Car Project

Class 1	
Soheil Talaat	1225
Momen Mohamed	128
David Tawfik	768
Mahmoud Abdelmoneim	808
Mostafa Gamal	1325
Hussam Elsayed	194

Table of Contents

Table of Figures

1. Introduction

This report talks about the documentation of a prototype of an Light-tracking car. This car project employees TivaC microcontroller. This particular undertaking harnesses the capabilities of two Light Dependent Resistor (LDR) sensors and an ultrasonic sensor to achieve seamless obstacle avoidance, ensuring a safe and efficient driving experience. Additionally, a temperature sensor to accurately measure the ambient temperature is integrated using ADC, which is then displayed on an LCD screen. The objective of this project is to engineer an intelligent and interactive car that adeptly navigates its surroundings while providing real-time temperature information to the driver using basic RTOS scheduling principles for more efficient and real time response.

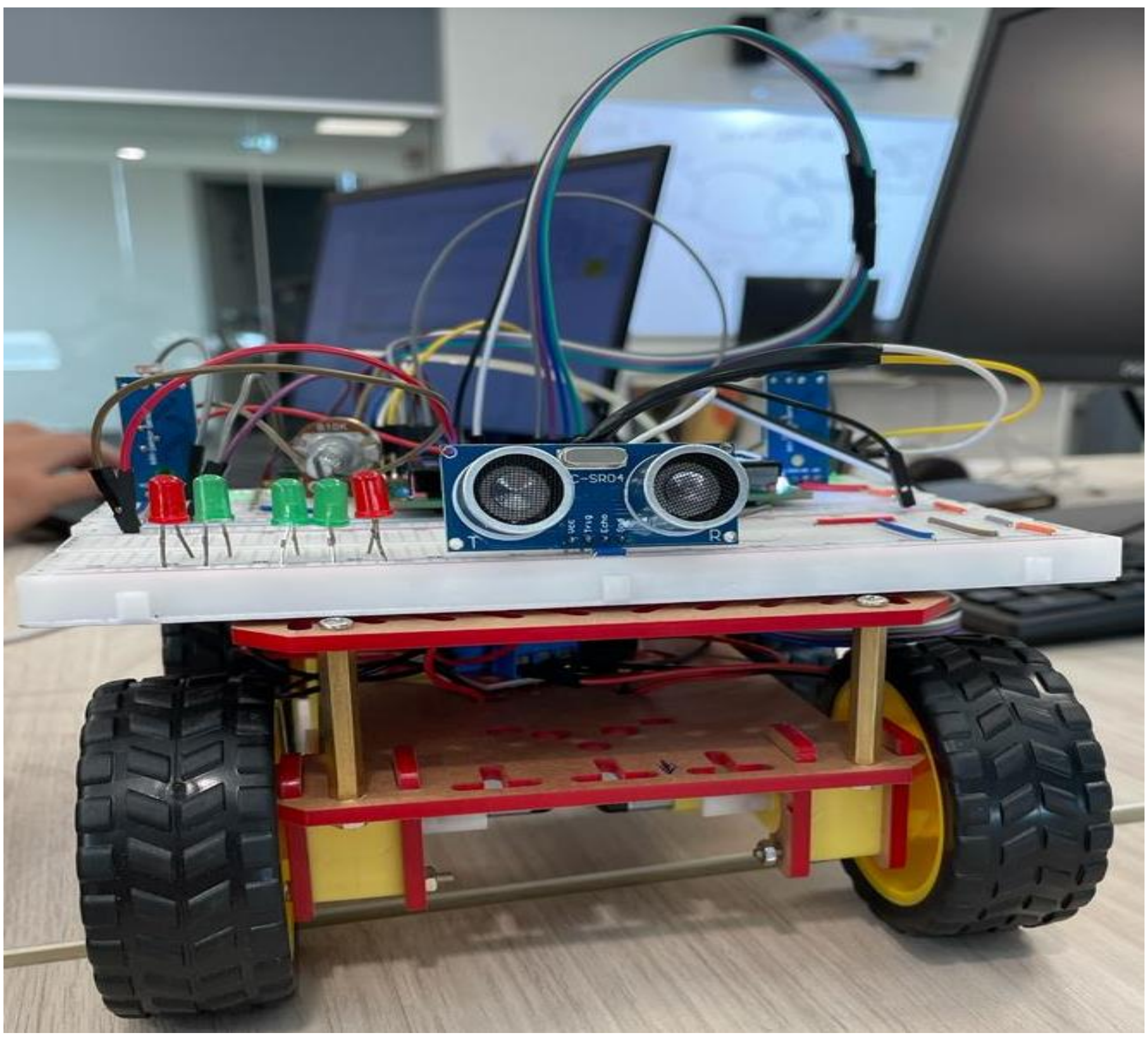

Figure 1: Car Model

2. Sensors and Circuit Topologies

In this section the sensors used in this project which consists of a Light Dependent Resistor (LDR), ultrasonic sensor and temperature sensor is briefly introduced and analyzed.

2.1. Light Dependent Resistor (LDR)

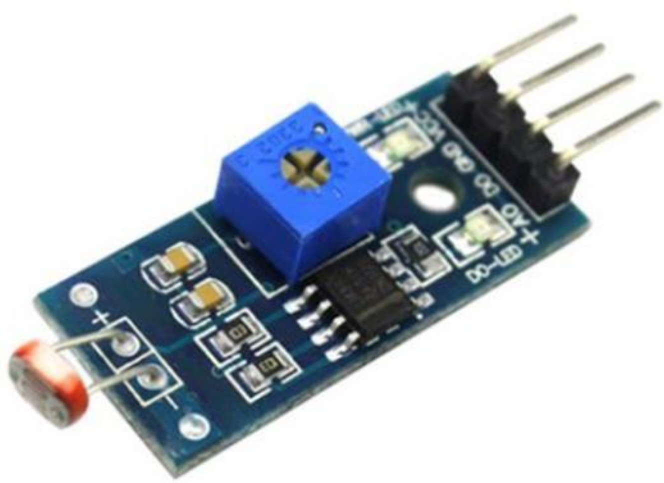

Figure 2: LDR IC

This LM393 Photosensitive Light-Dependent Control Sensor Module uses a high-quality LM393 voltage comparator. Easy to install using the sensitive type photosensitive resistance sensor the comparator output signal gives a clean and good waveform.

