

STEMSEL Automotive Project 7 – Transmission-gears

Problem

We see people driving cars every day. We know that cars speed up when we step on the accelerator and slow down when we step on the brake. But exactly how does the engine get the car to speed up?



Background

A car uses a gear transmission system to move the wheels. It consists of several different gears of different sizes to keep the car moving at different speeds. In older cars, the driver changes gears manually, however most modern cars use an automatic transmission gearbox to do this. When a car starts moving from its stationary position, it uses the first gear because the size ratio compared to the gear on the wheel is much larger, which enables the car to start moving easily with very little energy. However, it is unable to get the car to move fast and therefore requires several more gears to increase the car's speed. This means that each incrementing gear will have a smaller ratio.

Ideas

We normally see the speed change on the speedometer in the car but not the current gear. How can we simulate this using the available components in the kit box?

Plan

To simulate the gear change, we only require an LCD to display the information which will act as the car dashboard. This includes the tachometer, speedometer and also the gear display to see the current gearshift. The tachometer tells us the revolutions per minute (RPM), which is the rate at which the engine is spinning the gear. The speedometer shows the speed at which the car is travelling and the gear display shows the current gear the car is using.

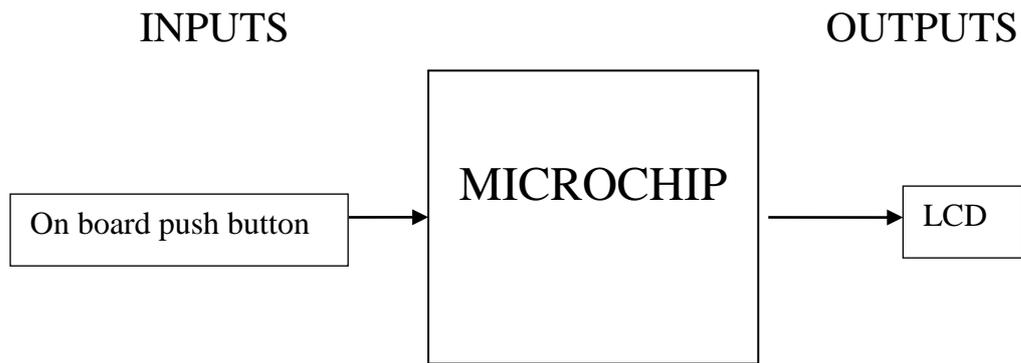


Figure 1: circuit plan

Design

All that is required is to click on the LCD icon from the circuit groups. The LCD will be automatically attached to the ezCircuit.

