Your digital Toolbox (2) – Getting things done

Physical Computing and Rapid Prototyping for Artists

New Talents Ruhr, 2024 · Day 01 · Johannes Bereiter-Payr

Variables explained in one minute (I)

- Program memory ≠ working memory (aka. RAM)
- Everything in memory is actually a number (also letters)
- Variables = a named (reserved) place in memory
- Data types = tells the program what to expect, ie. how large a number may get or how to interpret it
  - bool: only 0 or 1, ie. True or False
  - int: integral (whole) number – eg. 8-bit numbers: 0..255
  - float, double: decimal numbers, ie. 3.1459...
  - char: characters, ie. Letters, not to be used for math

Variables explained in one minute (II)

- Variables must be declared before they can be used (like reserving a seat)

```
int_8t my_variable;
float another_variable = 0.;
```

- Assign values with =

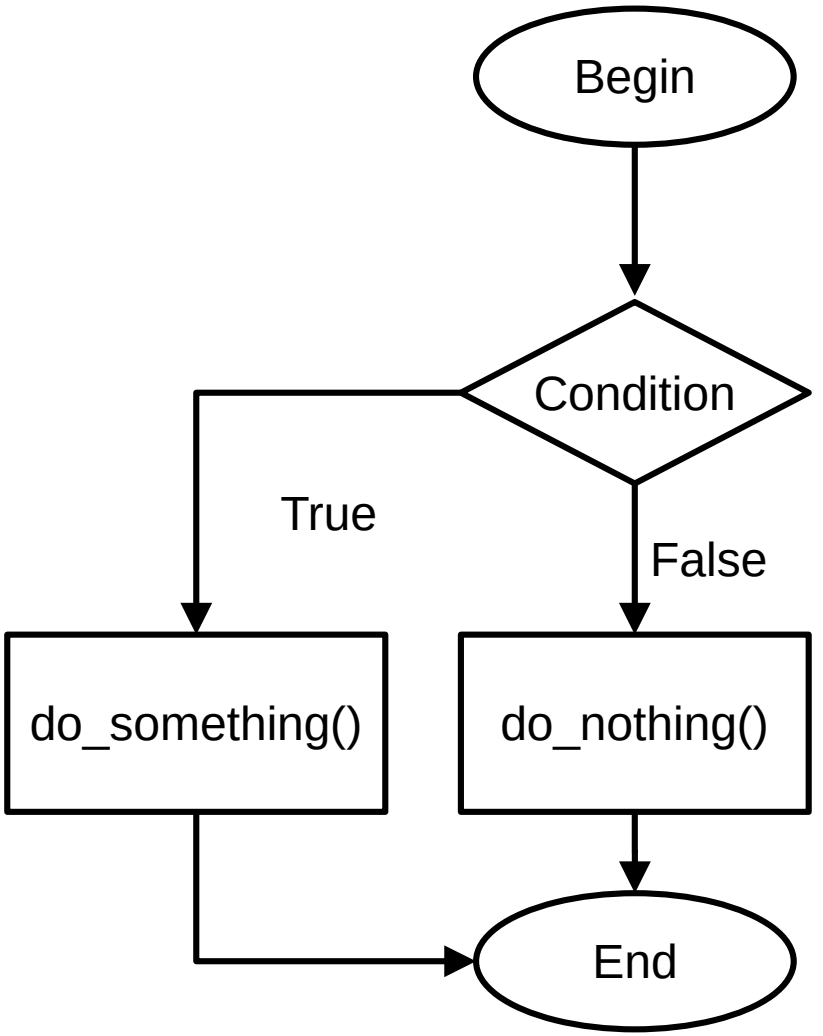
```
my_variable = 23 + 5;
another_variable = sin(1.35);
```

- Shorthand for adding and subtracting numbers:

```
my_variable++;  // Add 1 to
another_variable += 3.14; // Add 3.14
```

If … Then … Else – Conditional Logic

```
If ( condition ) {
   do_something();
} else {
   do_nothing();
}
```



