ENG 202C: Technical Description and Definition

Car Proximity Sensors

What are car parking sensors and how do they work?

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[Process: Proximity Sensors]

Audience and Scope

The purpose of this technical description document is to describe car proximity sensors used in vehicles work. Special attention will be given to the hardware and the software used in the process of sensing nearby obstacles by the sensors. Additional focus will be placed on the technology going behind the working of these sensors, called sonar ultrasonic.

Everyone that owns a modern car, knows how to drive or is interested about cars are aware about these sensors. The purpose of this document is to provide these people with more information and the functioning of the sensors. If properly maintained, these sensors last through the lifetime of a vehicle, therefore this topic will spark curiosity in the minds of these people that are associated to it.

Introduction

A proximity senor is an instrument that detects available space between the vehicle and a nearby obstacle that utilizes echo times of ultrasonic waves that bounce off nearby objects to determine the distance. The primary components of the parking sensor, also known as a "parking aid," are ultrasonic sensors, controllers, and screens. It enables the driver to "see" unseen objects in the rearview reflection and alerts the driver to potential hazards by sound or a more user-friendly display. The parking sensor helps the driver to eradicate the flaws of blind spots and blurred vision by removing the problem created by the driver's front, rear, left, and right views when parking, turning, and starting the vehicle. The parking sensors itself also has some blind spots, such as obstructions and ridges that are too low or too narrow.

The parking sensor employs the ultrasonic wave principles to detect vehicles when reversing. The rear bumper-mounted ultrasonic sensor uses ultrasonic waves to reach the obstruction, which then bounce back, calculates the real distance between the object and the vehicle body, and signals the driver to halt.

The parking sensor will immediately start when the vehicle is put in the reverse gear. The ultrasonic sensor at the back bumper regulates the ultrasonic discharge through the processor. Obstacles deflect the ultrasonic signal, which is then picked up by the ultrasonic sensor and sent to the amplifier circuit. The duration between the transfer of the ultrasonic signal and the receipt of the echo signal is used by the ultrasonic sensor to determine the propagation speed in the medium. The single-chip microcomputer processes the data, and the distance and orientation of the obstruction are then shown on the monitor to prompt the driver to act quickly.

Main Components of Proximity Sensor System

The parking sensor is a safety device that aids drivers when parking or reversing their vehicles. It alerts the driver to obstacles in their vicinity through audible or visual cues, which can make parking and maneuvering easier and more efficient. By compensating for blind spots and other visibility issues, the parking sensor enhances safety and convenience. Typically, the parking sensor consists of ultrasonic sensors, controllers, and displays or buzzers.

