National University of Sciences and Technology (NUST)
School of Electrical Engineering and Computer Science

EE-371: Linear Control System

LAB Project: Density Based Traffic Control System using Arduino

Class: BEE-11D

Submitted to: Mr. Saqib Nazir

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Group Members:

Muhammad Junaid Ali	290927
Amur Saqib Pal	288334
Osman Hasan	290620

Density Based Traffic Control System

Problem statement

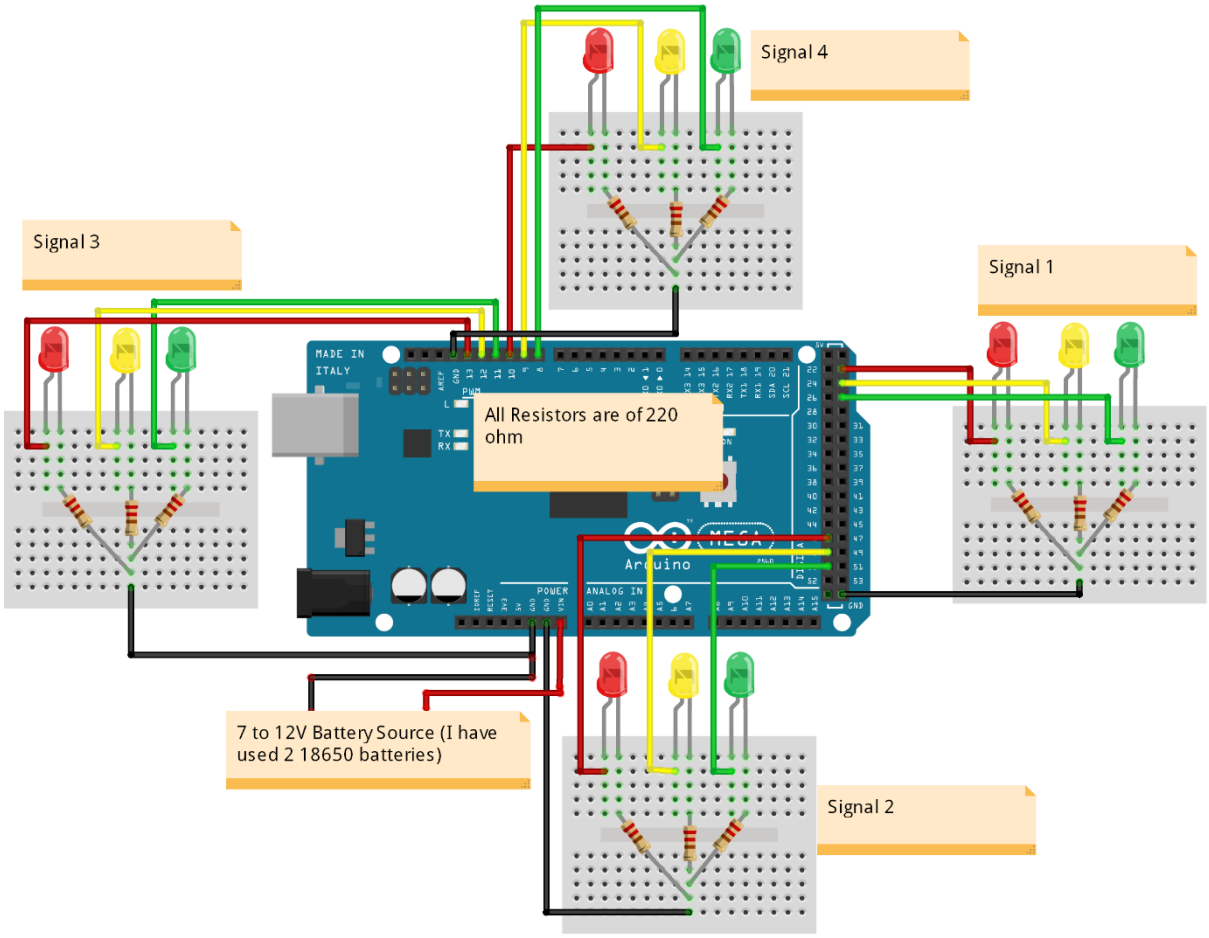
Majority of the traffic signals deployed on Pakistan's roads are controlled through set periods of time. This can cause a jam on roads where the amount of traffic is heavy. The solution to this problem is to move towards traffic signals being governed by a constraint other than time. One of the constraints can be "Traffic Density" on a particular side of the road. The signal would turn green for the side where the traffic density is comparatively higher.

