E29 Lab 3 Writeup.

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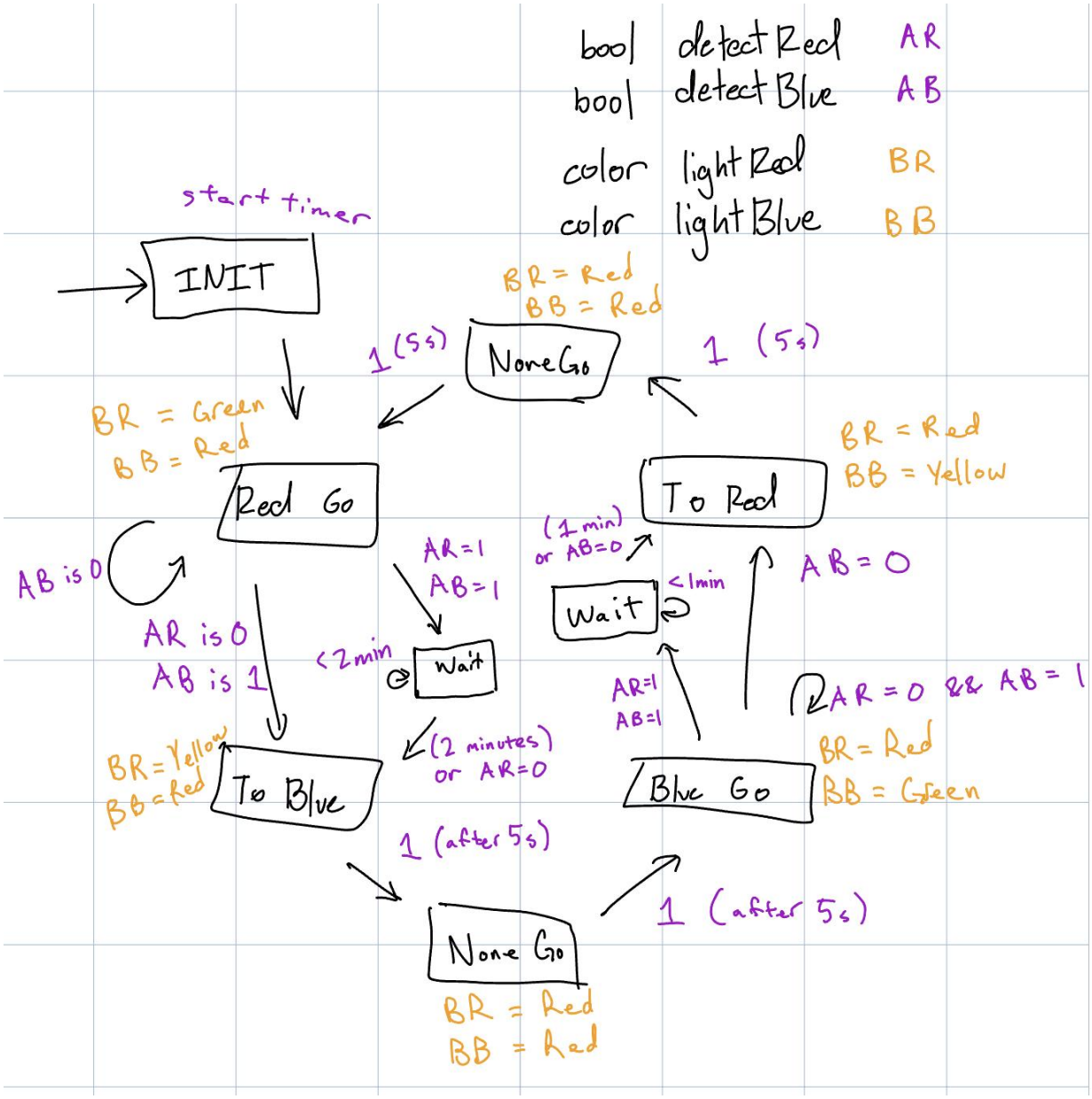
Exercise 1: *screenshot/image of full state diagram for the system*



Exercise 2: *nothing needed*

Exercise 3: *short video demonstrating the ultrasonic sensor returning distances as expected*

https://drive.google.com/file/d/1Yu7Cy38mlO7OV4jQaRvnFWfNuL3MsiYc/view?usp=sharing

Exercise 4: *about a paragraph describing your characterization*

The sensor appears to work well detecting objects in the range between 1 cm and roughly 270 cm. Beyond that distance, the value shown in the output of the program can vary erratically. To reliably detect cars in the lane, we checked if the distance measured by the ultrasonic sensor was smaller than some distance which we arbitrarily set at ten centimeters. One sensor corresponds to the blue lane and triggers a boolean variable to toggle between true and false based on the measurement, and the other sensor does the same for the red lane.

Exercise 5: *video documenting full functionality as expected (give an example from all four cases of inputs from the two sensors, and document the transitions as appropriate). Include a discussion of about one paragraph about how such a system might be implemented in practice.*

https://drive.google.com/file/d/15HvKo48KyNJTMsePY_bi2TIn0PuVDav-/view?usp=sharing

The most commonly used modern traffic systems include using inductive-loop sensors embedded in the pavement and infrared sensors mounted on traffic lights to detect the presence of cars at intersections. There are both active and passive infrared sensors. Active infrared sensors emit low level infrared waves and when that signal is disrupted, the traffic signal is prompted to change its lights. Passive infrared sensors are signaled when energy emitted by vehicles is detected. The ultrasonic sensors we implemented in this lab are most comparable to the active infrared sensors.

These types of sensor-driven traffic systems can be useful at intersections where busy roads meet roads that don't get a lot of traffic, because you don't ever want to stop the busy road except when it is absolutely necessary to let a car pass from the less busy road. At busier intersections, like downtown in the city, you might expect cars to always be present in each direction, so a sensor system might be less useful because the measurements from the sensors might never change. At these locations, pure timer systems might be a better choice for toggling traffic lights.