CLD Exercise 11: Producer Consumer Step Sequencer Based on CSV Data

Objective

Develop a producer consumer step sequencer with a timer and the given application front panel (Figure 1). Use the `CLD 6 CSV file utility.vi` file from *CLD Exercise 6*.

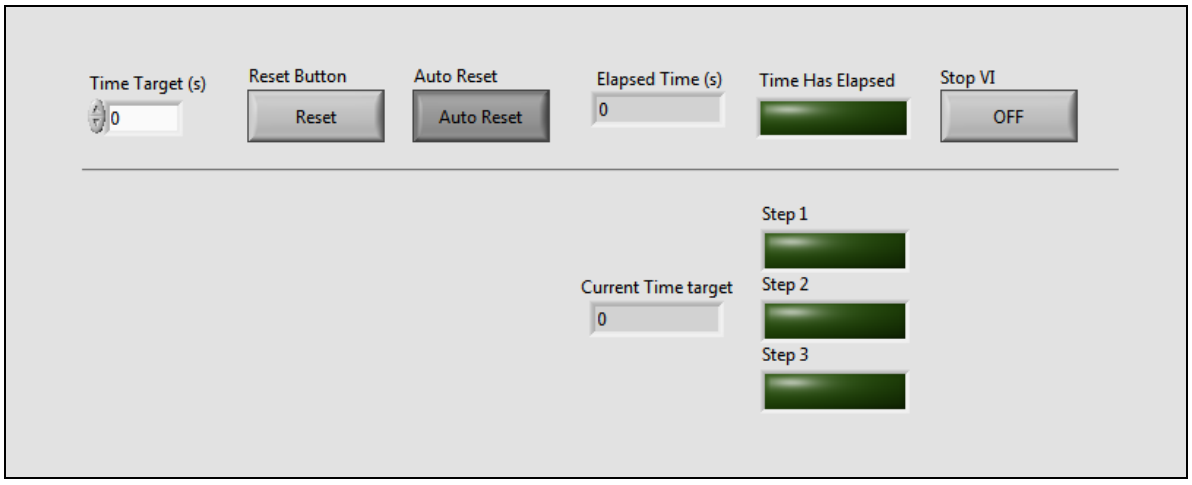

Figure 1. Application Front Panel

General Operation

The VI sequences three steps and the data file `CLD 11 CSV File.csv` to read step times and Boolean constants. The timer uses the time target for each step, and when that time is elapsed the application moves to the next step and begins a new time cycle. The application turns on the **Step** LEDs based on the step Boolean data. The timer must have Reset and Auto Reset functionality. The **Time Target** control overrides the step time constants when the time target is a positive non-zero number. The application only advances to the next step if the **Elapsed Time** is ON and the **Auto Reset** in ON.

Application Terminology

Data File

The file named `CLD 11 CSV File.csv`. This CSV file contains three rows of data that consist of a Step Time Target number, and three Boolean values. For this exercise, the Boolean ON/OFF values correspond to the sequence steps.

Reset

When the **Reset** button is pressed, the timer must start timing at zero and stay on the same step.

Elapsed Time

This indicator must continuously display the elapsed time in seconds.

Step

The **Step** LEDs are turned ON/OFF according to the values loaded form the data file in order to indicate the current step.

Current Time Target

The time, in seconds, for the current step. Not to be confused with the control **Time Target**.

The Step Time for each step is as follows, loaded from the data file:

Step	Step Time
1	5 sec
2	4 sec
3	3 sec

Table 1. Step Time Table

Time Target

The time in seconds used for the timer. If the value is positive then step times are overridden by the **Time Target**. While this value is zero or negative, the timer uses the Step Time Table (Table 1). The **Current Time Target** is displayed on the front panel.

Time Has Elapsed

This indicator turns ON when the time has expired. It is OFF whenever the time has not yet elapsed**.**

Auto Reset

The default value for the **Auto Reset** button is ON. When the **Auto Reset** button is ON and the time has elapsed, the sequencer progresses to the next step and the timer begins a new timing cycle.

When the **Auto Reset** button is OFF, and the time has elapsed, the timer must continue to count elapsed time, keep the **Time Has Elapsed** indicator ON, and not progress to the next step.

Stop VI

Stops the application on the current cycle.

Initialization

The application must initialize as shown in Figure 1, and the front panel controls and indicators must be in the following steps.

- **Time Target:** Set to 0 seconds
- **Auto Reset:** Set to ON
- **Reset:** Set to OFF
- **Step:** All set to OFF

Operation

VI Run

When started, the VI begins timing and display the **Elapsed Time**. The initial time target is the value of the first step in the Step Time Target Table. The VI traverses the steps in order, for the duration of the target time for each step.

When the **Time Target** is reached, the **Time Has Elapsed** LED must turn on.

If the **Auto Reset** is ON:

- The **Time Has Elapsed** LED turns ON
- The sequencer moves to the next step
- The **Step** LEDs change
- The timer must reset to zero and begin counting up
- The **Time Has Elapsed** LED turns OFF

If the **Auto Reset** is OFF:

- The **Time Has Elapsed** LED turns ON
- The sequencer does not move to the next step
- The timer continues counting up

Auto Reset

When the **Auto Reset** button is pressed, the application must immediately respond.

- If the **Time Has Elapsed** is OFF the application must continue operation regardless if the **Auto Reset** is on or off.
- If the **Auto Reset** is changed to ON while the **Time Has Elapsed** is ON, the sequencer advances one step and begins a new timing cycle.
- If the **Auto Reset** is changed to OFF while the **Time Has Elapsed** is ON, the timer must continue operation with the time elapsed.

Reset

Pressing the **Reset** button restarts the timing cycle from zero. **Reset** does not cause the sequencer to advance a step.

Set Time Target

Changing the **Time Target** to a positive number immediately substitutes its value for the current Step Time Target.

Changing the **Time Target** from a positive number to zero or a negative number immediately changes the timer to the current steps Time Target constant.