Driving ability is 15mA with the adjustable potentiometer, it can adjust the brightness of the light detected. Working voltage is 3. 3V to 5v. Where output is digital switch output. Since this module is sensitive to the light, it is usually used for detecting the ambient brightness and light intensity.

When there is no light or the light intensity cannot reach the a specified value, DO output is high level. When light intensity over that value, the module DO output is low level. This value can be adjusted by the potentiometer The module digital output DO can be directly connected to microcontroller which is TivaC in this project case, the microcontroller simply detects high or low level, and based on it it can make the decision to whether change direction or not.

2.2. Ultrasonic Sensor

Figure 3: ULtrasonic IC

The module is based on the measurement of time flight of ultrasonic pulse, which is reflected by an object. The distance to be measured mainly depends on the speed of ultrasonic waves in space or air –which is a constant- and the flight time of the pulse.

The module performs these calculations and outputs a pulse width depends on the measured distance, this pulse is easily interfaced to any microcontroller (TIVAC in this case) the exact method of calculating the pulse wave using the microcontroller is discussed in further in the following chapters.

Label	Definition	Direction	Function
VCC	Supply voltage	Power	Supply power to module 5VDC with 10mA max
Trig	Trigger	Input	Input trigger for measurement module. This pin is TTL/CMOS logic (5V and 0V). The trigger pulse should be 5µs minimum
Echo	Echo	Output	Output echo pulse from measurement module. This pin is TTL/CMOS logic (5V and 0V). The output pulse width time is function of the distance to be measured
GND	Ground	Ground	System ground connected to the same ground of the host.

