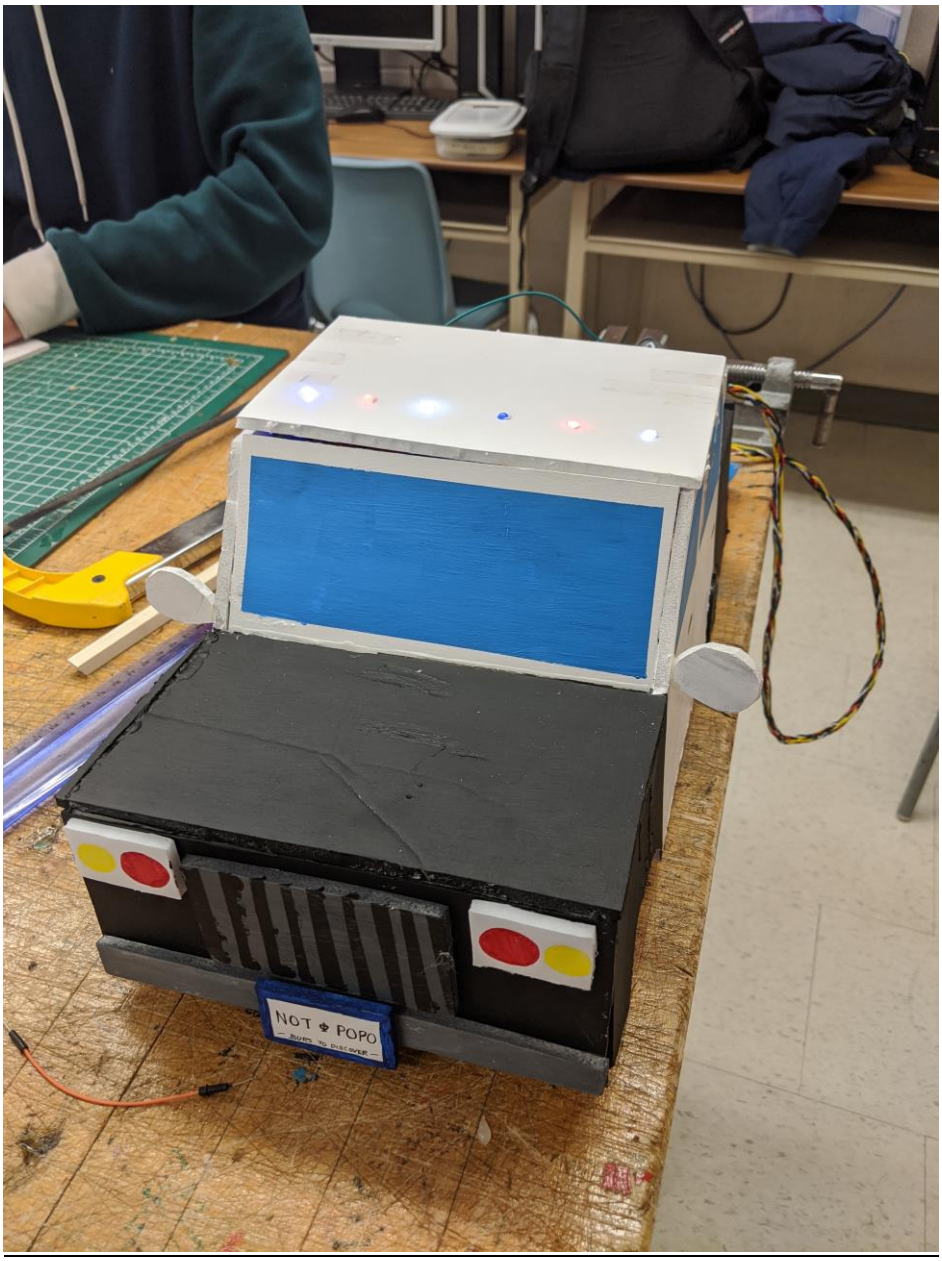
The goal of Operation POPO is to create a workable model of a police car that can fully steer and drive.



