스마트시스템입문

2018년 1학기

Summary

- Definition of the IoT
- Examples of IoT services
- Benefits and Risks of the IoT
- Importance of killer apps and pre-installed infrastructure for exponential growth of technology
- Driving force of the IoT development
  - Miniaturization
  - Affordability
  - De-wireization

What is Arduino?

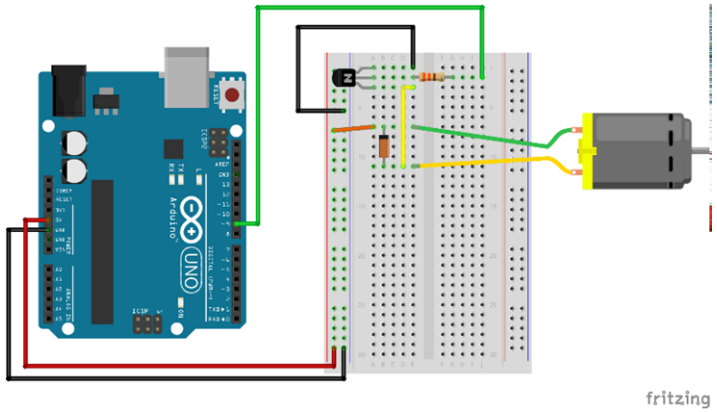
- **오픈소스를 기반으로 한 microcontroller로 완성된 보드와 관련 개발 도구 및 환경**
- **Arduino** is an **open-source** electronics platform based on easy-to-use hardware and software.
- Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online.
- You can tell your board what to do by sending a set of instructions to the microcontroller on the board.
- To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing.

https://www.arduino.cc/en/Guide/Introduction

Arduino projects

아두이노를 사용하는 이유와 아두이노의 역할은?

- Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online.
- You can tell your board what to do by sending a set of instructions to the microcontroller on the board.



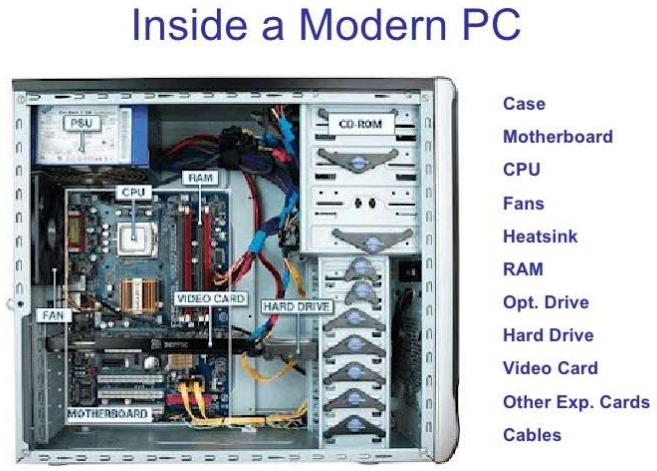
http://doolox.com/p/0304/

모터를 전원과 바로 연결하는 경우와의 차이점은?

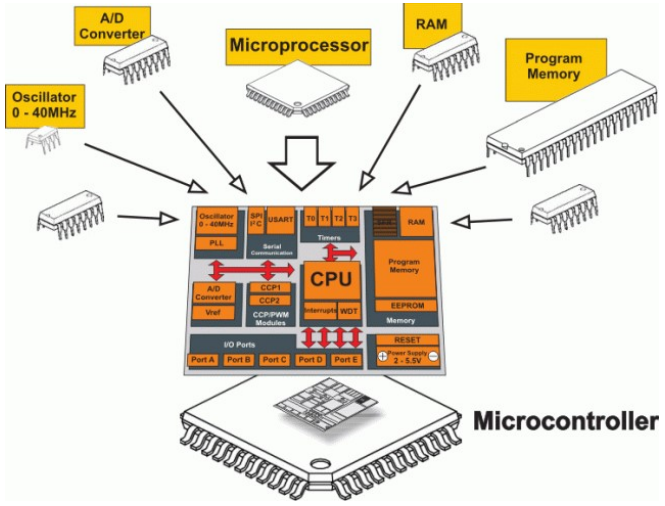
모터의 제어가 가능
제어를 위한 인터페이스 제공

MCU, microcontroller unit

- ATmega328P
- MCU란?
  - PC를 소형화시켜 칩 하나에 제작한 형태
  - PC의 CPU를 사용하기 위해서는 메인보드, 비디오 카드, 램, 하드디스크, 파워 등의 주변장치들 필요하지만 MCU는 칩 그 자체 하나로 작동이 가능함.
  - 기본적인 작동을 위한 회로가 MCU 칩 안에 모두 구현되어 있음 (CPU, 내장메모리, 산술/논리회로, 입출력 인터페이스 등)
  - PC 만큼의 성능이 필요 없는 특수한 목적으로 제작되며 저가 생산, 저전력이 가능함.

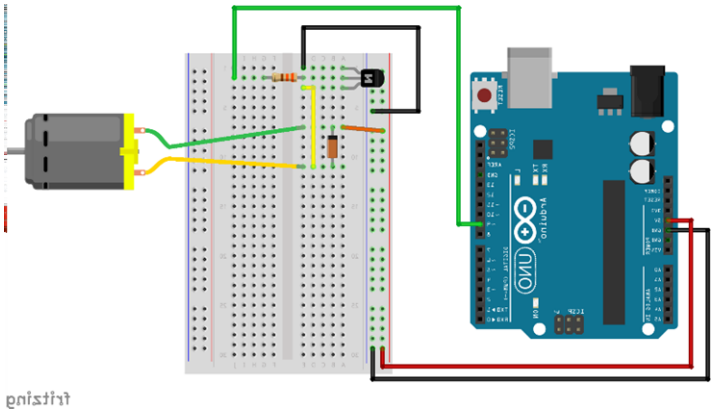


https://image.slidesharecdn.com/takecarecomputer-2012-05-24-120605111952-phpapp01/95/take-care-of-your-computer-part-5-how-to-work-on-your-own-pc-15-728.jpg?cb=1338895259

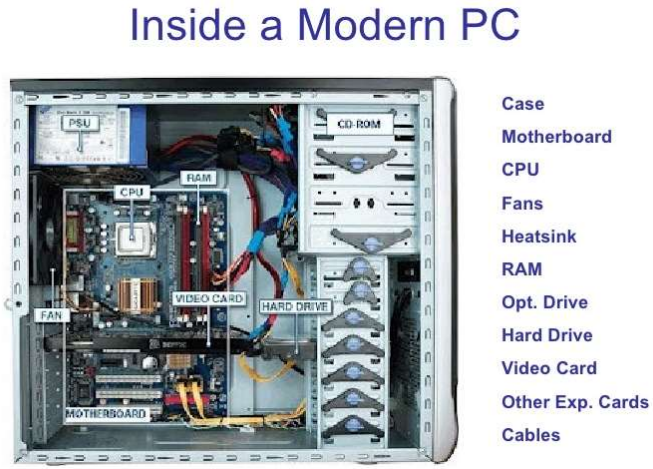


http://maxembedded.com/2011/06/mcu-vs-mpu/

MCU, microcontroller unit



http://doolox.com/p/0304/



https://image.slidesharecdn.com/takecarecomputer-2012-05-24-120605111952-phpapp01/95/take-care-of-your-computer-part-5-how-to-work-on-your-own-pc-15-728.jpg?cb=1338895259

모터 제어, LED 제어 등 제한적이고 특수한 목적이 있는 경우 MCU를 사용하면 간편하게 기능을 구현할 수 있다.

