

User's Guide for Setup for Online Teaching with Robotics and Arduino

Version 2.02 | June 2, 2020



1. Introduction

Online video conferencing software such as Zoom and Google Meet provide instructors with the capability to connect with students and use coding and virtual simulation software, such as Barobo's [RoboBlockly](#) and the UC Davis C-STEM Center's [C-STEM Studio](#) platform, for the remote teaching of coding, robotics, and math.

One obvious challenge in doing so, however, is to show students how it all works when there is actual hardware involved, such as robots or Arduino boards. In many distance learning situations students will of course not have access to the hardware, but it is nevertheless instructive and more engaging for them when they can at least view how what they are doing with the online software to control virtual robots works with actual hardware robots. The challenge for the teacher, therefore, is how to demonstrate both the software and hardware at the same time via an online session.

Programs like Zoom and Google Meet are not specifically designed to do such a simultaneous demonstration, but it's not too hard to make it work. The following document outlines how a teacher might use Zoom or Google Meet to do so. (Most video conferencing programs would also be able to do it in a similar manner as outlined below. A more sophisticated solution is to create a picture-in-picture situation on the instructor's screen, but that requires additional software.)

2. Required Equipment and Basic Overview

The required equipment is a laptop computer with a built-in webcam plus an external webcam that can be plugged in to the computer (usually via a USB connection). A tripod for the external webcam is also helpful. (In actual fact, the laptop camera is not needed, just the external webcam. But of course most laptop computers these days have a webcam built in, and it's easier to have the two cameras.)

The basic idea is to connect an external webcam to your computer so that it will provide video of the hardware demonstration area, perhaps on a tabletop or the floor:



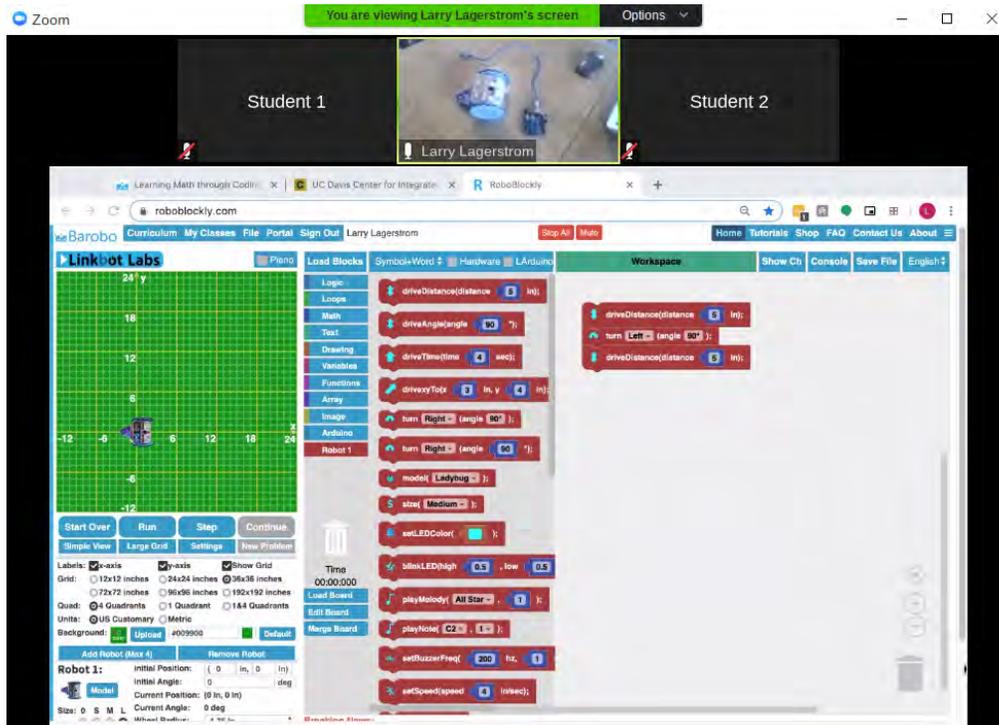
Once logged in to a Zoom or Google Meet class session, you (as the teacher) first switch the session's active camera from the normal laptop camera to the external webcam. So instead of seeing your face, students in the session will see a video display showing the hardware demonstration area.

