

Project Report On DNP

Date :- 11-04-2025

Bike Guardian: A Smart Alert System for Cyclists



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Theme:

Minimizing accidents involving cyclists who share the same roads or lanes with heavy motor vehicles by optimizing and making use of commonly available modern-day ultrasonic sensors, LEDs and Buzzers. Thus, making their ride safer and enjoyable.



Aim & objectives:

Technology has had a profound impact on mankind in numerous ways, be it communication, healthcare, education, transportation, etc. Ultrasonic sensors and Lidar tech being a few of its products also serve many purposes in large factories, navy ships, bullet trains and modern passenger cars with ADAS. One such Indigenous example is the deployment of Lidar tech in the Vande Bharat express trains. With the bicycles, the idea here is to install ultrasonic sensors at the rear section of the bicycle which will keep on constantly pinging at periodic intervals and then send this data to a microcontroller board which will then use an algorithm to control the LEDs and Buzzer installed on the steering handle to alert the bicycle rider of approaching vehicles in the vicinity and also alert those vehicles in low visibility conditions with the use of LEDs installed at the rear.

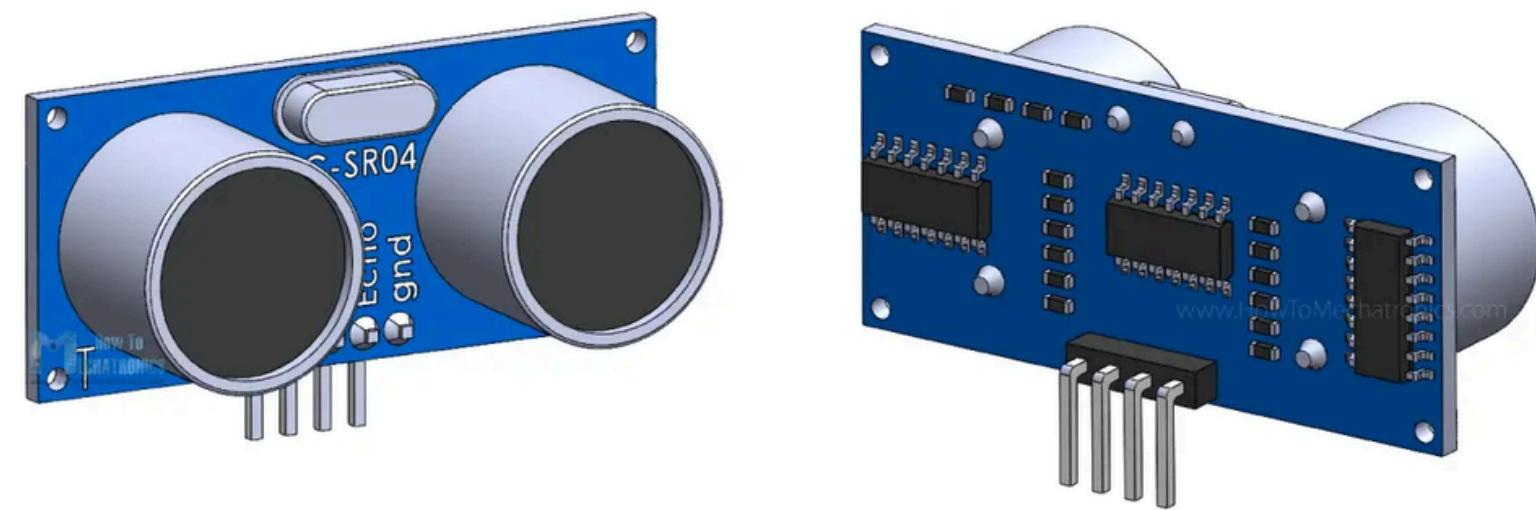
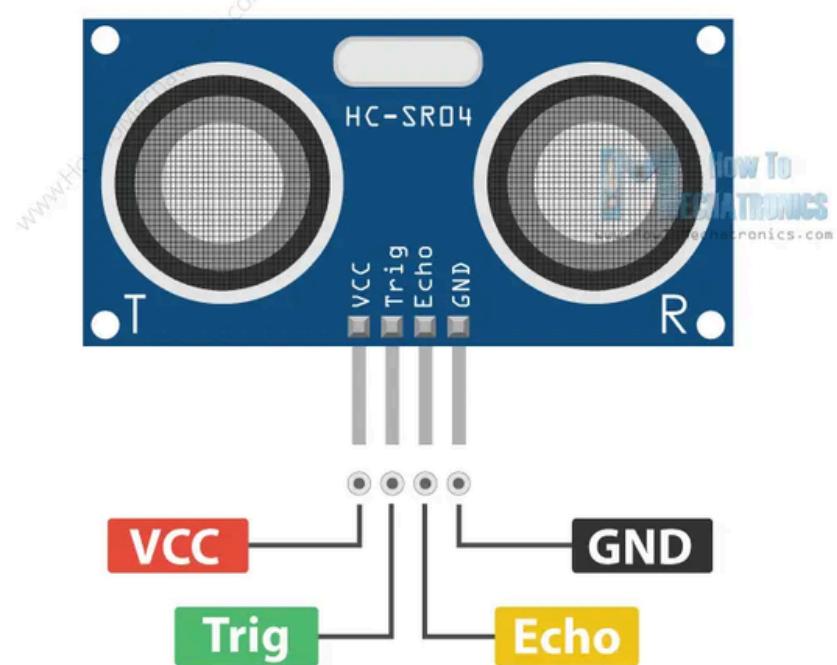
Materials Required:

