

BOSCO-FEST 2019

Wayne Tech

(Model Making)

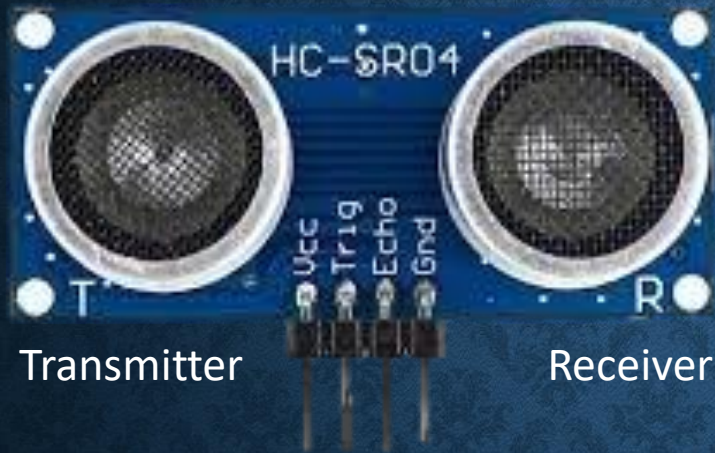
INTRODUCTION

- This model is a step towards reducing accidents while keeping in mind that this model will not obstruct anyone who needs to go faster than everyone else (like an ambulance).
- This model helps the local police station to have control over the speed limit of a particular road.

COMPONENTS USED :

- Ultrasonic distance sensor .
- Atmega328p microcontroller (running at a speed of up to 16 MHz) found in Arduino Nano development board .
- Servo motor .
- L.E.D.s, wires, etc.

ULTRASONIC DISTANCE SENSOR :



Transmitter

Receiver

It works on the principle of reflection of sound waves from an object .

The ultrasonic distance sensors are used to detect the presence of an object and also calculate the distance between the object and the sensor .

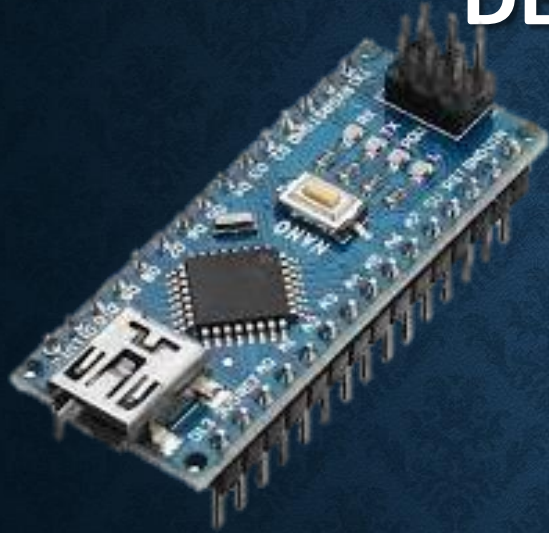
These sensors use ultrasonic waves. Ultrasonic waves are preferred because of the following reasons :-

- Ultrasonic waves can penetrate long distances because of their high frequency and short wavelength.
- Ultrasonic waves won't be heard by humans and thus won't be irritating for the people .

WORKING OF THE ULTRASONIC DISTANCE SENSORS :

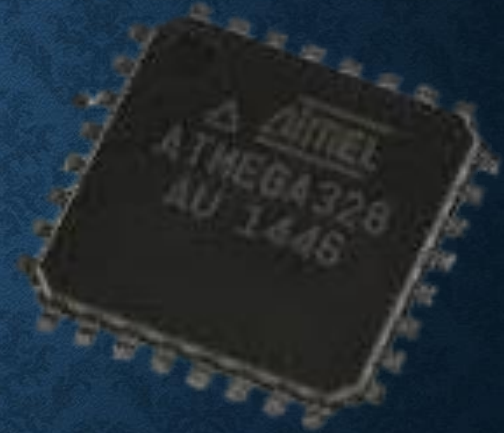
- If the trig pin of this sensor is given a high signal for 10 microseconds, the transmitter gives out a 8 cycle sonic burst.
- The sound waves are deflected by the object and returns to the receiver.
- The echo pin will give a signal to the microcontroller when the sound waves hit the receiver.
- The time(in microseconds) is calculated by the time difference of the transmission and the receipt of the sound waves. With the speed of sound known to us , we can calculate the distance between the sensor and the object.

ATMEGA328P(ARDUINO NANO DEVELOPMENT BOARD) :



The development board with integrated microcontroller (Atmega328p).

Runs at a clock speed of up to 16 MHz !



The actual microcontroller!

Has to be programmed with a computer language known as "Arduino" and in an Integrated Development Environment (I.D.E.) known as "Arduino IDE".

FEATURES OF ARDUINO NANO :

- Arduino makes microcontrollers easier to use and more user – friendly.
- Arduino development boards usually have on-board voltage regulators, L.E.D.s ,etc. and the microprocessor, the Atmega328p running at a clock speed of up to 16 MHz .
- It (usually) has a bootloader pre-burnt and has to be programmed by the user.
- The most important thing is that the user can run his/her own programs and put it to use for some creative and useful purpose. The programmer can also decide the level of security and the source code cannot be leaked.

