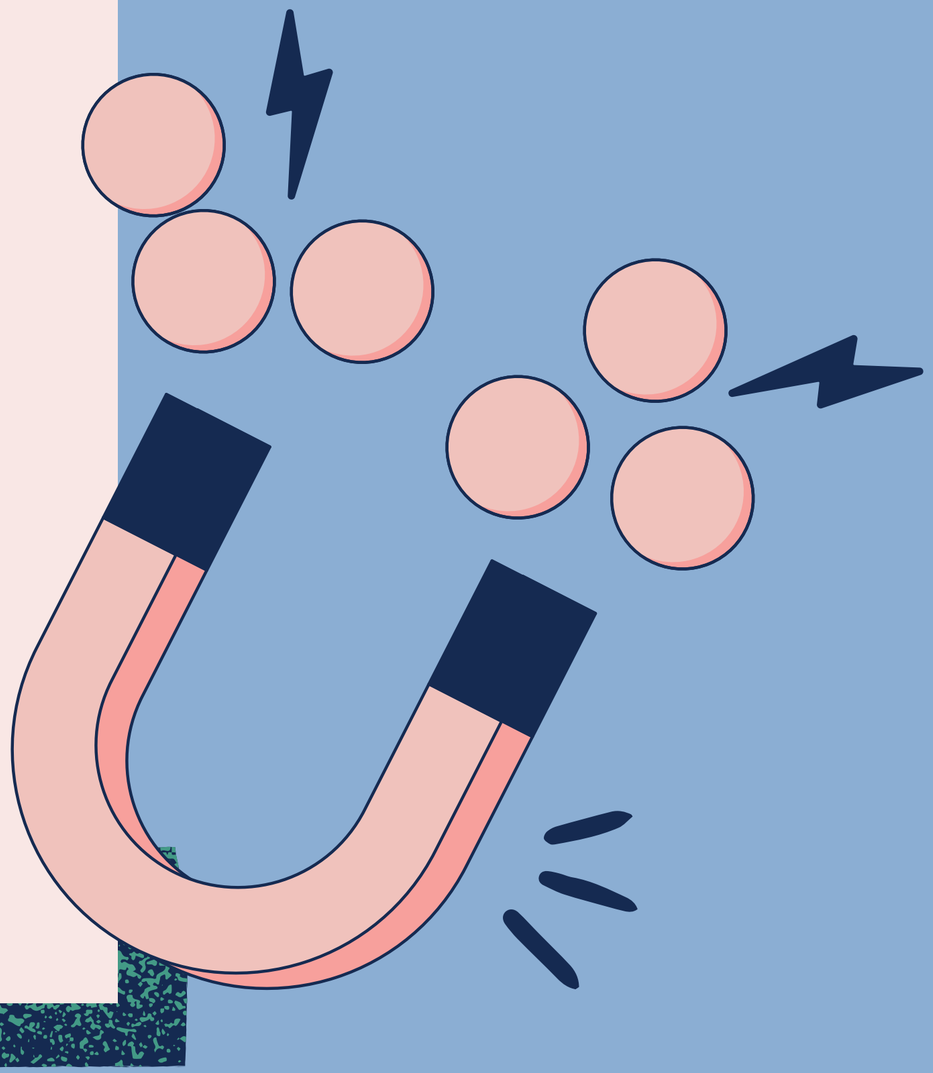
metal detectors



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What is the metal detector?

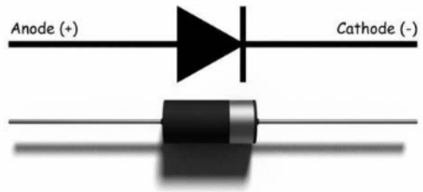
Metal Detector is a security device which is used for detecting metals which can be harmful, at various places like Airports, shopping malls, cinemas, etc. Previously we have made a very simple Metal detector without a microcontroller

What is the application of metal detector?

