Designing a Traffic Light

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Our Traffic Light Goals

The goal of our design is to make a traffic light that functioned in a busy city like Toronto, in the most efficient and effective way possible. We achieved this by creating classic traffic light, with a supplemental light for the pedestrian crosswalk. We have also included a right turn advance. The right turn advance should take traffic backups turning right down to a minimum. We based all our plans off the classic traffic light system with some modern day changes to boost performance.

Our Design

For our design we have one traffic signal with the colours red, yellow, and green. Red meaning stop, yellow meaning slow down, and green meaning go. We chose these colours because they are the classic traffic light colours. They are universally understood and are easily distinguishable from each other from far distances. The yellow light lasts 3 seconds so that the cars turning from the north side have enough time to take a left if needed. Secondly, the green light beside the traffic signal indicates a right turn advance. Lastly, the traffic signal for pedestrians has the colours blue and yellow on it. The blue light means not to cross and the yellow means to go, we added a flashing yellow light signaling that the light is changing soon. People already crossing should continue to the other side quickly and safely, people not already crossing must wait for the next light.

Potential Problems

There are a few and little potential problems that the old traffic light designs that could occur.

- Winter Conditions: These traffic lights have snow buildup on the lights, causing drivers confusion on which light is active.
- Potential Power failures: These traffic lights can be put out, in the case of a brown, or blackout.
- Static lights: The lights remain the same all year round and don't accommodate for changes in weather.

Solving The Problem

- Our modern light is equipped with heaters that would turn on when the temperature of our traffic light reaches a certain degree.
- Adaptive Traffic Technology: Our lights change the speeds at which they change to accommodate different factors. Ex, Weather Patterns, Foot Traffic and road traffic build ups.
- Solar power backup battery: Our traffic light has a battery that continually charges and stores energy in a nearby transformer for emergency situations. This is active all year round, and also supplies power for the traffic light heater.

