Deggendorf Institute of Technology

Ultrasonic distance monitor app

Mobile applications & interaction design in vehicle

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Overview

This project emulates a real-time Forward Collision Alert System with an ultrasonic distance sensor and a CC3200 LaunchPad. It keeps a watch on the car's proximity to other fronts in front of it at all times, and it reacts with LED and buzzer notifications depending on how close they are.

The distance readings are also publicly shared with MQTT protocol to a cloud broker (HiveMQ) for real-time monitoring on a custom-built Android application. The application portrays the measured distance, alert levels, and system status through color signals and warning messages.

The system mimics actual vehicle safety features such as adaptive cruise control and collision avoidance. It illustrates how IoT (MQTT + mobile) and embedded systems can collaborate for smart vehicle safety applications.

Use Case Scenarios

This application scenario outlines an ultrasonic distance sensor system operating in real-time utilizing an embedded sensor configuration and an Android smartphone app through an MQTT interface. The system detects distance to objects in close proximity and responds immediately with visual and audio warnings dependent on preconfigured safety limits.

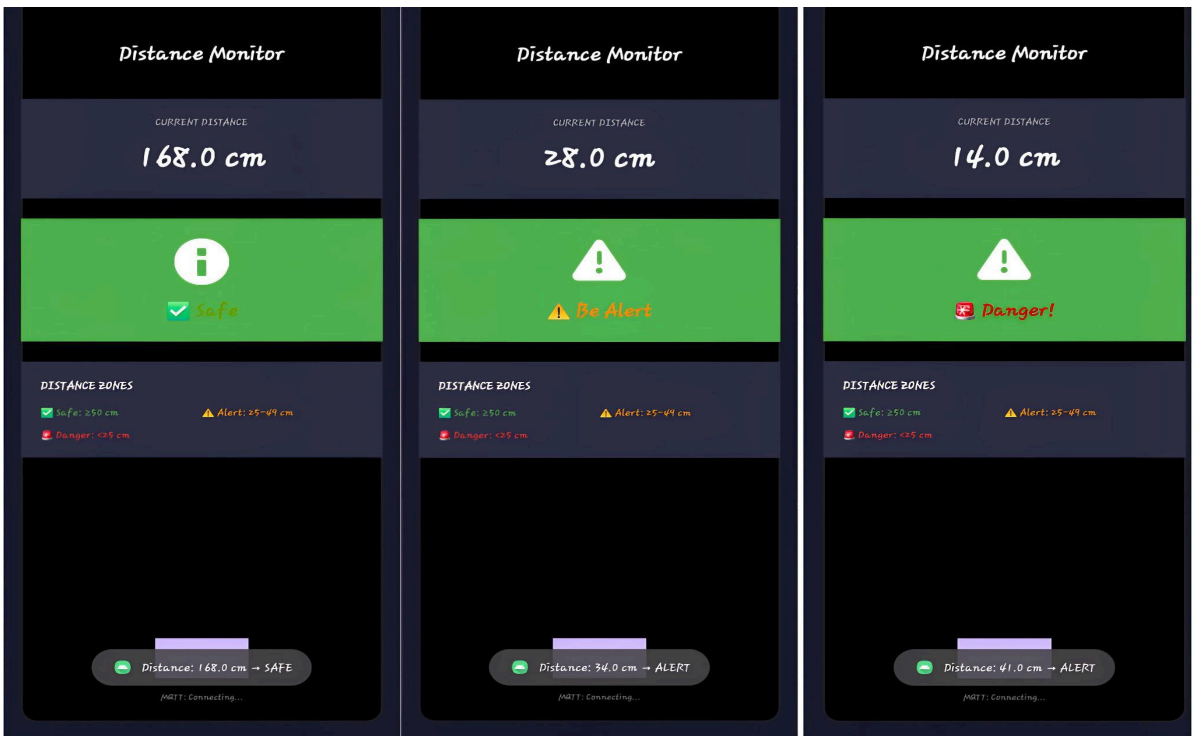
Working of System

The system uses a Grove Ultrasonic Ranger mounted on a CC3200 microcontroller to sense object proximity. Depending on the sensed distance, the microcontroller triggers a buzzer and onboard LED to notify safety measures. The distance information is also sent wirelessly with the MQTT protocol to a mobile app. The Android application is given such information in real-time and visually represents it as color-coded tags and status notifications like "Safe," "Be Alert," and "Danger." Such proximity states are thus remotely monitored and actioned instantaneously in the case of potential danger.
This dual architecture enables anticipatory collision avoidance through the users' ability to visually and aurally perceive and interpret sensor information—best suited for embedded learning, safety system prototyping, or smart car simulation.

App interface and Working

The Android app includes a simple and unobtrusive user interface for real-time visualization of the ultrasonic sensor data. It is connected to the sensor system via the MQTT protocol over Wi-Fi and receives distance readings continuously. The app displays the distance graphically in centimeters and updates the status label dynamically according to set safety zones (Safe, Alert, Danger). It also includes LED indicators and buzzer icons to mimic vehicle responses for various distance thresholds. When an obstacle is nearer than preferred, the app displays alarm messages critically and displays risk with red indicators and a buzzer alert.

Such interactive feedback makes the app appropriate for simulating real-world collision avoidance responses in car systems.



Conclusion

The ultrasonic distance sensing system is able to effectively prove the feasibility of proximity sensing for forward collision avoidance. Utilizing a CC3200-based sensor module and an Android application via MQTT, the system provides real-time output, visual notifications, and obstacle proximity-based safe-zone identification. The project was successful in emulating major automotive safety features using minimal hardware, paving a solid foundation for further innovation in smart vehicle technology and IoT-supported safety features.