SERVO MOTOR :



A servo motor .
(SG90 Tower Pro)

The servo motor uses a lot of gears, a motor and a control circuit.

A Servo Motor is an electrical device which can rotate an object with great precision (Range :- 0° to 180°).

- High torque.
- Requires 4.8V – 7.2V (for this model).
- Low rpm.
- High precision and can be controlled easily.
- Cheap.
- Easily available .
- Requires a P.W.M.(Pulse Width Modulation) control signal for the angular positions which can be provided by the Atmega328p microcontroller and other ICs (like the 555 timer IC , also called NE555 IC).

WORKING OF SERVO MOTOR :

- The control circuit interprets the P.W.M. signal and makes the motor rotate accordingly.
- The motor rotates with a relatively high rpm.
- The gears reduce the speed of the motor, increases the torque and also limits the rotation to 180° .

MORE ABOUT ARDUINO :

- Arduino was originally made in Italy to make microcontrollers easy to program and user-friendly.
- Arduino is open-source and anyone can manufacture clone Arduino boards (Should be without any copyright problems) after getting the circuit schematics and details from their website.
- Arduino has a large community worldwide and if one faces a problem , probably others have also faced that same problem and the solution is posted in the “questions and answers” section .

MODEL SPECIFICATIONS AND REQUIREMENTS

- Requires 5V(USB or +5V pin) or 6V--12V(Vin pin) input.
- Maximum detection range : 4m (approx.)
- Set detection range : 20 cm.
- Trigger velocity : 0.5 m/s or 1.5 km/h.
- Minimum distance from the sensor : 2cm.
- Each setup can be used for one lane only. The trigger distance has to be set according to the width of the lane.
- The speed breaker takes approximately 500 milliseconds to activate . So there should be an optimum distance between the servo and the retract sensor so that the car does not accelerate during that time and does not suffer the speed breaker.

WORKING OF THE MODEL

When a car moves along the lane, the time required for travelling the distance between the first two ultrasonic distance sensors , is obtained by a complex code in Arduino language , calculated by the microcontroller of the Arduino development board . With the distance between the first two sensors and the time required for travelling that distance known to us , we can calculate the velocity of the car and take the required actions if the calculated velocity exceeds the trigger velocity.

There can be two cases .
They are:

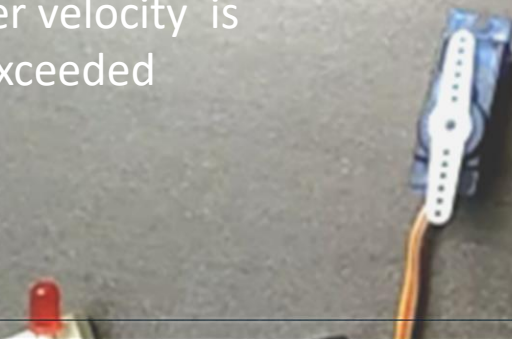
Case 1 : The velocity of the car is less than the trigger velocity

- The servo does not rotate and so the speed breaker is not activated
- Warning lights are not activated
- Warning buzzer is not activated

Trigger velocity is
not exceeded

L.E.D.

Servo which activates
the speed breaker



Case 2 : The velocity of the car is more than or equal to the trigger velocity

- The servo motor is activated which in turn activates the speed breaker mechanism and the speed of the car is reduced by its action.
- The warning L.E.D. turns on .
- The warning buzzer turns on and a irritating sound is produced.
- The L.E.D. ,the buzzer and the speed breaker remains activated till the third ultrasonic distance sensor is triggered after the car passes the speed breaker and the way is cleared for the next vehicle.

Trigger velocity
is exceeded

L.E.D.



Servo which activates
the speed breaker

ADVANTAGES OF THIS SETUP :

- It will prevent a number of accidents once is used in real life.
- Since it is operated by a microcontroller, the brain of this system would be in the hands of the local police station and it would be easy to change the trigger velocity within 15 seconds.
- The local police station may override it by Shutting it down or by making changes in the working algorithm, in case of a green corridor or in the event of an ambulance going through, in just 15 seconds or less.

IMPROVEMENTS TO MAKE IT REAL-LIFE

- The ultrasonic distance has to be replaced with industrial grade ultrasonic distance sensors for better result , more range and enhanced accuracy.
- The Arduino Nano development board has to be replaced with a faster microcontroller or microprocessor like the Esp32 (240 MHz) or Raspberry Pi (1 GHz – 1.4 GHz , depending on model).
- The small servo has to be replaced with a industrial grade servo which should be of a very high torque and should be rigid and frictionless. It should be lubricated properly.
- There can be a camera set-up attached(with Raspberry Pi) which will take the picture of the number plate of a car if it's velocity exceeds the trigger velocity of that particular setup .
- The trigger velocity should be changed to 50 km/h (or 13.88 m/s) or more depending on the lane and the traffic.

Thank You