

PROJECT REPORT ON

TRAFFIC LIGHT SYSTEM

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1.OBJECTIVE

To design an automated 3-road intersection traffic light system using Arduino.

2.ABSTRACT

Traffic signals are designed to ensure an orderly flow of **traffic**, provide an opportunity for pedestrians or vehicles to cross an intersection and help reduce the number of conflicts between vehicles entering intersections from different directions.

This report proposes a technique to control the traffic light system automatically by a microcontroller and it will ensure safety and proper time interval to stop, wait and pass for every vehicle.

3.INTRODUCTION

3.1 Traffic Light System:

So we all know that green means go, yellow means wait, and red means stop. However, many of us don't know about the history of traffic light control systems. The first traffic control device (like the ones we know today) was placed on top of a tower at the Rue Montmartre and Grande Boulevard in Paris. It was managed by a police officer who would operate it by hand but the first three coloured innovation first appeared in Detroit. An officer named William Potts was behind the invention who was concerned how officers couldn't change the lights they were in charge of at the same time. A lot of history has happened since then and no doubt that these changes will continue as years go on. Below we will be going over the many pros and the importance of traffic light control systems as well as some facts that you might not have known about.



Before this invention, you can imagine that roads were pretty chaotic. Luckily these days it is no longer the case. Some of the many benefits that a traffic light control system provides might include the safe movement for cars to help them avoid collisions with cars and people. They help movement and help conduct an orderly flow by giving right of way to some cars and not others. They not only make car traffic a lot safer but also pedestrian traffic. They help reduce the number of accidents and make collisions at intersections a lot less frequent. They play a crucial and vital role when it comes to safety in our everyday lives.

Signal timing is something that plays a very important factor in all of this. It is what actually makes this function and provides people with safety in traffic flow. There are three main types of signal timing which include fixed timing, actuated timing, and coordinated timing. Fixed

timing uses the same present time intervals that do not change in accordance to traffic volume. Actuated timing uses a detector that is able to adjust itself to different traffic volumes. Coordinated timing helps minimize starting and stopping at random which helps traffic flow and is less likely to create a traffic jam.

Some things that could happen if there were no traffic lights could include total chaos on the road. There would be nothing to tell people when to go and when to stop. Total gridlock would happen on a daily basis which is a nightmare for everyone! The number of accidents and fatalities would rise significantly. More and more people would also be late to school or work on a daily basis all because of the absence this one great invention. Not to mention that it would be nearly impossible for anyone to cross the road while being sure when cars are going to stop, which would also increase pedestrian related accidents. Hopefully, after reading this article you have come to appreciate just how special and convenient life can be from a single invention.

