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Overview

The general purpose computer coupled with the general purpose keyboard and mouse is a powerful combination, but wouldn't you like something a bit more specific purpose for launch applications, playing media, and firing off keyboard-combos? Enter the Launch Deck Trellis M4!

The Trellis M4 can emulate a USB keyboard, so your computer has no idea that when you press a single button on the Trellis M4 it isn't actually you pressing a four button keyboard combo on your real keyboard!

The Launch Deck Trellis M4 uses a simple CircuitPython program to send totally customized HID USB keycode and media commands with any of its colorful 32 buttons. You can decide which buttons do what, and color code them as you like. A red button to launch Gmail, an orange button for Firefox, a green button for an old school homebrew themed terminal window, and so on.

This guide will show you how to set up the NeoTrellis M4 to send keyboard combos out to an app launching program, such as Automator and Quicksilver on macOS, and AutoHotkey in Windows.
Parts

Adafruit NeoTrellis M4 with Enclosure and Buttons Kit Pack
So you've got a cool/witty name for your band, a Soundcloud account, a 3D-printed Daft Punk...
https://www.adafruit.com/product/4020

USB cable - USB A to Micro-B
This here is your standard A to micro-B USB cable, for USB 1.1 or 2.0. Perfect for connecting a PC to your Metro, Feather, Raspberry Pi or other dev-board or...
https://www.adafruit.com/product/592

NeoTrellis M4 Acrylic Enclosure Kit
So you've got your Adafruit NeoTrellis M4, a cool/witty name for your band, a Soundcloud account,
https://www.adafruit.com/product/3963
Silicone Elastomer 4x4 Button Keypad - for 3mm LEDs
So squishy! These silicone elastomer keypads are just waiting for your fingers to press them. Go ahead, squish all you like! (They’re durable and easy to clean, just wipe with mild... 
https://www.adafruit.com/product/1611

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**App Launching with Automator**

Before we can set up the NeoTrellis M4 buttons to launch our apps, we need to lay the foundation with software that can assign keyboard shortcuts to launch apps.

We're all accustomed to using certain keyboard shortcuts (e.g., control+c or command+d+c for copy) and media keys built into our keyboards (play/pause, mute, vol+/vol-). Some are universal and work in most apps, some are system wide, and most operating systems even allow a small degree of freedom in creating custom key combos to launch applications. However, this is often restrictive.

There is, therefore, a whole world of customizable macro script applications and services that can run on your computer in order to allow maximum control. You can search online for many options, here we'll cover three in particular, Automator, Quick silver, and Windows 10 Taskbar.
Automator

Automator is built into every macOS computer, so if you're on a mac, you've already got it!

Automator is incredibly powerful, as it can be scripted to do nearly anything and is neatly integrated into the operating system. It is commonly used to automate repetitive tasks, such as resizing and renaming huge groups of image files at the push of a button.

It can also be used as an application launcher, based upon keyboard shortcut entry. Here's an example of how you can set up Automator to launch Firefox with the keyboard combination of command+option+ctrl+1

Launch Automator

First, open Automator by finding it in your /Applications folder and double-clicking it.

It's possible to create app launching shortcuts directly from the System Preferences without using Automator, but this is a good way to learn to use Automator, which is capable of much more sophisticated macro-like behaviors as well.
Automator will start up and you'll be presented with a document type chooser window.

Click on the Service gear icon, then press the Choose button.

Action

Now, we have an empty service window waiting to be given an action. Click on the Actions box in the upper left corner of the interface, then click the Utilities item in the Li
library turndown to filter the actions to a smaller list. Then, click on Launch Application to highlight it.

Launch Application

Now, you can drag the Launch Application action over to the empty workspace on the right, this will add it to the service.
Input & Dropdown List

Next, we need to fine-tune some options. First of all, let's choose the application we want to launch from the dropdown list, in our case Firefox.app. Click where it currently says Contacts.app to show the full list popup, then find and click on Firefox.app.

Many services are set up to receive input of some kind, such as a file to manipulate, a bit of text to adjust, and so forth. Our service will not need any input, so we will change the Service receives selected field from the default of text to no input.
Test

It's a good idea to test out your action at this point -- simply click the Run button in the upper right corner and it will launch (or switch to) Firefox.

We want this service to run no matter where the system has focus, be it in the Finder, or a Terminal session, or inside of Photoshop, when we hit the shortcut to invoke the Firefox.app service, it should run. Therefore, we will leave the in field at the default of any application.

