

SISTEMI EMBEDDED

AA 2013/2014

Programming the DE2 Basic Computer:
playing with parallel ports

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Putting into practice (2a)

- Write a program that turns on a single green led among LEDG7-LEDG0 and makes the position of the on-LED rotate with a period of around 500 ms. Make the activation and direction of the rotation controllable by the pushbuttons KEY3-KEY1, as follows:
 - KEY2 stops rotation, KEY3 and KEY1 activate rotation clockwise and counterclockwise respectively
 - The program must be sensitive to the edges originated by the pressure of the pushbuttons KEY3-KEY1

Putting into practice (2b)

- Hints:
 - Recognize pushbutton activations through the EVENT register of the relevant Parallel Port
 - Store the LEDG7-LEDG0 status on a 8-bit unsigned variable
 - Use <<, >> for left and right rotation (be careful to manage the all-zero situation)
 - Use a finite state machine (Moore model) to:
 - update the rotation state according to the KEY3-KEY1 events
 - generate the new LEDG7-LEDG0 status through a *switch* instruction that scans the rotation state

Putting into practice (2c)

- Hints:
 - Use the *Wait_ms()* function to generate the rotation period

```
/* delay generation */
#define CYCLES_PER_MS 254
/* value hand tuned to achieve around 1 ms resolution
 * for DE2 Basic Computer (code optimization OFF)
 */
void Wait_ms(unsigned int time_ms) {
    int i,j;
        for(j=0; j<time_ms; j++) {
            for(i=0; i<CYCLES_PER_MS; i++) {;}
        }
}
```

- What does it happen if the LEDG7-LEDG0 status is stored in a signed variable?

Putting into practice (3)

- **Fast click game:**

- Detect which of KEY1 and KEY3 is pressed first after the turning on of one of the GREEN LEDS
- Make the interval time between two consecutive switching on of the LED random
- Make also the GREEN LED position random
- Signal which KEY has been pressed first using two different RED LEDS
- Display the number of times KEY3 has been pressed first on HEX3-HEX2 and KEY1 on HEX1-HEX0
- Use one SLIDER to start/stop the game and reset the scoring

Putting into practice (3a)

- **Week day**

- Show on GREEN LEDS 6..0 the day of the week of an arbitrary date after 1582 (Gregorian calendar). The date (day month year) is set using KEY3..1 and displayed on the 7-seg displays present on DE boards
- Use KEY3 to move circularly from day to month to year and KEY2 and KEY1 to change the selected digit of the date
- Use the RED LEDs below the corresponding 7-seg to indicate the selected digit

Putting into practice (3b)

- **Week day**

- How this task can be implemented in a C++ program for a PC using standard I/O:

```
// gionosett.cpp
#include <iostream>
using namespace std;
int main(){
    int giorno, mese, anno, sett;
    cout << " Scrivi una data nel formato giorno mese anno\n";
    cin >> giorno >> mese >> anno;
    if (mese <= 2) {
        sett = (anno+31*(mese-1)+giorno+(anno-1)/4-3*((anno+99)/100)/
4)%7; }
    else {
        sett = (anno+31*(mese-1)+giorno-(4*mese+23)/10+anno/4-
(3*(anno/100+1)/4))%7; }
    // ...
```

Putting into practice (3c)

- **Week day**

- How a C++ program for a PC using standard I/O streams looks like:

```
cout << "Il giorno " << giorno << '/' << mese << '/' << anno << " cade di  
";  
    switch(sett) {  
        case 0: cout << "sabato\n"; break;  
        case 1: cout << "domenica\n"; break;  
        case 2: cout << "lunedì\n"; break;  
        case 3: cout << "martedì\n"; break;  
        case 4: cout << "mercoledì\n"; break;  
        case 5: cout << "giovedì\n"; break;  
        case 6: cout << "venerdì\n"; break;  
    }
```