German University in Cairo
الجامعة الألمانية بالقاهرة

CSEN705lay

TEAM NUMBER: 24

TEAM MEMBERS:

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PROJECT DESCRIPTION:

Modern day vehicles come with various safety and entertainment features to make our lives better. In this project, we implemented these features using **two ARDUINO MEGA Boards** setting a suitable priority to each feature. We also developed this project using **Arduino C** alongside **FreeRTOS**.

Our project's main aim is to keep our car in its own lane and the car, of course, will prioritize staying in its own lane. For a variation of the safety components that we afforded and developed into the car. Firstly, front headlights that serve as the eyes of the car on the road. Secondly, a control indicator that shows the gear the car currently uses. There is no neglection to the entertainment features in the car, it offers the possibility to listen to the radio and choose between specific available radio stations.

PROJECT COMPONENTS:

From the wide accessible component options that was offered to us, our team decided to select the following components:

2x Arduino Mega 2560

2 Arduino Mega 2560 is a microcontroller that connects our FreeRTOS systems to our hardware implementations.

1x HW-095 Motor Driver

The motor driver connects the actual energy from the car to the Arduino Mega board, that is capable to make the car move.

1x Joystick Generic Module

We used this component to act as the gear for the car.

1x HC-05 Bluetooth Module

This component receives the data from an Android phone to control the radio channels.

1x LM393 LDR Sensor Module

This component is used to control the headlights and detect the actual light surrounding the car.

2x Green LED

Serving as the car's headlights in case of darkness.

1x Red LED

Works as an alert to the driver in case the Lane keeper sensors are in control.

2x KY-033 IR Sensor Module

The main sensors to keep the car in its own lane while moving.

1x TEA5767 FM Radio Module

The radio, works as the source of entertainment feature in the car.

1x Speaker

Outputs the sounds generated from the radio channels.

1x 7-Segment Anode Display

Outputs the type of gear generated from the joystick component.

3x 220 Ohm Resistor

We used these resistors to be able to display the outputs for the 7-Segment display, to serve the headlights and shine them, and for the driver alert LED display

4x DC Motors

The main motors of the car that ensures the movement of the wheels.

3x 3.7V Batteries

The energy generators, these batteries functions everything in the car.

1x Switch

A button whenever triggered the car turns on/off.