Student Name: Kelvin Cao

Due Date: January 20th, 2020

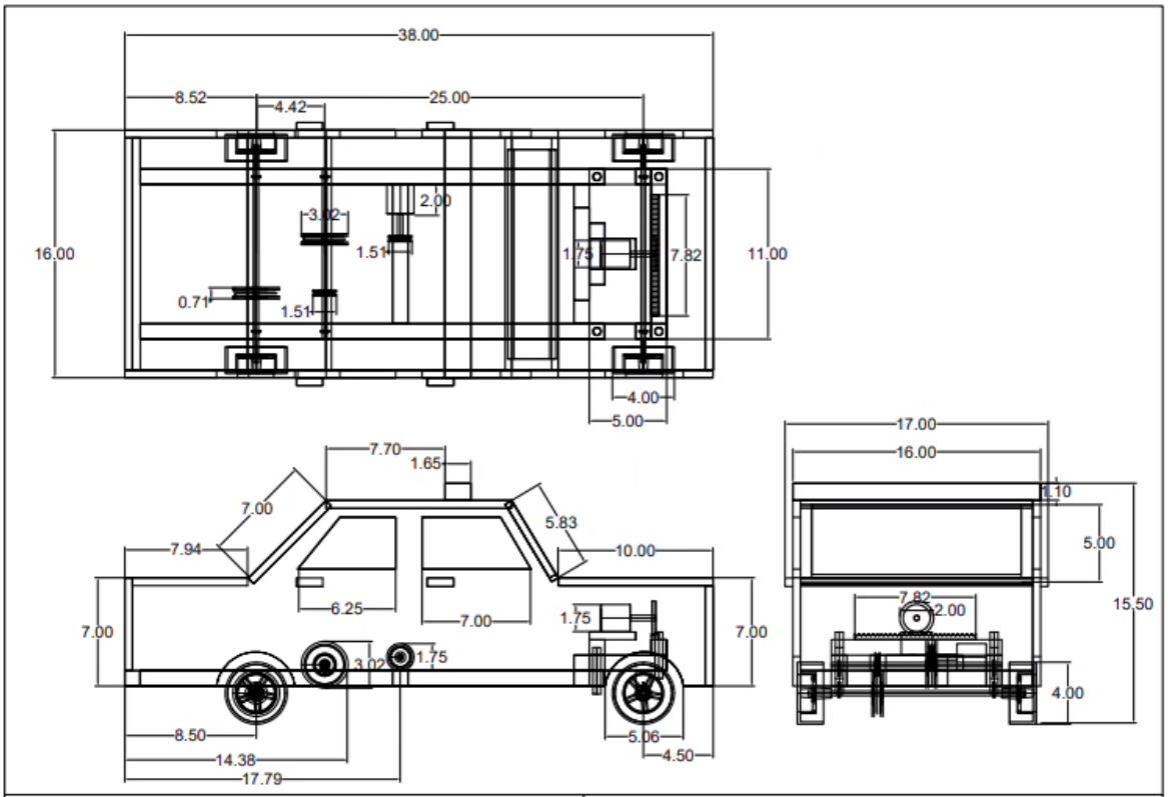
Institution: John Fraser Secondary School

