



DesignNews

Getting Hands-On With the M5Stack Core Platform

DAY 3: Building M5Stack Interactive Light and Sound Devices

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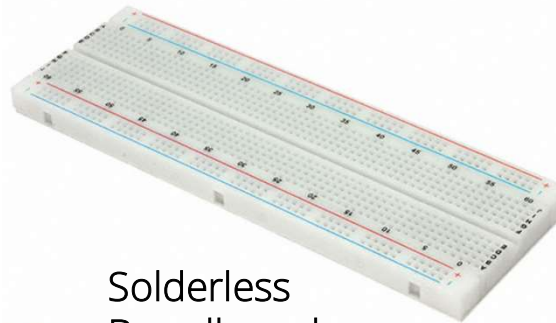
Dr. Don Wilcher

Visit 'Lecturer Profile' in your console for more details.

M5Go IoT Starter Kit V2.6



Course Kit and Materials

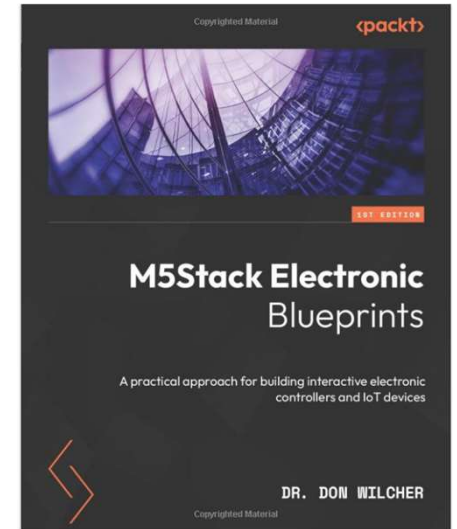


Solderless Breadboard



Adafruit Parts Pal Kit

2 Channel SPST Relay Unit



Agenda:

- M5Stack Core Hardware
- Research-Theory Perspective
- The M5Stack Core Speaker Circuit Characteristics
 - a) Programming sound with the M5Stack Core
 - b) Building a Basic Warning Alarm
- Programming the M5Stack Core RGB Bar
- Programming the M5Stack Core RGB LED as a Flashlight
- Building an M5Stack Core RGB LED Flasher

M5Stack Core UIs



“An important note in designing and developing M5Stack Core UIs is simplicity. Simplicity is the design consideration consisting of using the important UI elements for communicating features and functions of your M5Stack Core device. (Wilcher, 2023, p. 24).”

M5Stack Core Hardware



- Several internal hardware circuits support the M5Stack Core.
- The internal hardware circuits allow visual interactive devices to engage the human senses.
- The internal hardware circuits can be accessed using Blockly Code, C++, or MicroPython.
- The internal hardware circuits to be explored in this webinar session are listed next.
 - a) The M5Stack Core speaker-amplifier
 - b) The M5Stack Core RGB LED bar

Question 1

What are the two internal circuits to be explored in this webinar session?

- a)The M5Stack Core pushbuttons**
- b)The M5Stack RGB LED bar**
- c)The M5Stack Core speaker-amplifier**
- d)b&c**



M5Stack Unit Overview. . .



A Research–Theory Perspective:

The M5Stack Core and supporting Units provide a low entry point into rapid prototyping of small physical computing or Human-Computer Interaction (HCI) devices. Thus, engaging the product development team in research/design activities (Bellucci et al., 2017).

M5Stack Unit Overview. . .



A Research–Theory Perspective:

Visual and Acoustic alarm modules



Designing a Wearable Systems for Emergency and Work (Bonfiglio & De Rossi, 2011).

1-Visual alarm module (1x in the FF OG, 2x in the CP OG); 2-acoustic alarm module; 3-external temperature sensor; 4-Wi-Fi communication module; 5-Professional Electronic Box (PEB); 6-triaxial accelerometers (2x); 7-GPS module; 8-Flexible antenna (2x); 9-Flexible battery; 10-CO sensor; 11-Heat flux sensor (only FF OG)

The M5Stack Core Speaker Circuit Characteristics



- The M5Stack Core speaker circuit allows:
 - a) the programmable unit to be transferred into a portable creative sound generator.
 - b) a 3W class D amplifier to drive the M5Stack Core speaker.
 - c) the creation of an efficient driver circuit. Note: A class D amplifier has an efficiency of 90%.
- The thermal dissipation is reduced to the switching of the amplifier's output transistor.
- Pulse Width Modulation (PWM) is used to reduce the thermals based on the switching of the amplifier's output transistors.

The M5Stack Core Speaker Circuit Characteristics. . .

