Automatic Railway Crossing Control

1906A061 Muhammet Tarık Erkan Yıldız

1706A022 Selin Mina Kütük

***Abstract*—This report is about the integrated system which based on the relative position of the train. Project is made for usage of PIC16F877A microcontroller mainly and also Lcd,Buzzer,several leds and ınfrared sensors.**

Keywords—PIC16F877A , Lcd ,Ir sensor ,CCS C, Proteus, Servo Motor

I. INTRODUCTION

In our design purpose in this project; mainly design railway crossing system mainly focus on the gate which movements' is based on the Train's relative position with respect to the gate.

In addition to this, generally train stations have information instruments like displays,lights and also informative announcements so people can be informed about the timing and position of the train Therefore Train station which has railway crossing systems needs these primary features to maintain effective and safe usage.

We modelled the railway crossing system with utilize Lcd display for announcement screen, Leds for traffic light, Buzzer and Infrared sensors.

Project consist of

- 2 Infrared Sensors HW-201
- Servo Motor
- Red,Yellow,Green Leds
- Breadbords,Jumpers
- PIC16F877A
- 2x16 Lcd Display
- Buzzer

If train is approaching to the gate then control system will perform their task, and immediately gate will close and with respect to these signal Lcd and buzzer started to make their specified duties. and However, most important aim is control the gate position with utilize of servo motor.

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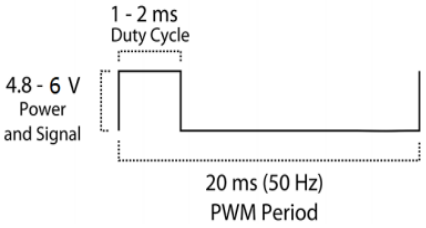
II. DESIGN ELEMENTS AND THEIR DUTIES

A. Servo motor

We select Servo motor to get more precise results They only require +5 V, ground, and an input signal.

We can control servo motors with using PWM. From datasheet we can get the duty cycles for arranging the position of motor. In this project we select **MG90** because it has fair cost and more reliable than the hobby servos (sg90). We know that from data sheet of MG90 our PWM period should be 20ms an controlling the position of motor we should arrange duty cycle 1-2 ms.



B. Infrared Sensors

An infrared (IR) sensor is an electronic device that measures and detects infrared radiation in its surrounding environment. In this Project we use HW-201.It works at 5V and it can measure 2-30 cm analogly it arranges with our hand . As working process of this device it always sends to pic high value until it faces a surface or material and it send low value to the pic.

C. Lcd

To show graphical data we use Lcd. İts connected to PortD and also it is brighteness is controlled by the potentiometer.

D. Led

Led's duties is that act like a traffic light to inform the gate passenger.

E Speaker

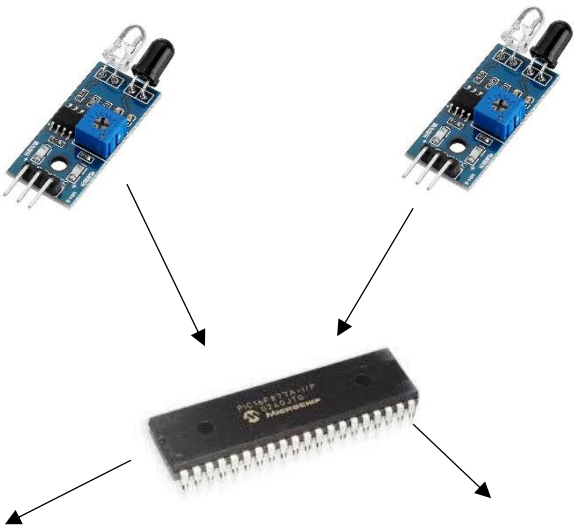
As making warning for the driver who is trying to pass the railway. We want just give warning before train pass from crossing point. To use that first we use a simple buzzer.However buzzer noice would not be satisfied for us so we decided to use 0.5 W Speaker. In order to use that component , we try to use “tones.c” library.

Firstly, “we took happy new year “ song,’s notes from internet. Then, We build an array for Frequencies and duration for each note and we play it orderly.