Design requirements

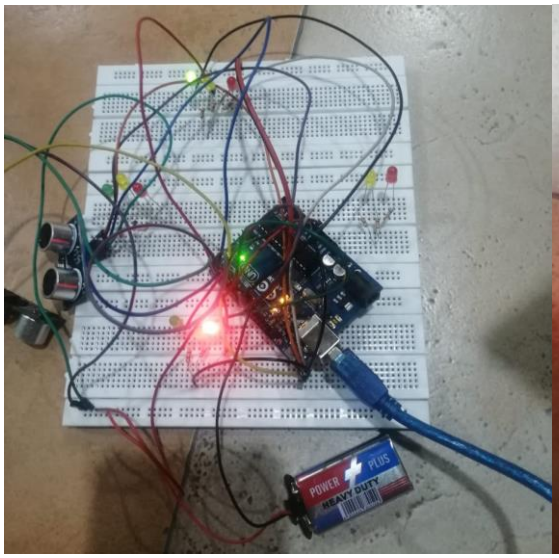
Basic materials required for the project.

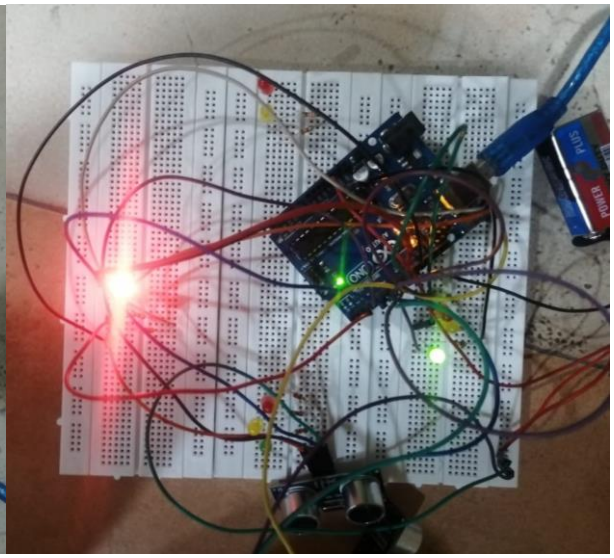
- Arduino Uno
- 2 X Ultrasonic Sensors
- 2 X Red LEDs
- 2 X Green LEDs
- 2 X Yellow LEDs
- 6 X 220-ohm resistors
- Jumper cables
- Breadboards

