Engineering Project Proposal

Crescenta Valley High School

Project Description

For this project, my partner, Roman, and I will be creating a car controlled by an Arduino Uno. The Arduino will receive the necessary instructions to either go forward, go backward, or stop using code in the Arduino Web Editor being sent to it by a Chromebook. Once we build the car, it will be used to transport small items such as erasers, pencils, or even a phone in a line very quickly. As well, it can race with other groups' cars to see how efficiently ours works compared to how other people made theirs.

This project will be very difficult as we have never done electrical, computer, and software engineering at this level. With this, it will be a fun challenge to tackle as it requires us to research and think outside the box to build such an intricate vehicle. Ever since I was a kid I have loved remote-controlled cars but always wondered how they worked. Now, I will be able to fulfill that childhood mystery and be the one to build and code a car. As well, I desire to have a career in software engineering, so learning how to code an actual device to complete a specified task will be interesting and necessary before entering college and the workforce. The process of creating a fully functioning car will also teach me extremely useful skills about the design process, and how to effectively research and understand what I read.

The car will incorporate 4 different aspects of engineering, electrical engineering, computer engineering, management engineering, and software engineering. As such, electrical engineering involves the powering of the Arduino and motors. The car will be powered using batteries connected to each part with wires. Furthermore, computer engineering will be used to understand how the Arduino works and functions. As well, management engineering is important to make sure the project is coming together and following along our desired path. It also is used to combine my partner and my research together into a more concise form to create a working car. Lastly, software engineering is key to the car because for the actual car to go forward and backward, the Arduino must be programmed so that it tells the motors how to run.

Project Research

We have researched the functions of the component and which parts would work the best for our design constraints

The Arduino Uno is the key element of the remote-controlled car and is in charge of decoding commands from the remote control and directing the motion of the car. It is compact, easily programmable, and user-friendly. Through the Bluetooth module, the microcontroller receives signals from the remote control and transforms them into instructions for the motor driver.

The DC Gearbox Motors power the RC car and provide the necessary torque to turn the wheels are DC gearbox motors. They are made to be small, strong, and effective. The motor driver, which controls the speed and direction of the motors, is connected to the motors.

The Bluetooth module is a translator between the Arduino and the remote control. Using Bluetooth, it wirelessly transmits the orders from the remote control to the Arduino.

The motor driver serves as a bridge between the Arduino and the motors. It receives the Arduino commands and converts them into signals that the motors can interpret. It also supplies the motors with electricity and regulates their direction and speed of rotation.



From my research, I have found that the less weight the wheels are, the quicker they are able to increase or decrease their speeds. Thus, we have chosen lightweight wheels and parts to decrease drag on the ground. If it was heavier, there would be a high downward force and while the car is moving, the motors would have to work harder. As well, the type of wheel is very important because depending on where the weight is placed, the drag and speed will be different. If the wheel has high polar movement, the wheel has its weight on the edges. This causes the wheel to take longer to break and get going since the power has to travel farther. However, low polar movement is when the weight is at the center of the wheel, allowing quicker transmission and the ability to start and stop quickly. The wheels we have chosen for the project have low polar movement which will improve speed and the car's ability to accelerate and be controlled.

At first, we contemplated using a wire to send information between the computer and the Arduino. We quickly realized that if the car was to go quickly, we would need to chase after it. So, we decided that the HC-05 Bluetooth Module would be a much better option. This transmitter receives information remotely and then sends that information to the Arduino Uno. It can transmit up to 10 meters away which is definitely enough for the project criteria.

A key component that is taken into consideration when building actual cars is how wind and airflow affect the car's performance and speed. Engineers design racing cars to be slick, thin, and on a downward slope so that the air travels up and over the car. So, our car will cover the least amount of space possible and the board we chose will also thin.

Constraints

For the project, there are a multitude of constraints that must be met.

- The project must be made of items that can be gotten either from home, from the school, or can be quickly ordered online
- The items we need to buy also have to be cheap
- It must be designed, built, and tested in 5 weeks
- Must be able to forward and backward in a straight line
- Can't weigh a lot, because the motors each can only move about 100 grams, and the lighter the build is, the quicker it can go
- Must be controlled remotely
- Power supply must be strong enough to power all components
- Arduino code must be concise so it doesn't get overloaded
- Has to fit on the 8' by 5' board

Build of Materials

Part #	Description	Price per unit	Quantity	Total Price
Arduino UNO REV3 [A000066]	Arduino to Control Car	$28.50	1	$28.50
DC Gearbox Motor Kit ID: 3777	Motors, motor driver, and wheels	$16.99	1	$16.99
9 Volt Battery Snap	Connects battery	$0.49	1	$0.49
HC-05 Bluetooth RF Receiver	Allows remote control	$10.39	1	$10.39
9 Volt Battery	Powers the car	$1.57	2	$3.14
8’ by 5’ plastic plate	Where everything mounts	$0.79	1	$0.79

Project Milestones

Week #1

A final decision will be made on which project we will do. Then, we will research what parts to use and how to build the RC car. Finally, I will complete the project proposal.

Week #2

We will have purchased and gotten the necessary materials, and also have created a model of the car.

Week #3

We will assemble the car and connect the wiring.

Week #4

We will code the Arduino Uno to move the motors

Week #5

We will test the car to make sure it works

Week #6

We will finalize the design of the car

Team Biographies

I am Cristian Hudson, a 10th-grade student. I took this engineering class because I feel that I want to pursue a career in engineering, specifically software engineering. So, I thought that the class would help me further my knowledge and teach me useful skills that I can use later on in life. Outside of this class, I take AP Computer Science which teaches how to code in Java. As well, I take a quantum computing class, which is very interesting but does not help in

this project. For this project, I will do a lot of the coding aspect of it as that is most interesting to me. I have already learned one programming language for computers and learning another would be a great tool. After doing the project, maybe I will find that electrical or computer engineering is more interesting to me and then switch my future decisions. Overall, I enjoy engineering and think it is a very lucrative career path, and I like testing myself will challenging projects like building a remote-controlled car.

My name is Roman Khachadoorian and I am currently in my senior year of high school. My emphasis for this project is from my recent interest in building analog devices and audio devices. I am currently working on audio effects devices at home and this sparked my interest in the project. I do not have any previous courses or extracurriculars that would lend experience but I have been studying analog devices and that might help with the electrical part of the project. My father used to have his own business which produced digital measuring devices that would be mounted on panels I believe. I'm not exactly sure what he did but that's what I think it summed up. It could also be that my interest in electronics comes from my father since he would take me down to the shop in Iran where he built these devices. As to what I'm currently working on, I'm making a box that has an input and output jack with a 3PDT switch that opens and closes the circuit. The device itself just compresses the audio signal coming through and sends it to output. This is relevant to the project because a majority of it is electrical and I'm positive that I will be able to put the parts together successfully. I'm not too interested in the computer programming part of it nor do I have experience with it. As to why I'm interested in electronics, it comes from my objective to save money on expensive effects pedals. I like the aspect of different sounds and how it works but when I saw the price tags I thought it would be more worth it to just make my own, I would save money and learn something in the process. I have a basic understanding of electronic parts such as resistors, capacitors, switches, etc. so I feel this project will be relatively easy. As for the coding for the Arduino, I would like to learn something new since I'm not familiar with programming.