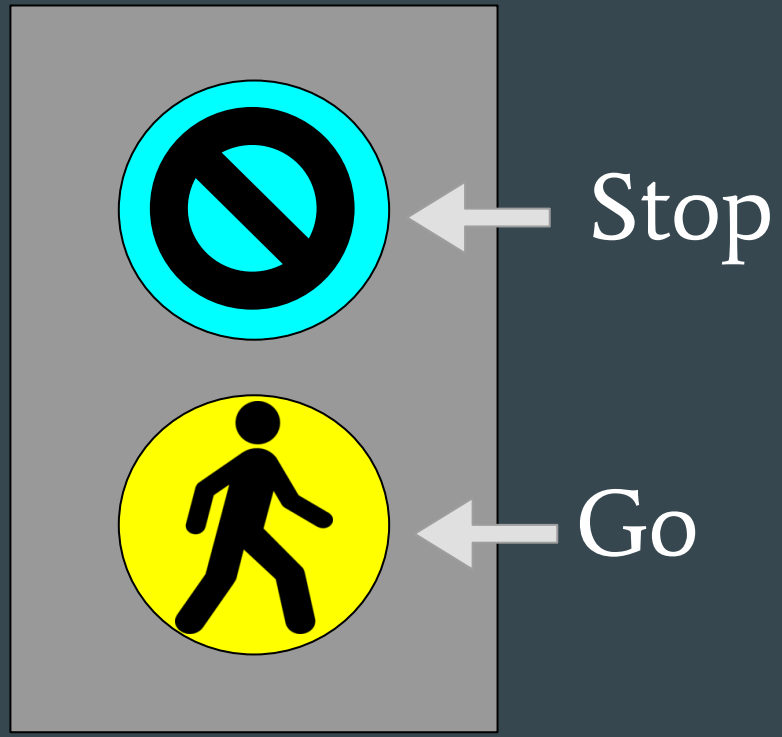
How It Works

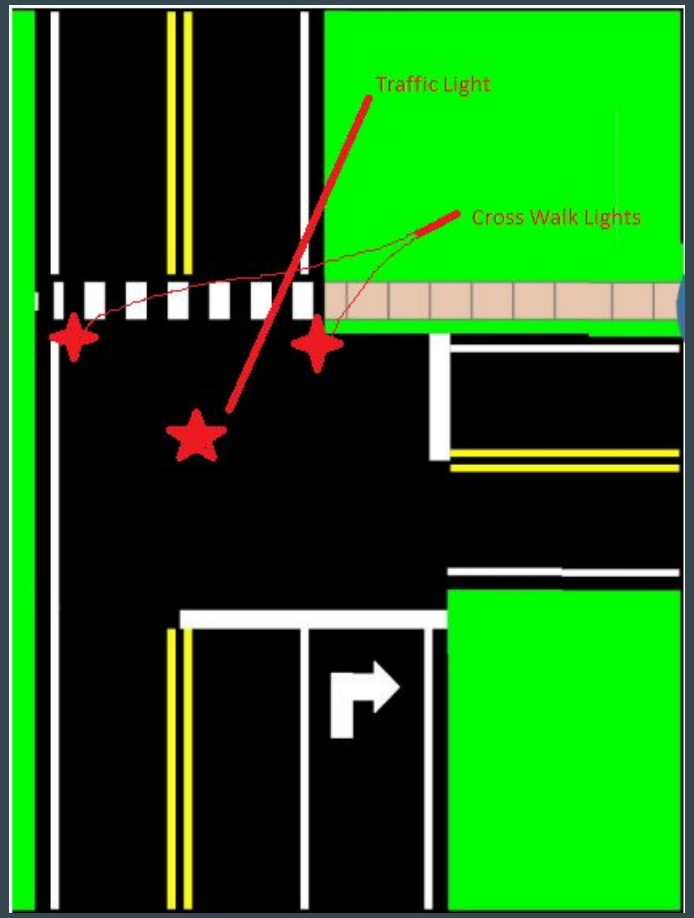
The green light indicating to go straight and advance to go right are always on. Next there is a button to press to make the light change to red and from there the pedestrian crossing sign changes. The light will stay green forever unless the button is pressed to cross. The light will only change if the green light has been on for at least 5 seconds. Next, the pedestrian crossing lasts for a total of 10 seconds. The first 5 seconds are a solid yellow light indicating to walk and the next 5 seconds is a flashing yellow indicating that the light will change soon. As the main traffic signal changes from green to red we have a yellow ‘slow down’ signal that lasts for 3 seconds to allow for cars to make a left hand turn.

