Engineering Technology (ENGR 101)

Introduction to Arduino
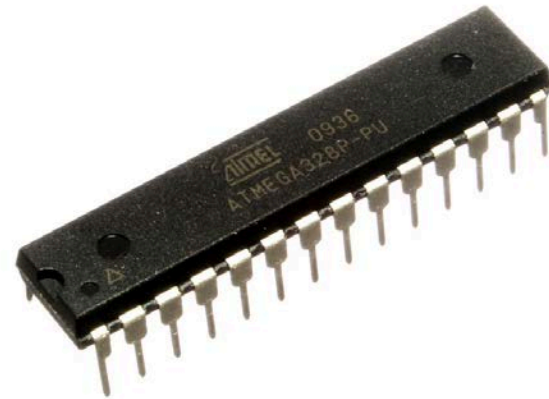
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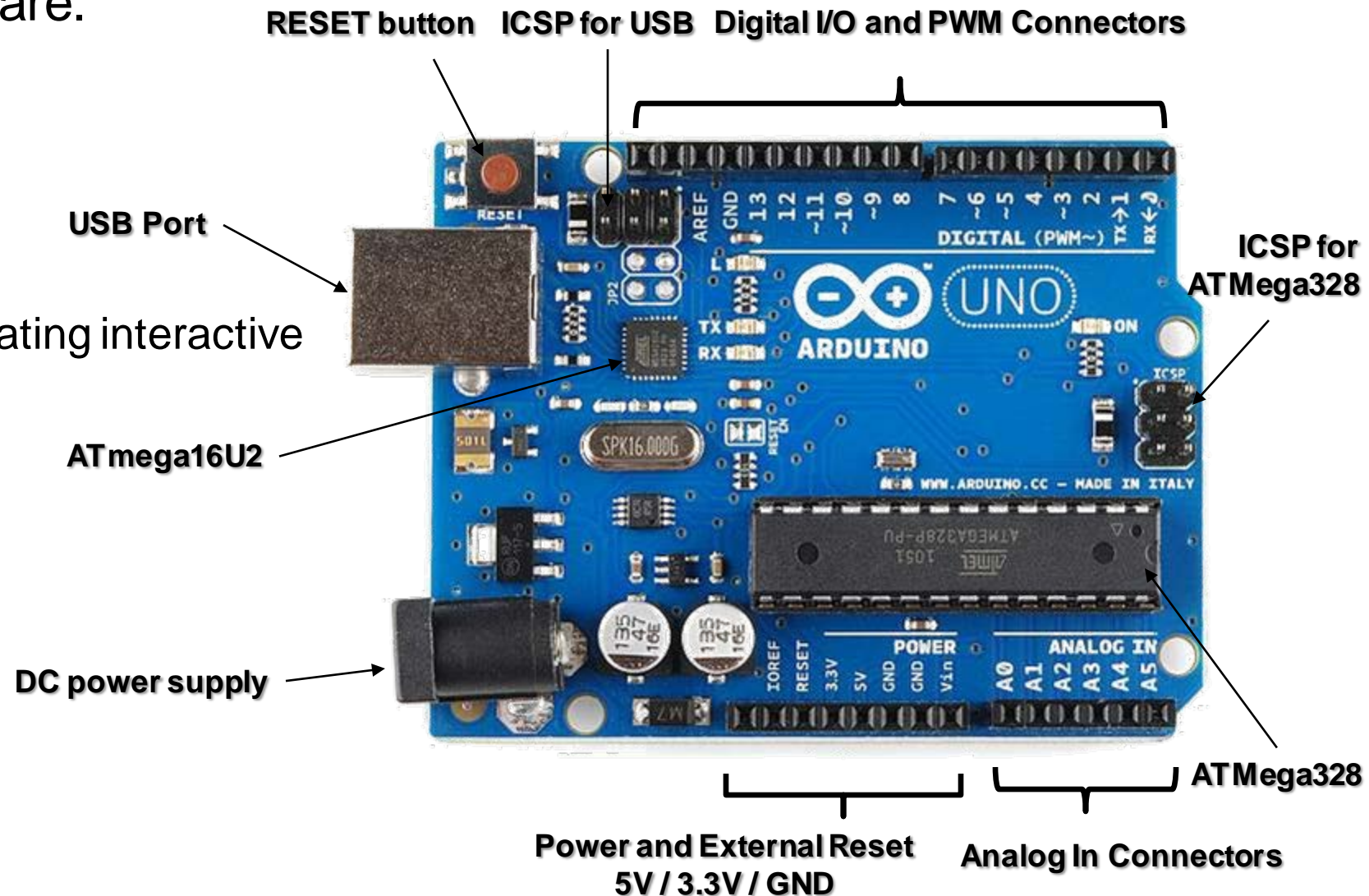
Victoria University of Wellington

What is processor?