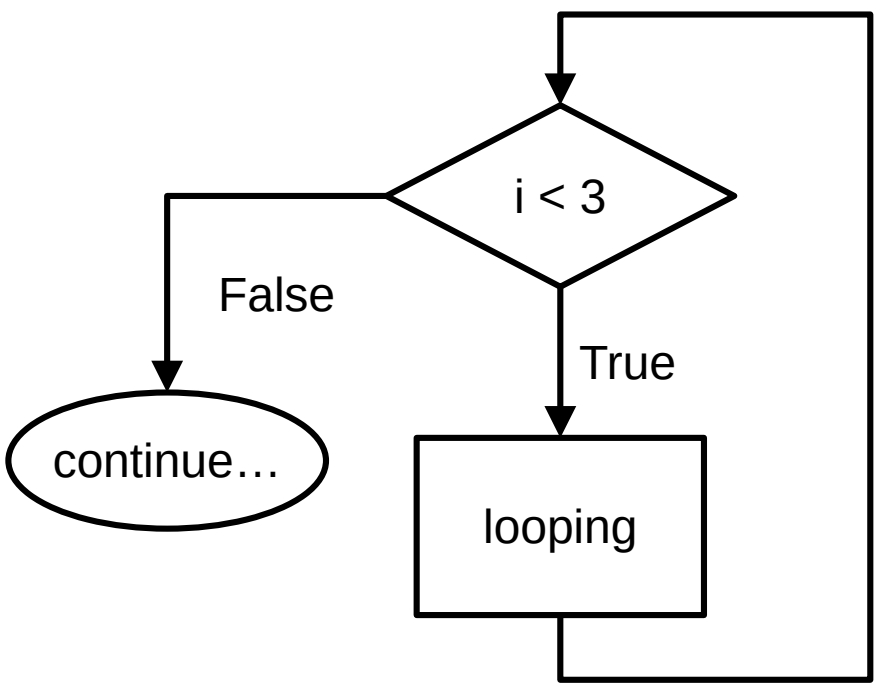
Rules for conditions

- Must be evaluated to boolean values (only true or false)
- Eg. comparing numbers:
  - a == b equal
  - a != b not equal
  - a < b, a > b less than, greater than
  - a <= b, a >= b less than or equal, equal or greater than

Now blink those LEDs!

Counting Loops

```
for(int i=0; i<3; i++){
   loop_the_loop();
}
```



- Loops as long as condition is true (ie. i < 3)
- i counts from 0 to 2
- When i is 3, the code continues below the loop

More tricks with loops

```
for(int i=255; i>=0; i--)
```

Count backwards from 255 to 0

```
for(int i=0; i<=255; i+=5)
```

Count in steps of 5

```
for(int i=1; i<=1024; i*=2)
```

Count in multiples of 2

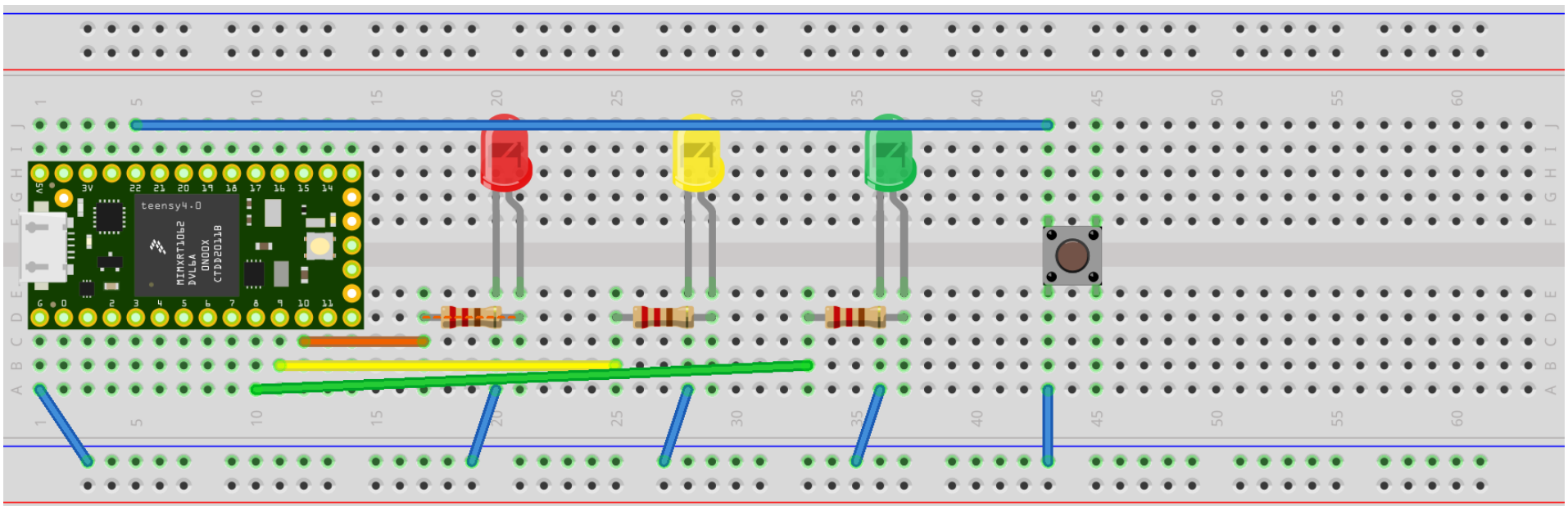
Less code = Less mistakes ;)

Or, “programmers are lazy”

More useful functions

`digitalRead( PIN )`	Get the state of a pin
`millis()`	Time since power on

Add a Button!