Second, you share your screen and navigate to the window of the robotics (or other) software that is being demonstrated. Now the students will see a large image of the screen-shared software and a smaller image of the hardware demo area in the sidebar (where they would normally see your face as one of the thumbnail video images, as shown in the image at the beginning of this document). Assuming that the robotics software has been appropriately connected with the robot (or other hardware) that is in the demo area, when you run the code shown in the screen-shared window, the robot will do its thing and the students will be able to see both your screen-shared code window and the video from the external webcam showing the robot in motion.

The following sections show how to set this up in either **Zoom (Section 3)** or **Google Meet (Section 4)**.

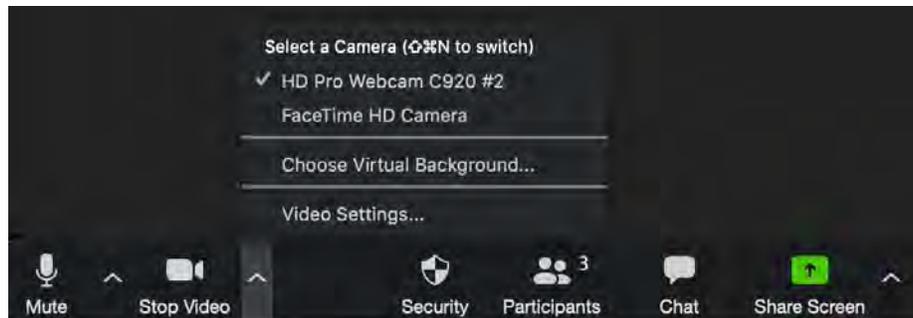
3. Setting It Up in Zoom (zoom.us)

The following outlines how to use Zoom to broadcast a dual view, one of your screen and one of a webcam view, so they can be seen simultaneously when you're presenting. The screenshot below shows how it might look for a student. They can see your shared screen (the RoboBlockly browser window) and thumbnail images of other session participants, including your webcam video feed (the top center image, with the webcam showing a Linkbot and an Arduino board with cable, as an example):



3.1. Set up webcam: Attach the external webcam to your computer (usually a USB connection) and make sure it's working. On a Windows machine, the built-in Camera app allows you to switch feeds between the laptop's regular camera and the external webcam and see what each looks like. On a Mac you can use the built-in PhotoBooth app to switch between cameras views.

3.2. Log in to the Zoom meeting and check your video feed: Log in to Zoom for the meeting. Once in the meeting, make sure that the video is on and set to your regular laptop camera to show yourself (for basic introductions, etc.). If it's showing the webcam feed instead, use the ^ popup menu next to the Stop/Start Video button to select your laptop camera ("FaceTime HD Camera" in this example):

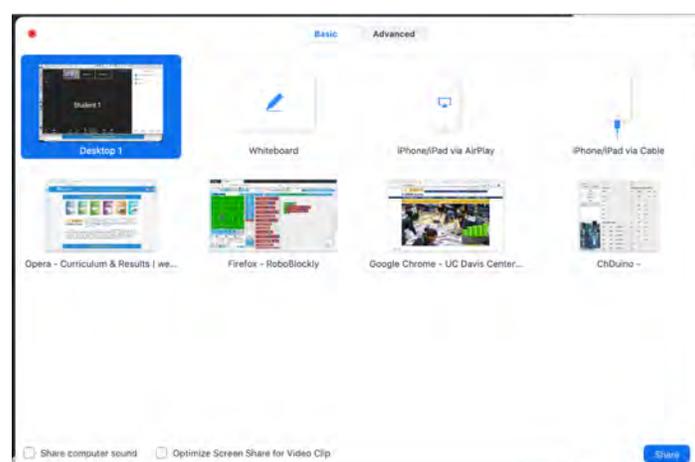


3.3. Switch to external webcam feed when ready: When you reach the point in the session where you want students to see the external webcam feed, repeat the process in #2 but choose the webcam for the video input. As long as students can see your video thumbnail among those of all the students in the meeting, they will see your webcam feed. Of course, they may have to scroll the thumbnail images on their screen to see it. But usually Zoom will ensure that the thumbnail for the person currently talking or presenting is visible, which would be yours.

