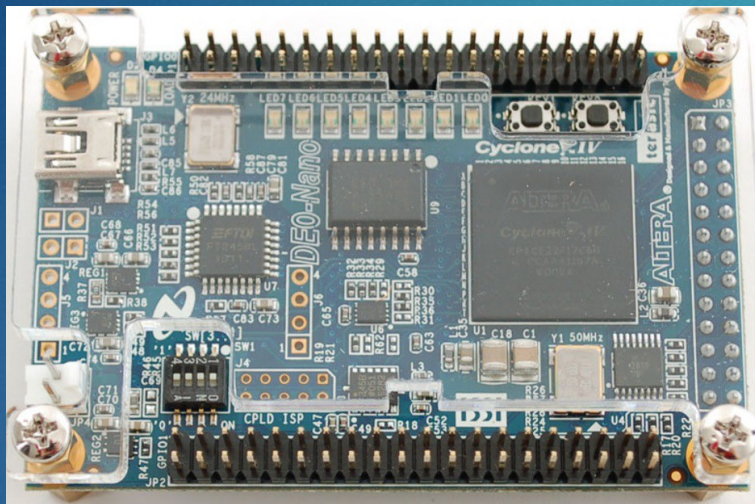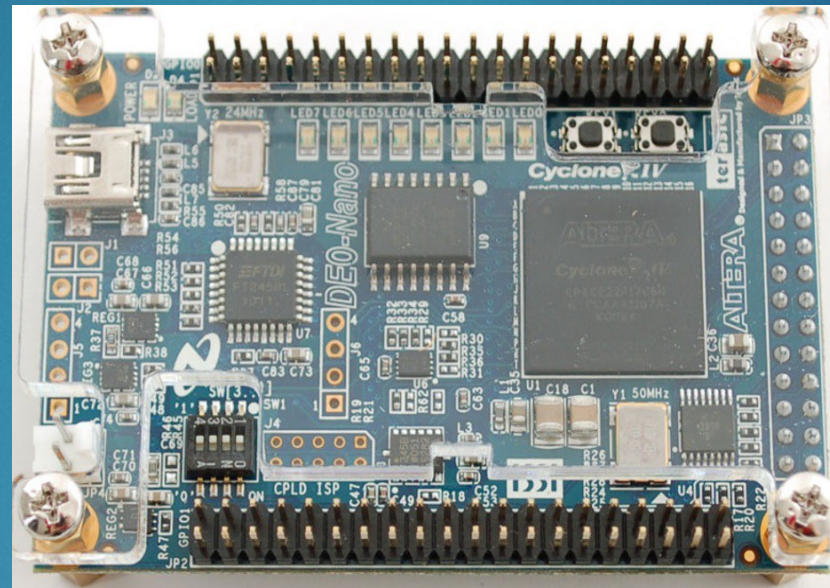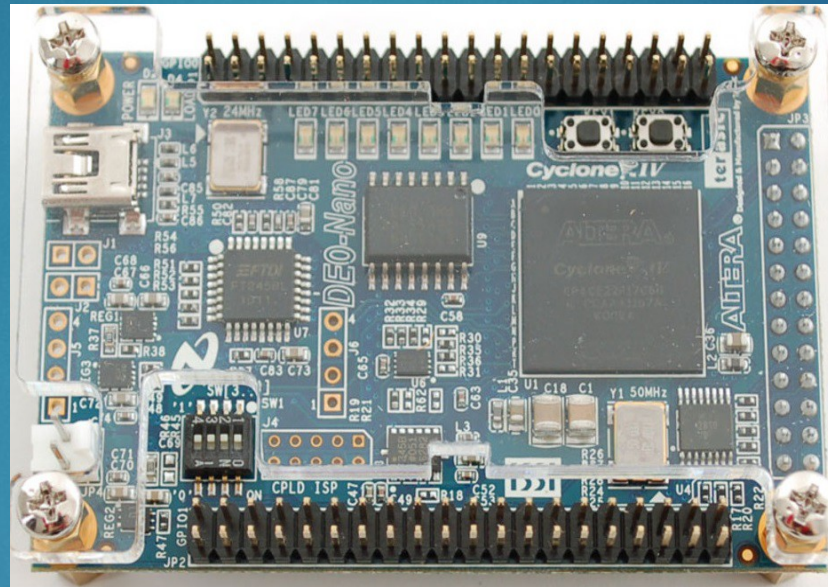# DE0-Nano