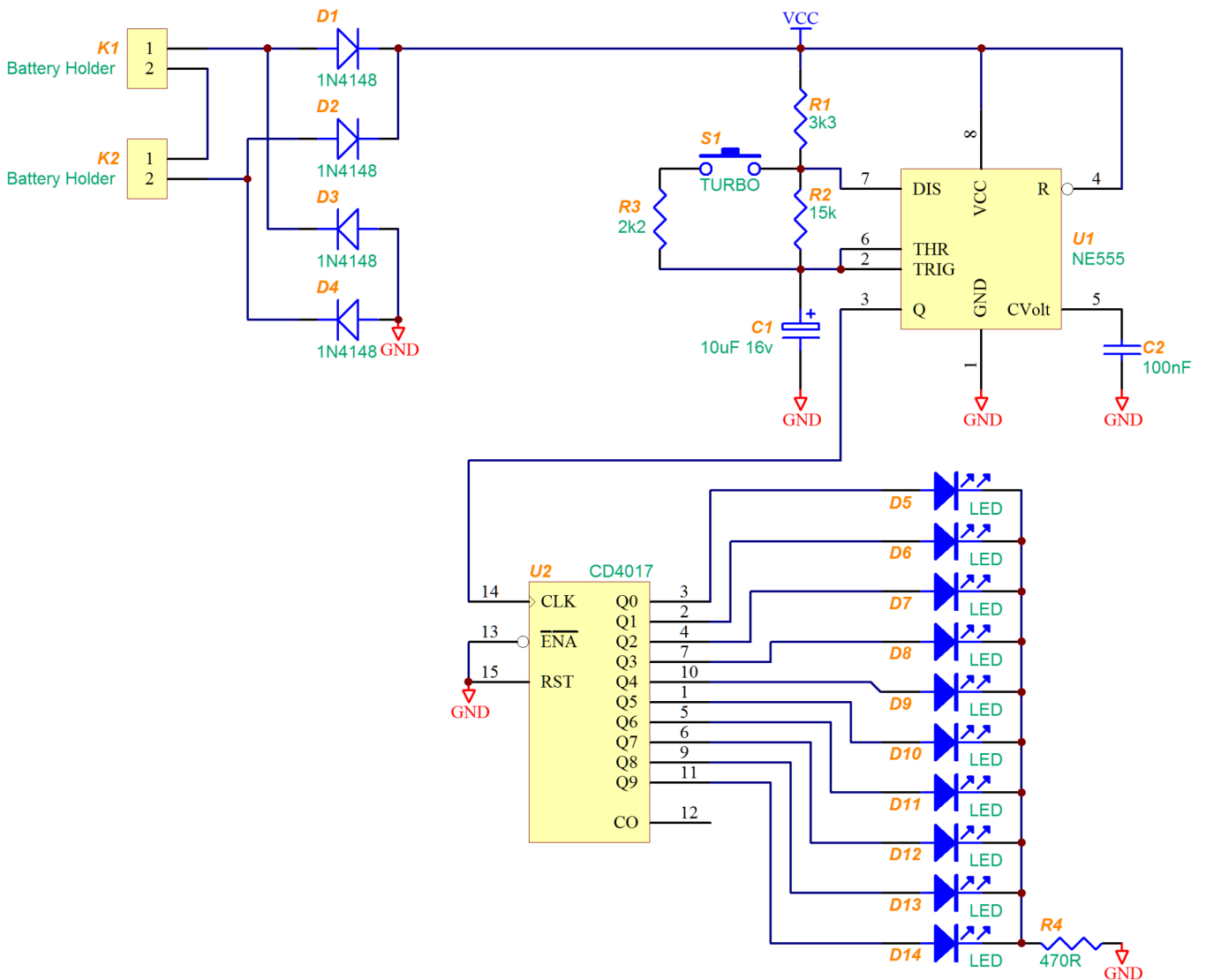
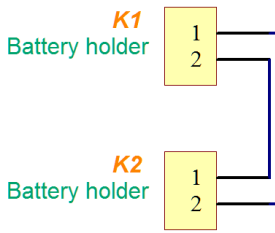


HT002: How it works

Here is the schematic diagram for this kit:

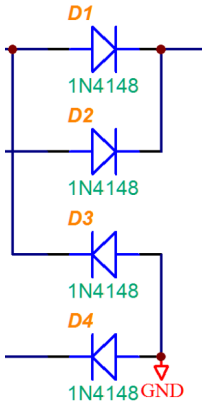
A schematic diagram is a drawing that shows how all of the components are connected in order to understand the operation of the circuit. As you learn more about electronics you will start to recognize some of these symbols. It is almost like a roadmap to show where all the houses are and how the streets are connected to each other.