Save the Service

That's all there is to our service, so let's go ahead and save it. Click on File > Save... and then give it the name Firefox App Launch and click Save.
That does it for the Automator section of the process. The service has now been saved and is accessible by the entire operating system. (Confusingly, it saves with the ".workflow" extension, even though we specified that it is a "service", you can ignore this.) You can quit Automator now.

If you're curious about it, the .workflow file is saved to the /Users/your_name/Library/Services/ directory, a.k.a., ~/Library/Services

Keyboard Shortcut Setup

Now that we have created the service we need a way to invoke it with a keyboard shortcut. We'll do so from the Keyboard system preferences. Click on the Apple Menu > System Preferences...
Once the System Preferences window opens, click on the Keyboard entry.

Click on the Shortcuts button at the top, and then the Services entry on the left. This window allows you to set and change keyboard shortcuts. Scroll to the bottom of the list on the right and you’ll see our Firefox App Launch service.

If you really wanted to skip using Automator, jump to the App Shortcuts menu item on the left instead.
Click on the Firefox App Launch service and then click the Add Shortcut button.

The field wants you to type your shortcut, so go ahead and press command+option+c 

ctrl+1
Now, you can close the Keyboard Preference window and test it out! Press command + option + ctrl + 1 and you'll launch or switch to Firefox!

Later, we'll set up the Launch Pad Trellis M4 to send the same four-button shortcut at the press of a single, color-coded Firefox-orange button!

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**Quicksilver**

Quicksilver is an alternate way to create app launching shortcuts on macs. It is a free, open source app that can be used for all kinds of searching, automation, triggered actions, and more.

First, [download the latest Quicksilver](https://adafruit.it/D9w) and install it on your computer. Double-click the Quicksilver icon in your Applications folder to run it.

To add app launching actions, click on the Quicksilver > Triggers... menu item.
In the Triggers window, click on the + sign and Keyboard item to add a trigger.
This will pop up the trigger creation window. Click in the top field and start typing "firefox" to have it autofill Firefox.app.

Click Save.

Assign Shortcut

Now, we'll add a keyboard shortcut. Double-click the word None under the Trigger column for the Open Firefox.app trigger entry. Then, in the shortcut field, create your shortcut, command+option+ctrl+1.
As you add more of them, you will build up a nice list of apps to launch with shortcuts!

When we set up the CircuitPython code we'll use this list of shortcuts as well as some new ones that don't require an app launching program, such as the media keys and screenshot hotkeys.

**Windows App Launching**

There are many different ways to launch applications from keyboard shortcuts in Windows. Here are a few to try.
Windows 10 Task Bar

A very quick and easy way to launch apps in Windows 10 is with keyboard shortcuts which correspond to the first ten apps pinned to your taskbar. By holding the Windows key plus any number from 1 - 0 (pretend the '0' is a '10') you can automatically launch that item.

So, place Chrome as the second item on your taskbar and then press windows+2 to launch. Easy!

This method works in Ubuntu Linux as well! The 'Super' key stands in for the 'Windows' key.

AutoHotkey

AutoHotkey ([https://adafru.it.Dao](https://adafru.it.Dao)) is a free, Open Source scripting language for Windows that allows you to automate all kinds of tasks on your machine, including setting up app launching keyboard shortcuts.
You can download it here (https://adafru.it/Dap) and then check out this tutorial to get started. (https://adafru.it/Daq)

Once you've installed AutoHotkey, it's a good idea to get familiar with it by doing the basic tutorial. Then, you can create shortcut launch scripts for any application you like. Here's an example script that uses windows+ctrl+alt+w to launch Chrome:

```
#^!w::
Run, Chrome.exe
return
```

Save and launch that script, and now when you set up your Launch Deck Trellis M4 code in CircuitPython you'll specify the windows+ctrl+alt+w keycode combo for your Chrome button!

Keyboard Launchpad

From Stardock, the $10 Keyboard Launchpad app (https://adafru.it/Dar) makes it very easy to set up app launching hotkeys.
If you are new to CircuitPython, we recommend you start with the Welcome to CircuitPython Guide (https://adafru.it/Bid) then come back here.

Adafruit recommends installing and using the Mu editor on your computer to edit CircuitPython files. Mu is available for Windows, macOS, and Linux. You can learn about Mu in this guide (https://adafru.it/ANO).

CircuitPython Preparation

To prepare the NeoTrellis M4 to run the code, follow these steps:

- Update the bootloader for NeoTrellis (https://adafru.it/RAw) from the Trellis M4 guide
- Install the latest version of CircuitPython (at least 4.0.0 Alpha 3) for NeoTrellis M4.

Download the latest version of CircuitPython for this board via CircuitPython.org

https://adafru.it/Em6

Click the link above to download the latest UF2 file.
Download and save it to your desktop (or wherever is handy).