- A processor is an integrated electronic circuit that performs the calculations that run a computer.

- A processor performs arithmetical, logical, input/output (I/O) and other basic instructions
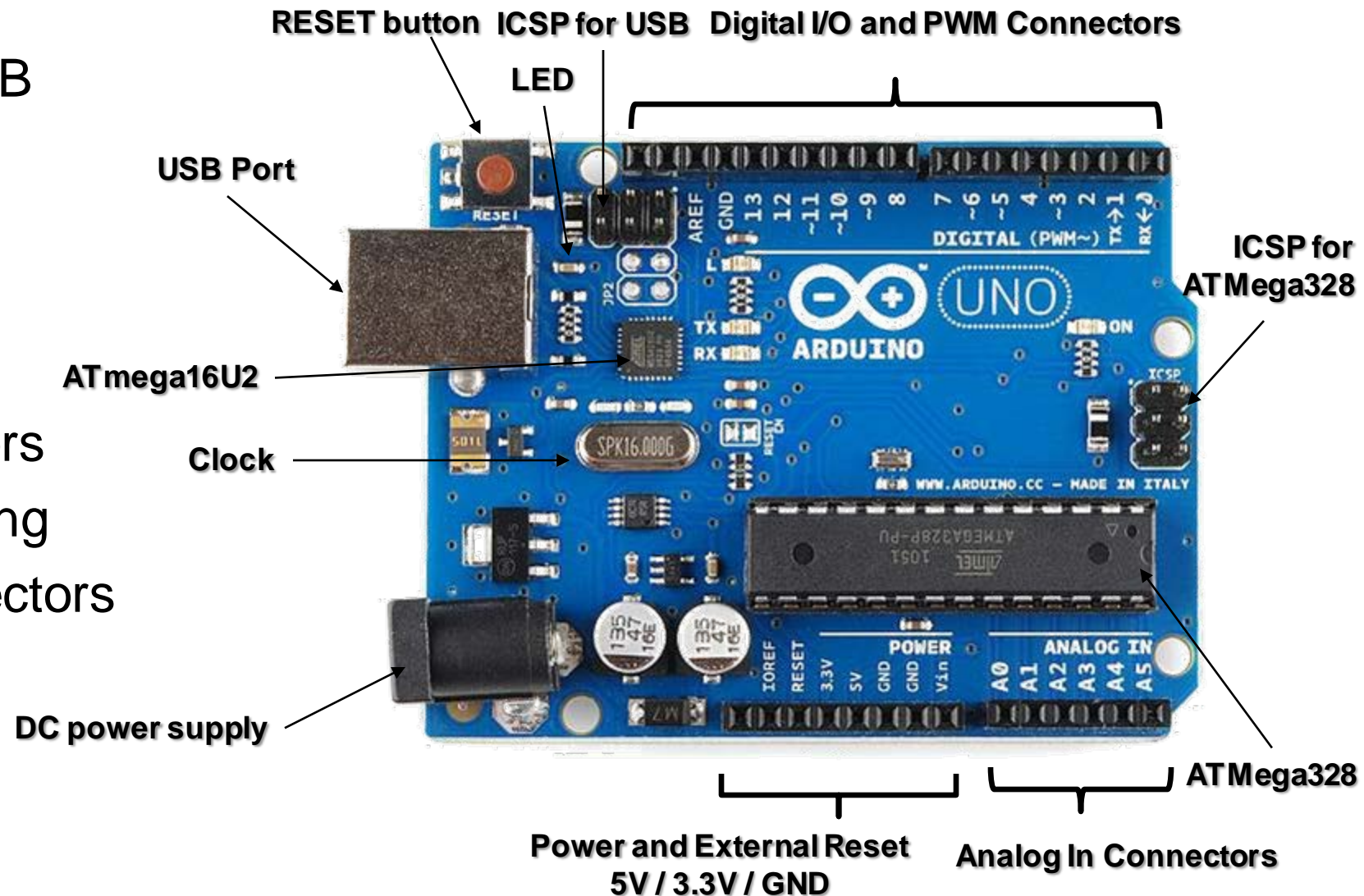
What is Arduino?

- Arduino is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software.

- It's intended for
    - artists,
    - designers,
    - hobbyists,
    - and anyone interested in creating interactive objects or environments.