3.2 THREE-WAY JUNCTION:

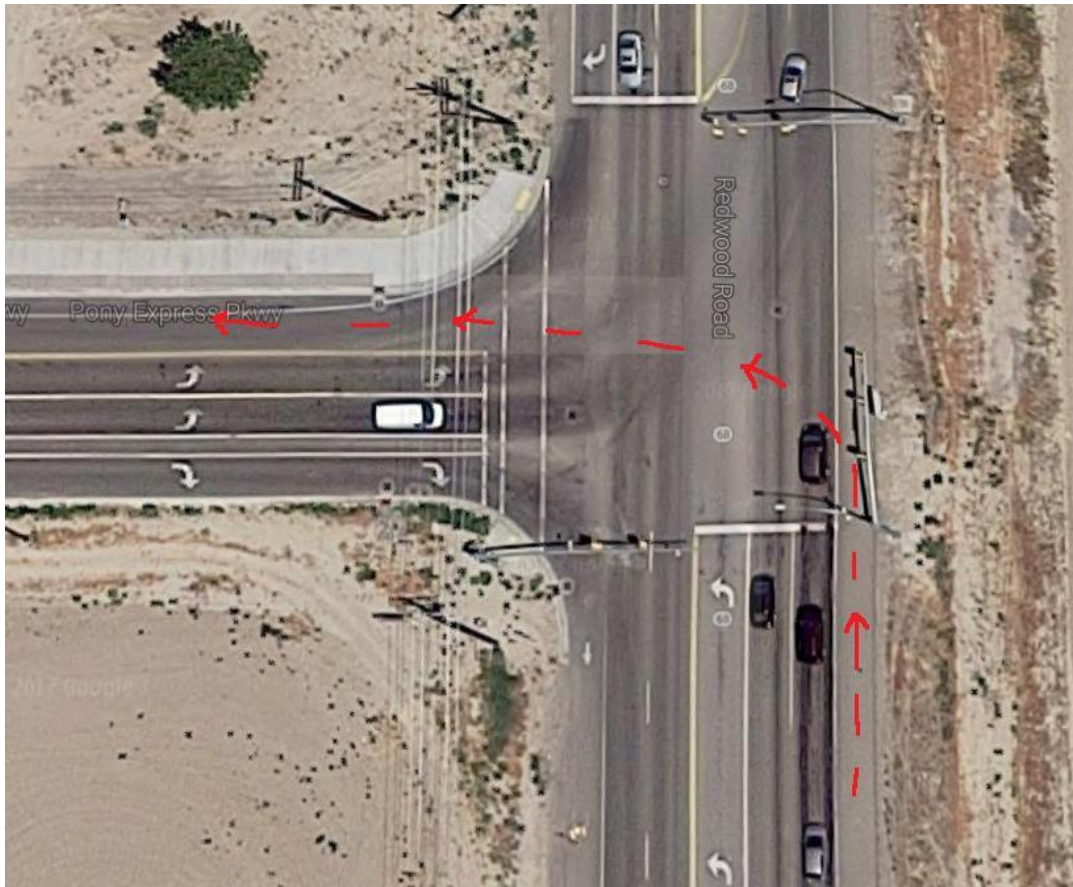
A three-way junction (or three-way intersection) is a type of road intersection with three arms. A Y junction (or Y intersection) generally has three arms of equal size. A T junction (or T intersection) also has three arms, but one of the arms is generally a minor road connecting to a larger road.

Once T junctions are controlled by traffic lights, others rely upon drivers to obey right-of-way rules, which vary from place to place. For example, in some jurisdictions, vehicles on the right always have the right-of-way (even at T junctions),^[1] while in other jurisdictions, vehicles travelling on the "through" road of a T junction have the right-of-way, meaning that vehicles approaching the "major" road must allow through traffic to pass before joining the flow of traffic.

In the People's Republic of China, going straight on red when approaching a T junction on the main road with the intersecting road on the left was permitted until the Road Traffic Safety Law of the People's Republic of China took effect on 1 May 2004.

In Taiwan (administered by the Republic of China), when at least two vehicles reach a T intersection without a working traffic light, the vehicle on the side road is to yield to any other vehicle straight on the main road. If two vehicles want to turn left, the vehicle on the left is to yield.

When one road at a 3-way junction has a higher traffic volume than the other (and particularly when the roads are perpendicular to each other), turns are characterized as "right-in", "right-out", "left-in" and "left-out". A turn "in" represents a turn from the major road into the minor road. A turn "out" represents a turnout of the minor road onto the major road. A 3-way junction allowing all four of these turns is characterized as "full-movement". These terms also apply to turns between roads and driveways.

