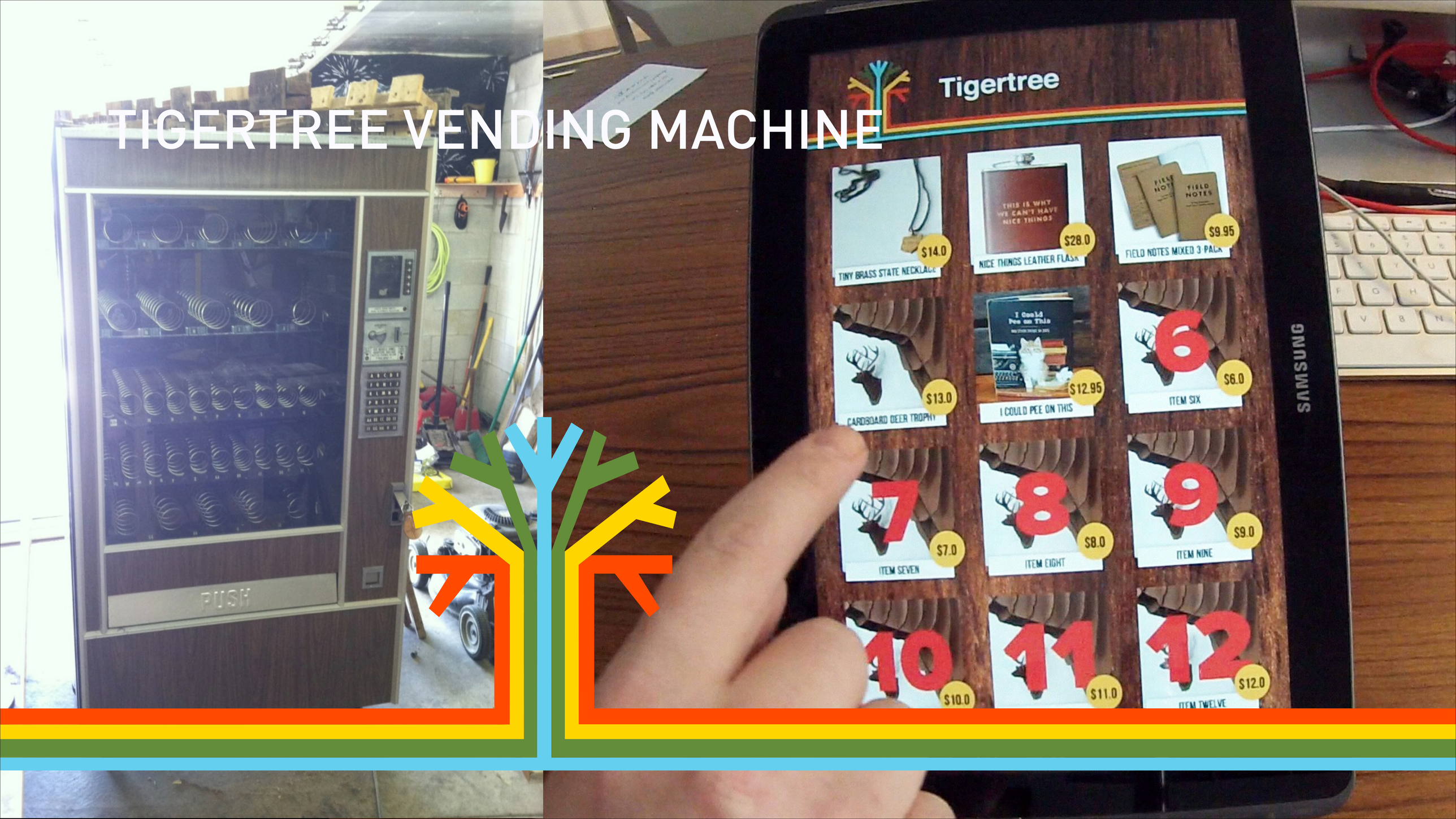
ENVIRONMENTAL I/O WITH ANDROID IOIO

RAPID PROTOTYPING HARDWARE-CONNECTED MOBILE APPLICATIONS

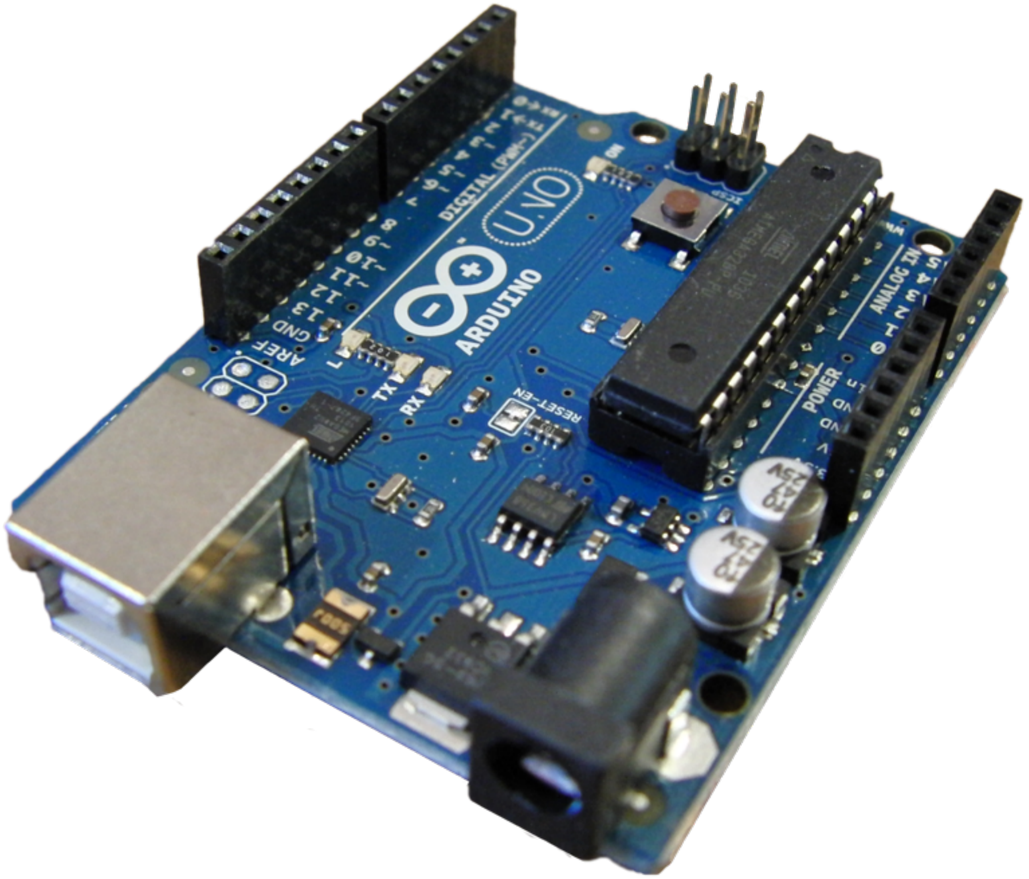
SCOTT SULLIVAN
@SCOTSULLIVAN
http://scottis.me

TIGERTREE VENDING MACHINE

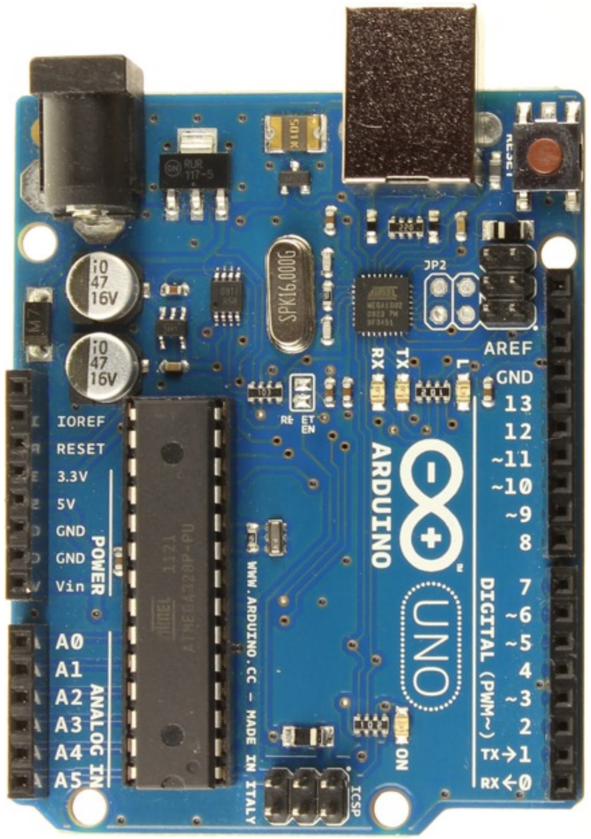


I/O

I/O

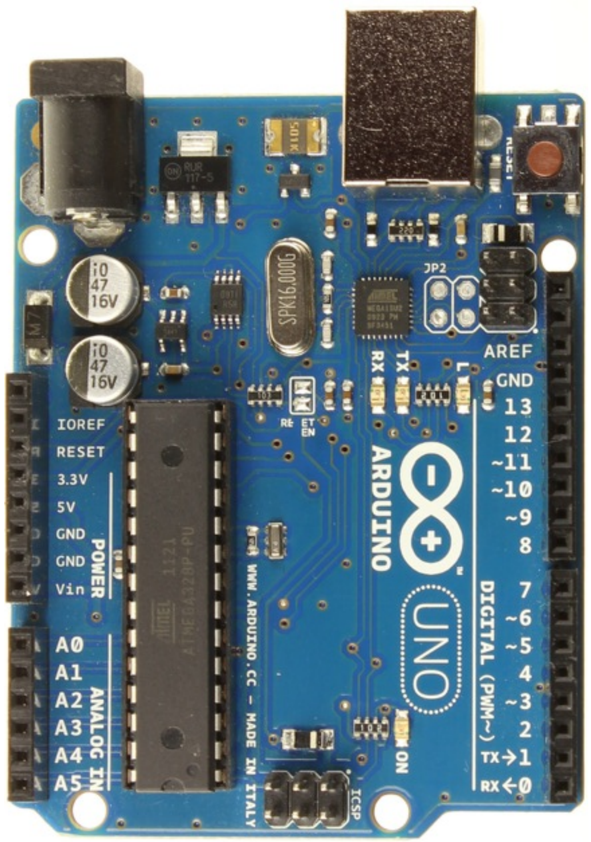

ARDUINO
UNO
DIGITAL (PWM~)
AREF
GND
13
12
~11
~10
~9
8
7
~6
~5
4
~3
2
TX
RX
L
RESET-EN
POWER
ANALOG IN

I/O


IOREF
RESET
3.3V
5V
GND
GND
Vin
POWER
A0
A1
A2
A3
A4
A5
ANALOG IN
ATMEGA328P-PU
WWW.ARDUINO.CC – MADE IN ITALY
ICSP
ON
ARDUINO
UNO
DIGITAL (PWM~)
TX→1
RX←0
7
~6
~5
4
~3
2
8
~9
~10
~11
12
13
GND
AREF
L
TX
RX
JP2
SPK16.000G
16V
47
10