1. HC-SR04 Ultrasonic Sensor (3X)
2. ABS Bracket to fix sensor (3X)
3. 5V Passive Buzzer (1x) - to alert the rider of upcoming traffic
4. Red DIP LED (3X) - two on handle bar and one on the rear
5. Arduino Uno R3 (1X)
6. Battery 9V (1X)
7. Battery holder with DC Barrel jack
8. Jumper wires & loose wires
9. Heat shrink tubes for insulation (optional)

Detailed Report:

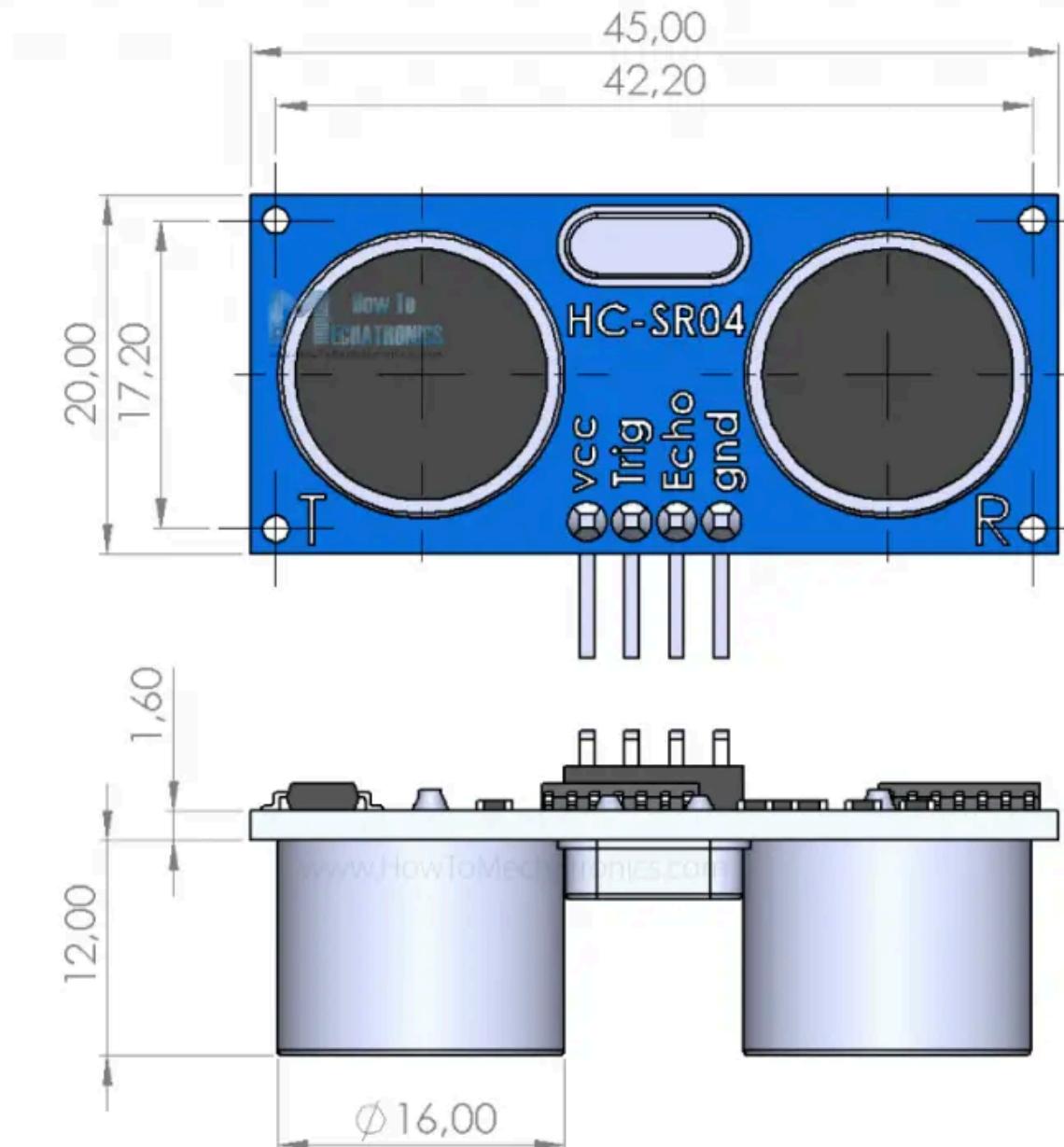
HC-SR04 is a very popular and affordable sensor that is found in many applications where it requires measuring distance and detecting objects. It has a maximum range of 4m (accurate up to 3mm) which is enough to detect and calculate the vicinity of approaching motor vehicles behind the bicycle. Each sensor can detect up to 15° in the horizontal plane and hence fixing three such sensors strategically can get us a total detection angle of 45° (Extendable).

