# Sonar Sensor with the Implementation

CSE 315
Peripherals & Interfacing
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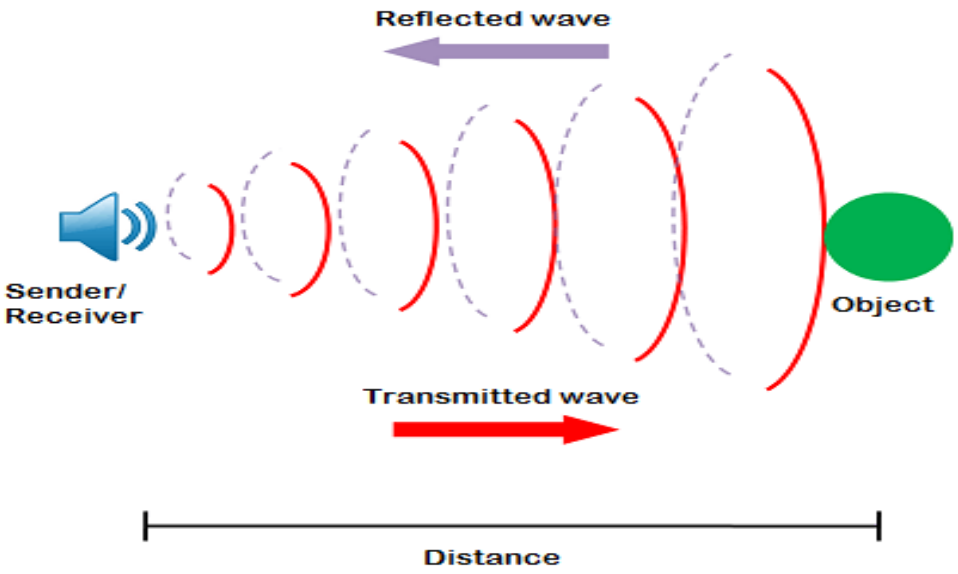
# What is Sonar?

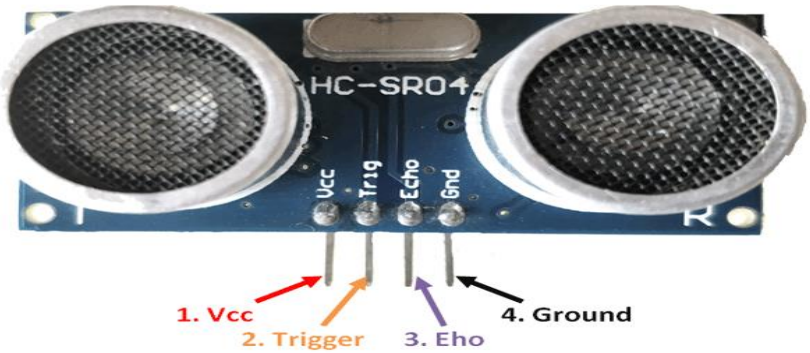
**Sonar** is a technique that uses sound propagation to navigate, communicate with or detect objects on or under the surface of the water.




# Ultrasonic Sensor

An **Ultrasonic sensor** is a device that can measure the distance to an object by using sound waves.

# Pin Configuration




**VCC**

- The Vcc pin powers the sensor, typically with +5V

**Trig**

- Trigger pin is an Input pin. This pin has to be kept high for 10us to initialize measurement by sending US wave.

**Echo**

- Echo pin is an Output pin. This pin goes high for a period of time which will be equal to the time taken for the US wave to return back to the sensor.

**GND**

- This pin is connected to the Ground of the system.

# Features:

- Operating voltage: +5V
- Theoretical  Measuring Distance: 2cm to 450cm
- Practical Measuring Distance: 2cm to 80cm
- Accuracy: 3mm
- Measuring angle covered: <15°
- Operating Current: <15mA
- Operating Frequency: 40Hz
- Trigger Input Pulse width: 10uS

# Working principle


1

The transmitter (trig pin) sends a signal: a high-frequency sound.

2

When the signal finds an object, it is reflected and back toward the sensor

3

And the receiver(echo pin) receives/observed it.

# Applications

**Obstacles finding robots**

biped robot, obstacle avoider robot, path finding robot etc.

**Easy Control of Trash Collection Vehicles**

**Liquid Level Sensing**

Water Depth Sensing with Ultrasonic and Wastewater Management

**Vehicle Detection**

Car Washes, Automotive Assembly, and Parking Garage Applications

**Product for Blind people**

Smart (gloves, white cane, shoe, hat) etc.