I/O

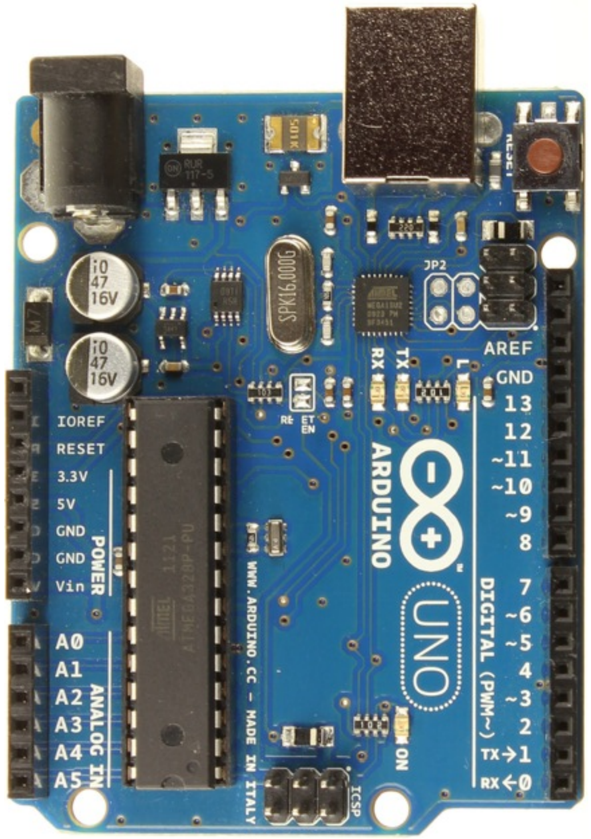
INPUT
FROM SENSOR
3.3V/5V



I/O

COMPUTATION

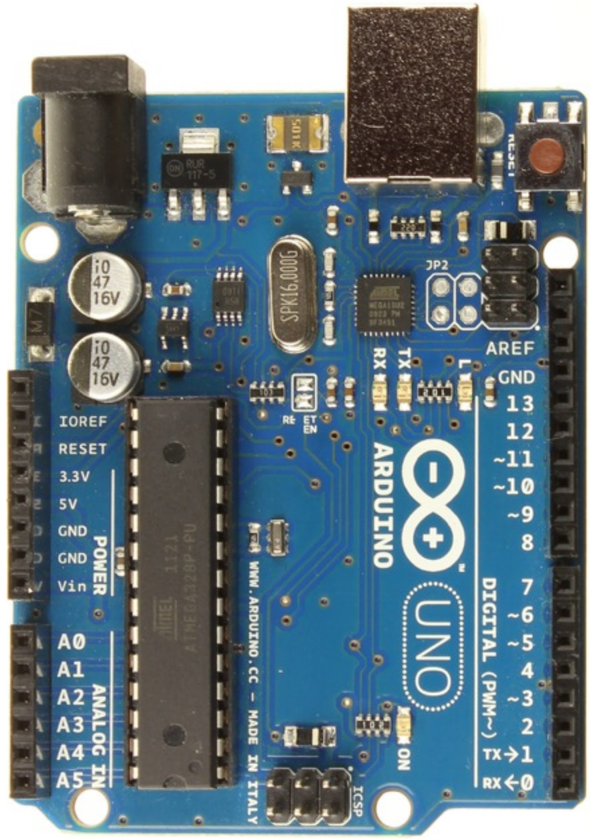
INPUT
FROM SENSOR
3.3V/5V



I/O

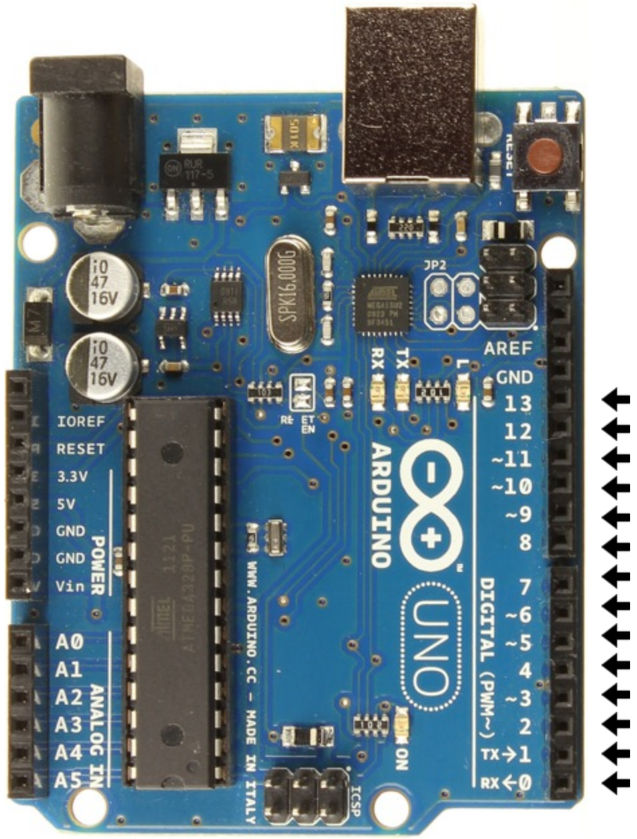
COMPUTATION

INPUT
FROM SENSOR
3.3V/5V



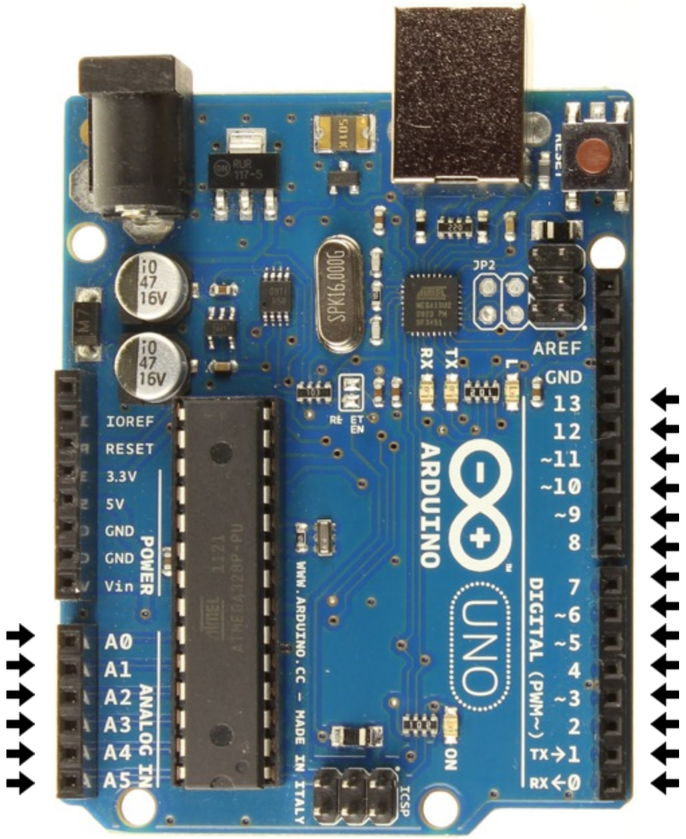
OUTPUT
TO ACTUATOR

I/O



14 DIGITAL PINS (0-13)
1 OR 0 (HIGH/LOW)
INPUT OR OUTPUT

I/O

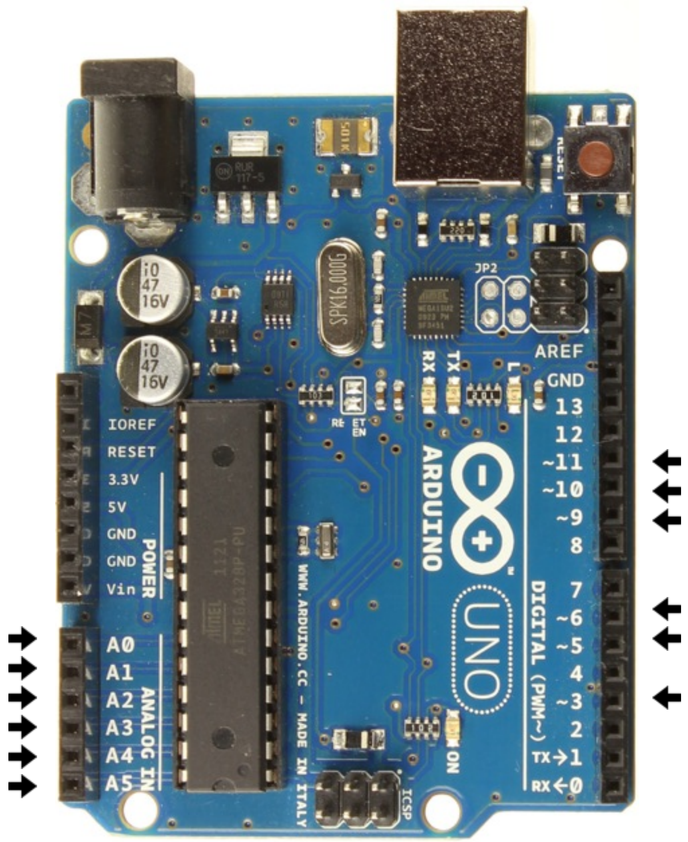


6 ANALOG PINS (A0-A5)
0 TO 1024
INPUT ONLY

14 DIGITAL PINS (0-13)
1 OR 0 (HIGH/LOW)
INPUT OR OUTPUT

I/O

6 ANALOG PINS (A0-A5)
0 TO 1024
INPUT ONLY

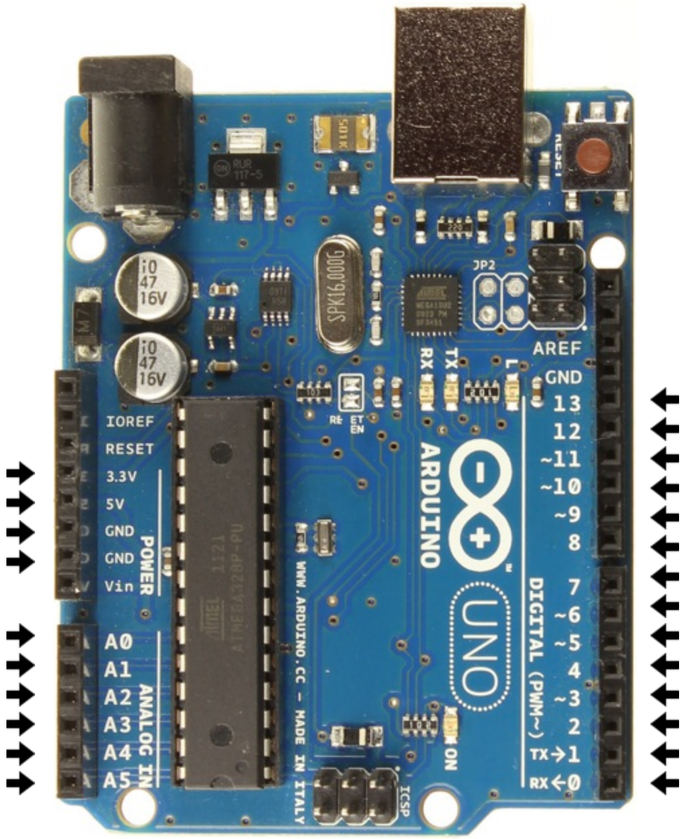


6 DIGITAL PWM PINS
(~11 - ~9, ~6, ~5, ~3)
FLASH ON AND OFF
FAKE ANALOG OUTPUT

I/O

POWER/GROUND

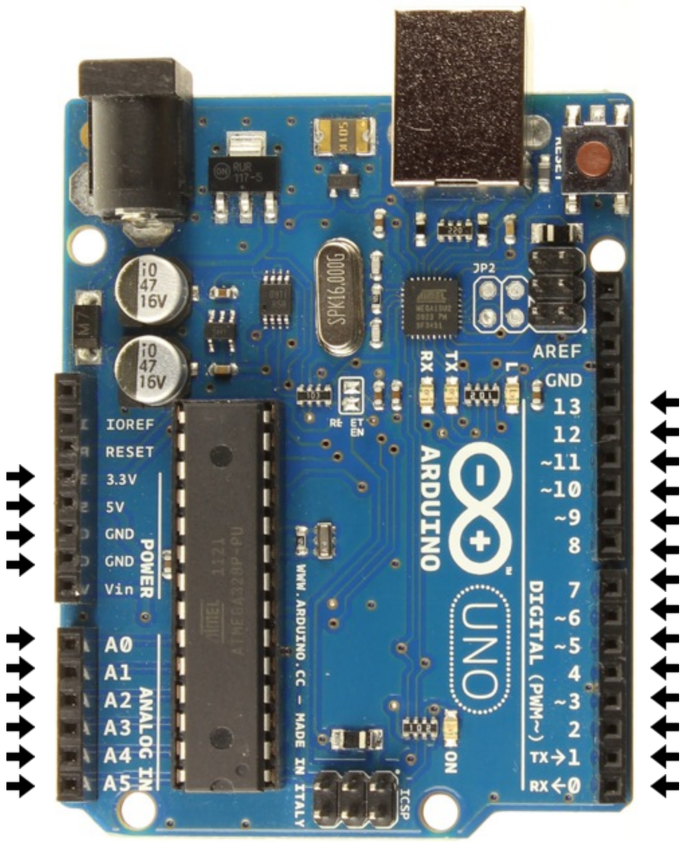
6 ANALOG PINS (A0-A5)
0 TO 1024
INPUT ONLY