Plug your NeoTrellis M4 Express into your computer using a known-good USB cable.

A lot of people end up using charge-only USB cables and it is very frustrating! So make sure you have a USB cable you know is good for data sync.

Double-click the Reset button next to the USB connector on your board, and you will see the status DotStar RGB LED turn green. If it turns red, check the USB cable, try another USB port, etc.

If double-clicking doesn't work the first time, try again. Sometimes it can take a few tries to get the rhythm right!

You will see a new disk drive appear called TRELM4BOOT.

Drag the adafruit_circuitpython_etc.uf2 file to TRELM4BOOT.

The LED will flash. Then, the TRELM4BOOT drive will disappear and a new disk drive called CIRCUITPY will appear.

- Get the latest CircuitPython library pack (https://adafru.it/zB-) matching your version of CircuitPython and save it onto your hard drive. You will need three .mpy files and one folder within the library pack for this guide. Drag the files listed below over into the /lib folder on CIRCUITPY:
  - adafruit_trellism4.mpy
  - adafruit_hid folder
  - neopixel.mpy
  - adafruit_matrixkeypad.mpy

USB keyboards and mice show up on your computer as 'HID' devices, which stands for 'Human Interface Device'
HID Keyboard Basics

This guide page (https://adafru.it/DaD) has a great intro to CircuitPython HID Keyboard.

For even more details, check out the documentation at https://circuitpython.readthedocs.io/projects/hid/en/latest/ which includes all of the keycodes and media codes you can use.

First, we'll import the adafruit_hid library into our program. This will allow us to make calls to send keyboard keys and media keys.

```python
from adafruit_hid.keyboard import Keyboard
from adafruit_hid.keycode import Keycode
from adafruit_hid.consumer_control import ConsumerControl
from adafruit_hid.consumer_control_code import ConsumerControlCode

kbd = Keyboard(usb_hid.devices)
cc = ConsumerControl(usb_hid.devices)
```

Keyboard Press/Release

Now we can send this command to "type" the letter 'a':

```python
kbd.press(Keycode.A)
```

```python
kbd.release(Keycode.A)
```

This would send a lowercase 'a' to the computer just as if you had typed it yourself. To send a capital 'A', we'd add the shift key to the command like this:

```python
kbd.press(Keycode.SHIFT, Keycode.A)
```

```python
kbd.release(Keycode.SHIFT, Keycode.A)
```

This is pretty cool, since it means we can layer on lots of keys all at the same time, just like you do on your physical keyboard when using keyboard shortcuts!

So, if there's some keyboard shortcut you want to use (or create for yourself in something like Quicksilver or AutoKeys) that is command+option+ctrl+a the CircuitPython code would look like this:
kbd.press(Keycode.GUI, Keycode.ALT, Keycode.CONTROL, Keycode.A)

kbd.release(Keycode.GUI, Keycode.ALT, Keycode.CONTROL, Keycode.A)

Media Control

There is a second command we'll use when we want to adjust volume, play/pause, skip tracks, and so on with media such as songs and videos. These are often represented on a physical keyboard as icons silkscreened onto the rightmost function keys.

In USB HID speak, these are known as "Consumer Control codes". To play or pause a track we'll use this command:

cc.send(ConsumerControlCode.PLAY_PAUSE)

Launch Deck Code

Here's the full code for the Launch Deck. Copy it and then paste it into Mu and save it to your Trellis M4 as code.py

Now, you'll need to edit the keycodes sent in the code to the ones you want to use! Just remember to match them up with your app launcher, such as Quicksilver, AutoKeys, or whatever you choose!

```python
#  Launch Deck Trellis M4
#  USB HID button box for launching applications, media control, camera switching and more
#  Use it with your favorite keyboard controlled launcher, such as Quicksilver and AutoHotkey

import time
import random
import adafruit_trellism4
import usb_hid
from adafruit_hid.keyboard import Keyboard
from adafruit_hid.keycode import Keycode
from adafruit_hid.consumer_control import ConsumerControl
from adafruit_hid.consumer_control_code import ConsumerControlCode

# Rotation of the trellis. 0 is when the USB is upself.
```
# The grid coordinates used below require portrait mode of 90 or 270

ROTATION = 270

# the two command types -- MEDIA for ConsumerControlCodes, KEY for Keycodes
# this allows button press to send the correct HID command for the type specified
MEDIA = 1
KEY = 2

