



COMP140 GAM160: Hacking Hardware/Advanced
Programming

Session 6: 12

Learning outcomes

- ▶ **Identify** the various parts of the Arduino and their function
- ▶ **Explain** the difference between analog and digital
- ▶ **Implement** a basic interface using Arduino and openFrameworks

Components

Come up and collect your components:

- ▶ **3x** 220ohm Resistors
- ▶ **1x** 10k Resistor
- ▶ **3x** LEDs (red, yellow & green)
- ▶ **1x** Potentiometer
- ▶ **1x** Push Button

What is an Arduino?



Space



The ArduSat satellites are powered by the Arduino Uno. It follows cube satellite (CubeSat) standards to build compact 10 cm cubes that can easily be sent to orbit.

Sea



The robotic prototype swimming under water propelled by fins, it was developed at the Control Systems and Robotics Laboratory of the Technological Educational Institute of Crete, in Heraklion (Greece) and it's controlled by an Arduino Mega.

Sensors & Actuators



Figure: Just another input / output controller

What is an Arduino?

- ▶ Open Source
- ▶ The Arduino is a small microcontroller board
- ▶ Basically, a small computer
- ▶ Perfect for rapid prototyping physical computing systems
- ▶ Arduino Uno is based on the Atmel ATmega328P

The basics

The Arduino can only processes electronic signals. This means that stimuli from the physical world need to be transduced to electrical signals before they can be processed from within your code.

- ▶ 14 Digital IO pins (0-14)
- ▶ 6 Analogue in pins(0-5)
- ▶ 6 Analogue out pins(3,5,6,9,10, and 11)

Technical specs

Microcontroller	ATmega328P
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limit)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
PWM Digital I/O Pins	6
Analog Input Pins	6
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328P) of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328P)
EEPROM	1 KB (ATmega328P)
Clock Speed	16 MHz
LED_BUILTIN	13
Length	68.6 mm
Width	53.4 mm
Weight	25 g

Figure: A more in depth version of what the Arduino Uno has to offer

Memory

- ▶ Flash memory (program space), is where the Arduino sketch is stored.
- ▶ SRAM (static random access memory) is where the sketch creates and manipulates variables when it runs.
- ▶ EEPROM is memory space that programmers can use to store long-term information.

Power

You can power the board using a USB port or DC power supply such as a 9v battery. The Arduino will default to the external power supply if there is one available.



Figure: Arduino can be powered by a DC supply 7-12v but all signals are processed at 5v

Analogue vs. Digital Signal

What is the difference?

Analogue vs. Digital Signal

What is the difference?

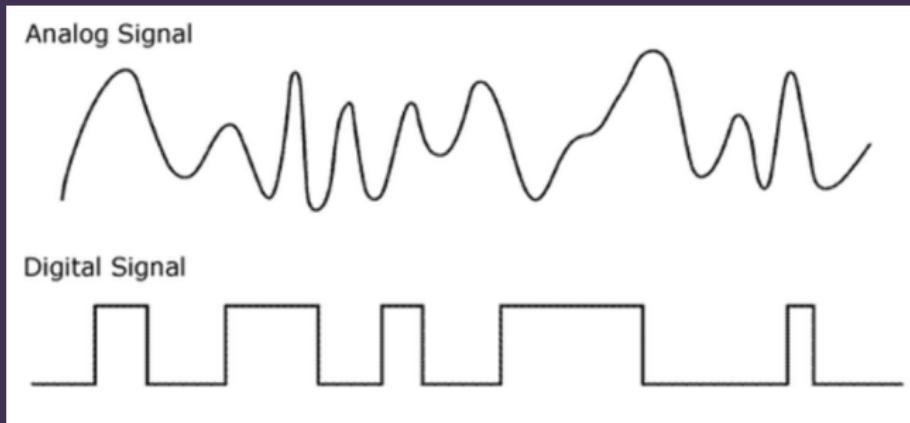
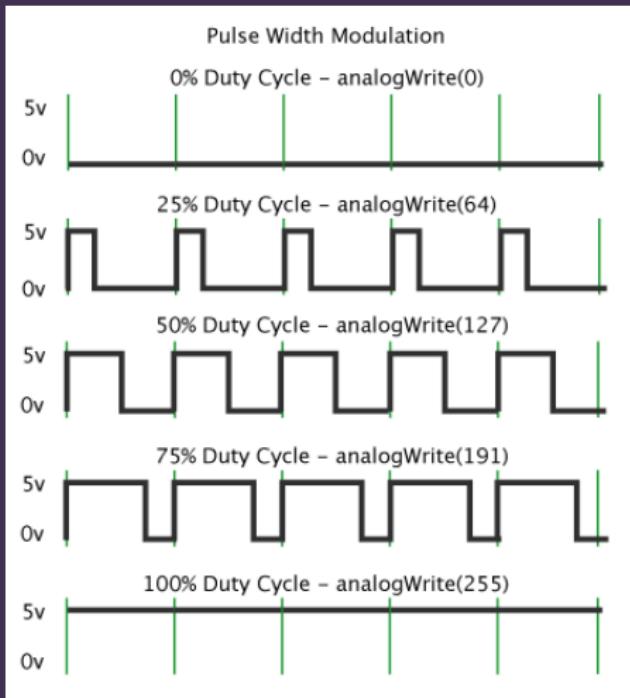


