

Automotive STEMSEL Project 4 – Electric car regeneration to battery.

Problem

Some newer cars run on electricity instead of petrol, and can even recharge their batteries when braking. In this project we will make a power monitor to show when the battery is draining as we accelerate and that the battery is recharging when we brake.

Background

Cars that run on fossil fuels like petrol are very convenient; in order to run they burn fuel in their engines. However when we burn these fuels in our engines we also generate large amounts of greenhouse gasses that contribute to the global warming problem.

As global warming is of great concern, it is important for us to find ways in which we can reduce the amount of greenhouse gasses being generated. One possible way of reducing the amount of greenhouse gas generation is by switching to alternative fuels for our cars. One of these alternatives is electric cars. These cars work by using batteries to store electricity and using the stored electricity to power an electric motor.

This has the benefit of not generating any greenhouse gasses as no fossil fuels are burnt. Electric cars have limited battery capacity so it is very important to save the battery power so you can travel further. A power monitor to show the battery charging and discharging information to the driver would help the driver in saving battery power.

Ideas

What components do we have in our kits for building the power monitor and what inputs and outputs will our power monitor have?

Plan

For our power monitor we will use push buttons as our inputs, LEDs and a motor as outputs. We will use the on board pushbutton for braking and an external pushbutton for acceleration of the car. We can use a green LED to show charging when braking and a red LED to show discharging of the battery when accelerating. When we accelerate we will spin the motor in our kit to simulate the cars motor. If there is braking and accelerating at the same time both LED's and the motor will be on.

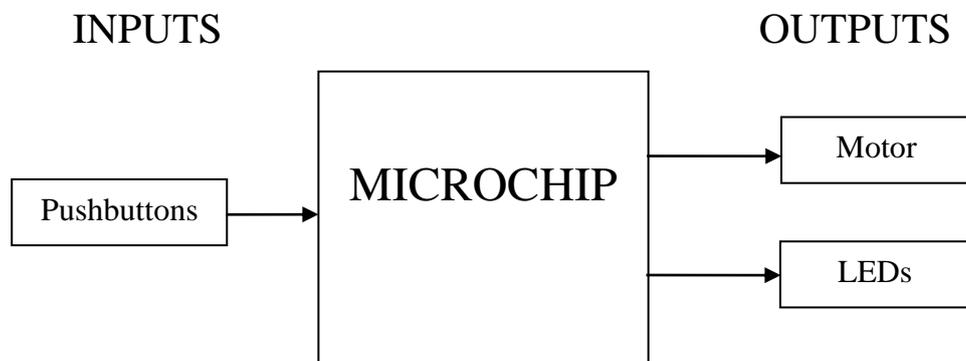


Figure 1: circuit plan

Design

Use ezCircuit Designer to construct an input/output (I/O) diagram. Add the pushbutton and both LED's to the recommended pins. This is indicated by pins turning light green when an icon has been clicked. Use a driver icon to add the motor. Remember to right click on the names to rename the components.

