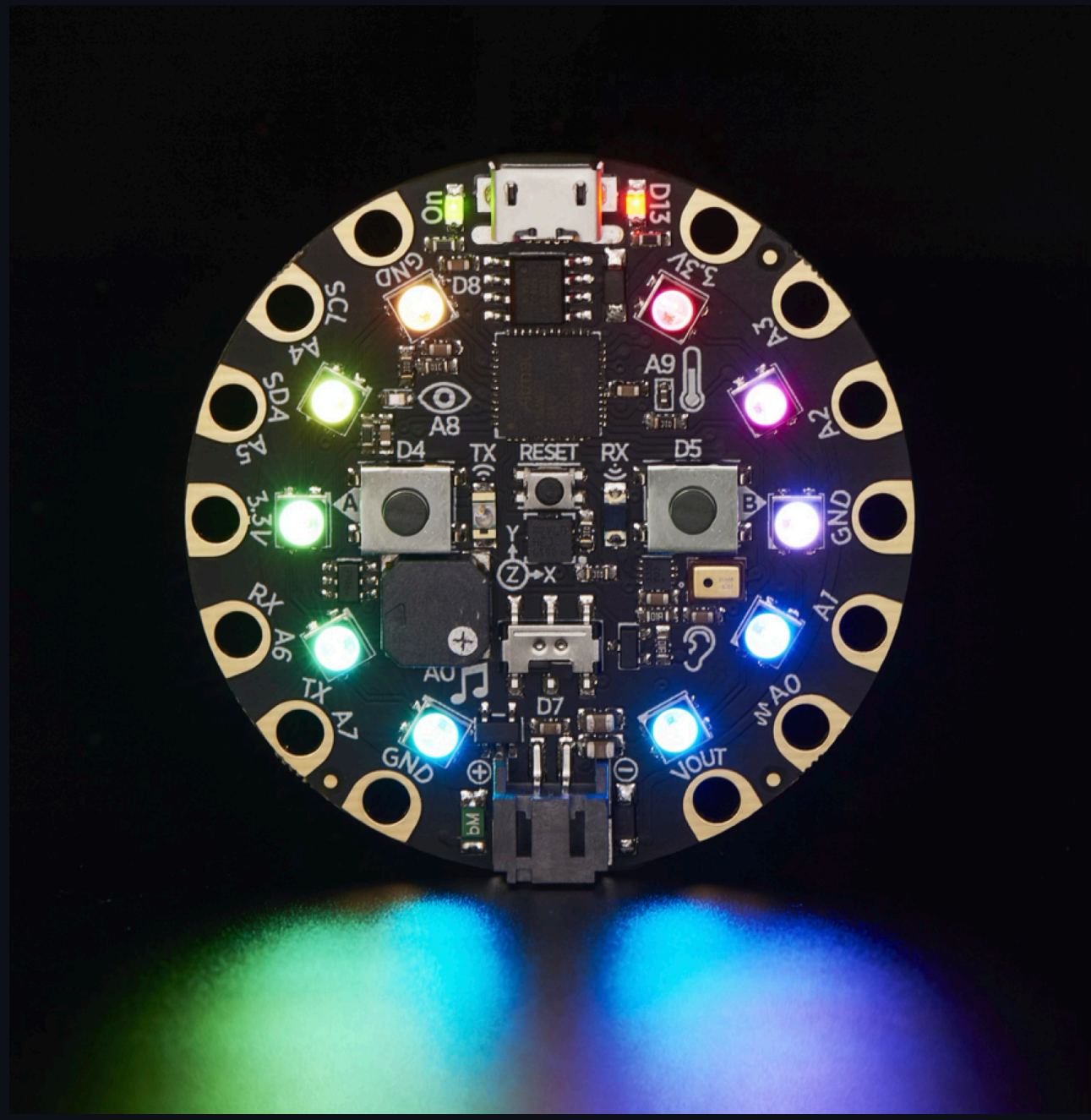
Circuit Playground

Class for Spark Makerspace

Kent Quirk, Feb-Mar 2025



Rough Agenda

(subject to intervention of reality)