14 DIGITAL PINS (0-13)
1 OR 0 (HIGH/LOW)
INPUT OR OUTPUT

I/O

EXTERNAL POWER



POWER/GROUND

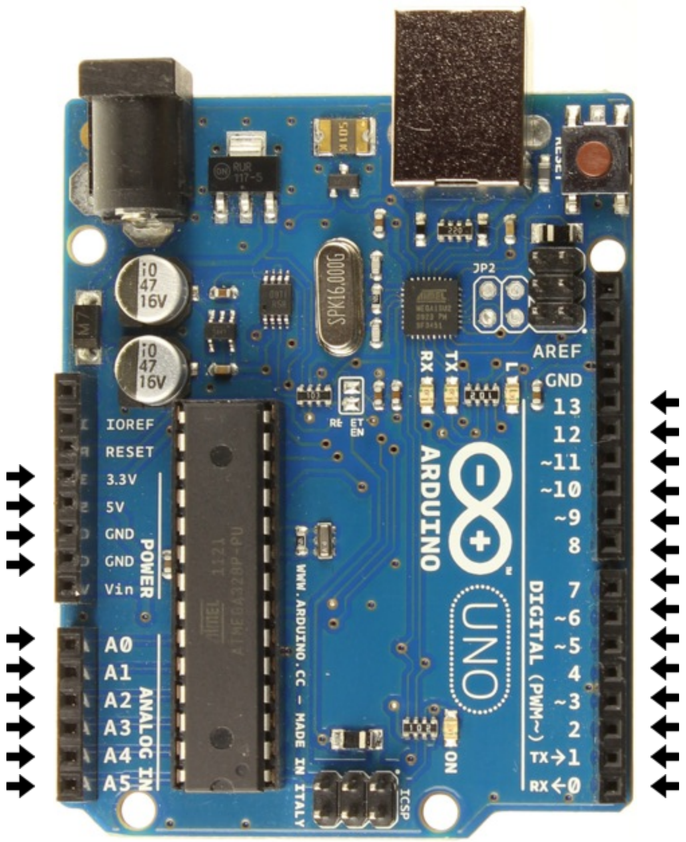
6 ANALOG PINS (A0-A5)
0 TO 1024
INPUT ONLY

14 DIGITAL PINS (0-13)
1 OR 0 (HIGH/LOW)
INPUT OR OUTPUT

I/O

EXTERNAL POWER

SERIAL COMMUNICATION

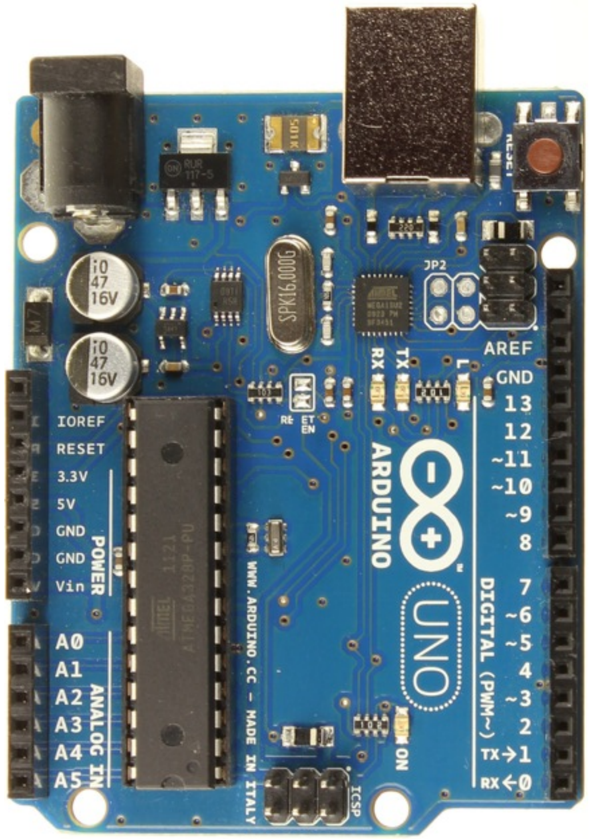


POWER/GROUND

6 ANALOG PINS (A0-A5)
0 TO 1024
INPUT ONLY

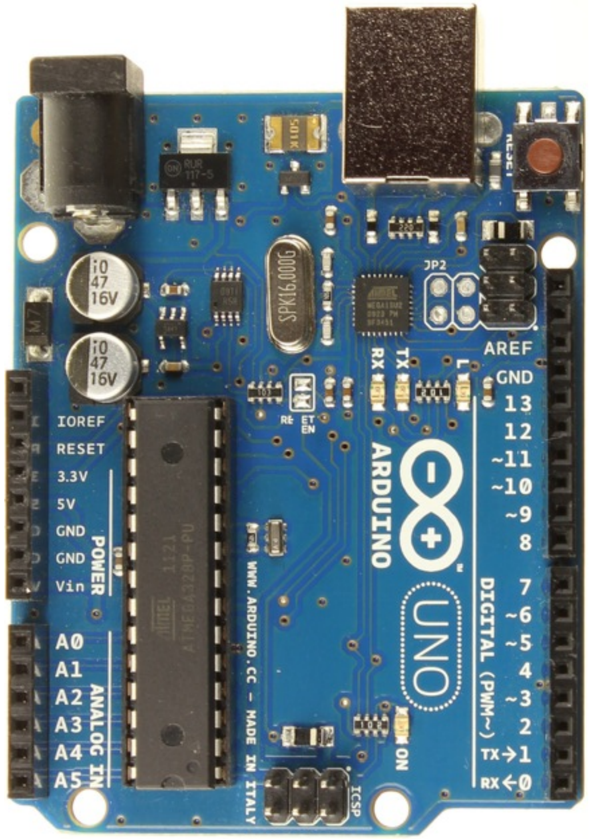
14 DIGITAL PINS (0-13)
1 OR 0 (HIGH/LOW)
INPUT OR OUTPUT

I/O


IOREF
RESET
3.3V
5V
GND
GND
Vin
POWER
A0
A1
A2
A3
A4
A5
ANALOG IN
ATMEGA328P-PU
WWW.ARDUINO.CC – MADE IN ITALY
ICSP
ON
ARDUINO
UNO
DIGITAL (PWM~)
TX→1
RX←0
7
~6
~5
4
~3
2
8
~9
~10
~11
12
13
GND
AREF
L
TX
RX
JP2
SPK16.000G
16V
47
10

