Pedestrian Traffic Safety Device

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Aim:

Our idea is to create a device that could warn pedestrians when a vehicle is approaching and hidden from view.

Introduction:

Electric vehicles have caused safety hazards for pedestrians[1] because they are too difficult to hear.
There are similar pedestrian safety systems but they work differently to our idea, these work by the car detecting the pedestrian and warning the driver[2].
Our idea is to detect vehicles travelling on a road and warn pedestrians by flashing two lights and producing a warning sound.

Design brief:

Our first step in building the system is to make the electronics that can detect a vehicle.

How to detect a vehicle on a road:

There are many different ways of detect a vehicle, these include Computer Vision (Video), Pneumatic Tubes,

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[1] https://www.sciencedirect.com/science/article/pii/S2665917422002690
[2]https://www.bodyguardsafety.com.au/bodyguard-100-australian-cutting-edge-pedestrian-warning-system/

Piezoelectric, Inductive Loop, Magnetic, Acoustic, Passive Infrared, Doppler, Radar[3]

Vehicle Detection using Computer Vision:
This is a really effective method for counting and detecting vehicles, many vehicles can be detected at the same time with one camera.

Pneumatic Road tube counting:
This is a system that uses a rubber hose that is stretched across a road. When a vehicle drives over the hose this causes a change in air pressure that is then sensed.

Piezoelectric Sensor:
Piezoelectric sensors work by converting mechanical energy into electrical energy. When a vehicle drives over the sensor it causes it to change shape and this causes it to produce a voltage signal.

Inductive Loop:
An inductive loop can be used to detect a changing magnetic field. The loop generates an electrical signal that can be sensed.

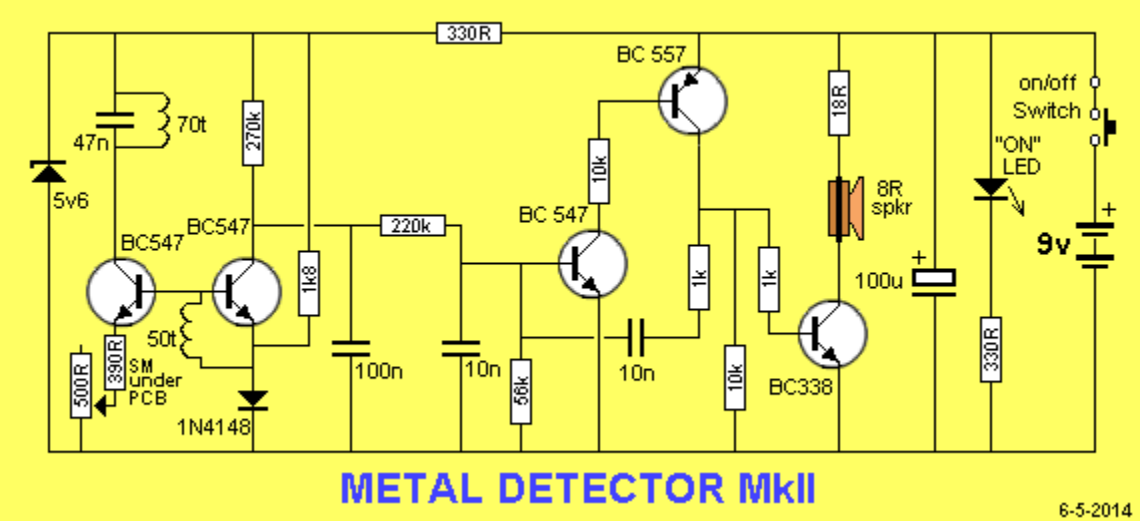
Vehicles are commonly detected by a coil under the road. The coil detects the metal body of the vehicle.

Electronics Design:

[3]https://www.retailsensing.com/people-counting/vehicle-detection-count-traffic/