Reasoning For Our Design

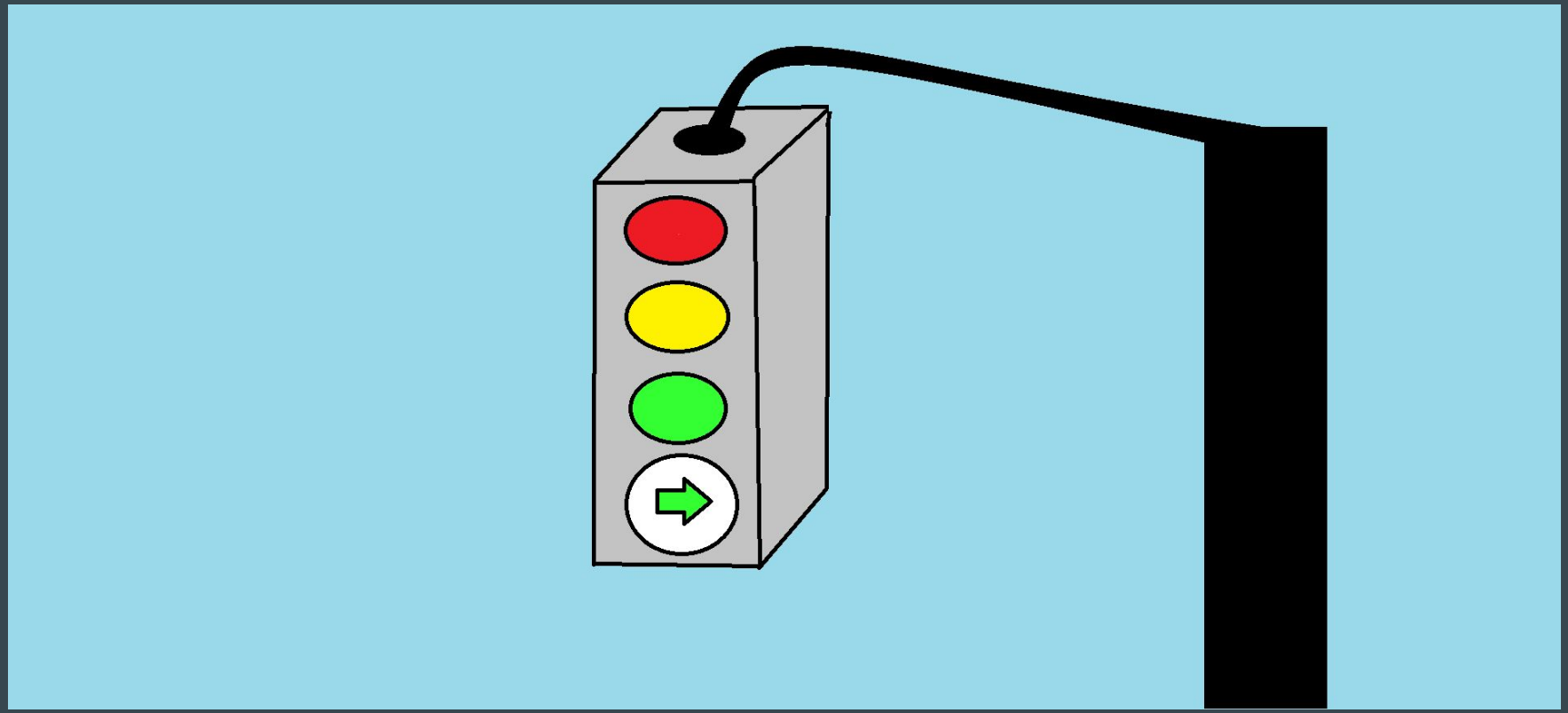
We followed a simplistic design for achieving our goal in reducing the traffic at the given intersection. We chose not to make an overly advanced design, for the sole reason of having a light that could be easily understood with current systems our city uses imbedded within it. We chose to instead make two separate lights, one strictly dedicated to displaying when pedestrians are permitted to cross, without any confusion. We also incorporated an advanced right signal to reduce backup for traffic heading north. We chose to incorporate the right turn as apart of the main traffic light to allow all every road member to be aware of the potential turns.