- http://www.arduino.cc/

RESET button   ICSP for USB   Digital I/O and PWM Connectors

USB Port

ICSP for ATMega328

ATmega16U2

DC power supply

ATMega328

Power and External Reset 5V / 3.3V / GND

Analog In Connectors

Arduino Components

- ATmega328: the processor programmed by the user
- ATmega16U2: handles USB communication
- USB port.
- EEPROM memory
- Flash memory
- Input and Output Connectors
- ICSP pins for reprogramming
- Power regulator and connectors
- Reset button
- LED
- Clock

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Application Code and Firmware

- Two types of code executing on a simple microcontroller
  1. Application code
     - ✓ Executes main functionality
     - ✓ We write this code
     - ✓ Stored in Flash memory
     - ✓ Uploaded via USB
 2. Firmware
     - ✓ Low-level code:
     - ✓ Manages the system and USB
     - ✓ Not user programmable
     - ✓ Bootloader is fixed
     - ✓ Other firmware stored in Flash memory
     - ✓ Reprogrammed through ICSP and the bootloader
     - In-Circuit Serial Programming (ICSP)

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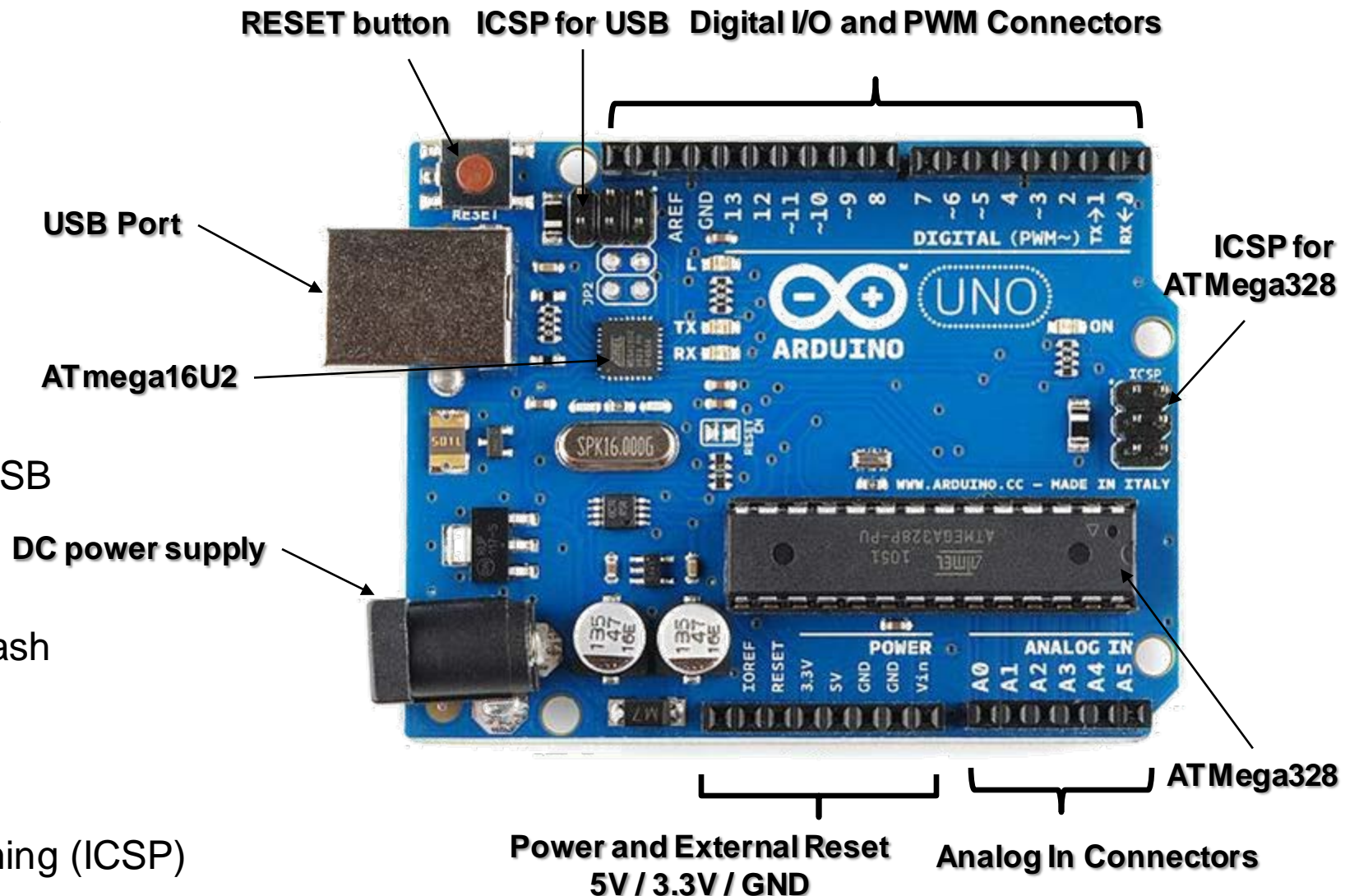
Connecting to the world

