ECE4011/ECE 4012 Project Summary

Project Title	Electric Commuter Car
Team Members (names and majors)	Daniel Bruce - EE Hong Yee Cheah - EE Christopher Hooper - EE Moongyu Kang - EE
Advisor / Section	Dr. Thomas Habetler
Semester	Semester/Year: Fall 2019 - Intermediate ECE 4011
Project Abstract (250-300 words)	(10 point font, single spaced) At this point, its common knowledge that the world is running out of gasoline to fuel our cars. Not only that, but the cars themselves are getting bigger and bigger each year. There is no reason one person should be commuting to work every day in a vehicle that is nearly twenty times their mass and powered with non-renewable resources. The vehicle market is showing a shift towards electric vehicles but the those currently on the market have the issue of still being as large as a typical car. Vehicles of this size are not necessary for the average commuter and waste power just moving that unneeded mass. A solution to this problem is to design a smaller, two-person, solar powered electric vehicle that can be used for the public's daily commute. The plan for this project is to take a pre-existing two-person 'go-kart' and remove the gas engine, replacing it with an electric motor that is powered by a battery composed of multiple lithium-ion cells and able to be recharged by a solar panel. The project will consist of choosing the proper motor, battery and solar panel to get the desired power and range that can fall within the budget. Then designing the interconnecting circuitry to send the proper power to the motor and safely recharge the battery. The gearbox of the vehicle will be designed to give a manual transmission feel as it would provide more control and fun to the driver. To provide this feel the gearbox will consist of state machine that feeds a logic signal to a microcontroller to tell what gear you are in. The microcontroller will then signal the battery to output a desired power with feedback to ensure that the motor's speed/torque does not exceed the limit set by the chosen gear.

<table>
<tr><td>Project Title</td><td>Electric Commuter Car</td></tr>
<tr><td>List codes and standards that significantly affect your project. Briefly describe how they influenced your design.</td><td>(10 point font, single spaced)

According to Georgia DDS, all commercial vehicle less than 25 years old must include:

Service Brakes, Parking Brake, Steering Mechanisms, Lighting Devices and mechanisms (headlights, blinker, etc.), Horn, Windshield, Windshield Wipers, Coupling Devices (alignment), Rear Vision Mirrors, Emergency equipment (airbag, seatbelt, etc.), Doors, Frame, and Tires (Must have at least 4/32 of an inch of tread on front tires and at least 2/32 of an inch of tread on all other tires)

Also, the maximum speeds in different areas is summarized in the table below:

<table><tr><th>Area</th><th>Speed (MPH)</th></tr><tr><td>Urban or Residential Districts</td><td>30</td></tr><tr><td>Unpaved County Roads</td><td>35</td></tr><tr><td>Rural Interstate</td><td>70</td></tr><tr><td>Urban Interstate or Multi-Lane Divided Highway</td><td>65</td></tr><tr><td>Other</td><td>55</td></tr></table>
Influence: We can either buy all the parts aftermarket (which is expensive) or design them ourselves (which takes time and resources). We settled on buying a kart with most parts already on-board.</td></tr>
<tr><td>List at least two significant realistic design constraints that applied to your project. Briefly describe how they affected your design.</td><td>(10 point font, single spaced)

Weight: A heavier vehicle requires more power to move, thus draining the battery faster, which decreases range. A heavier vehicle has more momentum that the brakes must overcome (our go-kart brakes may not be enough).

Cost: We have a budget limit of $500 to spend on the battery, frame, parts needed to fulfill codes and standards, motor, and PV panels. The battery module alone is $1,225, the motor will be another $300-ish, and the panels will be between $100 - $250.</td></tr>
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Briefly explain two **significant trade-offs** considered in your design, including options considered and the solution chosen.	(10 point font, single spaced) AC vs. DC motor: AC motors are more reliable, and safer, but harder to control. DC motors are more energy efficient but wear out faster (brush commutator). An AC motor needs extra inverting circuits to convert our DC battery to AC power Designing frame or buying pre-built kart: On one hand, designing the frame gives us more control over size and weight, but takes more time to design, simulate, and build. On the other hand, buying a pre-built kart is more expensive, but comes with most of the equipment needed to satisfy the codes and standards listed above. Also, we are not experienced with mechanical design and fabrication.
Briefly describe the **computing aspects** of your projects, specifically identifying **hardware-software** tradeoffs, interfaces, and/or interactions. *Complete if applicable; required if team includes CmpE majors.*	(10 point font, single spaced) N/A. No Computer Engineering Majors in this Project.

Project Title	Electric Commuter Car
Leadership Roles (ECE4011 & Forecasted for ECE4012) (NOTE: ECE4012 requires definition of additional leadership roles including: 1.Webmaster 2. Expo coordinator 3. Documentation	**Team/Expo Coordinator**: Christopher Hooper **Software Coordinator**: Hong Yee Cheah **Hardware Coordinator**: Daniel Bruce **Design/testing**: Moongyu Kang **Webmaster**: Hong Yee Cheah

International Program: Global Issues (Less than one page) (Only teams with one or more International Program participants need to complete this section)	(10 point font, single spaced) N/A