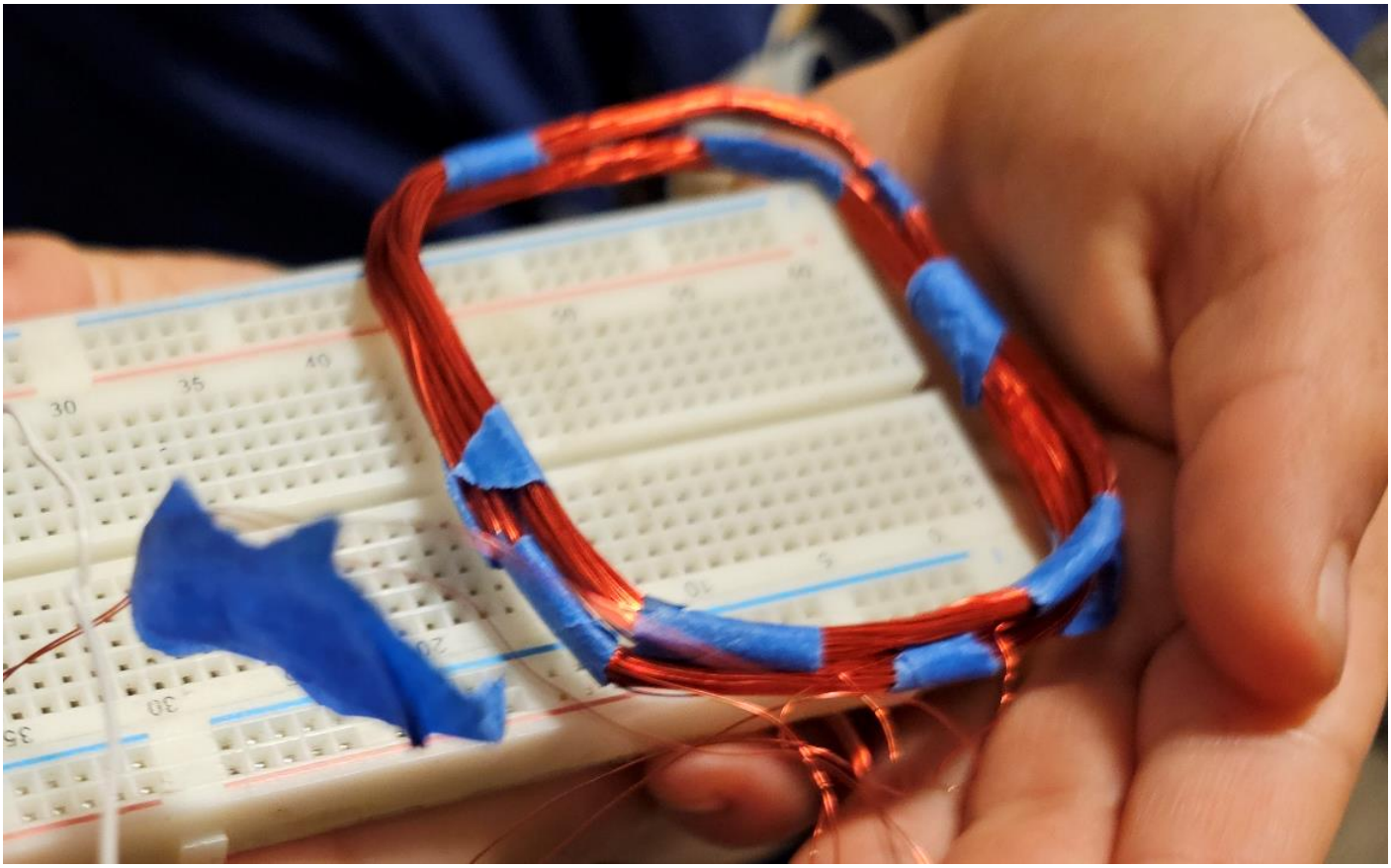
Components:

Metal detector circuit

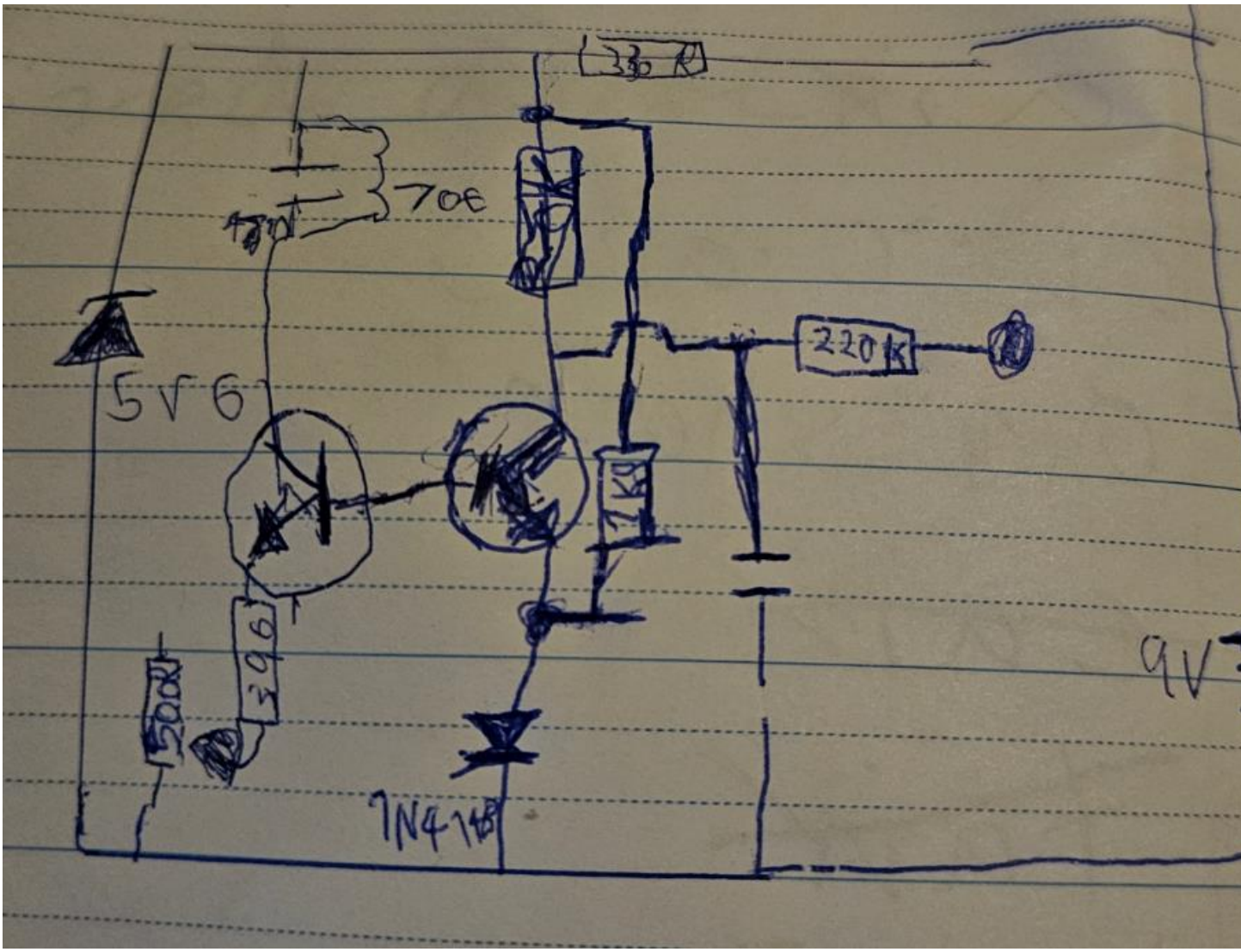


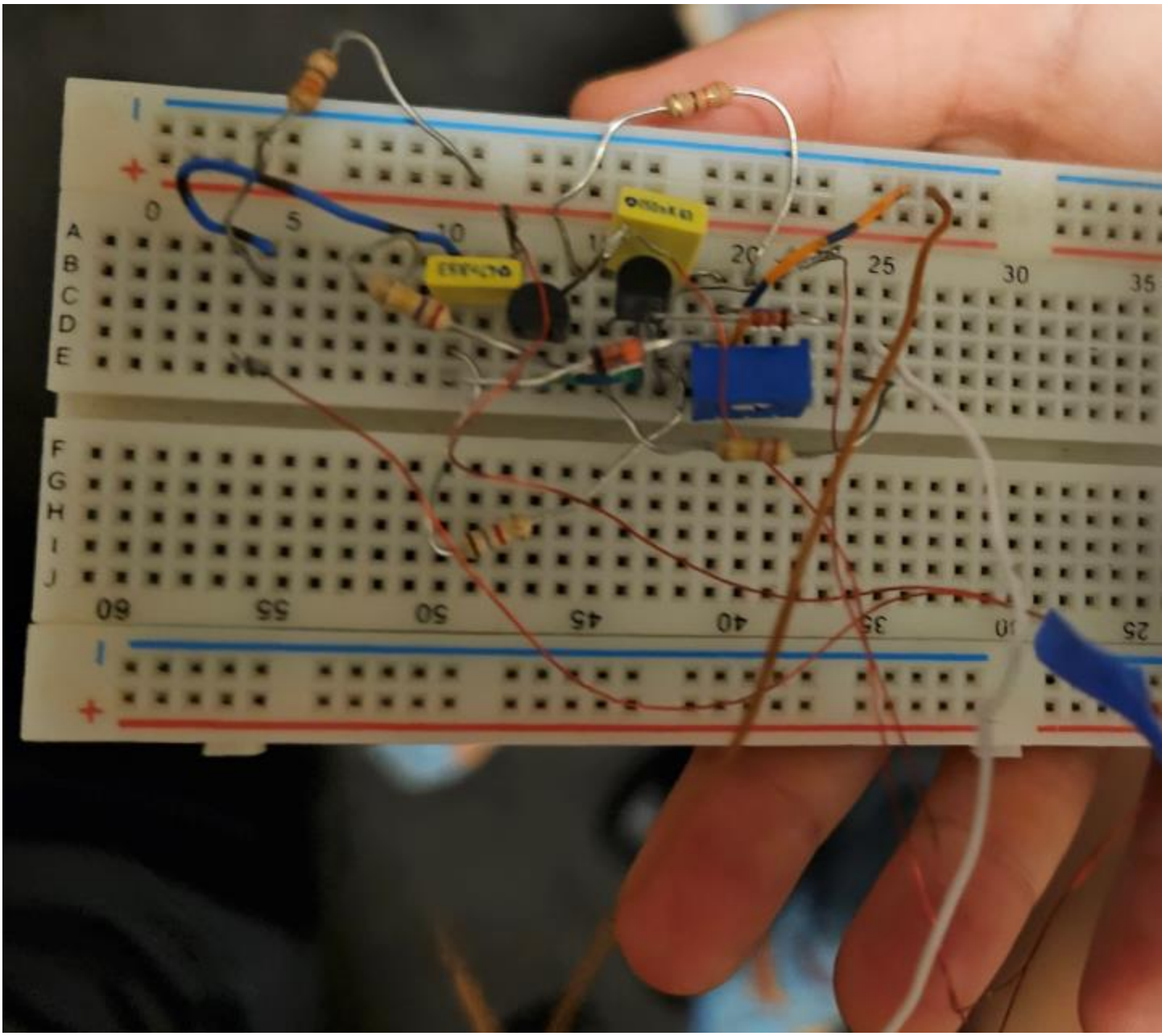
We used part of the above circuit to detect the presence of metal. This is similar to how vehicles are detected on a real road.

The first component that we made was the detector coils, we made these by winding enamel wire around a round object.



