Game Clock with Circuit Playground & MakeCode

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Overview

Make a game clock with multiple timers using your Circuit Playground Express. It's easy to get started with just the Circuit Playground itself, and lots more fun to add a NeoPixel strip and some custom switches and buttons using objects you can find around your house.

This is a great project for learning to code with MakeCode, with lots of customizations to play with. Easily change the timer duration, the colors and sounds for each player, and lots more. Keep your kids engaged and having fun as they learn programming basics.

Parts

Circuit Playground Express

Circuit Playground Express is the next step towards a perfect introduction to electronics and programming. We've taken the original Circuit Playground Classic and...

https://www.adafruit.com/product/3333
Pink and Purple Braided USB A to Micro B Cable - 2 meter long
This cable is super-fashionable with a woven pink and purple Blinka-like pattern!
First let's talk about the cover and over-molding. We got these in custom colors,...
https://www.adafruit.com/product/4148

The Circuit Playground Express and a known good data USB cable is all you really need for this project, but here are a few add-ons that will make it more fun:

Adafruit NeoPixel LED Strip w/ Alligator Clips - 30 LEDs/meter
Adding glowy color to your projects has never been easier: no more soldering or stripping wires, clip 'em on and glow! This Adafruit NeoPixel LED Strip with Alligator...
https://www.adafruit.com/product/3812

Large Alligator Clip Test Lead (set of 10)
Connect this to that without soldering using these handy alligator clip test leads. 20" cables with alligator clip on each end, color coded. You get 10 pieces in 5 colors. Strong...
https://www.adafruit.com/product/321
Assembly

This code will run on the Circuit Playground Express all by itself. You can plug it in with a USB cable for power, or use a battery. This is a great AAA battery pack that already has an on/off switch and plugs right into the Circuit Playground's JST connector.

Or, Adafruit has a whole host of other 5v batteries that will work too.

If you want to add a NeoPixel strip, connect your three alligator clips as shown:

- Red --> VOUT
- White --> A1
- Black --> G

The red and black clips always need to be power and ground. You could clip the black wire to any pin marked GND and it would work fine.
The white clip could connect to any of the digital I/O pins, so, any pins marked A1-A7. You could also connect to A0 and the lights would still work, but A0 is also the audio pin so adding lights to that pin would interfere with the board's audio. It's usually best to stick with A1. But, if you want to connect any more light strips, those other pins are free to use.

![Image of a circuit board with lights and alligator clips](image)

**Capacitive Touch Pads**

This code uses the capacitive touch pads A2 and A5. You can activate these just by touching them with your fingers. Magic! Just hook the alligator clips to whichever pads you decide to use in the code.

It's even more fun to hook up alligator clips to the capacitive touch pads, and connect the other end to an object that conducts electricity. We like using fruit, but anything conductive will work. This is also a fun game: what objects can you find that will trigger the timer?
Code with MakeCode

Here's the finished code, ready to be customized and uploaded to your Circuit Playground Express.

What it Does

This code works just like a chess clock: there is a 15 second timer that lights up in red attached to button A, in blue on button B, in yellow on touch pad A2 and green on touch pad A5.

Pressing any of those four inputs will start that player's timer. If the timer runs out, a "wawawawa" sound plays and the lights blink in that player's color. Pressing any of the inputs will reset the timer and start a new timer in the new player's color.

How to Upload to your Circuit Playground

Click "Download" below to download the code as-is. Plug your Circuit Playground into your computer's USB port and upload by dragging the file you just downloaded onto the CPLAYBOOT drive that appears. (Don't see it? Try pressing the reset button in the middle of the board)
Customizing the Code

Or, click the edit button in the top right corner below to open the code in MakeCode so you can edit it and customize your colors and timer length.

Look in the `on start` block to choose timer length (the timer variable) or player colors (color1, color2, color3 and color4). Click the Download button when you're done, and drag the resulting file onto the CPLAYBOOT drive that appears when you plug in your Circuit Playground Express via USB cable.

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**Code Explanation**

**Build the Code Yourself**

Here's a step-by-step guide to how I created this code, tested, and debugged it. Follow along for a fun ride through MakeCode Land!
Go to MakeCode.com () and choose the Circuit Playground Express. Click New Project, and give your project a name. I called mine "Game Clock".

You'll see an emulator on the left, some tabs in the middle, and some open workspace on the right. Drag an instance of `on start` from the LOOPS tab into your workspace. Anything inside this block will run just once, when the Circuit Playground boots up. Anything inside the FOREVER loop (which is probably already on your workspace) will run over and over, forever -- so that's where the bulk of our code will go.
Variables

Next, we'll set up our variables. These will allow us to set up things like duration and color choices right at the top, so if we want to change them later we don't have to hunt through all our code.