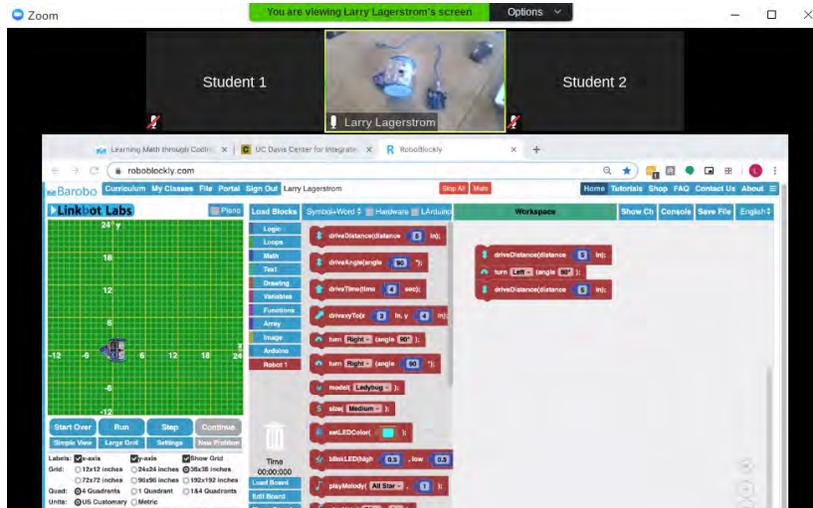
3.4. Share your screen: Share your screen using the "Share Screen" option in Zoom's menubar at the bottom of the Zoom window:



You'll be given a choice of sharing either your whole desktop/screen or just a particular window:



Your screen will be shown to the students in the main part of their Zoom window, along with student thumbnail video images along the top. In other words, they'll be able to see your on-screen presentation and your webcam video feed at the same time, assuming that they have their Zoom window layout set up so that the video image that belongs to you is visible (top center thumbnail image below):



Depending on what kind of computer, tablet, or smartphone the student is using, and how their screen layout is set up, the student may see the thumbnail on the right side instead of the top:

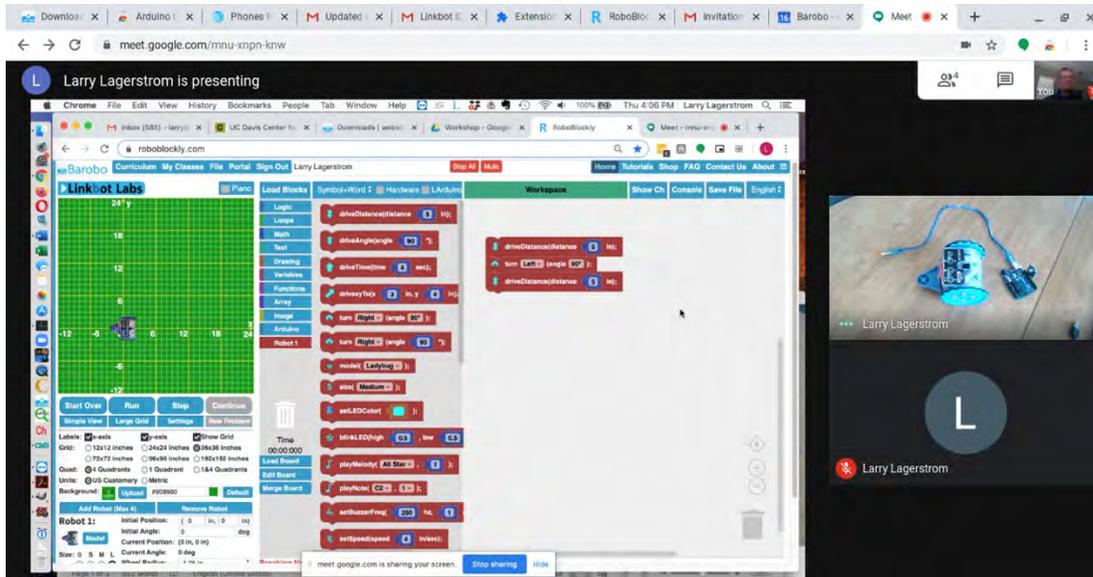


3.5. Run the program: You can then do things like run RoboBlockly or Ch code with a Linkbot or Arduino connected and students can see both the software window and the hardware responding accordingly.