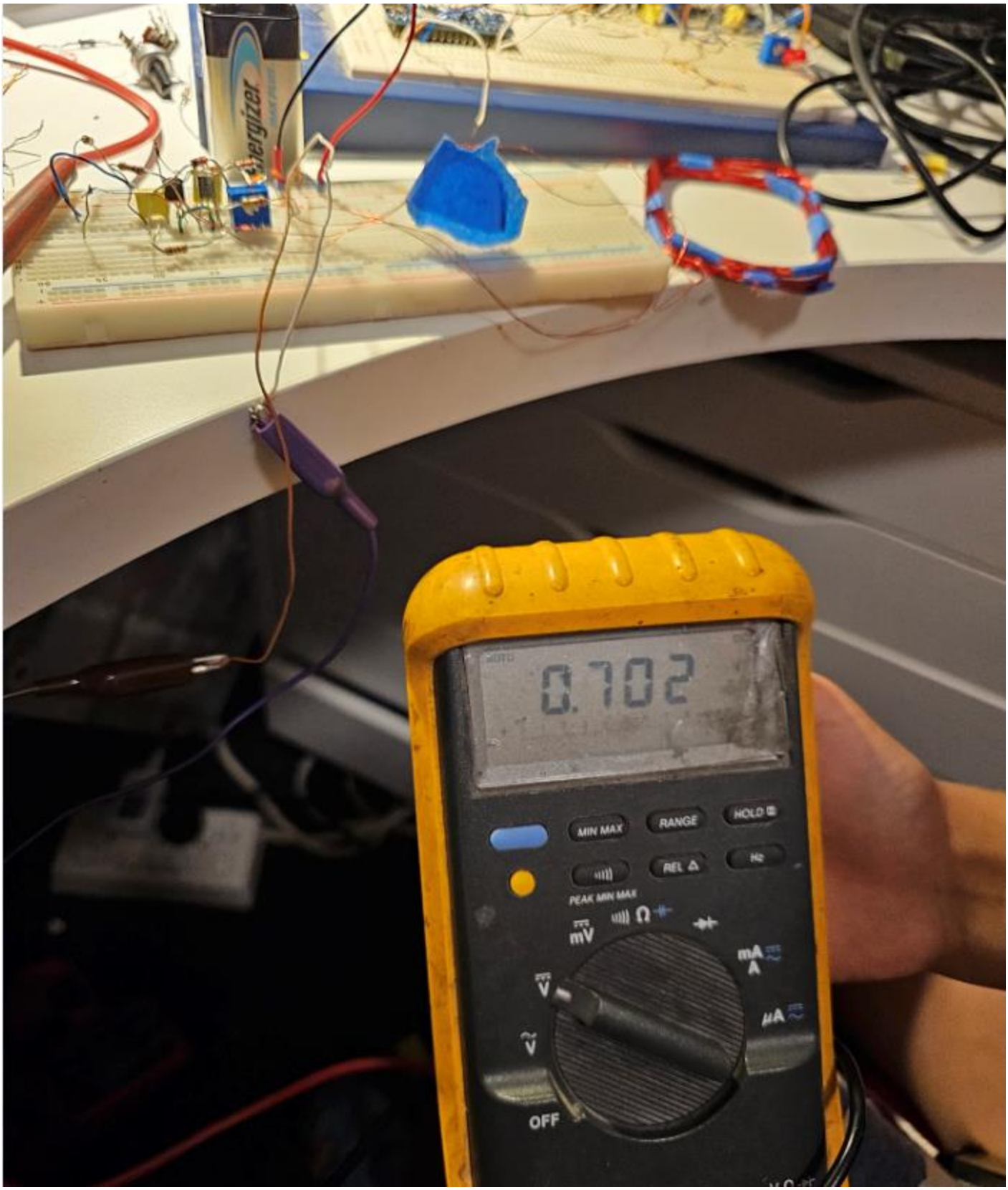
We then started to build the metal detector circuit on a breadboard.