# button mappings
# customize these for your desired positions, colors, and keyboard combos
# specify (button coordinate): (color hex value, command type, command/keycodes)
keymap = {
    (0, 0): (0x001100, MEDIA, ConsumerControlCode.PLAY_PAUSE),
    (1, 0): (0x110011, MEDIA, ConsumerControlCode.SCAN_PREVIOUS_TRACK),
    (2, 0): (0x110011, MEDIA, ConsumerControlCode.SCAN_NEXT_TRACK),
    (3, 0): (0x000033, MEDIA, ConsumerControlCode.VOLUME_INCREMENT),
    (0, 1): (0x000000, MEDIA, ConsumerControlCode.MUTE),
    (3, 1): ((0, 0, 10), MEDIA, ConsumerControlCode.VOLUME_DECREMENT),
    (0, 2): (0x551100, KEY, (Keycode.GUI, Keycode.AL, Keycode.CNTRL, Keycode.ONE)),
    (1, 2): (0x221100, KEY, (Keycode.CNTRL, Keycode.SHFT, Keycode.TAB)),  # back cycle tabs
    (2, 2): (0x221100, KEY, (Keycode.CNTRL, Keycode.TAB)),  # cycle tabs
    (3, 2): (0x333300, KEY, (Keycode.GUI, Keycode.AL, Keycode.CNTRL, Keycode.TW)),
    (0, 3): (0x001155, KEY, (Keycode.GUI, Keycode.AL, Keycode.CNTRL, Keycode.THREE)),
    (3, 3): (0x330000, KEY, (Keycode.GUI, Keycode.AL, Keycode.CNTRL, Keycode.FO)),
    (0, 4): (0x005511, KEY, (Keycode.GUI, Keycode.AL, Keycode.CNTRL, Keycode.FIVE)),
    (1, 4): (0x440000, KEY, (Keycode.GUI, Keycode.AL, Keycode.CNTRL, Keycode.SIX)),
    (3, 4): (0x003300, KEY, (Keycode.GUI, Keycode.AL, Keycode.CNTRL, Keycode.EIGHT)),
    (0, 5): (0x222222, KEY, (Keycode.GUI, Keycode.AL, Keycode.CNTRL, Keycode.W)),
    (1, 5): (0x000044, KEY, (Keycode.GUI, Keycode.AL, Keycode.CNTRL, Keycode.E)),
    (3, 5): (0x332211, KEY, (Keycode.GUI, Keycode.AL, Keycode.CNTRL, Keycode.T)),
    (0, 6): (0x001133, KEY, (Keycode.GUI, Keycode.AL, Keycode.CNTRL, Keycode.C)),
    (1, 6): (0x331100, KEY, (Keycode.GUI, Keycode.AL, Keycode.CNTRL, Keycode.V)),
    (2, 6): (0x111111, KEY, (Keycode.GUI, Keycode.CNTRL, Keycode.FO)),  # screen shot
    (3, 6): (0x110000, KEY, (Keycode.GUI, Keycode.AL, Keycode.CNTRL, Keycode.N)),
    (0, 7): (0x060606, KEY, (Keycode.GUI, Keycode.H)),  # hide front app, all windows
    (1, 7): (0x222200, KEY, (Keycode.GUI, Keycode.GRAVE_ACCENT)),  # cycle windows
    (2, 7): (0x010001, KEY, (Keycode.GUI, Keycode.TAB)),  # cycle apps backwards
    (3, 7): (0x010001, KEY, (Keycode.GUI, Keycode.TAB))  # cycle apps forwards
}

# Time in seconds to stay lit before sleeping.
TIMEOUT = 90

# Time to take fading out all of the keys.
FADE_TIME = 1
# Once asleep, how much time to wait between "snores" which fade up and down one button.
SNORE_PAUSE = 0.5

# Time in seconds to take fading up the snoring LED.
SNORE_UP = 2

# Time in seconds to take fading down the snoring LED.
SNORE_DOWN = 1

TOTAL_SNORE = SNORE_PAUSE + SNORE_UP + SNORE_DOWN

kbd = Keyboard(usb_hid.devices)
cc = ConsumerControl(usb_hid.devices)
trellis = adafruit_trellism4.TrellisM4Express(rotation=ROTATION)

for button in keymap:
trellis.pixels[button] = keymap[button][0]

current_press = set()
last_press = time.monotonic()

while True:
    pressed = set(trellis.pressed_keys)
    now = time.monotonic()
    sleep_time = now - last_press
    sleeping = sleep_time > TIMEOUT

    for down in pressed - current_press:
        if down in keymap and not sleeping:
            print("down", down)
            # Lower the brightness so that we don't draw too much current when we turn all of
            # the LEDs on.
            trellis.pixels.brightness = 0.2
            trellis.pixels.fill(keymap[down][0])
            if keymap[down][1] == KEY:
                kbd.press(*keymap[down][2])
            else:
                cc.send(keymap[down][2])
            # else if the entry starts with 'l' for layout.write
            last_press = now

    for up in current_press - pressed:
        if up in keymap:
            print("up", up)
            if keymap[up][1] == KEY:
                kbd.release(*keymap[up][2])

