Faculty of Computer Science and Engineering

CSEN 701

Embedded Systems

Project

By:

Name: Ahmed Yasser Elgohary Hanafy

ID: 43-2906

Tutorial: T-21

Name: Omar Emad Mahmoud Elbaroudy

ID: 43-2208

Tutorial: T-21

Name: Ahmed Medhat Abdelhamid

ID: 43-3052

Tutorial: T-18

Name: Omar Sameh Ali Abouhegaziah

ID: 43-1931

Tutorial: T-18

Name: Omar Hany Mohamed

ID: 43-5802

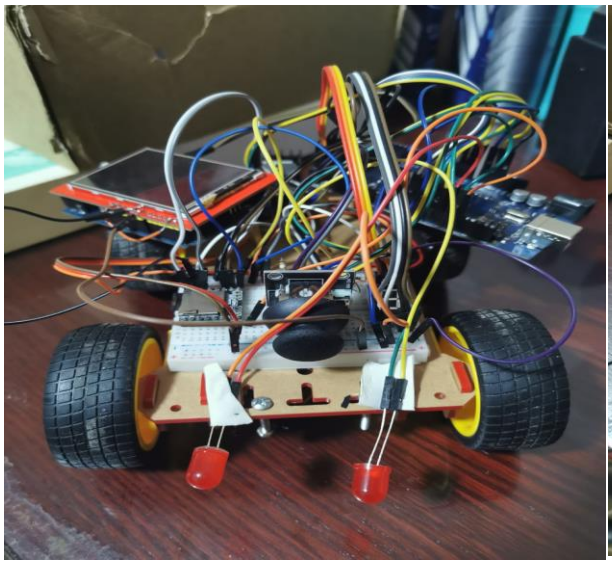
Tutorial: T-18

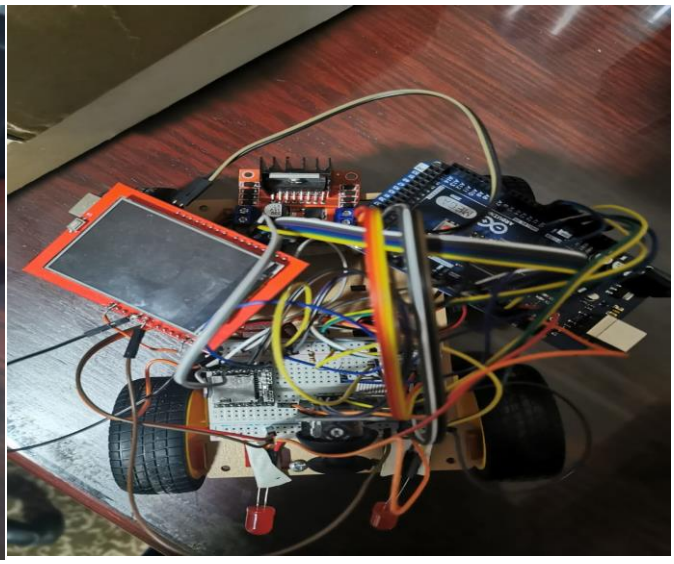
TABLE OF CONTENTS

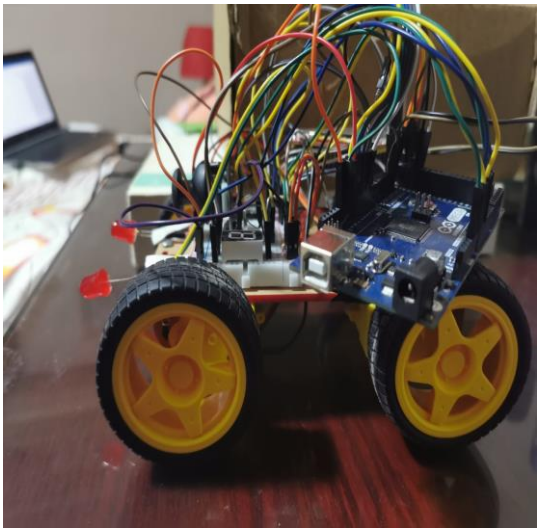
Brief description:

Every great car started with a prototype. In this report we are going to describe our car prototype which has a lot of features such as an mp3 player with a touch screen that control it, lane keeping assistance, auto adapting lights and a screen displaying the gearbox.

We are also going to tackle this prototype inputs, outputs, the prototype full circuit, the prototype's components and libraries, tasks and last but not least our team's contribution.





