Arduino Game Controller

Get the slides

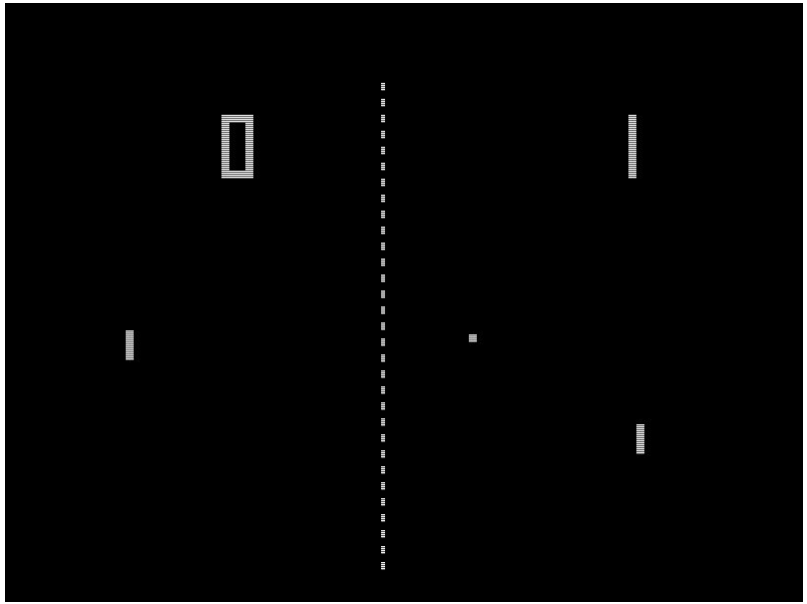
tinyurl.com/ears-pong

Get the software

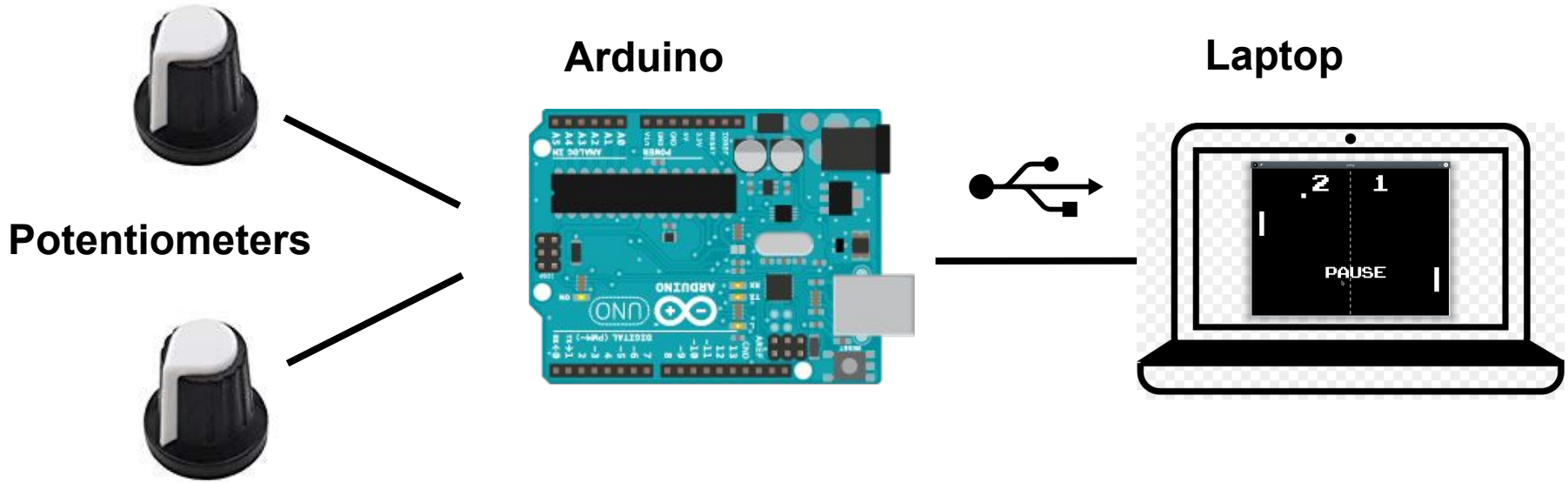
tinyurl.com/ears-arduino