- Can connect sensors, actuators, and other electronics to the IO connectors.
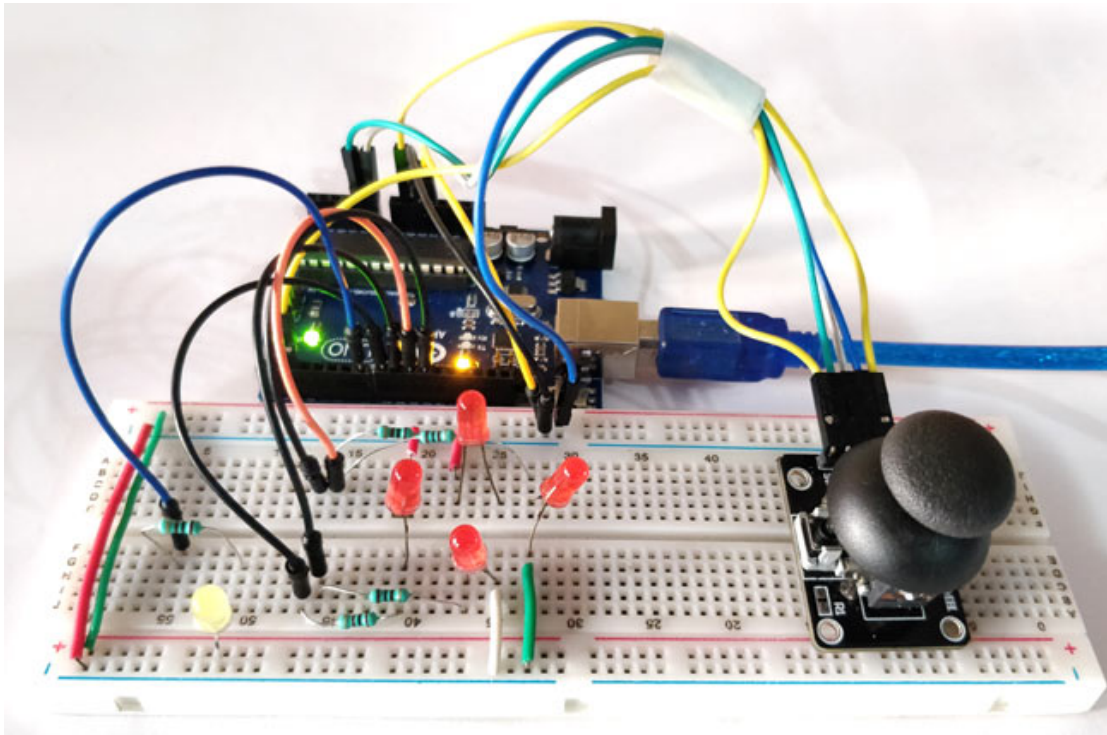
Arduino Shields

- ## Special-purpose circuit boards:
  - Specialised functionality
  - Extends the Arduino
  - Easy to attach
  - Good libraries provided

Buttons and Joystick Shield

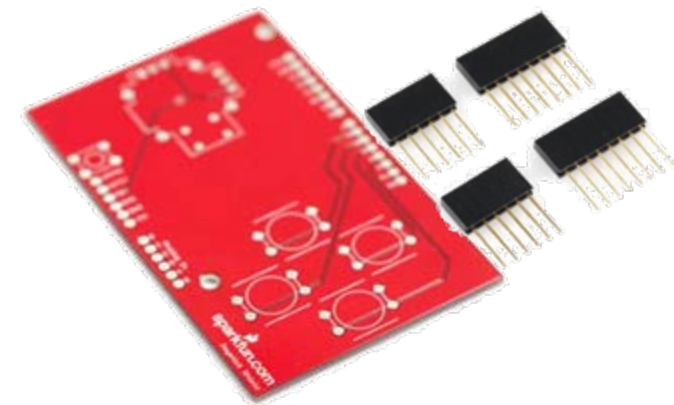Shield mounted on the Arduino

Micro SD Shield

MP3 Trigger Shield

LCD Shield

PCB: Build your own shield!

Arduino Uno Specifications

Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	14 (6 PWM)
Analog Input Pins	6
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328) of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328)
EEPROM	1 KB (ATmega328)
Clock Speed	16 MHz
Length	68.6 mm
Width	53.4 mm
Weight	25 g

Pseudocode

- A plain language description of the steps in an algorithm or another system

```
1   Repeat
2       Turn the built in LED on
3       Wait for one second
3       Turn the built in LED off
4       Wait for one second
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Programming language for Arduino

- At first, programming language in Arduino it might look cryptic.

