Team Assignment 1 —
Height measurement app

ENG1003, Semester 2, 2016

Due: Sunday August 28th, 11:59PM
Worth: 10% of final mark

Aim

Ever wondered how tall, or how far away an object was from you? This is the sort of question surveyors answer all the time. In this assignment you will work in your teams to develop a mobile app that uses the phone's gyroscope and accelerometer to estimate the height and distance from you to an object using simple trigonometry.

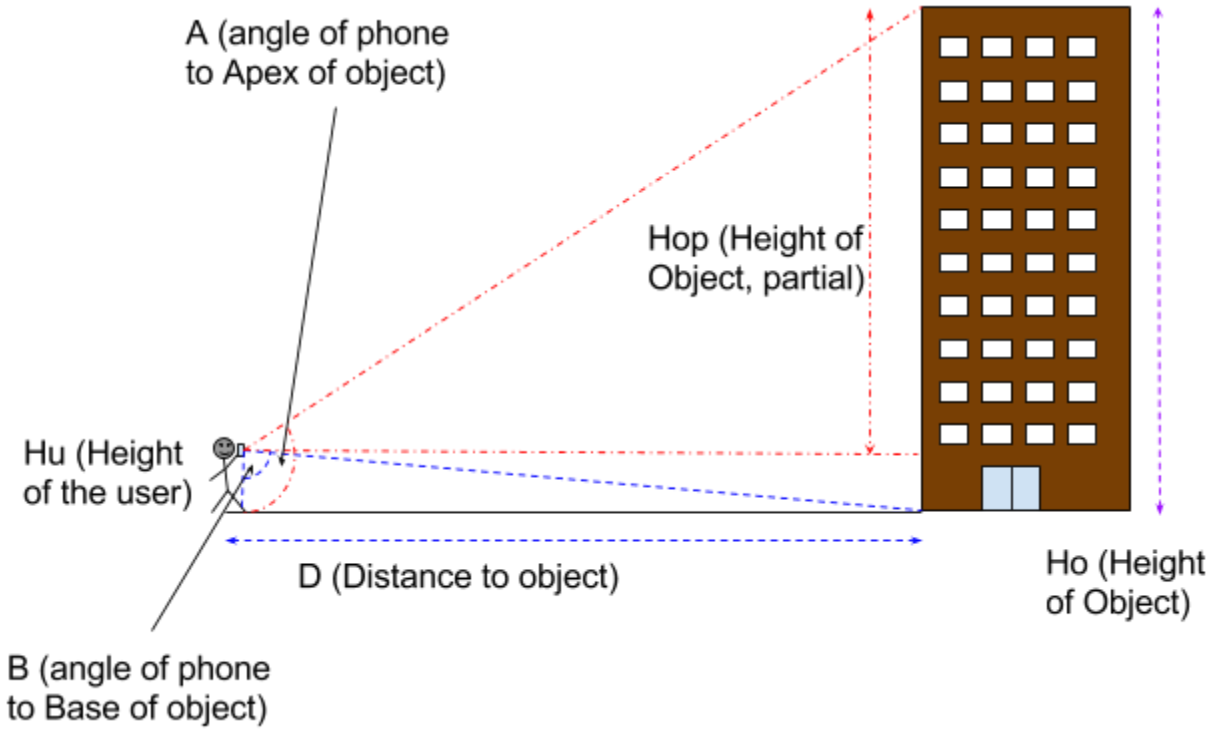
Background

Calculating height and distance of objects
The basis of this app is to determine the distance to and height of objects based on the angle made to the base and apex of the object by the phone and the height of the phone off the ground (or user's height as a proxy for this). It can be visualised as below.

You can assume the person and the object being measured are at right-angles to the ground, and the person and the object are on flat level ground.