발표과제 (3/20)

- 발표 주제: 스마트시스템 혹은 IoT 기술의 예
- 참고 문헌: DBPIA, IEEE Xplore, Google Scholar 등에서 검색 가능한 ***논문***으로 제한 (학교에서 접속 가능)
- 발표 시간: 10분
  - 핵심 기술에 대한 설명 포함
  - 기술의 장·단점은?
  - 보완 사항 제안
  - 수식, 이론 등을 모두 이해할 필요 없음
- 수업 시간 전까지 이러닝에 발표자료 제출
- 발표자: 4명 선발

발표과제 (3/20)

패션 웨어러블 디바이스 개발 사례 연구 [KCI등재]
양진숙, 김주연
한국디자인문화학회, 한국디자인문화학회지 21(2), 2015.6, 363-376 (14 pages)
원문저장 | PDF View N | QuickView | TextView N | 상세보기

뉴미디어 시대의 웨어러블 디바이스 사례분석 연구 : 휴대형 디바이스를 중심으로 [KCI등재]
양진숙, 김주연
한국디자인문화학회, 한국디자인문화학회지 20(2), 2014.6, 354-364 (11 pages)
원문저장 | PDF View N | QuickView | TextView N | 상세보기

사물인터넷 기반의 낙상 감지 시스템 [KCI등재]
정필성, 조양현
한국정보통신학회, 한국정보통신학회논문지 19(11), 2015.11, 254 553 (8 pages)
원문저장 | PDF View N | QuickView | TextView N | 보기

BLE 네트워크 상에서 사물인터넷 서비스 제공을 위한 CoAP과 6LoWPAN 구현 [KCI등재]
김철민, 강형우, 최상일, 고석주
한국방송·미디어공학회, 방송공학회논문지 21(3), 2016.5, 298-306 (9 pages)
원문저장 | PDF View N | QuickView | TextView N | 상세보기

발표과제 (3/20)

JKIICE Journal of the Korea Institute of Information and Communication Engineering

한국정보통신학회논문지(J. Korea Inst. Inf. Commun. Eng.) Vol. 19, No. 11 : 2546~2553 Nov. 2015

사물인터넷 기반의 낙상 감지 시스템

정필성[1] · 조양현[2*]

Fall Detection System based Internet of Things

Pil-Seong Jeong[1] · Yang-Hyun Cho[2*]

[1]FNS Value Corporation, 358-25, Hosu-ro, Ilsandong-gu, Goyang-si, Gyeonggi-do, Korea
[2*]Division of Computer Science, Sahmyook University, Seoul 139-742, Korea

발표과제 (3/20)

Ⅱ. 관련 이론

2.1. 낙상 감지 기법

낙상을 감지하는 방법은 영상 정보를 분석하여 낙상을 검출하는 방법과 센서 정보를 이용하여 낙상 감지 대상자의 움직임을 판별하여 낙상을 검출하는 방법으로 분류될 수 있다. 영상 정보를 분석하는 방법은 감지 대상의 움직임과 넘어지는 모양을 분석하여 낙상 여부를 판별하게 된다.

3.1. 시스템 모델

본 논문에서 제안하는 낙상 감지 시스템 모델은 그림 1과 같다. 센서 모듈은 가속도 센서 모듈과 결합한 아두이노 기반의 블루이노 센서 모듈로 이루어진다. 장기간