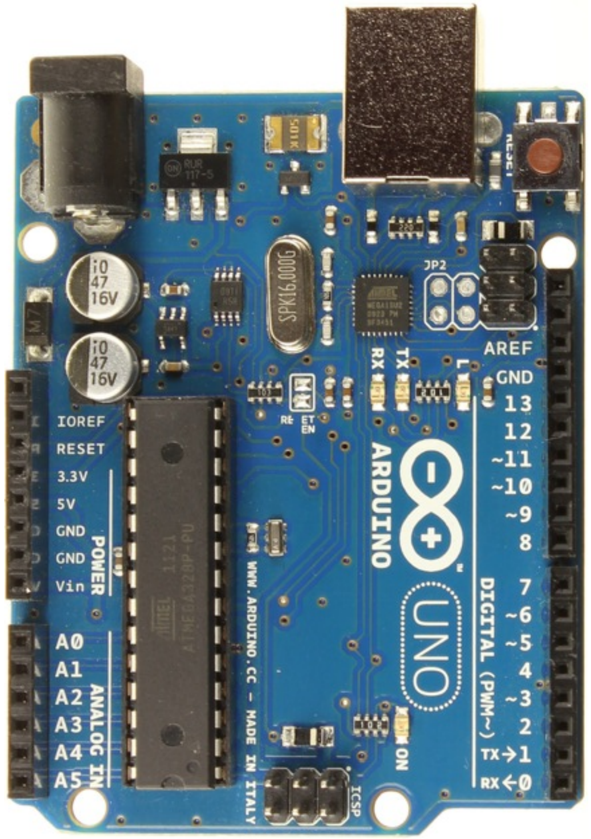
I/O

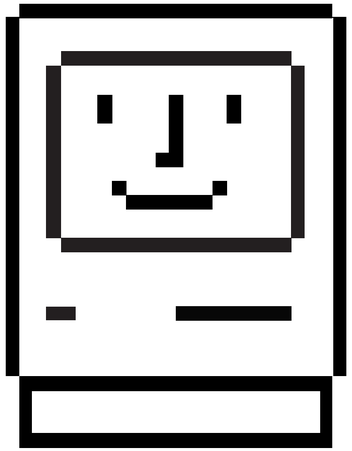
INPUT
FROM SENSOR



I/O

INPUT
FROM SENSOR

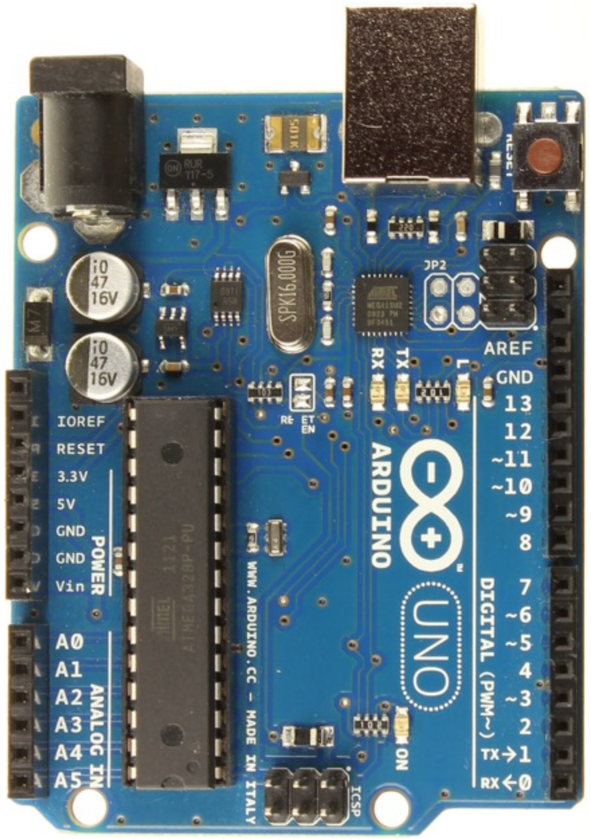




COMPUTATION

I/O

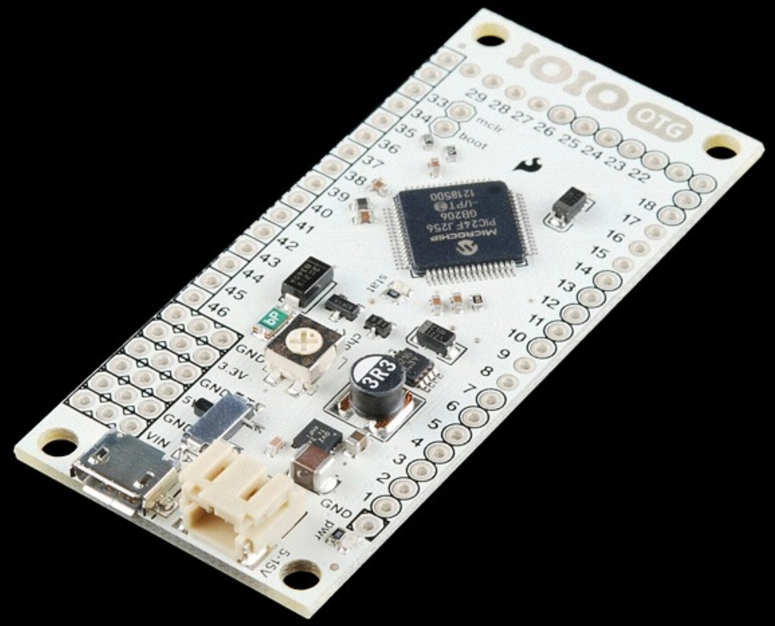
INPUT
FROM SENSOR

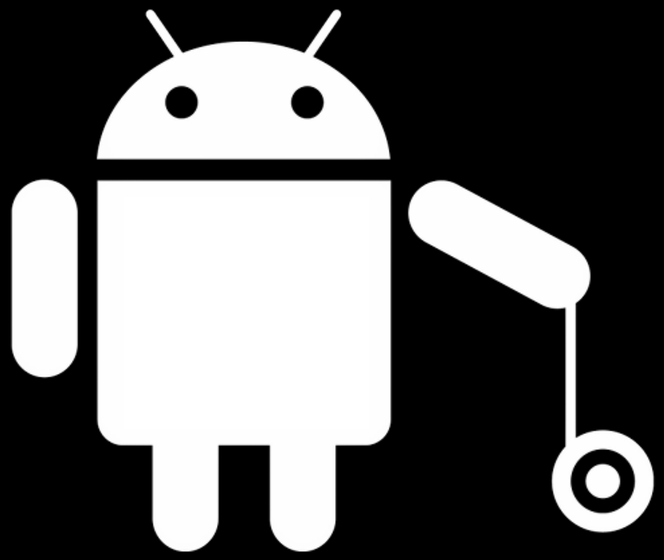


COMPUTATION

MOBILE/HARDWARE

MOBILE/HARDWARE

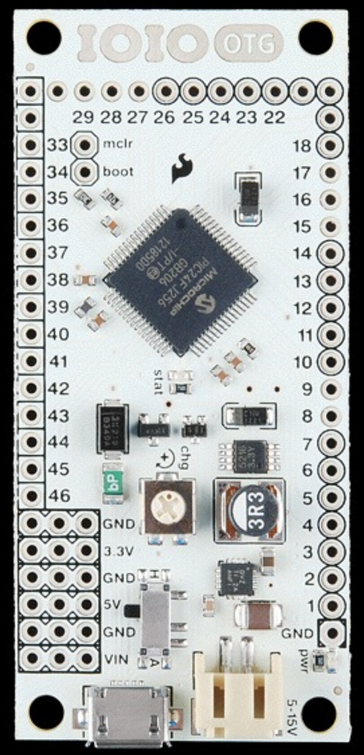




MOBILE/HARDWARE

INPUT
FROM SENSOR

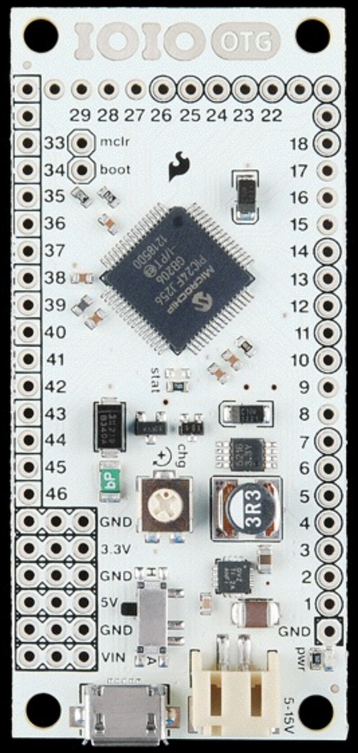
OUTPUT
TO ACTUATOR



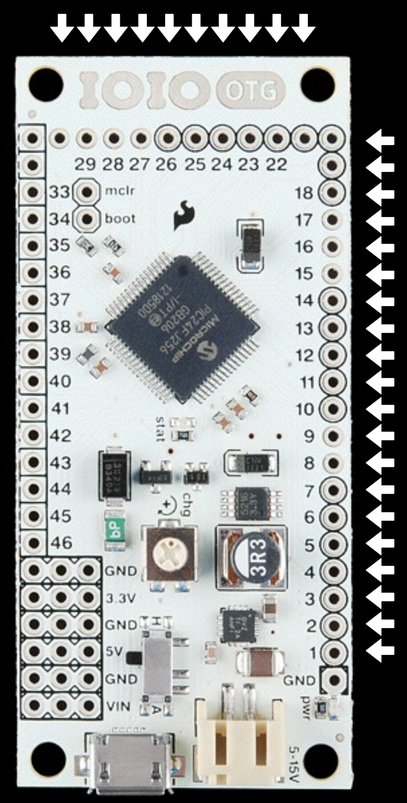
I/O FROM
ANDROID

COMPUTATION

MOBILE/HARDWARE



MOBILE/HARDWARE



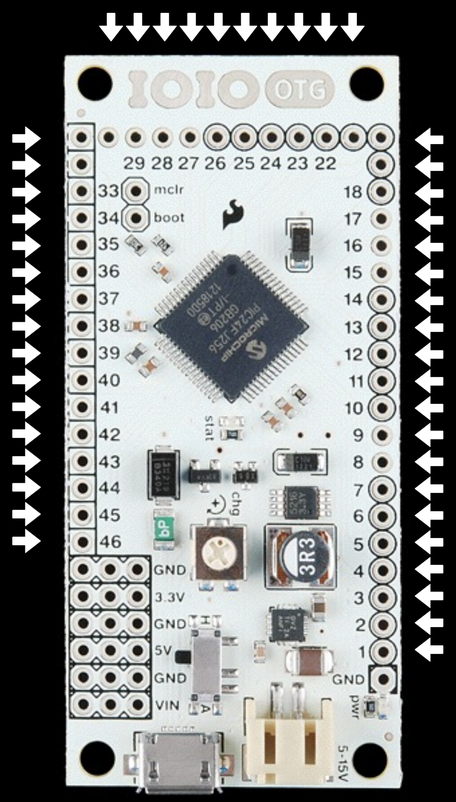
30 DIGITAL PINS (1-30)
1 OR 0 (HIGH/LOW)
INPUT AND OUTPUT
(A FEW ARE INPUT ONLY)

◯ 5V TOLERANT

MOBILE/HARDWARE

30 DIGITAL PINS (1-30)
1 OR 0 (HIGH/LOW)
INPUT AND OUTPUT
(A FEW ARE INPUT ONLY)

15 ANALOG PINS (31-46)
0 TO 1024
INPUT ONLY

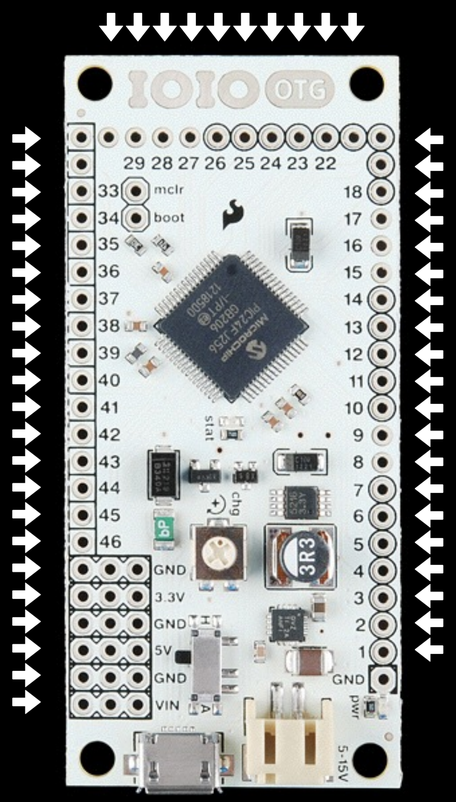


5V TOLERANT

MOBILE/HARDWARE

30 DIGITAL PINS (1-30)
1 OR 0 (HIGH/LOW)
INPUT AND OUTPUT
(A FEW ARE INPUT ONLY)

15 ANALOG PINS (31-46)
0 TO 1024
INPUT ONLY



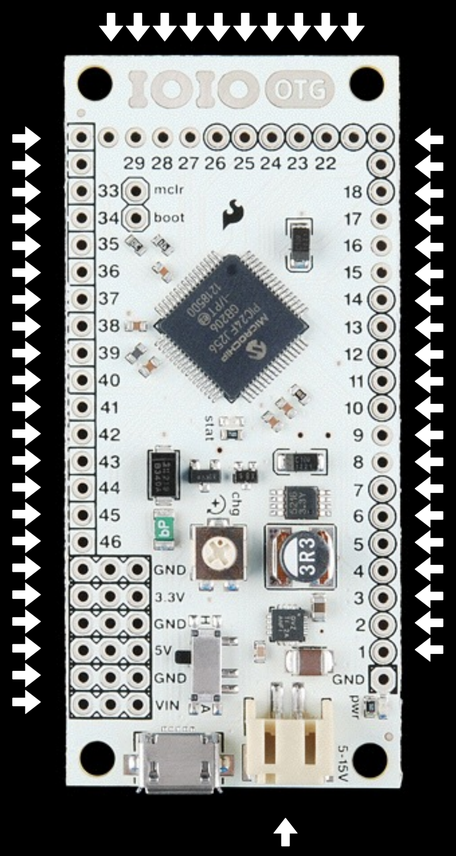
POWER/GROUND

◯ 5V TOLERANT

MOBILE/HARDWARE

30 DIGITAL PINS (1-30)
1 OR 0 (HIGH/LOW)
INPUT AND OUTPUT
(A FEW ARE INPUT ONLY)

15 ANALOG PINS (31-46)
0 TO 1024
INPUT ONLY



POWER/GROUND

5V TOLERANT

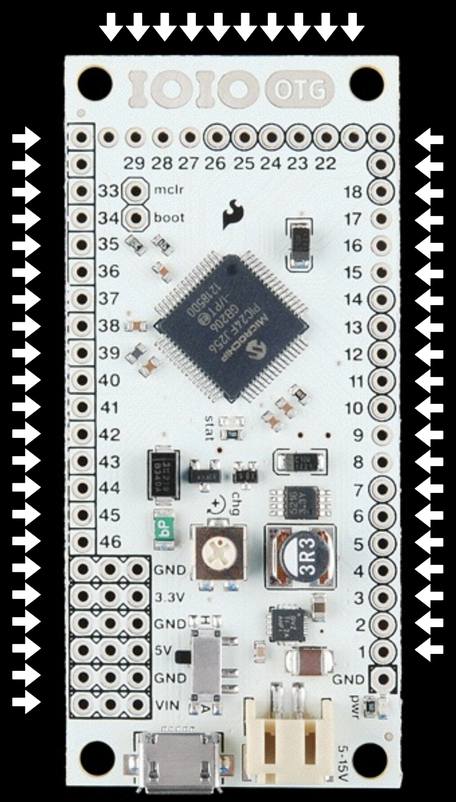
EXTERNAL POWER (JST)