Figure: Arduino can be powered by a DC supply 7-12v

Analogue Out - PWM



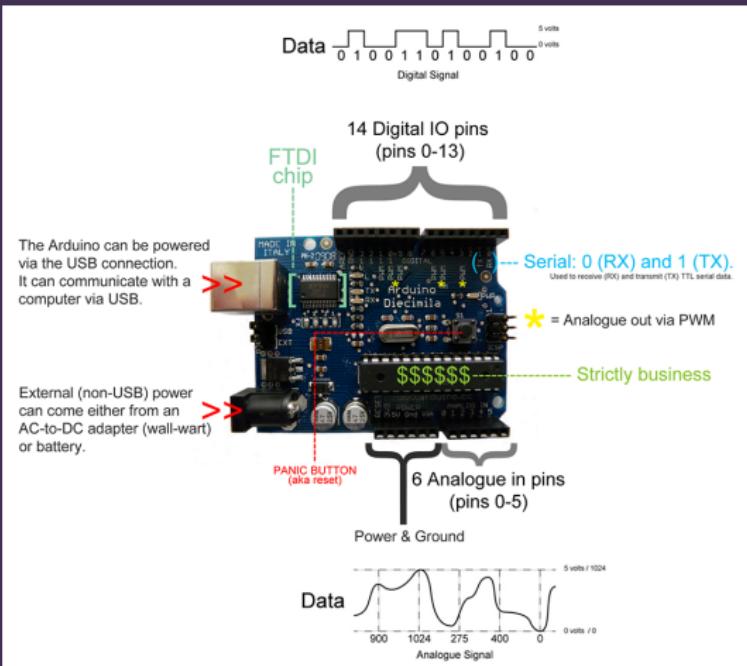
Serial Communication

Serial communication on pins TX/RX uses TTL logic levels (5V or 3.3V depending on the board).

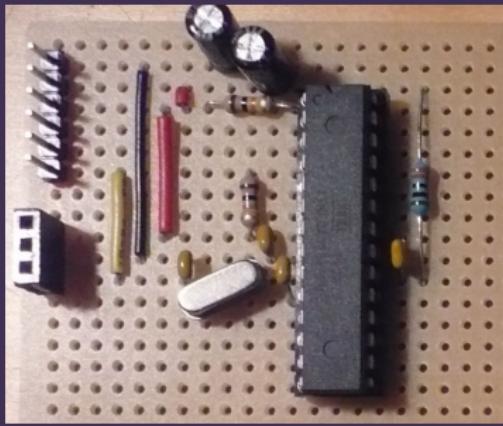
It communicates on digital pins 0 (RX) and 1 (TX) as well as with the computer via USB. Thus, if you use these functions, you cannot also use

pins 0 and 1 for digital input or output. Serial is used for communication between the Arduino board and a computer or other devices.

Arduino



DIY Arduino



Shields



Open Source Game Boy Clone



Places to buy components

Cool Components Home | Log In

All item ship from the USA

Contact Us | Community | Tutorials | Search cool stuff here... | Home | Log In

Want Raspberry Pi Accessories? Click here...

Search cool stuff here... | Home | Log In

Bitsbox

New, fast electronic components to order online - UK First Class P&P only £3.99 - All prices include VAT.

Categories

- 3D Printing
- Alarms & Clocks
- Antenna
- Antenna Kit
- Antenna Modules
- Antennas
- Bluetooth
- Books
- Breadboard
- Capacitors
- Components
- Computer Case
- GPS
- Heatsinks
- Inductors
- Jumpers
- Kit
- Kits
- LED
- Tools
- Audio
- GR8 Vouchers
- Das Beagle

CRAZYFLIE 2.0

Ideal for developers and supports bluetooth LE

Show More

Sign Up For Exclusive Access to New Products... - valid email address

Just Arrived ...

