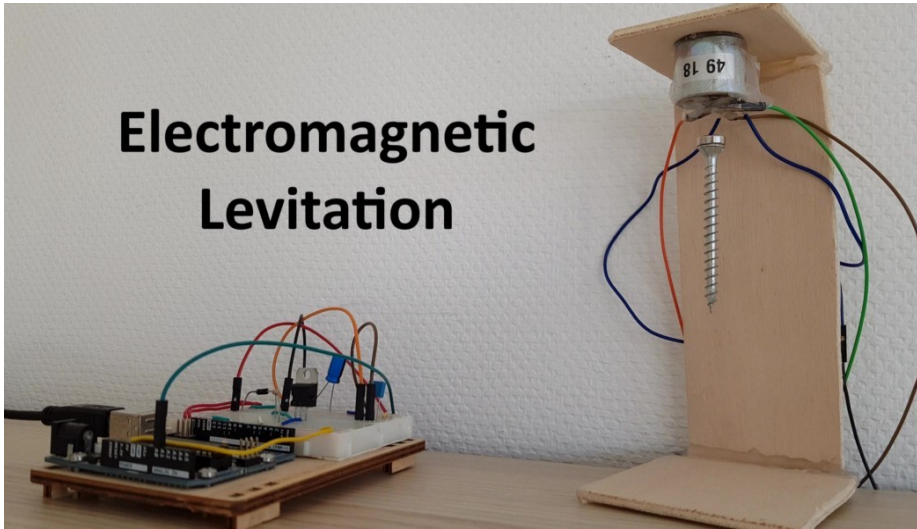


Electromagnetic Levitation

A practical example of the Theory of Science



Levitation is the most basic form of magic in probably any fictional magic system. If you think of magic, one of the first things that comes to your mind is levitation, whether it's objects hovering above the ground or witches and wizards flying on brooms. It all depends on levitation.

I'm on a quest to create magical phenomena with our magic system, science. And in this article, I'll show you how to create the magical phenomenon of levitation, and thus obtain the power of levitation.

I already talked about the connection between science and magic in my article about my Theory of Science, which explains the theoretical foundation for the things I'm showing you in this article. So go check it out if you haven't already.

And electromagnetic levitation, which is described in this article, serves as a practical example of my Theory of Science.

So, let's begin with the basics of levitation.

I want my magnetic object to hover a few centimeters above the ground.

But as you know, gravity constantly pushes it towards the center of the Earth.

So what I need is an opposite force with the same amount of strength. Thus, the sum of all forces should be equal to zero.

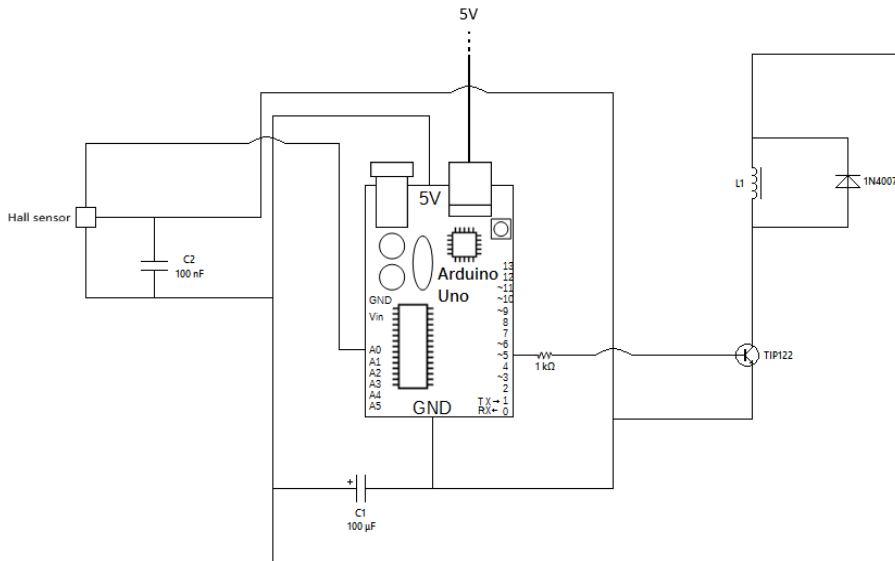
And that's where an electromagnet comes into play. Its magnetic field will pull the object in the opposite direction of gravity.

But the thing is that I need to quickly turn the electromagnet off if the object comes too close to it so that the object doesn't smash into the electromagnet, and then turn it back on if the object gets too far away so that it doesn't fall on the ground.