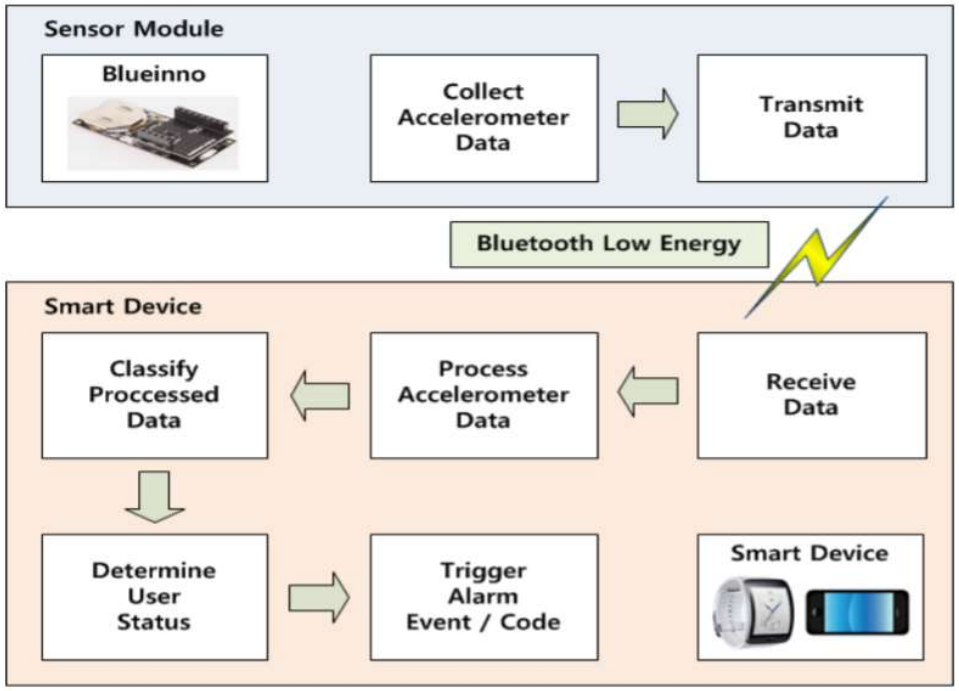
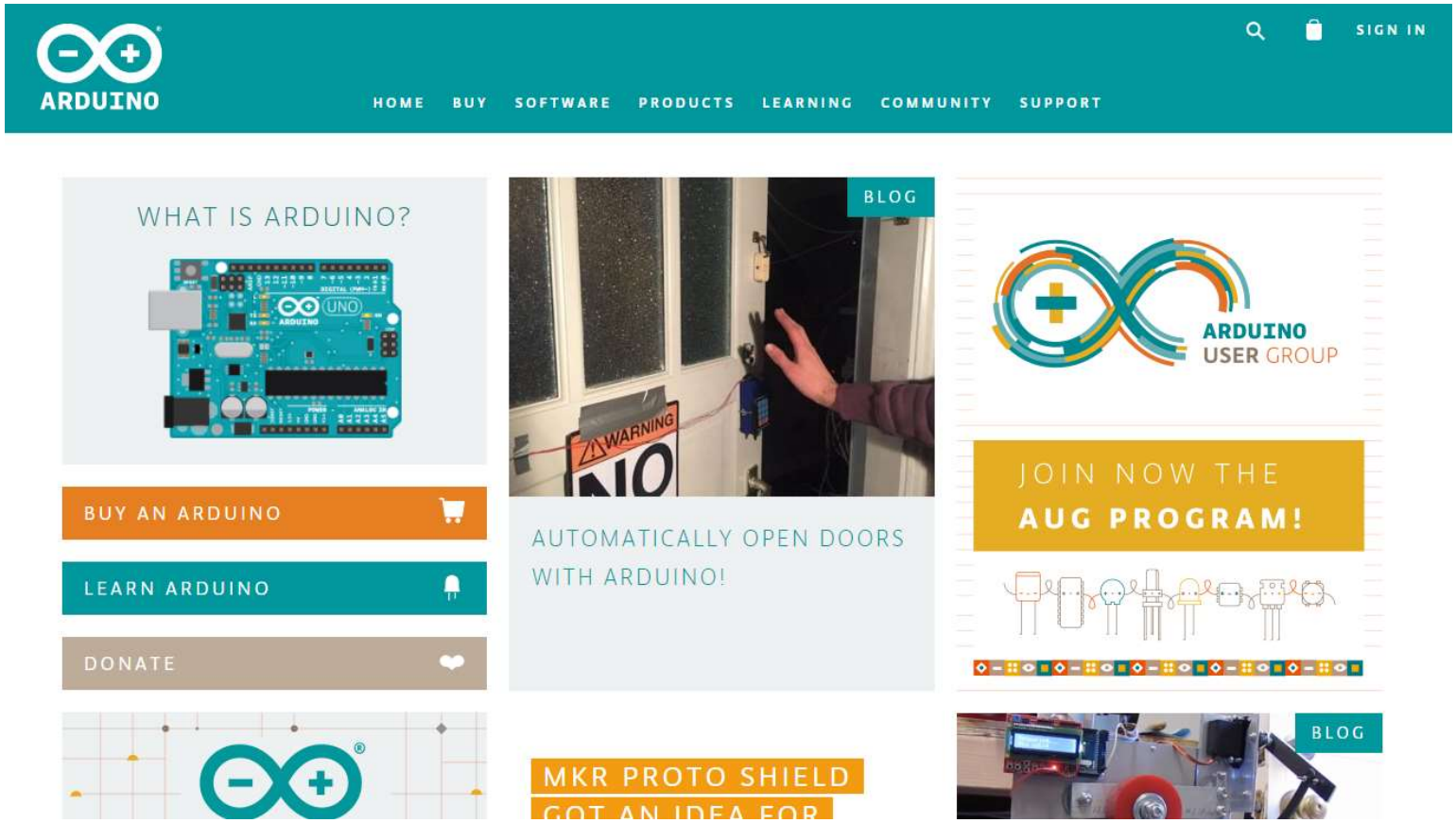


Fig. 1 System Model

정필성, 조양현, “사물인터넷 기반의 낙상 감지 시스템 “

More information

- You can find more information from the official webpage



https://www.arduino.cc/

How to destroy Arduino

https://www.rugged-circuits.com/10-ways-to-destroy-an-arduino/

Do not make a short circuit!

10 Ways to Destroy An Arduino

Introduction

Use a sledgehammer, fire a bullet at it, throw it into a pool....that's not what we're talking about. We're going to show you how to electrically destroy your Arduino, though many of you seem to already know how to do that through unfortunate experience. You know what we mean....that funny smell, the scorch mark on a component, or the dreaded "programmer not in sync" error message -- all signs that you've just learned a lesson the hard way.

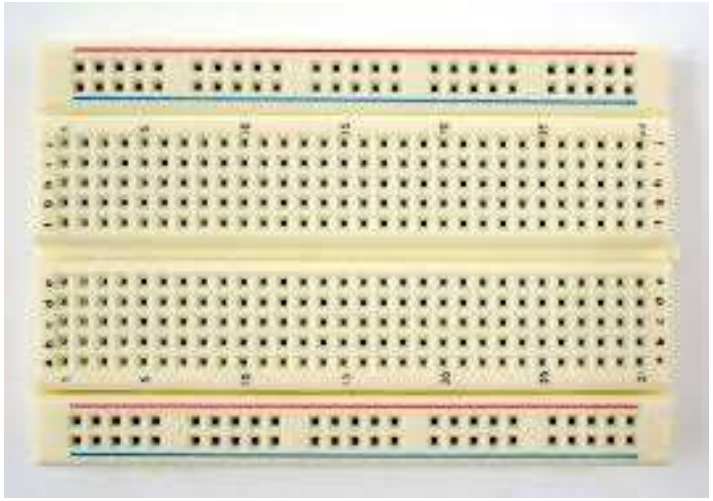
Why are we doing this? If you own an Arduino, it's good to know what is and what isn't OK to do with it. We also want you to consider buying our Ruggeduino, which will survive all of the tortures described below.

