MINI PROJECT

Project: Build a system using Nios II in kit DE10 to connect a LCD 16x2 and an H-bridge to control a motor. This system can do the following tasks:

- When SW0 is ON, LCD blinks the sentence “Hello World !!!” in the middle of row 1 with frequency 1Hz. (Using timer)

- When SW1 is ON, Nios II controls the motor by sending PWM pulses to the H-bridge. LCD displays the duty cycle and the frequency of PWM pulses.

- When SW0 and SW1 are OFF, turn off the system.

Reference:

- Datasheet of LCD 16x2

- An instruction of LCD interference

- L298_H_bridge datasheet

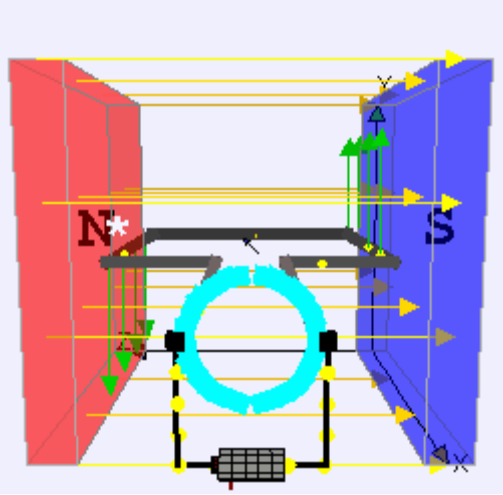
You can use the additional information below

Additional Information (source: https://docs.onion.io/omega2-maker-kit/maker-kit-servo-h-bridge.html)

How DC Motors Work

The simplest of all motors, DC motors turn when a DC voltage is applied across it. This kind of motor can be found in drones, power tools, and robots. A DC motor can change speend and direction depending on how much power is fed to it and in which direction.

The DC motor uses the uses a magnetic field generated by the by an electromagnet to turn the armature of a motor. The electromagnet is activated by applying voltage, so when the power is on, the magnetic field it generates will cause the armature (a coil of wire) to generate its own nagmetic field, these fields push eachother away and cause the armature to spin.



To get the motor to spin the other way, we need to reverse the applied voltage, meaning the flow of current through the motor will be reversed. Unfortunately switching the direction of current from a controller like the Omega is difficult. The processors use low current and voltages, plus they are usually disconnected from the motor to prevent inductive feedback distrupting their operation.

If only there was some kind of device that can help us control the power we supply to our DC motors…

Note that applying current to both terminals can cause damage to the motor.