Artwork and Pictures

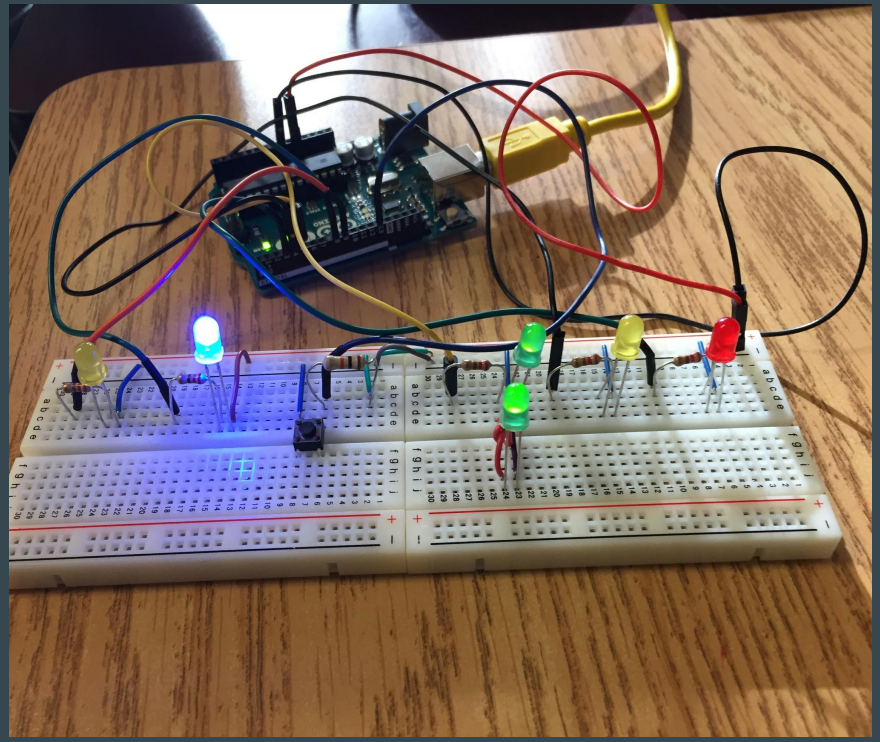


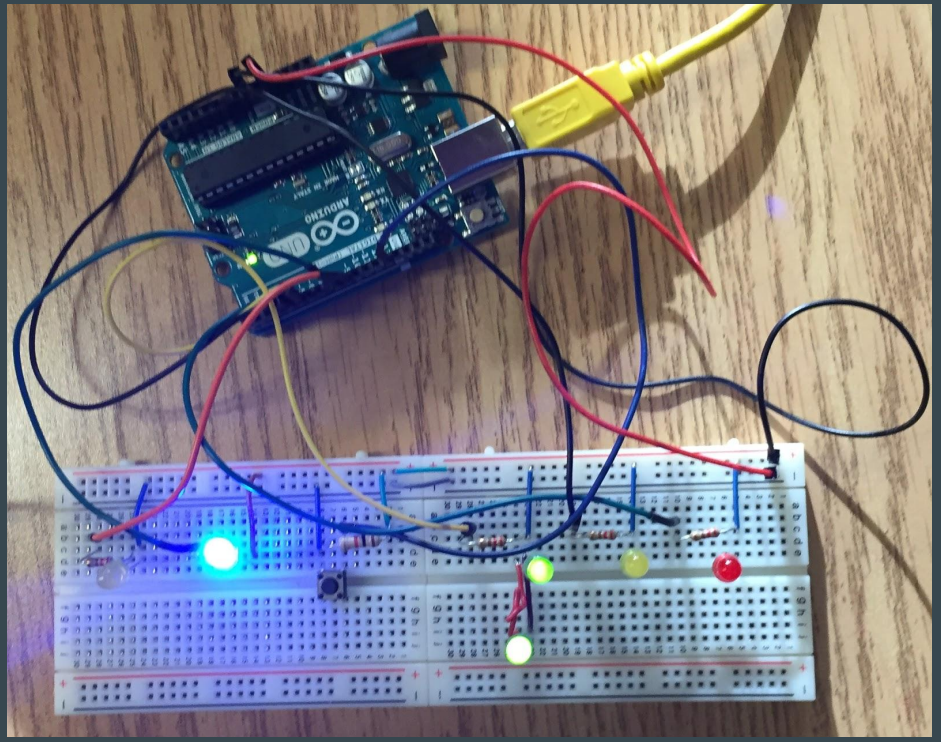


Artwork and Pictures Cont.



Pictures of Our Arduino





Video of Our Arduino

https://drive.google.com/open?id=1JSVQqKQrLiBULUnGMJbt1X3HtFpbE00v

Our Modified Code

```
/*
 * Stefano. G
 * Peter. P
 * Joseph. R
 * Gilvin. O
 */
int mainRoadRed = 3;
int mainRoadYellow = 4;
int mainRoadGreen = 5;
int crossRed = 8;
int crossGreen = 9;
int button = 13;
int crossTime = 5000; //The time for the pedestrians to cross is
10 seconds, followed by 5 seconds of flashing to indicate that
the light is changing soon.
unsigned long buttonGap ;

void setup () {
  pinMode(mainRoadRed, OUTPUT);
  pinMode(mainRoadYellow, OUTPUT);
  pinMode(mainRoadGreen, OUTPUT);
  pinMode(crossRed, OUTPUT);
  pinMode(crossGreen, OUTPUT);
  pinMode(button, INPUT);
  digitalWrite(mainRoadGreen,HIGH);
  digitalWrite(crossRed, HIGH);
}

void loop(){
  // check if button is pressed
  int state = digitalRead(button);

   //
  if(state==HIGH && (millis() - buttonGap) > 4000) {
    switchLights();
  }
}
```

```
oid switchLights() {
  digitalWrite(mainRoadGreen,LOW);
  digitalWrite(mainRoadYellow,HIGH);
  delay(2500);
//The delay between the changing of the lights is set to 1 seconds.
  digitalWrite(mainRoadYellow,LOW);
  digitalWrite(mainRoadRed,HIGH);
  delay(1000);

  digitalWrite(crossRed,LOW); //turn off red pedestrian light
  digitalWrite(crossGreen,HIGH); //turn on green  pedestrian light
  delay(crossTime); //delay preset time of 10 seconds
  //flashing of green cross pedestrian light
  for (int x=0; x<10; x++){
    digitalWrite(crossGreen,HIGH);
    delay(250);
    digitalWrite(crossGreen,LOW);
    delay(250);
  }

  digitalWrite(crossRed, HIGH); //Turns off the pedestrian cross light.
  delay(100);
```

```
digitalWrite(crossRed, HIGH); //Turns off the pedestrian cross light.
  delay(100);

 //Turns the light green, allowing the traffic to pass through the
intersection.
  digitalWrite(mainRoadGreen,HIGH);
  digitalWrite(mainRoadRed,LOW);

  buttonGap = millis(); //remember time since recent light switch

}
```