- Security Screening: In airports, malls, and public events to detect metallic objects such as weapons.
- Archaeology: Unearthing historical artifacts buried underground.
- Treasure Hunting: Searching for valuable metal objects like coins or jewelry.
- Construction: Locating metal pipes or cables before digging.

My Circuit Components

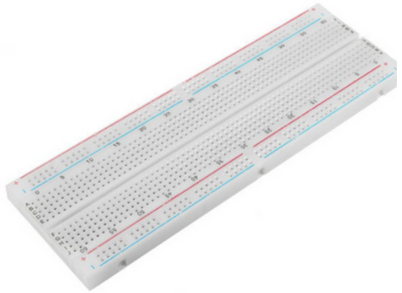
Resistance



Diod

Capacitors

Buzzer



bread board

Coil

Arduino Uno

Led

Capacitor

Due to this, short spikes will be generated by the coil in every transition. The pulse length of the generated spikes is proportional to the inductance of the coil. So with the help of these Spike pulses, we can measure the inductance of Coil. But here it is difficult to measure inductance precisely with those spikes because those spikes are of very short duration (approx. 0.5 microseconds) and that is very difficult to be measured by Arduino.So instead of this, we used a capacitor that is charged by the rising pulse or spike. It can be read by Arduino analog pin A5.

Coil

Generate magnetic field when ac current pass through it. And the change in the magnetic field generates an electric field. We used 50 turns to improve inductance ,so voltage increases.

$V = L \, di/dt.$

Resistance

- It is a high pass filter
- Limit current

Diode

- Limit voltage

Buzzer , LED

- detect if there is a metal , they works

The idea of the circuit

Whenever some current passes through the coil, it generates a magnetic field around it. And the change in the magnetic field generates an electric field. Now according to Faraday's law, because of this Electric field, a voltage develops across the coil which opposes the change in magnetic field and that’s how Coil develops the Inductance, means the generated voltage opposes the increase in the current. The unit of Inductance is Henry and formula to measure the Inductance is:

$$L = (\mu o * N2 * A) / l$$

$$L = \frac{\mu N^2 A}{l}$$

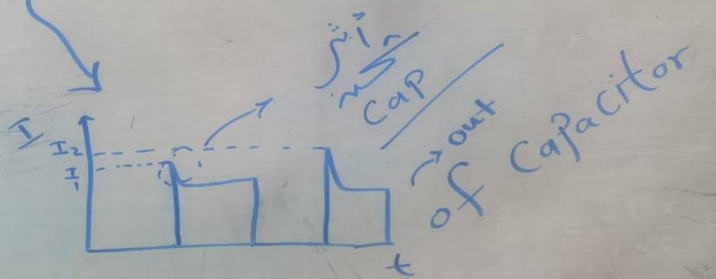
$$emf = -L \frac{dI}{dt}$$

Signal with T = 6 ms

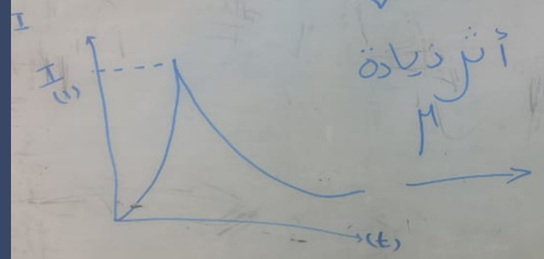
$I_2 > I_1$

in case ↑ μ → Metal

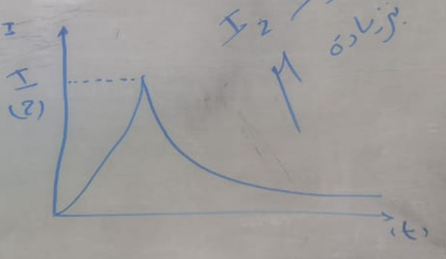
in case ↓ μ → Metal