K1 and K2 are the battery holders.

They are wired so that the batteries are all in series. Each battery is about 1.5volts, and when we connect them in series, we end up with $1.5 \times 4 = 6$ volts.

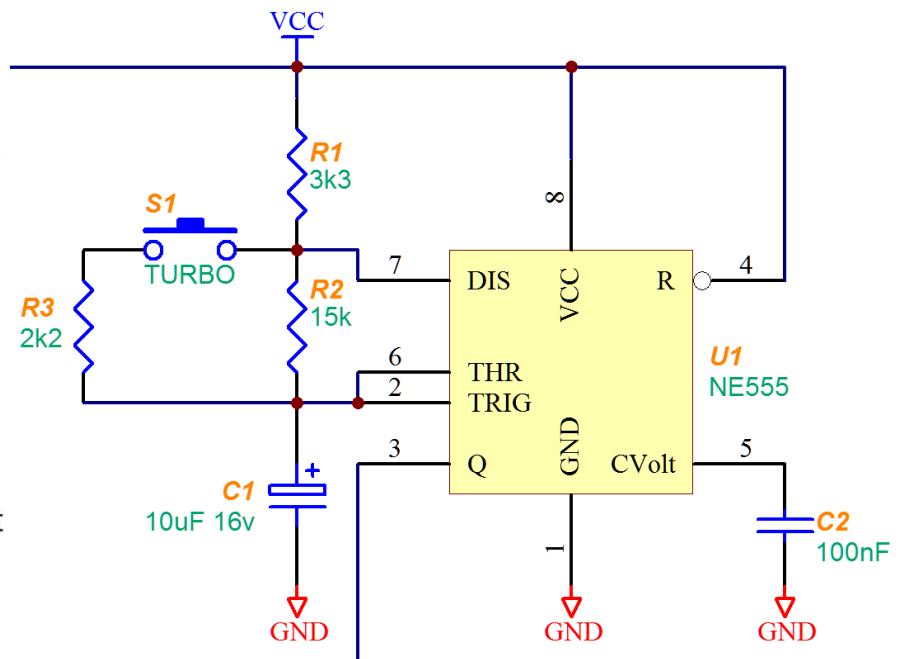


D1,D2,D3,D4 are diodes. Diodes are components that let current go in one direction only. In this circuit we use 4 of them to create a bridge rectifier, so that the circuit can be protected if you maybe put the batteries in the wrong way.

U1 is the heart of the project.

U1 is an Integrated circuit. It means there are many components all squeezed inside there, connected in a special way so that we can make it do things for us.

The 555 Timer is connected in a way that creates an oscillator, which is something that goes on and off, just like your own heart. R1 and R2 and C1 control the timing of the oscillator to make it go faster or slower. The oscillator output signal is at pin 3. C2 is there to stabilize the oscillator. (To keep the timing consistent)



If you make the value of R1 and R2 smaller, the oscillator will run faster. You will notice there is another resistor, R3, which is connected to R2 and to the TURBO switch. What happens here, is when the switch is pressed, R2 and R3 are connected to each other in parallel. When you do this, the resistance becomes LESS, so the oscillator runs faster, and the LEDs will flash faster!

U2 is a counter

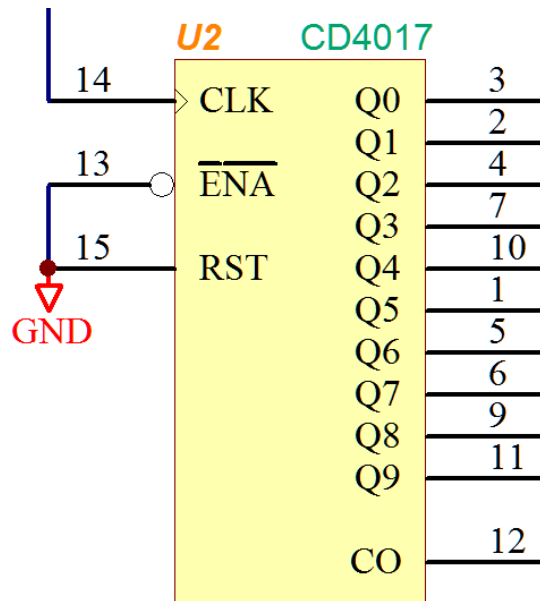
U2 is connected to the heartbeat signal from U1, and it counts every time it gets a new heartbeat.