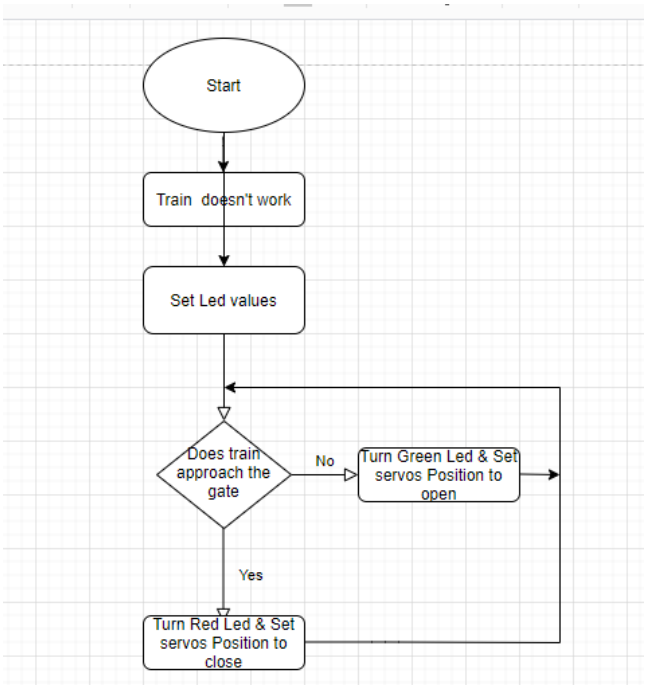
Moreover, to increase the voice of speaker we just want to use opamp as an amplifer but due to very small output impedance it drains a lot of current. Thus, we could not feed servo, pic and opamp at the same time and we decided to not use amplifier for our circuit but better conditions it should work.

E. Pic16f877A

III. System Working Procedure SEnsors



IV. Code Logic



V. CCS C Codes

```
#include <16F877A.h>

#use delay(clock=20000000)
#include<lcd.c>//Add Lcd Library
#include <tones.c>//Add tones library to play any song
#define SIZE 25

#FUSES NOWDT                    //No Watch Dog Timer
#FUSES NOBROWNOUT               //No brownout reset
#FUSES NOLVP                    //No low voltage prgming, B3(PIC16) or B5(PIC18) used for I/O
#FUSES NOPUT                    //No Power Up Timer
#FUSES NOCPD                    //No EE protection
#FUSES NOWRT                    //Program memory not write protected
#FUSES NOPROTECT                //Code not protected from reading
#FUSES NODEBUG
#define  servo PIN_B4           //Define servo pin

//Define necessary functions
int i;
void servo_close(); //Servo close Function
void servo_open();//Servo open Function
void play();//For playing the 'happy new year song'
```

```
const struct note
{
   long tone;
   long length;
} happy_bday[SIZE] = {
E_note[1],250, E_note[1],250, E_note[1],500, E_note[1],500, E_note[1],250, E_note[1],250,
E_note[1],500, G_note[1],250, C_note[1],250, D_note[1],250, E_note[1],1000, F_note[1],250,
F_note[1],250, F_note[1],250, F_note[1],250, F_note[0],250, E_note[1],250, E_note[1],250, E_note[1],250,
E_note[1],250, D_note[1],250, D_note[1],250, E_note[1],250, D_note[1],250,G_note[1],500};
```

```
void play(void)
{
   int i;

   while(1)
   {

        for(i=0; i<SIZE; ++i)
      {

         generate_tone(happy_bday[i].tone,happy_bday[i].length);
         delay_ms(5);
         if(input(pin_c3)==0)   ////When train comes song play until c3 pin detects 1
                               //so it means train goes so we'll exit the play function
      {
      break;
      }
      }
       if(input(pin_c3)==0)
      {
      break;
      }

   }
}
```

```
void servo_open()
{

printf(lcd_putc,"\fTren Gidiyor\nGecebilirsiniz");//We write Lcd a text
delay_ms(10);//Delay for make system more stable working
output_high(pin_b2);//we make Green led high and others low
output_low(pin_b1);
output_low(pin_b3);
output_high(servo);//We set the servos position zero so close the door
delay_ms(1);//-90 degree opened
output_low(servo);
delay_ms(19);

}
```