Week	*Content*
1	General intro; the Circuit Playground device; demo; getting set up; the mu editor; "Hello, Blinker"; Python 101; a smarter blinker; reference material
2	Exploring the device (what can it do by itself?); how to use the libraries and documentation; coding tips & tricks
3	Connecting to other things -- switches, LEDs, motors, servos; hardware info as appropriate; pick personal projects
4	Project week -- let's make progress on your idea

Links

- Repository with presentations and example code
- Circuit Playground Express Quickstart at Adafruit
- CircuitPython download for Circuit Playground Express
- A bunch of example programs from the API
- The API reference for the base library
- The Circuit Playground Express page on Adafruit

Circuit Playground Express

Connection pads

- 8 I/O pads (A0-A7)
- Alligator clips or bolts or solder or conductive thread
- Can be touch pads or PWM outputs (for driving servos) or analog inputs (for reading signals)
- Plus pads for power and ground

Circuit Playground Express

Sound & Light

- MEMS microphone
- Mini Speaker (class D amplifier)
- Visible light phototransistor for analog light level
- IR Receiver (phototransistor) and transmitter (IR LED)

Circuit Playground Express

Touch and Motion

- 1 2-position slide switch
- 2 pushbuttons (A and B)
- 3-axis accelerometer
- Touchpad
- Infrared can be a proximity sensor
- (Reset is not programmable)

Circuit Playground Express

Other

- I2C connection for interacting with a wide range of I2C components -- sensors, controllers, memory, etc.
- Serial interface (UART)
- Temperature Sensor
- 2 MB of Flash
- Runs at 48 MHz
- USB port can act like serial port, keyboard, mouse, joystick, or MIDI
- There is a version available with Bluetooth

Programming it

- This class is going to use Circuit Python
- But it also works with Arduino

Demo

Just messing around

- Lighting up LEDs in a sequence
- Touch pads control the color
- Switch controls the direction
- Speed control with buttons
- Both buttons turn LEDs off

Python

- Python has existed since the 90s
- It's not like most other languages - whitespace is significant!
- Context depends on indentation (after a colon ':')
- Don't mix tabs and spaces
- No explicit memory management
- Works well out of the box -- "batteries included"
- Circuit Python is Python 3.4...ish. (plus some later stuff)

Sample Python

```python
# simple LED counter for Circuit Playground Express
import time
from adafruit_circuitplayground import cp

while True:
    cp.red_led = True
    time.sleep(0.5)
    cp.red_led = False
    time.sleep(0.5)
```

Data Types

- Ints and floats are different, when you care use `int(x)` or * `float(x)`
- `_` is ignored in constants, `0x`, `0b`, `0o` prefixes supported
- bools are `True` and `False` (caps required)
- Many ways to write strings: `'`, `"`, `'''`, `"""`
- Lists: `[1, 2, 3, 4]` -- can mix types, append, delete, sort, etc.
- Tuples: `(1, 2, 3)` -- immutable (efficient)
- Dictionaries (maps): `x={"a":1, "b":2}` -- retrieve with `x["a"]`. No dot notation.
- You don't declare types or variables -- just use them

Functions and Classes

- Functions: `def myfunc(a, b, c):`
  - Can specify default values (also makes things optional): `def add (v=1)`
- Supports defining classes with member vars and methods
- Some things that are automatic in other languages are weirdly explicit in Python (self, operator overrides, global)

Keywords and Operators

- `if`, `elif`, `else`; `while`; `for x in range`; `for item in list`
- No parens needed
- Always use a `:` after
- exceptions if you must (`try` / `except`)
- Math: `+`, `-`, `*`, `/`, `%` -- integer divide is `//`
- Logical (bool) operations: `and`, `or`, `not` (words)
- Bitwise operations: `&`, `|`, `^`, `~`
- Comparison: `==`, `!=`, `<`, `>`, `<=`, `>=`
- String concatenation: `+`

System Libraries

"Batteries Included"

- For basic tasks, there's probably already a library
- Use `import` statement
  - `import time`
    - imports as a namespace
    - then use `time.sleep(1)`
  - `from time import sleep`
    - imports just that name into global namespace
    - use as `sleep(1)`
  - `from adafruit_circuitplayground import cp`
    - just to save a lot of typing!