MOBILE/HARDWARE

30 DIGITAL PINS (1-30)
1 OR 0 (HIGH/LOW)
INPUT AND OUTPUT
(A FEW ARE INPUT ONLY)

15 ANALOG PINS (31-46)
0 TO 1024
INPUT ONLY

5V TOLERANT

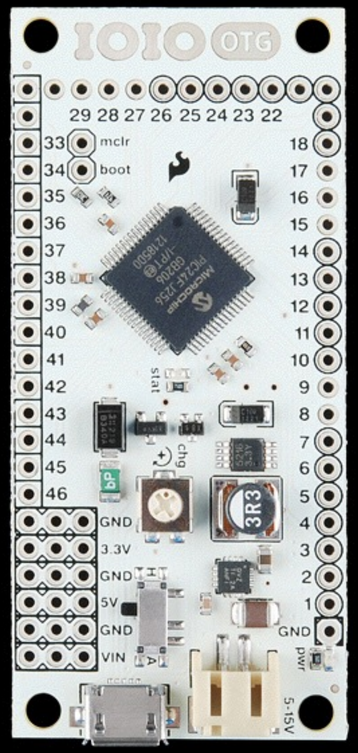


POWER/GROUND

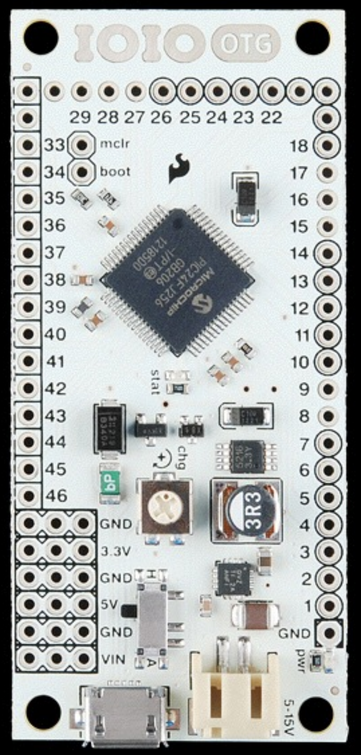
SERIAL COMMUNICATION

EXTERNAL POWER (JST)

MOBILE/HARDWARE

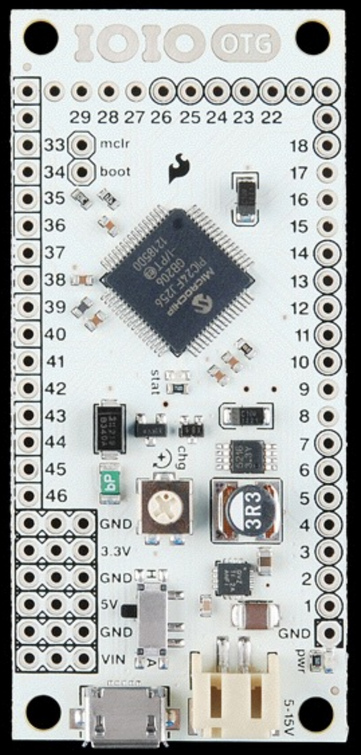


MOBILE/HARDWARE



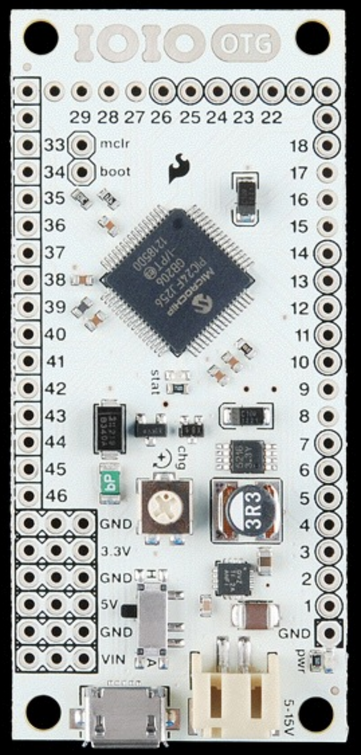
SERIAL COMMUNICATION

MOBILE/HARDWARE



SERIAL COMMUNICATION

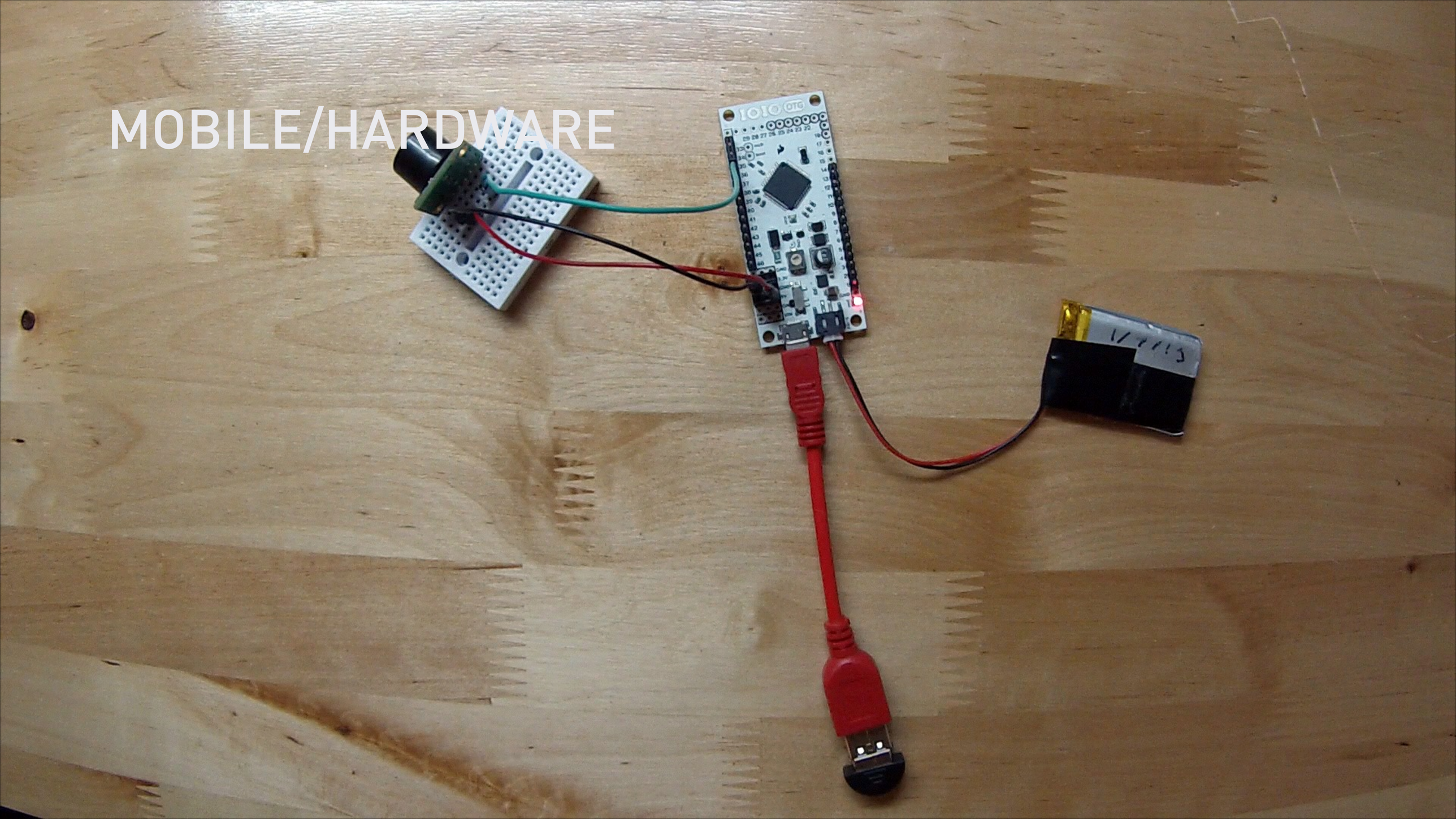
MOBILE/HARDWARE



SERIAL COMMUNICATION

EXTERNAL POWER (JST)

