In Phase 2, our primary focus shifts to translating our Phase 1 design ideas into practical solutions for the Smart Parking initiative. This document provides a comprehensive overview of the specific actions required to execute the design, clarifying how each element will be realized.

\*\*Design Evolution Process\*\*

1. \*\*Deployment of IoT Sensors\*\*

- \*Objective:\* Implement IoT sensors for monitoring parking spaces in real-time.

- \*Stages:\*

- \*\*Acquisition of Sensors:\*\* Procure chosen IoT sensors (ultrasonic and infrared) and accompanying wireless communication modules.

- \*\*Installation:\*\* Position the sensors in designated parking areas, ensuring secure attachment and weather protection.

- \*\*Wireless Data Transfer:\*\* Establish wireless communication links between the sensors and the central hub (Raspberry Pi).

- \*\*Data Validation:\*\* Incorporate validation mechanisms to guarantee the accuracy of sensor data.

2. \*\*Development of a Mobile Application\*\*

- \*Objective:\* Create a user-friendly mobile app for accessing real-time parking information.

- \*Stages:\*

- \*\*Choosing the Development Platform:\*\* Select appropriate development platforms (e.g., Android Studio and Xcode).

- \*\*User Interface/User Experience (UI/UX) Design:\*\* Construct an intuitive interface with maps, real-time updates, and navigation features.

- \*\*Backend Development:\*\* Construct a robust backend server for data processing and API endpoints.

- \*\*Integration:\*\* Link the mobile app to the central server to retrieve real-time data.

- \*\*Testing:\*\* Rigorously test the app for functionality and user experience.

- \*\*Feedback Loop:\*\* Collect user feedback and make necessary improvements.

3. \*\*Configuration of a Central Server\*\*

- \*Objective:\* Establish a central server for data processing and storage.

- \*Stages:\*

- \*\*Procurement of Server Resources:\*\* Obtain the necessary hardware and cloud resources.

- \*\*Database Design:\*\* Create a database schema for storing parking-related data.

- \*\*API Development:\*\* Develop APIs for inputting sensor data and retrieving data through the mobile app.

- \*\*Security Implementation:\*\* Apply robust security measures to safeguard data integrity.

- \*\*Scalability:\*\* Ensure the server infrastructure can scale to accommodate increased data volume as the project expands.

4. \*\*Integration of Raspberry Pi\*\*

- \*Objective:\* Incorporate Raspberry Pi for data collection and transmission.

- \*Stages:\*

- \*\*Setting Up Raspberry Pi:\*\* Configure Raspberry Pi devices for data collection and transmission.

- \*\*Aggregation of Sensor Data:\*\* Enable communication between the sensors and Raspberry Pi.

- \*\*Data Transmission:\*\* Establish protocols for transmitting data to the central server.

- \*\*Monitoring and Maintenance:\*\* Implement remote monitoring and maintenance procedures for Raspberry Pi devices.

5. \*\*Integration of Public Transportation\*\*

- \*Objective:\* Include public transportation vehicles within the system.

- \*Stages:\*

- \*\*Integration of Vehicle GPS:\*\* Connect public transportation vehicles to the central server for tracking their locations.

- \*\*Real-time Data Updates:\*\* Implement mechanisms for vehicles to transmit location data in real-time.

- \*\*Integration with Mobile App:\*\* Update the mobile app to display real-time vehicle locations and arrival times.

\*\*Summary\*\*

The transformation process of the Smart Parking project's design encompasses a series of vital stages, including the deployment of IoT sensors, the development of a mobile application, the setup of a central server, the integration of Raspberry Pi, and the incorporation of public transportation. By meticulously executing these stages, we will bring our innovative design concepts to life, revolutionizing public transportation with real-time parking information.