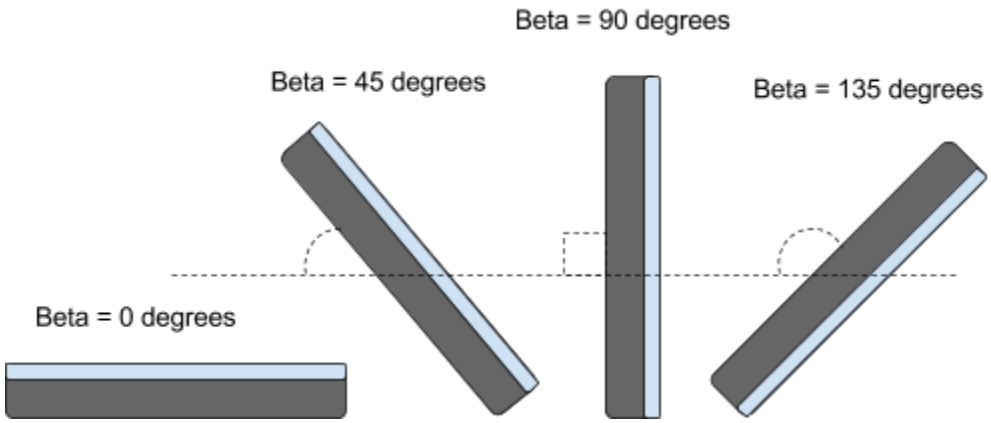
A simple application of trigonometry can be used to determine the distance to the object (D) using the angle to the base of the object (B) along with the height of the camera (Hu).

The distance to the object (D) and the angle to the apex of the object (A) can be used, along with the camera height (HU) to determine the height of the object being measured (Ho).



Angles obtained from the phone using device orientation

When using device orientation there are three angles that you have access to: alpha, beta and gamma; where beta represents the forwards-backwards tilt of the phone. It can visualised as below:



This means that when the device is flat on a surface, screen facing up it will have a beta of 0 degrees, whereas when it is upright, its beta angle will be close to 90 degrees.

You can observe these Beta values on the team phone using the SensorTest app:

https://eng1003.monash/apps/sensortest/

What you are provided with

We have made available a skeleton version of the app. This code runs and displays a page with a video stream from the back-facing camera, but doesn't do much else. You need to implement the functionality described below.

The app skeleton can be found in the ENG1003 resources folder:

http://eng1003.monash/resources/

The app skeleton contains a file 'HeightEstimate.js' which should contain your submission.

You don't need to understand the other files we provide you with as part of the base app -- they include some concepts we haven't yet covered.

What you need to do

Getting started

1. As a team you should download a copy of the project skeleton and unzip this.
2. The 'assignment1' folder contains the code of the web app.
3. In the 'scripts' directory, open the 'HeightEstimate.js' file. You will implement your solution in this file.
4. The 'assignment1' folder can be uploaded to the ENG1003 web server via the ENG1003 Assignment Uploader web page and run on your team smartphone.

Programming tasks

For the programming tasks, we suggest you complete each part together before moving onto the next one.

Step 1: Sensing device orientation

Write code to capture DeviceOrientation events and show these on the screen for the user. The important orientation component for us is the one representing tilt from front to back.

Step 2: Smoothing sensor data

You may notice that the values you get from the sensors are very "jumpy". It is a good idea to report to the user just one decimal place or the whole degree value. A simple smoothing strategy is to take the current value as the average of the last N sensor values. You should implement this so that you display a more stable tilt value. It is up to you to decide how big N should be. You should explain your choice.

Step 3: Set camera height

There is a button which should prompt the user to enter the height of the smartphone camera from the ground. They should estimate this based on their height. The camera height will be used later. You should write code to prompt the user for this information and then store it.

Step 4: Record tilt angles

There are buttons to allow the user to record the device angle when the screen crosshairs point at the 'base' of an object and when the crosshairs point at the 'apex' of the object. The user should be able to tilt the device and tap these buttons at the appropriate point.

