GAUGING COUNTER

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Abstract - This report presents the analysis and development of a device capable of counting the number of people in a facility. Making use of the C programming learned throughout the course of Digital Electronics II being applied to the PIC16F15244. Photoresistors and lasers are used to detect the passage of people either when they leave or enter the establishment, it should be noted that the project "capacity counter" was programmed thanks to the MPLABX tool.

I.OBJECTIVES

General objective:

- To develop a device capable of maintaining the capacity of an establishment at a desired level.

Specific objectives:

•Select the optimal construction for the elaboration of the same.

•Indicate how many people are in an establishment in real time.

•Display visual and auditory cues that assist and indicate the percentage of people on site.

II. INTRODUCTION

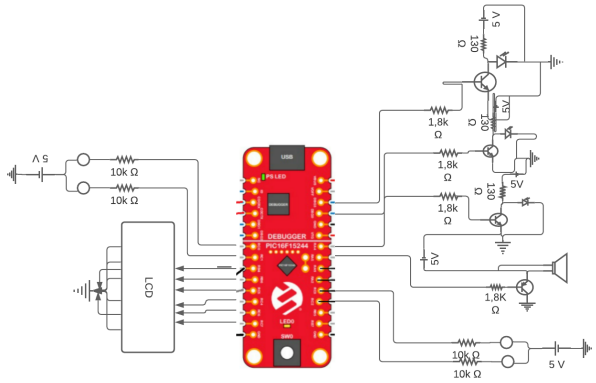
The capacity counter is a device which will allow the improvement of crowd controls, giving signals when the establishment reaches certain percentages of occupancy, for example "Entry allowed" this message responds when the capacity of the establishment is below 50% occupancy, "Caution, capacity exceeds half" this will be what will be displayed on the LCD when exceeding 50% occupancy and finally "Prohibited, full place" when the capacity of people is 100% occupied, each percentage will have visual signals apart from the LCD, for example, three LEDs will be implemented for this, the first will be the green LED responding simultaneously with the first message that is planned to display, the second LED that is implemented is an orange or yellow LED to indicate that the capacity is subtracting 50% of the established, finally it makes use of a red LED which will indicate that the capacity is at its limit, However, it is also thought of the possibility that someone does not respect this type of warnings and wants to enter the establishment even being at maximum capacity, therefore in the design was implemented the use of a buzzer which will emit noise when the limit is exceeded.

III. Materials.

- PIC16F15244.
- Alarm buzzer.
- Led Red.
- Led Orange.
- Led green.
- LCD 16x2.

- Micro pushbutton 4 pins.
- 2N2222.
- Various resistors.

IV. Development.



fig,1, Conexiones del PIC.

In this part the safety of both the inputs and outputs of the PIC must be performed, it is necessary to ensure that the current and voltage passing through the inputs and / or outputs of the PIC does not affect it, for this the use of resistors and transistors is implemented. For this, LVK is applied, thus having the following expressions:

$$Re = \frac{Vcc-(VD+0{,}1)}{Icq} \quad (1)$$

$$Rb = \frac{Vcc-0{,}7}{Icq*10} \quad (2)$$

Taking these two equations into account, and replacing values we have that:

Led Red:

Re= 120Ω y Rb= 1720Ω

In commercial resistors it is possible to make use of:
120Ω y 1,8kΩ

Led Green:

Re= 112Ω y 1720Ω

Making use of commercial securities:

Re = 120Ω y Rb = 1,8KΩ

Led orange:

Re= 116Ω y Rb = 1720Ω

Commercial resistors:

Re= 120Ω y Rb = 1,8KΩ

Finally for the Buzzer:

Rb=1720Ω

Making use of commercial resistors:

Rb = 1,8KΩ

At the beginning of the project it was proposed to make use of laser photoresistors, however when calculating the possible cases in which the device will not work, it was thought about the confusion of objects with people, that two people will pass at the same time, animals that also manage to confuse the laser, for these and more reasons it was decided to design out that people make their entry record when entering by pressing a button and the exit by pressing the other one.