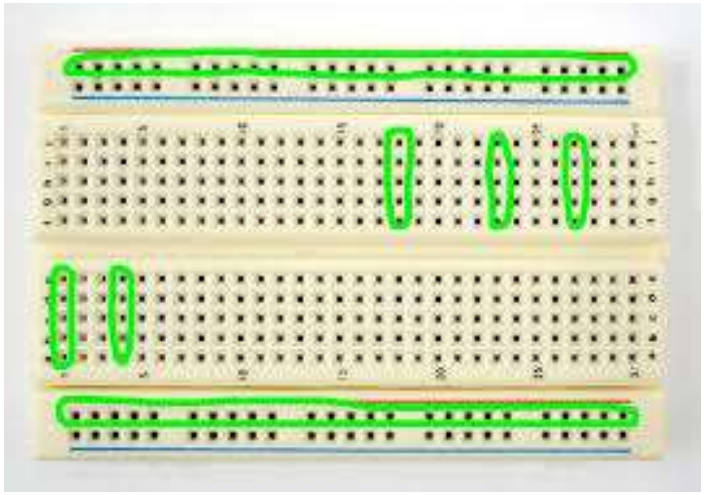
Method #1: Shorting I/O Pins to Ground

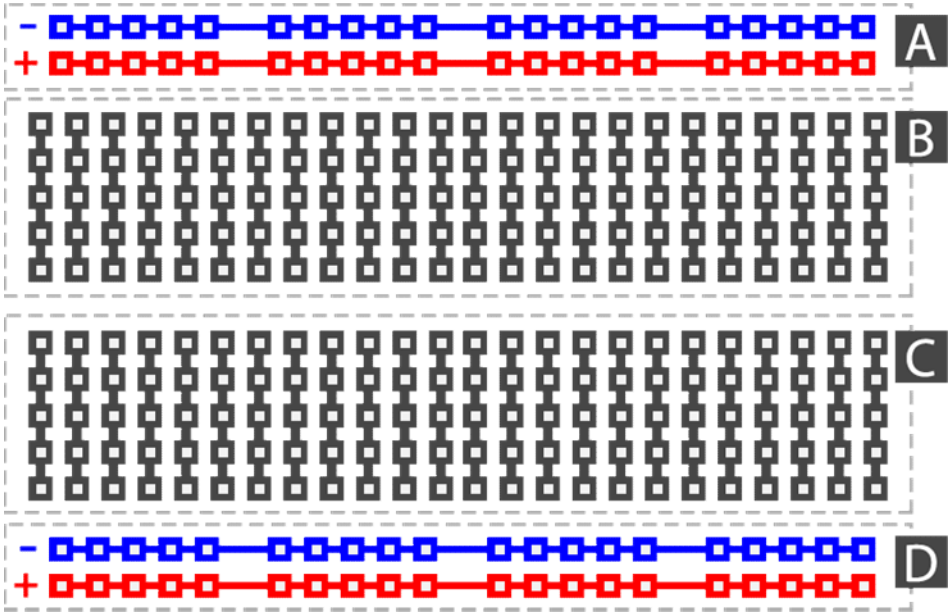
HOW

Configure an I/O pin to be an output then set it high. Short the pin to ground. You have now created an overcurrent condition on the I/O pin and it will be destroyed.

Breadboard





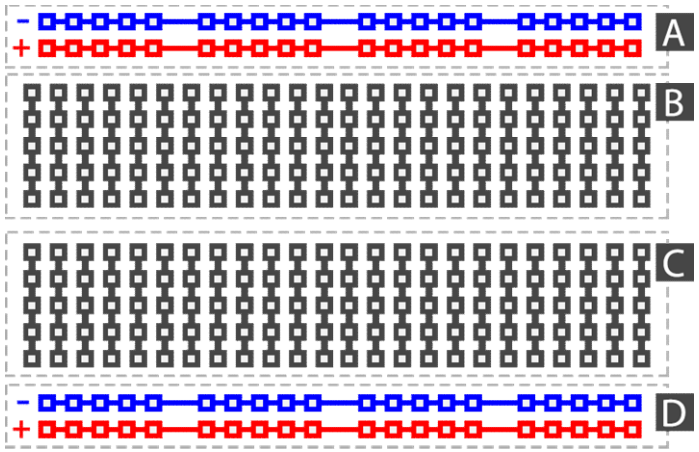


https://www.tweaking4all.com/wp-content/uploads/2013/12/basic_breadboard_layout.png

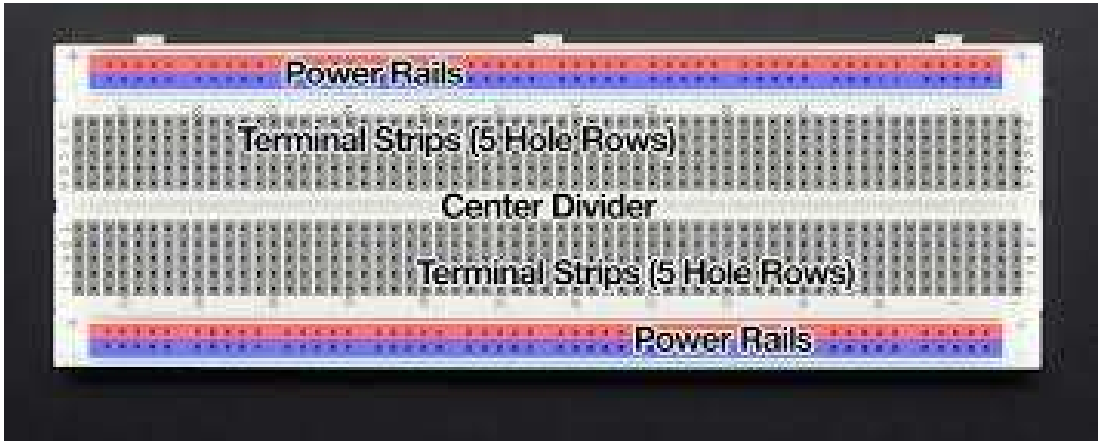
https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcS_JK1WV9iT070i5hwivskrwTGbMfHu_ek0lMEpNUADmWSsEkvx

https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcQcgUGI233OVpO_Y1o2a1uEuWJb1TyzT_XAb69mQ2eeS_WcJ2xy