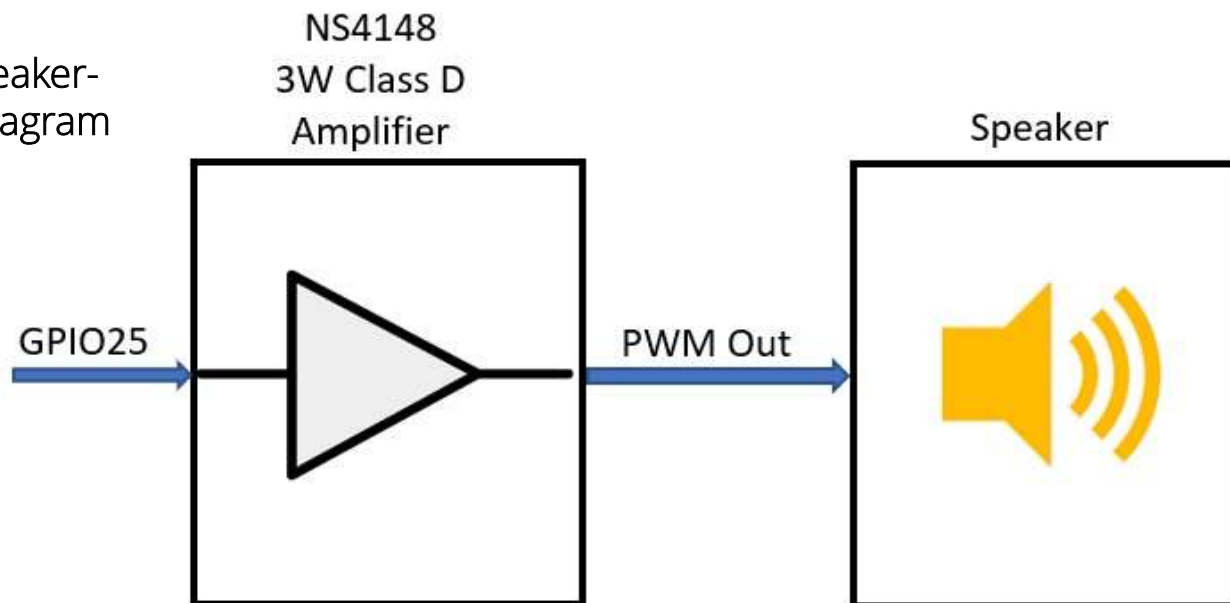
M5Stack Core Speaker-
Amplifier Block Diagram

Image courtesy of the author

The M5Stack Core Speaker Circuit Characteristics. . .

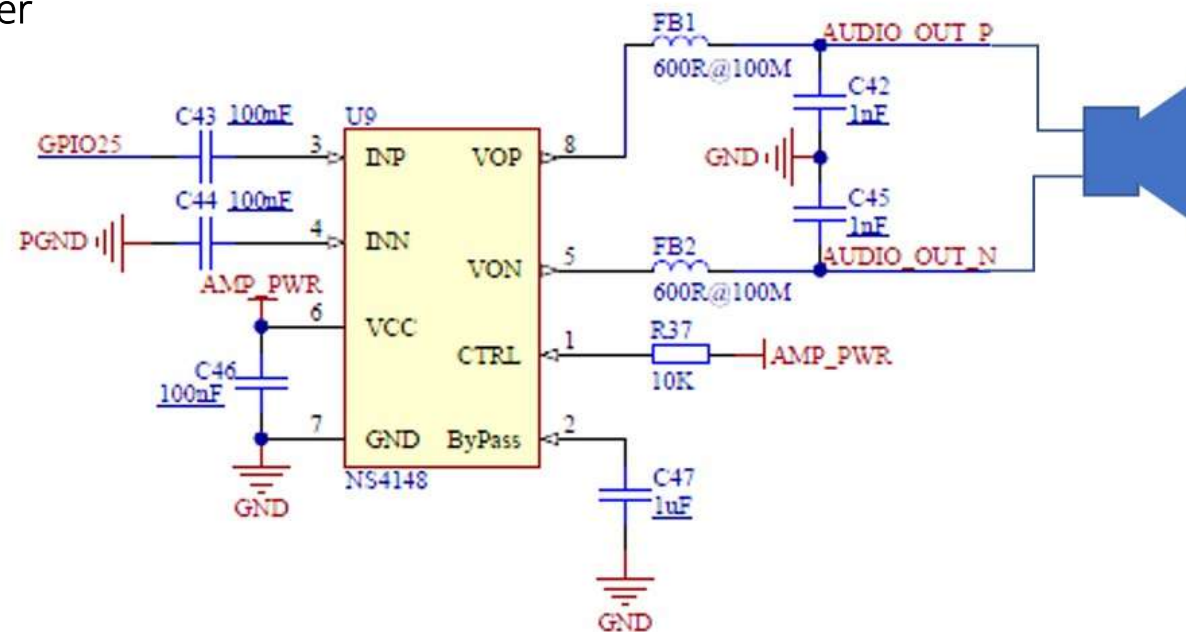
M5Stack Core Speaker-Amplifier
Block Subcircuit diagram

Image courtesy of M5Stack

Question 2

What type of amplifier circuit is shown on slide 13 ?

- a) class A amplifier**
- b) class AB amplifier**
- c) class D amplifier**
- d) none of the above**



The M5Stack Core Speaker Circuit Characteristics. . .



