



Faculty of Engineering
Cairo University



Cairo University

Electronics Project

Traffic light

Team 21

Team Members:
Khaled Mohammed Badr
Yassmeen Tarek Attia
Nourhan Ahmed
Carole Emad

Submitted to: Eng. Samar Taher

Table of contents:

→Our objective

→Components used

→Diagram of the circuit

→An overview of how our project works

→Pictures of our prototype

→Problems we faced and how we overcame them

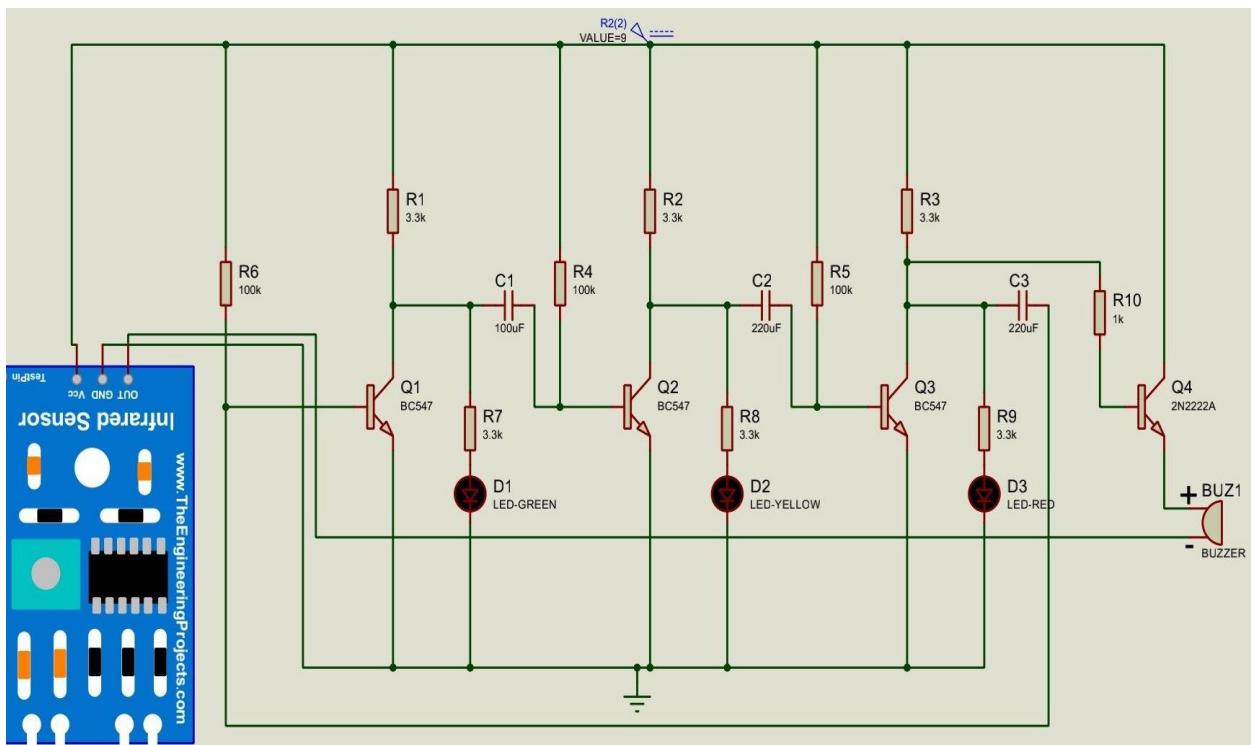
Our Objective:

The main goal of our project is to build a traffic light circuit by having 3 LEDs(red, green and yellow) that work simultaneously to indicate whether the vehicles are allowed to pass or not while controlling the time in which each LED is on using capacitors. The IR sensor is connected to a buzzer in order to be used as a warning when a vehicle approaches the traffic lights while the red LED is on. This is all done with the help of the transistors that switch a large current using a small current. In real life, traffic lights are mainly used to help reduce the number of conflicts between vehicles entering intersections from different directions. That's why, traffic lights are considered a must rather than a luxurious application. The driver is instructed to stop and wait for the green light by a red light sign. Drivers are given the go-ahead to drive when the signal turns green. When the light turns yellow, the driver is warned to wait; if it turns red, they should stop; and if it turns green, they should proceed.

Components used:

- 3 BC547 npn transistors
- 1 2N2222A npn transistor
- 3 LEDs (red, green and yellow)
- 3 capacitors (2 220 uF and 1 100 uF)
- 6 3.3k resistors
- 3 100k resistors
- 1 1k resistor
- Buzzer
- IR sensor
- Jump wires
- Breadboard
- 9v battery