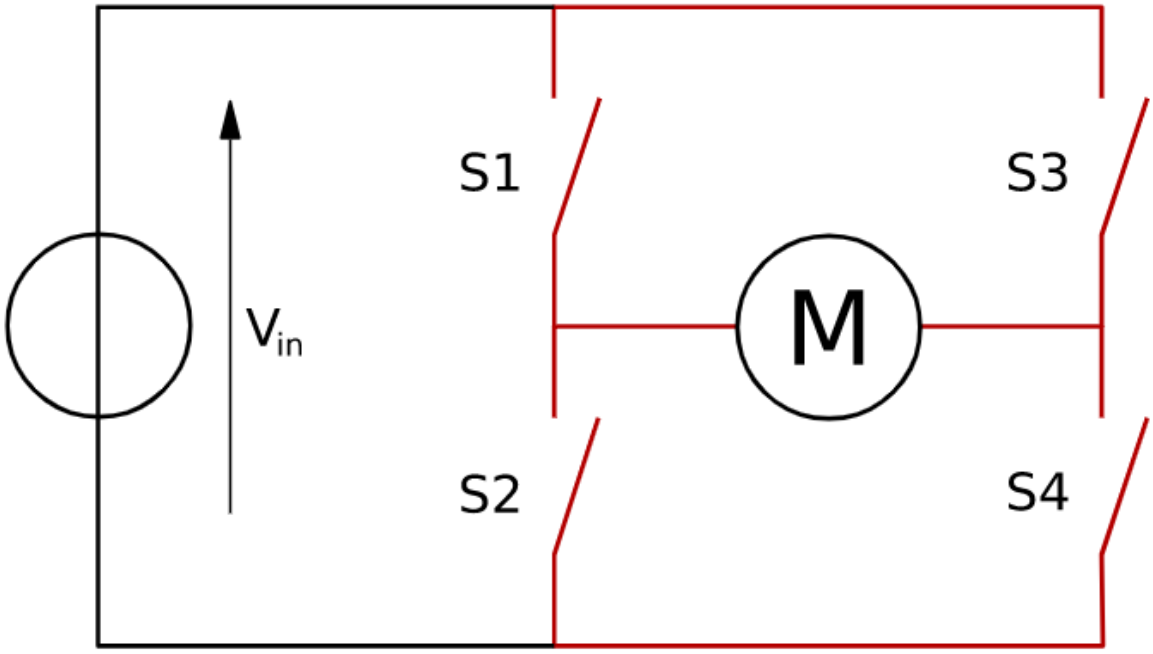
How H-Bridges Work

An H-Bridge is a circuit that allows voltages to be applied across a load in either direction. Electric current flows from the source to ground, and many components need

to be oriented according to the direction of current to work as expected. An H-Bridge is a circuit built to change the direction of the voltage and thus the current flowing to a load.

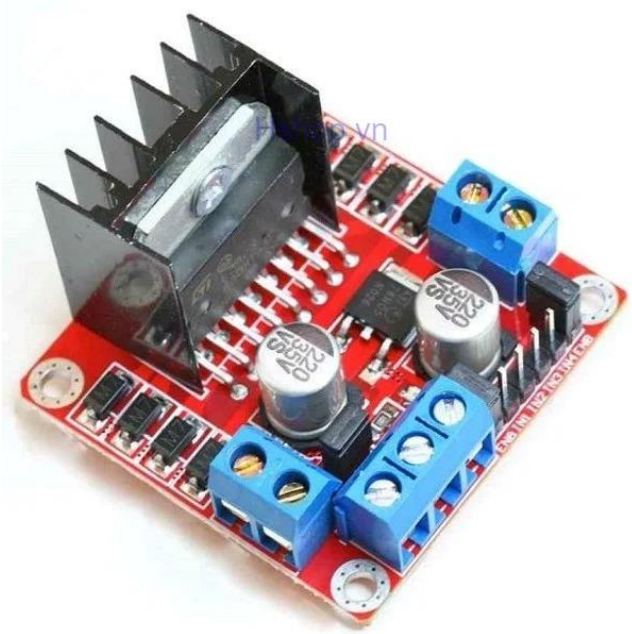
In electrical terms, a **load** is any piece of a circuit that consumes electric energy to do things - heating, turning, lighting up, and so on.