Teacher: Mr. Lightbody

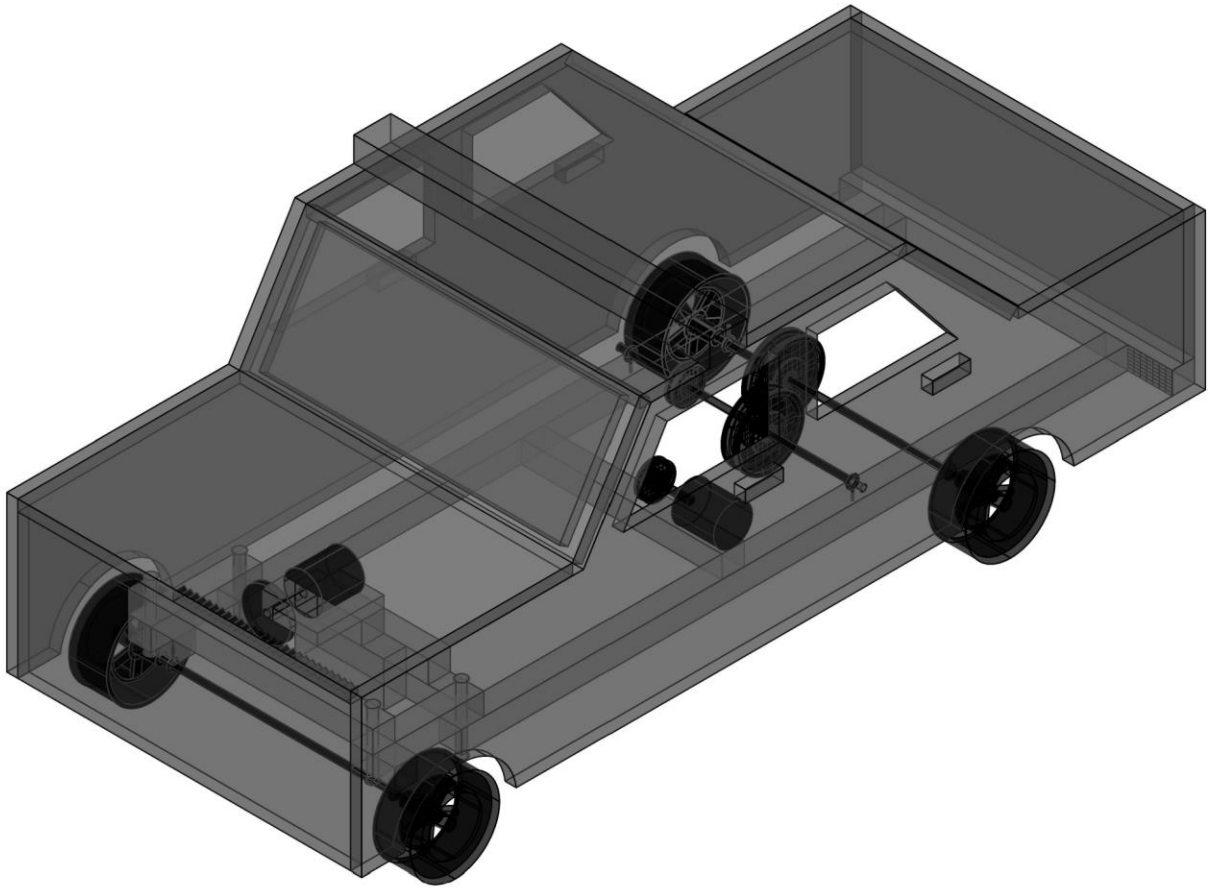
The problem I have is that I need to create a workable prototype of a police car. The prototype should be durable (meaning it won’t randomly collapse overnight). The prototype will need to have a working motor that runs it. However, I will attempt a steering mechanism that allows the police car to actually make turns. The car must fit the dimensions of 25 x 45 x 30 cm. With the planned dimensions of my vehicle being 38 x 15.5 x 17 cm. The car also should not be too heavy for that would require a very inefficient amount of energy to run (under 1000 grams)

In order to design the police car and steering mechanism, research had to be done. I went online to YouTube, and Instructables in order to figure out the different components of the police car. The steering mechanism was one of the hardest parts to figure out and I researched multiple different YouTube videos on how others were able to implement a steering mechanism. I also used my knowledge from the computer engineering course and 555 timers in order to create flashing lights and police sirens.

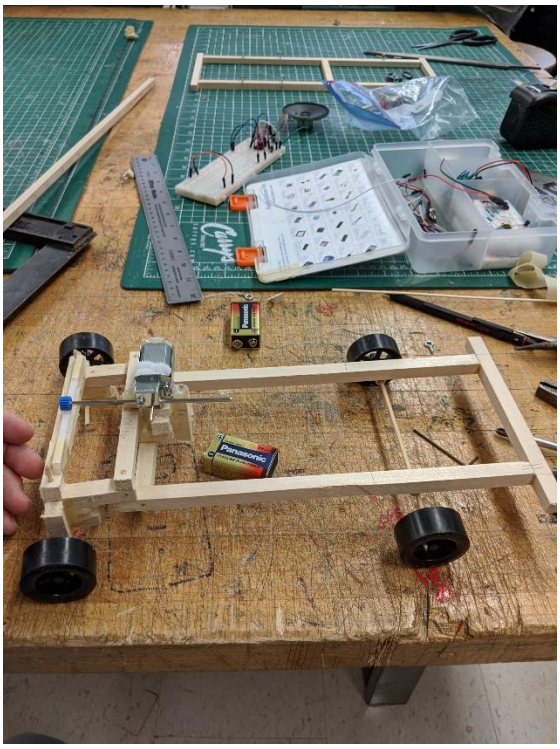
To build a police car, there were many materials that I had to use. For the motor sections, I would need an L293D motor driver, wires, motors, gears (including a gear rack and pinion), pulleys and rubber bands. For the wooden frame, just 1 x 1 cm wooden sticks, dowels, and wheels to fully complete the base of the car. The LED flasher contains a breadboard, 555 timer, capacitor, resistors, and LEDs. The police siren, on the other hand, contains two 555 timers, speakers, capacitors, and resistors. The shell of the car is made fully out of foam and hot glue. Paint is used to make the vehicle look like an actual police car. The tools required to make all these sections are: Soldering Iron, Wire stripper, Exacto Knife, ruler, scissors, saw, pencil, eraser, sandpaper, hot glue gun, backsaw, angle clamp, hammer, and a MITRE box. Other materials include nails, screw eyes, hot glue and wood glue.



