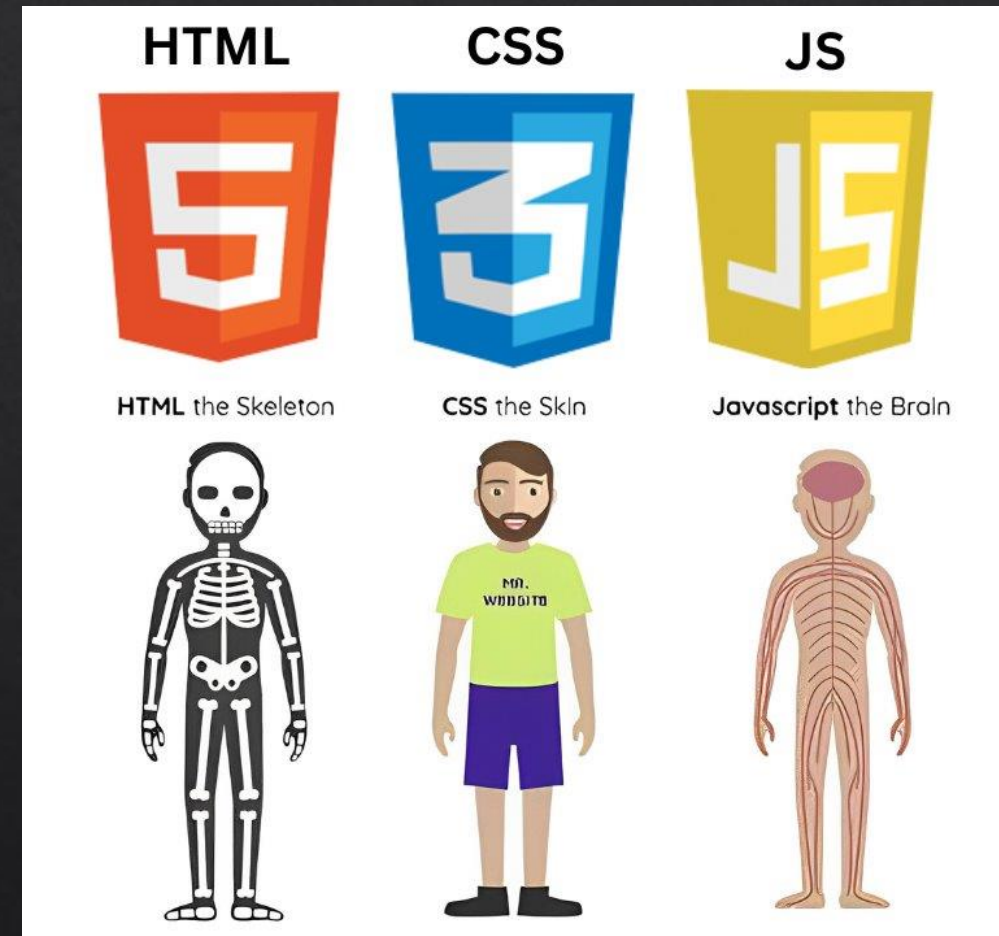


Workflow



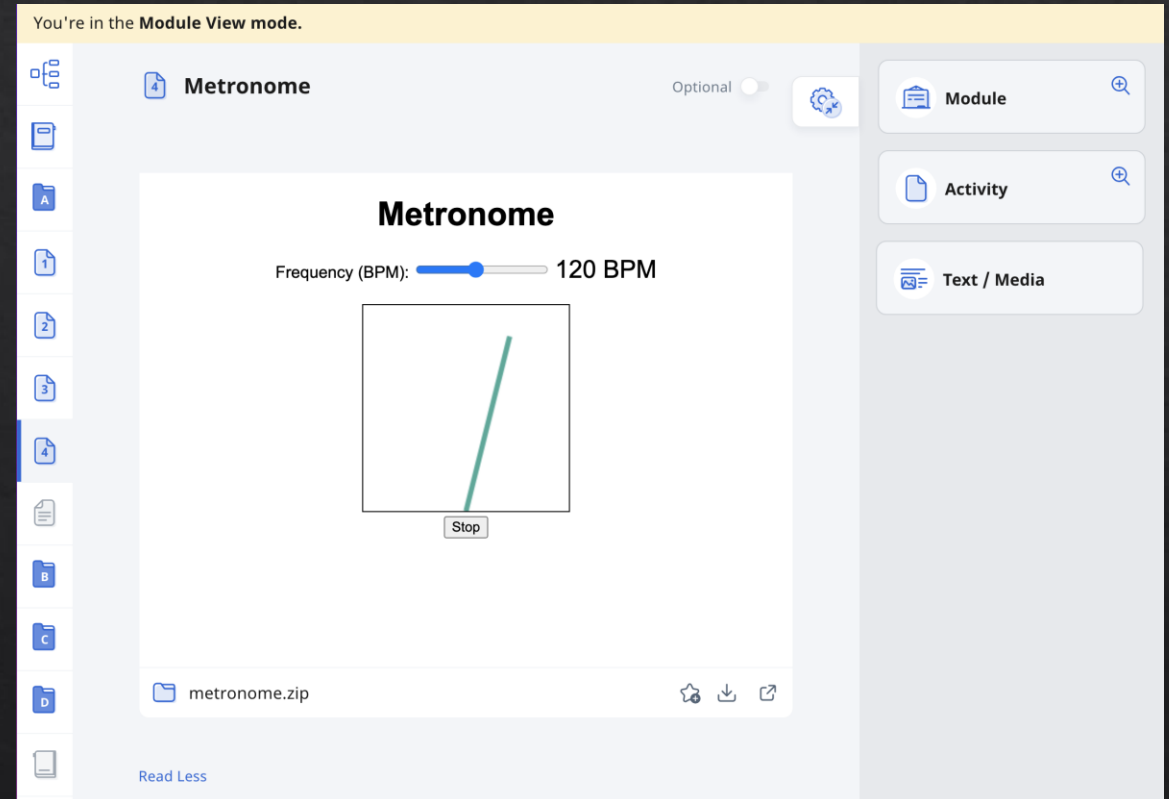
Basics of Web Apps/Sites

- Three languages in use (**html**, **css**, **javascript**)
 - For large sites, these codes are usually placed in separate files for universal use
 - To simplify workflow, we will put all 3 sets of codes in one file.
- Alternative is to code in **python** for <https://www.glowscript.org>



Limits of standalone apps in SLS

1. No connection to online databases. However, data can be stored in browser.
2. No transfer of information between SLS and app.



Prompt Engineering Tips

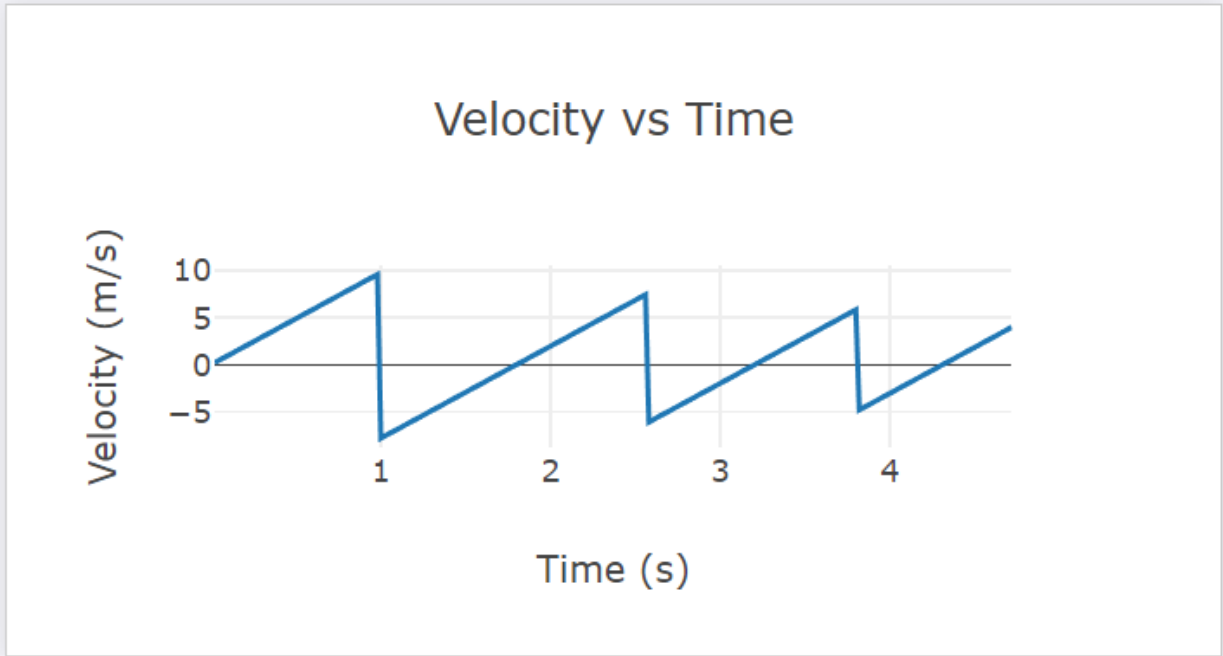
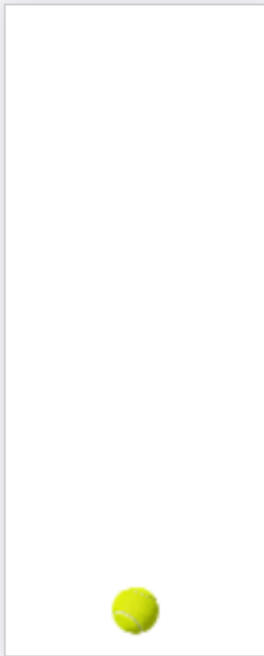
1. Start by asking for the html and javascript codes in a single file.
2. Describe what the app is supposed to show. Do you need a canvas (for graphics) or a graph, or both?
3. Describe the interactions in the app. Use elements such as buttons, sliders or input boxes
4. (If necessary) Give the names of image/video files to be used and put them in the same directory as the html file.
5. (If optimizing for SLS), max width: 580px, height: 460px
6. Finally, change the stylesheet to make the UI more appealing
7. Ask AI to comment or explain the codes if it did not do so