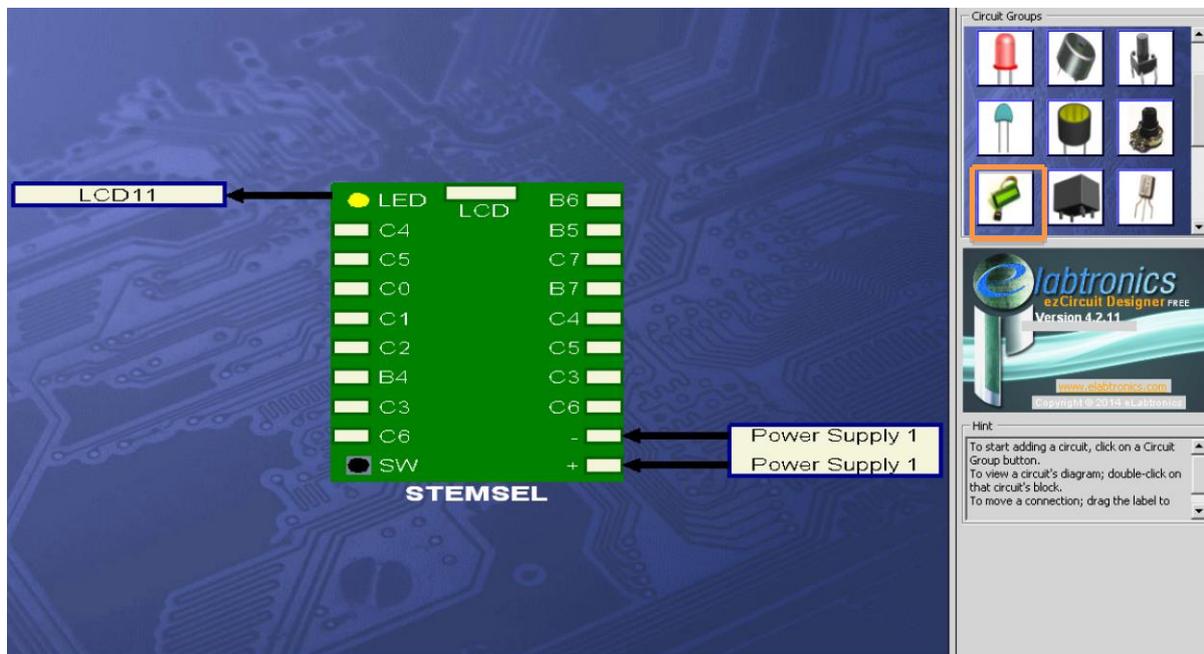


Figure 2: circuit design

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. Once you have built your circuit, send the design to CoreChart.

