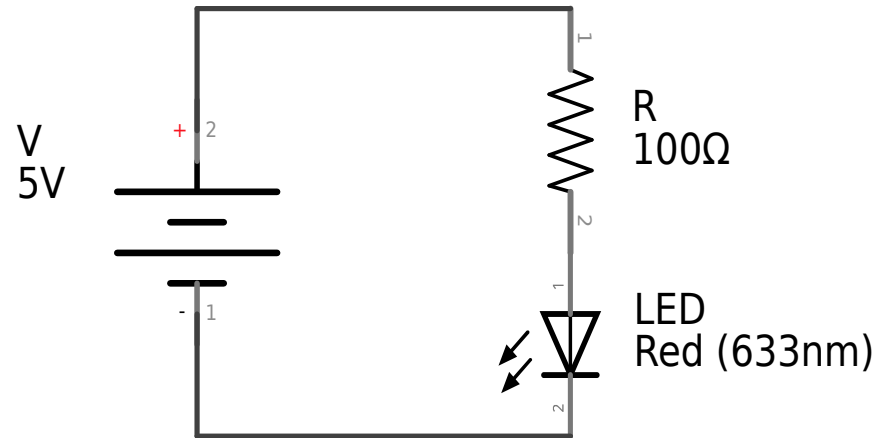# *12 Ways to Blink an LED*
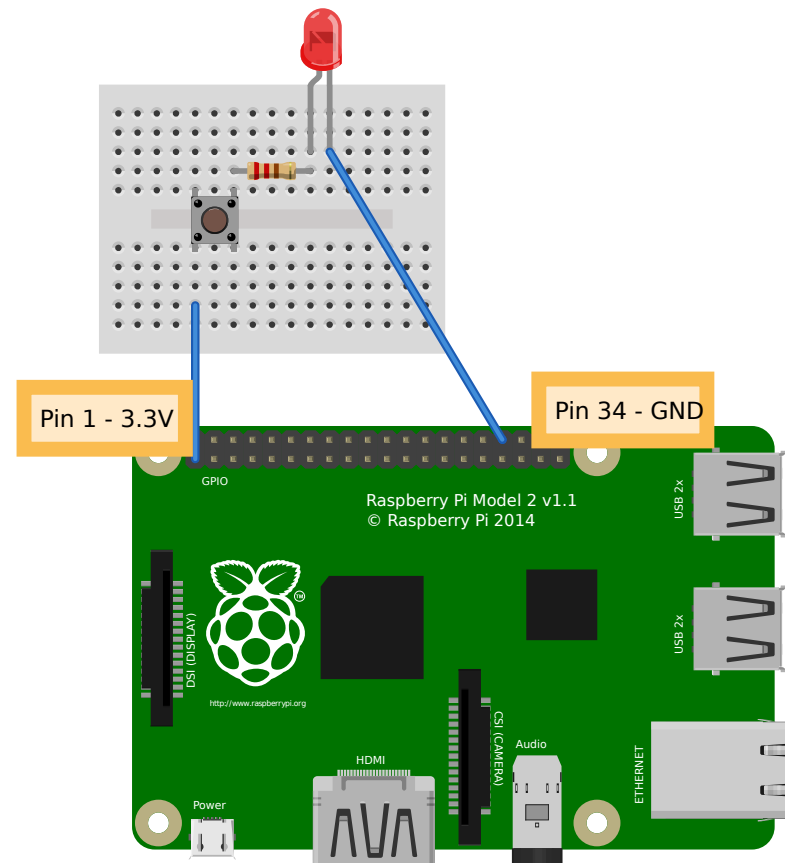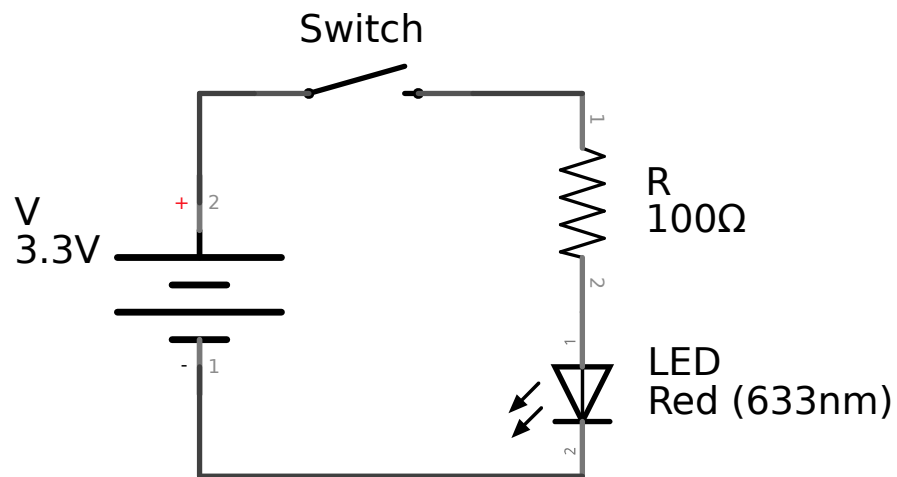
Charlotte Hackerspace
Neil Roeth

