Final Report

Intelli RC Toy Car

RC car project

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IECE

Intelli Electronic Car Enthusiasts

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Product Development I
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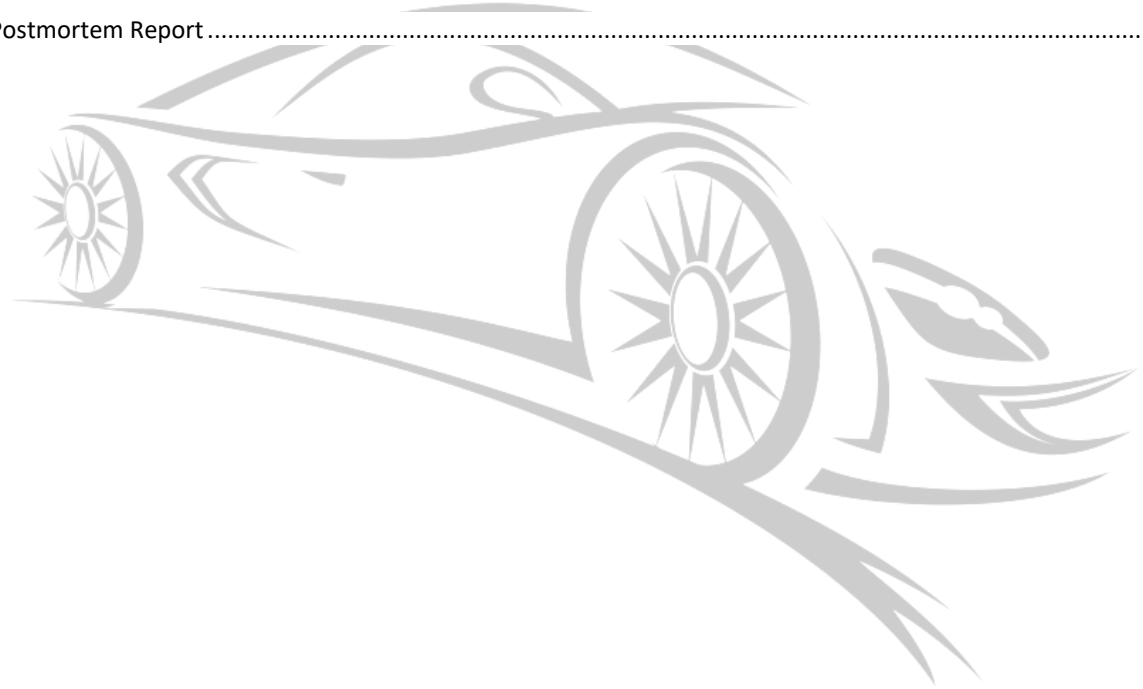

1.0 PROJECT DEFINITION

What is this project?

- The Intelli RC Toy Car consists of two main functional objects, that being a handheld remote and a small toy car. The movements of the small toy car are controlled by the end-user with the handheld remote. The handheld remote is a custom assembly, that includes a custom enclosure, but follows the same conventional look as other handheld video game remotes.

  The control of movements for the small toy car comes from the handheld remote and gets transferred to the small toy car wirelessly. Similar to the handheld remote, the small toy car is also a custom assembly, that includes a custom car frame layout, but also follows the same conventional look as other small toy cars.

  When the handheld remote or small toy car are initially turned on, a unique initialization sequence occurs. The end-user cannot manipulate these two functional objects at this time. Once done, the end-user will be able to control the small toy car with the handheld remote as per normal operation.