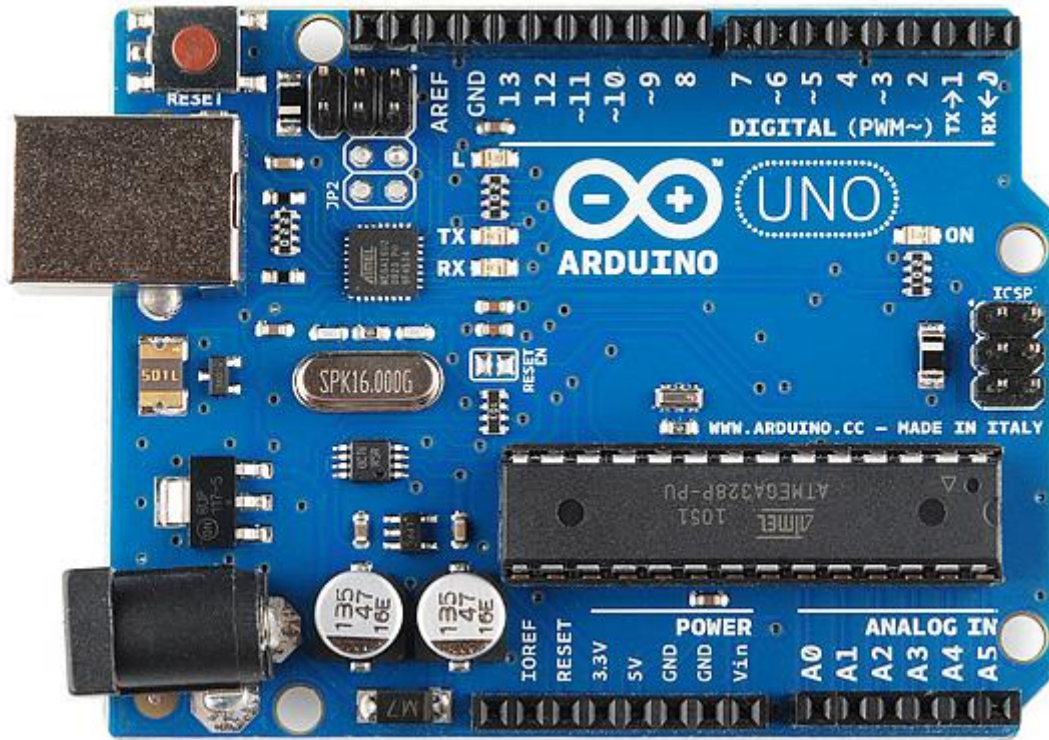


3.3 ARDUINO UNO:

Arduino UNO is a very valuable addition in electronics that consists of a USB interface, 14 digital I/O pins, 6 analog pins and an Atmega328 microcontroller. It also supports serial communication using Tx and Rx pins. You should also have a look at this UNO for beginners. There are many versions of Arduino boards introduced in the market like Arduino Uno, Arduino Due, Arduino Leonardo, Arduino Mega, however, the most common versions are Arduino Uno and Arduino Mega. Arduino boards are normally used to design projects related to digital electronics, embedded systems, robotics, automation, IoT etc.

The software used for Arduino devices is called IDE (Integrated Development Environment) which is free to use and required some basic skills to learn. It can be programmed using C and C++ language.

Some people get confused between **Microcontroller** and **Arduino**. While the former is just an on-system 40 pin chip that comes with a built-in microprocessor and later is a board that comes with the microcontroller in the base of the board, the bootloader allows easy access to input-output pins and makes uploading or burning of the program very easy.



Arduino Uno Board

4.TOOLS AND ENVIRONMENT USED

4.1 HARDWARE REQUIREMENT:

1. Arduino Uno Board
2. Three RED LEDs
3. Three YELLOW LEDs
4. Three GREEN LEDs
5. Three 220 ohm Resistors
6. Three Switches
7. Three push buttons
8. One Bread Board
9. One Computer

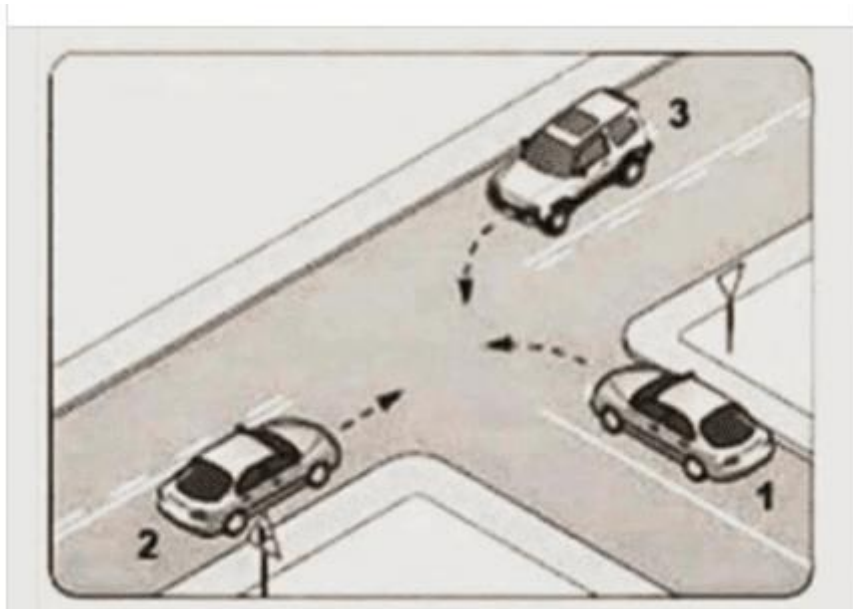
4.2 SOFTWARE REQUIREMENT:

1. Operating System- windows 10
2. Autodesk Tinkercad (For design Purposes)
3. Aurdino IDE

5.DESIGNING:

The Designing of traffic light system will be done on **Autodesk Tinkercad** Platform.