Tip: If possible, it's helpful to log in to Zoom using a different email on a separate computer, so that you can verify what students are seeing.

4. Setting It Up in Google Meet (meet.google.com)

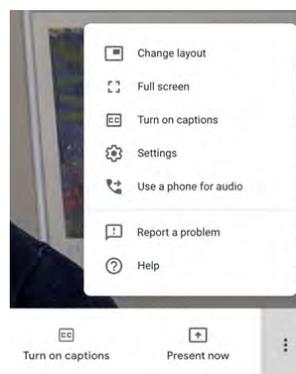
The following outlines how to use Google Meet (meet.google.com) to broadcast a dual view, one of your screen and one of a webcam view, so they can be seen simultaneously when you're presenting, as shown below (with the webcam showing a Linkbot and an Arduino board with cable, as an example):



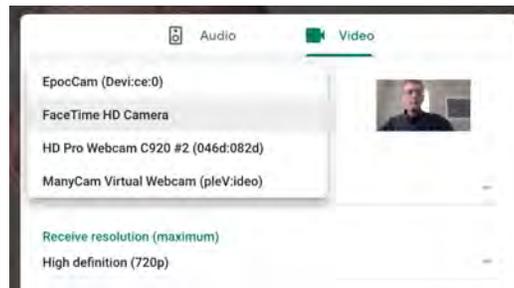
Meet is part of G Suite, and if you're logged in to an email associated with a G Suite account, Meet appears as one of the available apps. (Google Hangouts is similar and free, but designed more for individuals connecting with friends, and has fewer capabilities.)

4.1. Set up webcam: Attach the external webcam to your computer (usually a USB connection) and make sure it's working. On a Windows machine, the built-in Camera app allows you to switch feeds between the laptop's regular camera and the external webcam and see what each looks like. On a Mac you can use the built-in PhotoBooth app to switch between camera views.

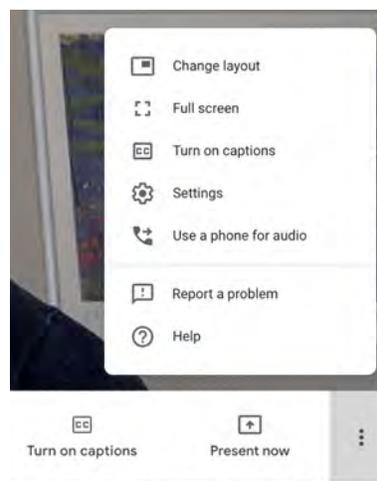
4.2. Log in to the meeting and check your video feed: Log in to Meet for the meeting. Make sure to choose "Join now" not "Present" (the latter will not show your video camera feed during the meeting). Once in the meeting, make sure that the video is on and set to your regular laptop camera to show yourself (for student introductions, etc.). If it's showing the webcam feed instead, use the three-vertical-dot menu at lower right to choose Settings:



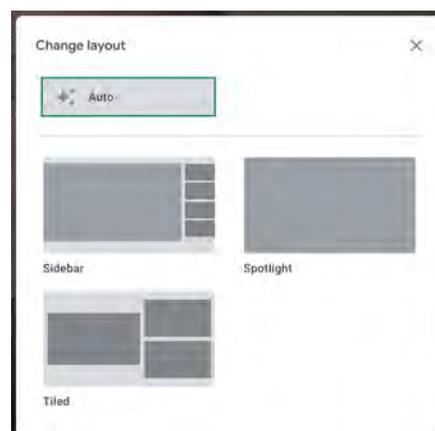
Then click video to choose the laptop camera video input (you can also set high def resolution):