330 Ω
700
5V6
220K
1K
390
500Ω
1N4148
9V

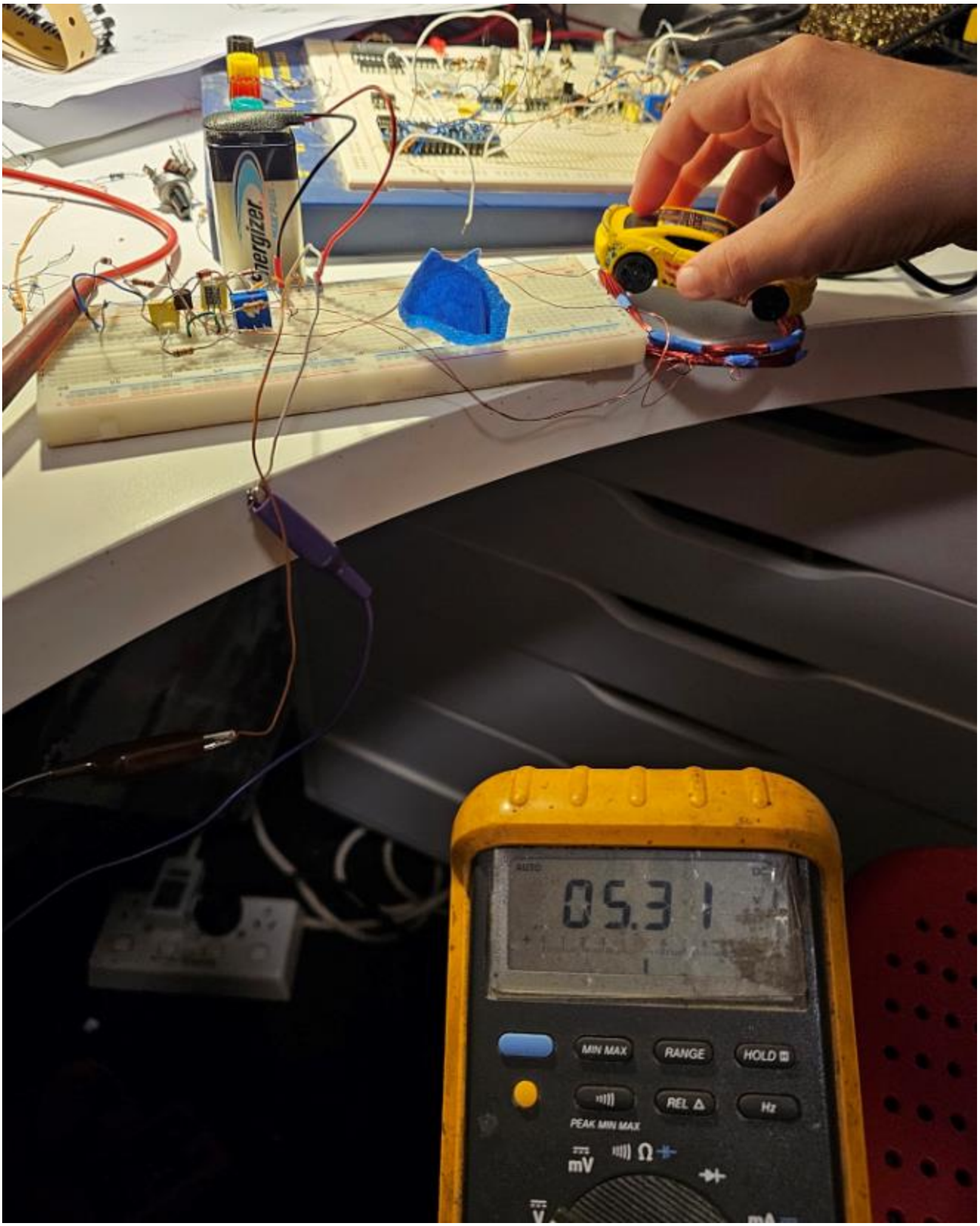


This circuit produces a voltage when it detects metal.

This photo shows the low output voltage on the multimeter when no metal is on the coil.