HC-SR04 Pinout



Technical Specs:

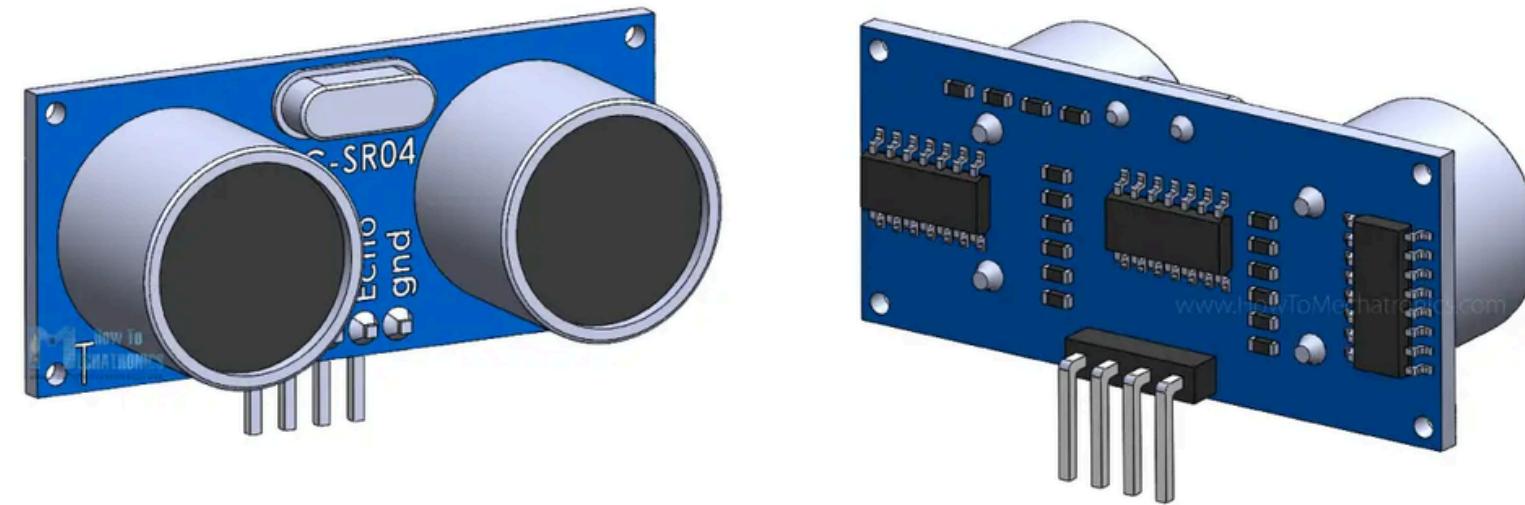
Operating Voltage	5V DC
Operating Current	15mA
Operating Frequency	40KHz
Min Range	2cm / 1 inch
Max Range	400cm / 13 feet
Accuracy	3mm
Measuring Angle	<15°
Dimension	45 x 20 x 15mm