Programming Sound with a M5Stack Core:
A Basic Warning Alarm Block Diagram

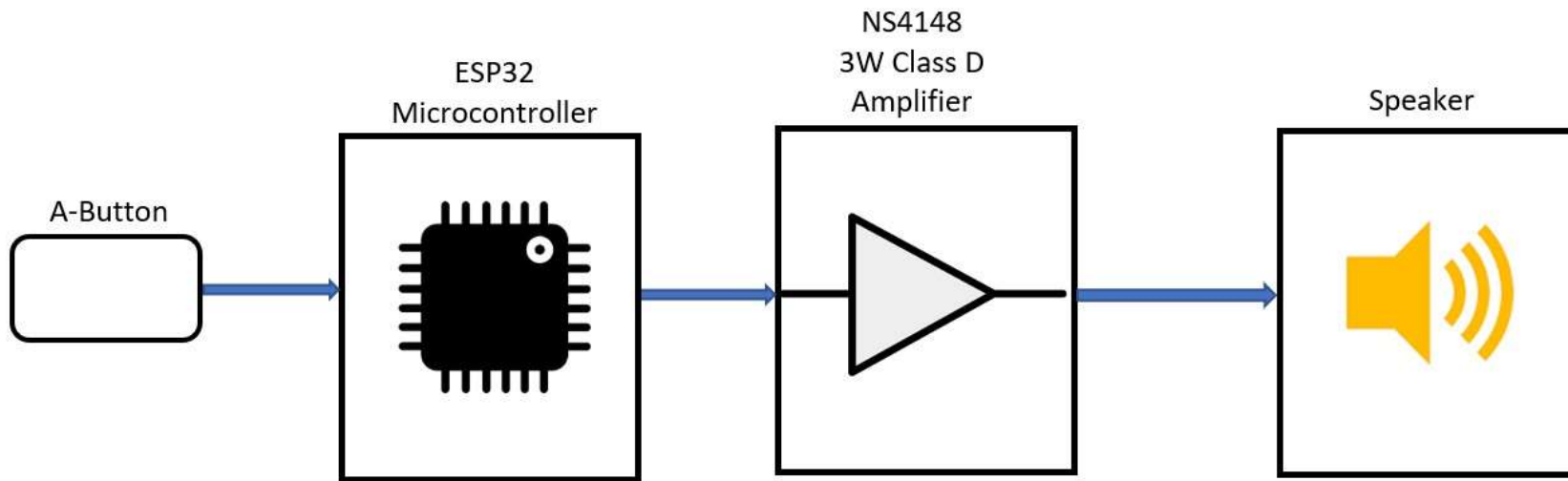
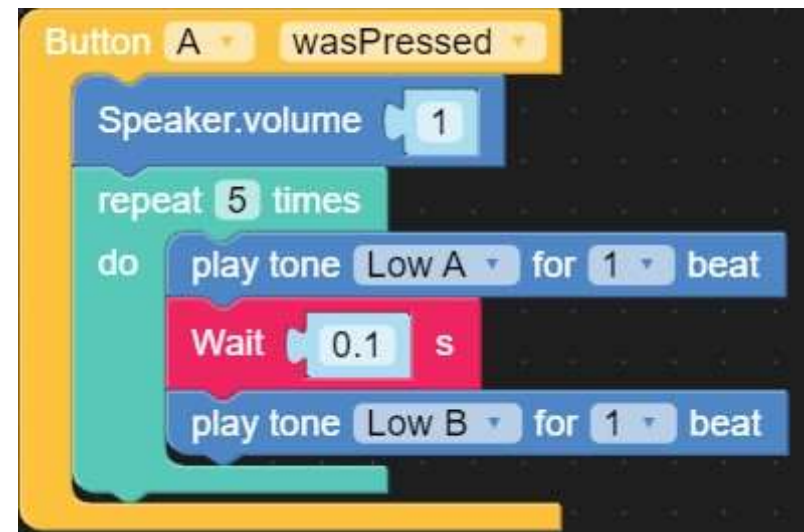


Image courtesy of the author

The M5Stack Core Speaker Circuit Characteristics. . .



Programming Sound with a M5Stack Core:
A Basic Warning Alarm Blockly Code



Images courtesy of the author

The M5Stack Core Speaker Circuit Characteristics. . .