When it starts, it will show count 0, and the counter will give out a signal at Q0, which is pin 3.

The next time it gets a new heartbeat, it will count to 1 and the counter will give out a signal at Q1, which is pin 2

The next time it gets a new heartbeat, it will count to 2 and the counter will give out a signal at Q2, which is pin 4

It goes on like this and counts all the way to 9 (At Q9). After 9, the counter goes back to zero.

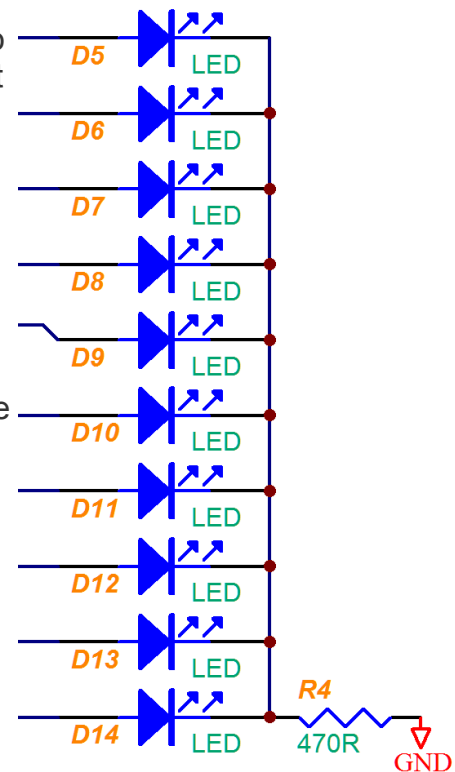


LEDs and Resistor

Each of the signals from Q0 to Q9 on U2, are connected to LEDs so we can see the signals. When a signal is present on the Q0 pin, some electricity will go into the LED that is connected to it (D5), and the LED will light up.

Each signal on U2 is connected to its own LED, and the LEDs are in a circle.

R4 is there to prevent too much electricity from flowing through the LED. R4 is now for 470ohm. If we make it a smaller value like 330ohm, more electricity will flow and the LEDs will shine brighter. If we make it a larger value like 560ohm, less electricity will flow and the LEDs will shine less bright.



IMPORTANT:

Check out the instruction videos
at www.hypertronics.co.za.



What do you need?

- 1: Solder iron
- 2: Solder wire
- 3: Side cutters
- 4: Your HyperTronics kit
- 5: Batteries

Step 1: Make sure you have everything. Compare the Parts list with your kit and make sure that all the components that are shown on the Parts list, is in your kit. Some of the parts are on the Component sheet, and some of them may be loose in the package.

Step 2: Mount the components in the same order as they appear in the Parts list. We mount the larger components first. Stick the leads of the component through the Printed Circuit board, and we solder them on the other side. After soldering, we cut off the leads that are long.

Step 3: Make sure everything is correctly done. Maybe ask your mom or dad to have a look. Compare your completed printed Circuit board with the pictures included with your kit. **If it is not done correctly and you turn it on, it will not work and it is possible that you can break something.**













Step 4: Install the batteries and have fun!!

Troubleshooting: What must I do if it does not work?



- 1: Take out the batteries
- 2: Check that you have all the components soldered
- 3: Check that all the components are the right way in
- 4: Check that you do not have solder that is bridging two pads.