tinyurl.com/ears-processing

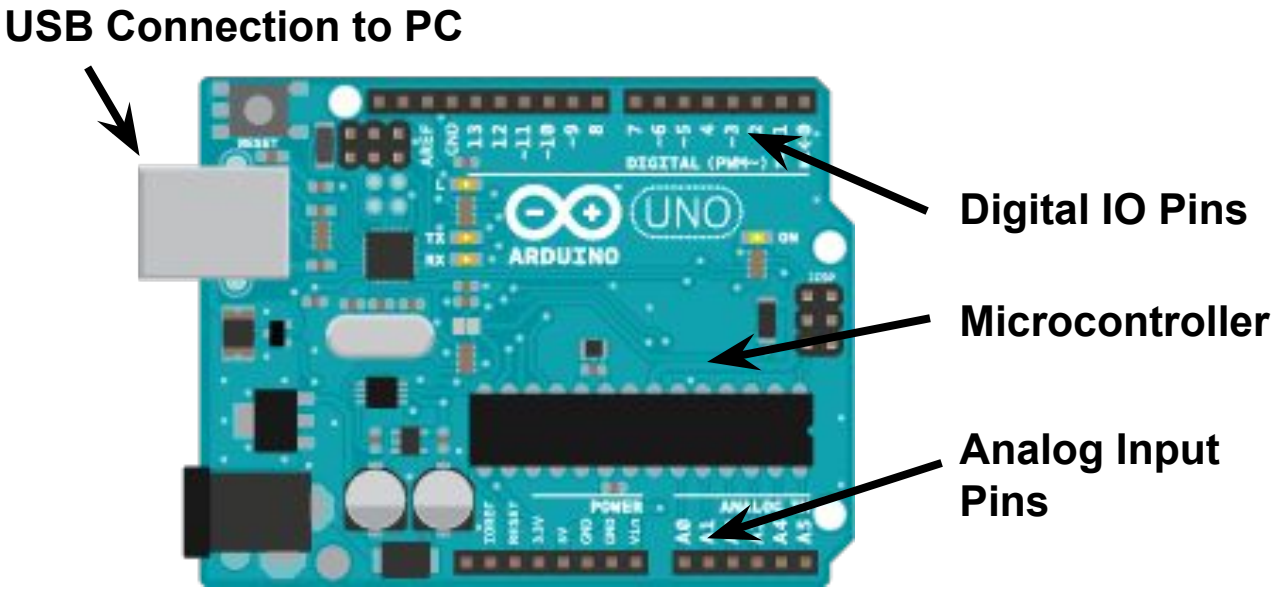
What is Pong



Concept Map

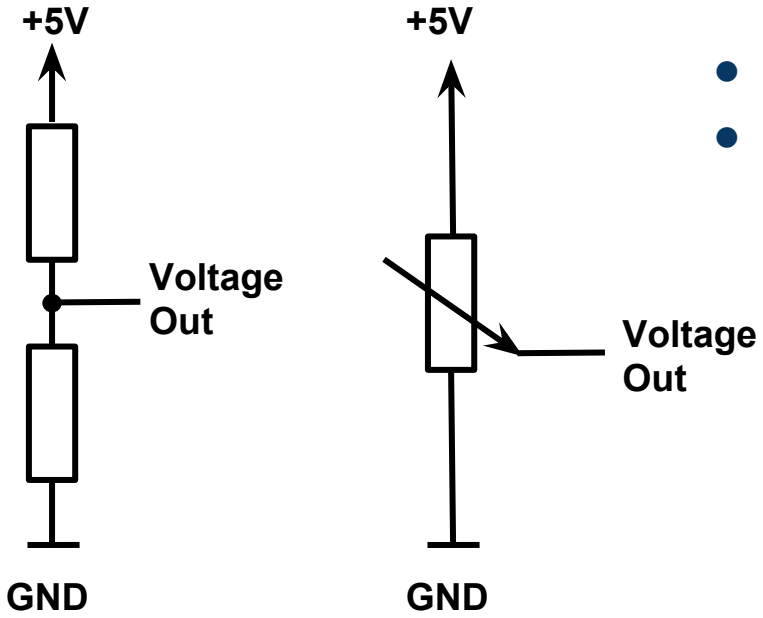


What is an Arduino



- Programmed in a C++ dialect