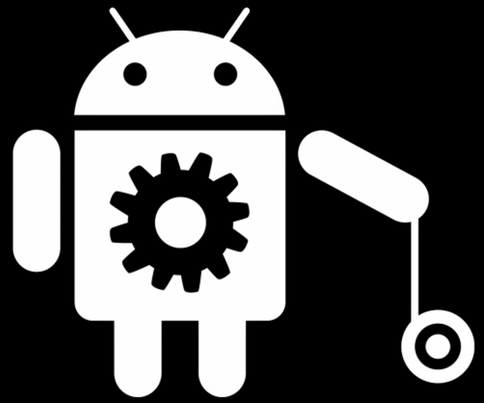
MOBILE/HARDWARE



MOBILE/HARDWARE

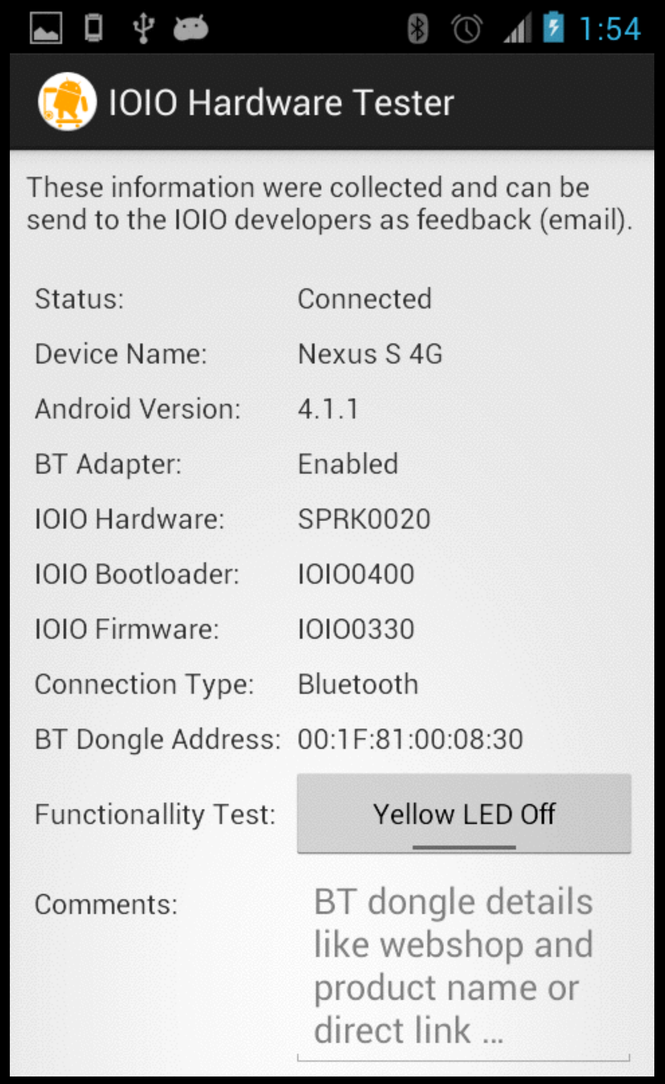
IOIO HARDWARE TESTER

IOIO MANAGER

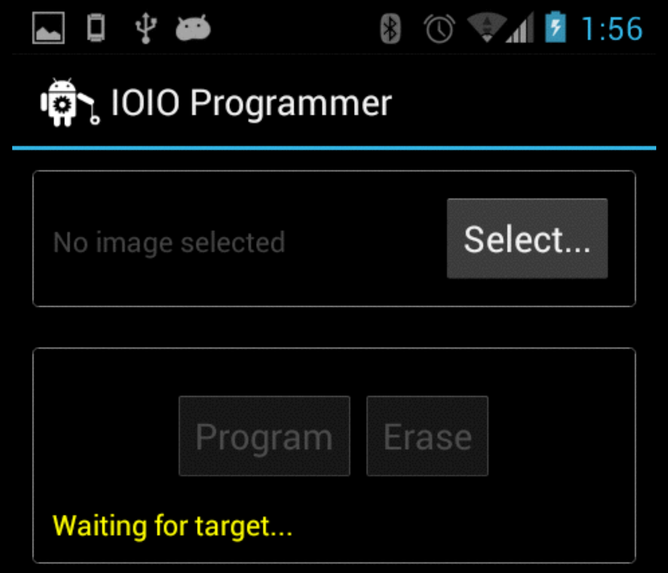


MOBILE/HARDWARE

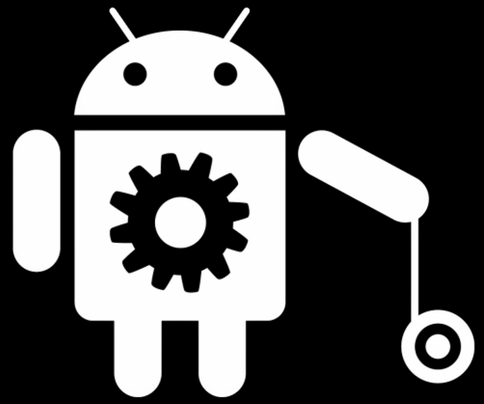
IOIO HARDWARE TESTER



MOBILE/HARDWARE



IOIO MANAGER



MOBILE/SOFTWARE

MOBILE/SOFTWARE/JAVA

MOBILE/SOFTWARE/JAVA/DIGITAL OUTPUT

INSTANTIATE

```
DigitalOutput led = ioio.openDigitalOutput(IOIO.LED_PIN);
```

SET PIN TO LOW (0)

```
out.write(false);
```

SET PIN TO HIGH (1)

```
out.write(true);
```

WHEN FINISHED CALL

```
out.close();
```

MOBILE/SOFTWARE/JAVA/DIGITAL INPUT

INSTANTIATE

```
DigitalInput in = ioio.openDigitalInput(pinNum);
```

READ PIN

```
boolean value = in.read();
```

WHEN FINISHED CALL

```
in.close();
```

MOBILE/SOFTWARE/JAVA/ANALOG INPUT

INSTANTIATE

```
AnalogInput in = ioio.openAnalogInput(pinNum);
```

READ PIN

```
float value = in.read();
```

WHEN FINISHED CALL

```
in.close();
```

MOBILE/SOFTWARE/PROCESSING

MOBILE/SOFTWARE/PROCESSING

coDistance | Processing 2.0.3

Java

coDistance

```
void setup() {
  size(600, 300);
  background(#FFFFFF);
  smooth();
}

void draw() {
  background(#FFFFFF);

  float lineLength = dist(width/2, height/2, mouseX, mouseY);
  int lengthInt = int(lineLength);

  line(width/2, height/2, mouseX, mouseY);

  fill(#FF0000);
  text(lengthInt, 20, 20);

  noFill();
  ellipse(width/2, height/2, lineLength * 2, lineLength * 2);
}
```

1

MOBILE/SOFTWARE/PROCESSING/STRUCTURE

INSTANTIATE/DEFINE VARIABLES/IMPORT LIBRARIES

```
import ipcapture.*;
import processing.video.*;

int numPixels;
int[] previousFrame;
IPCapture video;
```

MOBILE/SOFTWARE/PROCESSING/STRUCTURE

SETUP

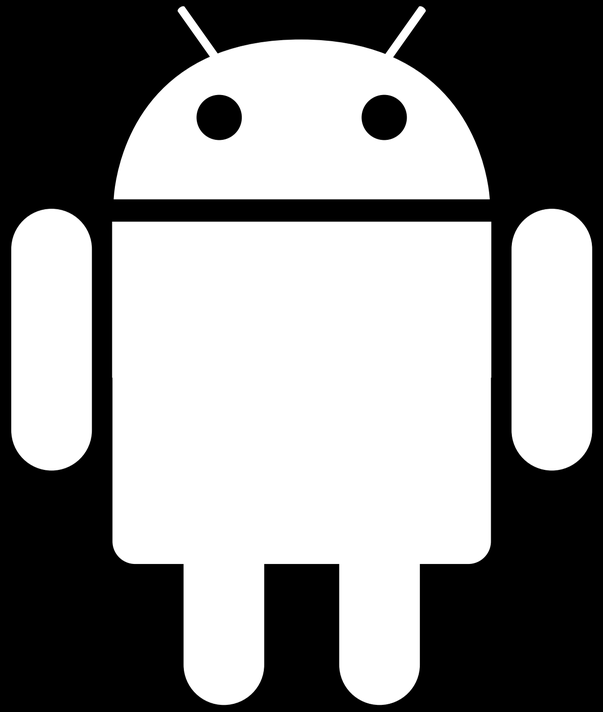
```
void setup() {
  size(600, 300);
  background(#FFFFFF);
  smooth();
}
```

MOBILE/SOFTWARE/PROCESSING/STRUCTURE

DRAW LOOP

```
void draw() {
  background(#FFFFFF);

  float lineLength = dist(width/2, height/2, mouseX, mouseY);
  int lengthInt = int(lineLength);

  line(width/2, height/2, mouseX, mouseY);

  fill(#FF0000);
  text(lengthInt, 20, 20);

  noFill();
  ellipse(width/2, height/2, lineLength * 2, lineLength * 2);
}
```

MOBILE/SOFTWARE/PROCESSING/ANDROID



Processing File Edit Sketch Tools Help

coDistance | Processing 2.0.3

Java

coDistance

```
void setup() {
  size(600, 300);
  background(#FFFFFF);
  smooth();
}

void draw() {
  background(#FFFFFF);

  float lineLength = dist(width/2, height/2, mouseX, mouseY);
  int lengthInt = int(lineLength);

  line(width/2, height/2, mouseX, mouseY);

  fill(#FF0000);
  text(lengthInt, 20, 20);

  noFill();
  ellipse(width/2, height/2, lineLength * 2, lineLength * 2);
}
```

1

Processing File Edit Sketch Tools Android Help

coDistance | Processing 2.0.3

Android

coDistance

```
void setup() {
  size(600, 300);
  background(#FFFFFF);
  smooth();
}

void draw() {
  background(#FFFFFF);

  float lineLength = dist(width/2, height/2, mouseX, mouseY);
  int lengthInt = int(lineLength);

  line(width/2, height/2, mouseX, mouseY);

  fill(#FF0000);
  text(lengthInt, 20, 20);

  noFill();
  ellipse(width/2, height/2, lineLength * 2, lineLength * 2);
}
```

1

Processing File Edit Sketch Tools Android Help

00:22, 26 MB

coDistance | Processing 2.0.3

Android

coDistance

```
void setup() {
  size(600, 300);
  background(#FFFFFF);
  smooth();
}

void draw() {
  background(#FFFFFF);
```

Android SDK Manager

SDK Path: /Users/macbookair/Documents/adt-bundle-mac-x86_64-20130219/sdk

Packages

Name	API	Rev.	Status
Tools			
Android SDK Tools		22.2.1	Installed
Android SDK Platform-tools		18.0.1	Installed
Android SDK Build-tools		18.1.1	Installed
Android SDK Build-tools		18.1	Installed
Android SDK Build-tools		18.0.1	Installed
Android SDK Build-tools		17	Installed
Android 4.3 (API 18)			
Documentation for Android SDK	18	2	Installed
SDK Platform	18	2	Installed
Samples for SDK	18	1	Installed
ARM EABI v7a System Image	18	2	Installed
Intel x86 Atom System Image	*18*	*1*	*Not installed*
Google APIs	18	3	Installed
Sources for Android SDK	18	1	Installed
Android 4.2.2 (API 17)			
SDK Platform	17	2	Installed
Samples for SDK	17	1	Installed
ARM EABI v7a System Image	17	2	Installed
Intel x86 Atom System Image	17	1	Installed
MIPS System Image	17	1	Installed
Google APIs	17	3	Installed
Sources for Android SDK	17	1	Installed
Android 4.1.2 (API 16)			
SDK Platform	16	4	Installed

Show: Updates/New Installed Obsolete Select New or Updates

Install packages...

Sort by: API level Repository Deselect All

Delete packages...

Done loading packages.

emulator64-mips Window

01:31, 85 MB

5554:NexusS4G

12:58

Thu, October 24

Connect your charger.

Android

Basic Controls

Hardware Buttons

MENU

DPAD not enabled in AVD

Hardware Keyboard

Use your physical keyboard to provide input

coDistance | Processing 2.0.3

Android

```
dist(width/2,
(lineLength);
t/2, mouseX, m
20);
ight/2, lineLe
```

Android Virtual Device Manager

Android Virtual Devices | Device Definitions

List of existing Android Virtual Devices located at /Users/macbookair/.android/avd

AVD Name	Target Name	Platform	API Level	CPU/ABI
AVD_for_2_7in	Android 1.5	1.5	3	ARM (armeabi)
Processing-01	Google APIs (Google Inc.)	2.1	7	ARM (armeabi)
AVD_for_Nexu	Android 2.3.3	2.3.3	10	ARM (armeabi)
AVD_for_Galax	Android 4.0	4.0	14	ARM (armeabi-v7
NexusS4G	Android 4.1.2	4.1.2	16	MIPS (mips)
newTest	Google APIs (Google Inc.)	4.3	18	ARM (armeabi-v7

New... Edit... Delete... Repair... Details... Start... Refresh

A valid Android Virtual Device. A repairable Android Virtual Device.

An Android Virtual Device that failed to load. Click 'Details' to see the error.