HC-SR04 Data Sheet ([click here](#))

Technical Specs: (HC-SR04)

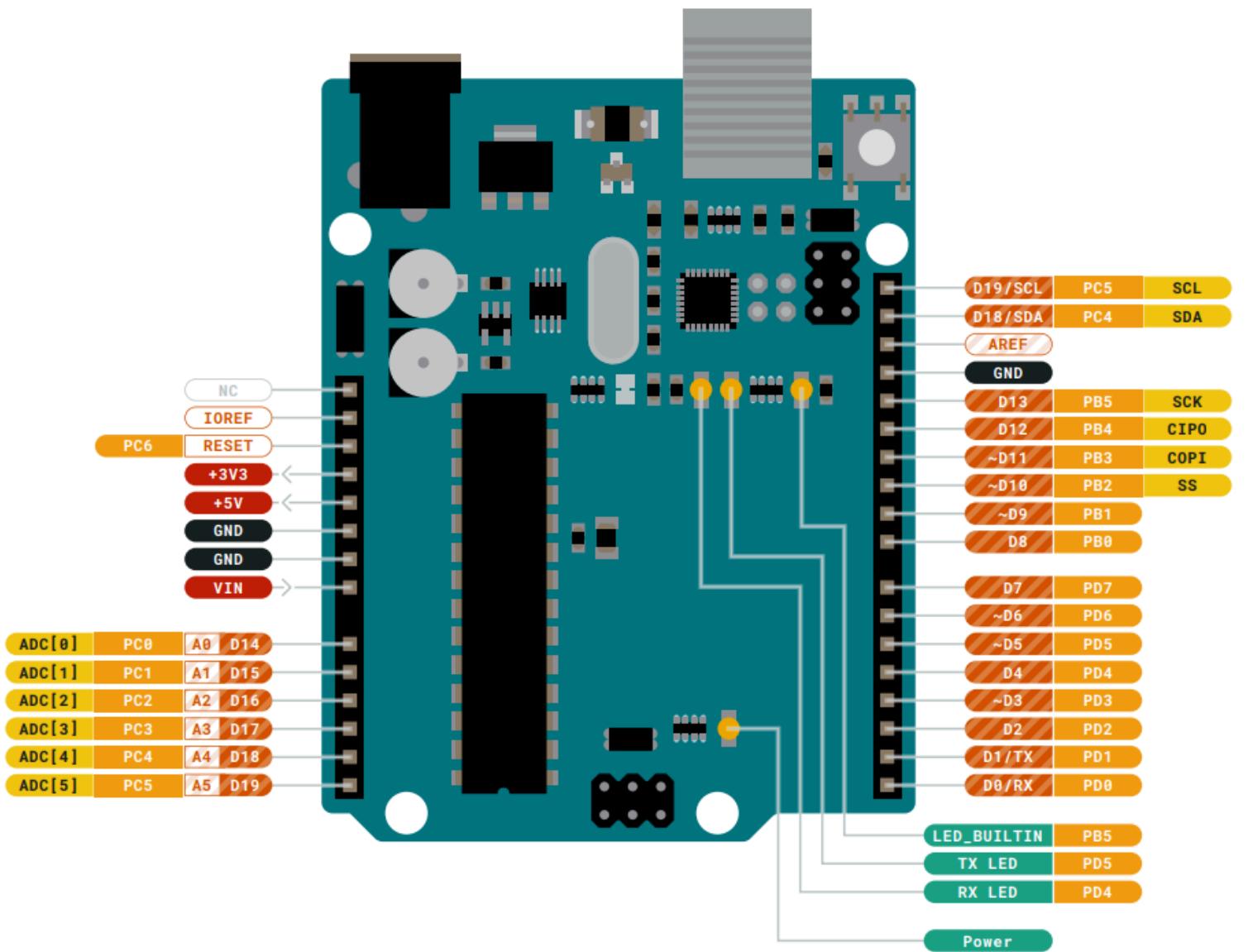
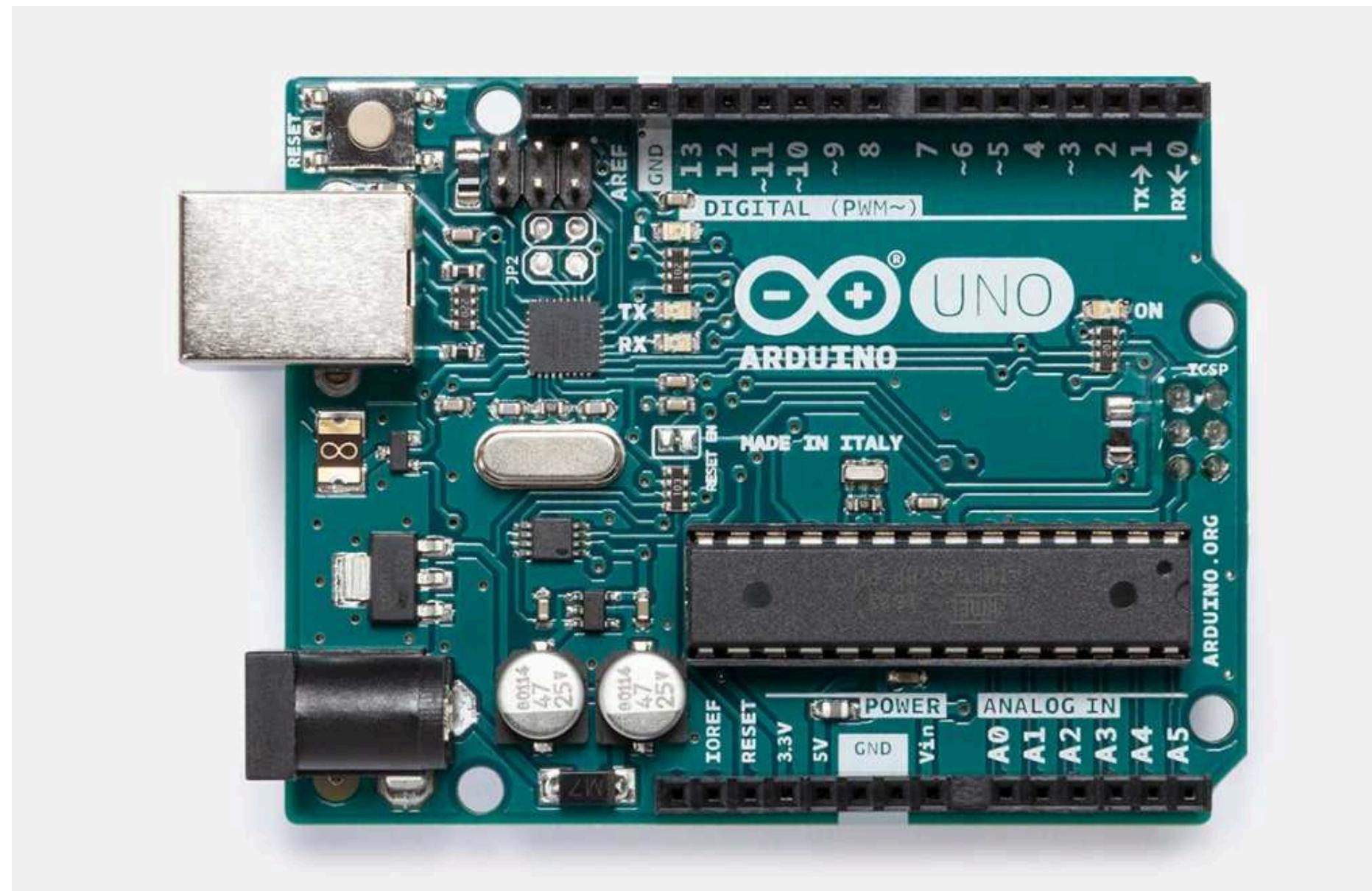
HC-SR04 has 4 pins namely for VCC, Gnd, Echo, and Trig. The Echo and Trig pins of all three sensors are connected to the Arduino Uno board via jumper cables. Arduino IDE used to program Arduino boards have pre-defined libraries made by open-source programmers to interface many sensors and modules with various Arduino boards. One such library <NewPing.h> made by Tim Eckel has been used to interface all three sensors in this project.