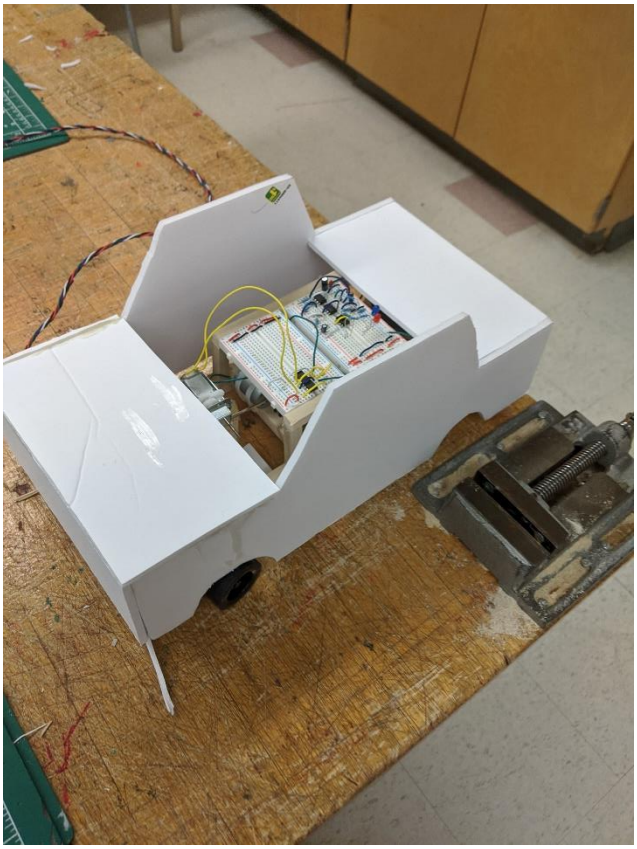
Kelvin Cao	Mr. Lightbody
Operation "POPO"	January 18th 2020