```
void setup() {
    pinMode(LED_BUILTIN,OUTPUT);
}
void loop() {
    digitalWrite(LED_ BUILTIN, HIGH);
    delay(1000);
    digitalWrite(LED_ BUILTIN, LOW);
    delay(1000);
}
```
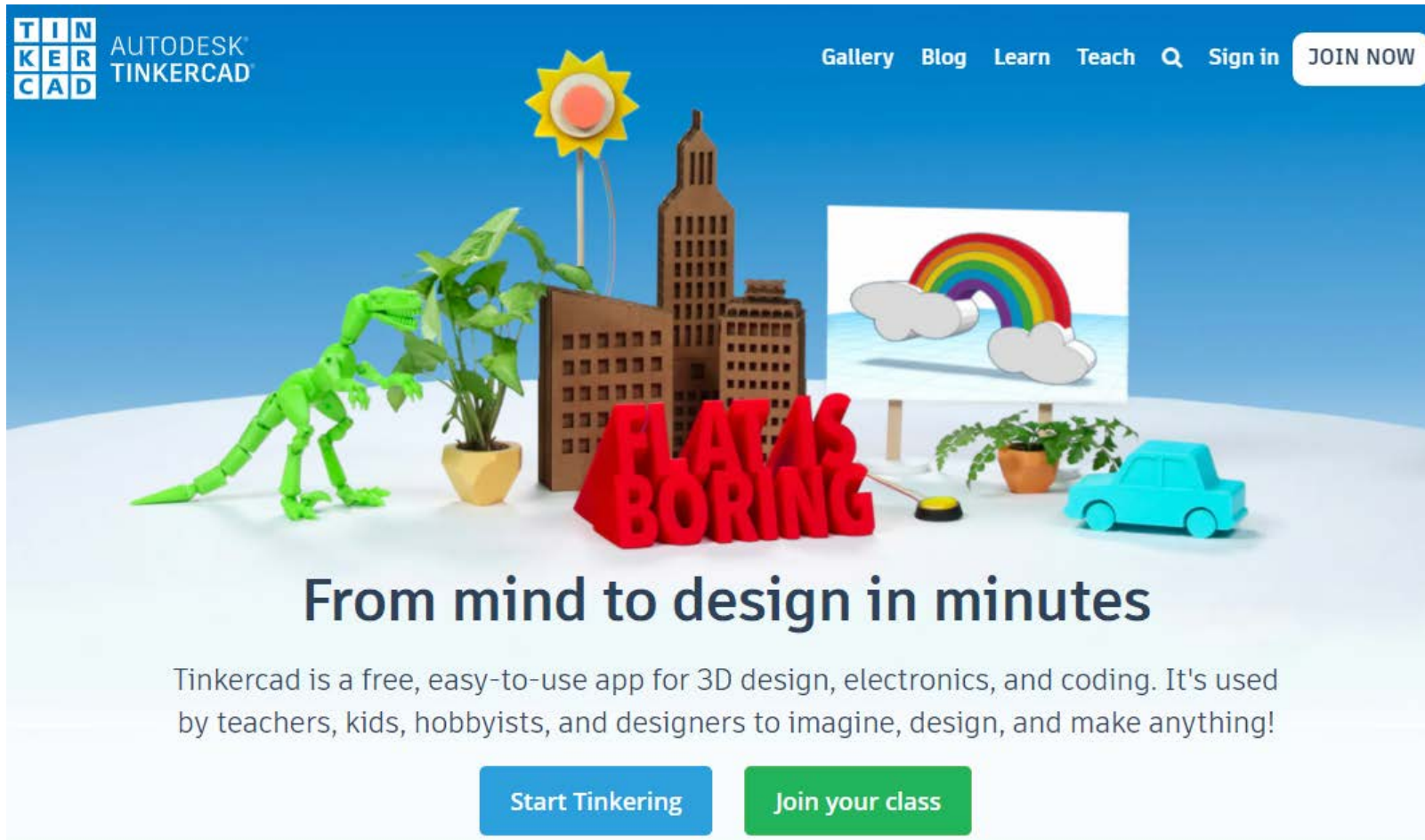
- We can use graphical programming
  - You can learn programming fundamentals