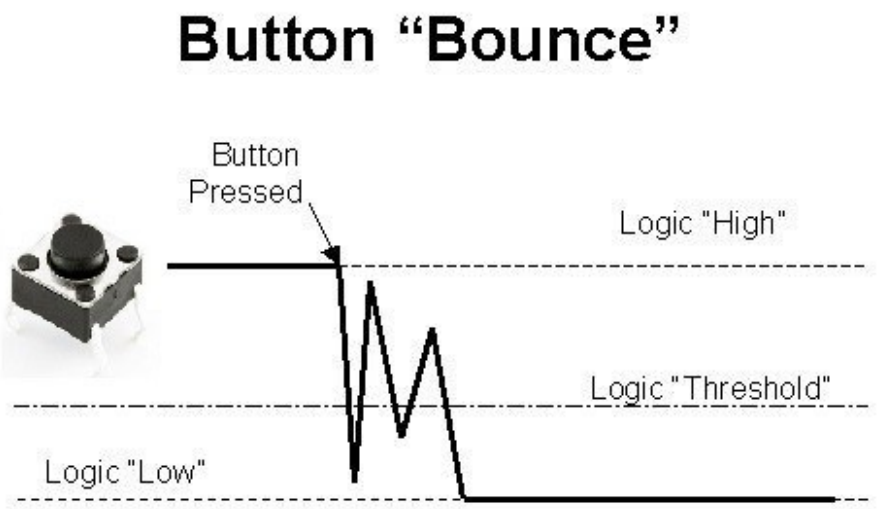


Cycle LEDs on Button Press

Inter- and Action!

~~Debug~~ Debounce

- When pressed, button contacts bounce on each other
- Microcontroller reads input so fast this is like multiple button presses
- Solution: wait a bit before taking another reading

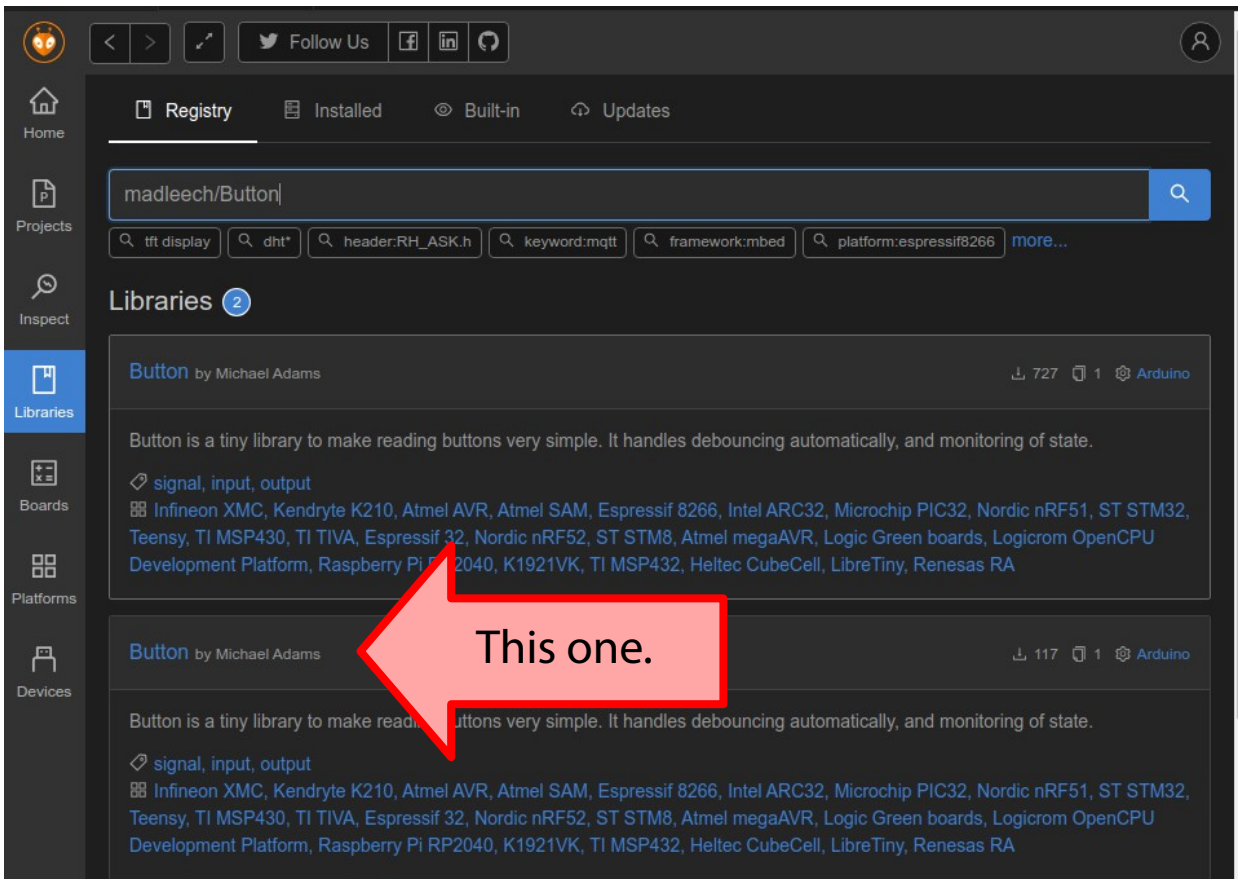


Why and why not to use delay()

- Delay interrupts the program → nothing else can happen
- Solution: use `millis()` instead
- Background info: system clock

Using other people's solutions (libraries)

- Add a library in PlatformIO:



Theory Time?

Object Orientation

More (Advanced) Topics

- Turning knobs: Analog input
- Making Sounds
- Human Interface Device – Keyboard emulation
- Motors