LED basic circuit

Circuit diagram:
- V 5V (battery)
- R 100Ω
- LED Red (633nm)

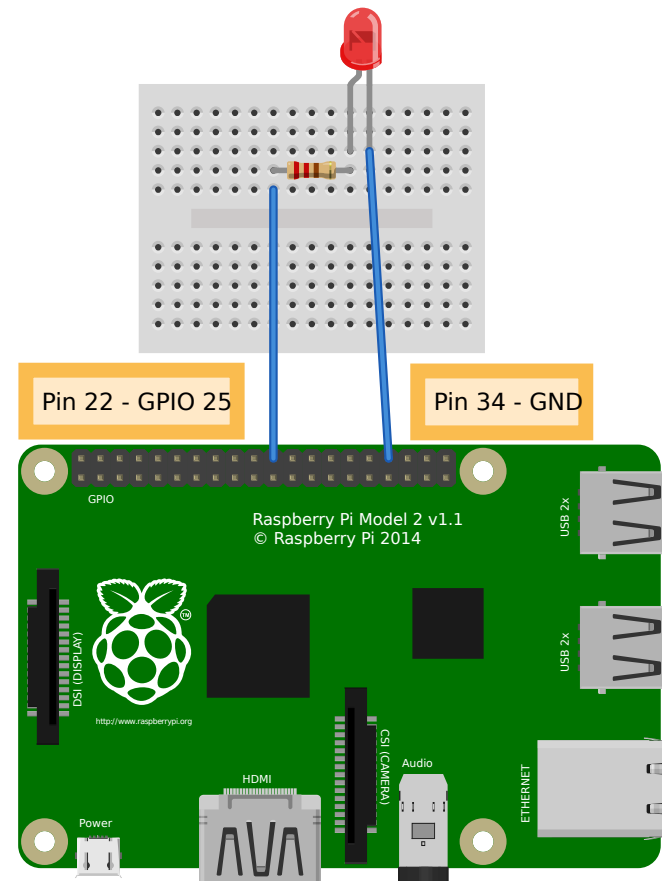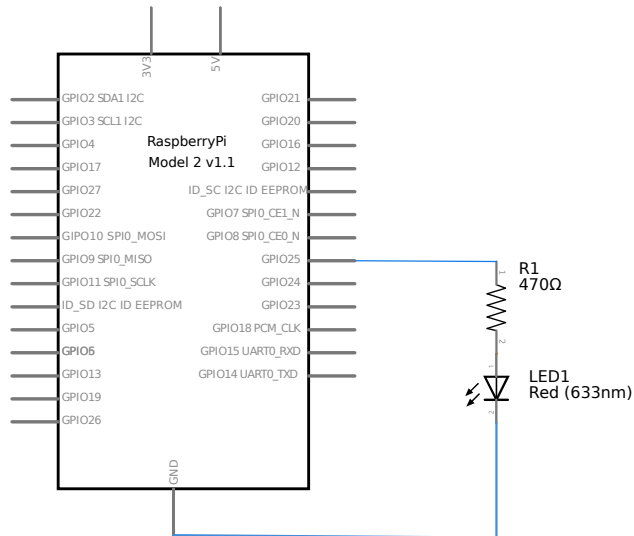- Need to limit current (no magic smoke)

- $V = V_{LED} + V_R$

- $V_R = IR$ (Ohm's Law)

- $V = V_{LED} + IR$ => $R = (V - V_{LED})/I$

- LED: $V_{LED} \sim 2.5V$

- Raspberry Pi: 3.3V, 16mA

- $R = (3.3 - 2.5)/0.016 = 50$ ohms

- Arduino: 5V, 40mA

- $R = (5 - 2.5)/0.040 = 62.5$ ohms

- Bigger is safer

Blink LED with pushbutton

Switch

V
3.3V

R
100Ω

LED
Red (633nm)