2.0 PROJECT SCHEDULE

Final Project Schedule:

Week	Task Completed
1 (August 23rd)	Starting point of project. Project requirements & constraints given.
2 (August 30th)	Prototyping for Car & Remote (assemble, test, improve, etc...).
3 (September 6th)	Prototyping for Car & Remote (assemble, test, improve, etc...).
4 (September 13th)	Prototyping for Car & Remote (assemble, test, improve, etc...).
5 (September 20th)	Prototyping for Car & Remote (assemble, test, improve, etc...).
6 (September 27th)	Finalize schematic for Car & Remote.
7 (October 4th)	Design PCB for Car & Remote.
8 (October 11th)	Design PCB for Car & Remote.
9 (October 18th)	Final review for Car & Remote PCBs. Submit design files to PCB manufacturer.
10 (October 25th)	Assemble and test Car & Remote PCBs.
11 (November 1st)	Submit 3D designs to be printed for Car & Remote.
12 (November 8th)	Assemble 3D designs for Car & Remote.
13 (November 15th)	Submit acrylic design to be cut for Car & Remote.
14 (November 22nd)	Assemble acrylic for Car & Remote.
15 (November 29th)	Final programming for Car & Remote.
16 (December 6th)	Final programming for Car & Remote.
17 (December 13th)	Final touch-ups & ascetics. Final project report submitted.

***Note:** *some of the above tasks were executed in parallel.*

3.0 Components & Parts List

List Breakdown:

[For Remote]

- (1x) custom designed & manufactured PCB.
- (1x) custom designed & printed case.
- (2x) custom designed & cut clear acrylic.
- (1x) NRF24L01 wireless module.
- (1x) Arduino Nano MCU.
- (5x) 100nF @ 50V ceramic capacitors.
- (1x) 330nF @ 50V ceramic capacitors.
- (1x) 10kΩ ¼ watt resistor.
- (2x) 10uF @ 25V electrolytic capacitor.
- (1x) 1N4001 diode.
- (1x) green 2-pin 2.54mm" screw terminal.
- (1x) green 3-pin 2.54mm" screw terminal.
- (1x) green 4-pin 2.54mm" screw terminal.
- (1x) 220Ω ¼ watt resistor.
- (2x) 220uF @ 25V electrolytic capacitor.
- (2x) 330Ω ¼ watt resistor.
- (1x) 7805 5V linear regulator.
- (1x) 5mm blue clear LED.
- (3x) 2x1 2.54mm" male pin header.
- (4x) 1x1 2.54mm" male pin header.
- (2x) 5mm green clear LEDs.
- (1x) joystick module.
- (1x) 16x2 LCD display.
- (1x) illuminated SPST switch.
- (4x) 20mm female-female M3 hex brass standoffs.
- (4x) 30mm female-male M3 hex brass standoffs.
- (8x) 10mm M3 screws.
- (1x) 9V battery holder.
- (1x) 9V battery.
- (?x) wide assortment of wire.

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[For Car]

- (1x) custom designed & manufactured PCB.
- (1x) custom designed & printed case.
- (3x) custom designed & cut clear acrylic.
- (4x) custom designed & printed motor holders.
- (4x) custom designed & printed wheel-adapter mounts.
- (1x) NRF24L01 wireless module.
- (1x) Arduino Mega Pro MCU.
- (17x) 100nF @ 50V ceramic capacitors.
- (2x) 330nF @ 50V ceramic capacitors.
- (9x) 10uF @ 25V electrolytic capacitors.
- (1x) 1N4001 diode.
- (17x) 1N5822 Schottky diodes.
- (1x) green 7-pin 2.54mm" screw terminal.
- (1x) green 8-pin 2.54mm" screw terminal.
- (4x) 220uF @ 25V electrolytic capacitors.
- (10x) 330Ω ¼ watt resistors.
- (2x) 470uF @ 25V electrolytic capacitors.
- (5x) 600Ω ¼ watt resistors.
- (1x) 7404 hex inverter IC.
- (1x) 7432 quad 2-input OR gate IC.
- (1x) 744075 triple 3-input OR gate IC.
- (2x) 7408 quad 2-input AND gate IC.
- (1x) green 2-pin 5mm" screw terminal.
- (1x) 5mm blue clear LED.
- (13x) 2x1 2.54mm" male pin header.
- (6x) 1x1 2.54mm" male pin header.
- (9x) 5mm green clear LEDs.
- (2x) L298N motor drivers.
- (1x) 7805 5V linear regulator.
- (1x) 7812 12V linear regulator.
- (1x) 8x 330Ω resistor network.
- (4x) black 2-pin 5mm" screw terminal.
- (2x) Multiwatt heatsinks.
- (3x) 5mm red clear LEDs.
- (1x) green 3-pin 5mm" screw terminal.
- (2x) TO-220 heatsinks.
- (8x) 5mm white clear LEDs.
- (6x) 5mm orange clear LEDs.
- (1x) illuminated SPST switch.
- (5x) 35mm female-female M3 hex brass standoffs.
- (5x) 45mm female-male M3 hex brass standoffs.
- (4x) 20mm female-female M3 hex brass standoffs.
- (37x) 10mm M3 screws with hex bolts.
- (1x) 12V 6AHr rechargeable battery.
- (4x) Mecanum robotic wheels.
- (4x) General purpose robotic wheel hub adapters for small motor shafts.
- (?x) wide assortment of wire.