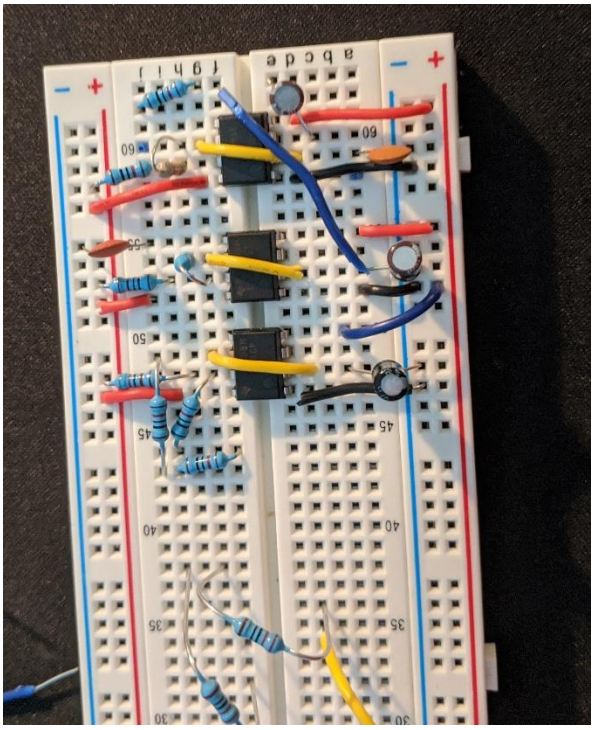
3D Model of the Police Car



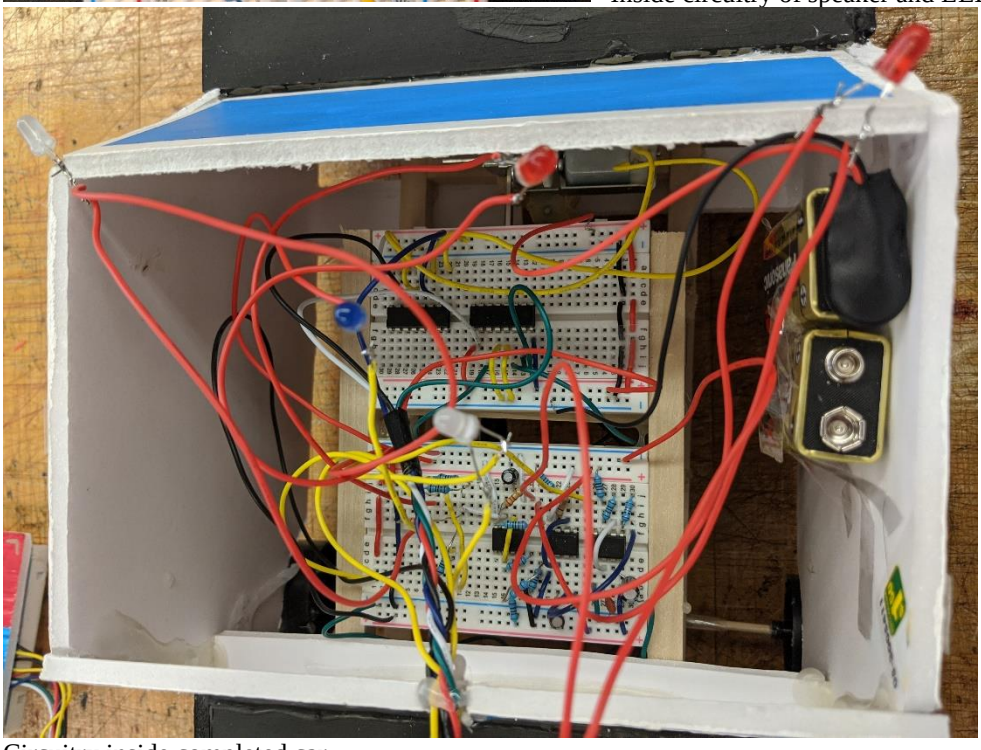
Frame of Vehicle



Outer Shell



Inside circuitry of speaker and LED circuit



Circuitry inside completed car

Police Car Reflection

Operation POPO is the final project of the year and it is the culmination of all the experiences and knowledge I have gathered throughout the year. I gained many skills in this unit by creating my initial design in 3D on the AutoCAD software. It is a great experience working on AutoCAD because it is very satisfying when you finish the project and then admire it using the 3D orbit command. I also feel like I can get more accurate drawings by making a 3D model first and get a better understanding of my design.

Though the process of building the tower was fun and entertaining, there were many challenges that I had to overcome to finish the project. The first problem that had to be dealt with is the steering mechanism. That is the hardest part of the entire project. The steering mechanism requires 4 axels and making this mechanism out of wood can pose a slight problem. Handmaking this mechanism with drills, wood glue, and wooden dowels is not very accurate. In the end, the steering mechanism had a lot of vertical flex. This meant that if I lifted the car off the ground, the gear would disengage with the rack. The rack and pinion only engage when the car is on the ground. This quirk is quite annoying because when I first set down the car the wheels often lean off to one side and I need to spend time re-engaging the rack and pinion. I think next time, I would add more wooden supports to try to prevent the rack and pinion from moving as much.

Another problem I had to deal with was the problem with the way I implemented the circuits, I just used a breadboard to create all the electronics in the car. Breadboards are convenient when making and testing a circuit, but it is not a permanent solution. The wires can often come out of the breadboard. This is very annoying since wires can randomly come out and I would need to go trouble shoot my circuit in the mess of wire I have created in the vehicle. Next time, I might make the circuits on a Perfboard so that wires don’t accidently get disconnect. Overall, the creation of my car was a great experience and helped me gain a lot of knowledge about the process of designing and building.