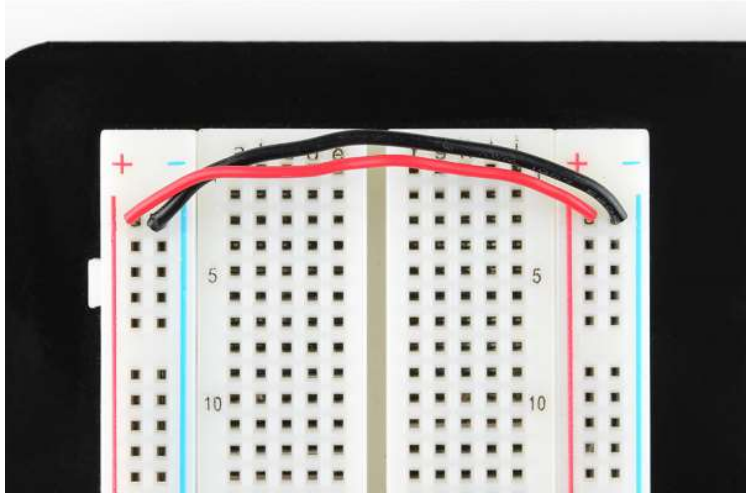
Breadboard



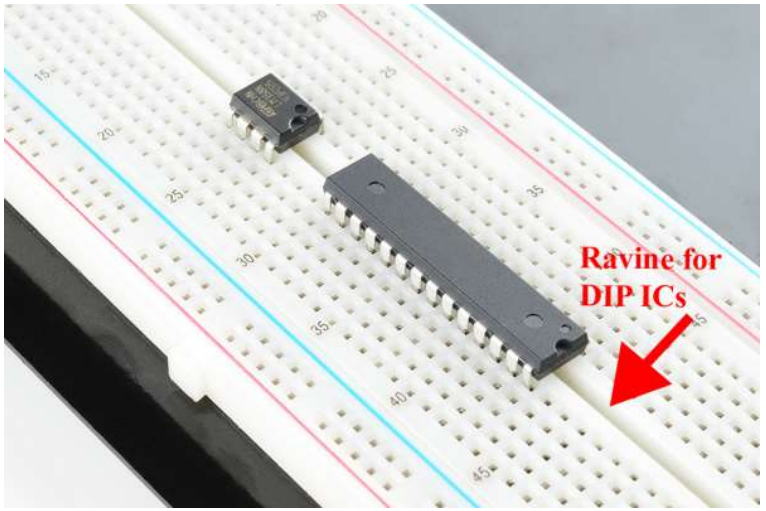
https://www.tweaking4all.com/wp-content/uploads/2013/12/basic_breadboard_layout.png



https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcQVr2BtZ8enjA-ZTOF_HIvY0yTD5LTdsiOpa7-6rPuPEAoXy3pSLA



https://learn.sparkfun.com/tutorials/how-to-use-a-breadboard



Analog vs Digital

- 아날로그 신호 vs 디지털 신호

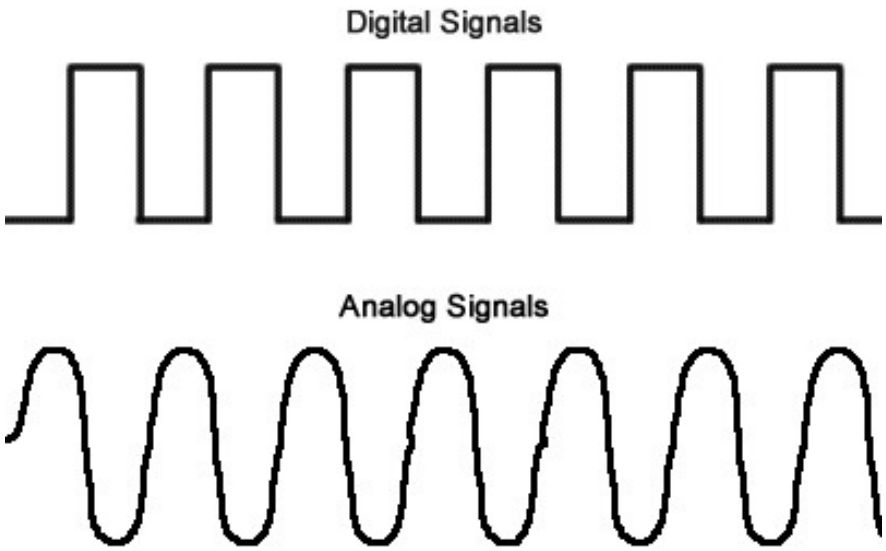
- 신호, signal
  - Time-varying “quantities” which convey some sort of information. In electrical engineering the quantity that’s time-varying is usually voltage.

https://learn.sparkfun.com/tutorials/analog-vs-digital

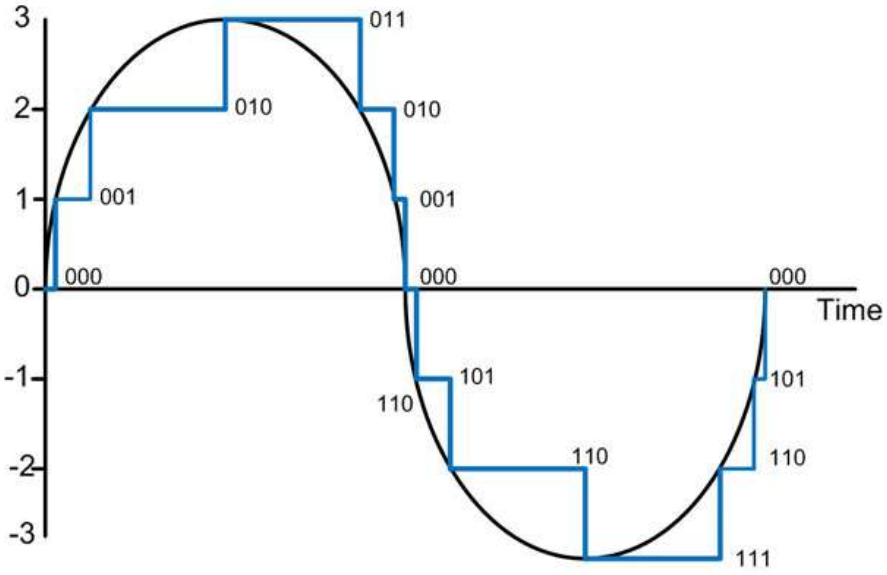
- 차이점: 변화량이 가질 수 있는 값의 범위

Analog vs Digital

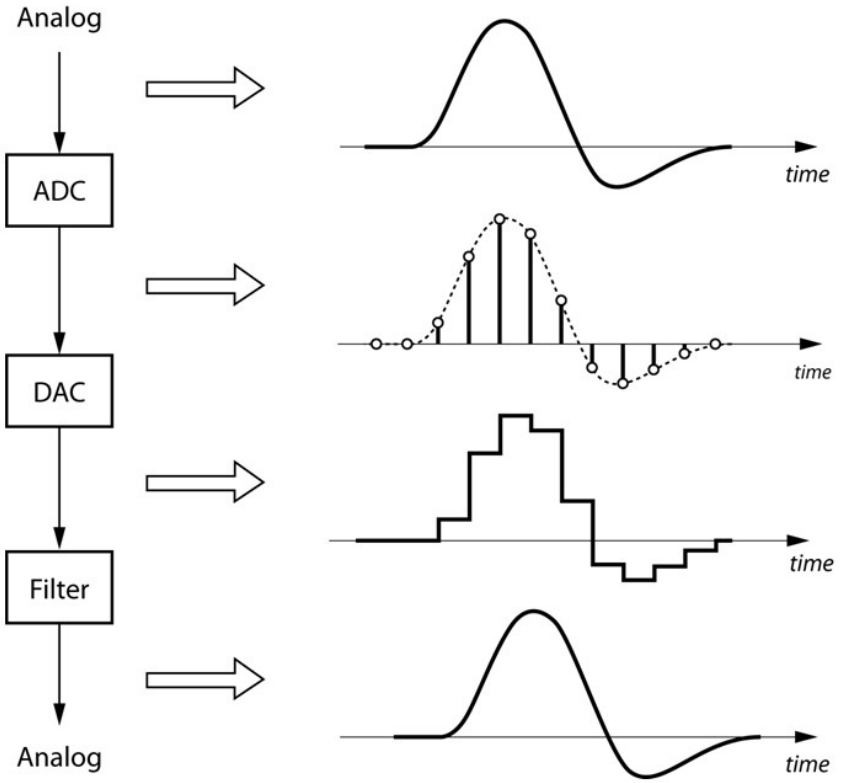
- Digital signal: only 0 and 1 exist
  - On / off button, switch
- Analog signal: continuous value
  - Analog sensors: light sensor