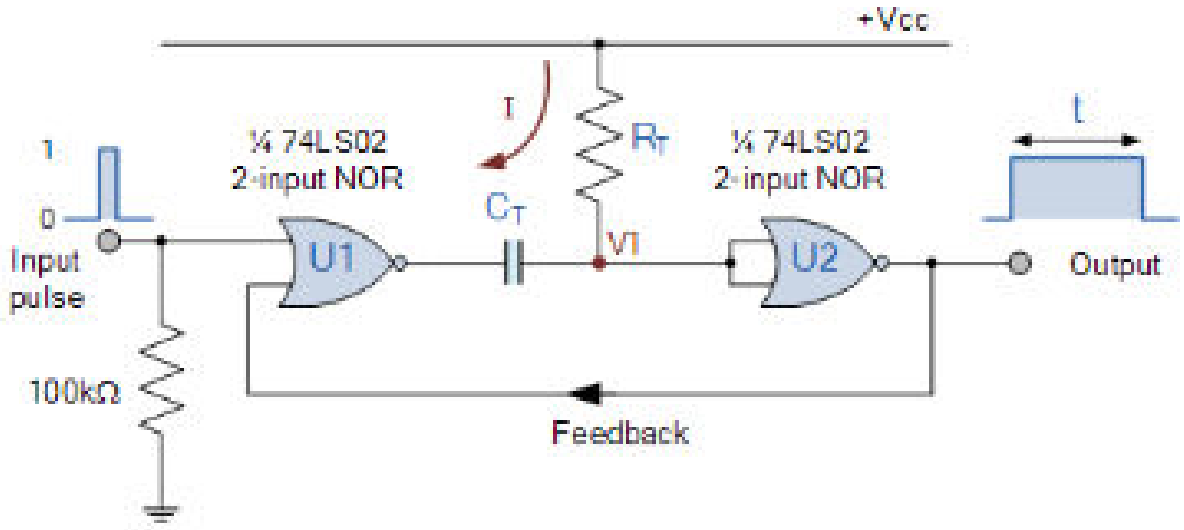

Energizer
0.702
MIN MAX
RANGE
HOLD
REL Δ
Hz
PEAK MIN MAX
mV
mA
A
V
μA
OFF

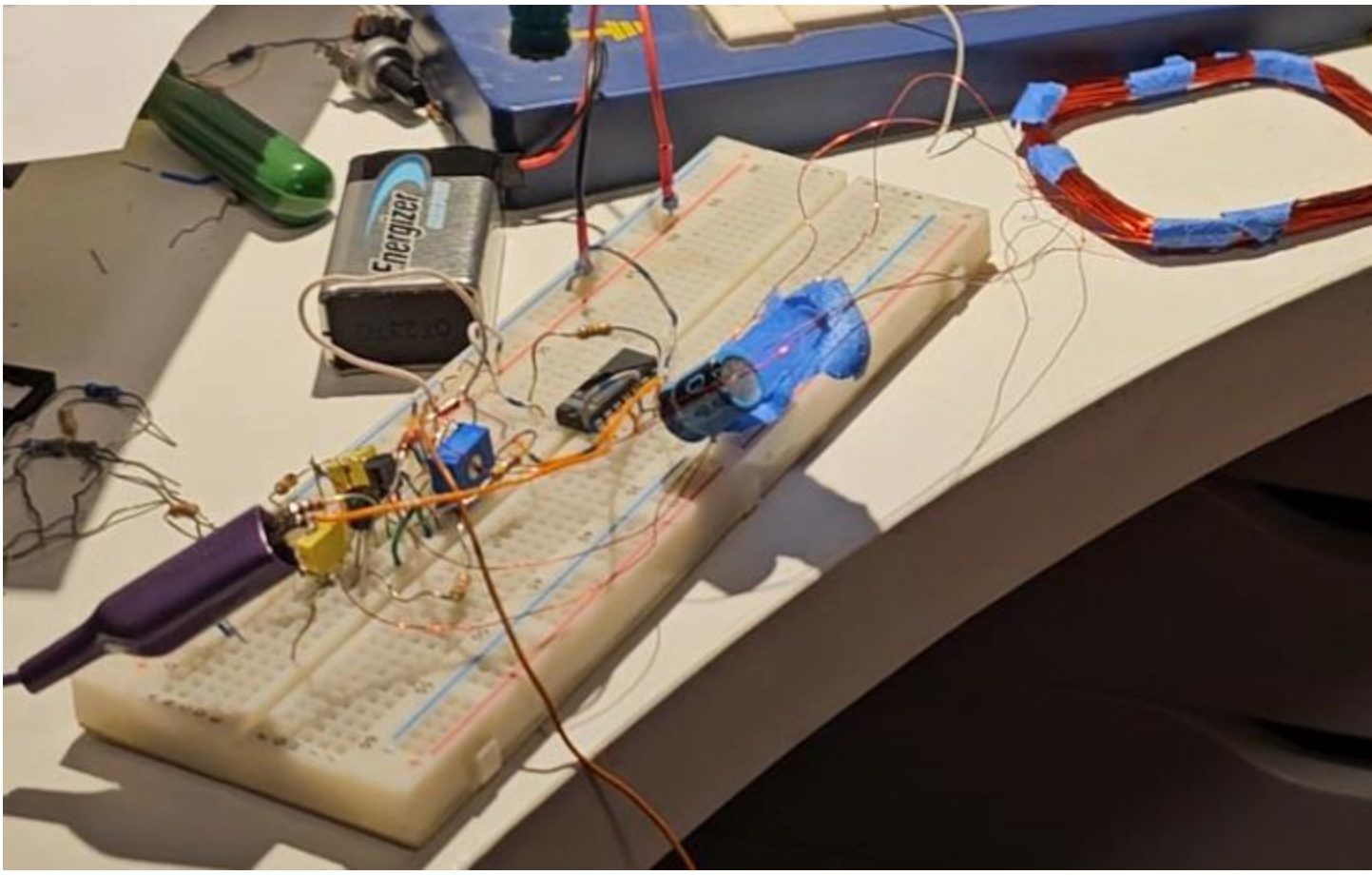
This photo shows the higher output voltage on the multimeter when a metal car is on the coil.


Energizer
05.31
MIN MAX
RANGE
HOLD
REL Δ
Hz
PEAK MIN MAX
mV

We couldn't connect the metal detector circuit to the flashing light circuit because the lights would stop flashing immediately once the vehicle passed.

To solve this problem we added a one shot circuit to the output of the metal detector circuit. This circuit converts a short pulse to a long pulse.
We built this circuit on the same bread board as the metal detector circuit. The components we built it from were a NOR gate chip, resistor and capacitor.
The resistor and capacitor values set the time of the output pulse.





Once this circuit was built we connected the metal detector circuit to it.

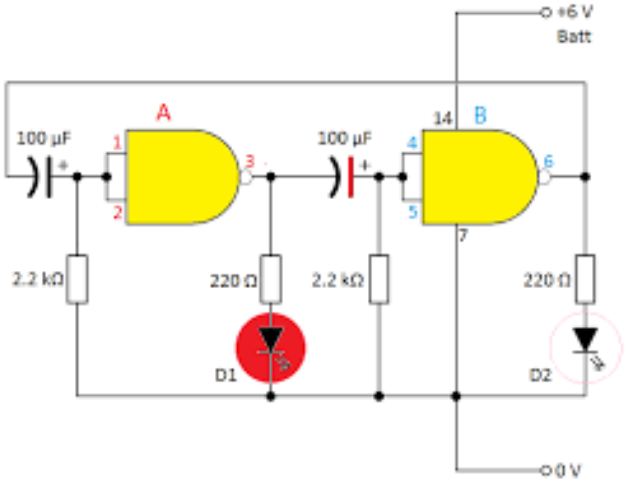
When we tested the circuit it did not work! We found out that removing a resistor from the input was the solution to the problem.