4.0 Electrical Schematic

Electrical Diagrams for Car & Remote:

[For Car]

- Refer to "Car-schematic v5.pdf" under the "Schematics" folder that is included with this report submission.

[For Remote]

- Refer to "Remote-schematic v2.pdf" under the "Schematics" folder that is included with this report submission.

5.0 PCB Prototype

Car & Remote PCB Prototypes:

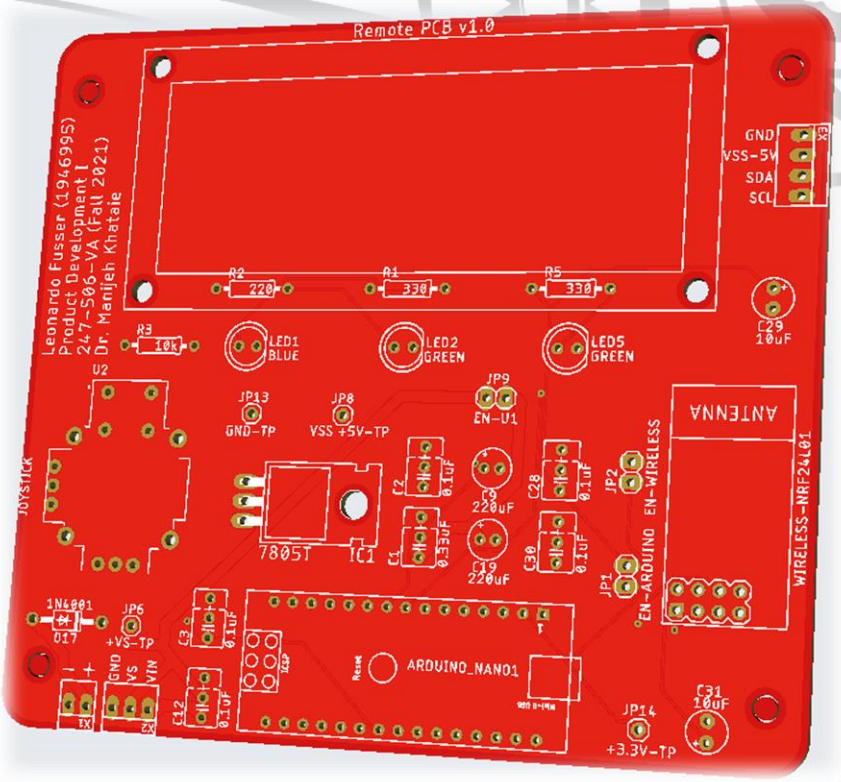

Figure 1. Remote PCB (top view).