Table 1: Pins Layout

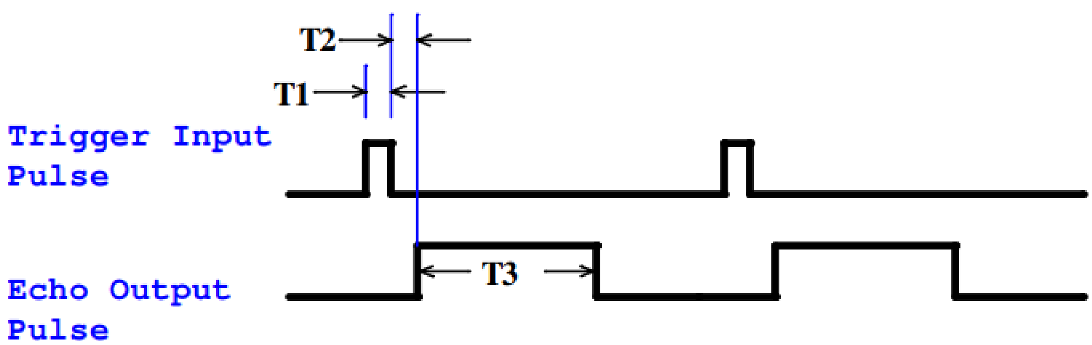

Figure 4: Timing Diagram

When a trigger signal is put by the microcontroller upon the trigger pin a pulse wave is sent by the sensor and the echo pin becomes high. When the echo wave hits an object and bounces back to the sensor the high state of the echo pin becomes low, the width of this pulse is then used to calculate the distance which the echo has traveled.

2.3. Temperature sensor

Figure 5: Temperature Sensor

This temperature sensor offers a wide measurement range, spanning from -55°C to 150°C, making it suitable for various temperature monitoring applications. Its compact size makes it particularly advantageous for remote installations. Additionally, the sensor's affordability is enhanced by the implementation of wafer-level trimming.

With a current drain of less than 60µA, the sensor operates with minimal power consumption. Furthermore, it exhibits low self-heating characteristics, with a mere 0.08°C increase in temperature when placed in still air.

The sensor accommodates a wide input voltage range, with a minimum of -2V and a maximum of 35V. Its output voltage is directly proportional to the temperature, following a linear relationship. Specifically, for every 1°C temperature rise, there is a corresponding 0.01V (10mV) increase in voltage, demonstrating a 10mV/°C scale factor.

Accuracy is a key feature of this sensor, as it guarantees a high level of precision with a maximum deviation of ±0.5°C. Additionally, it boasts a low output impedance of 0.1Ω when driven with a 1mA current. These characteristics contribute to the sensor's reliability and accuracy in temperature measurement applications.

The sensor has three pins which are the output, supply voltage and reference.