Flashing light display

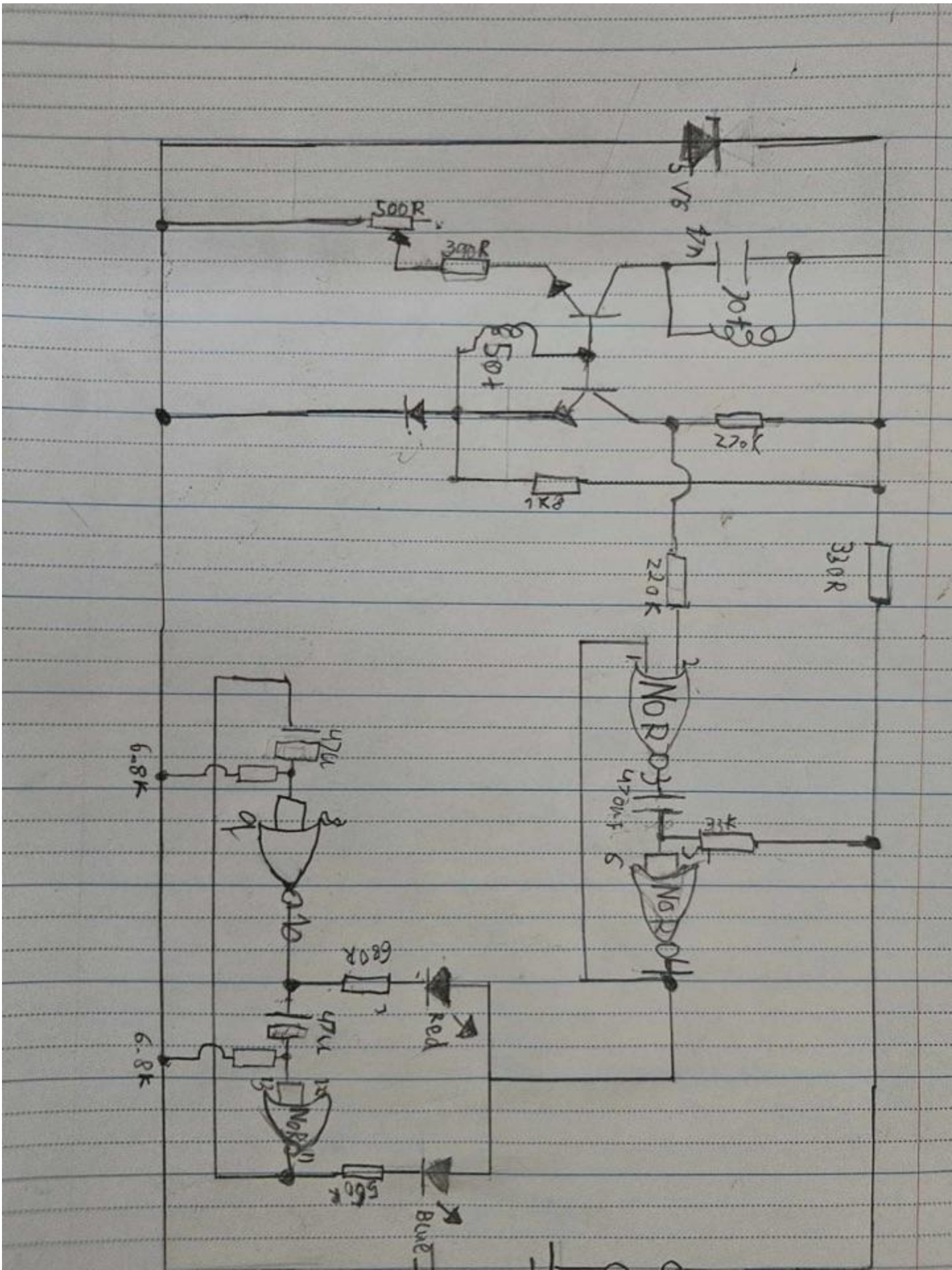
The last circuit that we needed to make was the flashing light circuit.
We made it using the two remaining NOR gates from the one shot circuit.

We made a similar circuit to the one below. We adjusted the flashing speed by trying different resistors until we were happy with the way it looked.

Once it was working we connected it to the one shot circuit.

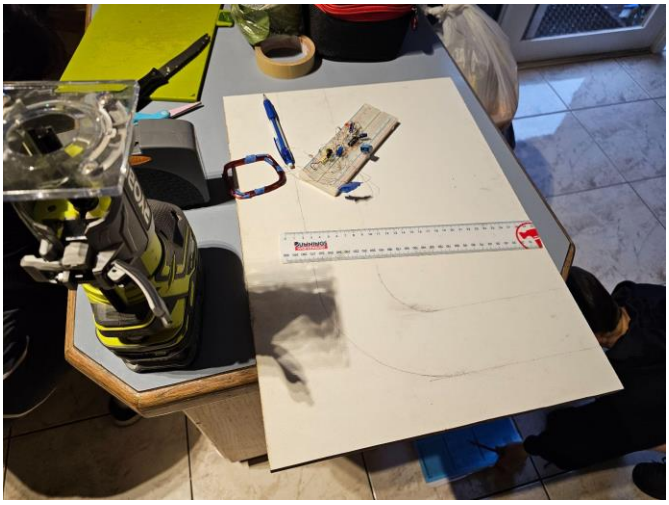


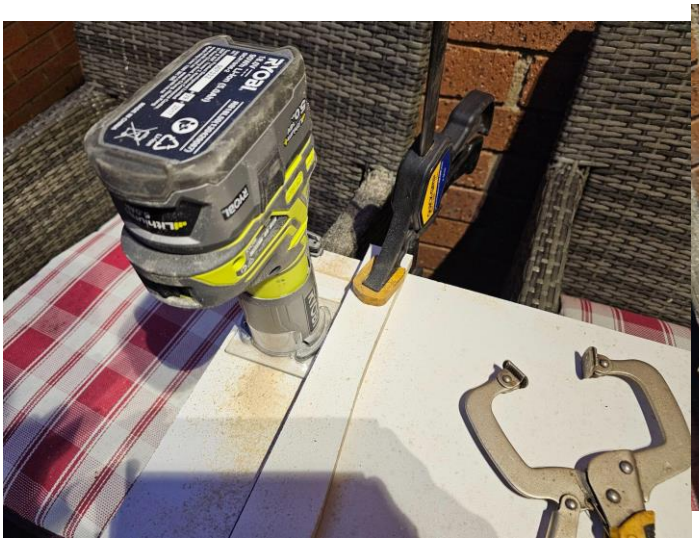
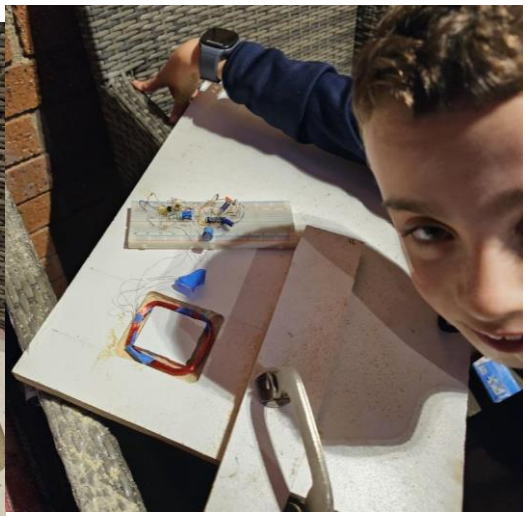
Complete electronic circuit:


5 Vs
500R
390R
47n
10µ
150µ
270K
1KΩ
220K
330R
NOR 01
NOR 04
NOR 03
NOR 10
NOR 11
6-8K
6-8K
47µ
47µ
47µ
68Ω
68Ω
Red
Blue

Once everything was working on the breadboard we started to make the model road.

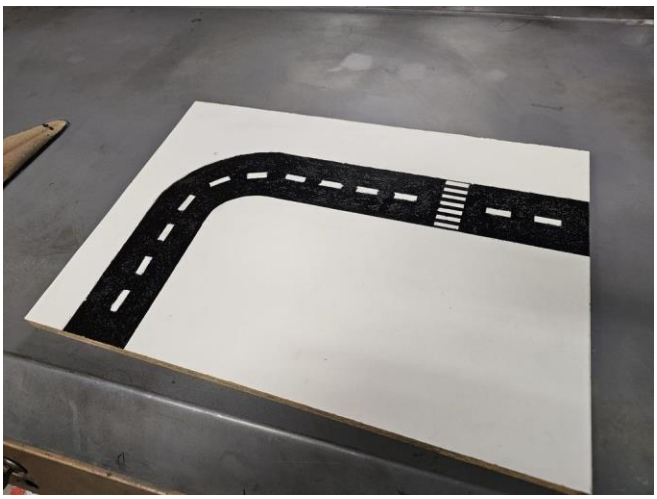
To do this we started with a big piece of wood then we cut it down to a smaller size.

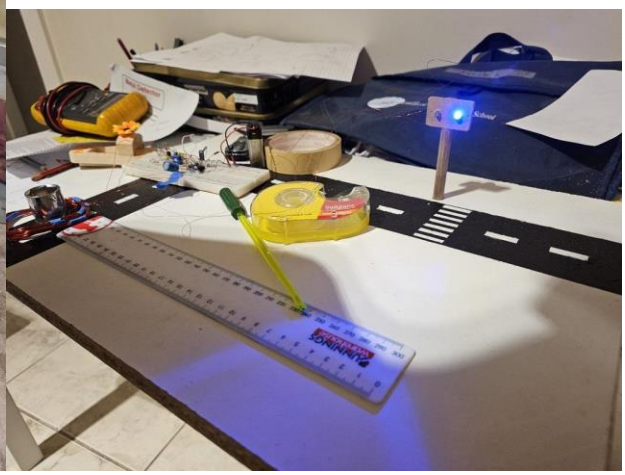


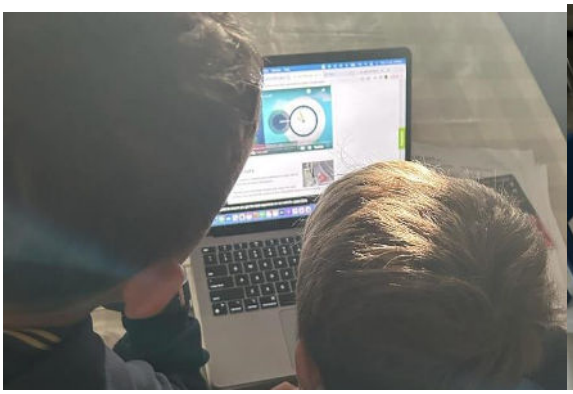
After that we started to mask the top surface of the wooden piece in the shape of a curved road.

After the surface was masked , we used black paint to paint the road






QUICKGRIP



Discussion:

We used many different scientific principles in the design of our invention, these include:

- **A way to detect a vehicle. To do this we used electronic circuitry to detect a change in magnetic field.**
- **We learnt about how to read a circuit diagram and how electronic components work, how to build a circuit on a breadboard and about different types of circuitry.**

Our invention is innovative since there are no existing systems that can warn pedestrians of oncoming vehicles that are hidden from view. Our invention can solve this problem.

One of the limitations of the invention is it is unable to warn people that are vision impaired, in the future we could add circuitry that makes a sound.
We could also replace the battery with a solar panel.

Equipment/tools used:

- **Multimeter**
- **IC insertion tool**
- **Wire cutters**
- **Pliers**
- **Soldering iron**
- **Band saw**
- **Drill**
- **Router**
- **Hand file**
- **Screwdrivers**

Bibliography:

- **Vicroads** https://www.vicroads.vic.gov.au/traffic-and-road-use/traffic-management/traffic-signals/how-traffic-signals-work **(Accessed: 10-04-2024, 7:30pm)**
- **TALKING ELECTRONICS (Updated 01-05-2024)** https://www.talkingelectronics.com/projects/MetalDetectorMkII/MetalDetectorMkII.html **(Accessed: 10-04-2024, 8:30pm)**
- **ELECTRONICS Tutorials (https://www.electronics-tutorials.ws/waveforms/monostable.html (Accessed: 21-04-2024, 7pm)**

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