ADC (analog to digital converter)



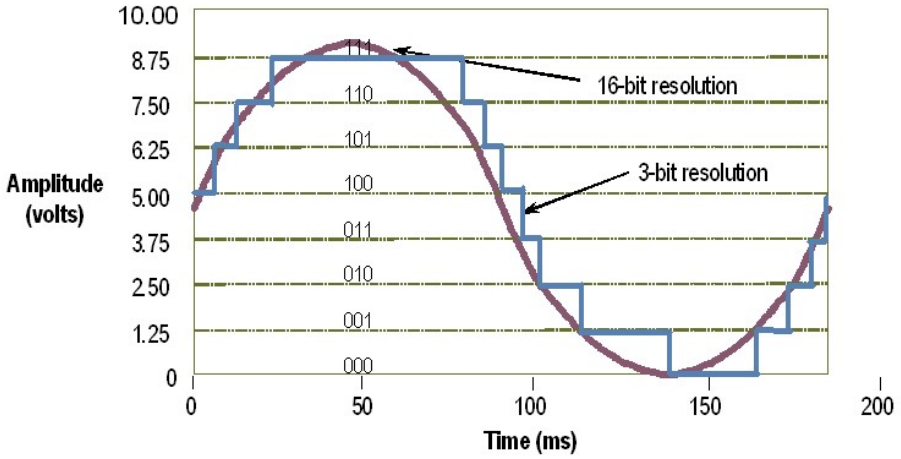
http://screaminfx.com/images/tech-images/what-is-analog-verse-digital-explanation.jpg



https://www.nutaq.com/sites/default/files/images/blog-images/Process%20of%20digitizing%20and%20converting%20a%20signal%20with%20an%20infinite%20precision%20ADC-DAC_0.png

ADC (analog to digital converter)

What is “resolution”? For example, 10-bit resolution.



❑Resolution: Examples

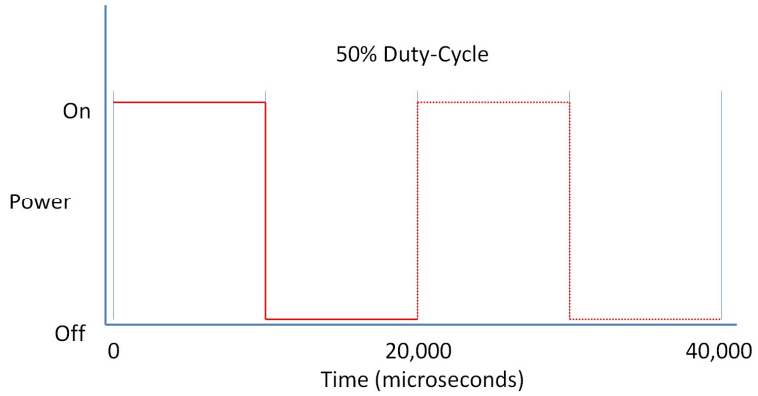
	Formula	4-bit DAC
Number of bits	n	4
Number of output codes	2^n	16
Number of steps in the output	2^n-1	15
Percentage resolution	$1 / (2^n-1)$	1/15
Step size (assuming 5 V reference voltage)	$V_{ref} / 2^n-1$	$V_{ref} / 15$

http://www.globalspec.com/learnmore/data_acquisition_signal_conditioning/signal_converting/digital_to_analog_converters

https://image.slidesharecdn.com/group1-141018102550-conversion-gate01/95/dacdigital-to-analog-converter-11-638.jpg?cb=1486790152

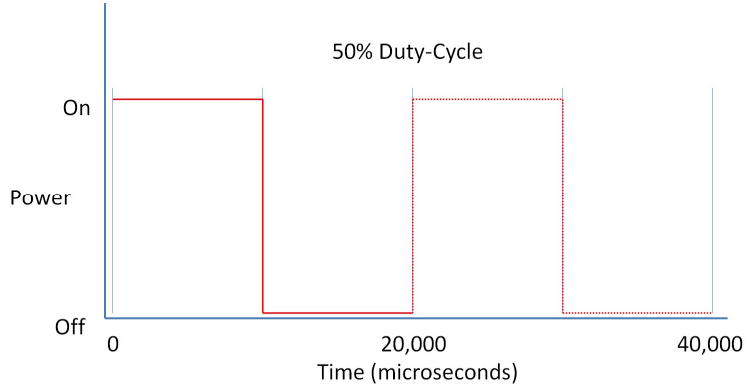
PWM (pulse width modulation)

- Let's control the brightness with the microcontroller.
- Microcontroller are digital. It only has two states, ON/OFF.
- PWM provides ability to simulate varying levels of voltage using oscillating on/off states
- How?



http://www.waitingforfriday.com/?p=404

PWM (pulse width modulation)



- The board provides **oscillating on/off digital signal (= pulse)**
- 50% duty cycle: LED is on for 50 % and off for 50 %
- This makes LED to appear half as bright
- The total light output over the time duration is only half → **average voltage is half**