3. Project Components Layout

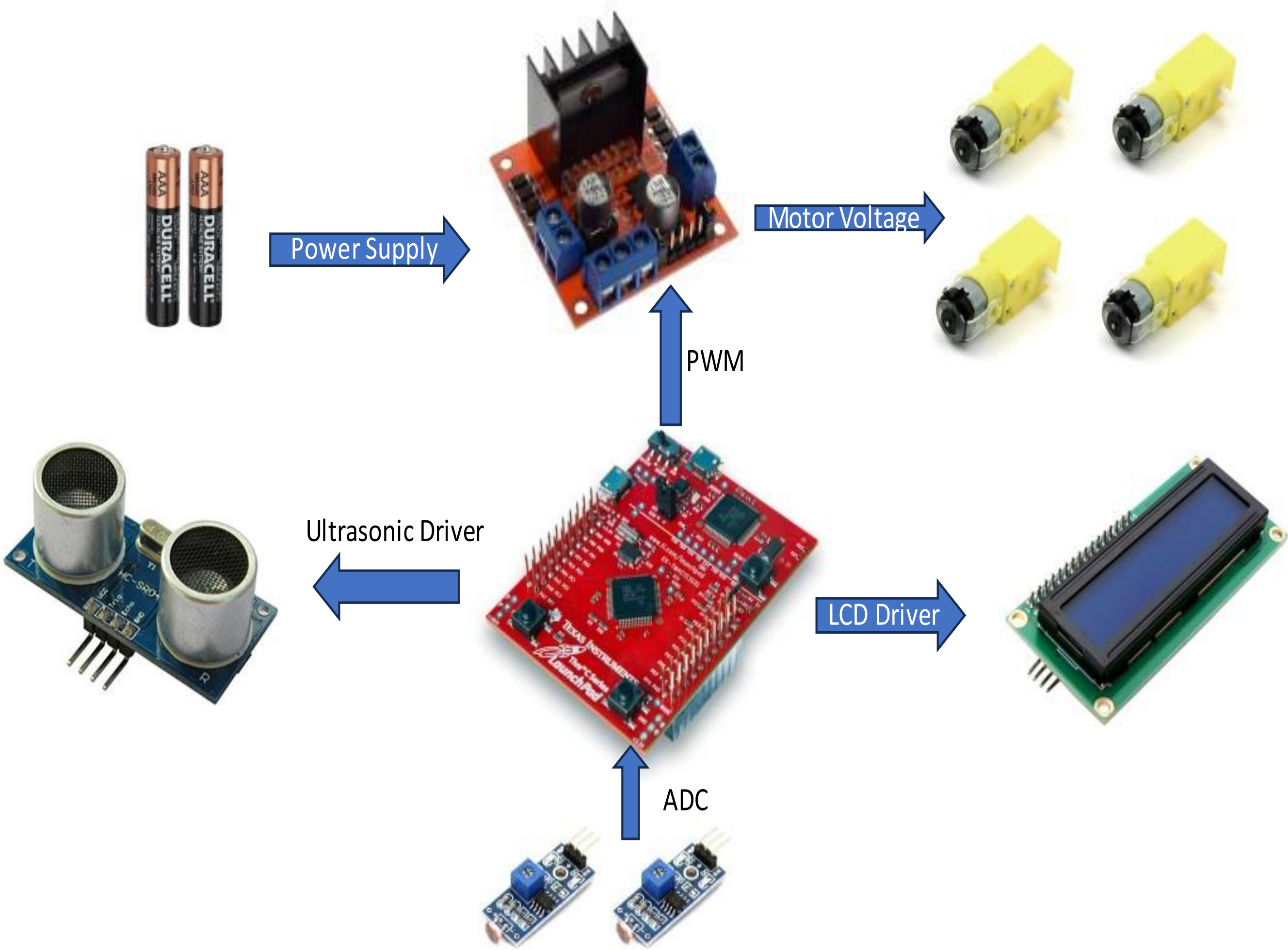

Figure 6: System Layout

4. Cicuit Schematic

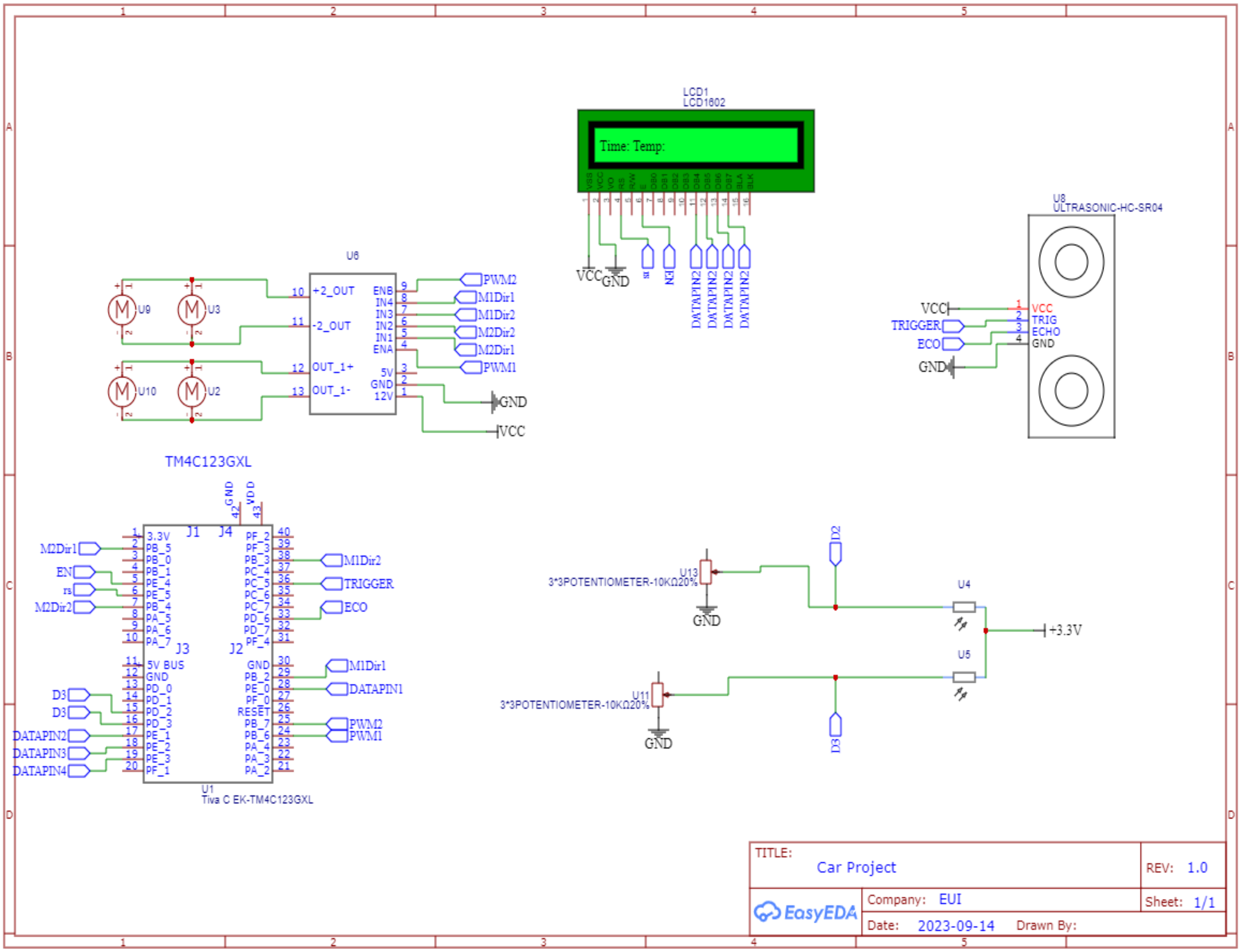

Figure 7: Circuit Schematic

5. Features and Delimitations

There are some features in our project like:

- Internal temperature sensor for the system.
- Collision avoidance.
- Implementation for our scheduler.
- LCD for showing informations like time and temperature.
- Implementation for drivers like: GPTM timers, PWM and LCD.