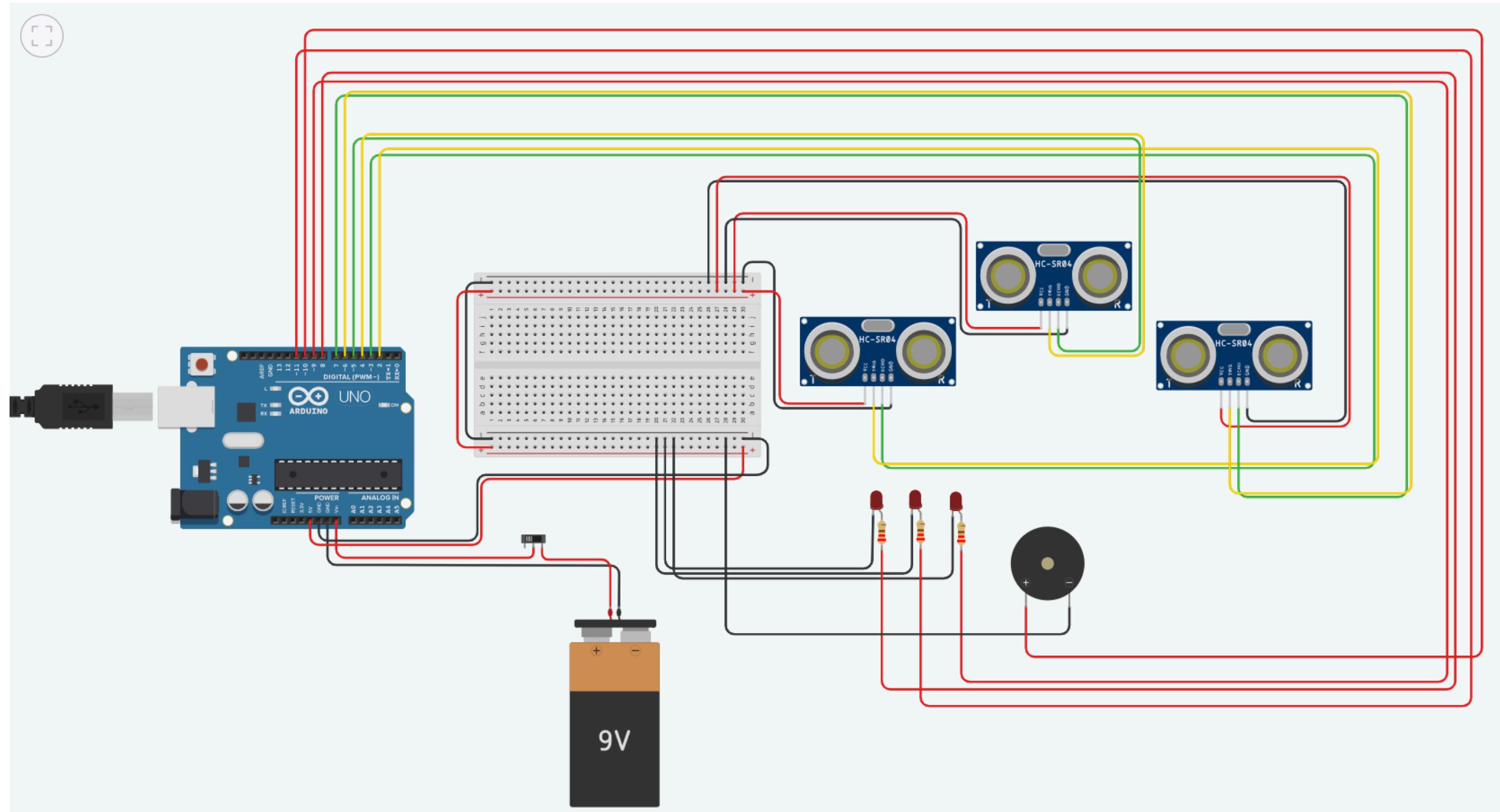
Technical Specs:

The Arduino Uno board then calculates the distance using the formula $\text{Distance} = (\text{Speed} \times \text{Time}) / 2$ from each sensor simultaneously and controls the Buzzer and LEDs as programmed. Two LEDs installed on the steering handle alert the bicycle rider of approaching vehicles such that if the vehicle is approaching from the left, the left side LED will be triggered and if from the right, the right side LED will be triggered accordingly. Both can be triggered simultaneously as well when the vehicle is right behind or when two different vehicles are approaching from both sides and in other similar scenarios.

Technical Specs: (Arduino Uno)

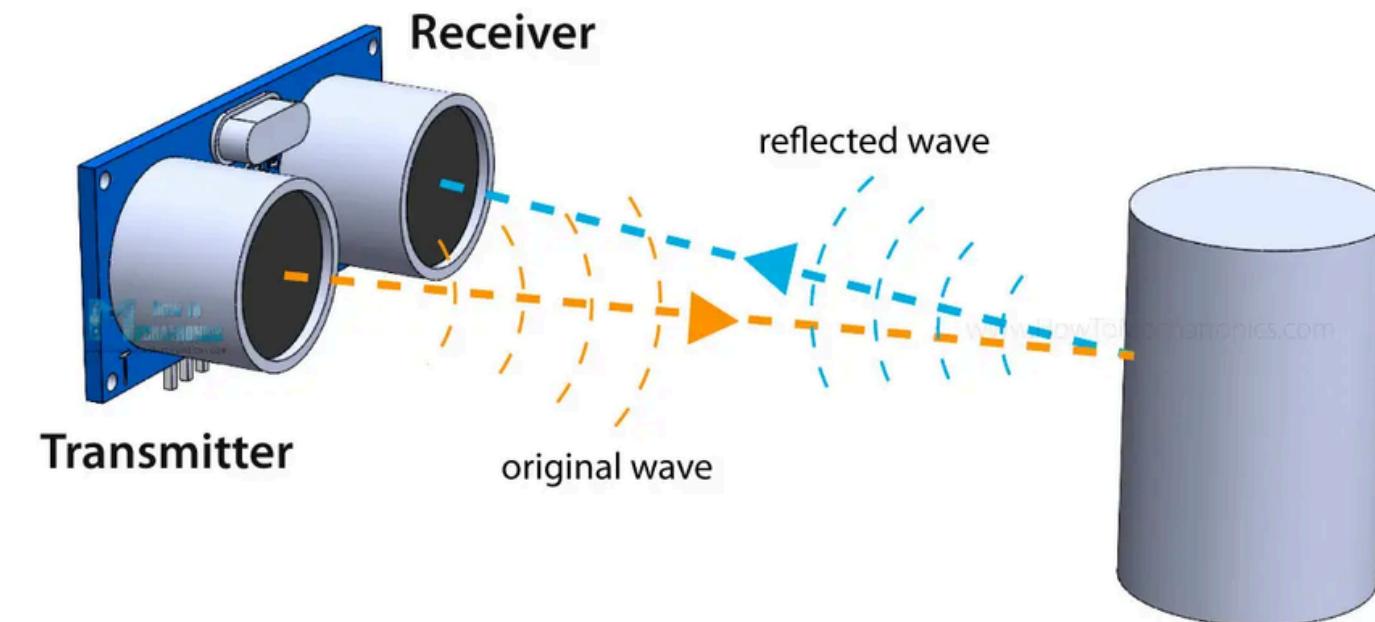


Schematic:



Working Principle:

Sound Navigation & Ranging i.e. SONAR is used by scientists to develop nautical charts, locate underwater hazards to navigation, search for and map objects on the seafloor such as shipwrecks, and map the seafloor itself. killer whales and bottle-nose dolphins also use echolocation for hunting and navigation which has inspired mankind to develop similar SONAR technology. HC-SR04 Modules use the same technology but on a small scale and range, thus making them very affordable and convenient for daily use cases.



Functional Value:

This whole project is designed to be as much cost-effective as possible. Well-optimized components are chosen to withstand harsh weather conditions with minimal water & dust proofing. All the components can be fixed quite easily on an already-assembled bicycle. Arduino & battery holder can be fixed inside the seat cavity to provide a safe cover from rain and dust. Any 9V Battery easily available in the market can be a reliable power source that can work for an estimated 2-3 months with daily use of about 1 hour.

Future scope of improvement:

This project can be deployed at a large scale with the bicycle industry, helping riders to be more confident and safe on public roads which they share with motor vehicles which can be a great threat to them in certain conditions. As it gets more and more common with bicycles, A mobile app can also be developed to adjust the sensor's sensitivity and various other settings to the rider's preference on the go via a Bluetooth module making the whole system even more convenient and user-friendly.

Further, a few more ultrasonic sensors can be installed strategically to increase the overall range to a great extent whenever required. An Inertia switch module can also be installed inside the seat cavity which can send data to Arduino Uno during an accident which in turn notifies the nearest hospital through an automated call using a GPS & GSM module for cloud connectivity to a dedicated server designed for the purpose.

Thank You



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