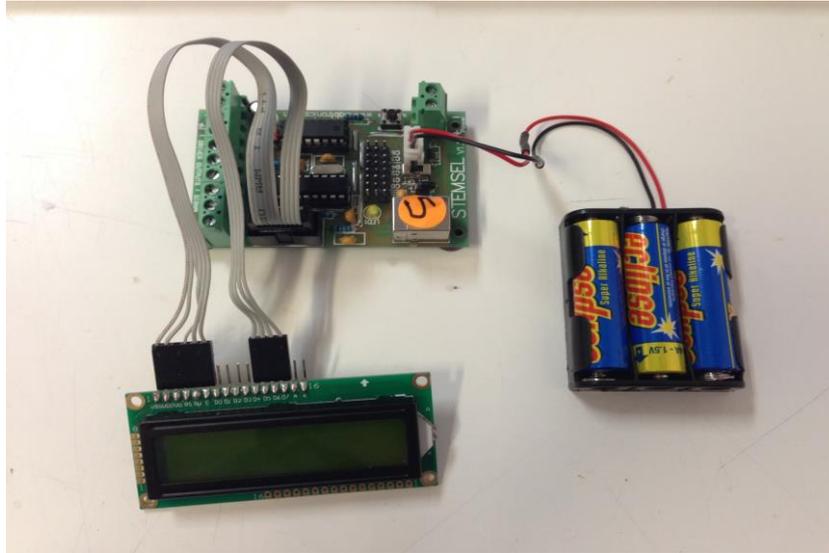
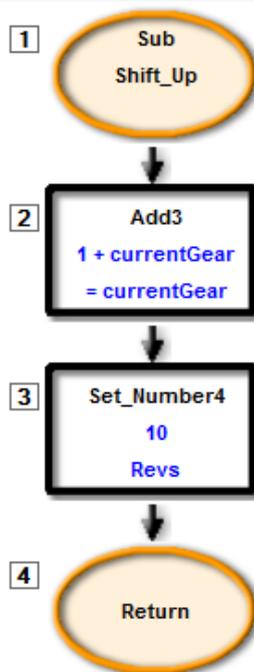
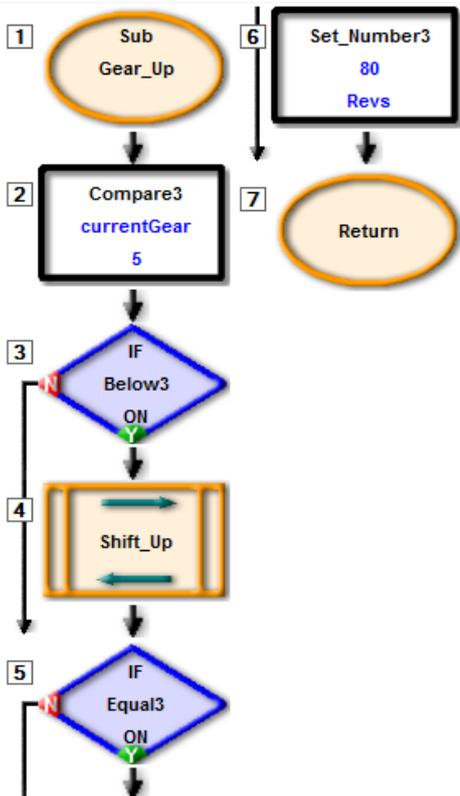
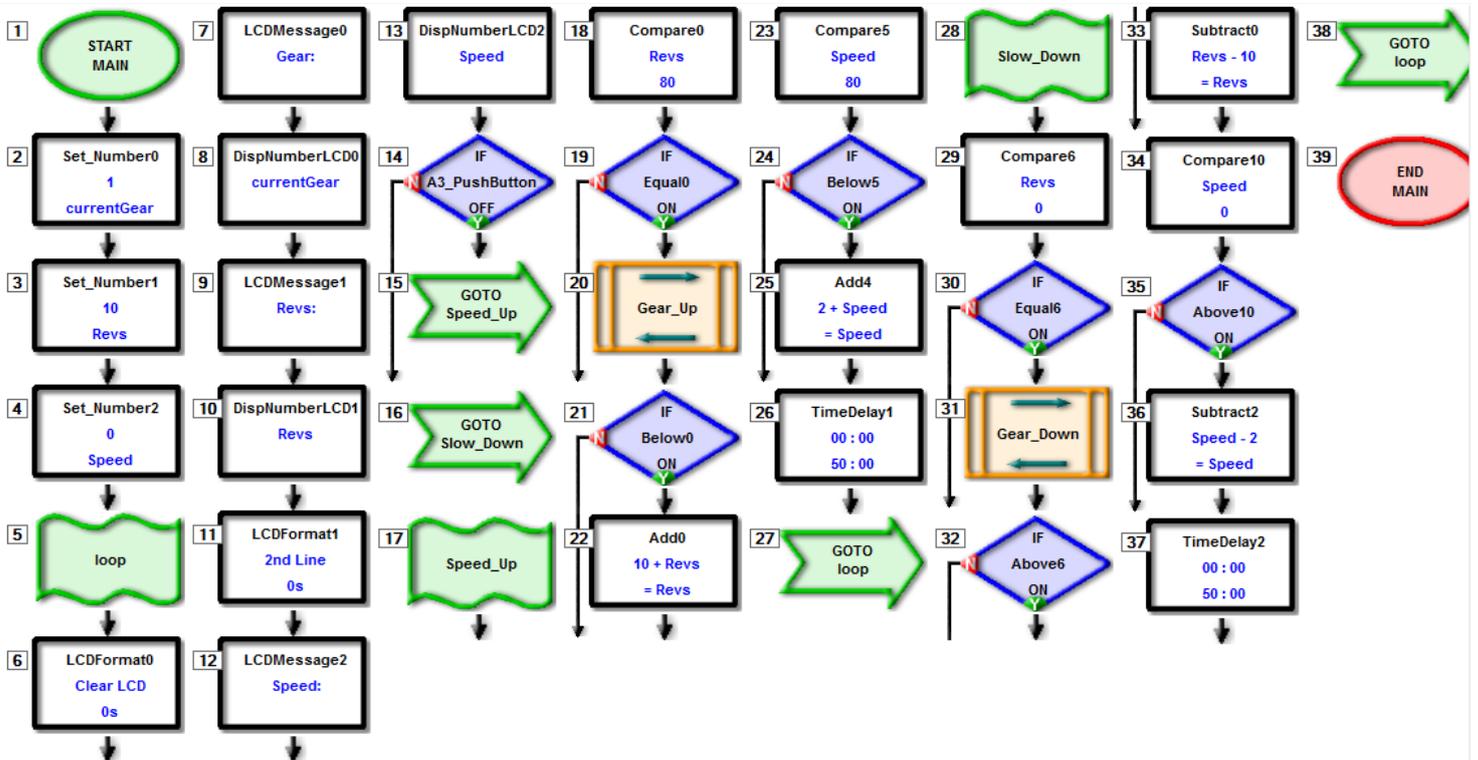