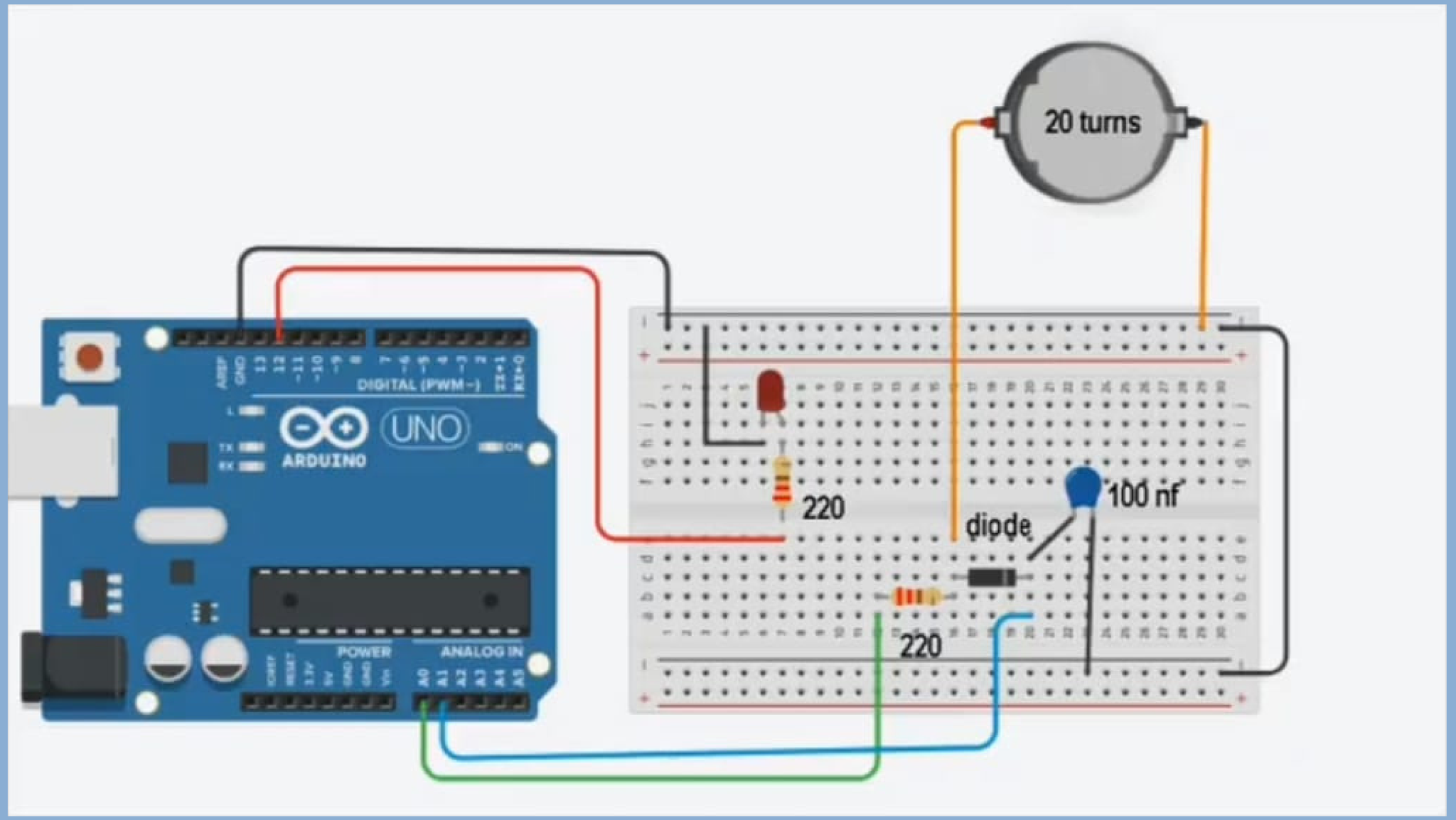
Signal with T = 6 ms



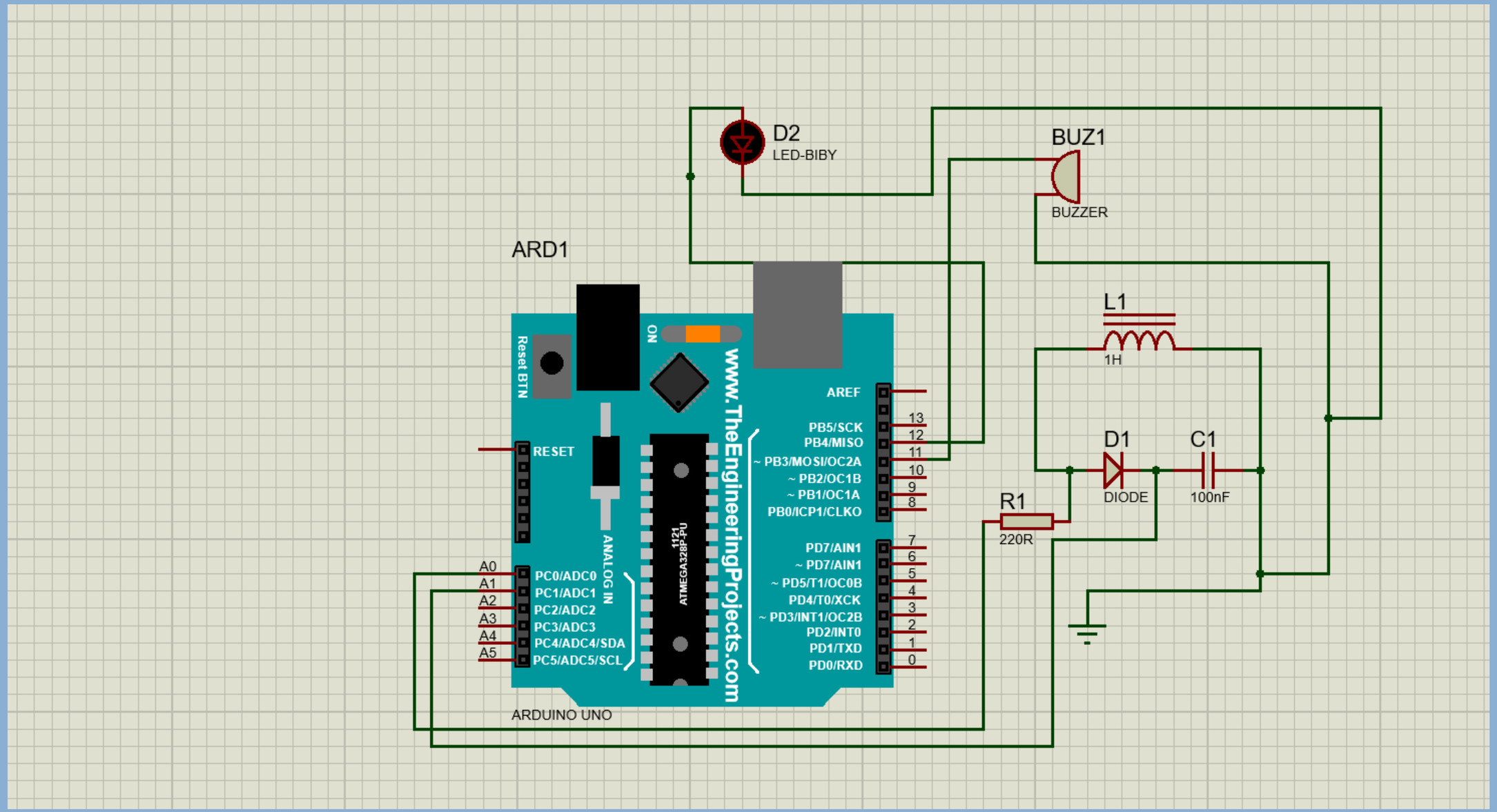
زیاد کردن μ



Circuit:


20 turns
220
diode
100 nf
220
DIGITAL (PWM~)
UNO
ARDUINO
POWER
ANALOG IN

Circuit on protues:



Code

Thank You ^_^

DON'T FORGET THEM IN YOUR PRAYERS