We're also adding a few variables we'll use for our timer: `timer`, `index`, and `counter`, and one called `timerRunning` so we can stop and start the timer. I'll talk more about what these all do later on.

Click the VARIABLES tab and create all the variables shown, then drag an instance of `set <variable> to 0` into the `on start` loop for each one.

How Do I Know What Variables I Need?

Good question. When I first wrote this code, I started with just one variable called `timer` and made the rest as I discovered they were needed. You can always add more variables. These are the ones I ended up with after a bunch of experimentation. It's really hard to break anything in MakeCode so, please, feel empowered to experiment and try stuff -- that's the very best way to learn.

The cool thing about using variables is that now we can set them to whatever we'd like, and refer to them throughout the code. I can just ask for `color1` at any point, and if I change `color1` later on, it will automatically change everywhere. Nifty!

Choose a couple colors for `color1` and `color2`. You can find a color block in the LIGHT tab. Also, let's set our timer to 15 seconds for the moment, just for testing purposes.
Create the Light-Up Counter

We want our lights to come on one at a time when the timer is running, to count off the seconds. For this, we'll need a conditional statement. This is a bit of code that says: "If the timer has been started, Then (do these things)".

Click the LOGIC tab and drag the top `if/then` statement into your FOREVER loop. Then, drag a `comparison block` to replace the `true`. Drag your `timerRunning` variable into the first space, and change the second space to `1`. Now, whatever we put inside will only happen if `timerRunning` is set to `1`.

(So, to stop it happening later on, we'd just need to set `timerRunning` to `0`).

Now click the LIGHT tab and choose `set pixel color at 0 to red` and drag that into your conditional if/then block.

Now go up to your `on start` block and change `timerRunning` to `1`. Check your emulator. Look! The first pixel (at position 0) has lit up in red! It's working. Muahahaha...

For now, let's leave `timerRunning` at `1` so we can test our code on the emulator. Later, we'll set it back to `0` in `on start`, and use the buttons to change it back to `1` to start the timer.
Now, let's assign it a color and see if we can make it count off the seconds.

Replace the 0 with your index variable (from the VARIABLES tab), and change the red to your color1 variable. Then, drag an instance of change index by 1 right underneath the set pixel color block.

Then, drag an instance of pause 100 ms from the LOOPS tab, and change it to 1 second (1000ms).

Check your emulator. The lights are counting up, one per second. Hooray!

What is happening here?

The FOREVER loop runs over and over, forever. So whatever's inside this block is running over and over (as long as timerRunning = 1 as we specified in the last step).

Every time it runs, the index variable is increased by 1, thanks to change index by 1. By adding the pause loop and setting it to 1 second, we've got our index variable counting up by 1 each second, and lighting up the next light in the series each time it does that.

Create "Time is Up" Code

Now, let's tell it to count up until it reaches the number we chose for the timer variable, and figure out what we want it to do when the timer limit is reached.
Drag another conditional `if/then` statement into your FOREVER loop. Make sure it's placed as shown: inside the `if timerRunning` block but below the code you just wrote for lighting up the lights.

Add another comparison block, and set it up as shown so it reads `if index = timer then` ...

Anything we put in this block will now run if the count for the `index` variable reaches the number we chose for `timer`.

If the timer count is reached, it means that player lost the game! I want a sad sound to play, and the lights to all blink on and off in that player's color. Drag `play sound bading until done` into this conditional block and choose your favorite "you lost" sound. Then, add `set all pixels to black`, `pause`, `set all pixels to red`, `pause` below that to make the lights blink on and off.

Test it with the emulator by letting the timer run for 15 seconds.

It's looking good, but when the timer runs out I'd like it better if the lights blink three times instead of just once. We can tweak this by adding a `repeat 3 times` block around our blink code. This is found in the LOOPS tab.
Test the Timer / Bug Fixes

It's working! The sound plays at 15 seconds and the lights all blink on and off. We're getting closer!

However, we've run into a bit of a bug. Our timer is set to 15 seconds, but there are only 10 lights on the Circuit Playground. So the last 5 seconds of the timer doesn't appear to do anything.

It'd be better if all the lights went off after 10, and started counting up from 1 again, wouldn’t it?

We can rearrange our code a bit to make this work.

We need a variable that can count up to 10, then be reset to 0, then count up again. But we can't use the `index` variable -- we need that one to be able to count up to whatever the `timer` variable is set to. If we keep resetting `index` to 0, we'd never reach 15.

Let's use our `counter` variable instead.

We can think of `counter` as indicating which of the 10 lights is being lit, and `index` as counting off seconds.
Drag another conditional loop into your FOREVER loop, placed as shown. Add a comparison block, and make it read `if counter = 10 then`. Anything inside this block will happen only if the `counter` variable reaches 10.

