Formula Racecar Paddle Shifters

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Project Narrative Description

This project consists of the design and implementation of an electronic paddle shifter that would be mounted on the UCF formula race car. The newly designed and installed paddle shifter is going to replace the currently installed stick shifter that would enhance the performance of the vehicle and would make it more comfortable and easier for the driver to shift through the gears. The electronic paddle shifters is going to make the manipulation of the vehicle much easier due to the dynamics of the device. Shifting through the gears using the paddle shifters is going to be much faster and smoother which would increase the performance of the vehicle and driver. These paddle shifters would be placed somewhere close to the driver's fingers and close to the steering wheel to make it easier to access. It still haven't been decided whether to make the shifters to be buttons or oval-shaped paddles. Either way, the paddle that is going to be responsible for the upshift will be on the right hand side of the steering wheel with a plus sign or an up arrow on it to indicate that it is for upshifting and the paddle responsible for the downshift is going to be on the left hand side of the steering wheel with a minus sign or an arrow pointing down to resemble that it's for downshifting and the reason for this is to make the device easier for the driver to operate and understand. The electronic display that is going to be provided along with the paddle shifters is going to assist the driver since it would indicate which gear the engine and transmission is running on. The display would probably be mounted in the middle of the steering wheel or in an area directly facing the driver where it would be visibly clear to see from the driver's perspective. the display should be light in weight and small enough for the driver to be able to see it clearly so the it wouldn't affect the functionality of the steering wheel if it is going to be mounted on the steering wheel and that it wouldn't add more significant weight to the vehicle.

List of Requirements Specifications

- System must be able to shift gear up and down.
    - Needs to move 1-2” in each direction.
    - Shifts needs to be fast, less than 1 second.
    - Shifts should apply greater than 30lb force to ensure a shift will occur.
    - Shifts will work based upon the location of 2 buttons or paddles, one for up and the other for a downshift.
    - Shifts between 1st and 2nd should skip neutral
    - A neutral button or paddle will be a bonus to find neutral only if the vehicle is in 1st gear
- One Electric motor will be needed to achieve the above specifications.
    - Motor will need to be durable
    - Able to withstand high temperatures, vibrations and resist the environment
- System needs to be 12V.
- Weight should be kept as low as possible.
- Should be able to cut power temporarily for shifts to reduce strain on the transmission.
- Accomplished either killing power to the coil packs or severely reducing fuel
- Method used needs to be fast and safe on engine
- Buttons or paddles will be placed on the steering wheel for easy access to shifting
- Gear position display with gear positions, one through six and possibly an ‘N’ for neutral, will be a bonus feature for the project.