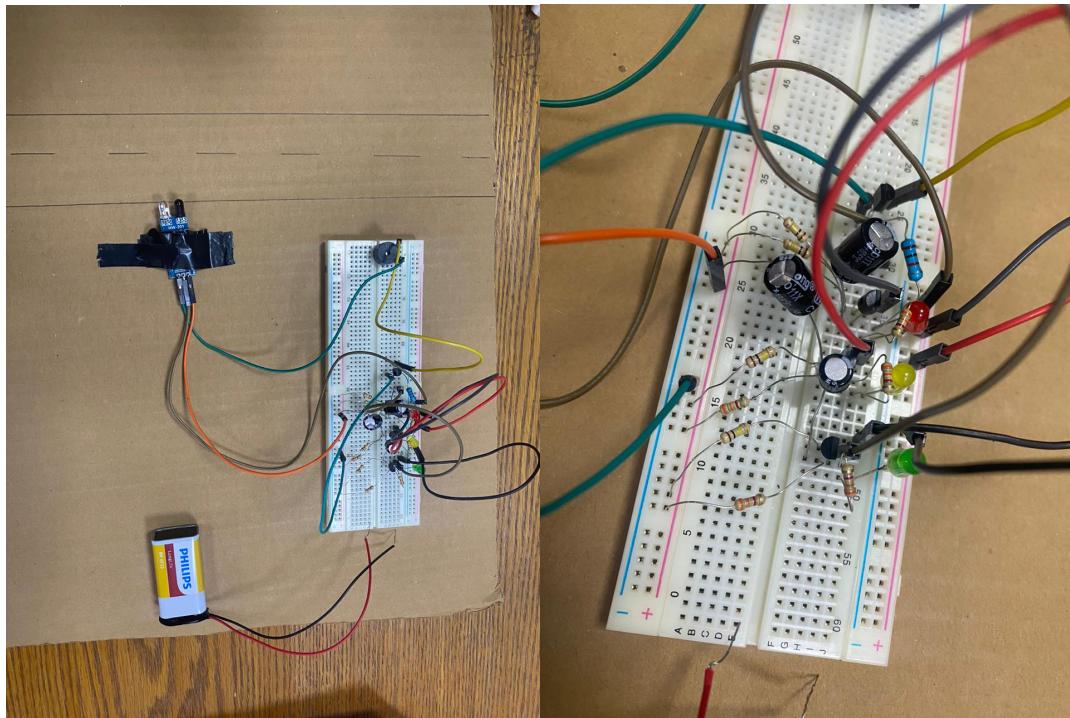
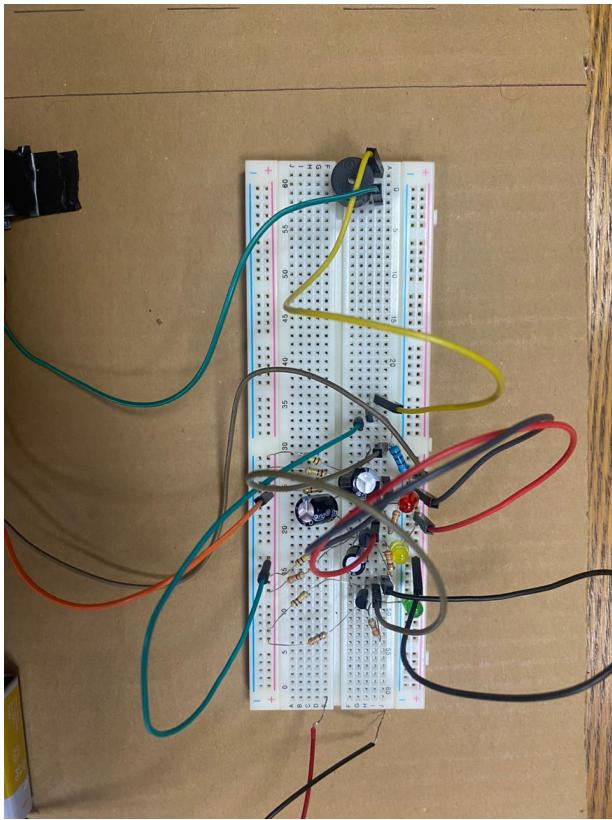
Diagram of the circuit:



Overview:

A sufficient **DC power supply**, typically ranging from 5V to 12V is necessary for the circuit to function (we used a 9v battery). The current flow to the LEDs that make up the traffic lights is controlled by the **BC547 transistors** which act as switching components. When a transistor is biased correctly with a suitable voltage, it allows current to flow through it, turning on the corresponding LED. Each transistor has a **3.3k resistor** attached to its base to control the amount of current flowing through it and protect it from overheating. The collector terminal of each transistor is connected to the anode of the corresponding LED (red, yellow or green) while the cathodes of all LEDs are connected to the negative terminal of the power supply. **Capacitors** can be used to modify the charging and discharging times of capacitors, which in turn can modify the base biasing of transistors and the timing of the LED switching sequence. A stronger capacitor slows down the chasing process while a weaker capacitor quickens it. They are also used to prevent any potential interference or flickering of the LEDs. The circuit is designed to simulate the traffic light sequence of red -> red + yellow -> green -> yellow -> red which is controlled by the transistor switching. We also added an IR sensor. When the Red LED is on, **2N2222 transistor** operates as a switch and provides the buzzer with the needed voltage to generate sounds but just in case, it is also provided with a negative value from the IR sensor when there is a moving object while the red light is on. If the light is red, it operates and detects any moving object (car) and beeps as a warning to reduce danger of accidents.

Pictures of our prototype:



Problems we faced and how we overcame them:

- The voltage at the collector of the BC547 transistor connected to the red LED was not enough to bias the 2N2222A correctly to operate as a switch. That's why, three 3.3Kohm resistors are connected in series with each LED to elevate the voltage at the collectors of each BC547 transistor.
- The adjustment of the polarity of the buzzer was a bit challenging because we needed the buzzer to go off if and only if an object approached the IR proximity sensor and the red LED was on. Knowing that our IR proximity sensor module is high at the output pin when there's no object nearby and low when an object is in close proximity, we figured out that the negative leg of the buzzer should be connected to the output pin of the IR sensor whilst the positive pin should be connected to the collector of the 2N2222A transistor, so that when the red LED is off and no object is near the IR sensor, the buzzer doesn't go off. Also, when the red LED is on and no object is near the IR sensor the buzzer doesn't go off as well. While when the red LED is on and an object is near the IR sensor (meaning that the positive leg of the buzzer at the collector of the BC547 is high and the negative leg of the buzzer at the output pin of the IR sensor is low), the buzzer goes off.