# Google HackNU 2022

Problem statement

We are entering the era of 3D maps with a lot of exciting opportunities for a lot of use cases!

While 3D location data has been available for a while now, it still has quite a limited usage even in the most advanced maps solutions like Google Maps, Google Earth, food delivery apps, and so on. 3D location data has a huge potential in making everyday navigation easier for lots of use cases: shopping in a multi-storey shopping mall, helping firefighters locate the correct floor to extinguish a fire source in the skyscrapers, or for any other emergency responders to quickly get to where there is an incident.

So, we challenge you to build an innovative 3D map solution for the 3D location data!

You will be given location data and your task will be to build a 3D mapping application to visualize this data along with its horizontal and vertical uncertainties.
- Think about how you can present the uncertainties (especially vertical ones) so that they make sense to your users! (See Google Maps: What does the blue dot and circle mean?)
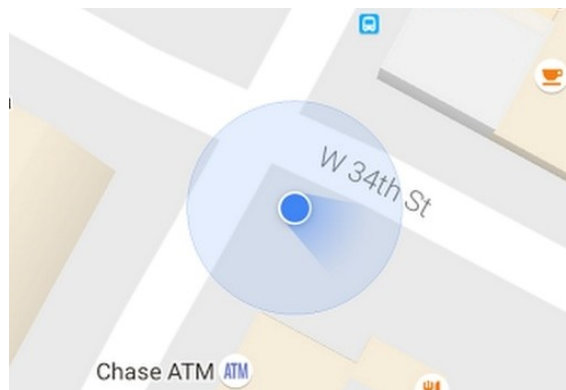
- Solutions can be built as a web page or as an Android/iOS app.

Location data

Location data will have the following schema:

Values	Units	Nullable?	Example
Latitude	degrees	No	37.4217845
Longitude	degrees	No	-122.0847413
Altitude (AGL, height above ground)	meters	No	34.7

Identifier (e.g. Alice, Bob)	-	Yes	Alice
Timestamp (elapsed)	ms (elapsed timestamp)	No	120003
Floor label (as in elevator button floor label, maybe non-numeric)	-	Yes	4
Horizontal accuracy	meters	No	20
Vertical accuracy	meters	No	2.5
Confidence in location accuracy	percent (0-1)	No	0.6827 (always)
Activity (one from [walking, running, driving, cycling, swimming, null])	-	Yes	walking

Dictionary

Fix. A previously determined position.

Stretch goals

1. Display the historical, 3D location replay based on the previous fixes over time.
2. Display other metadata about the object (e.g. activity, floor)

Note: these goals are not in order of importance! Pick whatever you fancy to implement :)