Programming Sound with a M5Stack Core:
A Basic Warning Alarm UI

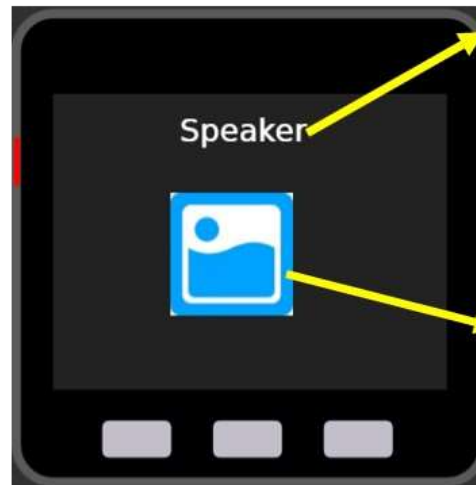
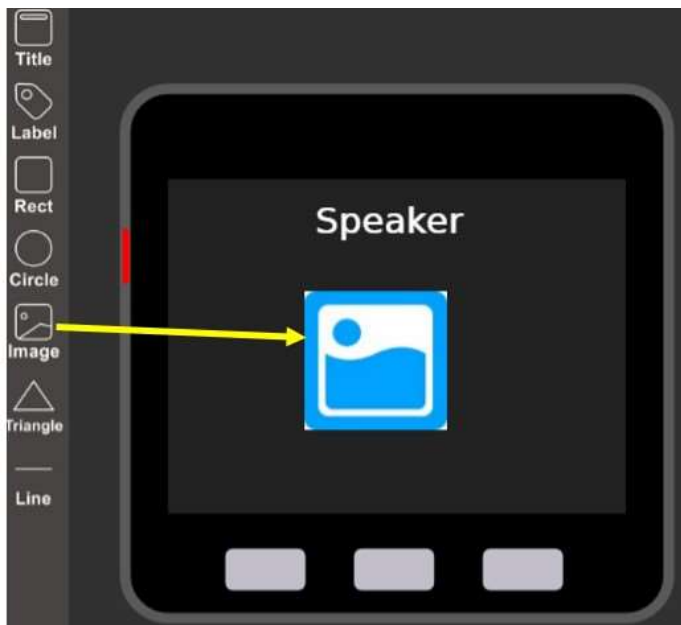


Image courtesy of the author

The M5Stack Core Speaker Circuit Characteristics. . .



Programming Sound with a M5Stack Core:
A Basic Warning Alarm UI: Adding Speaker Image Icon



label0 vibrator8 unit.get(unit.V) x

name:	label0
x:	103
y:	17
color:	
text:	Speaker
font:	DejaVuSans 24 ▾
rotation:	0
layer:	4

image0 x

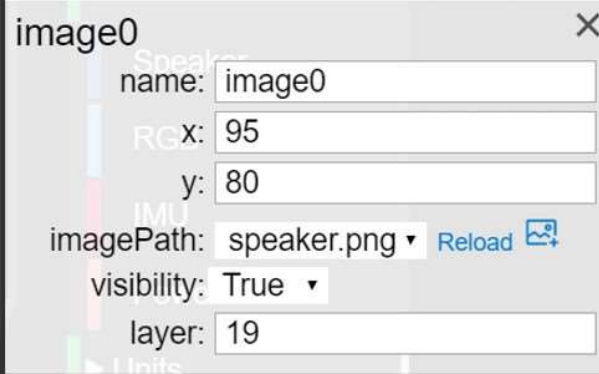
name:	image0
x:	95
y:	80
imagePath:	▾ Reload
visibility:	True ▾
layer:	19

The M5Stack Core Speaker Circuit Characteristics. . .

Programming Sound with a M5Stack Core:
A Basic Warning Alarm UI: Adding Speaker Image Icon. . .



Speaker Icon visible on M5Stack Core



Programming the M5Stack Core RGB Bar



- The M5Stack Core has internal RGB LEDs that are operated by the device's internal ESP32 Microcontroller.
- The SK6812 is the programmable family of RGB LEDs.
- The SK6812 integrates a smart control circuit with an optoelectronic emitter.
- Integration of the two semiconductor devices make a programmable LED.
- The SK6812 is a Red, Green, Blue, and White (RGBW) LED component.
- The SK6812 LED can emits a natural white light.



Programming the M5Stack Core RGB Bar...

SK6182 LED Component

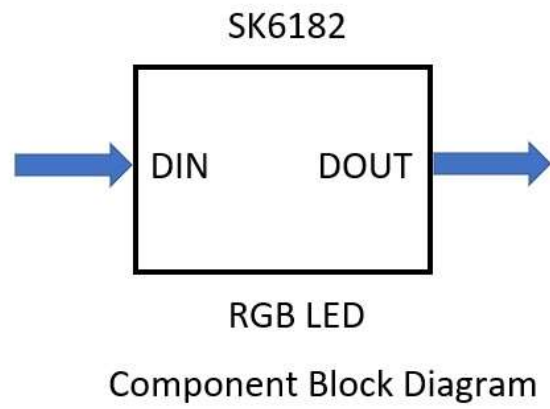
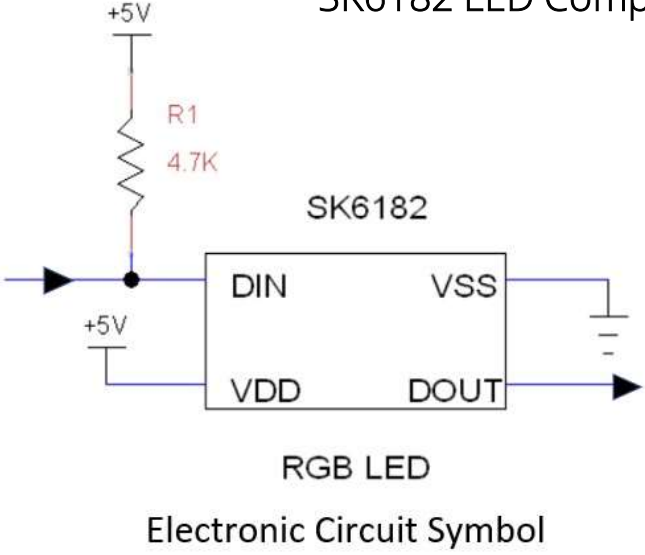