Pin 1 - 3.3V

Pin 34 - GND

GPIO

Raspberry Pi Model 2 v1.1
© Raspberry Pi 2014

USB 2x

USB 2x

DSI (DISPLAY)

http://www.raspberrypi.org

CSI (CAMERA)

Audio

ETHERNET

HDMI

Power

Blink LED with Pi

3V3	5V
GPIO2 SDA1 I2C	GPIO21
GPIO3 SCL1 I2C	GPIO20
GPIO4	GPIO16
GPIO17	GPIO12
GPIO27	ID_SC I2C ID EEPROM
GPIO22	GPIO7 SPI0_CE1_N
GIPO10 SPI0_MOSI	GPIO8 SPI0_CE0_N
GPIO9 SPI0_MISO	GPIO25
GPIO11 SPI0_SCLK	GPIO24
ID_SD I2C ID EEPROM	GPIO23
GPIO5	GPIO18 PCM_CLK
GPIO6	GPIO15 UART0_RXD
GPIO13	GPIO14 UART0_TXD
GPIO19	
GPIO26	

RaspberryPi
Model 2 v1.1

R1
470Ω

LED1
Red (633nm)

GND

Pin 22 - GPIO 25

Pin 34 - GND

GPIO

Raspberry Pi Model 2 v1.1
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USB 2x

USB 2x

DSI (DISPLAY)

http://www.raspberrypi.org

CSI (CAMERA)

Audio

ETHERNET

HDMI

Power

- Create a file named BlinkRaspberryPi.py with Python code:

```
import RPi.GPIO as GPIO
import time

GPIO.setmode(GPIO.BCM)
GPIO.setup(25, GPIO.OUT)

while True:
    GPIO.output(25, GPIO.HIGH)
    time.sleep(1)
    GPIO.output(25, GPIO.LOW)
    time.sleep(1)
```
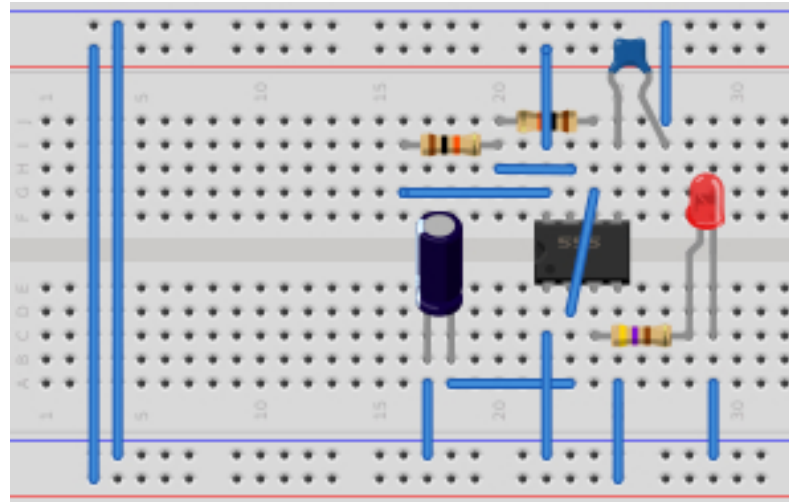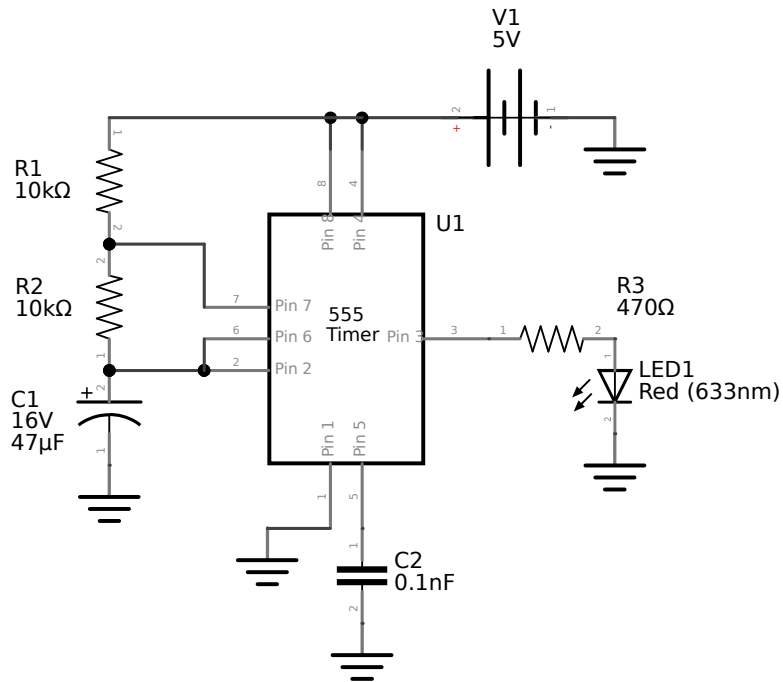
- Ensure you have the Python libraries for accessing GPIO pins installed:

```
$ sudo apt-get install python-rpi.gpio python3-rpi.gpio
```
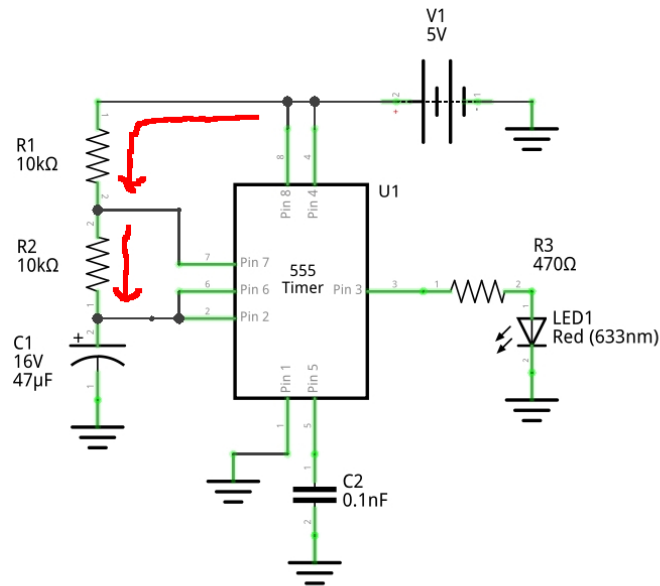
- Run it: `python BlinkRaspberryPi.py`