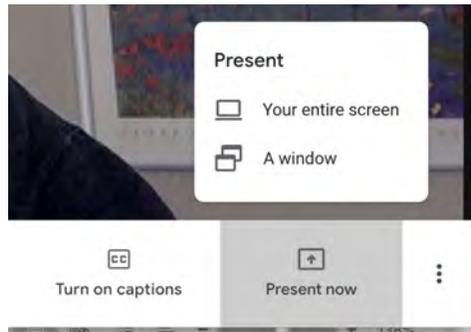
4.3. Switch to external webcam feed when ready: When you reach the point in the session where you want students to see the external webcam feed, repeat the process in #2 but choose the webcam for the video input. As long as students can see your video image among those of all the students in the meeting, they will see your webcam feed. Of course, they may have to scroll on their screen to see it, although usually Meet will show the thumbnail for the person currently talking or presenting, i.e., which would be yours. Students may also need to set up their on-screen Meet layout to either the “Tiled” or “Sidebar” view, using the “Change layout” option in the three-vertical-dots menu:



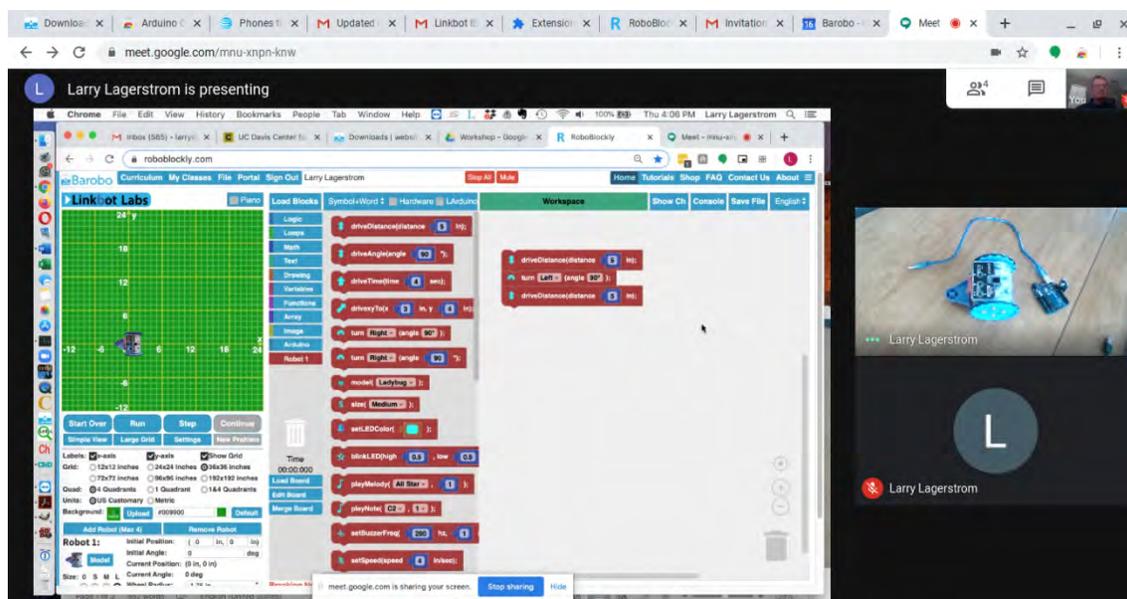
The “Change layout” window:



4.4. Share your screen: Share your screen using the “Present Now” option in the lower right next to the three-vertical-dots menu:



Whether you choose “entire screen” or “a window”, your presentation will be shown to the students in the main part of their Meet window, along with student thumbnail video images along the right side. In other words, they’ll be able to see your presentation and your webcam video feed at the same time, assuming that they have their Meet window layout set up so that the video image that belongs to you is visible in the sidebar, as shown below.



To clarify a little bit more, the image above is what the student sees, with a shared screenshot of RoboBlockly from the instructor (“Larry Lagerstrom is presenting”). The top thumbnail image in the sidebar is the instructor’s video image, which is set to the external webcam (showing the Linkbot and Arduino). The “L” image below it is the video feed from one of the meeting participants with their video turned off (i.e., “Larry Lagerstrom” logged in from a different computer masquerading as a student). The instructor’s laptop camera feed is also visible as a very small image at the top right (only visible to the instructor).

4.5. Run the program: You can then do things like run RoboBlockly or Ch code with a Linkbot or Arduino connected and students can see both the software window and the hardware responding accordingly.

The Meet layout and behavior can be somewhat confusing to manage. But going to the three-vertical-dots menu at the bottom right and changing the layout to “Tiled” or “Sidebar” usually works.

Tip: If possible, it’s helpful to log in to Meet using a different email on a separate computer, so that you can verify what students are seeing.