Project Prototype Illustration

Figure 1: Electronic paddle shifter concept with all parts necessary

Figure 2: Electronic paddle shifter after setup and connection

Estimated Project Budget and Financing

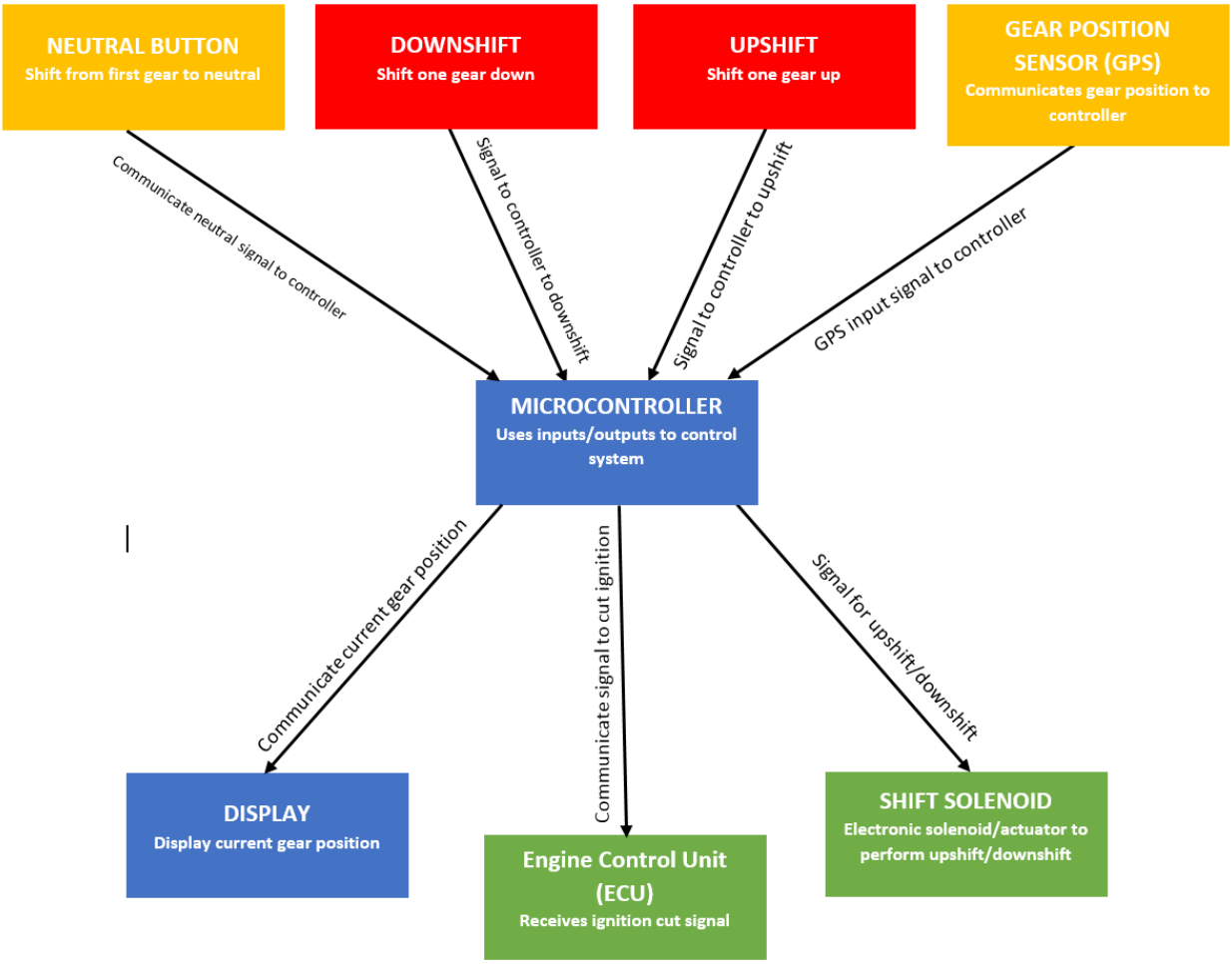
Project budget is estimated to be $1000 as the fabrication will be handled by the design team. Financially, each student will need to cover all additional costs that is not covered by the SAE funding. Students will not need to provide more than $250 each breaking down to $125 for each semester. Currently, the funding from SAE and SGA is unknown, but is highly likely to occur. A secondary goal for this project is to be able to reproduce the same highly accurate system at very reduced price. Current similar systems for motorcycles range anywhere from $900 to $1500. The most expensive part of this project is the electronic motor ranging from $200-$800. The microcontroller used for testing the will most likely be the msp-exp430g2 which has already been obtained. After testing with our msp-exp430g2 a custom microcontroller will be designed and purchased at about $33. All other parts for the system may already be obtained by the group members but further research is needed to see if other hardware is needed.

Initial Project Milestones

For the first semester of this project, all parts needed to reproduce a manual shift will need to be researched and chosen. All measurements, constraints and location availability will be used to choose the correct parts keeping costs low. All wiring harnesses and needed electronics to lower the RPMs of the engine will be designed. The motor will be researched and chosen. All brackets and placements for the motor will designed. The method and placement of the buttons on the steering wheel as well as the material used with be researched and chosen. The method for controlling the motor and will be chosen. The coding needed to control the motor and display the gears will be started. The type and location of the display will be researched and chosen.

For the second semester, all the project parts will need to be purchased. The team will test the actuator and the code and make any modifications needed before installing. Once the system performs effectively, it will be installed on the vehicle. All wiring will be installed and the the buttons for shifting will be applied to the steering wheel. The system will then undergo testing without the motor on to ensure that shifting is occurring and to test timing of the actuator for each shift as well as attempt to find neutral and program it using a 3rd button. Final stage will be to test the system with a live engine and undergo a series of testing.

Project Block Diagram



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All blocks are being researched

Microcontroller Flowchart