Image courtesy of szledcolor and the author

Question 3

Which type of programmable device is the SK6182?

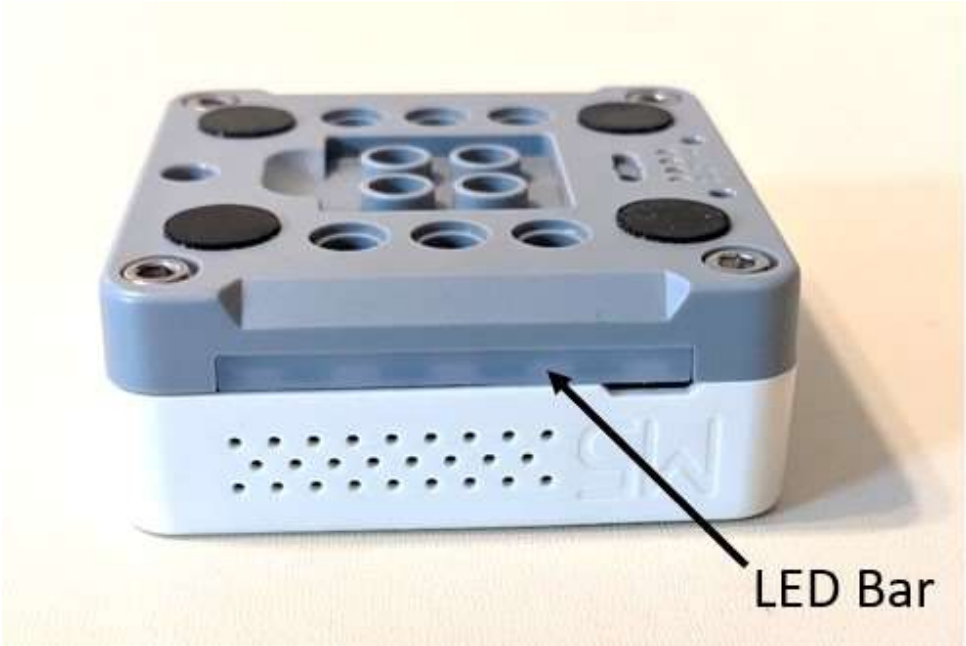
- a) microprocessor**
- b) microcontroller**
- c) unijunction transistor**
- d) LED**



Programming the M5Stack Core RGB Bar...



SK6182 LED Component



2 LED Bars:
One on
each side

Image courtesy of the author

Wilcher, D. (2023, p. 89). *M5Stack Electronic Blueprints*. Packt.



Programming the M5Stack Core RGB Bar...