Step 5: Estimate the distance to the object

Given the height of the smartphone from the ground, and the angle to the base of an object also on the same level, calculate with trigonometry the estimated distance to the object. Display this for the user once the base angle is set (or updated). The JavaScript Math object provides trigonometry methods that may be useful to you. See the documentation in the References section below.

Step 6: Estimate the height of the object

Given the estimated distance to object and the angle to the base and apex, calculate with trigonometry the estimated height of the object and display this for the user. This should be calculated and displayed once both angles have been updated and subsequently whenever the camera height, or angles, are updated.

Your app need only work in portrait mode. You can assume the phone is locked in portrait mode and the app will never be used in landscape mode.

Testing the app

Upload your code to the ENG1003 server using the assignment upload page. It will open the uploaded app, the address of which you can then visit on our team phone. The uploader can be found here:

> https://eng1003.monash/uploader/

Resources

- https://developer.mozilla.org/en-US/docs/Web/API/Detecting_device_orientation (Mozilla Developer Network: Detecting device orientation)
- https://developer.mozilla.org/en/docs/Web/JavaScript/Reference/Global_Objects/Math (Mozilla Developer Network: Global Objects - Math)

Submission

Your team should submit their final version of the application online via Moodle; You must submit the following:

- Completed Group Assignment cover sheet (from Moodle page)
- HeightEstimate.js

These should be zipped up with the team name as the filename, e.g., "`Team014.zip`".

The submission should be uploaded by the team leader and must be finalised by Sunday August 28th, 11:59PM (local time)

You also need to individually complete the

- CATME peer assessment survey

as described below.

Your assignment will be assessed based on the version of "`HeightEstimate.js`" file you submit via Moodle. Before submission check your code still works with the original app skeleton, in case you have modified your copy of any of the other files. We will run it with the original app skeleton and test it on your team smartphone. We will use the same phones when marking your assignments.

Plagiarism

Cheating and plagiarism are serious academic offenses at Monash University. Students must not share their team's work with any student outside of their team. Students should consult the policies linked below for more information.

http://www.monash.edu.au/students/policies/academicintegrity.html
http://eng.monash.edu.au/currentstudents/cheatingandplagiarism.html

See also the video linked on the Moodle page under the Assignment block.

Students involved in collusion or plagiarism will be subject to disciplinary penalties, which can include:

- The work not being assessed
- A zero grade for the unit
- Suspension from the University
- Exclusion from the University

Late submissions

We do not accept late submissions without special consideration. Such special consideration applications should be made to the unit email address with a completed form and supporting documentation within two business days of the assignment deadline.
http://www.infotech.monash.edu.au/resources/student/equity/special-consideration.html

Peer Assessment

You are expected to work together as a team on this assignment and contribute roughly equal amounts of work. Peer assessment will be conducted via the CATME online system. You will receive email reminders at the appropriate time.

Not completing the CATME peer assessment component may result in a score of zero for the assignment.

Do:

- Give your teammates accurate and honest feedback for improvement
- Leave a short comment at the end of the survey to justify your rating
- If there are issues/problems, raise them with your team early
- Contact your demonstrators if the problems cannot be solved amongst yourselves

Do NOT:

- Opt out of this process or give each person the same rating
- Make an agreement amongst your team to give the same range of mark

Marking criteria

Assessment criteria:

- Whether the app functionality satisfies the assignment specification
- Quality of app source code, including structure and documentation

You will be marked as a group, however your individual marks will be subject to peer review moderation based on CATME feedback and scaling factors.

Where to get help

There will be FAQ posted in Moodle and updated periodically. You can also ask questions about the assignment on the General Discussion Forum on the unit's Moodle page. This is the preferred venue for assignment clarification-type questions. You should check this forum (and the News forum) regularly, as the responses of the teaching staff are "official" and can constitute amendments or additions to the assignment specification. Before asking for a clarification, please look at the FAQ and forum.