    # Reset the LEDs when there was something previously pressed (current_press)
    # but nothing now # (pressed).
    if not pressed and current_press:
        trellis.pixels.fill((0, 0, 0))
        for button in keymap:
            trellis.pixels[button] = keymap[button][0]

    if not sleeping:
        snore_count = -1
    else:
        sleep_time -= TIMEOUT
        # Fade all out
        if sleep_time < FADE_TIME:
            brightness = (1 - sleep_time / FADE_TIME)
            # Snore by pausing and then fading a random button up and back down.
            else:
                sleep_time -= FADE_TIME
                current_snore = int(sleep_time / TOTAL_SNORE)
                # Detect a new snore and pick a new button
                if current_snore > snore_count:
Customizing

In order to customize the Launch Deck, you'll want to know a few things about how the Trellis M4 code in CircuitPython works. This guide (https://adafru.it/D2W) is a great place to read up on all the details, but we'll go over a few specifics here.

Single, Unmodified Keystrokes

If you want to use the Launch Deck to send a single, unmodified keystroke, we need to enclose it in brackets. This is because of the code's expectation of a tuple.

So, to send a letter g with the bottom, left button in portrait orientation, this would be the command (replacing line 61 in the code above):

```
(0, 7): (0x052405, KEY, ([Keycode.G])),
```

Button Coordinates

The Trellis M4 can be oriented in landscape (wide) or portrait (tall) modes. We've set the rotation to portrait mode, so the button grid coordinate system consists of eight rows of four buttons. Here's an example with the rotation set at 90.
Add a Button

Let's say you wanted to add a button to the second row. Currently, there are two unused ones in that row in our example code.

This is the code currently:

```
(0,1): (0x110000, MEDIA, ConsumerControlCode.MUTE),
# intentional blank button
# intentional blank button
(3,1): ((0,0,10), MEDIA, ConsumerControlCode.VOLUME_DECREMENT),
```

Here you can see we've made it easy to drop in two more buttons by commenting out the second and third lines.
So, let’s add a shortcut to the second button that is green and can be used to force a reload on a web page in a web browser inside of Windows (you can also add this on a macOS machine by following these instructions (https://adafru.it/Dbe)). That's the ctrl+F5 key combo.

First, we need to specify the button coordinate: \((1,0)\):

Then, we'll specify the green color. You can use an RGB color value such as \((0,50,0)\) or a hexadecimal color value. \((0x004400)\) You don't want them too bright, so these are dimmer green values.

Next, we specify that this is a keycode, rather than a media key with the \texttt{KEY} flag.

Lastly, we list out any keys that will be held down simultaneously, in this case \((\texttt{Keycode.CONTROL, Keycode.F5})\)

This is the full line of code: \((1,1): (0x004400, \texttt{KEY}, (\texttt{Keycode.CONTROL, Keycode.F5}))\)

And, here it is inserted among the rest of that row:

\[
(0,1): (0x110000, \texttt{MEDIA, ConsumerControlCode.MUTE}),
(1,1): (0x004400, \texttt{KEY}, (\texttt{Keycode.CONTROL, Keycode.F5})),
# intentional blank button
(3,1): ((0,0,10), \texttt{MEDIA, ConsumerControlCode.VOLUME_DECREMENT}),
\]

**Edit a Button**

If you want to edit the functionality or color of an existing button, simply edit that section. For example, to set the mute button to blue:

\[
(0,1): (0x000011, \texttt{MEDIA, ConsumerControlCode.MUTE})
\]

**Button Removal**

To remove a button you can simply delete the line of code, or just comment it out with a '\#' symbol like this:

\[
# (0,1): (0x110000, \texttt{MEDIA, ConsumerControlCode.MUTE}),
(1,1): (0x004400, \texttt{KEY}, (\texttt{Keycode.CONTROL, Keycode.F5})),
\]
That will effectively remove the first button of the second row.

Layout Tips

Here’s how I have mine laid out. Here are a few tips for an easy-to-use Launch Deck:

- Color code buttons to their icons
• Group like things together in rows or columns. The entire upper two row set is used for media control here
• Notice the brighter colored Vol + above the dimmer Vol - which mimics a remote control layout
• Leave some space. Blank buttons help serve as visual landmarks for the important functional buttons nearby