RGB Flasher Block Diagram

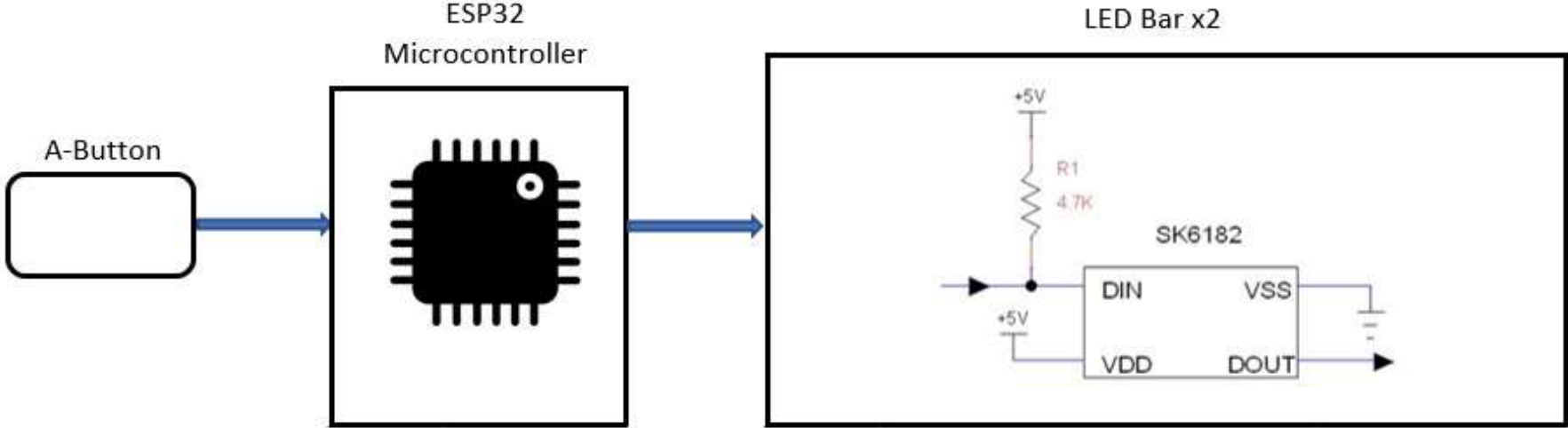
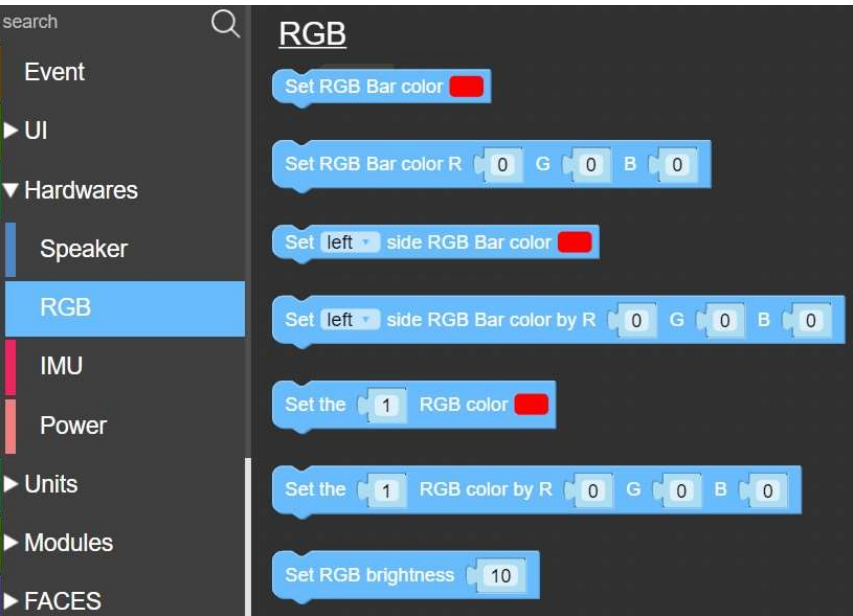


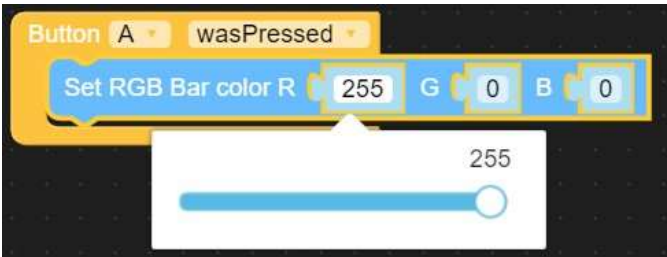
Image courtesy of the author



Programming the M5Stack Core RGB LED as a Flashlight



The A-Button Control color scheme setup



Adjusting each color LED to 255

Images courtesy of the author

Wilcher, D. (2023, p. 91). *M5Stack Electronic Blueprints*. Packt.

Question 4

What RGB values are used to turn off the RGB LED using the “set RGB Bar color” Blockly code block?

- a) 0 1 0**
- b) 1 0 0**
- c) 1 1 0**
- d) 0 0 0**





Programming the M5Stack Core RGB LED as a Flashlight. . .

Establishing the Flashlight A-Button/B-Button Controls



The RGB color values to emit White Light from the RGB LED Bar

The RGB color values to turn off the White Light from the RGB LED Bar

Image courtesy of the author

Programming the M5Stack Core RGB LED as a Flashlight. . .