Board & KS103 Ultrasound Module
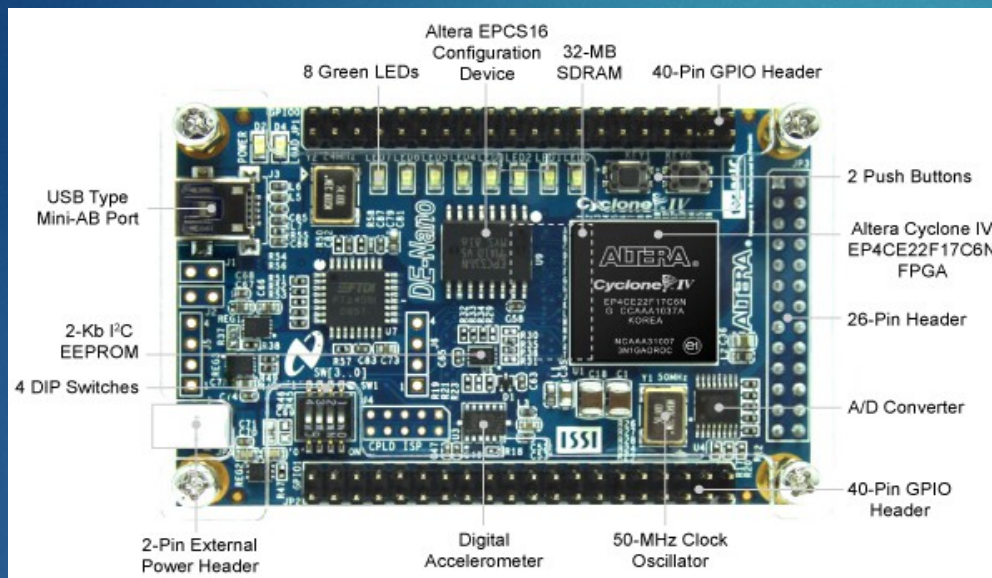
Why do we need the Nano Board?