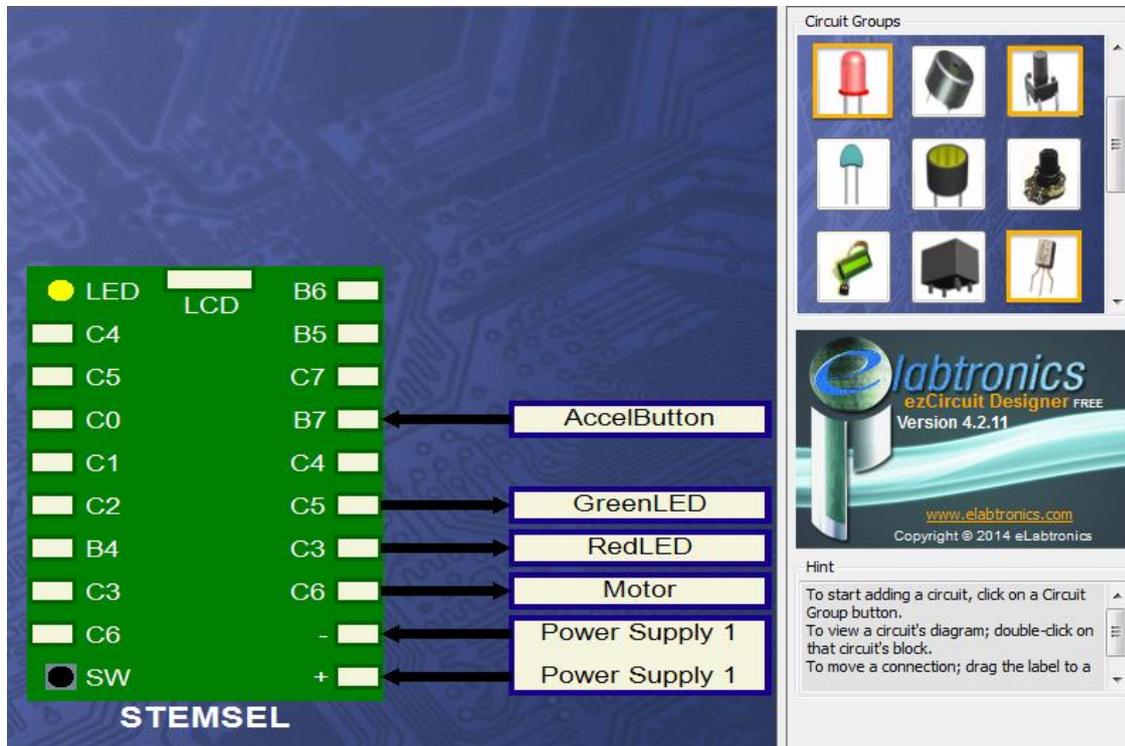


Figure 2: circuit design

Build the circuit

Use the ezCircuit Designer I/O diagram to connect the hardware. Remember that black wires connect to the negative pin (-), red wires connect to the positive pin (+), and white wires connect to the pin we designated in our design. When connecting the motor, place one of the wires into the pin we designated in our design and the other in the negative pin. Once you have built your circuit, send the design to CoreChart.



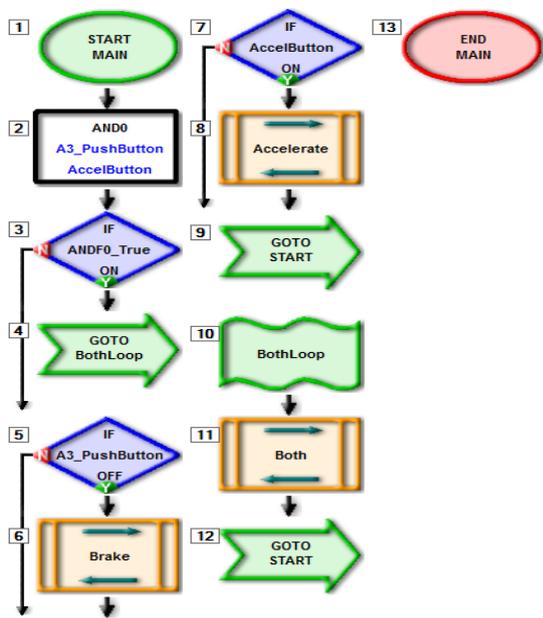


Figure 3: circuit

Programming

We will use CoreChart to program the functions of our power monitor. After you have used the test routines to check the outputs, delete them so that we can start writing our own program.

1. We will start with the situation that the driver is accelerating and braking at the same time. This means that both pushbuttons will be pressed, to check for this use an AND icon from (numbers->AND) and edit to the condition to A3_PushButton off (remembering that this on board pushbutton is an active low) and AccelButton to on. Place at the start of the program.
2. If this condition is met, we want to turn on both LEDs and the motor. Create an address label called “BothLoop” at the end of the program to go to a subroutine of turning on and off all the outputs with a 5 ten-thousandth second delay between turning on and off outputs to give the motor time to spin up. Group these icons and place a GoTo “START” at the end of the program after the group.
3. Next create a GoTo “BothLoop” after the AND decision.
4. Create decision icons for the buttons being on separately after the AND decision, and place group icons to turn on and off outputs depending which button is being pressed under the decision icons. It is important to remember that the on board pushbutton is an active low.
5. When turning on and off outputs place a 5 ten-thousandth second delay between turning on and off outputs to give the motor time to spin up and to let the LEDs reach full brightness.
6. Place a GoTo “Start” icon after the group from the last decision.
7. Send your program to the chip and test it.