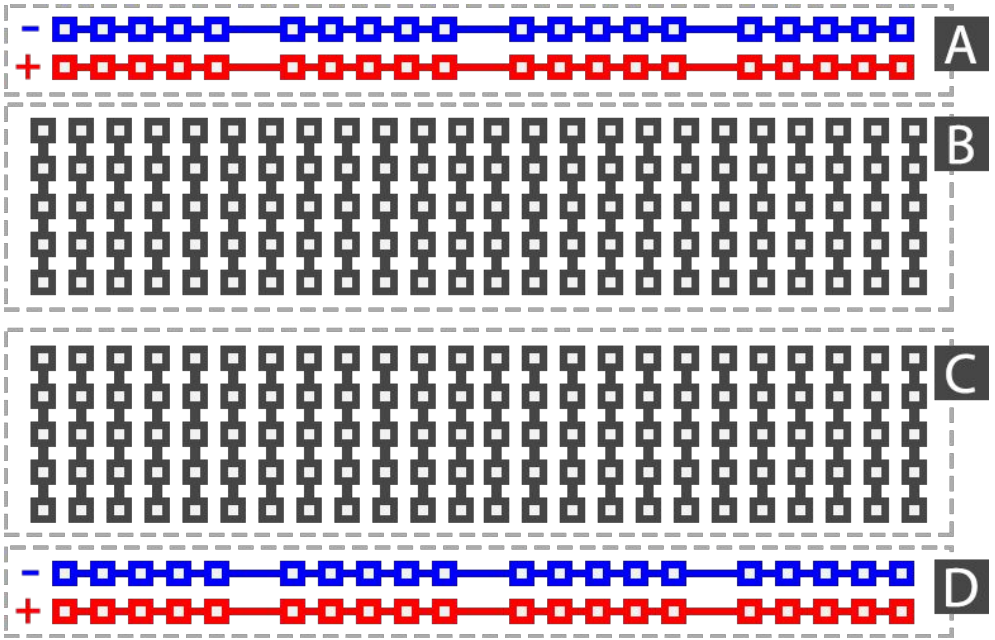
What is a potentiometer



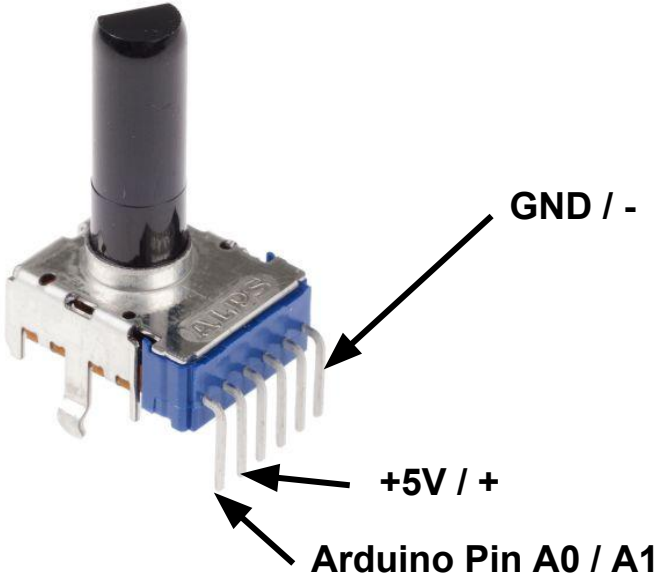
- Variable Resistor
- Output voltage corresponds to turn of potentiometer

