

Technische Hochschule Deggendorf

Faculty of Applied Computer Science

Master of Automotive Software Engineering

Mobile applications & interaction design in vehicles

Topic: Mobile Control Vehicle Lock/Unlock System

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Mobile Control Vehicle Lock/Unlock System

Overview:

The Car Lock Control System is a safe access management system for vehicles that securely connects via WiFi. The system has the capability to lock and unlock the doors of a vehicle remotely via a mobile application. The system is based on a CC3200 WiFi microcontroller employing a relay mechanism to simulate a door lock. While the corresponding Android app is designed using Jetpack Compose and provides real-time feedback, dark/light theme change capability, and automatic detection of connection state.

This project exemplifies the convergence of employment of mobile UI/UX and embedded systems in improving access control of vehicles in the contexts of shared mobility or shared family vehicle.

Problem Statement:

Traditional car locking mechanisms require manual operation via physical keys or remotes, offering no remote control or lock status feedback. These systems lack integration with modern smartphones and do not provide:

- Remote lock/unlock via mobile app
- Visual or audible feedback of status change
- Theme adaptability or connection monitoring

A smart, connected solution is needed to provide mobile-based locking control with a responsive and intuitive UI.

Target Users:

This solution is designed for:

- Ride-share drivers and taxi operators
- Families needing child/elder-safe access
- Tech-savvy car owners seeking app control
- DIY vehicle modification enthusiasts
- Smart car research and educational projects

System Components

Hardware

- CC3200 LaunchPad: WiFi-capable microcontroller
- Relay Module: Simulates lock mechanism
- Buzzer: Feedback
- Power Supply: USB or vehicle 5V input

Firmware (Energia Code)

- Starts WiFi Access Point (CarLockSystem)
- Listens for /lock and /unlock HTTP requests
- Controls relay state to simulate door locking
- Sends feedback to Android app on command success

Android App

- Connects to CC3200 WiFi AP (192.168.1.1)
- Sends lock/unlock requests
- Displays lock status visually using car images
- Shows real-time WiFi connection status
- Plays sound and vibrates on lock/unlock
- Includes light/dark theme toggle in top bar

Use Case Flow

Normal Operation (Remote Lock/Unlock):

- User connects phone to CC3200's WiFi.
- App displays current connection and lock status.
- Tapping 'Lock' sends /lock → relay is activated.
- Tapping 'Unlock' sends /unlock → relay is deactivated.
- App provides visual change, sound, and vibration on action.

Connection Monitoring:

- App pings /sensor every 5 seconds.
- If there is no response, 'Disconnected' is shown in red.
- Once reconnected, the status switches back to 'Connected'.

Theme Customization:

- User taps 🌞 or 🌙 icon in top app bar.
- UI dynamically switches between light/dark mode for comfort.

Key API Endpoints

Endpoint	Function
/lock	Locks the vehicle (Relay ON)
/unlock	Unlocks the vehicle (Relay OFF)

Benefits

- Secure, wireless car access using mobile device.
- Hands-free operation with single tap commands.
- Visual status updates using car illustrations.
- Energy-efficient and standalone(no internet required).
- Easily extensible for future upgrades.

Future Enhancements

- Include status feedback from relay (via /sensor response)
- Add lock history logging (timestamp + action)
- Auto-lock timer feature (e.g., auto-lock after 30 seconds idle)
- Bluetooth fallback for connectivity when WiFi fails
- Real time Lock/Unlock status tracking

Android App Screenshots