Figure 4: completed program

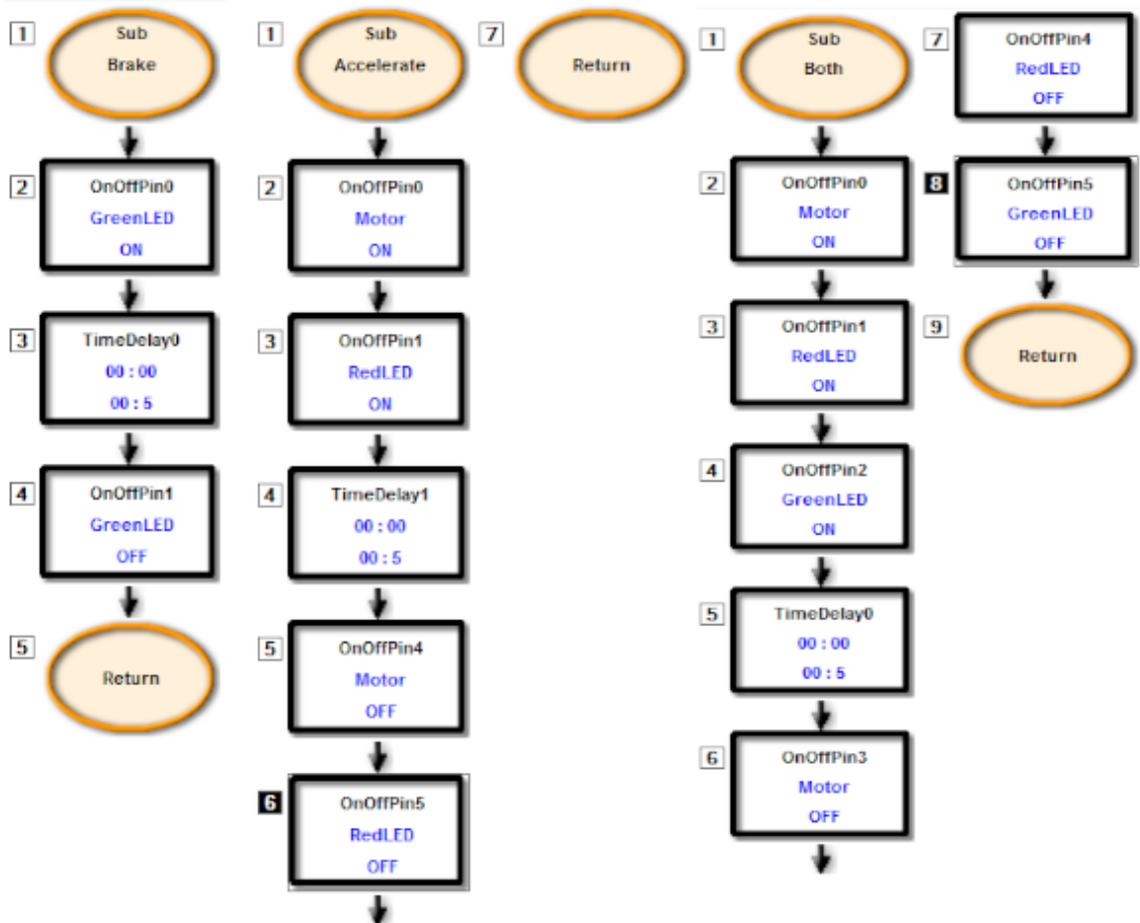


Figure 5: program groups

Activity/extension

If the driver of the electric car unwisely tried to accelerate and brake at the same time they would cause power from the battery to be wasted stopping them from driving as far. It would also cause unwanted additional wear and tear on the car. Our current design has no way of warning the driver that they are accelerating and braking at the same time. To warn to driver, add another colour LED and Buzzer to be an indicator to the board.

1. Modify your program to use the added LED and Buzzer when both accelerate and brake pushbuttons are pressed.

Summary

In this project microchips have been used to create a power monitor that could be used to display battery charge and discharge information to the driver of an electric car. This would allow electric cars to be easier for people to use. It would also allow the driver to travel further on a single battery charge as they could adjust their driving knowing the information given by the monitor. With electric cars being easier to use people may switch from fossil fuelled cars giving a reduction in greenhouse gas generation, as electric cars don't generate any greenhouse gasses.