

ezSystem STEMSEL Projects Overview

Aims of the Workshops

These workshops are organised to be carried out over the course of approximately one school term, and aim to teach not only programming skills but also problem solving techniques that can be applied in all aspects of life. To this end, each workshop has several specific stages, each with their own goals:

- Problem definition – define the problem that needs to be solved in the project.
- Background information – contains information the students may need in order to complete the project, and also to increase learning in STEM.
- Idea generation – Some questions to prompt ideas on how we can solve the stated problem. This step should be interactive with the students.
- Plan development – from the ideas, we develop a workable plan of action that can be followed using the STEMSEL kits. This will be referred to during the following stages of the project.
- Design/build/test/program – Instructions on how to assemble and program the circuit, following the plan to solve the problem. This may include extensions such as ways to improve our solution, or considering different scenarios.

STEMSEL

A microcontroller is a tiny computer similar to those used in a PC or laptop but designed to control things like lights and switches rather than run systems like Windows, Word or Excel. Microcontrollers are used everywhere to run new technologies and inventions.

Our new microcontroller board is named STEMSEL (Science Technology Engineering Maths Social Enterprise Learning). Our aim is to teach STEM in an interesting and relevant hands-on approach and demonstrate how to make it a Social Enterprise. Just like biological Stem Cells our STEMSEL can grow with the needs of the user.

ezSystem

The aim of ezSystem is to develop Creativity and Innovation in people using Project Based Learning (PBL).

ezSystem software integrates ezCircuit Designer, CoreChart and the STEMSEL controller board into a user friendly training system. Both ezCircuit Designer and CoreChart use an intuitive icon selection process to design, build and program the STEMSEL controller board. With ezSystem the user does not need to learn text programming language or know a lot about electronics to make complex systems.

Learning Outcomes

This workbook provides the non-technical user with easy to read instructions on how to apply STEMSEL on ezSystem to design, build and program a number of simple hands-on projects.

Equipment requirements

Computer

PC running Microsoft Windows XP, Vista, Windows 7 or higher with USB connections

Software

- Microsoft .NET Framework Version 4
- ezSystem Version 4.2.2 or higher
- installed from CD or as arranged by eLabtronics

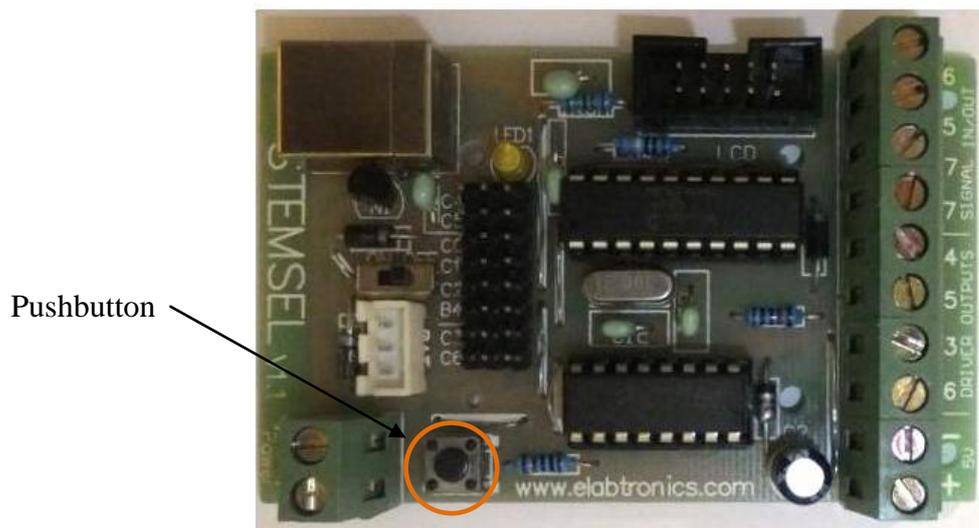
Hardware

- ezSystem STEMSEL Inventors Kit consisting of:
 - STEMSEL (PIC18F14K50) Controller Board
 - USB cable
 - Battery Holder
 - Prewired Input / Output Circuit Pack
- 3x AA batteries (Alkaline or better, rechargeable are OK)
- Small flat head screwdriver