6. Flowcharts

6.1. UltraSonic

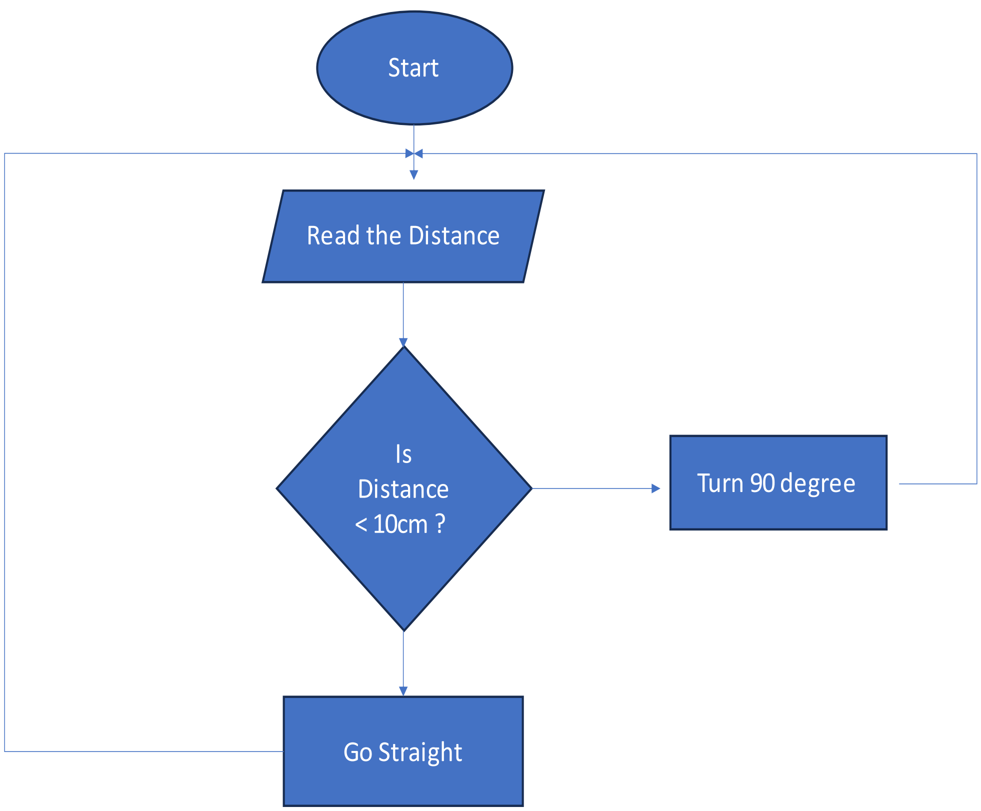

Figure 8: UltraSonic Flowchart

6.2. LDR

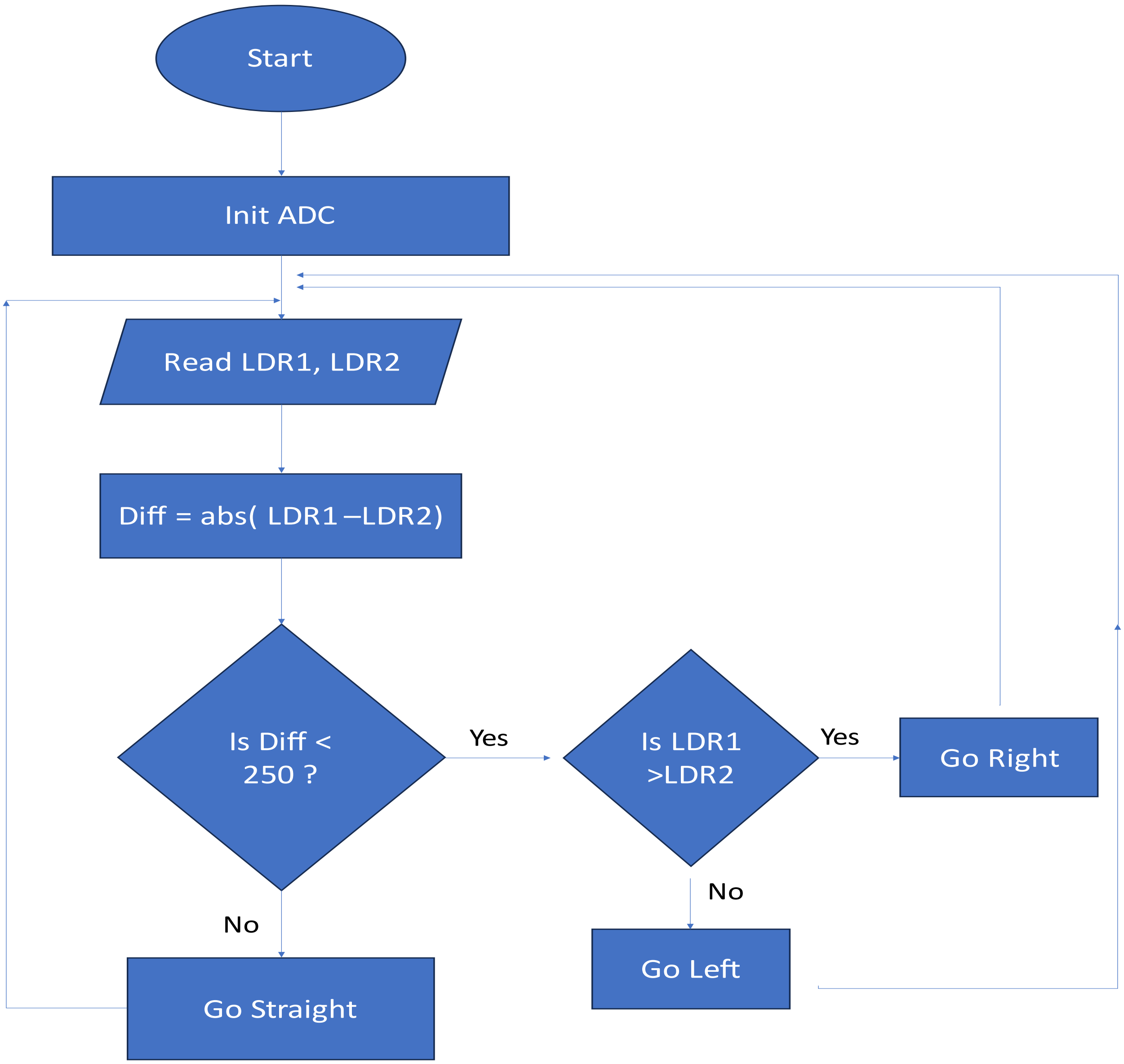

Figure 9: LDR Flowchart

7. Links

Drive Linkk for project and Demo video:

https://drive.google.com/drive/folders/15m3IC_NUXV57lZfEZoZl5vETSTzM4V11?usp=sharing