  - You do not need to worry about syntax

Graphical programming
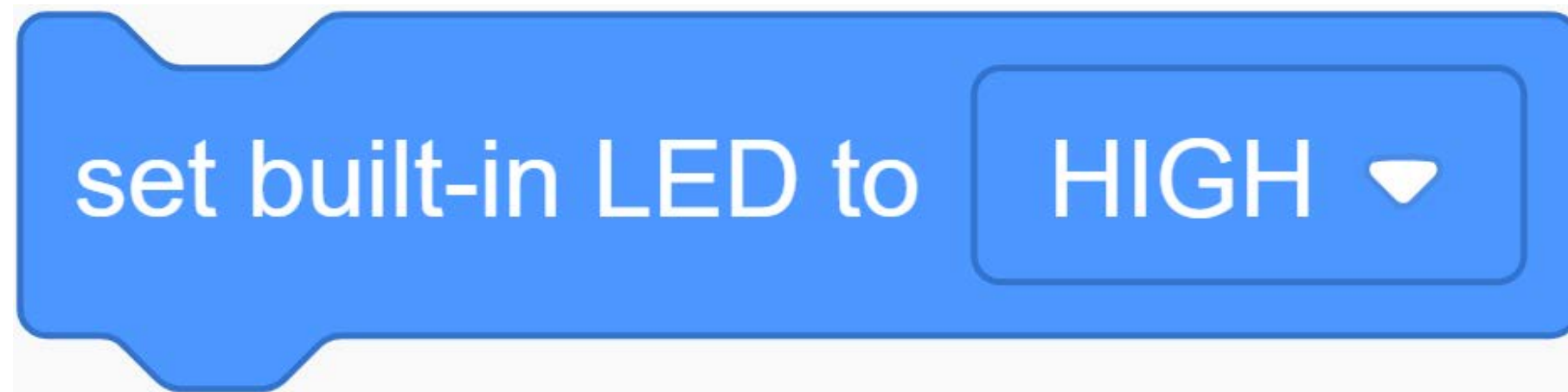
Using the Simulator

- AUTODESK,Tinkercad: https://www.tinkercad.com/

Using the TinkerCad Simulator
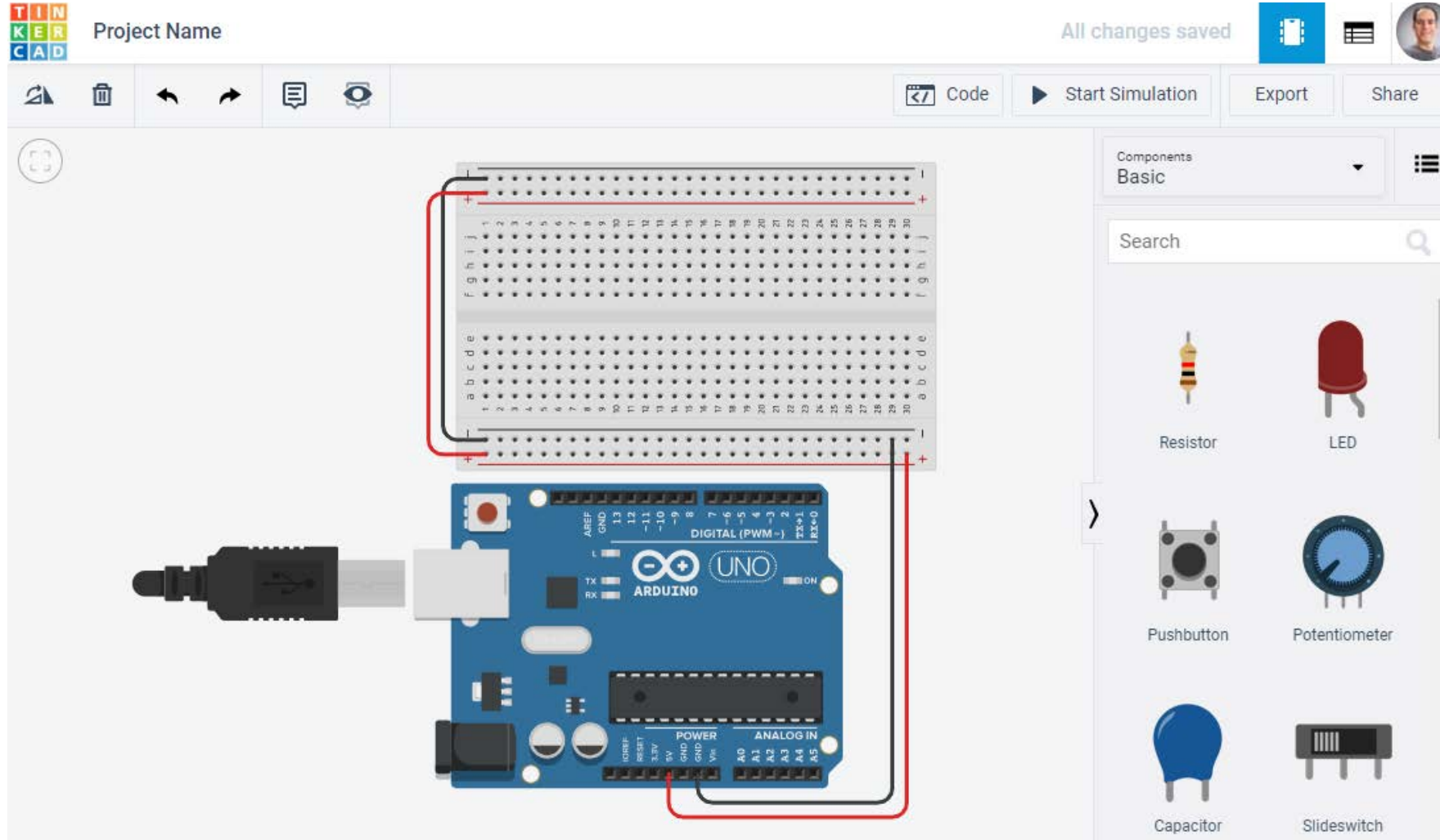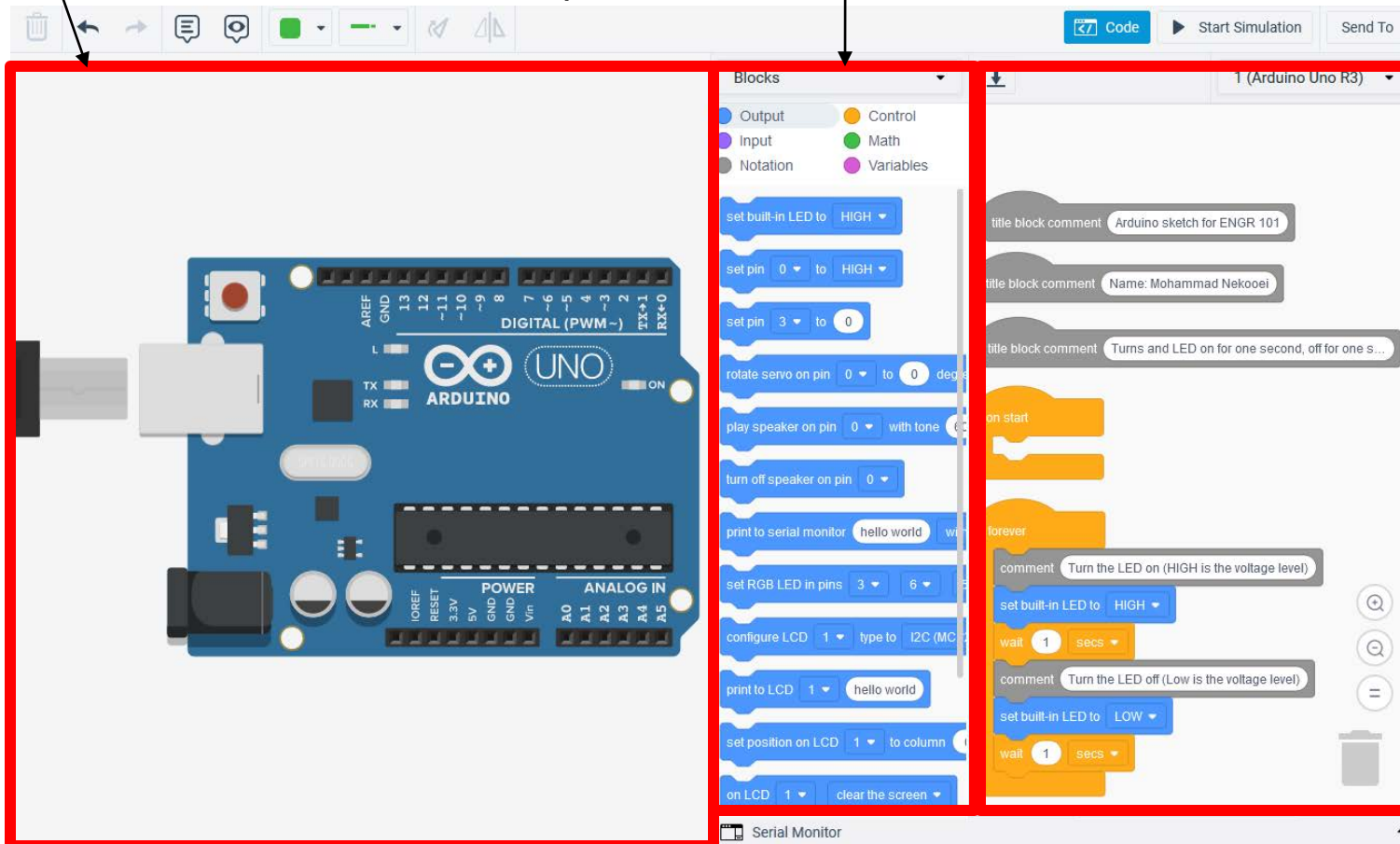