A three-way junction has three traffic light posts, each one having three lights red, yellow and green. The movement of vehicles according to traffic light can be seen by the diagram blow:



One car is in moving state, one is in waiting state and other is in stoping state. According to this if one post has red signal then other two will have yellow for waiting state and green for moving state. No two posts will have same signal. The signals in post will change like:

RED → YELLOW → GREEN → RED

The time interval taken here for each traffic light post to change to the next state is 15 seconds.

This is the key designing concept of our project. We have three LED sets as traffic light posts, each having three LEDs. If first one is red then the next state after delay will be yellow and then green.

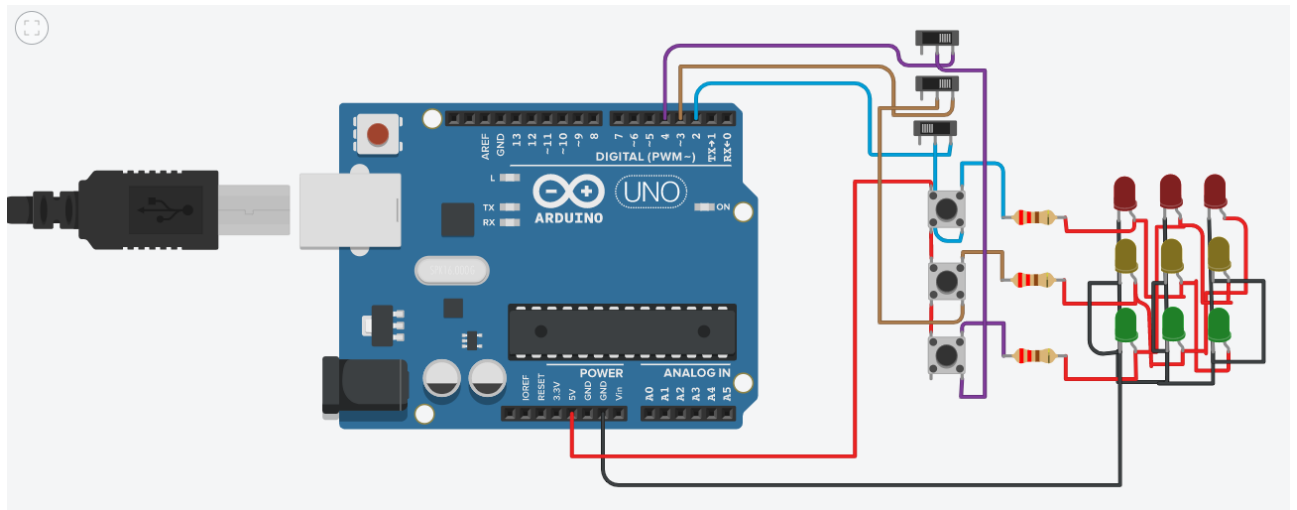
We have two options to control Traffic Lights:

1. **Automatic control by Arduino Uno.**
2. **Manual control by humans using push buttons**