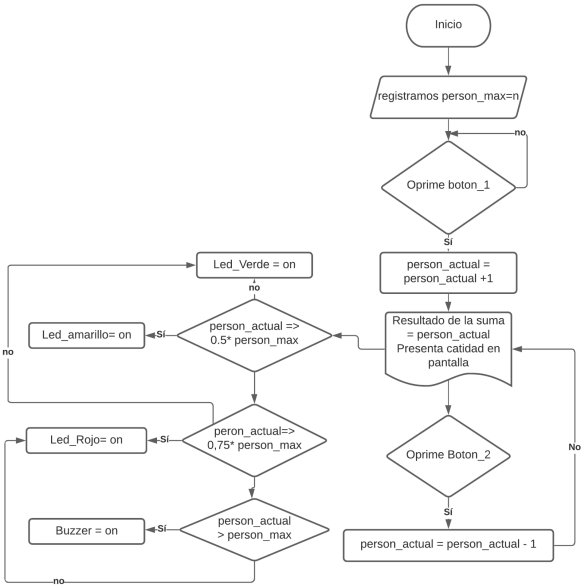


Diagram.1, State Diagram

Analyzing the Diagram.1 we can observe the changes that the project and its functions will present, when button 1 is pressed it will make a change in the value of the current people increasing the number of record that will be displayed by the LCD, but if button 2 is pressed what will happen is that it will reduce the number of current people, it should be noted that this value will not be below 0, now well, the LEDs have the function of giving certain warnings which will be noticed according to the percentage of capacity, if the percentage is less than 50% the green led will be active, however if it is greater than 50% but less than 75% will be the orange led which will be activated, in the interval of 75% and 100% will unleash the red led, finally, to prevent people from violating the limit agreed to locate a buzzer which when exceeding the maximum number of people will make an annoying noise as a warning.

V. Results

For the verification of the code and its functionality, the use of the MPLBX code reader/simulator is implemented.

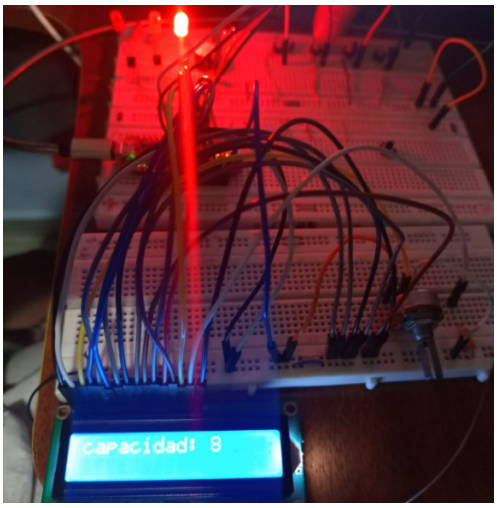


fig.2, Assembled circuit

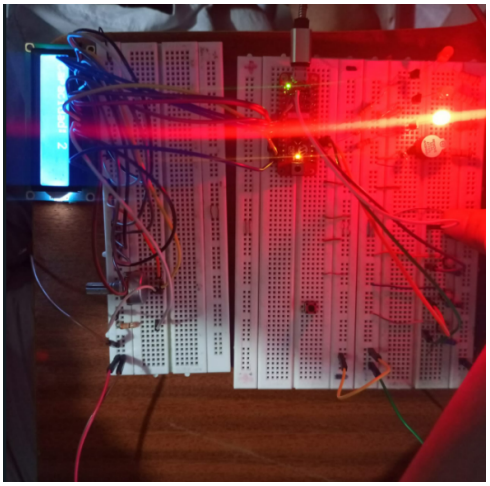


fig.3, Assembled circuit

However the assembly of the proposed circuit was made in protoboard, since, The PIC is quite new therefore it was decided to mount, now well, as it is observed in the fig.2 the leds respond each one to the current and voltage of the transistors, followed by a buzzer to which we previously highlighted its function, now well, as seen in the image is made use of four buttons, two of these will respond to increase and

decrease the maximum number of people allowed in the establishment, taking this into account, the other two buttons that accompany are used for people to register their exit and entry to the establishment, it is planned that people make their mandatory registration, you will notice this device because it is intended to put accompanying the alcohol that is always in the establishments.

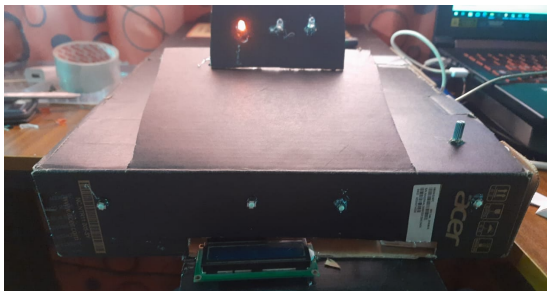


Fig.4 Operations warnings.

```
while(1){
    if(PORTCbits.RC0 == 0){
       per_max=per_max+2;      //aumentar la cantidad maxima
       __delay_ms(100);
       mostrargenmax();
    }
    else if(PORTCbits.RC1 == 0){
        per_max=per_max-2;       //disminuir la cantidad maxima
        __delay_ms(100);
        mostrargenmax();
    }
```

Fig5, Maximum quantity setting.