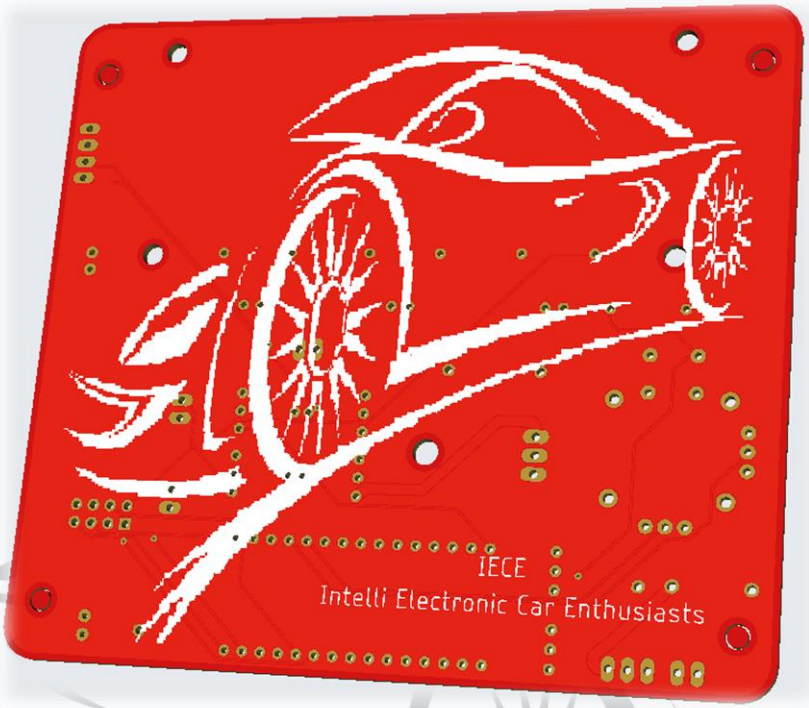

Figure 2. Remote PCB (bottom view).

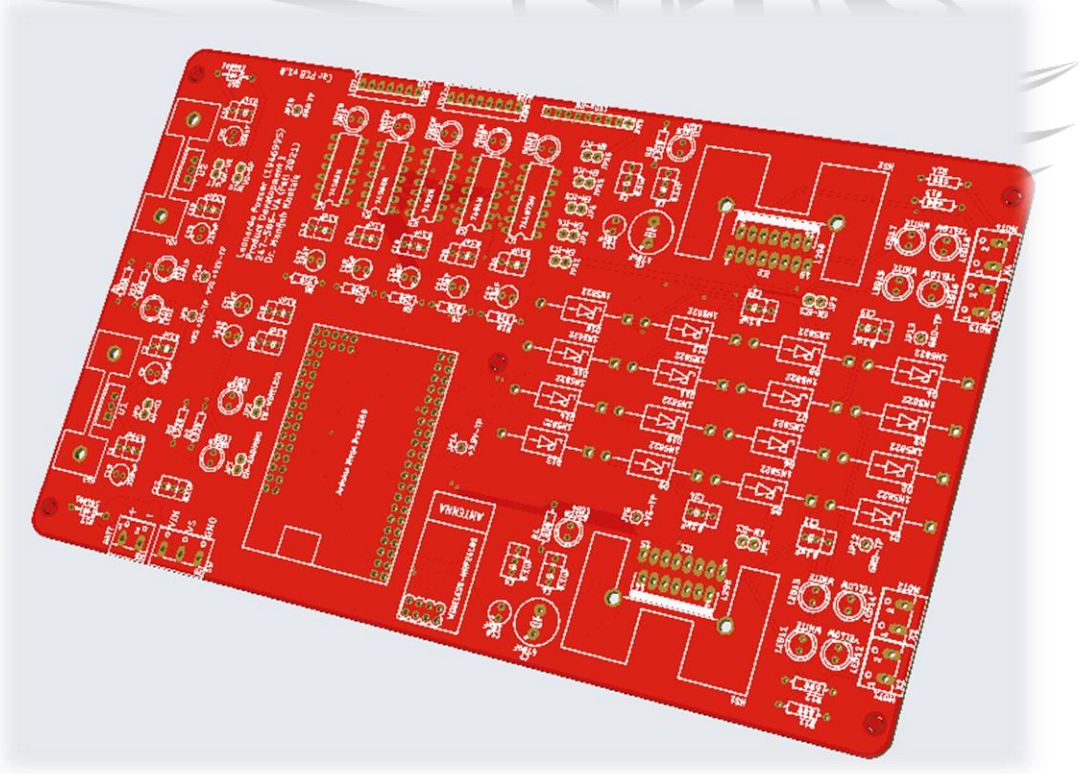

Figure 3. Car PCB (top view).

Figure 4. Car PCB (bottom view).

6.0 Car & Remote Design

Car & Remote Physical Designs:

- Refer to pictures on next page.