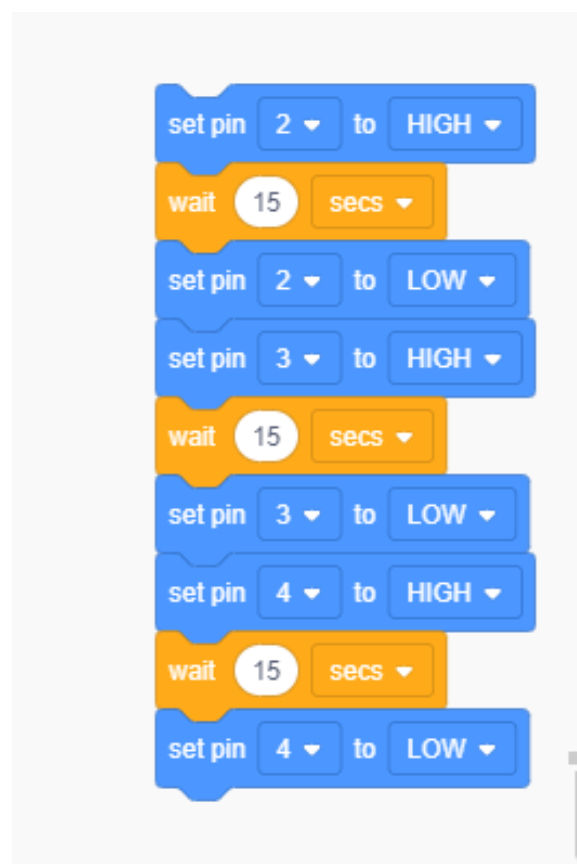
When controlled by arduino uno, the digitals signals **HIGH** and **LOW** from three digital pins are responsible for the LEDs to glow to give proper signal at a regular interval.

When controlled by Pushbuttons, three digital pin signals are switched off by three switches and the pushbuttons are used manually to control the LEDs.