# Why do we need the Nano Board?

We use the DE0-Nano Board to provide an interface for the Raspberry Pi 3 to control the car

Features of the Board

- **Memory Devices**
  32-MB SDRAM
  2Kb I2C EEPROM

- **General user input/output**
  8 green LEDs
  2 debounced pushbuttons
  4-position DIP switches

- **Expansion header**
  Two 40-pin Headers (GPIOs) provide 72 I/O pins, 5V power pins, two 3.3V power pins and four ground pins

- **Clock system**
  On-board 50MHz clock oscillator

- **Power Supply**
  USB Type mini-AB port (5V)
  DC 5V pin for each GPIO header (2 DC 5V pins)
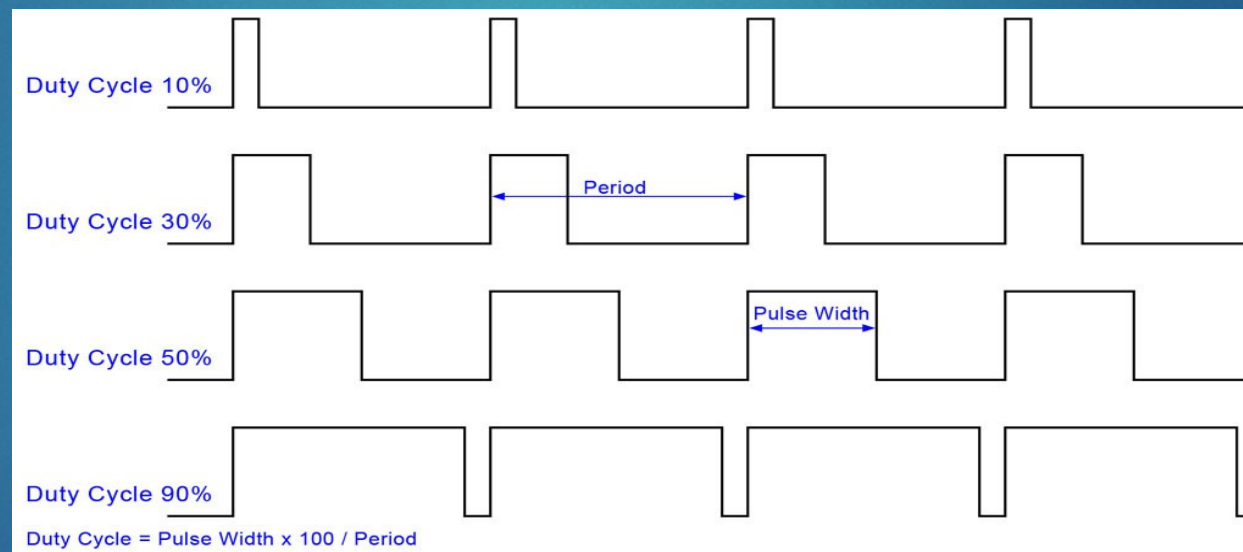 2-pin external power header (3.6-5.7V)
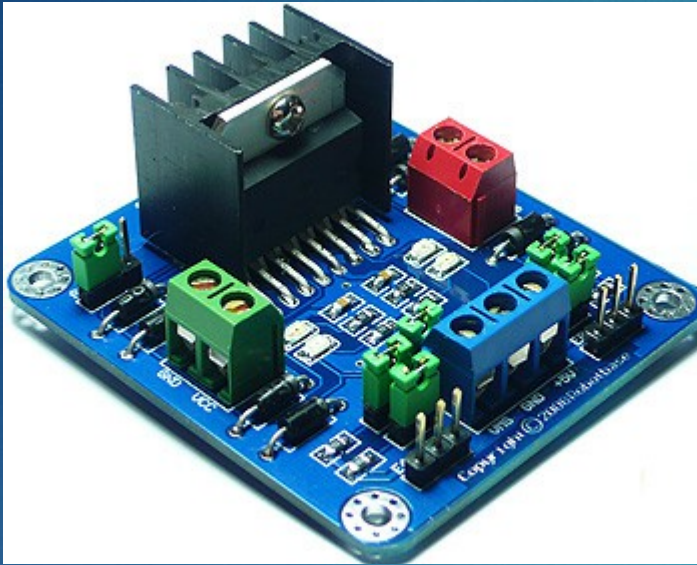
Our Nano board works at 5V, so we use an H-bridge to convert from the battery coming current to 5V.
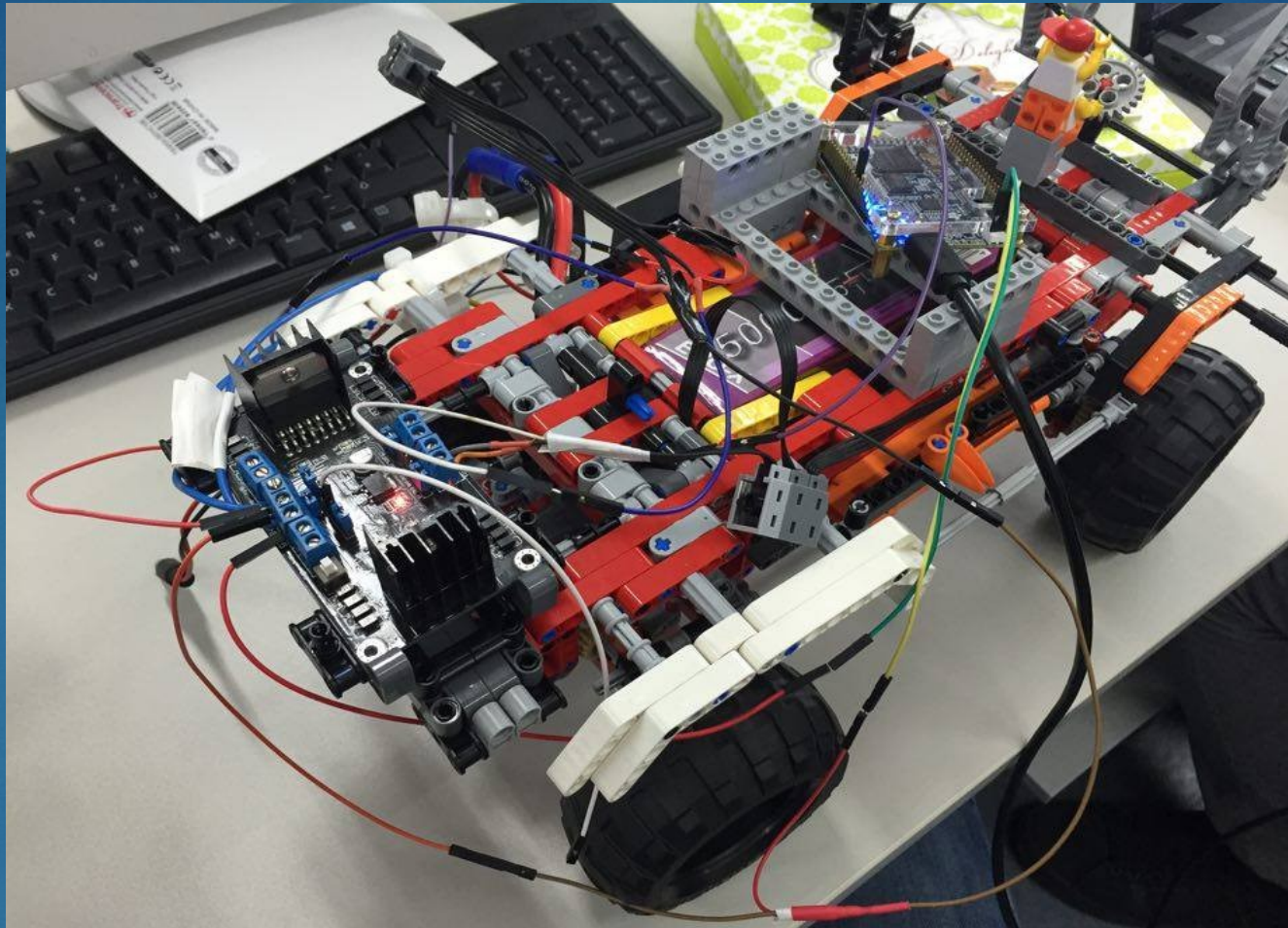
Connection between the H-Bridge and Nano Board