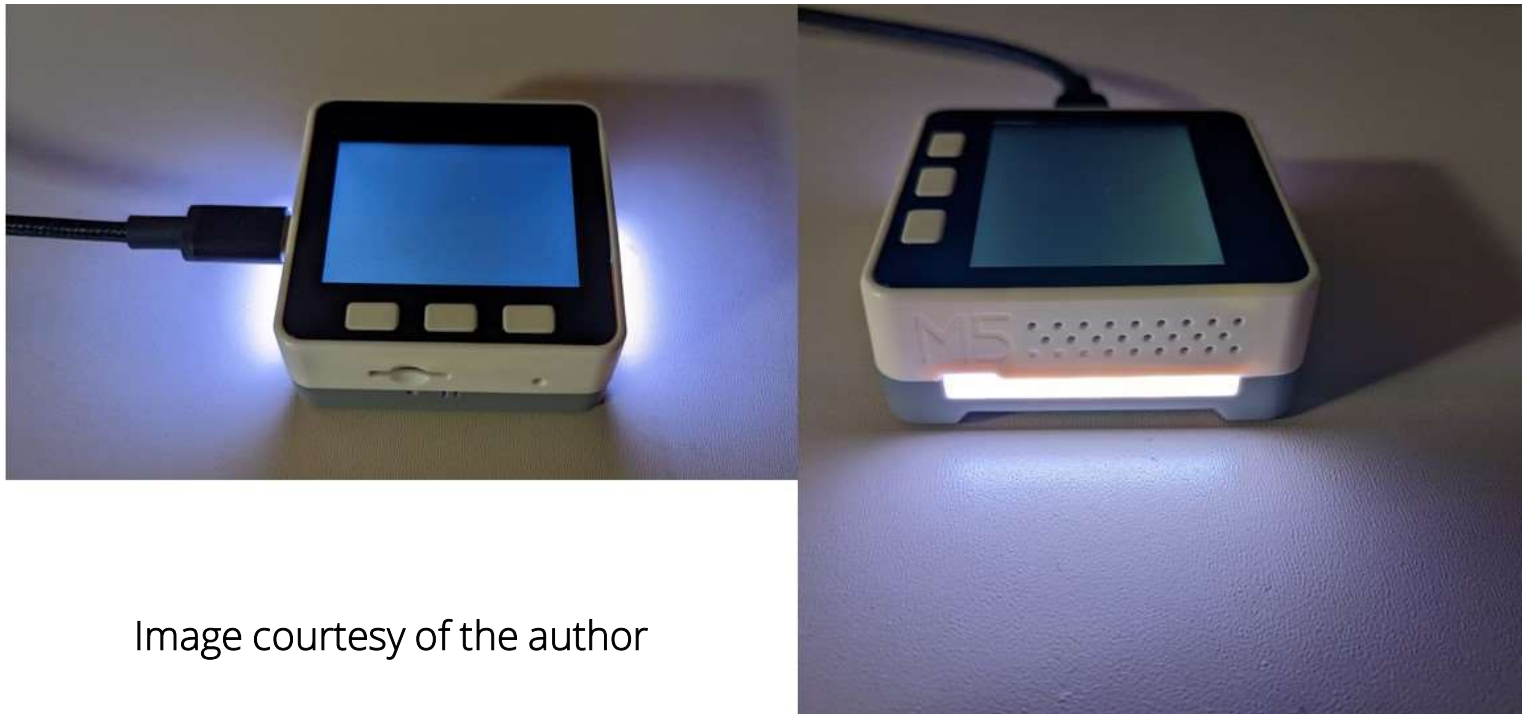


Image courtesy of the author

Wilcher, D. (2023, p. 92). *M5Stack Electronic Blueprints*. Packt.

Building a M5Stack Core RGB LED Flasher



- The RGB LED bars will flash until the *repeat* value is reached.
- The A button starts the RGB LED bars' flashing cycle.
- The *repeat* loop code block will run a set of code block instructions.
- When the *repeat* loop code has completed the RGB LED bars flashing operation, the effect will stop.
- A counter is used to track the programmed *repeat* cycles.

Building a M5Stack Core RGB LED Flasher

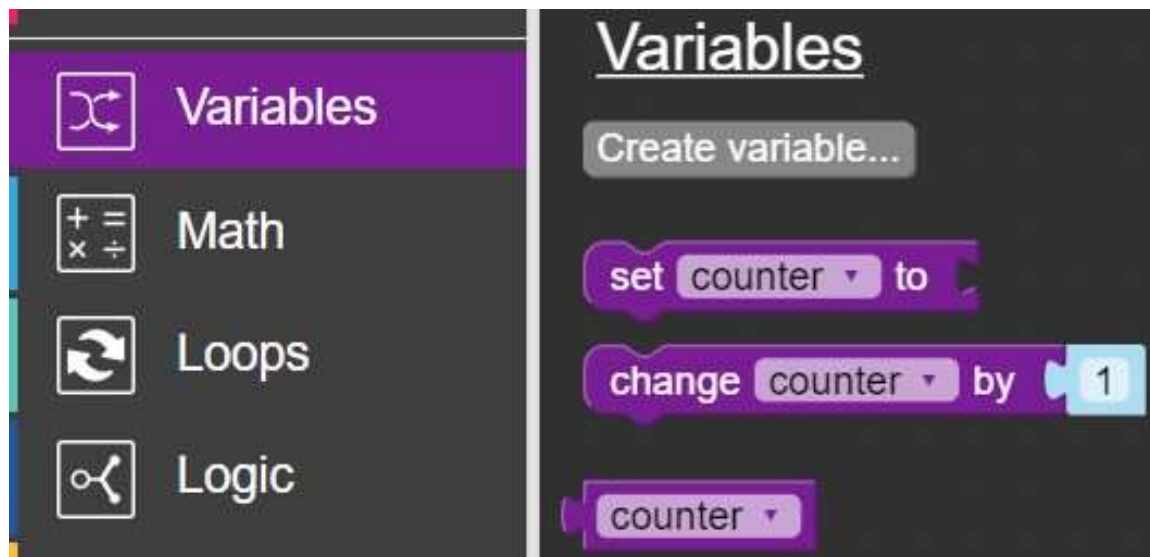


```
Button A wasPressed
  set counter to 0
  repeat 10 times
    do
      Set RGB Bar color R 255 G 255 B 255
      Wait 1 s
      Set RGB Bar color R 0 G 0 B 0
      Wait 1 s
      change counter by 1
      Label label0 show counter
```

Blockly Code for RGB LED Flasher

Image courtesy of the author

Building a M5Stack Core RGB LED Flasher. . .