6.CIRCUIT DIAGRAM



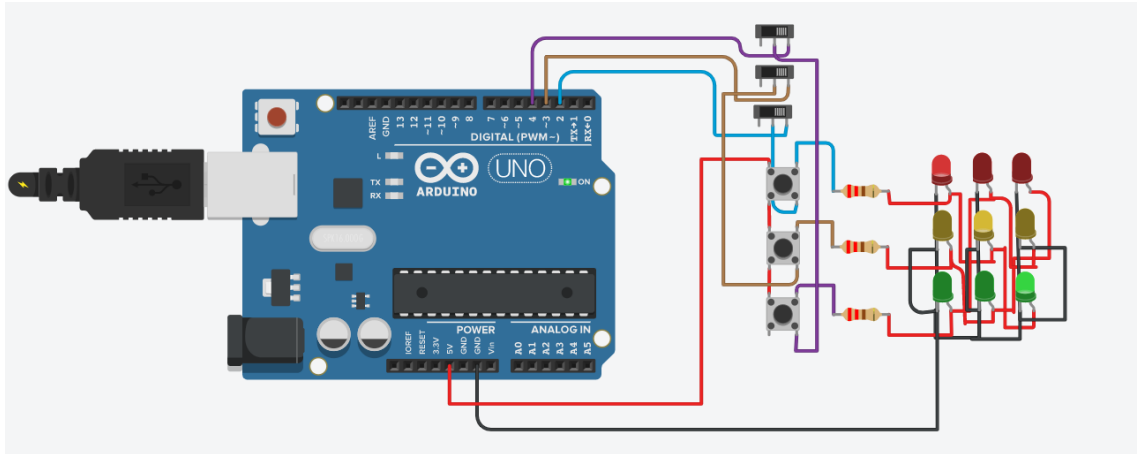
7.BLOCK DIAGRAM VIEW



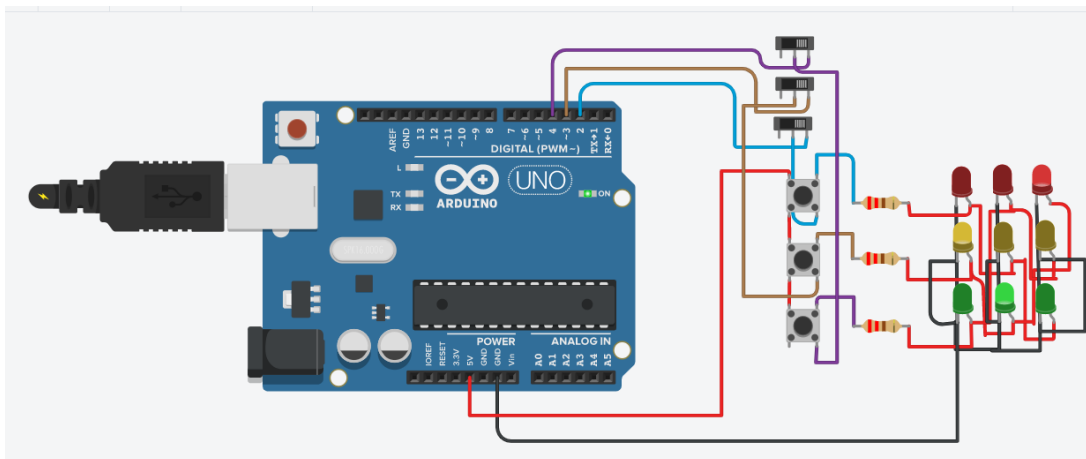
8.WORKING OF TRAFFIC LIGHT SYSTEM

8.1. Automatic Traffic Light Control by Arduino:

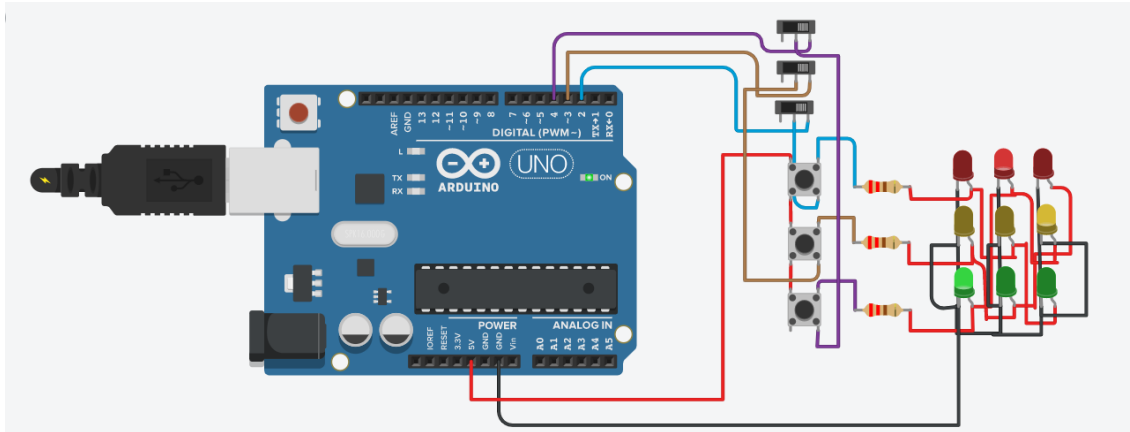
- For automatic traffic light control by arduino three switches in the circuit should be in on state.
- 220 ohm resistors are used to limit the currents through LED for safe operation.
- For digital pin 2 the connections are red led of first post or column, yellow led of second post or second column and green LED of third post or third column. Whenever the signal is HIGH in digital pin 2. The LEDs will glow as shown below:



- For first road it is red signal, for second road it is yellow signal and for third road it is green signal.
- Now, For Digital pin 3, the connections are yellow LED of first column (Which was red is previous state), green LED of second column (which was yellow in previous state) and red LED of third column (which was green in previous state).



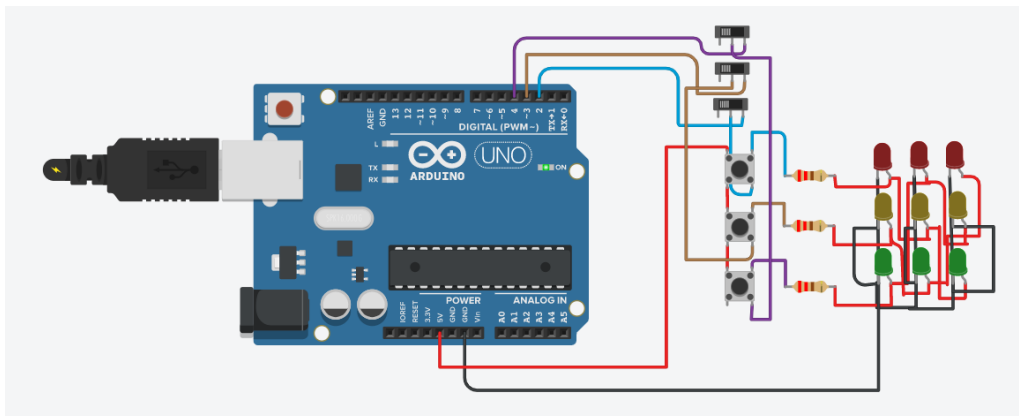
- For Digital pin 4, the connections are green LED of first column (Which was yellow in the previous state), red LED of second column (which was green in previous state) and yellow LED of third column (which was red n in previous state).