PWM(Pulse-width Modulation)

- PWM is a modulation technique used to encode a message into a pulsing signal

- The width of the pulse is modulated depending on the requirement

Duty Cycle 10%

Duty Cycle 30%   Period

Duty Cycle 50%   Pulse Width

Duty Cycle 90%

Duty Cycle = Pulse Width x 100 / Period

Why do we use the PWM?

The voltage can be changed to control the speed of our motor
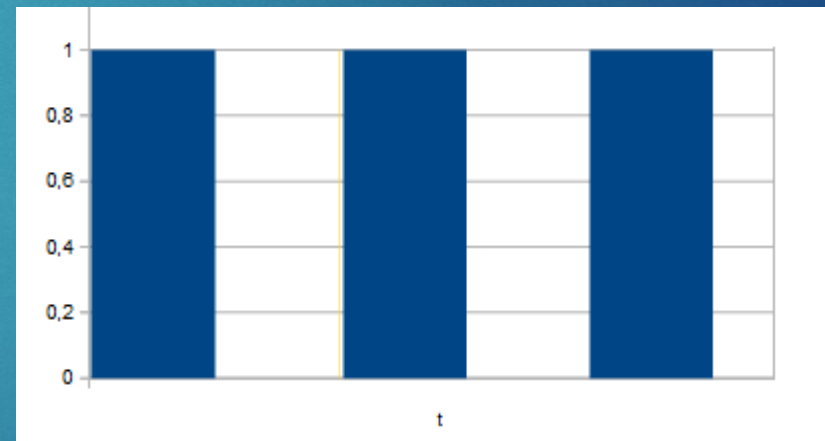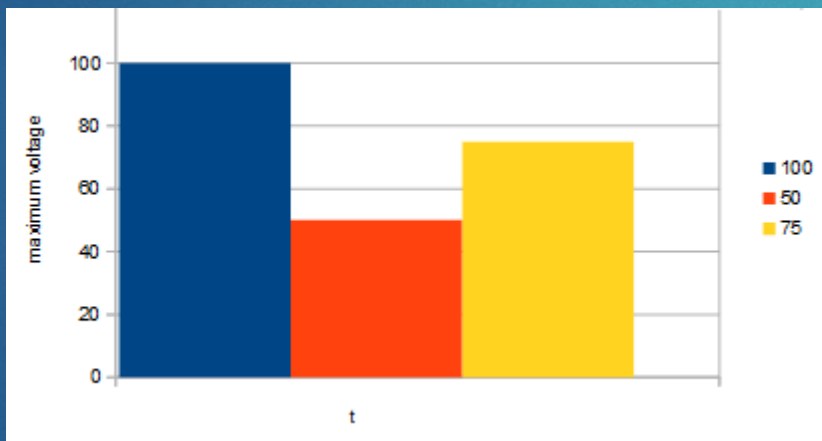
Why do we use the PWM?

The voltage can be changed to control the speed of our motor
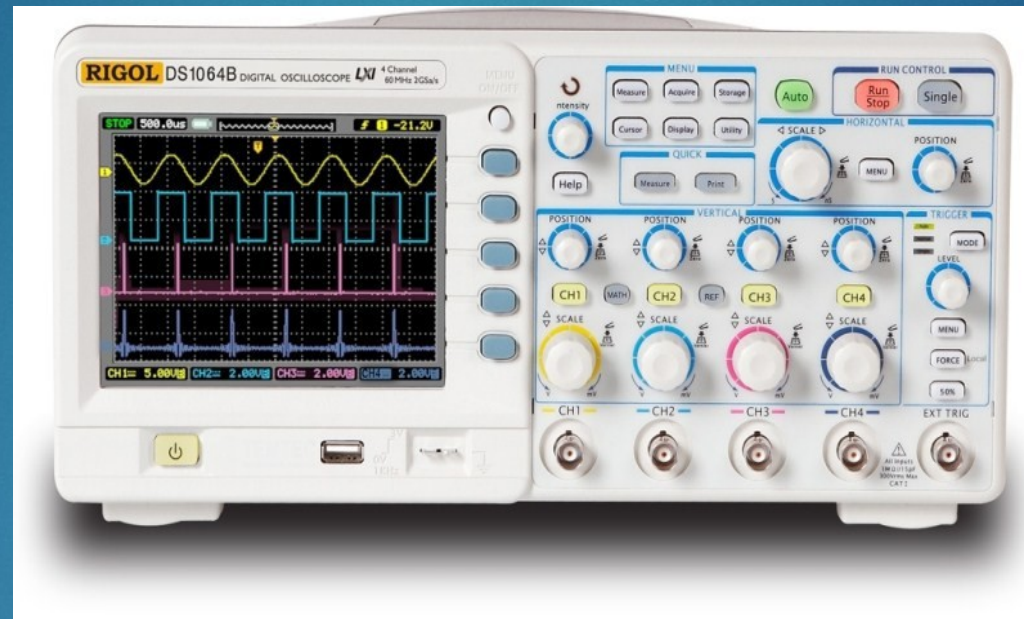
Analog vs Digital Voltage Control

Why do we use the PWM?