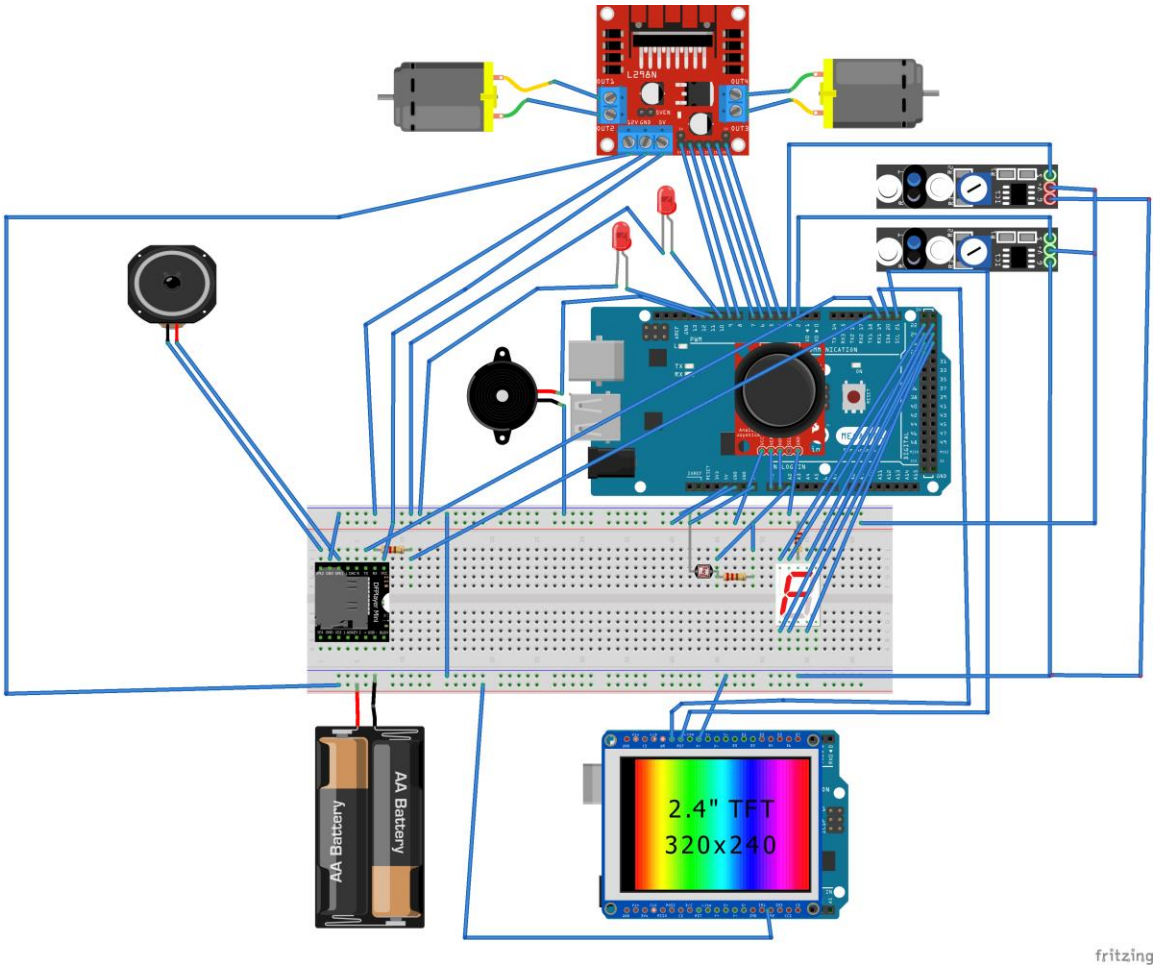


Components:

Component	Functionality	Number	Link	Price
Robot Kit	The car body including Dc motors	X1	https://ram-e-shop.com/product/ro-base-dg008/	275
Line Follower Sensor	To detect the line	X2	https://ram-e-shop.com/product/kit-line-track-x1/	30x2
Arduino Mega	Control all the tasks	X1	https://ram-e-shop.com/product/kit-arduino-mega2560/	250
Arduino Uno	Control the touchscreen	X1	https://ram-e-shop.com/product/kit-arduino-uno/	135
Joystick Module	Act as the gear box	X1	https://ram-e-shop.com/product/sf9032/	35
LDR sensor	Measure light intensity to control car lights	X2	https://ram-e-shop.com/product/ldr-mid-12mm/	7x2
LEDS 10mm	Act as the car lights	X1	https://ram-e-shop.com/product/led-pack-10mm/	30
LCD TFT 2.4 With Touch Screen	Touch screen to control the mp3	X1	https://ram-e-shop.com/product/kit-lcd-tft2-4-ts/	175
Motor Driver L298 module	Control the Dc motors	X1	https://ram-e-shop.com/product/kit-l298-red/	60
MP3 Player	Control the speakers and read the SD card	X1	https://ram-e-shop.com/product/kit-mp3-m87/	100