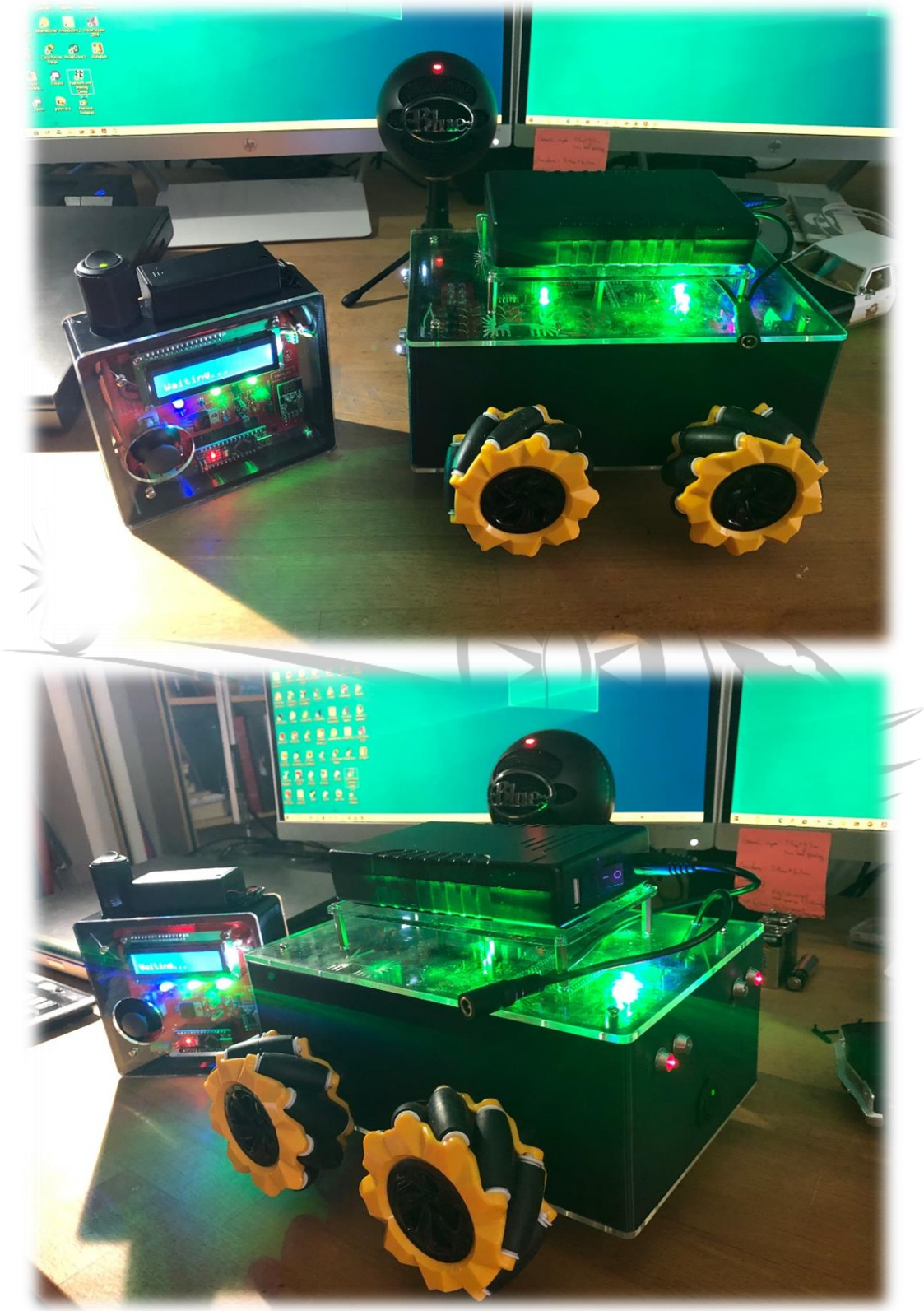

Figure 5. Car & Remote fully assembled.

Figure 6. Custom engraving on Car.

Figure 7. Car & Remote fully assembled.