Graphical programming in TinkerCad

Graphical programming in TinkerCad

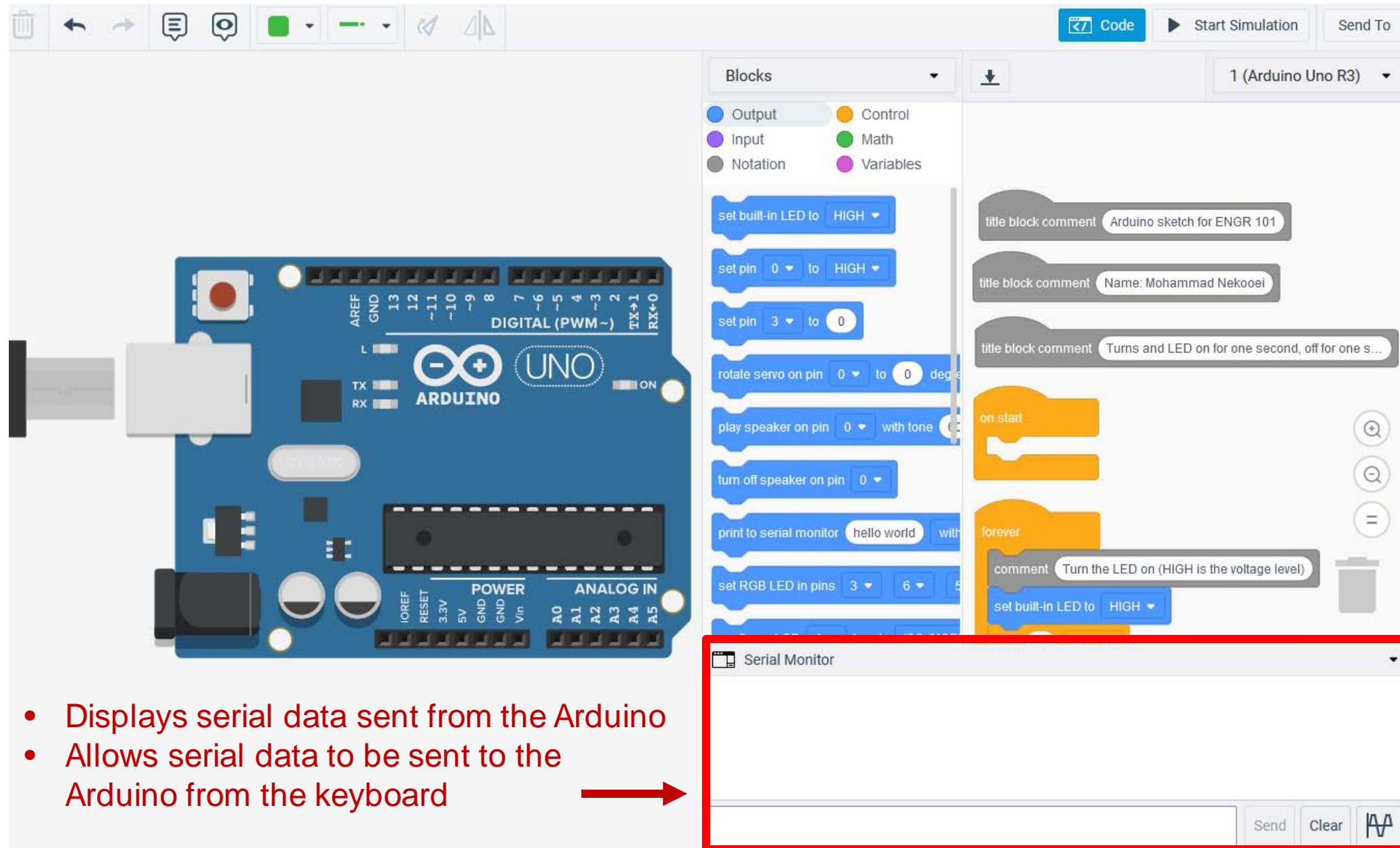**Designing area:** designing digital circuits and connecting different components to Arduino

Programming blocks: they are like puzzle pieces
- We have functions, variables, conditionals and Boolean expressions and more in different colours and shapes

Programming area: Connecting the block together

Serial Monitor in TinkerCad

- Displays serial data sent from the Arduino
- Allows serial data to be sent to the Arduino from the keyboard