Creating a "counter" variable

Image courtesy of the author

Building a M5Stack Core RGB LED Flasher...



label0

Logic

name: label0

x: 141

y: 81

color:

text: Text

font: DejaVuSans 40 ▾

rotation: 0

layer: 5

Creating a "Counter" UI

Image courtesy of the author

Wilcher, D. (2023, p. 93). *M5Stack Electronic Blueprints*. Packt.

Building a M5Stack Core RGB LED Flasher. . .

Functional RGB LED Flasher with Counter

<https://youtu.be/gkEUGFP8rw8>

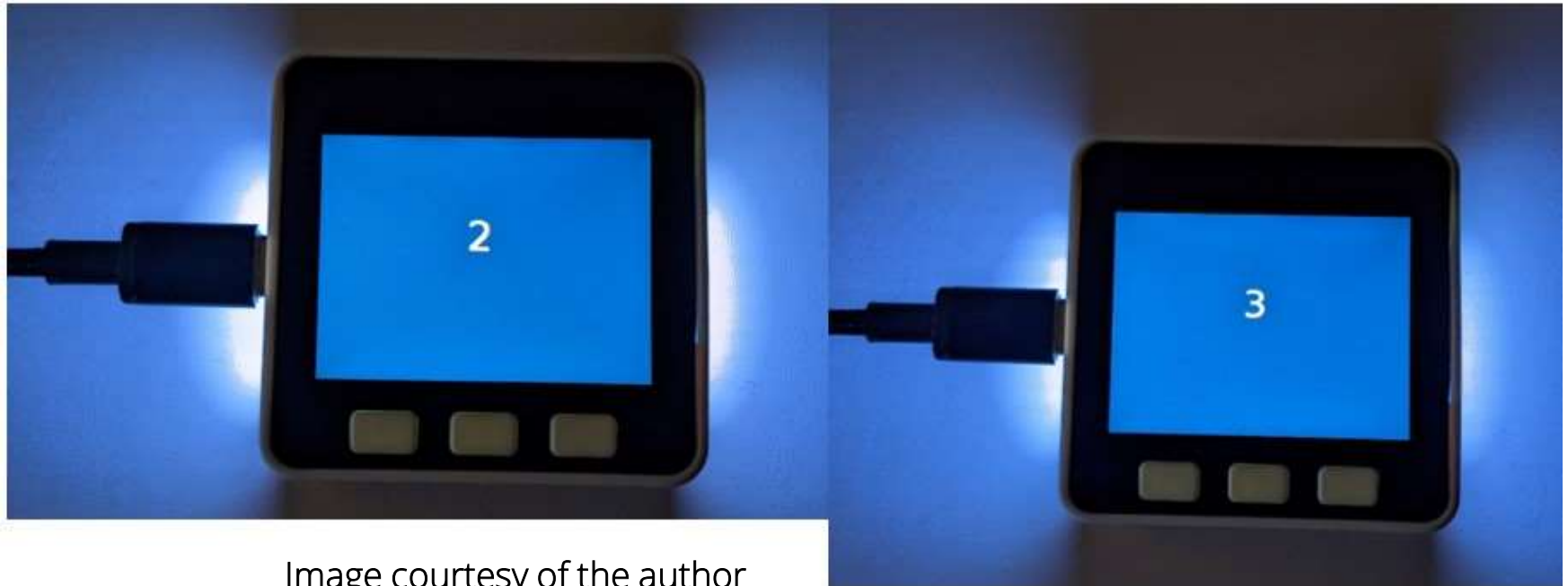


Image courtesy of the author

Question 5

What is the function of the *counter* Blockly code block shown in slide 30?

- a) provide a nice visual on the M5Stack Core's TFT LCD**
- b) to change the LED colors automatically**
- c) to track the programmed repeat cycles**
- d) none of the above**



Thank you for attending

Please consider the resources below:

Bellucci, A., Aedo, I., & Diaz, P. (2017). ECCE toolkit: Prototyping ping sensor-based interaction. *Sensors*, 17(3), 438. <https://doi.org/10.3390/s17030438>

Bonfiglio, A., & DeRossi, D. (Eds.). (2011). *Wearable monitoring systems*. Springer. <https://link.springer.com/book/10.1007/978-1-4419-7384-9>

Wilcher, D. (2023). *M5Stack electronic blueprints*. Packt.

M5Stack Electronic Blueprints Code:

<https://github.com/PacktPublishing/M5Stack-Electronic-Blueprints>



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