HT002 Parts List

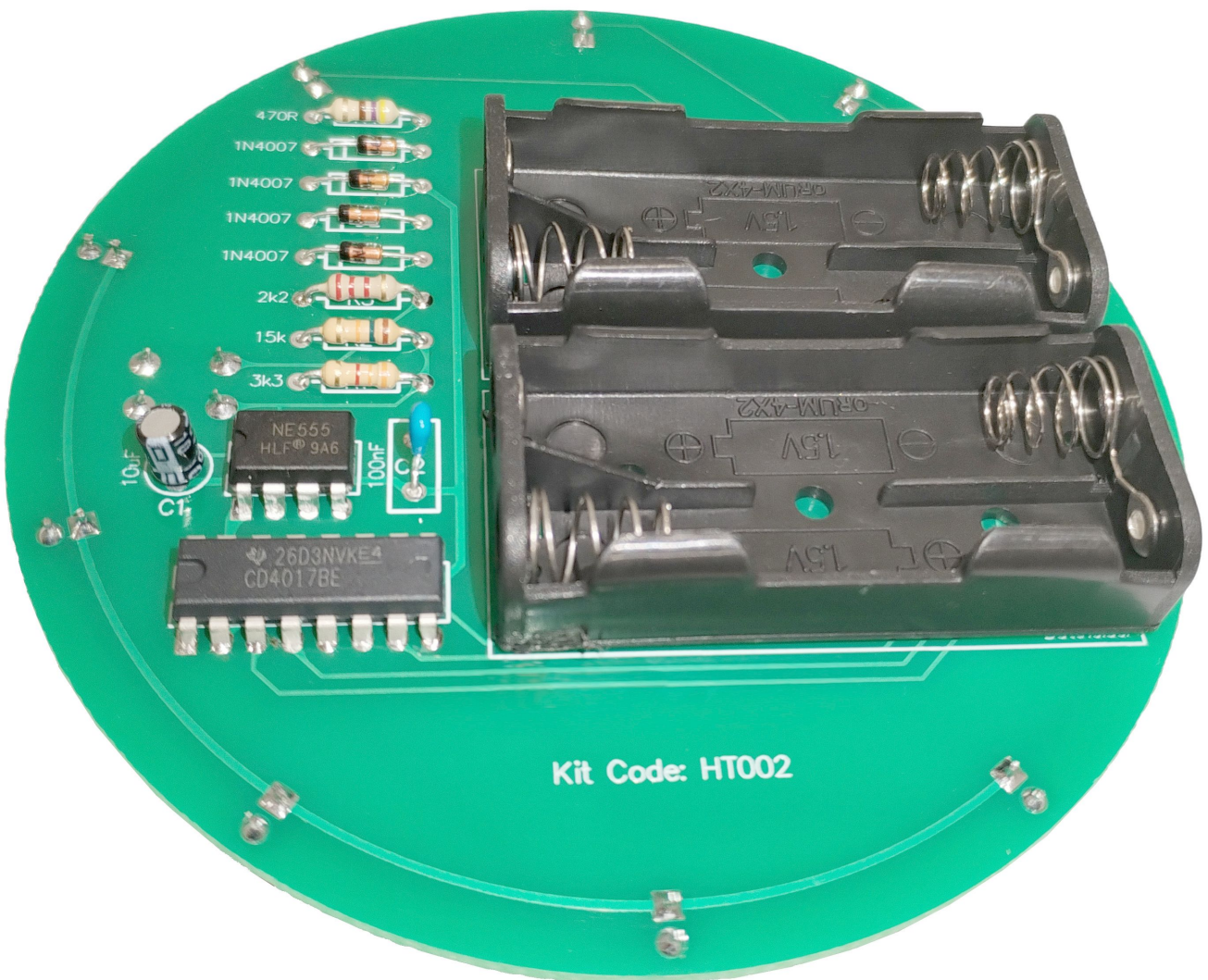
Designator	Part Description	Picture	Marking	Notes to the Young Engineer
R1	3.3Kohm Resistor 1/4Watt Leaded		Orange-Orange-Red	Can go in any direction
R2	15Kohm Resistor 1/4Watt Leaded		Brown-Green-Orange	Can go in any direction
R3	2.2Kohm Resistor 1/4Watt leaded		Red-Red-Red	Can go in any direction
R4	470ohm Resistor 1/4Watt leaded		Yellow-Violet-Brown	Can go in any direction
C1	10uF Electrolytic Capacitor		10uF	BE CAREFUL which way you put it in!
C2	100nF Ceramic Capacitor		104	Can go in any direction
D1,D2,D3,D4	1N4148 Diode		Black band	BE CAREFUL which way you put it in!
D5,D6,D7,D8, D9, D10,D11, D12,D13,D14	Red LED 5mm		Flat side / Short pin	BE CAREFUL which way you put it in!
U1	NE555 Integrated Circuit		NE555	BE CAREFUL which way you put it in!
U2	CD4017 Integrated Circuit		CD4017	BE CAREFUL which way you put it in!
K1, K2	AAA Battery holder			
Switch1	6x6 Tactile pushbutton			