- What does script do?

- Raspberry Pi has digital outputs only (HIGH, LOW)
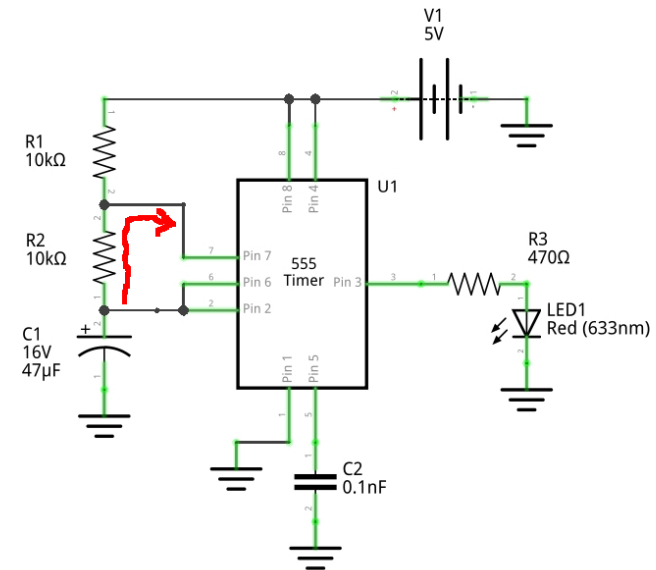
555 Astable Multivibrator

- Connect 5V from Pi to red rail, ground to blue rail

- Dot on IC is pin 1, C1 has +/-

- Timing is determined by how quickly capacitor C1 charges/discharges

How the 555 circuit works

- Charging (left): Capacitor C1 charges through R1 and R2
- When capacitor voltage reaches 2/3 V1, pin 7 connects to ground
- Discharging (right): Capacitor C1 discharges through R2
- When capacitor drops to 1/3 V1, pin 7 disconnects from ground
- Water analogy: voltage like pressure, current like flow rate
- Capacitor like bucket, resistor like hose restriction
- Bigger capacitor or bigger resistor means longer time
- Time constant for charging = (R1+R2)*C1
- Time constant for discharging= R2*C1