In this code fragment, as shown in Fig. 4, we propose the growth of the variable "person_max" affected by "person_maxsum" which causes a variation of two in this quantity, while "person_maxres" is in charge of subtracting the accumulated quantity by two.

```
    }
    else if(PORTCbits.RC3 == 0){
    cantidad=cantidad+1;      //sensor 1 lee que entro alguien
    __delay_ms(500);
    mostrarcantidad();
      apagarsalidas();
}
else if(PORTCbits.RC2 == 0){
    cantidad=cantidad-1;     //senson 2 lee que salio alguien
    __delay_ms(500);
    mostrarcantidad();
      apagarsalidas();
}
```

Fig6 Adjustment of persons admitted.

However, in the case of these lines of code, although they are similar to those in Fig. 4, we can emphasize that these variables do not affect the maximum number of people allowed, but rather cause a variation in the number of people in the establishment.

```
mitad=0,5*persomax; //el porcentaje de la mitad de personas
apagar_led_verde;
apagar_led_naranja;
apagar_led_rojo;

while (mitad>contadoperso)
{
  encender_led_verde;
   __delay_ms(1000);
   mitad=0,5*persomax;      //volver a evaluar para salir
}

while (mitad <=contadoperso <persomax)
{
   apagar_led_verde;
   encender_led_naranja;
   __delay_ms(1000);
  mitad=0,5*persomax;       //volver a evaluar para salir
}
while (contadoperso=persomax)
{
  apagar_led_naranja;
  encender_led_rojo;
   __delay_ms(1000);
 mitad=0,5*persomax;        //volver a evaluar para salir
}
  while (contadoperso>persomax){

  encender_alarma;
   __delay_ms(1000);
 mitad=0,5*persomax;        //volver a evaluar para salir
}

}
```

Fig7 Operations warnings.

Fig. 6 shows the functions that each LED and the buzzer must fulfill, so that when applying the functions previously dictated by the pushbuttons, we will have light and sound signals.

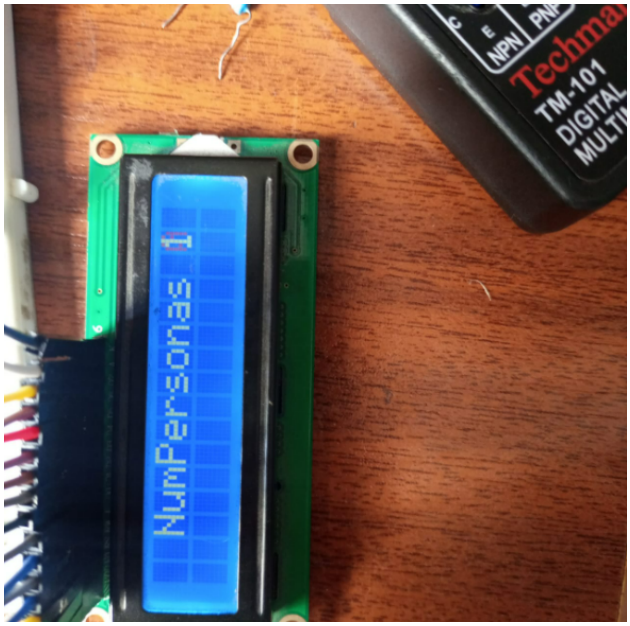


Fig.8 Operations warnings.

Fig. 7 shows the proper functioning of the LCD used.

IV.Conclusiones

- MPLAB's development and compiler allow the creation of code in C language and simulate step-by-step instructions, making programming easier in the detection of error moments.
- The instrumentation can be optimized by adjusting more professional sensors and including more, perhaps, sensors that detect the proximity of people and/or cameras for image programming and that in turn differentiate people from animals or objects.
- When assembling the circuit, it is quite difficult because, not having a simulation like the ones that can be done in proteus, it is necessary to experiment with the assembly itself, causing damage to the components, delays, etc.