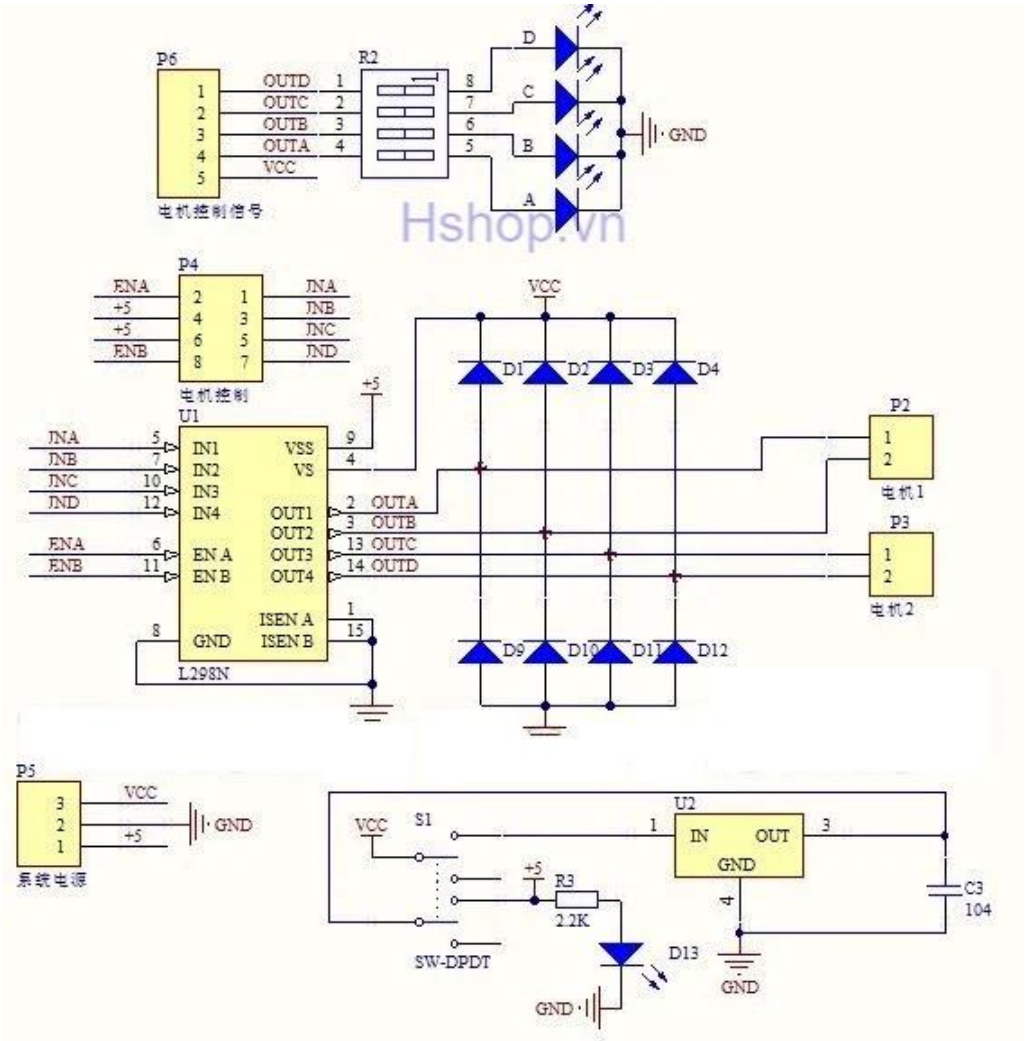
An H-Bridge is made up of four switches: two in series, and two in parallel, with the load placed in between the switches. In this configuration the circuit takes an “H” shape.



In order to change the direction of the voltage supplied, the H-Bridge controls the switches that deliver power to the load (S1). Looking at the diagram, if we close S1 and S4 while leaving the rest open, the voltage will be applied from left to right across the motor. If S2 and S3 are closed instead and the others open, the voltage will be applied from right to left.
This configuration has potential to create a short circuit, so most H-Bridges do not allow direct control of these switches.

L298 H-Bridge module (H shop)




P6
OUTD
OUTC
OUTB
OUTA
VCC
电机控制信号
R2
D
C
B
A
GND
Hshop.vn
P4
ENA
+5
+5
ENB
JNA
JNB
JNC
JND
电机控制
VCC
D1
D2
D3
D4
U1
IN1
IN2
IN3
IN4
EN A
EN B
VSS
VS
OUT1
OUT2
OUT3
OUT4
ISEN A
ISEN B
GND
L298N
OUTA
OUTB
OUTC
OUTD
P2
电机1
P3
电机2
D9
D10
D11
D12
P5
系统电源
S1
SW-DPDT
U2
IN
OUT
GND
R3
2.2K
D13
C3
104

GPIO configuration of DE10 standard kit (DE10 standard datasheet)