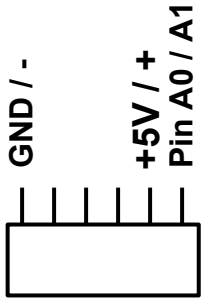
Breadboard

Connect Arduino 5V to Breadboard ‘+’
Connect Arduino GND to Breadboard ‘-’

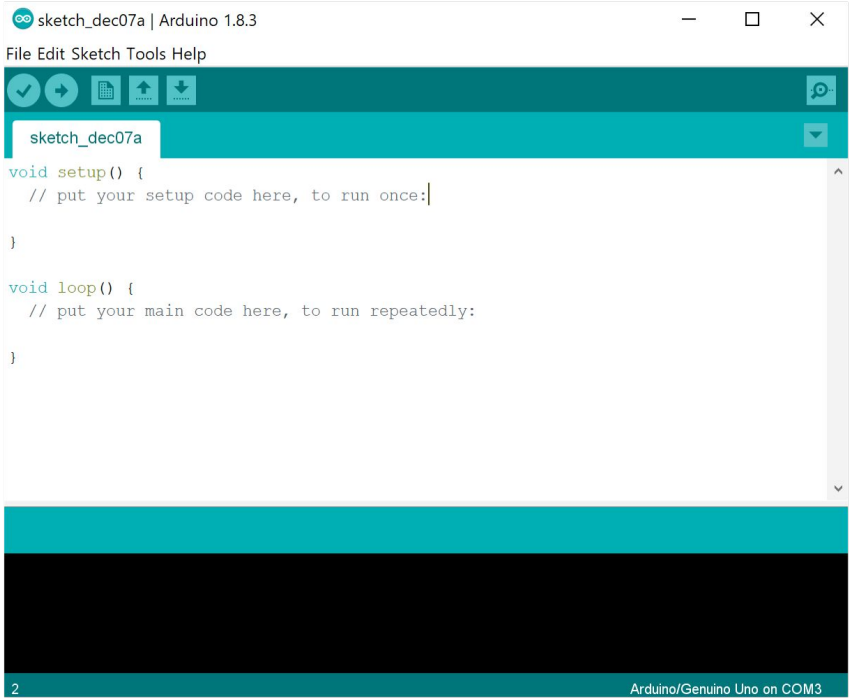


How to connect potentiometer





Start Arduino Environment



Reading the potentiometers

```
void setup() {
  // code here will run at startup
}

void loop() {
  // repeated forever and ever
}
```

Reading the potentiometers

Configure a Pin as Input:

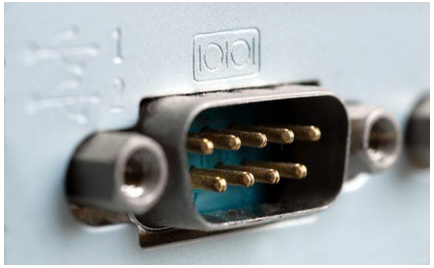
```
pinMode(A0, INPUT);
```

Read from voltage from an analog pin (0 to 1023)

```
int x = analogRead(A0);
```

Reading the potentiometers

What is a Serial Port



- Simple way to transmit text between computer and microcontroller
- Emulated via USB

Initialise Serial Port:

```
Serial.begin(9600);
```

Reading the potentiometers

Transmit text to PC:

```
Serial.println("Hello!"); // with newline
Serial.print("Hello!"); // without newline
```

Sleep Function

```
delay(20); // sleep for 20ms
```

Reading the potentiometers

TODO:

- Initialise Serial Port
- Configure Pin A0 and A1 as input
- Read A0 and A1 and store into two variables
- Transmit to PC: value of A0, value of A1

  `e.g. 235,780`

- Delay for 20ms

Reading the potentiometers

```
void setup() {
  pinMode(A0, INPUT);
  pinMode(A1, INPUT);
  Serial.begin(9600);
}

void loop() {
  int x = analogRead(A0);
  int y = analogRead(A1);
  Serial.print(x);
  Serial.print(",");
  Serial.println(y);
  delay(20);
}
```

What is Processing?

- Simple programming environment for graphics
- Uses language Java
- Software is precursor to Arduino environment

Processing Simple Test

```
void setup() {
  // executed once at beginning
  size(800, 600); // window of width 800 and height 600 pixels
}

void draw() {
  // runs forever
  clear();                        // set background to black
  fill(255);                      // set colour to white
  rect(10, 20, 300, 500);         // rectangle at x = 10, y = 20
                                  // width = 300, height= 500
  ellipse(600, 300, 100, 100); // draw circle at x = 600, y = 300
                                  // radius = 100
}
```

Get the template

tinyurl.com/pong-template

Install Font

For a retro style font double click on the **ARCADECLASSIC.TTF** file in template folder and install font on your computer

Draw Paddle

TODO:

- Write function printPaddleA() and printPaddleB() that draw white rectangles for the paddles

  Use constants:
  PADDLE_A_POSX, PADDLE_B_POSX,
  PADDLE_HEIGHT, PADDLE_WIDTH

  And variables:
  paddleAPos, paddleBPos (as y coordinate)

Draw Paddle

```
void printPaddleA() {
  /* draw rectangle for paddle in correct position */
  fill(255);
  rect(PADDLE_A_POSX, paddleAPos / 2, PADDLE_WIDTH,
PADDLE_HEIGHT);
}

void printPaddleB() {
  /* draw rectangle for paddle in correct position */
  fill(255);
  rect(PADDLE_B_POSX, paddleBPos / 2, PADDLE_WIDTH,
PADDLE_HEIGHT);
}
```

Move Ball, Draw Ball

TODO:

- Write function moveBallI() that changes posX and posY of the ball depending on speedX and speedY

- Write function drawBall() that draws a rectangle for the ball

  Use contants: BALL_WIDTH, BALL_HEIGHT

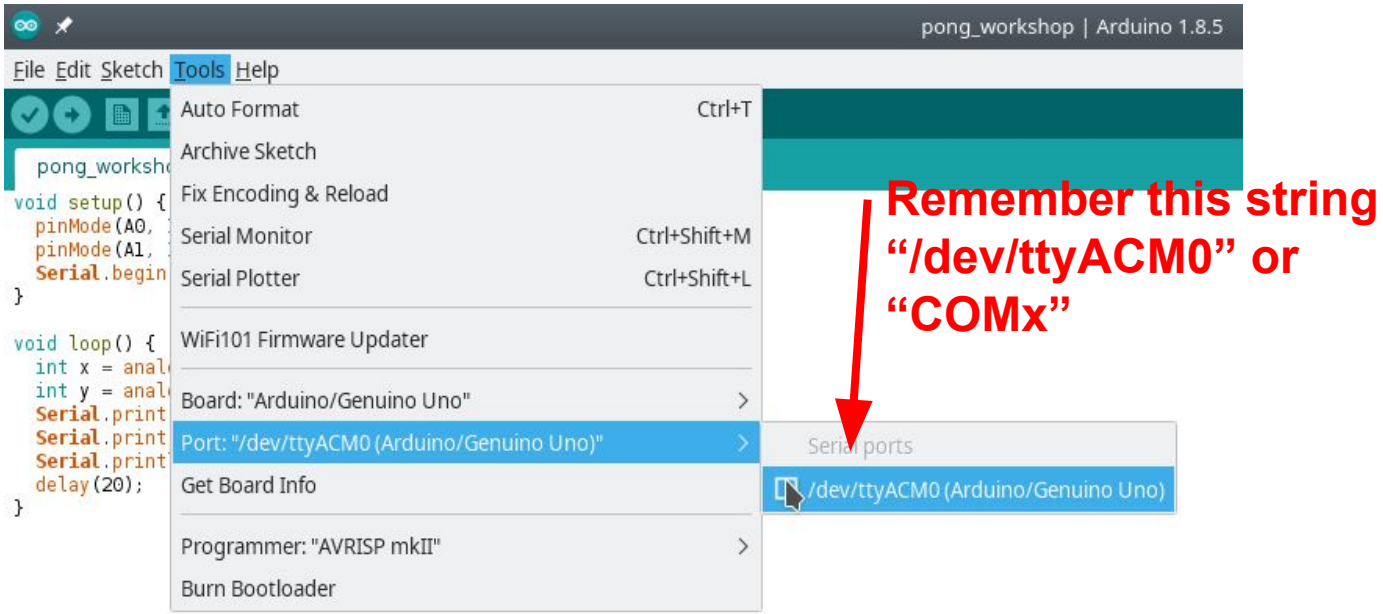
  And variables: posX, posY, speedX, speedY