Processing File Edit Sketch Tools Android Help

ttVMbeta05IOIO | Processing 2.0.3

Android

ttVMbeta05IOIO | IOIO_thread | pagelayouts | targetInterface

```
// - - - - - - - - - - - - - - - - - - - - - - - -
// Tigertree Vending Machine v05 08-03-13
// BY SCOTT SULLIVAN
// - - - - - - - - - - - - - - - - - - - - - - - -

// FEATURES TO ADD

// - - main functionaility
// Credit card payment
// Bluetooth connectivity to IOIO

// - - minor functionality
// get rid of Android bar at bottom
// get rid of screen timeout
// get app to read from web (just change the paths with internet permissions ena

// - - - - - - - - - - - - - - - - - - - - - - - -
// LIBRARIES
// - - - - - - - - - - - - - - - - - - - - - - - -
import ioio.lib.api.*;
import ioio.lib.api.exception.*;
import com.pinkhatproductions.pioio.*;

// - - - - - - - - - - - - - - - - - - - - - - - -
// ANDROID
// - - - - - - - - - - - - - - - - - - - - - - - -
```

1

00:00

MOBILE/SOFTWARE/PROCESSING/ANDROID

SETUP

```
size(displayWidth, displayHeight);

orientation(PORTRAIT);
orientation(LANDSCAPE);
```

Macintosh HD

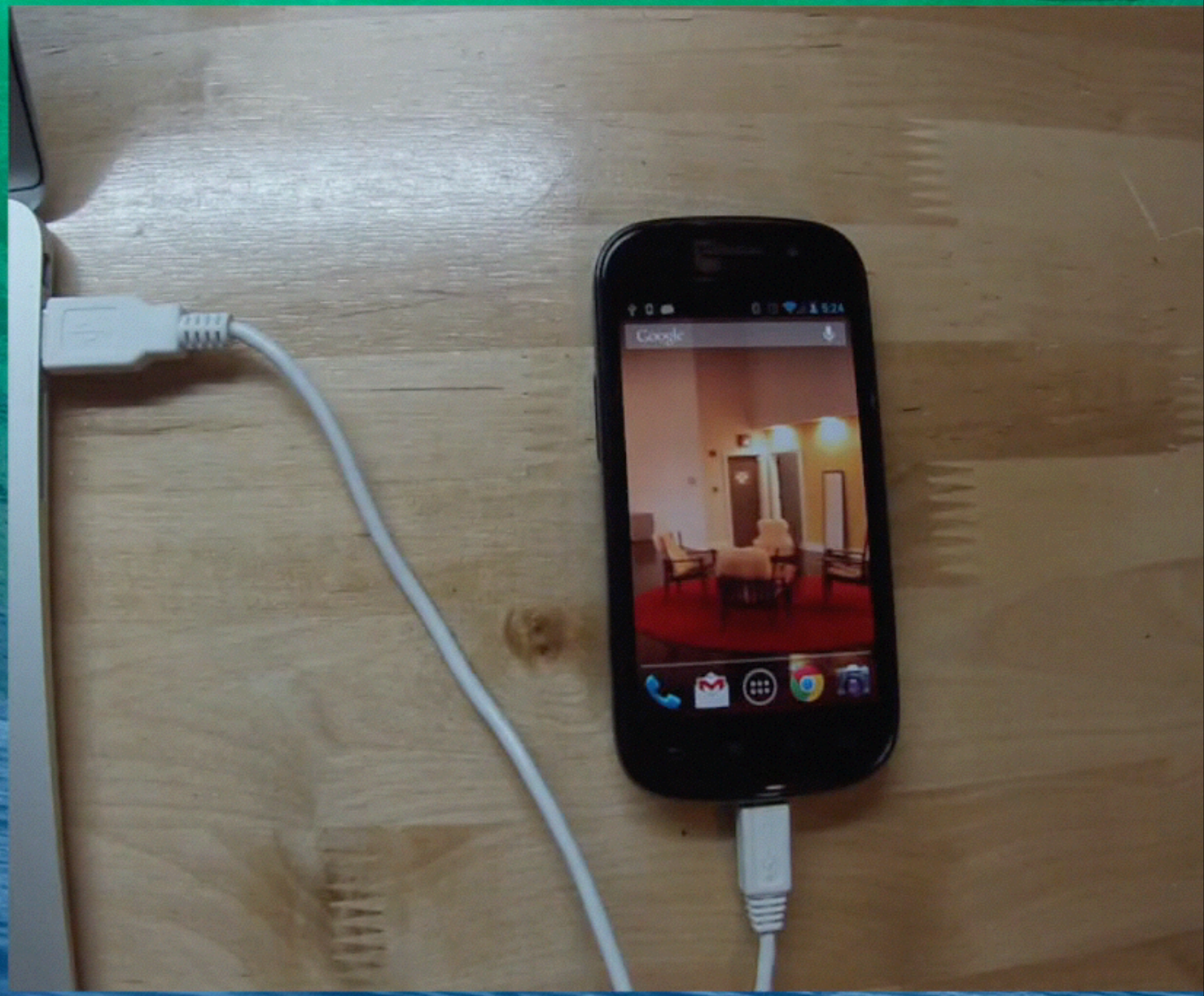
Accelerometer | Processing 2.0.3

Android

Accelerometer

```
/**
 * <p>Ketai Sensor Library for Android: http://KetaiProject.org</p>
 *
 * <p>KetaiSensor Features:
 * <ul>
 * <li>handles incoming Sensor Events</li>
 * <li>Includes Accelerometer, Magnetometer, Gyroscope, GPS, Light, Proximity</l
 * <li>Use KetaiNFC for Near Field Communication</li>
 * </ul>
 * <p>Updated: 2012-03-10 Daniel Sauter/j.duran</p>
 */

import ketai.sensors.*;

KetaiSensor sensor;
float accelerometerX, accelerometerY, accelerometerZ;

void setup()
{
  sensor = new KetaiSensor(this);
  sensor.start();
  orientation(LANDSCAPE);
  textAlign(CENTER, CENTER);
  textSize(36);
}

void draw()
```

1



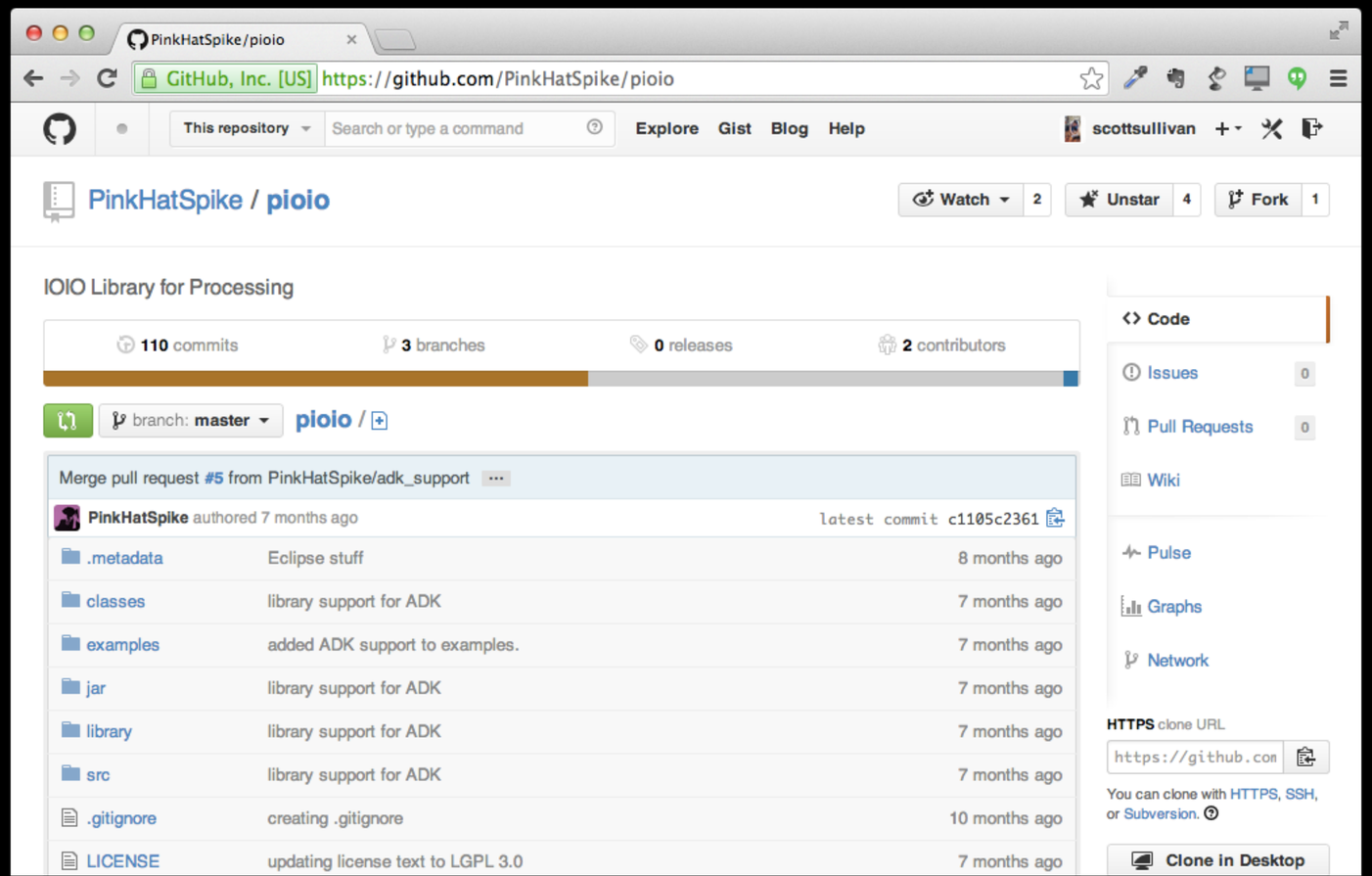
MOBILE/SOFTWARE/PROCESSING/ANDROID

ACCELEROMETER
GYROSCOPE
CAMERA
FACE DETECTION
MULTI-TOUCH GESTURES
BLUETOOTH
KEYBOARD
VIBRATE
DATABASE
WIFI NETWORKING
NFC

KETAI LIBRARY

MOBILE/SOFTWARE/PROCESSING/PIOIO

https://github.com/PinkHatSpike/pioio



MOBILE/SOFTWARE/PROCESSING/PIOIO

INSTANTIATE/DEFINE VARIABLES/IMPORT LIBRARIES

```
import ioio.lib.api.*;
import ioio.lib.api.exception.*;
import com.pinkhatproductions.pioio.*;

import android.view.Window;
import android.view.WindowManager;
import android.content.pm.ActivityInfo;
import android.os.Bundle;
import android.bluetooth.*;

DigitalOutput led1;
DigitalOutput led2;
DigitalOutput led3;
```

MOBILE/SOFTWARE/PROCESSING/PIOIO

SETUP

```
void setup() {
  size(displayWidth, displayHeight);
  new PIOIOManager(this).start();
}
```

MOBILE/SOFTWARE/PROCESSING/PIOIO

DRAW LOOP

```
void draw() {
}
```

MOBILE/SOFTWARE/PROCESSING/PIOIO

MOUSE EVENTS

```
void mousePressed() {
  if (light1On == true) light1On = false;
    else if (light1On == false) light1On = true;
}
```

MOBILE/SOFTWARE/PROCESSING/PIOIO

IOIO THREAD SETUP

```
void ioioSetup(IOIO ioio) throws ConnectionLostException {
  led1 = ioio.openDigitalOutput(1);
  led2 = ioio.openDigitalOutput(2);
  led3 = ioio.openDigitalOutput(3);
}
```