Criteria for a successful solution

1. Meet the basic problem requirements.
2. Meet stretch goals.
3. Be creative!

Useful resources

Codelab for a web solution

See [Build 3D map experiences with WebGL Overlay View](#) codelab from Google. This codelab teaches you how to use the WebGL-powered features of the Maps JavaScript API to control and render on the vector map in three dimensions.
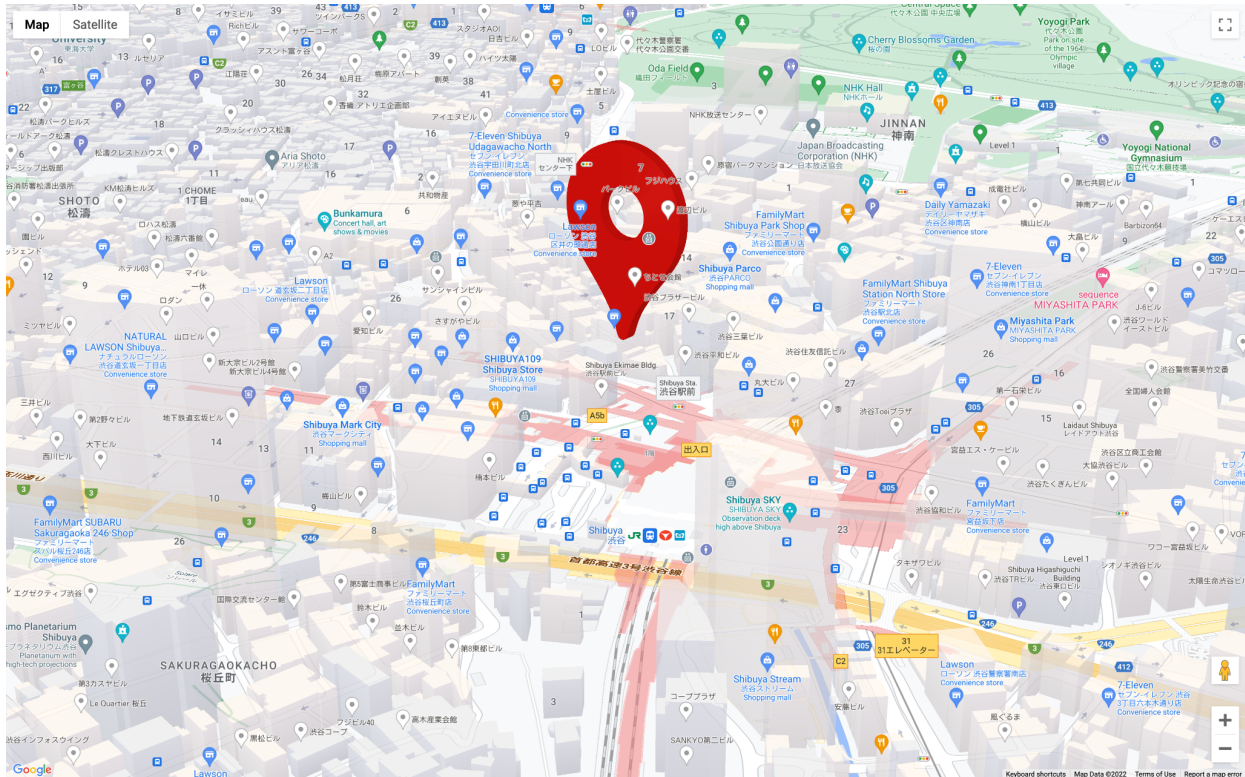
Codelab prerequisites

- A Google Cloud Platform account with billing enabled
  - Google Cloud offers a free trial with 300$ credit that can be used for any of the GCP products including Google maps platform
    - The trial expires at either end of 90 days or after the account has accrued $300 worth of charges, whichever comes first.
    - You won't be charged for any usage above 300$ trail credit unless you upgrade your account to a standard GCP account.
    - While using a free trial account, once you use your trial credit, your access to the GCP will be paused.
    - You can cancel your account anytime.
  - **Additionally, Google Maps Platform features a recurring $200 monthly credit.** For more information, see [Billing account credits](#) and [Billing](#).
    - You can also create budget alerts to help you stay on top of your spending. You will be notified when you are about to exceed the $200 monthly Google Maps credit.
  - More on [Google cloud free trial](#).
- A Google Maps Platform API key with the Maps JavaScript API enabled.
  - All requests to Google Maps Platform require an API key.
- Intermediate knowledge of JavaScript, HTML, and CSS
- A text editor or IDE of your choice

- [Node.js](#)

Libraries

Three.js

Three.js, a popular graphics library that provides a simplified abstraction layer on top of WebGL. Three.js comes with a wide variety of convenience functions that do everything from creating a WebGL renderer to drawing common 2D and 3D object shapes to controlling cameras, object transformations, and much more.
https://threejs.org/

glTF Loader

glTF Loader is a royalty-free specification for the efficient transmission and loading of 3D scenes and models by engines and applications. glTF minimizes the size of 3D assets, and the runtime processing needed to unpack and use them. glTF defines an extensible, publishing format that streamlines authoring workflows and interactive services by enabling the interoperable use of 3D content across the industry. https://www.khronos.org/gltf/

Blender

Blender is a free and open-source 3D computer graphics software tool set used for creating animated films, visual effects, art, 3D-printed models, motion graphics, interactive 3D applications, virtual reality, and, formerly, video games.

For the purposes of this problem, students can use this solution for building their own 3D models.
https://www.blender.org/

Appendix

Google Maps platform

- [Google Maps Platform](#)
- [Google Maps SDK for Android/iOS/Javascript](#)
- [WebGL Overlay View | Maps JavaScript API | Google Developers](#)
- [Build 3D map experiences with WebGL Overlay View](#)