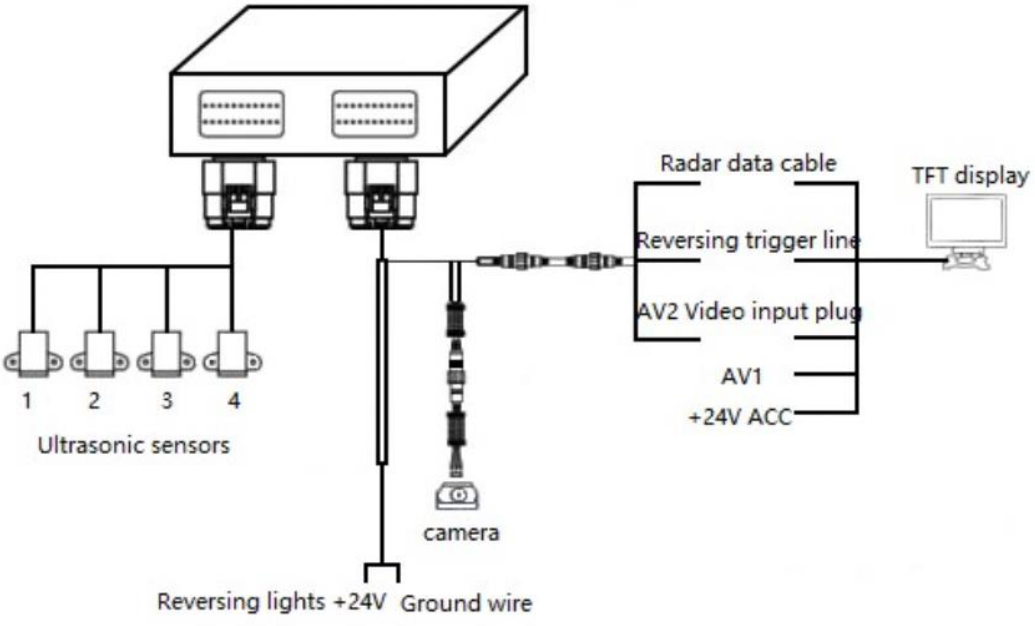

Figure 1: Components of car proximity sensors

1. **Ultrasonic sensor**: The function of the ultrasonic sensor is to send and receive ultrasonic signals, then input the signals into the host, and lastly to display them through the display device located inside the car.

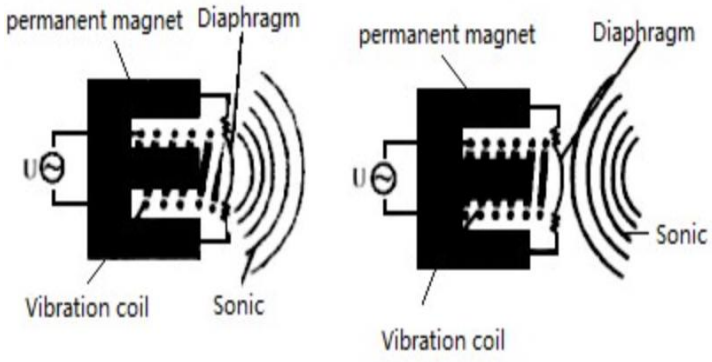

Figure 2: Working of an Ultrasonic Sensor

When the controller transmits an electronic signal to the ultrasonic sensor, the piezoelectric sheet vibrates, producing ultrasonic signal waves. The emitted ultrasonic waves have a certain directivity due to the construction of the circular piezoelectric sheet, and the beam section is comparable to an ellipse, so the sensing range of the ultrasonic sensor is restricted.

In most cases, the sensor used functions as both a transmitter and a receiver. Allowing for both transmitting and receiving of the ultrasonic waves by the same instrument.

2. **Controller**: It initiates and processes the signal to calculate the distance and orientation between the vehicle body and the obstacle. The controller transmits a sine wave pulse to the sensor, processes the received signal, and obtains the corresponding distance value, and then communicates with the display. The main function of the controller is filtering and calculation. The controllers of different brands of parking sensor systems may be different, but the principles are basically the same.

The controller for the parking sensor is typically mounted near the dashboard, while the ultrasonic sensor is positioned on the front and rear bumpers and connected to the controller via long wires. These wires can introduce some noise into the system, so the controller must be designed to filter out these extraneous signals.

3. **Display or buzzer**: As the sensor detects a dangerous amount of distance left between the car and the obstacle, the system will send an alarm through the in-car display and sound buzzer to alert the operator. The display provides corresponding distance and the car's speakers alarm sound according to the distance. Most cars have a sensor system which has a sound that gets louder or increase in tempo with a decrease in distance remaining with an obstacle.

Conclusion

Proximity sensors play an important part in modern vehicles, by offering several advantages such including improved safety, increased convenience and enhanced visibility. making them safer and easier to operate. Parking sensors can have accuracy issues, which can make it difficult for them to provide reliable proximity readings. One common reason for this is that the sensors may need to be calibrated to ensure their accuracy. If they are not properly calibrated, their readings may be inaccurate. This leaves us with an option of combining parking sensors with reverse cameras. Using a setup containing both the instruments allows for greater human intervention and decision making. Something not caught by sensors can be caught by human eye.

References

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