Notes on Using the STEMSEL controller board and ezSystem

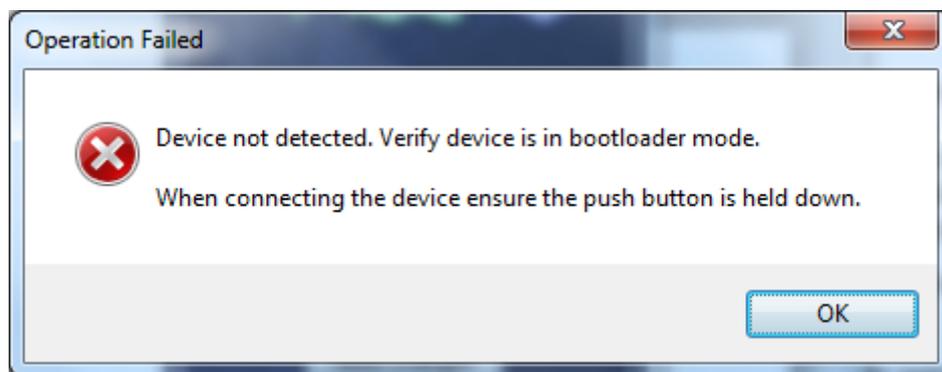
About sending programs to the STEMSEL controller board

The STEMSEL controller board can operate in two modes: Bootloader Mode used for programming the microchip, and Run Mode used to run that program, which is also the default mode. The mode is set each time power is supplied to the board, either by switching the ON/OFF switch near the battery connector to ON, or by connecting the STEMSEL controller board to a PC via the programming cable. In order to put the chip into Bootloader Mode, the pushbutton at the bottom of the STEMSEL controller board must be pressed while activating the STEMSEL controller board.



To program the STEMSEL controller board, it is recommended that you turn the power switch to OFF, then connect the cable while holding the pushbutton to enter bootloader mode. After programming is complete, remove the cable from the STEMSEL controller board and/or the PC, then turn the power switch to ON to enter Run Mode.

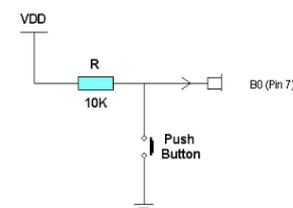
If you try to program the chip when it is in Run Mode, an error displaying “device not detected” will be displayed. If you see this, confirm the power switch is in the OFF position, and then try reconnecting the STEMSEL controller board to the computer, ensuring the pushbutton is held down while you do so.



Operation of the Push Button switch on STEMSEL Controller Board Figure A.1

The push button as shown in Figure A.1 connects pin 7 to “Ground” or zero volts when it is pressed. This Active Low circuit sets the signal to zero volts or OFF when it is pressed. This is why the decision icon in the program is selected as “IF Push_Button OFF” in the first project, Alarm System.

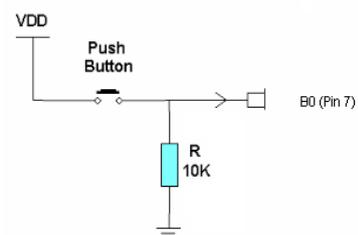
Active_Low



Most push button circuits are Active High. This means that the signal is ON when the push button is pressed. The push button on the STEMSEL controller board is Active Low because this type of circuit allows the push button on the STEMSEL controller board to be used as a RESET button.

Active Low circuits are used as they require fewer wires than an Active High circuit. Active Low circuit only need to be connected to ground. For this reason most switches in cars are Active Low as the cars chassis is grounded. Meaning that one connection of the switch can be connected directly to the cars body and only require the other connection connect to a controller. On the other hand an Active High switch would require two wires, one connecting to a power supply and another connecting to a controller. Therefore Active Low switches require fewer wires compared to Active High switches.

Active High



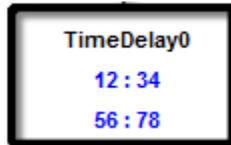
Notes about the TimeDelay icon

TimeDelay icons have labels written as aa:bb:cc:dd



where aa = minutes, bb = seconds, cc = hundredths (of a second) and dd = ten thousandth (of a second).