Add `set all pixels to black` to turn all the LEDs off, and then add a `set counter to 0` block to reset counter to 0 so we can count up a second time (or a third time, for a 30 second timer, etc).

You'll also need to change the `set pixel color at index` block to read `set pixel color at counter`, and add `change counter by 1` so it counts up along with `index`.

Test it again on the emulator. It works great... once. But we want it to reset itself so we're ready to play again.

Drag `set index to 0` into the bottom of your `if index = timer` conditional block, to reset the index count to 0 after the sound and lights play, so the timer is ready for the next round.

Lastly, I want the timer to stop running when the time runs out, and wait for a button press. So I've added `set timerRunning to 0` at the end of this block.

Let's move on and set up the button triggers.
Adding Inputs

We want to trigger the timer by pressing a button or touching a capacitive touch code. For now let's start with pressing button A.

All the sensors and buttons can be reached from the INPUT tab. Drag on button a click into your workspace. Anything we put in this block will trigger whenever we press button A on the face of the Circuit Playground.

Take a minute and look through all the different inputs. There are so many ways to trigger your lights! Maybe come back and play with this more later.

First, let's assign `timerRunning` to this button instead of having it run on startup. Change the `set timerRunning` block in `on start` back to `0`, and add `set timerRunning` to `1` to your button input block.

Now your timer will wait until someone presses a button to begin running.

Let's make a few more things happen when we press the button. We'll reset our `index` variable (so it starts counting from 0 seconds again), and also reset our `counter` variable (so it starts lighting pixel #0 again). We'll also `set all pixels to black` so we're starting from a dark canvas each time.
Changeable Colors

Next we want to add in our `color1` and `color2` variables, so we can easily customize colors for each player.

We'll want to make one more variable for this: I added a new variable and called it `whichColor`. That way we can specify as many color variables as we want, and use `whichColor` to quickly pick from the list.

`whichColor` is our friend because we can set it with the button press and then call it in our FOREVER loop, and whichever color was set by the button will automatically populate to our LEDs.

Add a `set whichColor to color1` block into your button A input loop. Then, change all the calls for a color in your FOREVER loop to call `whichColor`.

Test it again on your emulator. See if changing your `color1` variable from red to another color in your on start loop actually changes the color on the LEDs. Try changing your timer length as well. This is a great time to hunt down and squish any bugs you find.

Granted, this does seem like a super complicated way to choose a color. However, since we did it this way, the next few steps become incredibly easy. Drumroll please... it's time to add more players!
Add Player 2

Let's set up button B to be player two. You can simply select your button A block, and copy/paste it onto your workspace. Change the dropdown to read button B, and change your color to color2, and voila! We've created a second timer. Test it out on the emulator to be sure you like how it works.

I added a sound to each of these blocks as well, to give a little more user feedback when the timer starts for each player.
Adding More Even Players

Add more timers if you like! I added two more, and hooked them up to touch pad A2 and A5. Now the timers will reset whenever someone touches either of those copper pads on the Circuit Playground -- and it's fun to hook up alligator clips to capacitive touch pads and turn everyday objects into buttons. More about that on the Assembly page. For now, just make as many timers as you want!

Notice I also added a `color3` and `color4` variable for these two players. Remember to also add those to the `on start` block so you can define what colors you'd like them to be.

Adding a NeoPixel Strip

If you're hungry for even more lights, you can clip a NeoPixel strip onto your Circuit Playground with alligator clips, and get the strip to light up along with the timer as well. Here's how:
Start by telling the Circuit Playground that we have a NeoPixel strip on pin A1. This block is under the NEOPIXEL tab (you may need to click the LIGHT tab to see this one).

Anything in the NEOPIXEL tab will apply to the NeoPixel strip you've attached, whereas anything in the LIGHT tab applies to the lights on the face of the Circuit Playground.

Drag set strip to create strip on A1 with 30 pixels into your on start loop. If your strip has more than 30 pixels, change this block to reflect the number you have.

Now we'll set up another counter variable (let's call it stripCounter) and repeat some of the steps above to make the code apply to the NeoPixel strip. Basically the only difference is that we're dragging blocks from the NEOPIXEL tab (that say set strip..) instead of the LIGHT tab (that say set pixel..).

Here's a screenshot of how my code looks once I've added all the calls to stripCounter.
More Ideas

Take a look at the code you just wrote. It's complicated! Congratulations. It's doing a whole lot of things. From here, there are so many ways to tweak and customize the code. Some fun ideas:

- Try triggering the timer with a loud sound or a shake of the Circuit Playground instead of a button.
- See if you can get the colors to light up in a rainbow instead of a solid color.
- Try adding a five-second warning beep before the timer finishes.
- See if you can light up multiple NeoPixel strips, one for each timer.

Have fun playing!