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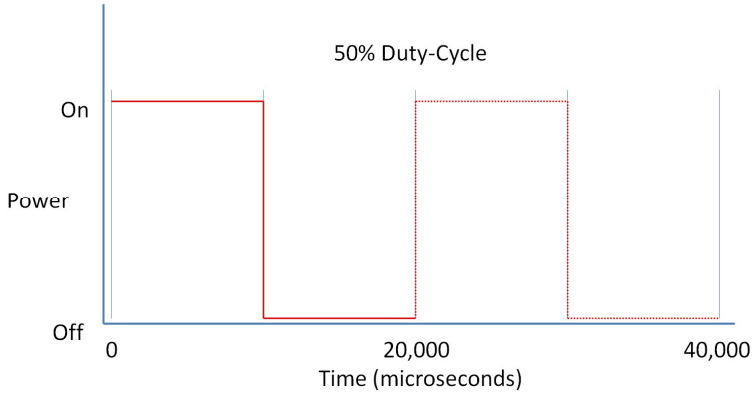
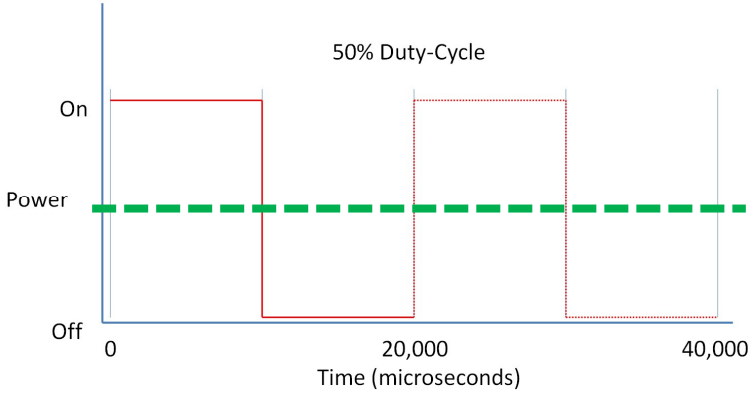
PWM: short duration is important



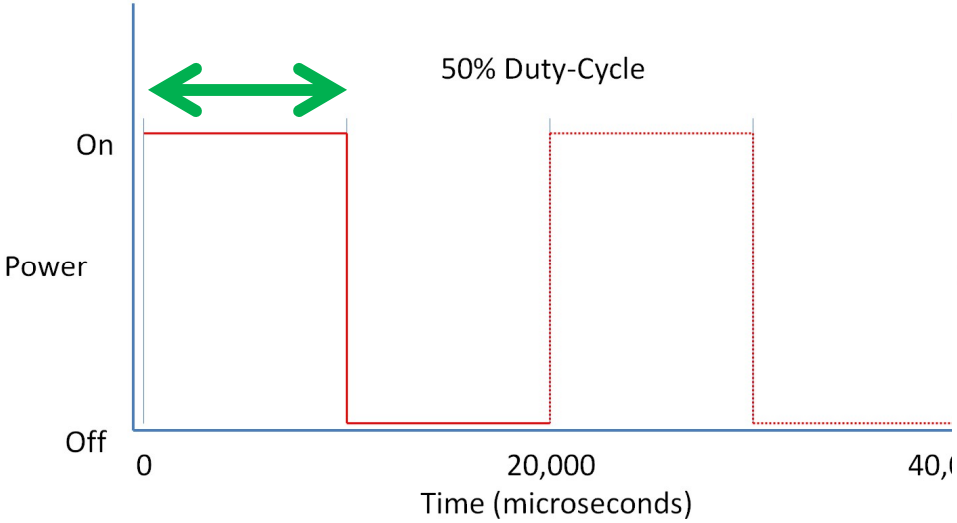


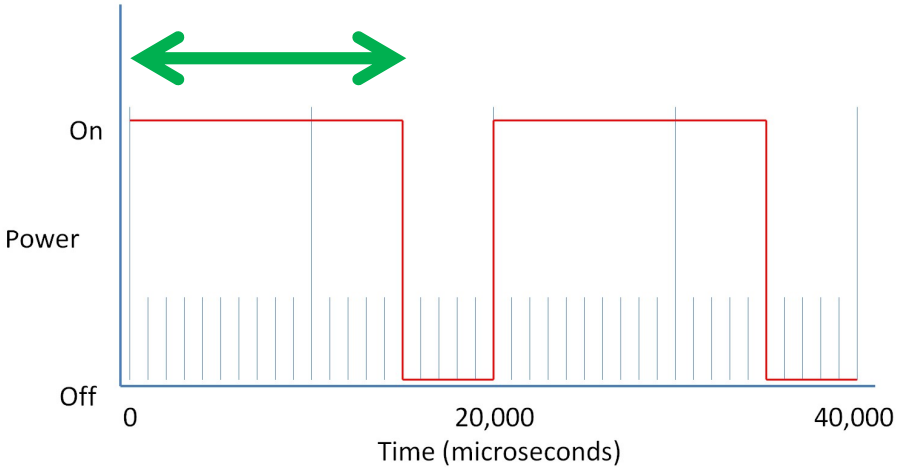
- On average, PWM provides only of the voltage
- Duration is very short (50 HZ in the figure)
- You cannot see the flashing of the LED

http://www.waitingforfriday.com/?p=404

PWM: short duration is important

- What if duration was very long? (turn light on and off slowly)
  - Flashing of the LED
  - No constant light output
- PWM – pulse width modulation
  - You **modulate (vary) the width** of the pulse





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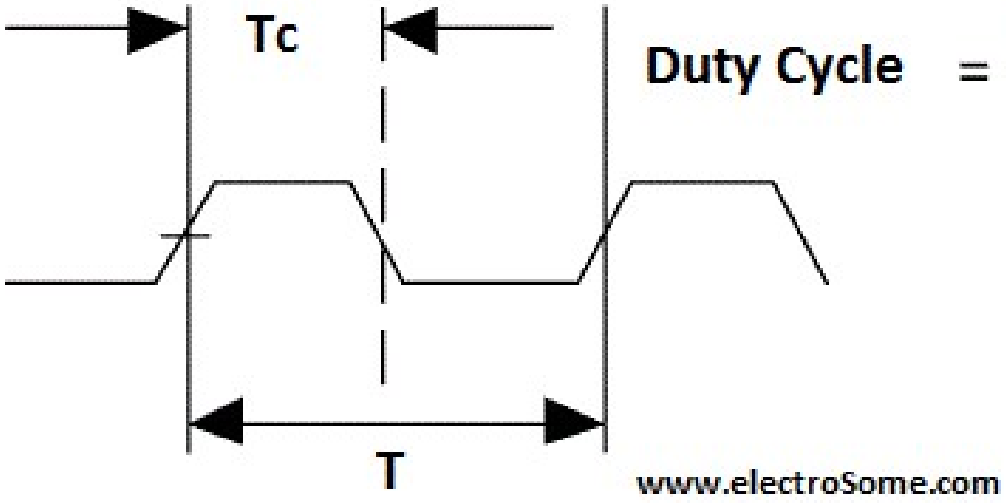
PWM: short duration is important

- **Duty cycle**: the amount of time a pulse is ON over the total duration of the cycle
- 50% duty cycle = on for 50%, off for 50%
- 75% duty cycle = on for 75%, off for 25%
- **Total duration dose not vary!**