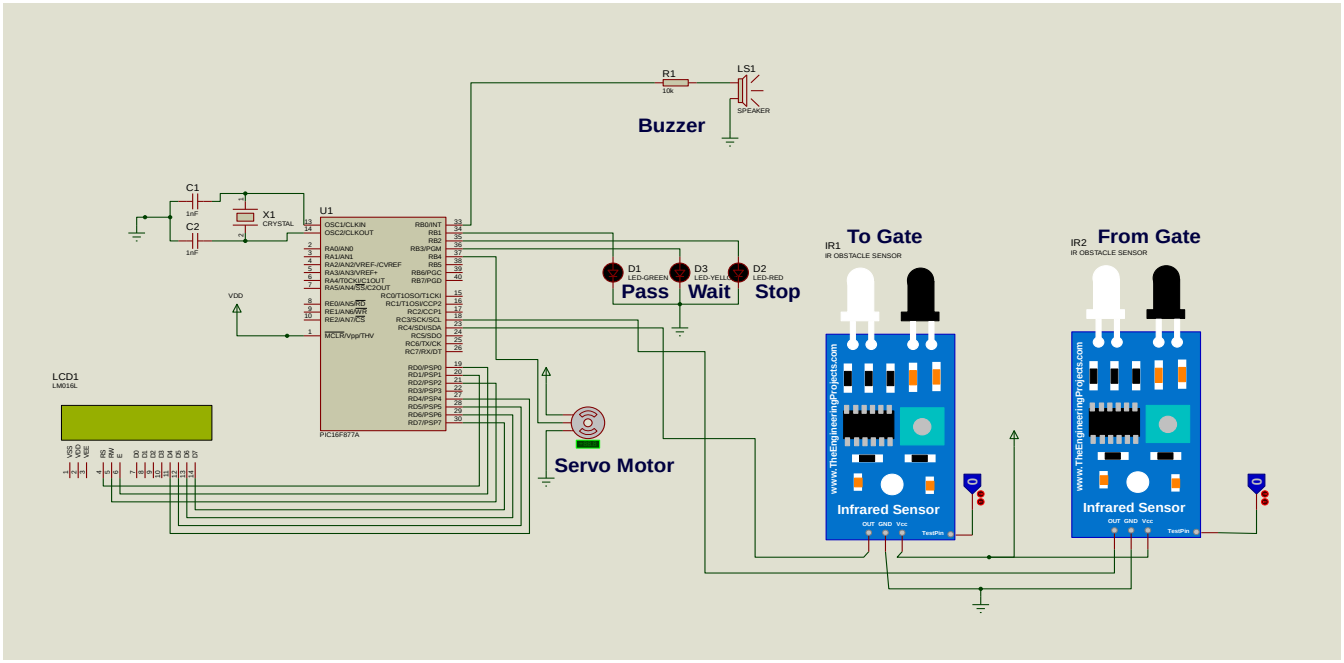
```
void servo_close()
{
printf(lcd_putc,"\fTren Geliyor\nDurunuz");//We write Lcd a text
delay_ms(10);
output_high(pin_b1);//we make Red led high and others low
output_low(pin_b2);
output_low(pin_b3);
   for(i=0;i<50;i++)//It's written to ensure the
                    //maintain the gate position exactly
                    //so we write it in a for loop
   {
output_high(servo);
delay_us(1500);//0 degree closed
output_low(servo);
```

```
void main()
{
 int y=5;//initial value

   set_tris_d(0x00);//Make D port output,Lcd give output because
   set_tris_b(0x00);//Make B port output
   set_tris_c(0xFF);//Make C port input,Infrared sensor give the logic state of experiment
   output_d(0x00);//Clear the output
   output_b(0x00);//Clear the output
   lcd_init();

   output_low(pin_b1);//Without any detection,Our system will be in waitin position se make Yellow led high and others low
   output_low(pin_b2);
   output_high(pin_b3);
   while(TRUE)
   {
//Important point when sensros detect object it sends '0' not 1
      if(input(pin_c3)==1 && input(pin_c4)==1){//If there 1 and 1 so any object detected
         output_low(pin_b1);//Yellow red High
         output_low(pin_b2);
         output_high(pin_b3);
         if(y==1) printf(lcd_putc,"\fTren Gidiyor\nGecebilirsiniz");
         if(y==0) printf(lcd_putc,"\fTren Geliyor\nDurunuz");
         }
         if(input(pin_c3)==1 && input(pin_c4)==0){//c4==0 so it detects the object
            y=0;
            servo_close();//when gate is closed Happy New year play
            play();}//Call play function to get to know train is coming
         if(input(pin_c4)==1 && input(pin_c3)==0){//c3==0 so it detects the object
            y=1;
            servo_open();}}}//Call servo_open
```