**Mapping**

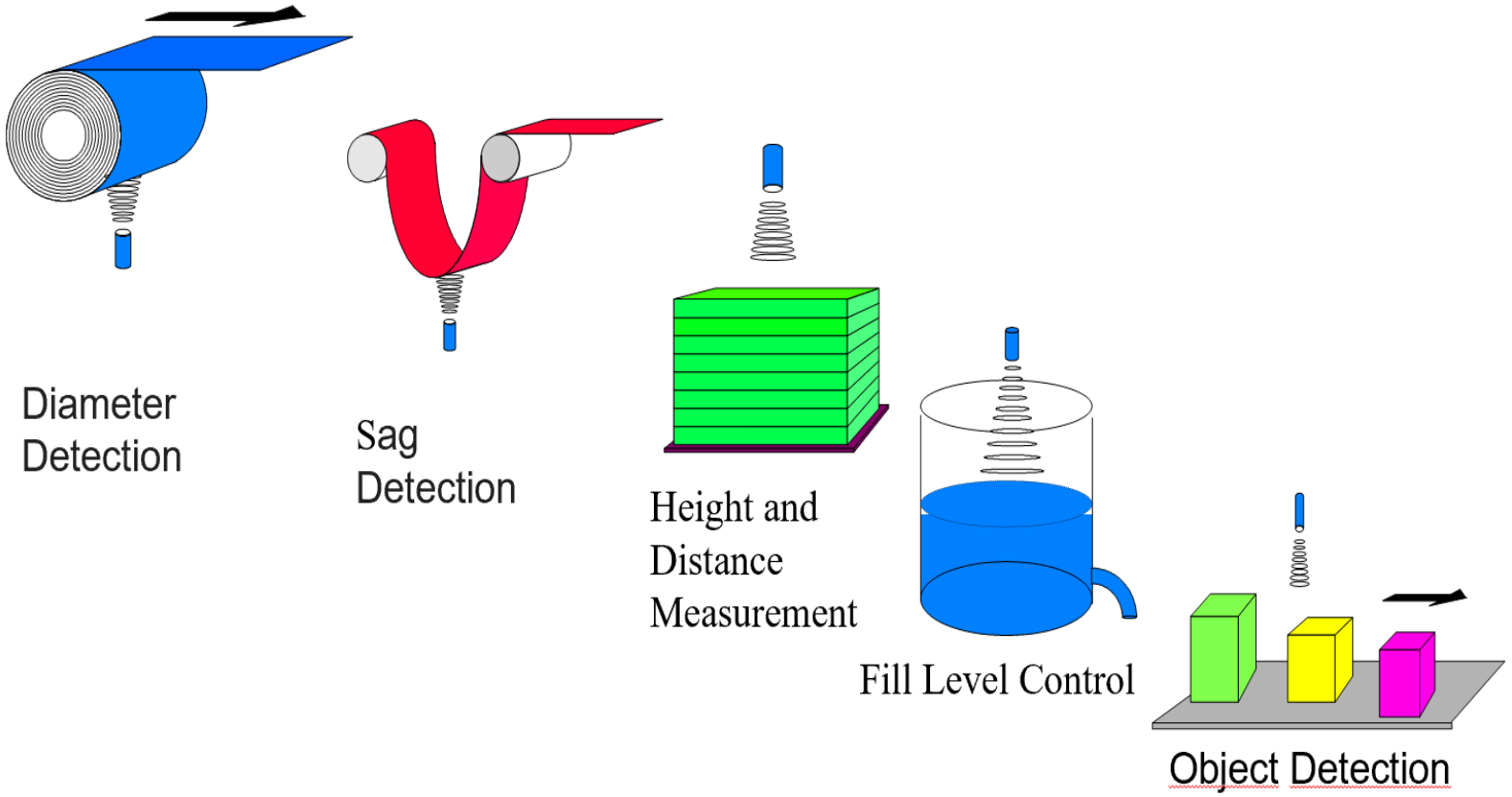
**150 ultrasonic projects**

https://www.hackster.io/projects/tags/ultrasonic

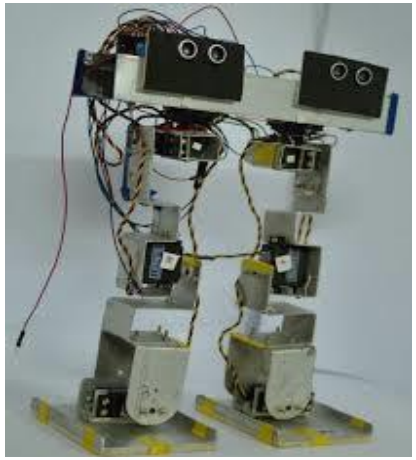
# Contd…

STANDARD APPLICATIONS