MOBILE/SOFTWARE/PROCESSING/PIOIO

IOIO THREAD LOOP

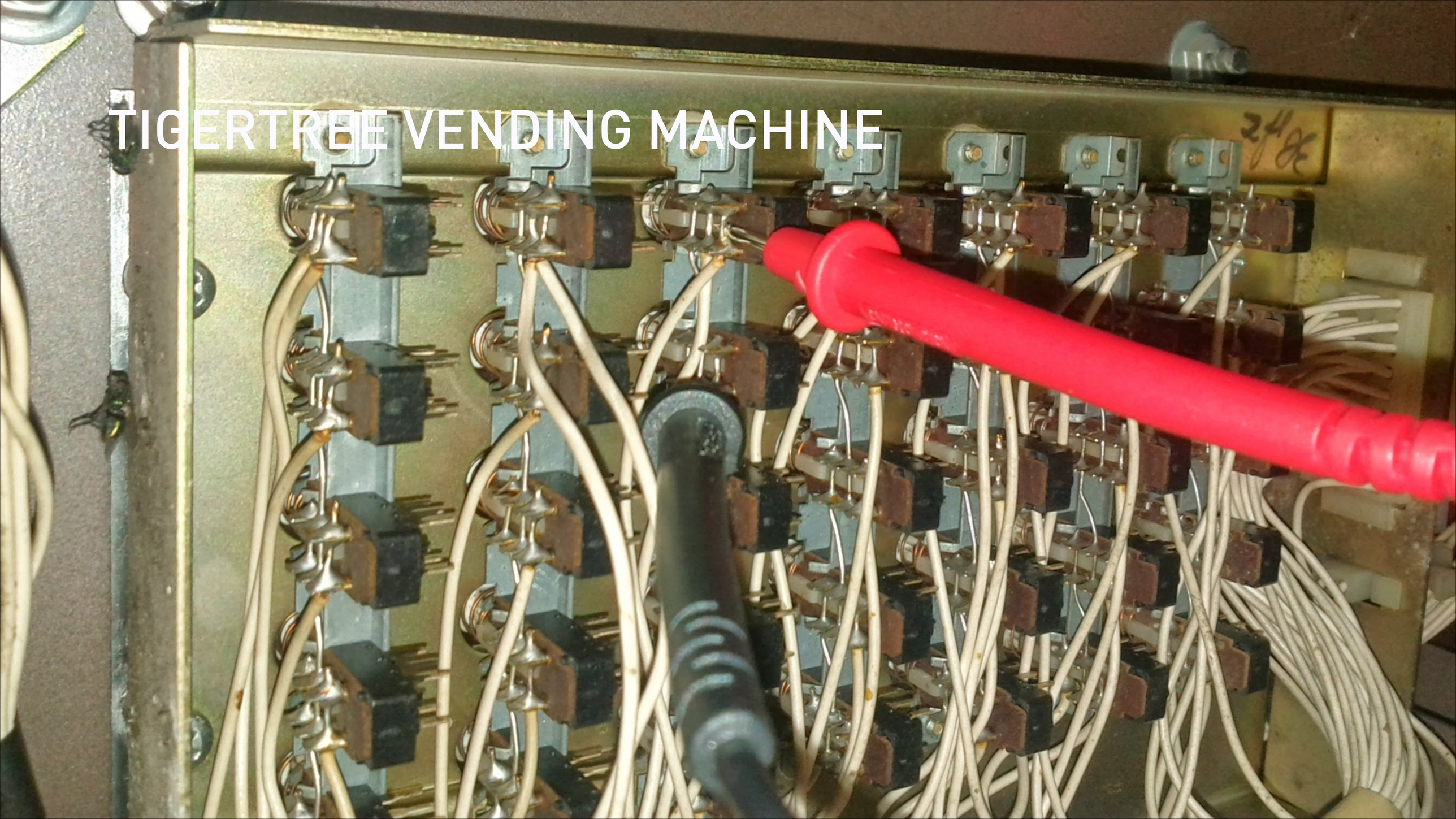
```
void ioioLoop(IOIO ioio) throws ConnectionLostException {
  try {
    led1.write(light1On);
  }
  catch (ConnectionLostException e) {
  }
  try {
    led2.write(light2On);
  }
  catch (ConnectionLostException e) {
  }
  try {
    led3.write(light3On);
  }
}
```

TIGERTREE VENDING MACHINE

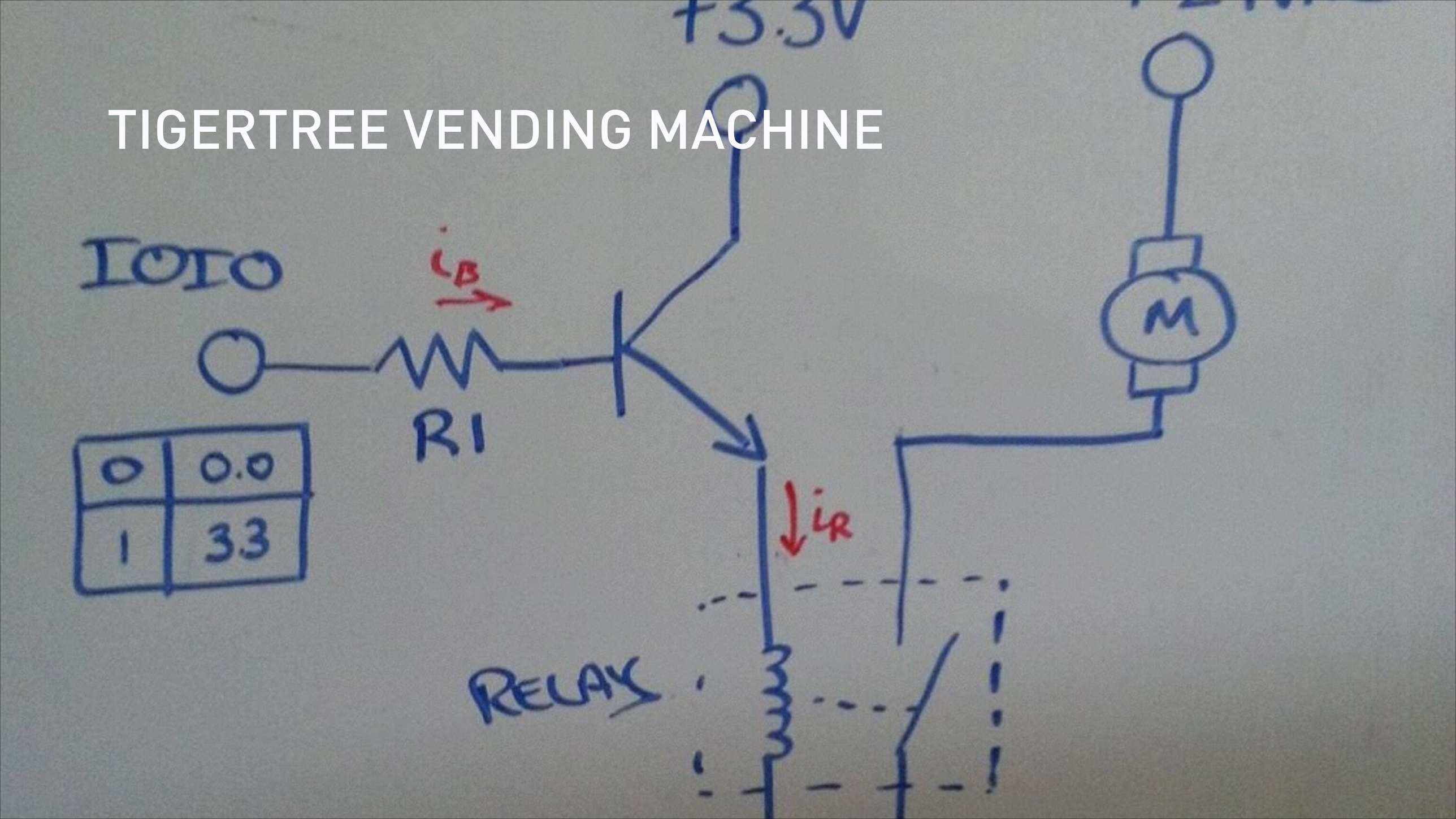
TIGERTREE VENDING MACHINE

TIGERTREE VENDING MACHINE

TIGERTREE VENDING MACHINE

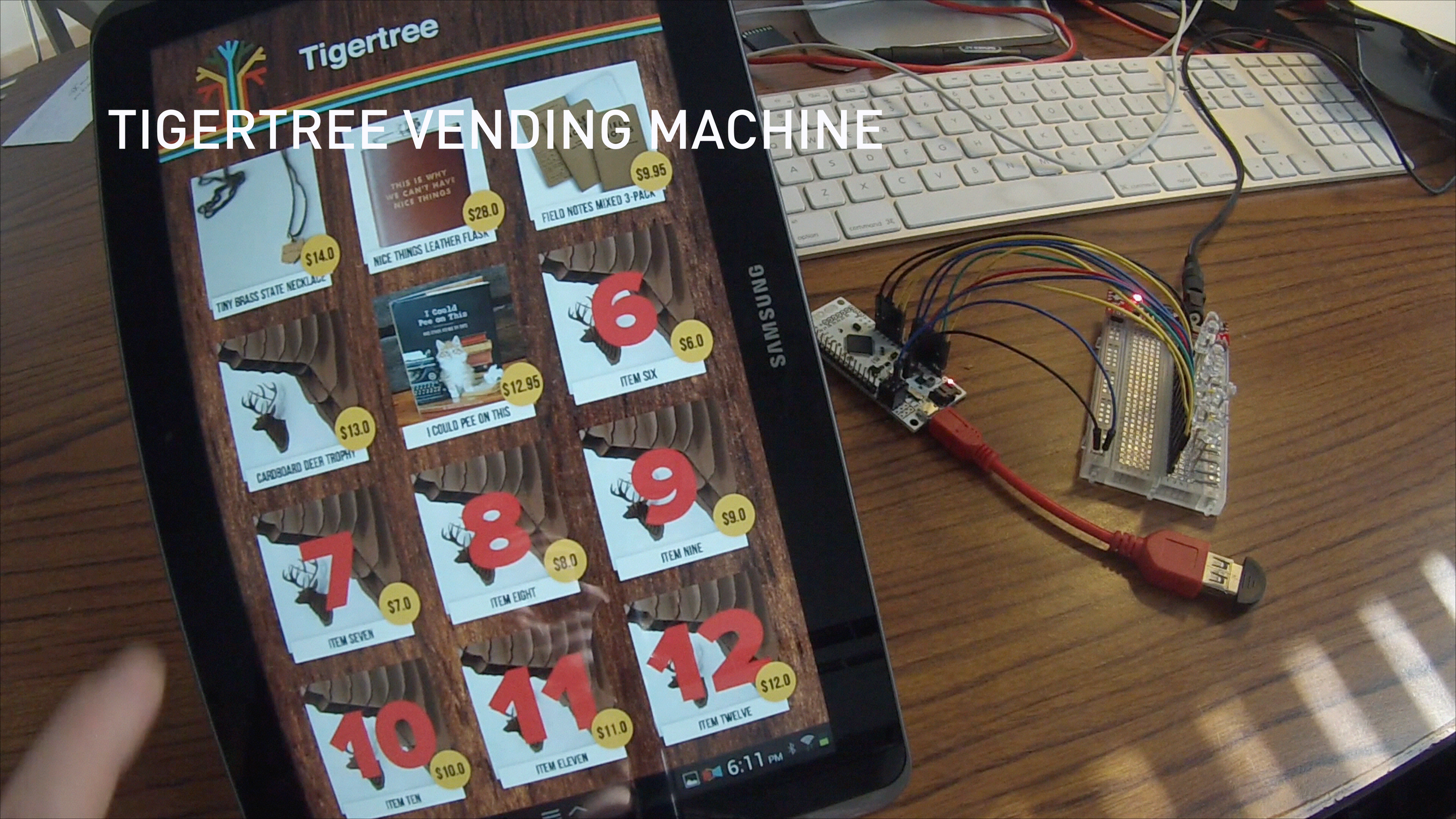


TIGERTREE VENDING MACHINE



0	0.0
1	33

TIGERTREE VENDING MACHINE



ENVIRONMENTAL I/O WITH ANDROID IOIO

RAPID PROTOTYPING HARDWARE-CONNECTED MOBILE APPLICATIONS

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