- LilyTwinkle

Raspberry Pi 3 Model B and 16GB SD Card with NOOBS

Triple Axis Breakout - 13DoF

Access money off deals

View Basket | Wish List | New Arrivals | Log In | Register | Help | Contact | User Sell | Get Paid

Welcome to Bitsbox - UK Electronic Component Supplier

Would you like to log yourself in?

Once logged in the contents of your cart will be remembered between sessions.

Log in to your account or create a new account if you don't have one yet. Once logged in you can add items to your basket and we will remember what's in there until you log out.

We are a small, independent family business based in the English Midlands specialising in the supply of electronic components at low prices.

Log in or Create Account

Use our on Facebook | Use our on Twitter

New Products For February

100R 10W Ceramic W/W

£0.28

220R 10W Ceramic W/W

£0.28

22R 10W Ceramic W/W

£0.28

View All | Home | Contact | Log In | Help | Contact | User Sell | Get Paid

ebay

Shop by category | Search...

View as a grid

Refine Results

Arduino Sensors

Arduino Sensor

Kits

Arduino Vibration Sensors

Arduino Light Sensors

Arduino Motion Sensors

Arduino Pressure Sensors

Arduino Temperature Sensors

Arduino Sensor Kits

Arduino Sensor Shield

Arduino Pressure Sensors

Refine Results

37-in-1 sensor module kit for arduino uno/raspberry pi starter kits for \$10.99

\$25.99

4-in-1

Electronics projects for arduino module - 37-in-1 sensor module for arduino uno/raspberry pi. Complete with arduino uno/raspberry pi. The request is for sensor kits. Arduino Uno Sensor Kit

Free Shipping

Super Value Ultimate 37-in-1 Sensor Modules Kit for Arduino & MCU Education - User

With 37 built-in sensors, it's the perfect way to start your sensor project!

Business & Industrial

Shop Menu | Shop by Brand | Electronic Kits by Type | Micro Bit | Blog | YouTube | Policies | Contact Us | About Us

PROTO-PIC

BBC microbit

Show Now

Catalogue

Antena

BBC Microbit

Breakout Boards

Cables and Connectors

Components

LEDs and Displays

Development Boards

Electronics Kits

exhibit the prototyping system for the micro-bit

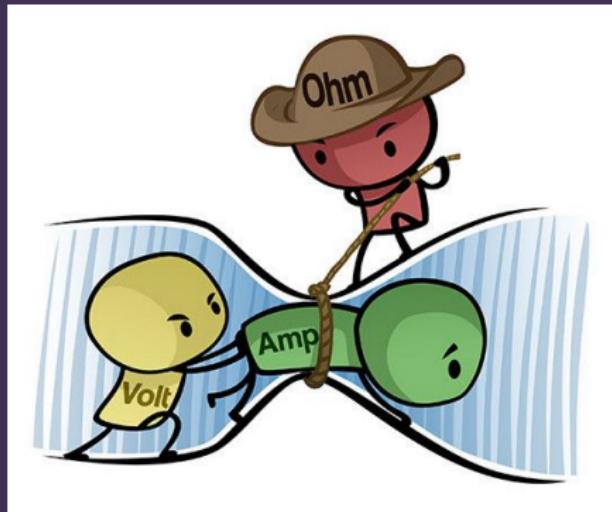
Featured Products - Current Top Sellers

- Micro:bit Breakout
- Micro:bit Cables
- Micro:bit Connectors
- Micro:bit Components
- Micro:bit Development Boards
- Micro:bit Electronics Kits