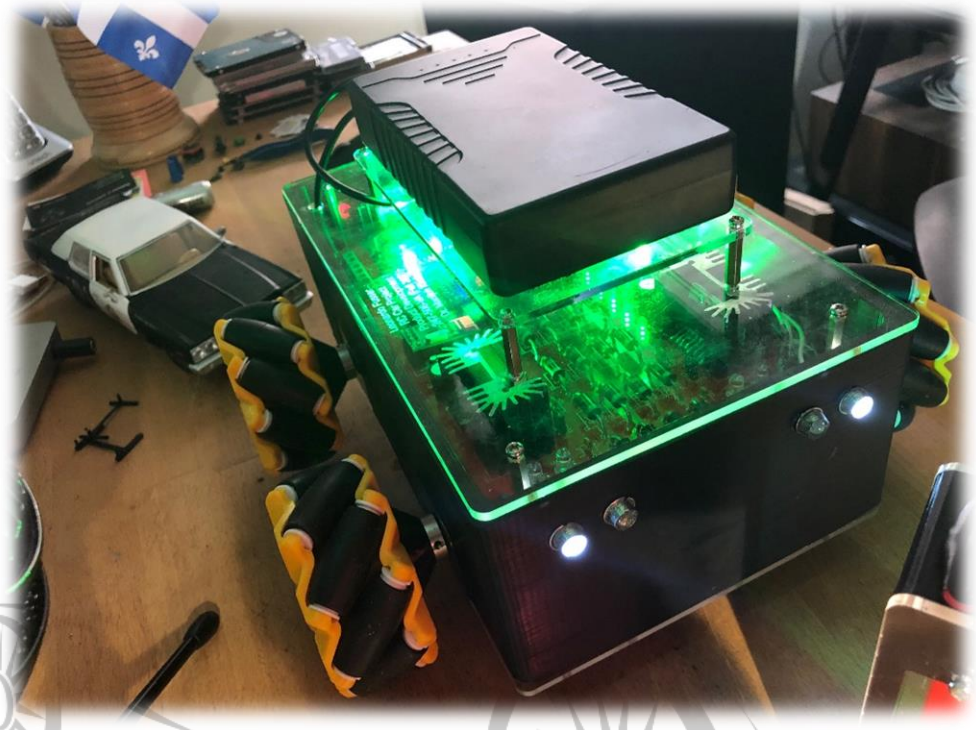

Figure 8. Car & Remote fully assembled.

Figure 9. Remote fully assembled.

7.0 Cost Breakdown

Final Production Cost Breakdown:

Purpose	Cost
Prototyping for Car & Remote	$100.00
3D prints for Car & Remote	$15.00
Laser cuts for Car & Remote	$24.00
PCBs for Car & Remote	$35.00
Electrical components for Car & Remote	$80.00
Physical components for Car & Remote	$50.00
Total:	**$304.00**

8.0 Programming

Software for Car & Remote:

[Car]

- Refer to “Car.ino” file under the “Code” folder included with this report submission.

[Remote]

- Refer to “Remote.ino” file under the “Code” folder included with this report submission.

9.0 POSTMORTEM REPORT

Thoughts After Project Completion:

Problems encountered:

- Thankfully, not many errors were encountered during the making of this project. The first errors that were encountered were during the prototyping phase, where some electrical connections between some of the components were not correct. These errors were addressed and fixed before going onto the next phase of the project.

  Other errors that occurred were encountered during the last phase of the project (programming). Typical logical issues and syntax issues were present and were addressed and fixed before proceeding to the next phase of the project.

  One other issue that occurred only happened after the whole entire project was assembled. The car deemed a little too heavy for the motors being used on the car (DC motors without a gearbox). The car would be a little difficult to maneuver and get going due to the weight of the car. If the car was elevated, the motors would run without a problem (no load on the motors).

Improvements:

- Despite the minimal errors that occurred, the one improvement that I would like to implement in a future update of my project is in the PCB design for the Car and the Remote. The improvement would be replacing the existing components with smaller components, such as surface mount components, to reduce the overall size of the Car and the Remote.

  The other improvement that I would like to implement in a future update of my project is in the motor design for the Car. The improvement would be that the motors would use a geared system. Since the car is a little heavy, the added gears will add torque to the car which will help it move and maneuver better.