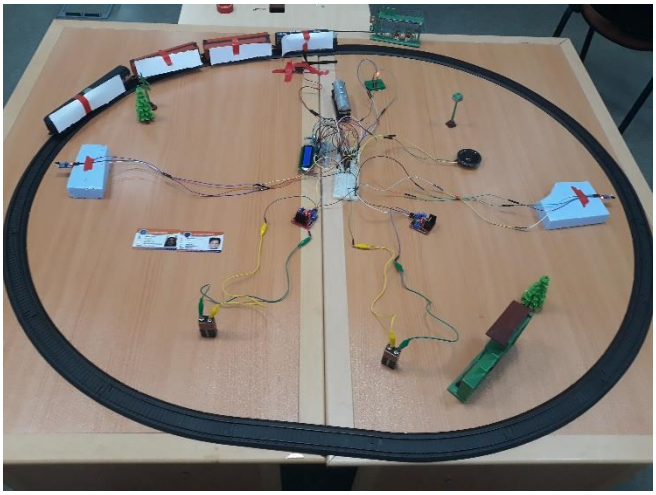
VI. SCHEMATIC ON PROTEUS

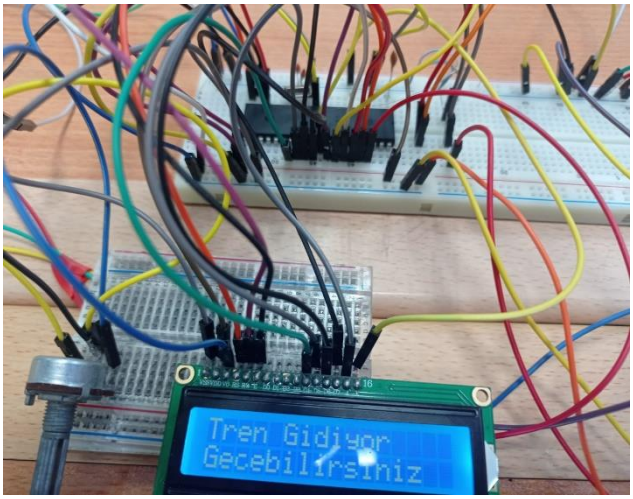


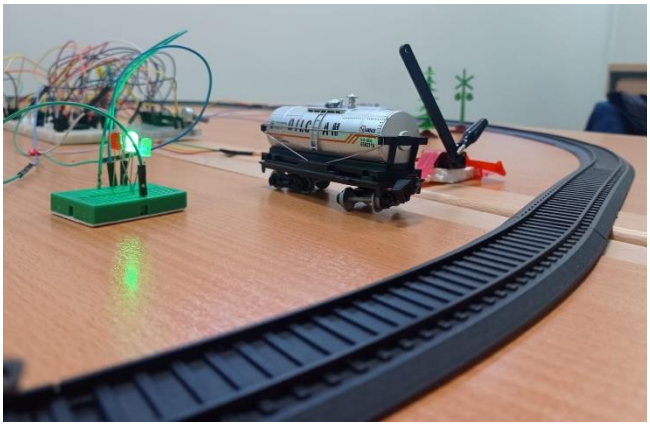
REALIZATION

First of all connected to ınfrared sensors oppositely to breadboard,then we merge servo and lcd , leds to breadbord. We supply the circuit with 9V battery. Main reason is buzzer and servo pull relatively high current so there is some fluctuations in the servo so we decided to supply circuit with 2 battery . Also L298N motor driver can convert up to 12V input signals to 5V output signal so 9V which is given by the battery can be reduced to 5 V .

After setting up the circuit , all systems work correctly and they performed their spesific duties wthout any problem.

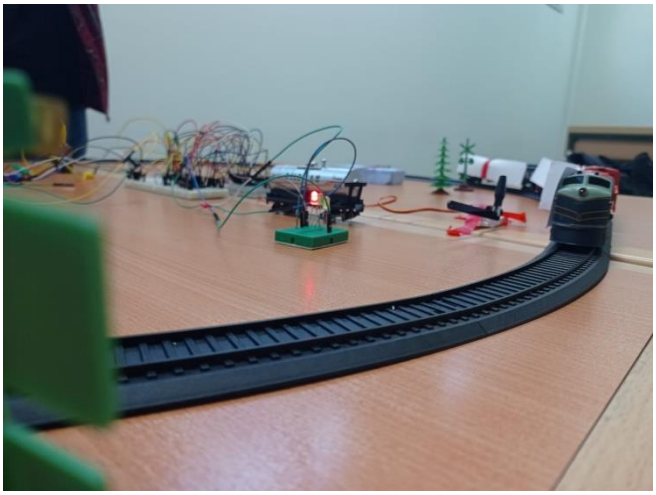






With the achieving this task, we had to have a basic understanding of analog and digital electronics their working conditions and also have esemtial eperience to use Proteus,CCS C programming and also happens logic of a system with profit by flowcharts.

Taking into account all aspects of this project, we comprehend the capability of PIC16F877A and also communication pic between other peripherals



VIII. REFERENCES

Lecture Notes

https://minatechnologysupport.blogspot.com/2019/08/ir-sensor-interfacing-with.html

VII. CONCLUSION

This railway crossing control is highly benedicial due to it created a good chance to merge our theoretical knowledge to real life experience. As the project of ‘Microprocessors and Programming’, the primary goal of this project is the have understanding the the basics of microprocessors and microcontrollers and their architecture, software and connect all these information to make a solution and realization of real life problems and duties.