Also shop in Business & Industrial

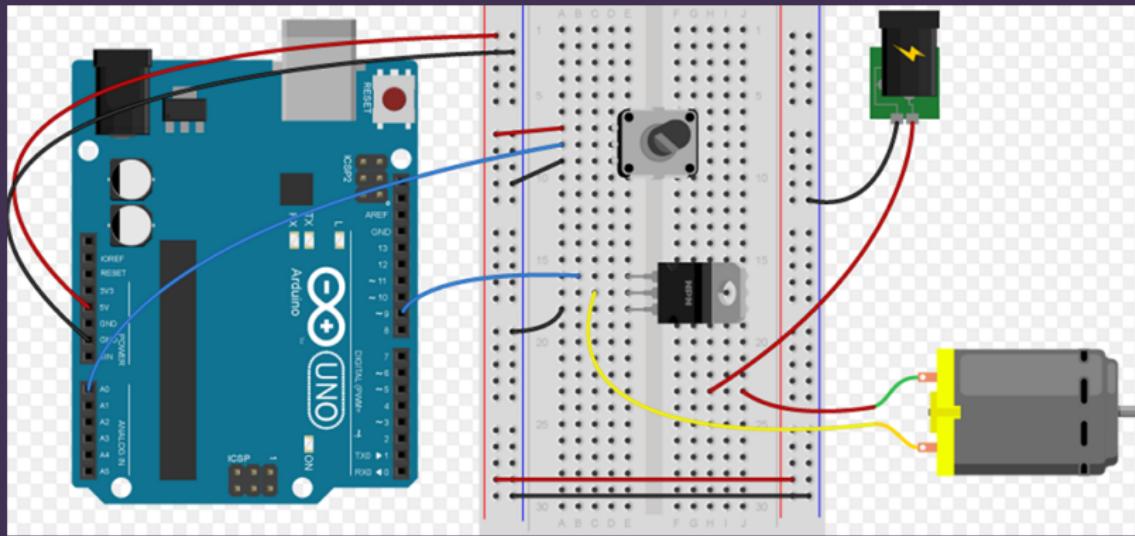
Figure: Insure that you buy your components from UK sellers, especially on Ebay

Ohms Law - Comic



Driving Large Loads

See spec



Reverse Voltage

The Arduino should be protected from reverse voltage of solenoids, relays, motors and any other component that use coils. This can be done using a Diode. They act as a one way valve to channel the electric back into the coils.



Mains Electricity



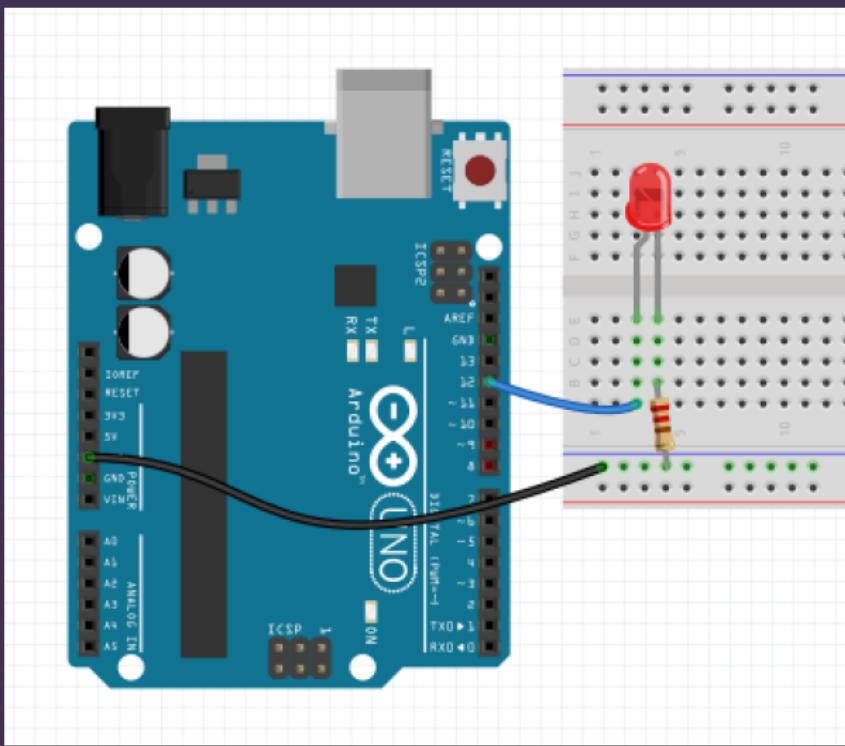
Figure: There is never any reason why you should be working with mains electricity supply - stay below 12v and even then take care.

Programming for Arduino

The Arduino language is merely a set of C/C++ functions that can be called from your code. Your sketch undergoes minor changes (e.g. automatic generation of function prototypes) and then is passed directly to a C/C++ compiler (avr-g++).

<https://www.arduino.cc/en/Reference/HomePage>

HELLO ARDUINO



Resistor



In electronic circuits, resistors are used to reduce current flow, adjust signal levels and divide voltages.

LED



LEDs, being diodes, will only allow current to flow in one direction. And when there's no current-flow, there's no light. Luckily, this also means that you can't break an LED by plugging it in backwards. Rather, it just won't work.

Potentiometer



Potentiometer is a small sized electronic component whose resistance can be adjusted manually. Increasing or decreasing the value of resistance controls the amount of current flowing in a circuit.

Button



A device for making and breaking the connection in an electric circuit.