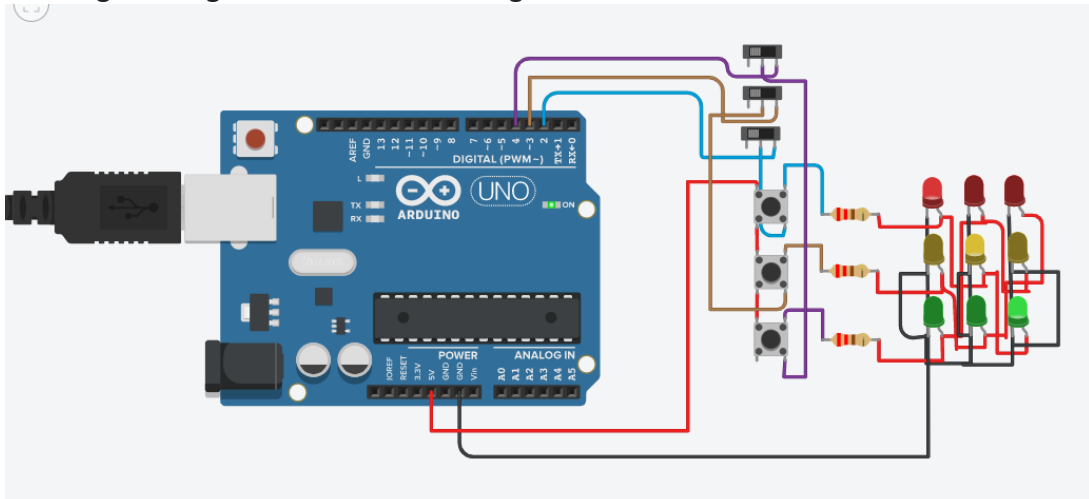
- Arduino will make sure that the changing of lights happen at regular intervals (15 s).

8.2. Manual control by humans using push buttons:

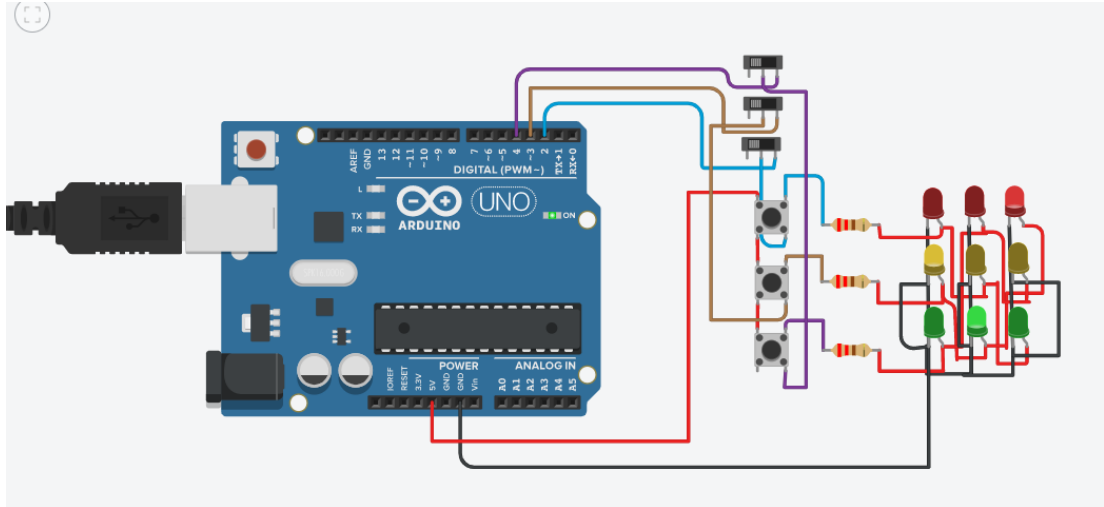
- For this three switches will be in OFF state. This will disconnect the LEDs from automated Arduino connection.