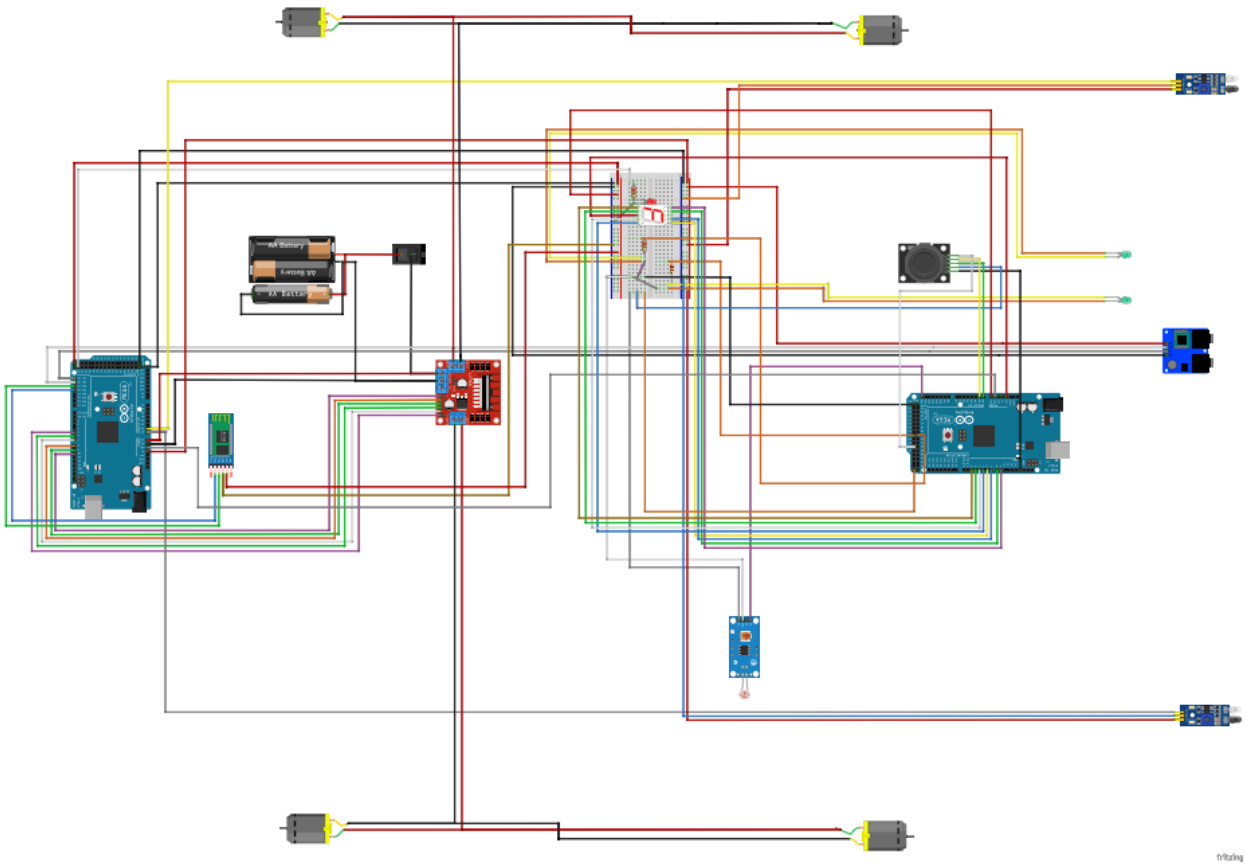
1x Breadboard

Gathers and connects the resistors, the LED light, the 7-Segment Display, and other wires that were used as jumper wires in order to connect two far components together.

30x Jumper Wires

The wires that connected everything together.

PROJECT CIRCUIT:



PROJECT LIBRARIES:

- ## FreeRTOS

  We called this library the FreeRTOS since it is the main system that runs all of the operations and codes in our car, it schedules the tasks based on their priorities and then to whatever commands the user gives to the car itself. It has all the connections to it i.e.: the gear, the radio, and the lane tracker etc.

- ## TEA5767

  A library fully focused on the radio, how its built and wired to our system. How to switch between channels and frequencies is more definite in this library.

PROJECT INPUTS:

In this project we tend to make everything easy for users to observe.

Our main sensors that keeps the car in its own lane.

The LDR sensor checks the levels of light that surrounds the car in order to shine the headlights in response to the brightness of any place the car is in.

To change gears, we added a joystick in which you can decide whether the car would be in drive, park, reverse, or normal mode.

We implemented an application in an android device that connects to the car via Bluetooth in order to decide which radio channels to listen to while driving.

The antenna to receive the frequencies and qualifies the best 3 channel frequencies to the system.

PROJECT OUTPUTS:

In this branch we made sure that every output would appear in a simple way to the users.

We implemented and attached LED headlights beside our sensors in each side that will light up to the road for the car, to have our security measures in the most effective and efficient ways, these headlights acquire three different levels, when its completely dark, when it is a bit dark, and when the light is clear. The LED headlights shines and darkens according to which level and responds to it automatically and effectively.

Our gear, that is controlled by the joystick to our user, will have its output shown in the 7-Segment Display. Like any car the gears the user chose will appear by their letters, i.e.: (P for park, D for drive, R for reverse, N for normal) the 7-Segment Display is connected in the breadboard.

The radio while connected with a speaker it will generate the sounds from it and will appear to the user in the application developed which channel he is on at the moment.

PROJECT PRIORITIES:

As we learned throughout the course there are soft, firm, weakly hard, and hard real time systems, and based on that we developed our priorities for this project while also following the project conditions and guidelines.

Our main and the most important feature would be the Lane Keeping Assist (LKA), where we start, move and keep the car in the lane it is on, and this feature also took a full Arduino MEGA so that it would never get interrupted by calling any other feature to take place.

At this same Arduino MEGA board, we connected the Bluetooth features too that we connect to the Android application we created so that the user controls which radio channels they would listen to.

To the other Arduino MEGA board, we connected all the other safety and entertainment features, so the headlights would have the first priority. Displaying the light in front of the car serving to make the road visible to the driver, in case of any obstacles in the road.

Next, the gears handle the second level of priorities in this Arduino MEGA board, to usually decide which gear the car will be on and to let the user acknowledge how the car would generate and according to which command.

Finally, the entertainment features, the radio is the least important task we preform so that there wouldn't exist any risks toward the safety features. The radio functions lastly by listening to whichever channel while the car is moving or not.

PROJECT PROBLEMS:

There is nothing that is perfect, and as a group of students who for the first time built a car, connected all the separate components, and to make the software code reach the hardware elements directly in the car, we faced a lot of struggles mainly in the hardware connections itself how to find a place for every component in such a tight space available.

The cable following too was another struggle our team faced during building the car, following every cable and also to remember which cable connects to which component was a small struggle we faced.

At one of the testing stages we had as a team the batteries did not respond well and one of the batteries got burned, dealing with such a nerve wrecking situation during the crowded time took a heavy negative toll in our team's mental state.

The main limitation our team faced, and we think many other teams struggled with too was the availability of the components and their high prices in the limited distributors here in Egypt, in which some of these distributors raised their prices weekly.

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THE DIVISION OF WORK:

Ahmed Khaled – Handled the coding and scheduling of the FreeRTOS systems of the car and parts of the hardware connections of the car.

Misk Mohamed – Handled parts of the hardware building of the car and some of the coding related to the radio parts in the car.

Ali Elserafy – Handled parts of the hardware and connections of the car and some of the coding related to the gear parts in the car

Andrew Sameh - Handled the coding of the Bluetooth components and some of the hardware connections of the car.

Ziad Ismael - Handled parts of the hardware and connections of the car and the coding of the LED display parts in the car.