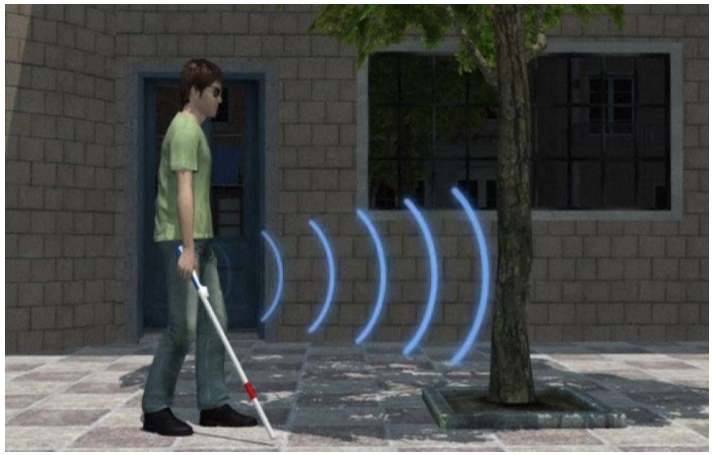
All ultrasonic sensor applications can be essentially attributed to 5 standard applications:



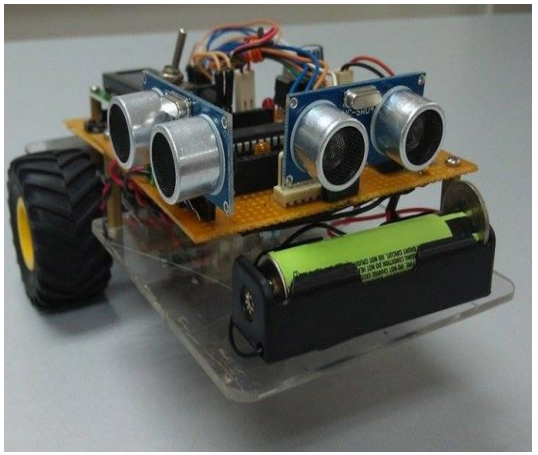
# Contd....



