CSE 316
Project Report
Red Light Green Light

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Group : 03
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1 Introduction

Traffic lights are integrated part of our lives. This project is aimed to give a solution to existing manual traffic control systems and hereby look forward to eliminate traffic congestion.

2 Description

2.1 Road

The algorithm works as a scheduling algorithm with dynamic ratio/weight with no starvation. As we know the number of roads (3/4/5 usually) in a crossing, it is easy to hardcode that into the program.

1. Take inputs from the IRs and count the current number of cars every 1ms. IRs at the beginning of the road increments the count and the IRs at the end of the road decrements it.

2. There should be a CYCLE_TIME by which all the roads should be done with one cycle. We took a cycle time of 20 seconds for a smooth and fast demonstration.

3. Now according to the number of cars in a road, it should be allocated a time and the that time would be subtracted from timeRemaining, which is being initialized to CYCLE_TIME after every cycle.

4. We had a timeCounter which increases every 1ms and now we shall assign a timeTillStuck according to the allocated time to that particular road.

5. We have to turn that road GREEN and the others RED for sure. So we turn that raod YELLOW first, turn other roads RED (via YELLOW obviously) and then after a delay of 2ms we turn this road GREEN.

6. This particular road should not become RED after it completes its allocated time aka timeTillStuck. After that we would do the same with the remaining roads in that cycle and allocate time to each according to their current circumstances.

Fun Fact : After we are done with one road in a cycle, we would not bother to have that again before that particular cycle ends. This may be the only fault of this algorithm.

2.2 Train

We used another pair of IRs to detect the train. If one IR detects a train, we simply rotate our Servo Motor and set the barricades down. After another IR detects the train, that means the train has already left the road, we turn the barricades up again.

Not having individual track controls and the ability to handle concurrent trains could be a downside to this approach.

3 Charts and Diagrams

3.1 Flow Chart

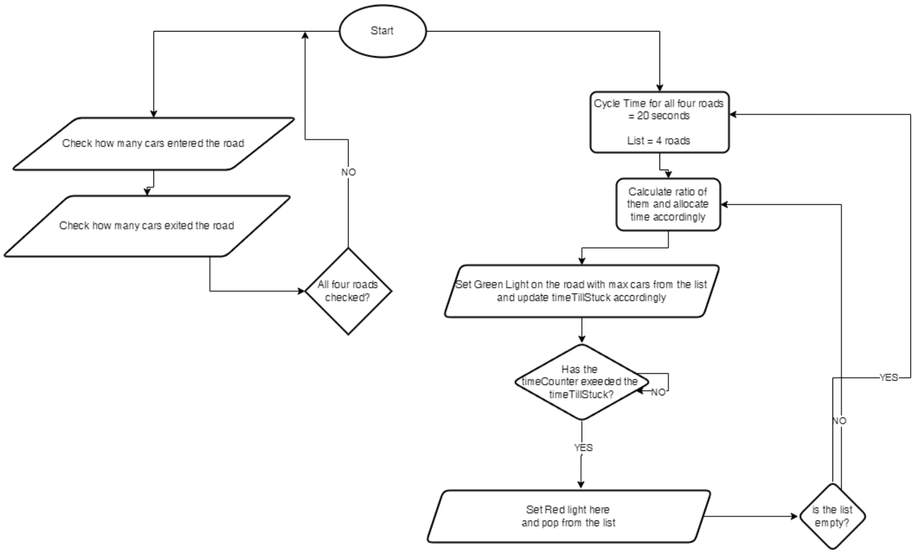
Start
Check how many cars entered the road
Check how many cars exited the road
All four roads checked?
NO
Cycle Time for all four roads = 20 seconds
List = 4 roads
Calculate ratio of them and allocate time accordingly
Set Green Light on the road with max cars from the list and update timeTillStuck accordingly
Has the timeCounter exeeded the timeTillStuck?
NO
YES
Set Red light here and pop from the list
is the list empty?
YES
NO

Figure 1: A flow chart showing the algorithm

3.2 Circuit Diagram

4 Components' List

No.	Name	Quantity	Purpose
01	Arduino UNO R3	02	One for the traffic control and another for the train barricades
02	IR Obstacle Sensor	10	Eight for the four way crossing (two each) and two for train detection
03	Servo Motor (SG90)	2	For actuating the barricades
04	LED	12	Red, Green and Yellow LEDs for the traffic lights
05	Power Bank (5V)	1	For powering the whole system.

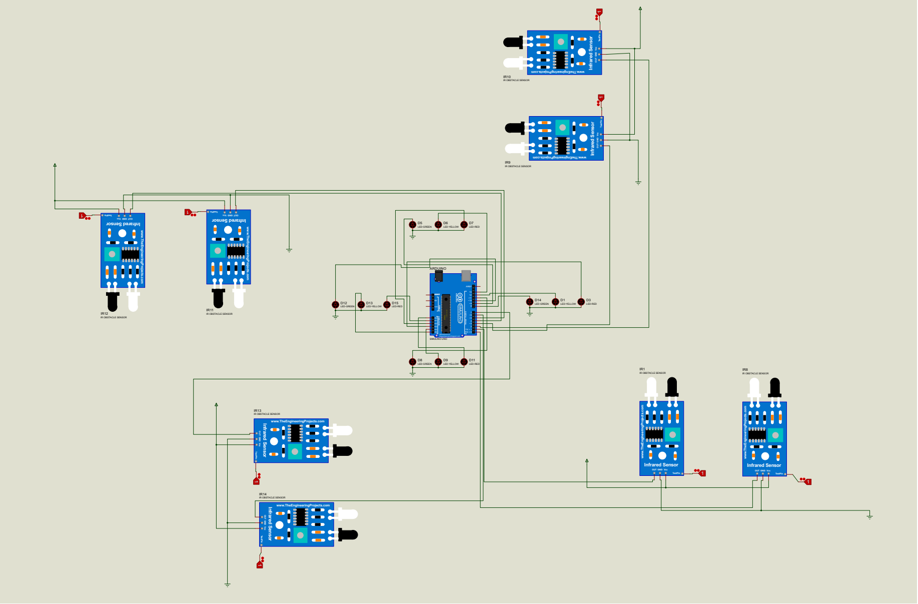

Figure 2: Circuit Diagram

5 How to recreate

This project can be recreated by using 2 Arduinos. We used Arduino UNO R3 but you can use Mega too. One of them should be uploaded the file road/roadV2/roadV3/simpleRoadFinal and the other should have the file named train.

6 Challenges

Like all the hardware projects out there, ours also ran into some major problems which we had to overcome or overlook.

1. A significant problem of using IR sensors is that they are sensitive to daylight, meaning the Infrared Lights in daylight can also trigger the IR sensor rather than it's own reflection. That is why we had to work on this project in dark places or dark times of the day.

2. An alternate to this problem was to use Pressure/Force sensor which can sense and some of them can even measure the pressure/force acting upon them. But the problem is they are very costly, at the time this project was in development, they were almost 900/- a piece. This price tag is one of the main reasons we thought of using IR in the first place because even to demonstrate a 4 way crossing, one needs at least 8 sensors (2 in each road). So this was a bad idea.

3. You will always fix the ranges of the sensors before every demonstration as they always changes.

4. No scheduling algorithm was exactly a perfect match for traffic control as we have a fixed number of subroutines here and we cannot afford starvation at all here. There are other parameters too. For example we have to shut off a road when it has no cars in it whether it has some time left or not.

7 Codes

Please go to this GitHub repository to find all the codes -
https://github.com/niananto/traffic-light-controller