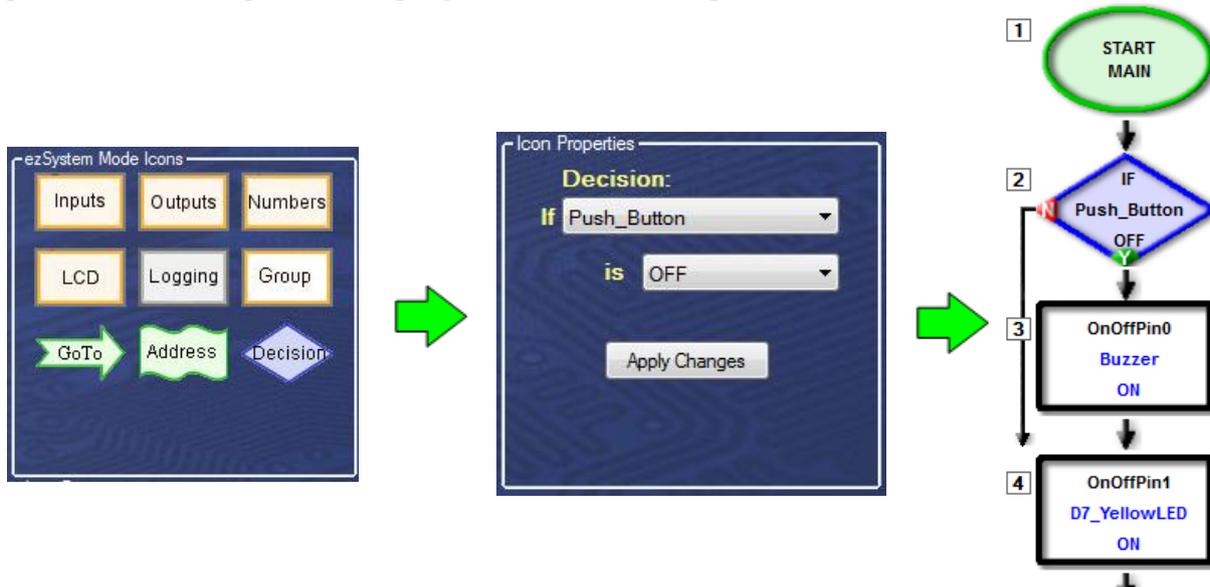
So for example:



This TimeDelay gives a time delay of 12 minutes 34 seconds 56 hundredths and 78 ten thousandth of a second. Or 12 minutes 34.5678 seconds

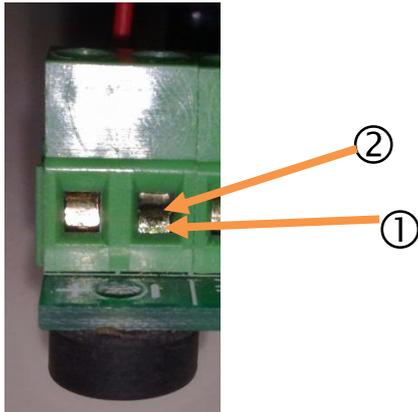
How the Decision icon works

The decision icon has two branches “Y” (yes) and “N” (no). The Push Button on the controller board gives an OFF when it is pressed. Looking at Figure 6.1 in this case, when the push button switch is pressed, the program will follow the path of the Green “Y”. If the push button is not pressed the program will follow the path of the Red “N” arrow.



IMPORTANT - The “No” decision can only skip one icon so if there is more than one icon to be skipped those icons must be formed in to a GROUP so they show up as a single icon.

How to connect the wires into the terminals



Turn the screw anti-clockwise until a gap appears above the metal plate ①, insert the wire between the metals at gap ② and then turn the screw clockwise to hold the wire.

Note:
If the wire is trapped beneath the metal plate, the connection might not be made.

Variables

In some of the projects we will use special numbers that are called variables since they can change. The easiest way to think of a variable is as a labelled box that can hold exactly one number. We can look in the box and check what the number is, and we can also change what number is in there but we have to throw away the old number first. So for example if we want to add one to the variable, the microchip looks in the box to see what number is in there, works out what the new number should be, then takes out the old number and puts the new number in instead.