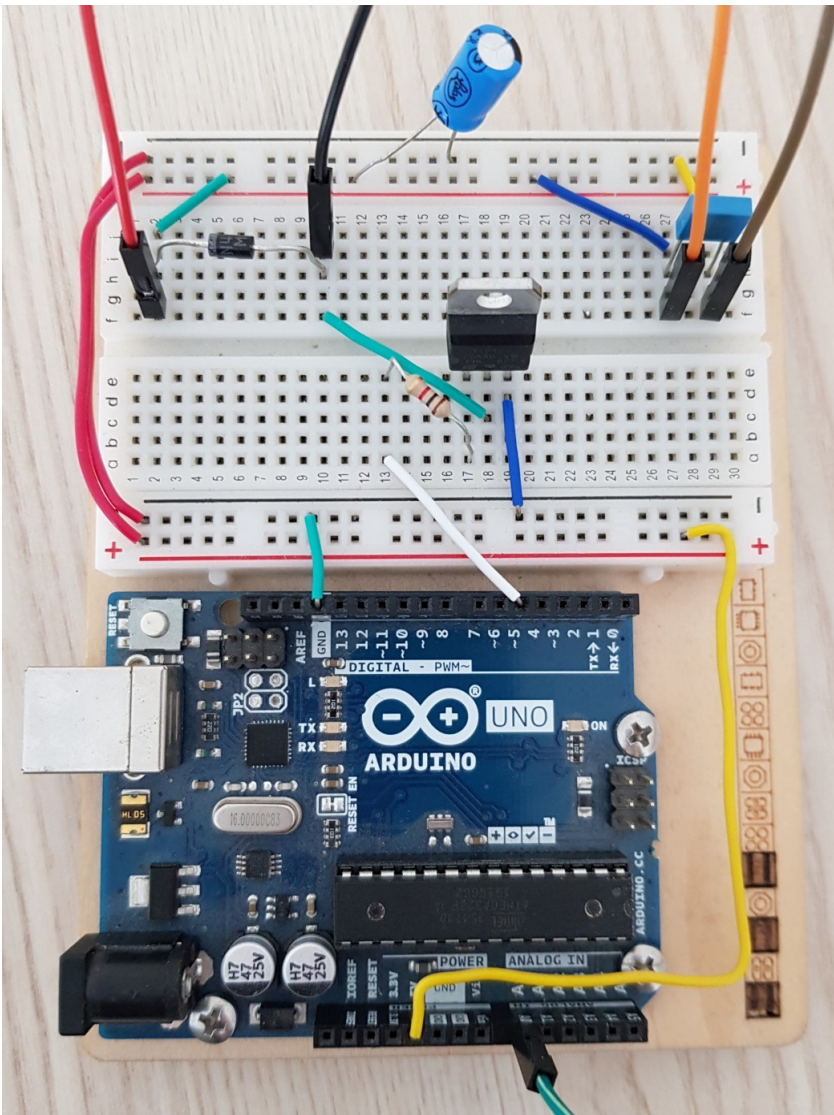
So to measure the position of the object, I'm gonna use a Hall sensor.

And to automate this process, I need a microcontroller that runs software. I'm using the Arduino Uno for this purpose. The software itself will be written in C++.

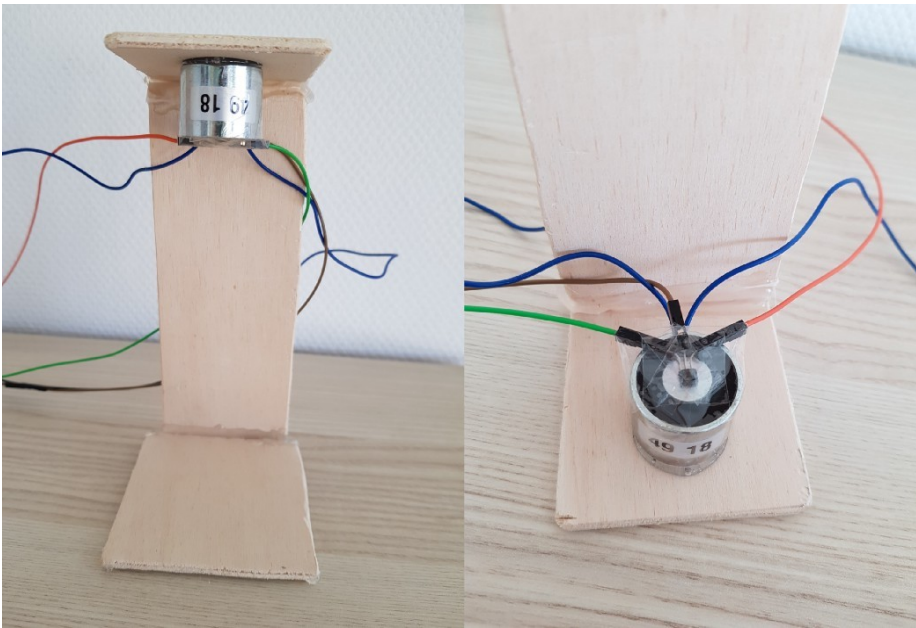
Here is the circuit diagram for the hardware I'm using:



And this is how it looks after the assembly:



I mounted the electromagnet to this wooden stand with the Hall sensor directly below it.



And finally, this is the software that has been uploaded to the Arduino Uno:

```
1  #include <Arduino.h>
2
3  int setPoint = 272;
4  int sensorPin = A0;
5  int outputPin = 5;
6  int sensorValue = 0;
7  unsigned long time;
8
9  void setup() {
10
11     Serial.begin(9600);
12     pinMode(outputPin, OUTPUT);
13     time = millis();
14 }
15
16 void loop() {
17
18     sensorValue = analogRead(sensorPin);
19
20     if(millis() - time >= 500){
21         Serial.println(sensorValue);
22         time = millis();
23     }
24
25     if(sensorValue >= setPoint){
26         digitalWrite(outputPin, HIGH);
27     }else {
28         digitalWrite(outputPin, LOW);
29     }
30
31 }
```

Check out my video about this topic if you want to see the object actually levitating:

<https://youtu.be/rhIbBcCKLDE?t=140>

Personally, I think it's just a really amazing experience to witness how magical phenomena from fiction and fantasy can sometimes be easily recreated in real-life. And levitation is the perfect example to begin with since it's the most common spell in fiction.