Move Ball, Draw Ball

```
void moveBall() {
  /* move ball depending on speedX and speedY */
  posX += speedX;
  posY += speedY;
}

void drawBall() {
  /* draw rectangle for ball at right position */
  fill(255);
  rect(posX, posY, BALL_WIDTH, BALL_HEIGHT);
}
```

Select Correct Serial Port



Select Correct Serial Port

```
// find this line in setup()
myPort = new Serial(this, Serial.list()[0],
9600);

// replace with string remembered from
Arduino
myPort = new Serial(this, "COM3", 9600);
```

Receive Data from Serial Port

Get string from serial port:

```
String raw = myPort.readString();
```

Replace newlines:

```
str.replace("\n", ""); // remove newline
str.replace("\r", ""); // remove newline
```

Receive Data from Serial Port

Split array in parts:

```
String[] parts = raw.split(","); // split array
// parts[0] -> 1st value, parts[1] -> 2nd value
```

Convert String to Integer

```
int x = Integer.parseInt(“123”);
```

Receive Data from Serial Port

TODO:

- Write function serialEvent() and get string from serial port
- Remove newlines and split string
- Save first number (divided by 2) into variable paddleAPos
- Save second number (divided by 2) into variable paddleBPos

Needs to be in try/catch!

Receive Data from Serial Port

```
void serialEvent(Serial myPort) {
  /* this function is called whenever a line is received */
  try {
    /* read string and parse into paddleAPos and paddleBPos */
    String raw = myPort.readString();
    raw = raw.replace("\n", "");
    raw = raw.replace("\r", "");
    String[] parts = raw.split(",");
    paddleAPos = Integer.parseInt(parts[0]);
    paddleBPos = Integer.parseInt(parts[1]);
  } catch (Exception ex) {
  }
}
```

Set Paddle Speed

TODO (optional):

- Calculate difference in paddle position
- Scale by a factor
- Save to `paddleASpeed` and `paddleBSpeed`

Set Paddle Speed

```
...
int prevPosA = paddleAPos;
int prevPosB = paddleBPos;
paddleAPos = Integer.parseInt(parts[0]);
paddleBPos = Integer.parseInt(parts[1]);
paddleASpeed = (paddleAPos - prevPosA) / 3;
paddleBSpeed = (paddleBPos - prevPosB) / 3;
...
```

Get the template

tinyurl.com/pong-solution

Challenge Task:

- Add in acceleration and deceleration for the ball

- Create Cheat Mode
  Computer controls paddle at right times
  Try to make it as invisible as possible

Challenge Your Partner :D