

Magnetic Levitation Theory of Operation

Simple explanation:

When the "electronic eye" (the phototransistor) does not see the ball, it turns on the electromagnet. The metal ball is attracted to the magnetic field created by the electromagnet. As the ball rises, the "electronic eye" sees the ball and turns off the electromagnet. This causes the ball to fall. When the "electronic eye" does not see the ball again, it turns on the electromagnet, the ball rises, and the cycle is repeated.

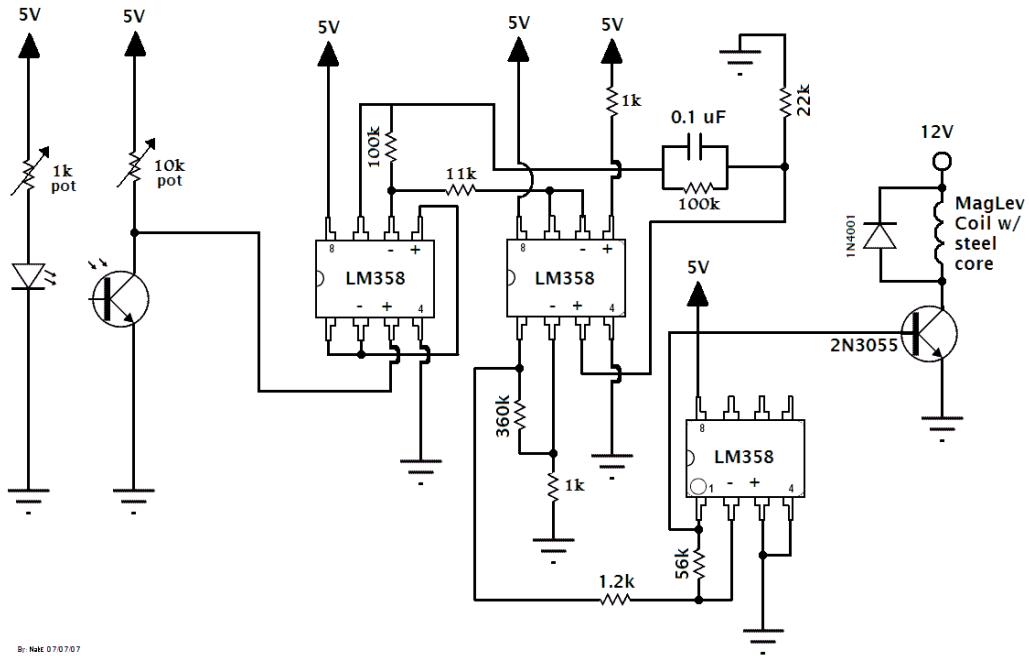
More detailed explanation:

When a current passes through a wire, a small magnetic field is generated. When that wire is coiled around a ferromagnetic core, a very strong magnetic field is created. This magnetic field provides the lifting force to cause ferric metal objects (e.g. a steel ball) to rise towards the electromagnet. The IR diode and IR phototransistor measure the location of the ball. With the essential phase lead circuitry, a control signal is generated that drives a power transistor. The power transistor turns on or off the electromagnet. The timing of when to turn off or on the electromagnet causes the ball to rise and fall so fast as to appear to be levitating. Just before the ball is outside the controlling distance of the electromagnet, the current is sent through the coil and the ball is pulled back up.

Notes about building a magnetic levitator:

1. Starting at maximum resistance, adjust the 1k ohm potentiometer until you are at the maximum rated current flow for the IR diode (100 mA for the one specified).
2. Adjust the 10k ohm potentiometer until your voltage swing on the output of your transistor is as close to 0-5V as you can make it.
3. I wound the electromagnetic coil by hand. Use magnet wire rated for at least 2 amps. Wind around core as many times as you can (approximately 200 times). Keep the wire tight.
4. Test the current flow through the coil and add a power resistor to limit the current if you have to.
5. Video of my Magnetic Levitator can be found here:
<http://video.google.com/videoplay?docid=-5868820669161417730>

MagLev Schematic



Magnetic Levitator Parts

Amt	Description	Allied Part#
1	1k ohm potentiometer	754-2371
1	10k ohm potentiometer	754-1146
2	1k ohm resistor	832-0537
1	1.2k ohm resistor	832-0697
1	11k ohm resistor	832-0708
2	100k ohm resistor	832-0706
1	22k ohm resistor	296-4755
1	56k ohm resistor	832-0859
1	360k ohm resistor	895-0861
1	0.1 uF capacitor	881-0453
1	IR LED (SE3470-003)	276-0018
1	Phototransistor (VTT9103H)	980-0108
3	LM358N op amp	288-0544
1	2N3055 power transistor	248-2042
1	1N4001 Diode	266-0001
1	Large bolt and coil (see text)	
	Misc:	
	5v and 12v DC power supplies (see text)	