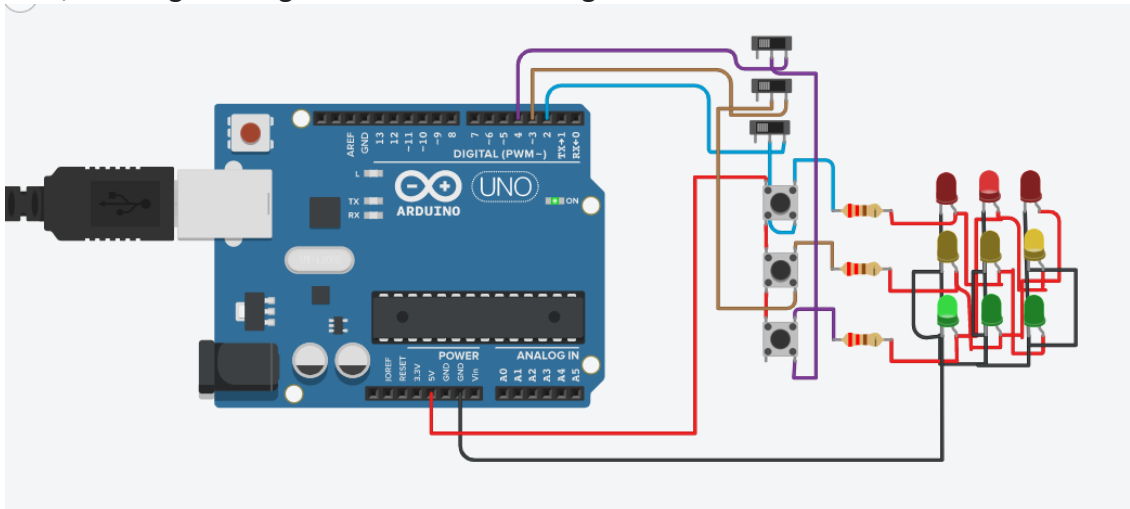
- Now the push buttons have the control, one end of every push button has been connected to 5v power supply.
- When first push button is pressed the connection happens between blue and red wire, creating a voltage differences and LED glows as shown below:



- When second push button is pressed the connection happens between brown and red wire, creating a voltage differences and LED glows as shown below:



- When third push button is pressed the connection happens between purple and red wire, creating a voltage differences and LED glows as shown below:



- There is no specific interval limit for pressing the buttons. Its control is fully upto humans.

9.ARDUINO IDE CODE

```
// C++ code
//
void setup()
{
  pinMode(2, OUTPUT);
  pinMode(3, OUTPUT);
  pinMode(4, OUTPUT);
}

void loop()
{
  digitalWrite(2, HIGH);
  delay(15000); // Wait for 15000 millisecond(s)
  digitalWrite(2, LOW);
  digitalWrite(3, HIGH);
  delay(15000); // Wait for 15000 millisecond(s)
  digitalWrite(3, LOW);
  digitalWrite(4, HIGH);
  delay(15000); // Wait for 15000 millisecond(s)
  digitalWrite(4, LOW);
}
```

10.RESULT

We have designed our traffic light control system and we got the following results below:

Automatic Traffic Light Control by Arduino:

1. This is fully automatic and once started will go on continuously without any failure as the system is being controlled by the microcontroller.
2. No two lights of the same post will glow together, ensuring no chances for accidents,
3. Provides equal chances for every three road's vehicles to stop and pass.
4. No two lights of different posts will glow together.

Manual control by humans using push buttons:

1. It is fully manual and can be controlled by humans or traffic police.
2. It is up to human mind which button they are going press and for how much time.

11.CONCLUSION AND FUTURE SCOPE

We want to conclude that the traffic light controller system is the basic need for today's busy people. This system is basically designed to reduce human efforts to watch for traffic controls but to control the system fully by a microcontroller with greater accuracy. This system defines a more secure way of preventing day to day accidents.

Using timer and micro-controller and more complex digital components, this circuit can become more efficient and accurate. Using methodology of this circuit we can design four way traffic light controller also.

It can be also expanded to recognise emergency services like ambulance and act accordingly to let them pass first by displaying proper light signals to other vehicles.

12.REFERENCES

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