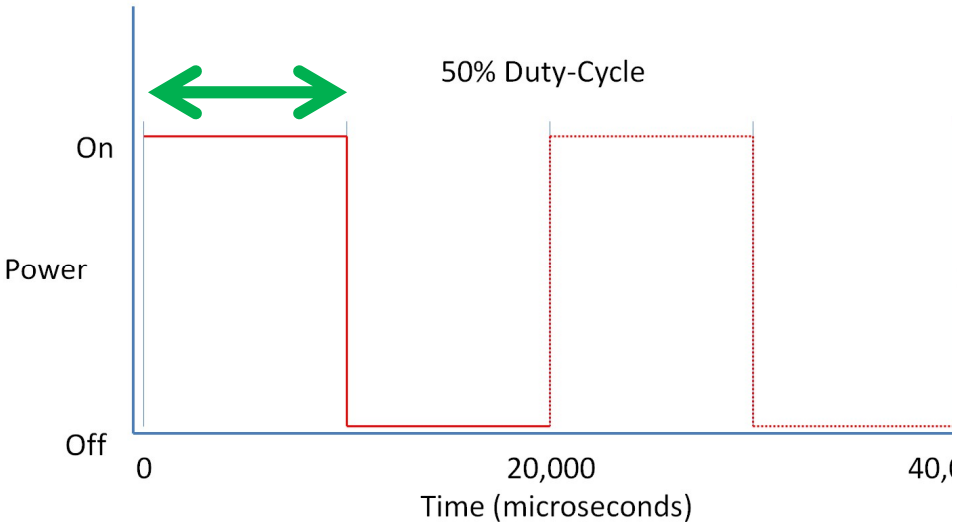
$$\text{Duty Cycle} = \frac{Tc}{T}$$

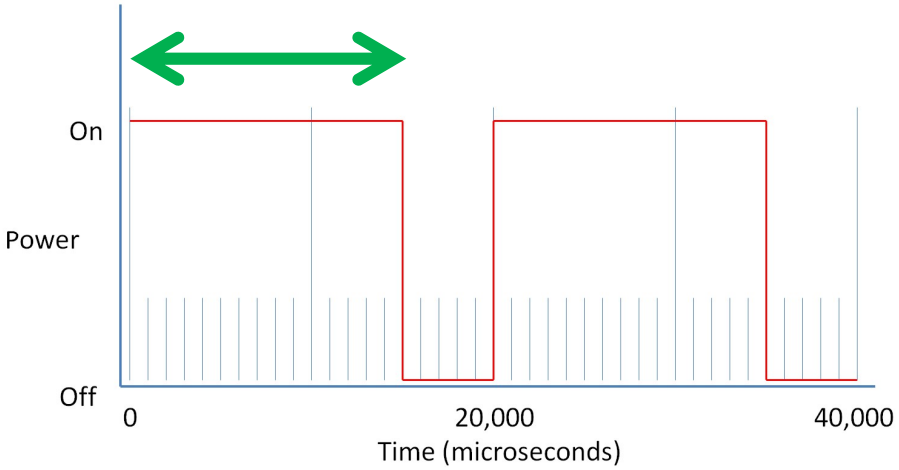
T = PWM period

https://electrosome.com/pwm-pulse-width-modulation/

PWM

- **Cycle** is defined in Hz
- 50 Hz cycle: duration of a single cycle = 0.02 s
- 50% duty cycle: on 0.01 s, off 0.01 s
- 75% duty cycle: on 0.015 s, off 0.005 s

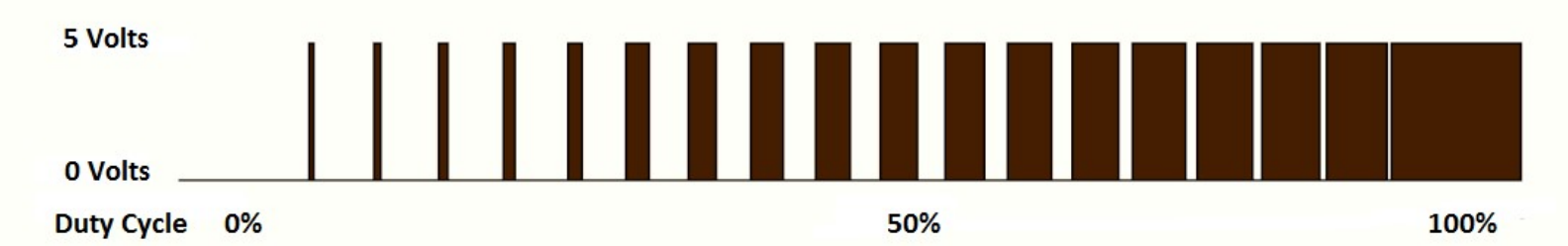




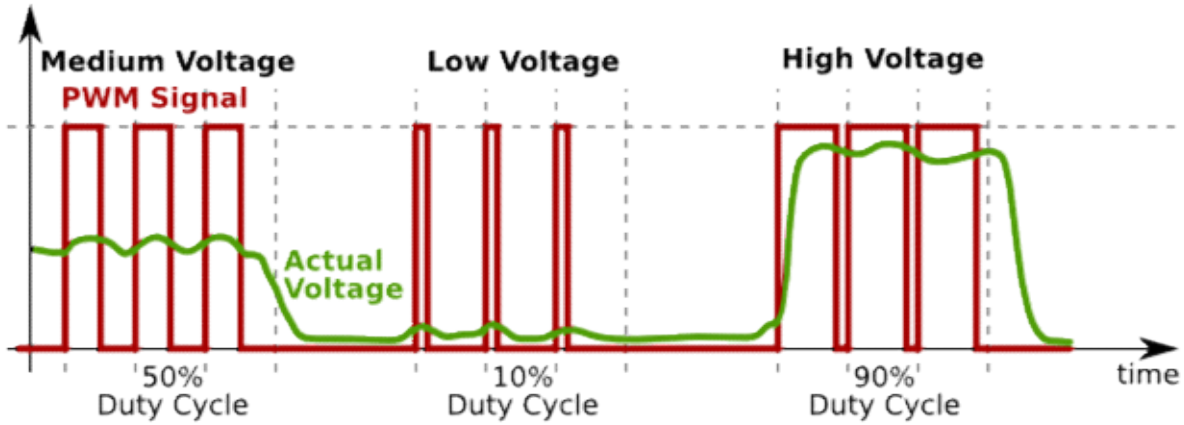
http://www.waitingforfriday.com/?p=404

PWM

- Control duty cycle → control average voltage



https://electrosome.com/pwm-pulse-width-modulation/



https://www.wayneandlayne.com/projects/video-game-shield/design/