Hands-on: Our Aim

Bouncing Ball Simulation

Initial Height (m): Vertical Axis: ▼

Energy Loss per Bounce (%): 20 %



Hands-on: Prompt Sample

STEP 1:

Open ChatGPT or any other GAI (e.g. Claude, CoPilot, Gemini)

STEP 2 (PASTE THIS INTO THE AI):

“Put all the codes in one page.

Create a canvas showing a ball dropped from rest from a height and bouncing off the ground using javascript.

Using the plotly library, plot the graph of velocity versus time for the ball. The time of contact with the ground is negligible.

Create an input box that allows the user to key in the initial height in metres.

Create a slider that changes the percentage energy loss after every collision with the ground

Create a dropdown menu that changes the vertical axis to velocity or displacement.

Initialise the animation and graph upon loading. Use a button to start and stop the animation.”

Hands-on: Testing

STEP 3:

Copy the generated code

```
html
```

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <title>Ball Drop Simulation</title>
  <script src="https://cdn.plot.ly/plotly-latest.min.js"></script>
```

Copy code

STEP 4:

Paste into editor at <https://for.edu.sg/html>

“Run in New Tab” to view



Hands-on: Debugging

STEP 5:

Be prepared to generate 10 or more versions! Repeat STEPS 3-4.

Options:

1. Change the code manually yourself
2. Describe any unexpected behaviour / missing component to AI
3. Ask AI to try a new approach (usually after a few failed iterations)
4. To save time, just ask AI to generate the codes that need to be changed. It will tell you where to update

Hands-on: Make the App Look Pretty!

STEP 6:

1. Optimise for SLS by asking AI to “limit the entire page to a size of max width 580px and max height: 460px”
2. Ask AI to beautify the app with styling
3. Ask AI to add image / video / audio files into the code, giving it the filenames. Save the media files in the same root directory as the index.html file.

Hands-on: Using Code Libraries

STEP 7:

To embed into SLS, you will need to copy the code libraries that are used (if any) in a new .js file. The code library is a collection of pre-written code that you can use to perform specific tasks, e.g.

- [plotly.js](#) for continuously changing graphs
- [chart.js](#) for static charts
- [papaparse.js](#) for processing csv data

7.1 Paste the link to the script on browser e.g. <https://cdn.plot.ly/plotly-latest.min.js>

7.2 Save the page using the "Save as" in the same directory as the html file.

7.3 Rename the path to the file:

Change

```
<script src="https://cdn.plot.ly/plotly-latest.min.js"></script>  
<style>
```




to

```
<script src="plotly-latest.min.js"></script>  
<style>
```

Hands-on: Packaging for SLS

STEP 8:

Download as HTML.
Save file as index.html.

bouncing-ball				
Name	^	Date Modified	Size	Kind
 ball.png		Today, 9:36 PM	3 KB	PNG image
 index.html		Today, 9:45 PM	7 KB	HTML text
 plotly-latest.min.js		Today, 9:45 PM	3.5 MB	JavaScr...t source

STEP 9:

Zip all the files and upload the zip file into SLS component.

Share your work with the community!

- ◆ Host it online, e.g. AWS, Github, or
- ◆ Include in SLS package and submit to Community Gallery or
- ◆ Share with me via <https://forms.gle/a4XuvrdhsP1WNvyP6>