Figure 3: circuit

Programming

1. Firstly remove the LCD test file from CoreChart and then initialize 3 variables using *Set_Number* with “currentGear” = 1, “Revs” = 10 and “Speed” = 0. This is to initialize a stationary car in first gear with its engine revving at 10rpm.
2. We then create and address labelled “loop”.
3. Program the LCD to display the Gear, Revs and Speed.
4. We now have to create 2 addresses, 1 with the label “SpeedUp” and the other “SlowDown” with both addresses ending with a *GOTO* “loop”.
5. Before the 2 new addresses, add a *Decision* for when “A3_PushButton” is “OFF” with the condition *OFF* jumping to “SpeedUp”, else *GOTO* “SlowDown”.
6. Under the “SpeedUp” label, if Revs is less than 80, add 10 to it. Otherwise, if Revs is equal to 80, create a gear up Group.
7. The gear up group will need to add 1 to the “currentGear” and set revs back to 10, (remember to group them together) if “currentGear” is less than 5 otherwise if it is equal to 5 “revs” should be set 80.
8. Now we check if speed is less than 80, add 2 to it then set a time delay for half a second.
9. Under the “SlowDown” label, if Revs is above 0, subtract 10 from it. Otherwise, if Revs is equal to 0, create a gear down Group.

10. The gear down group will need to subtract 1 to the “currentGear” and set revs back up to 80, (remember to group them together) if “currentGear” is above 0 otherwise if it is equal to 0 “revs” should be set 0.



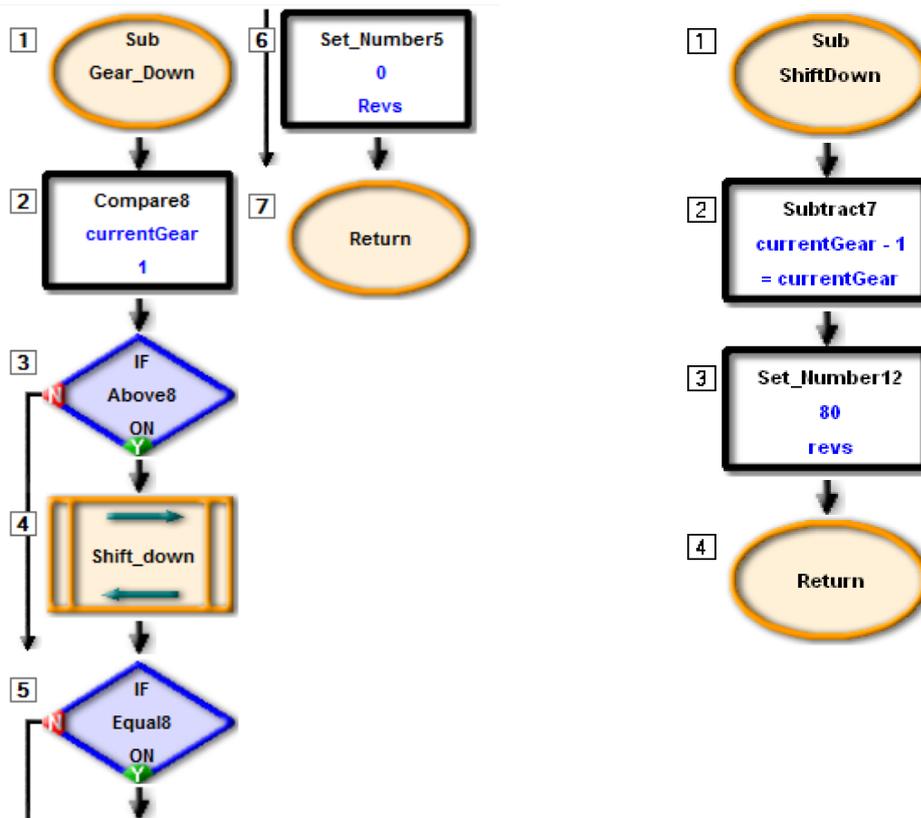


Figure 4: completed program

Activity/extension

Now that we have simulated the gear changing along with the speedometer and tachometer, see if you can add a motor to the circuit and modify the program to see if the motor increases in speed along with the gear change as displayed on the LCD. You may need to use the USB together with the battery to get enough power for the circuit to work properly.

Summary

By using an LCD and properly programming the microchip, we were able to simulate and understand how a transmission gear works in controlling the car speed. Transmission gear is the fundamental basic in locomotive system for most motor vehicles. Without transmission gear, vehicles will have difficulty travelling at different speed.