

## Lemon counter

*Digital electronic II*

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### Introduction

A farm in which Tahiti lemons are grown intends to start with the sale of this product in one-kilo packages, taking into account that each kilo of lemon contains an approximate amount of 10 lemons, a device is required which believes a count to know how many lemons are packed per kilo and thus not have losses.

In order to give a solution to this problem, **the PIC16F15244 Curiosity Nano** will be used in order to perform a count of units and packages, and with that to have better control over production.

### Objetive

- Design the prototype of the system using the PIC16F15244 Curiosity Nano.
- Implement algorithms that allow optimal control of the system.
- Experimentally validate the operation of the system.

### Materials

- PIC16F15244 Curiosity Nano
- Display LCD 16x2.
- Sensor TCRT5000 (Infrared).
- Potentiometer 50k ohm
- Jumpers
- Switch
- Resistors

### Metodología

1. Understand and learn to relate the necessary materials with the microcontroller, switches, sensors, screens, etc.
2. Gradually apply this knowledge both to start the code and the mechanical part of the device, and likewise assimilate all the variants that we can find. One of them has been how to connect the sensors and the LCD
3. Create a small prototype, in order to be able to carry out small tests, and to perfect, analyze and create if

necessary new solution options,  
starting from the main objectives.

4. After applying all of the above, start assembling the circuit and final assembly in order to carry out the last functional tests.
5. Create a small prototype, in order to be able to carry out small tests, and to perfect, analyze and create if necessary new solution options, starting from the main objectives set.

## Resultados

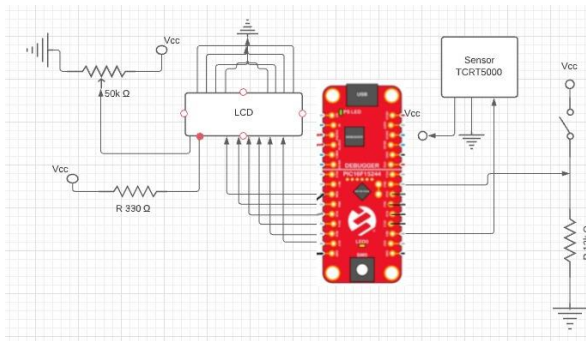


Fig 1: schematic diagram

For the LCD, lemons and bales are projected on the screen, the lemons represent the amount of lemons that are being counted, and the bales represent a number of lemons stored, in this case for every 10 lemons, 1 paca is accumulated



Fig 2: LCD

Through the infrared receiver sensor (TCR15000) which is what detects when a lemon has passed.

And to reset the count of lemons and bales, we use a push button that resets the count.

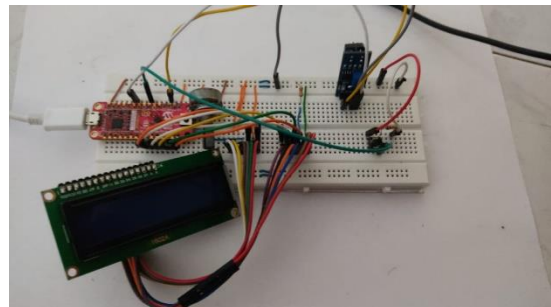


Fig 3: final circuit assembled

Regarding the code for the meter, to define the ports that are the sensor and the Switch we assign them to the analog inputs of the pic 16f15244.

```
#define S1 PORTBbits.RB5 //Sensor
#define SW1 PORTAbits.RA1 // Switch
```

Fig 4: definition of inputs

For the counter code, first the variables to be used are initialized and in an if the sensor is called, which is defined as S1 where it is set to 1, since if we set it to 0 the counter would work the other way around, and it is needed that adds up when the sensor detects the passage of a lemon.

Then another if is placed than what you do by calling the sensor again and this setting it to 0, the counter variable is set and we make it add up to 1 and we print on the lcd so that 1 is added.

```
int contador;
int paca;
int pulsador;

void main(void)
{
    PIN_MANAGER_Initialize();
    LATAbits.LATA2=1;

    Lcd_Init();
    Lcd_Cmd(LCD_CURSOR_OFF);
    __delay_ms(1000);
    while(1){
        if(S1==1){
            __delay_ms(20);
        }
        if(S1==0){
            contador++;
            sprintf(CONT, "Limones %d", contador);
            Lcd_Out2(1,2,CONT);
            __delay_ms(1000);
        }
    }
}
```

Figur 5: Counter code.

For the Switch inside the if we set the variables to 0, we clean the LCD and print lemons and pacas at 0

```
if(SW1==0){
    __delay_ms(20);
}
if(SW1 ==1){

    contador =0;
    paca =0;
    Lcd_Cmd(LCD_CLEAR);
    Lcd_Out(1,2, "Limones 0");
    Lcd_Out(2,2, "pacas 0");
    __delay_ms(2000);
}
}
```

Fig 6:Codigo pulsador

## Conclusions

- It was a different way of working since we not only needed to work with basic tools (led resistors, transistors, etc.) but also with microcontrollers.
- We learned how to program in c language how to use pic 16f15244 for the elaboration of projects and thus be able to use it more easily in the future.
- There were difficulties when implementing the LCD as there are not many libraries for this pic and it was time to make modifications to make it work.

## References

- <http://ww1.microchip.com/downloads/en/DeviceDoc/PIC16F15244-Curiosity-Nano-Hardware-User-Guide-DS50003045A.pdf>

- <http://ww1.microchip.com/downloads/en/devicedoc/50002053g.pdf>
- <http://ww1.microchip.com/downloads/en/DeviceDoc/PIC16F15213-14-23-24-43-44-Data-Sheet-DS40002195B.pdf>