TECHNISCHE HOCHSCHULE DEGGENDORF

Deggendorf Institute of Technology

Faculty of Computer Science

Gesture Control App

Mobile applications & interaction design in vehicle

Author:	Bharath Subramaniam Jayakumar
Matr. Number:	12500800
Course of study:	Automotive Software Engineering
Version from:	July 12, 2025
Examiner:	Prof. Dr. Goetz Winterfeldt

Contents

1 Gesture-Controlled Volume Adjustment System

Introduction

This project implements a gesture-controlled volume adjustment system for automotive environments, By using the CC3200 LaunchPad microcontroller with an Android application. The system replaces traditional button controls with intuitive hand gestures detected by an ultrasonic sensor, demonstrating practical IoT integration through HTTP communication. Designed for driver convenience and safety, this solution improves drivers safety and reduces distraction while driving.

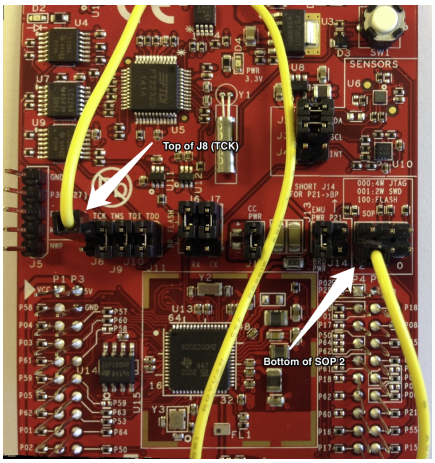

Figure 1.1: CC3200 Launch Pad

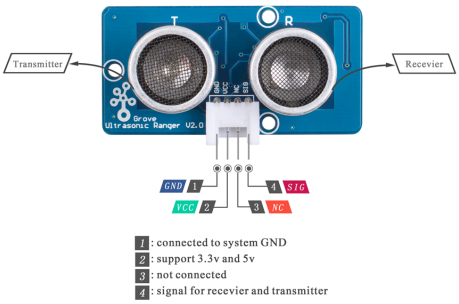

Figure 1.2: Ultrasonic Sensor

2 System Architecture

The architecture comprises a CC3200 LaunchPad connected to an HC-SR04 ultrasonic sensor to GPIO24, operating in single-pin mode for simplified wiring. The microcontroller hosts a lightweight HTTP server that provides both a JSON API endpoint (/sensor) and interactive web interface (/). The Android application, developed with Jetpack Compose, polls sensor data every 500ms and ranges 5-50cm hand distances into 0-100% volume values using linear mapping. To reduce noise and to prevent rapid volume fluctuations this system uses 5-sample moving average algorithm and features debouncing logic respectively.

3 Technical Implementation

The Android application employs several advanced techniques including coroutine-based network calls with Ktor client, real-time audio management through AudioManager, and smooth UI animations. The Compose interface features an automotive-inspired design

with circular progress indicators and status cards that provide immediate visual feedback. Special attention was given to error handling, with robust parsing logic that accommodates multiple response formats from the sensor and automatic reconnection mechanisms for unstable network conditions. The volume adjustment algorithm incorporates hysteresis to prevent constant minor adjustments during hand positioning.

4 User Experience

Drivers interact with the system by simply moving their hand closer to or farther from the console. The Android interface displays both the calculated volume percentage and actual system volume levels, with color-coded visual indicators showing connection status and hand detection.

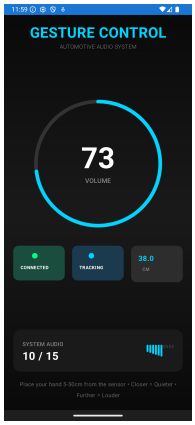

Figure 4.1: Volume Increase

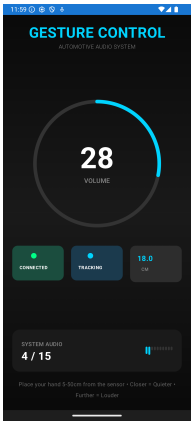

Figure 4.2: Volume Decrease

A distinctive blue circular progress bar animates smoothly during adjustments, while the distance readout helps users calibrate their gestures. Finally, when no hand is detected, the system maintains the last valid volume detected.

5 Future Enhancements

This system can be extended by placing multiple ultrasonic sensors perpendicular for 3D gesture recognition and Bluetooth Low Energy for offline use. Its architecture supports controlling other vehicle functions like air-conditioning or media through gestures.

6 Conclusion

This gesture-controlled system showcases how IoT can enhance automotive interfaces and safety. By combining embedded programming with mobile development, it provides distraction-free control. Its modular design and HTTP-based communication make it adaptable to various vehicle platforms and infotainment systems.