Intelligent self balance robot

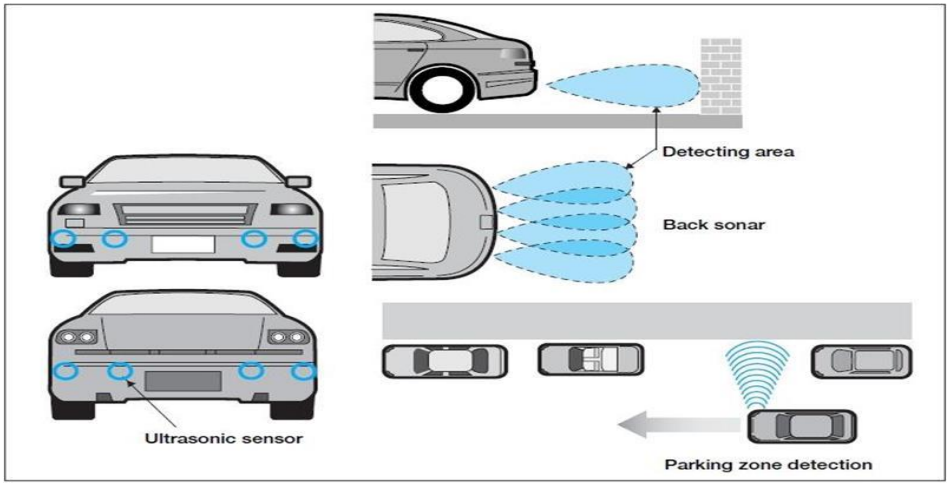


Smart White Cane



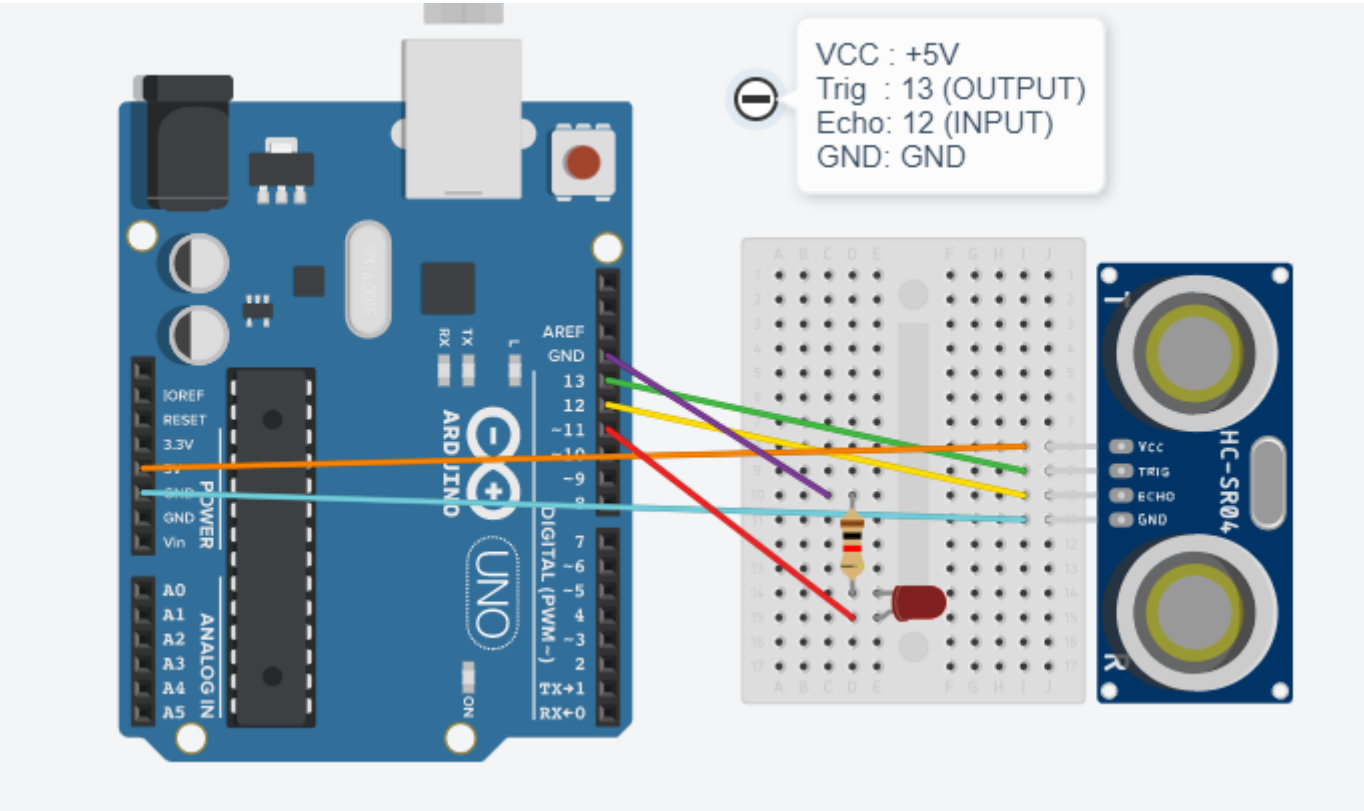
Wall follower robot

Trash level detection




Car parking

# Diagram :


VCC : +5V
Trig : 13 (OUTPUT)
Echo: 12 (INPUT)
GND: GND
HC-SR04
Vcc
TRIG
ECHO
GND
UNO
ARDUINO
POWER
ANALOG IN
DIGITAL (PWM~)

# Code:

```
const int trigPin = 13
const int echoPin  = 12
const int led = 11
void setup()
{ Serial.begin (9600);
pinMode(trigPin, OUTPUT);
pinMode(echoPin, INPUT);
pinMode(led, OUTPUT);
}
void loop()
{
long duration, distance;
digitalWrite(trigPin, LOW);
delayMicroseconds(2);
digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW);
duration = pulseIn(echoPin, HIGH);
distance = (duration/2) * 0.034;
if (distance < 10)
{
digitalWrite(led,HIGH);
}
else {
digitalWrite(led,LOW);
}
}
```

# Distance= velocity * time

s= 343 m/s * (duration/2) [As the duration of time has been calculated for two ways]

s= 34300 cm/s * (duration/2)

s= 34300/1000000 cm/micro-sec * (duration/2)

s= 0.0343 cm/us * (duration/2)

**pulseIn():**Reads the echoPin, returns the sound wave travel time in microseconds. if value is HIGH, **pulseIn**() waits for the pin to go HIGH, starts timing

**Distance = Speed × Time ;** here universal speed of US wave at room conditions is 340m/s. convert to 0.034 cm/us.

**Duration:** divide the duration by 2 because the wave was sent, hit the object, and then returned back to the sensor.

# THANK YOU

## Any Question?