The voltage can be changed to control the speed of our motor
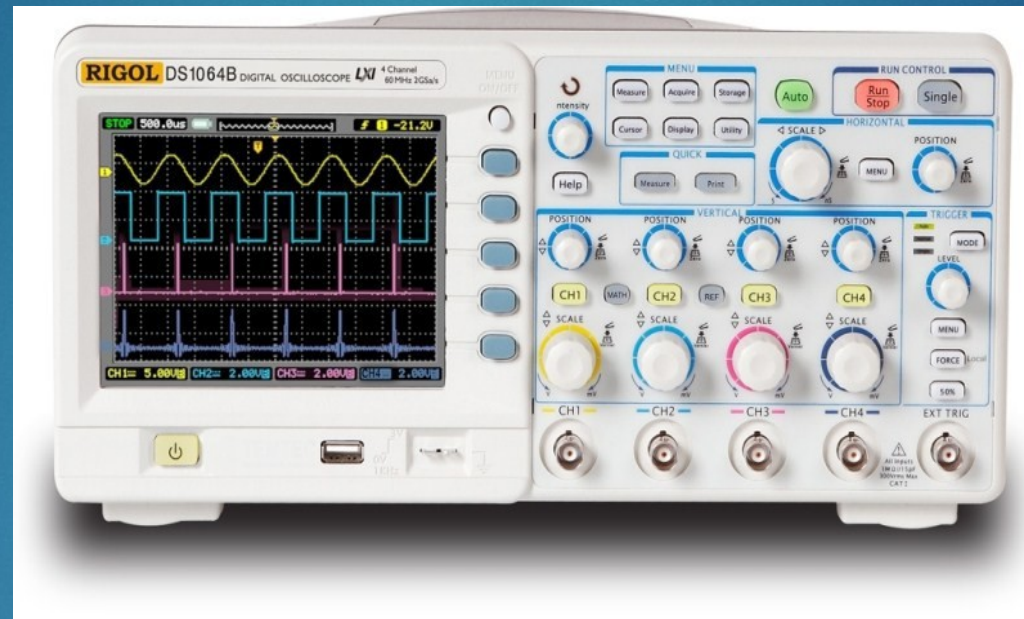
Analog vs Digital Voltage Control

Oscilloscope

We use the oscilloscope to verify the duty cycle

Oscilloscope

We use the oscilloscope to verify the duty cycle

Link to Lego Car

KS103 Ultrasound Module

We use this device to measure the distance between our car and the obstacle
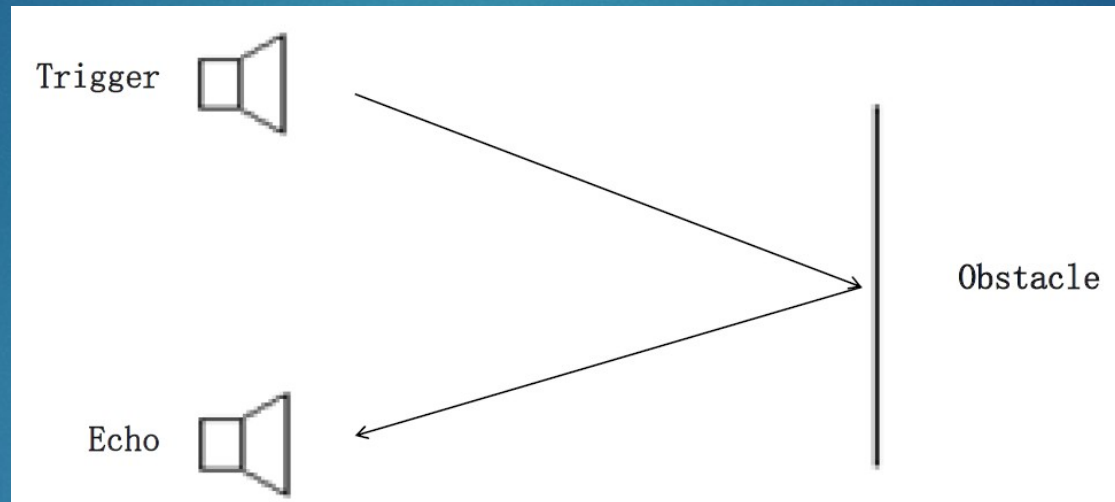
KS103 Ultrasound Module