Circuit Diagram



Real World Implementation

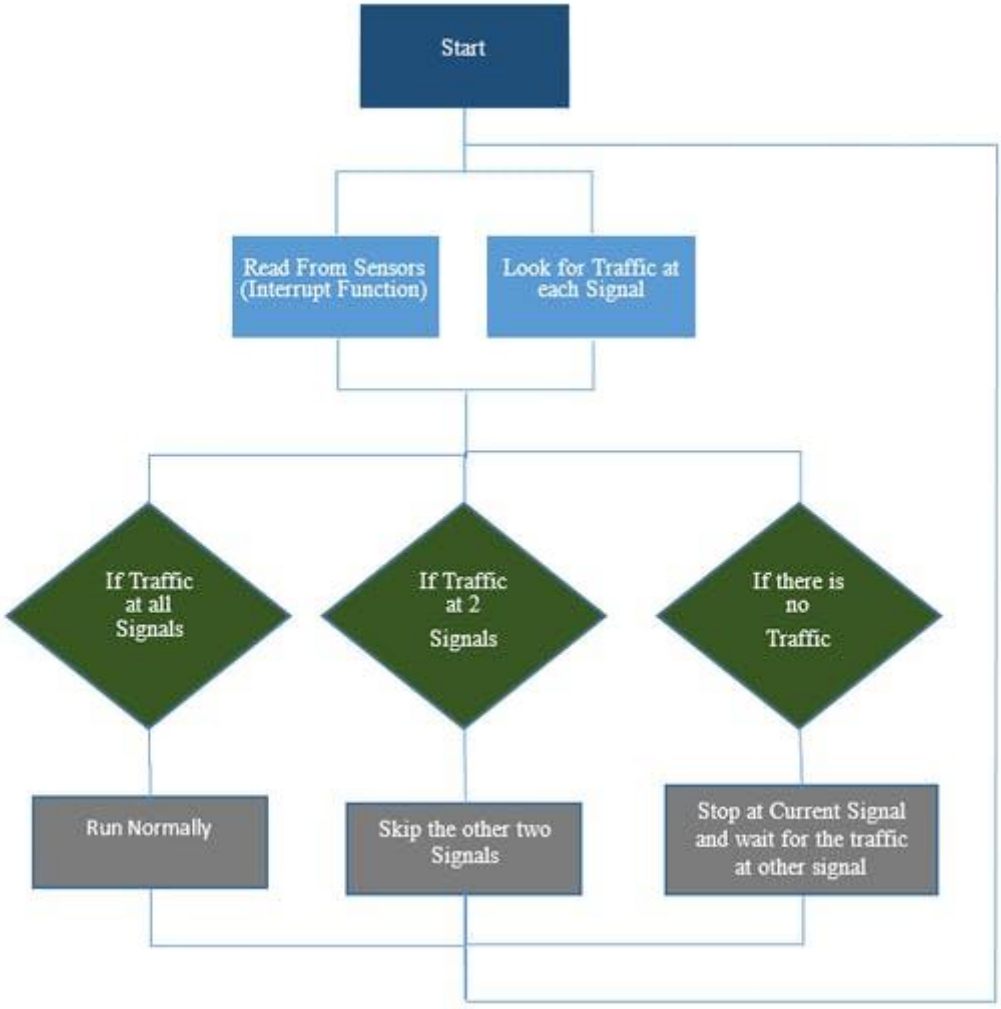




Working and Flow Diagram

The working of the project is divided into three steps

- Normal Working of a traffic signal if there are cars present on all 4 signals or 2 in our case.
- If there is only traffic at one signal and no traffic at the others, this loop skips all the non-traffic regions and turns green on for the traffic one leading to better road navigation.
- If there is no traffic at any signal, the signals stop at their concurrent position until further presence.



Controller Design

We were tasked with a traffic control system which required 4 ultrasonic sensors adding to the density-based charm/novelty of our project.

Firstly, we used the TimerOne.h library which is used to repetitively measure time in microseconds and repeatedly iterate over normal signal functioning until or unless interrupt is called.

The main purpose of this project is, if there is no traffic at a signal, one should skip over that signal and move on to the next one. This is where the Interrupt signal comes into play. It's called after every 1/10th of a second and is constantly detecting "cars" / "traffic" at the signals.

Limitations and Improvements

1. We were monetarily limited to an Arduino UNO, so we sorted to a highway (2-way) traffic system. This can be rendered into a 4-way traffic system as earlier intended using an Arduino MEGA.
2. Instead of detecting presence and absence of a car, this can detect the number of cars at a station. This can be improved by adding more sensors to the circuit.
3. Use better ultrasonic sensors or use Infrared technology i.e., Infrared sensors for better detection and analysis.
4. Program can be further coded to prevent the signals to stop if there is no traffic at all.
5. LEDS can be programmed to work repeatedly on loop (normally) without subdue traffic.

Programs Used

- Arduino IDE

References

Density Based Traffic Control System using Arduino [https://create.arduino.cc/projecthub/muhammad-aqib/density-based-traffic-light-controller-using-arduino-8636ad]