Pictures

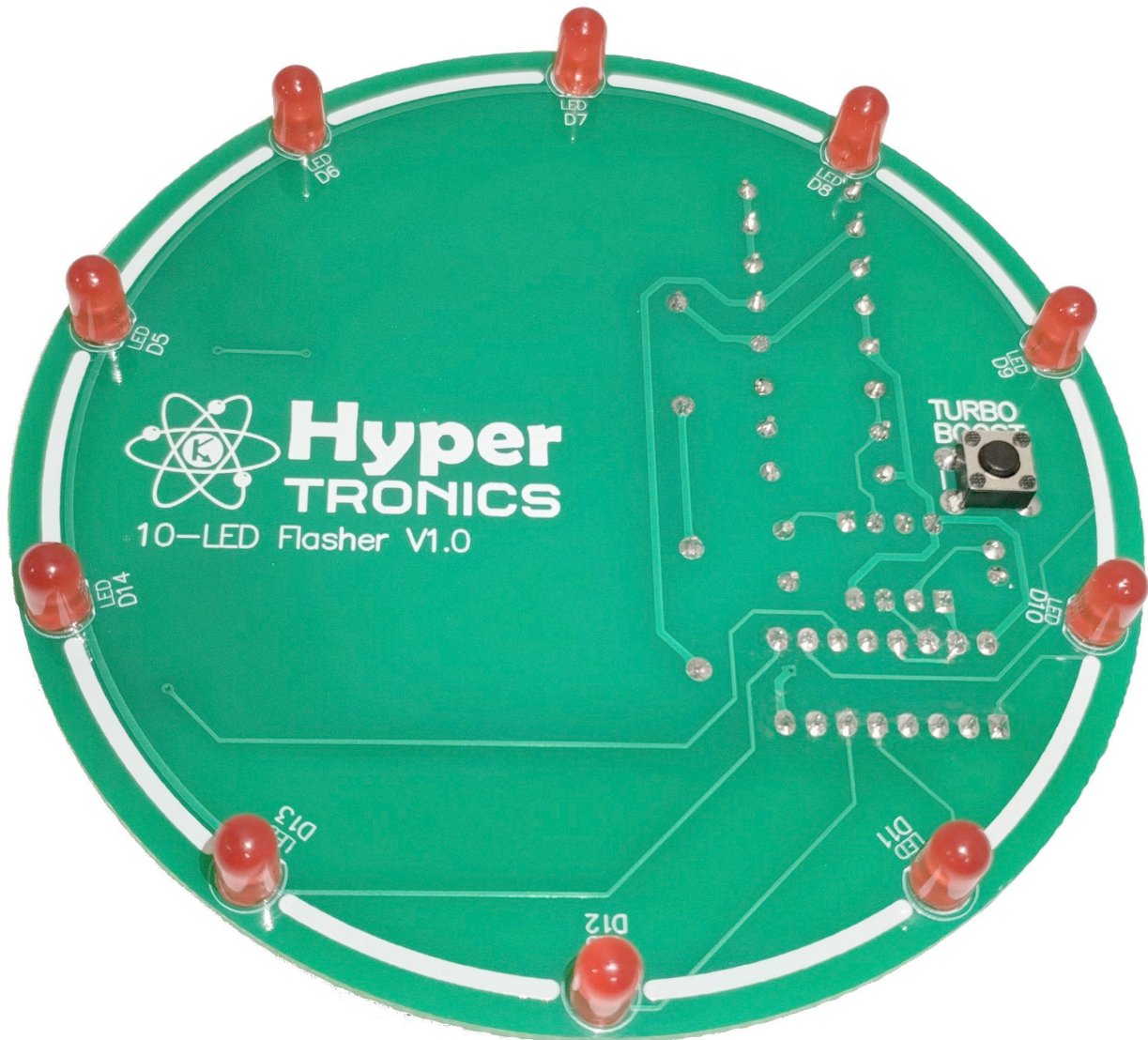
Use these pictures to **DOUBLE CHECK** that you have everything done correctly **BEFORE** putting in the batteries!!



Component side



Solder side



What to do if it is not correct?

DO NOT switch it on.

You will need to fix it to look the same as the picture before switching on.