We use this device to measure the distance between our car and the obstacle

Pins

- VCC: power pin

- SDA/TX: data pin

- SCL/RX: clock pin

- GND: power ground pin

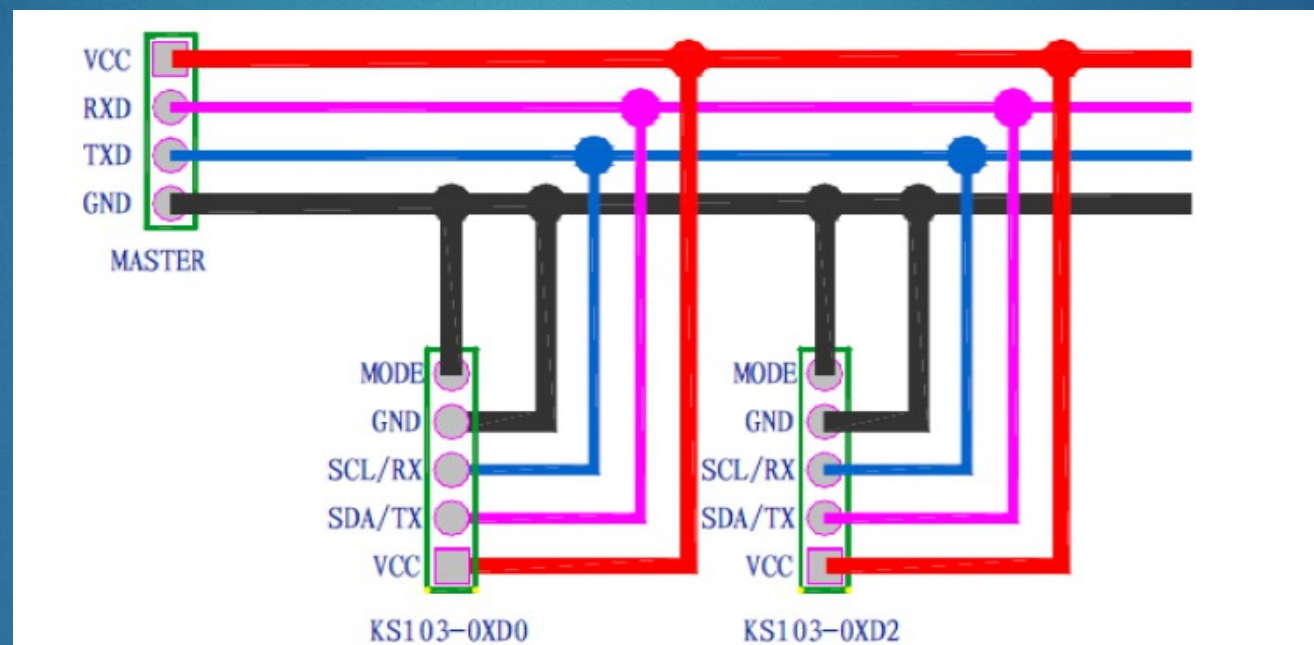- Mode: selects the communication mode

How It Works?

The trigger sends chirps and then the device calculates the distance by using this formula: (340(m/s) x Δt(s)) / 2)

Connection of Three Modules

Our task was to connect three modules with each other

Thank You For Your Attention!