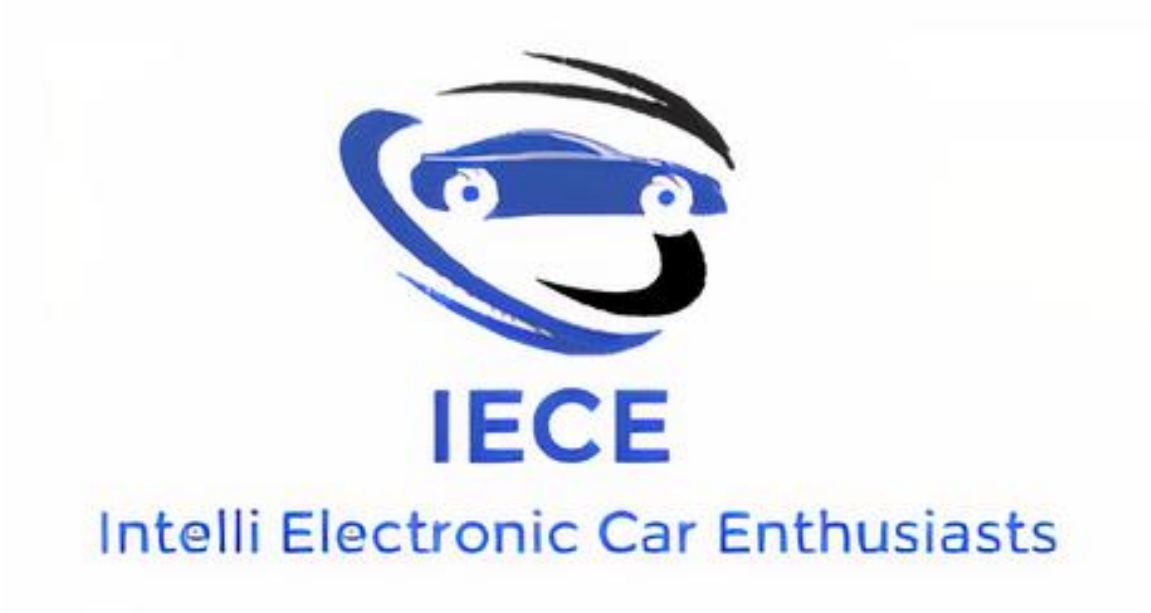
Prototype Report

Intelli RC Toy Car

RC car project

Leonardo Fusser, 1946995



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Department of Computer Engineering Technology
Product Development I
Dr. Manijeh Khataie

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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 Drawings

Physical Drawings for Car & Remote:

[For Car]

- Refer to PDFs under the "Car" subfolder in the "Drawings" folder included with this report submission.

[For Remote]

- Refer to PDFs under the "Remote" subfolder in the "Drawings" folder included with this report submission.

3.0 PROTOTYPING

Prototyping the Car & Remote:

- The prototyping began with doing some general research about similar projects to this one. Comparisons were done between similar completed projects to see what worked well and what did not work well. The project that worked best was used as a reference for this project. Once this was complete, a list of parts was compiled, and purchases were done to get these parts. Parts consisted of items such as passive electronic components all the way to DC motors.

  Once all the parts were received, assembly for the prototype begun. All components such as the Arduino MCU and DC motors were a part of it. The prototype for the Car & Remote was implemented on one large breadboard, and all preliminary wiring was done on it. Wiring was based off diagrams that were used in similar projects and past prior knowledge. Tests were done to ensure that the Car & Remote circuitry worked as it should. Adjustments were also made in the process and if there were any errors, it was corrected so that there would be no issues later on in the project. Basic code was loaded onto the MCU to be able to conduct these tests.

  Once the circuit for the Car & Remote was deemed functional, the next step was to create the PCBs for the Car & Remote. A schematic capture for the Car & Remote circuitry was done in Autodesk EAGLE software. After the schematic capture was complete, the physical layout for the two PCBs was taken care of in the same software. As an additional feature, graphics were added to the two PCBs (company logo). Tests were done (using built-in tools) to verify PCB functionality for the Car & Remote. Once all tests passed, and a final verification was complete, the necessary files were sent to a PCB manufacturer to get the boards produced and sent back to me.

  While the PCBs were being produced, CAD design was done for the Car & Remote. For the Remote, three designs were done. A 3D printable case for the Remote and two small pieces of acrylic were designed for the Remote. For the Car, around six designs were done. A 3D printable case for the Car, three pieces of acrylic designed for the Car, four 3D printable motor holder adapters and four 3D printable motor wheel hub adapters were designed for the Car. Once all CAD design and final verification was done, all the necessary files were sent to those who were in charge of cutting pieces of Acrylic and 3D printing the 3D designs.

  Once the PCBs arrived, all component assembly was done and both boards were tested for functionality. After passing all tests, the boards were placed in the Car & Remote cases (from the CAD design). At this point, the Car & Remote were being assembled to completion and all necessary wiring was done on the Car & Remote.

  After the Car & Remote were fully assembled. Final code was uploaded to the MCUs on the two devices. Tests were done to ensure the Car & Remote functioned as intended.

4.0 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.

5.0 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.

6.0 Problems Encountered

What went wrong?

- Since proper research and testing was done beforehand, most of the issues that were encountered only happened in the early stage of the project, and since corrective action was taken early, no major issues were faced after initial prototyping for the Car & Remote.

  Typical issues such as incorrect wiring was present in the initial stages of the project and were corrected and verified for proper functionality before proceeding any further with the project.

  Other issues that were seen were with the results of the 3D CAD designs. For some of them, the printer settings were not set correctly, and the prints did not come out correctly. New settings were applied and the results from those prints were deemed functional.

  During programming, typical issues such as logical errors and syntax errors were present, and corrective action was applied. Code was verified and tested for functionality.

  The only significant issue that was encountered was with the Car. Since the Car had a little weight on it, the motors struggled a little with getting the car to go. The solution would be to use geared DC motors, in order to give some more torque for the Car. This might be done in a later time.

  As mentioned before, the prior knowledge and research done during the early stages of the project drastically reduced the possibilities for major error to occur in the other stages of the project.

7.0 PROJECT SCHEDULE

Timing for project:

[For current timing]

- Refer to "Project Timing" sheet in "GanttChart-LeonardoFusser.xlsx" file that is included with this report submission.

[For course outline timing]

- Refer to "Course Outline Timing" sheet in "GanttChart-LeonardoFusser.xlsx" file that is included with this report submission.

8.0 FINAL PLAN

Next steps:

Week	Task
11 (November 15th)	Submit acrylic design to be cut for Car & Remote.
12 (November 22nd)	Assemble acrylic for Car & Remote.
13 (November 29th)	Final programming for Car & Remote.
14 (December 6th)	Final programming for Car & Remote.
15 (December 13th)	Final touch-ups & ascetics. Final project report to be submitted.

***Note:** *some of these tasks will be executed in parallel, to avoid any shortcomings, and to finish earlier before project deadline (end of semester).*