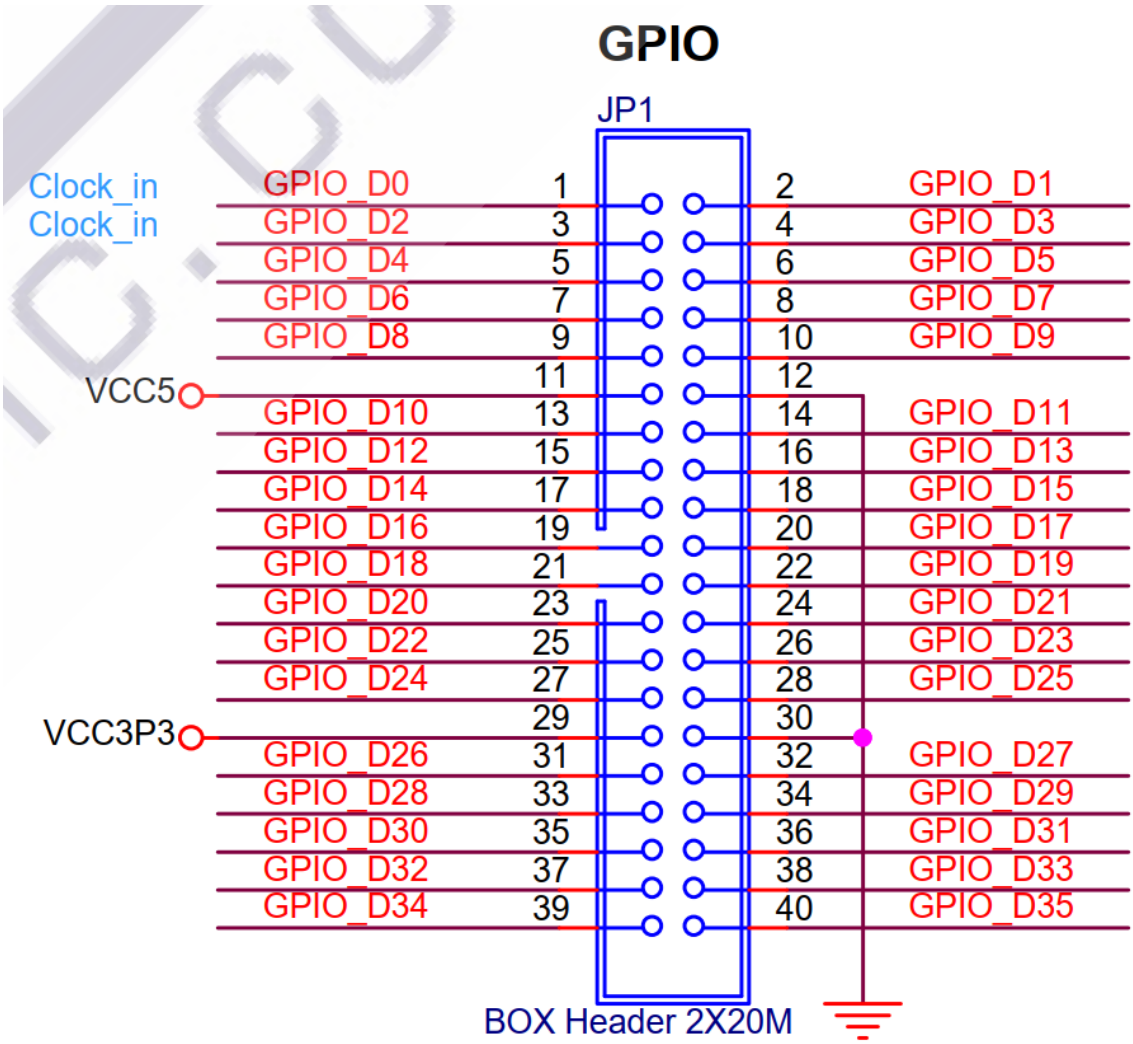


Table of configuration

PIN OF DE10 KIT	PIN OF COMPONENT	COMPONENT
GPIO_D1	INA	L298
GPIO_D2	INB	
GPIO_D28	D0	LCD16x02
GPIO_D30	D1	
GPIO_D32	D2	
GPIO_D34	D3	
GPIO_D29	D4	

GPIO_D31	D5	
GPIO_D33	D6	
GPIO_D35	D7	
GPIO_D23	RS	
GPIO_D24	RW	
GPIO_D25	E	