Seven Segment	Display the gear	X2	https://ram-e-shop.com/product/7s0-5a/	3.5x2
Female long pinheaders	connector	X10	https://ram-e-shop.com/product/ph50-1x8-female-long/	2.5x10
Long pinheaders	To replace the LCD pin headers in case needed	X10	https://ram-e-shop.com/product/ph10-1x40-male/	2.5x10
Male Male wires pack	connector	X2	https://ram-e-shop.com/product/ph61-mm-20cm/	22x2
Female Female wires pack	connector	X1	https://ram-e-shop.com/product/ph62-ff-20cm/	22
Female Male wires pack	connector	X1	https://ram-e-shop.com/product/ph60-mf-20cm/	22
Speaker	Play songs	X1	https://ram-e-shop.com/product/sp-mp4/	5
Lithium Rechargeable Battery 18650 / 3.7V	Supply power to the circuit	X4	https://ram-e-shop.com/product/battery-18650-1100/	3x35
Battery holder	Holds the battery	X2	https://ram-e-shop.com/product/battery-holder-18650x2/	2x8
buzzer	Alert when leaving the lane	X1	https://ram-e-shop.com/product/buzzar6v/	5
SD card	Store songs	X1	Bought offline	80
Total				1489LE

Full circuit:



Libraries:

Library	Functionality
DFRobotDFPlayerMini	Control the mp3 module
Wire	Perform the i2c communication between the main mega Arduino which the master and the uno Arduino which is the slave
TftSpfd5408	Control the TFT LCD visuals
TouchScreen	Control the TFT LCD touch
FreeRTOS	Schedule the tasks

Inputs:

Input	Handling
2 Track sensors	Connected to pin 2 and 3 in the Arduino mega and read digitally every loop
LDR circuit output	Connected to pin A2 and read as an analog signal
Joystick 2 outputs	Joystick outputs which are x and y coordinates are connected to A0 and A1 and read as an analog signal

Outputs:

Outputs	Configuration
2 motor enables	Connected to pwm pins 3 and 9
4 motor direction signals	Connected to pins from 4 to 8
Seven segments signals	Connected to pins from 22 to 28
2 LEDs signals	Connected to pins 10 and 11
Buzzer signal	Connected to pin 12

Tasks and prioritization:

Task	Priority and Description
Line following	Priority:1 Description: in this task, depending on what the 2 line follower sensors see, we control the movement of the car; if both sensors see white, we keep moving forward, and if the left sensor sees black while the right one sees white, the car turns left to return to lane, and if the opposite happens it turns right, and finally if both sensors see black the car break.
MP3	Priority:1 Description: in this task, we are able to control the mp3 player depending on the input coming to it from the lcd screen. We can either play, pause, play next song, play previous song, increase or decrease the volume. It receives the input from the touch screen as a character and we are able to know which operation to do using a condition
LDR	Priority:1 Description:in this task, we simply control the level of the light depending on how much light the ldr sees, and we have 3 different light intensities; off, low and high.
GearBox	Priority:1 Description:in this task, depending on the position (x,y) of the joystick we are able to control the 7 segment to display P,D,R and N.

We opted for continuous tasks which is why all the tasks share the same priority value which is 1.

Limitations:

Problem	How we solved it
The space on the car	We used the spacers to hang both arduinos and the other components underneath them like the hbridge module , the battery and the breadboard.
The problem of powering the UNO Arduino because of the shield put on it	We weld on the top of the vin pin and the ground pin of the shield a male male jumper and connected it to ground of the breadboard and the voltage source
The problem of interference between the i2c communication pin A4 and the reset of the TFT LCD	We cut the A4 pin header so that it is not connected to the Arduino and weld the top of it to a male male jumper and the other side of this jumper we weld it to the top of the reset pin of the Arduino on the sheild

Work division:

Team member	Rule
Omar Hany	Worked on the mp3 module, TFT LCD and the communication between the two arduinos
Ahmed Yasser	Worked on the mp3 module, TFT LCD and the communication between the two arduinos
Omar Sameh	Worked on the joystick and the line following
Ahmed Medhat	Worked on the joystick and the line following
Omar Baroudy	LDR module and the FreeRTOS