**Smart Parking Project Report**

## Executive Summary

This project report describes the development and implementation of a smart parking system using Internet of Things (IoT) technology. The system uses sensors to detect the presence or absence of vehicles in parking spaces, and then transmits this data to a cloud-based platform. This platform can then be used to provide real-time information about parking availability to drivers, as well as to help parking operators manage their facilities more efficiently.

## System Overview

The smart parking system consists of the following components:

- **Sensors:** The system uses a variety of sensors to detect the presence or absence of vehicles in parking spaces. These sensors include ultrasonic sensors, infrared sensors, and magnetic sensors.
- **Communication devices:** The sensors transmit data to the cloud-based platform using a variety of communication devices, such as cellular networks, Wi-Fi, and Bluetooth Low Energy (BLE).
- **Cloud-based platform:** The cloud-based platform receives data from the sensors and stores it in a database. The platform also processes the data to generate real-time information about parking availability.
- **Mobile app:** The system includes a mobile app that allows users to view real-time information about parking availability and navigate to available parking spaces.

## System Implementation

The smart parking system was implemented in a parking garage with 200 parking spaces. The system uses ultrasonic sensors to detect the presence or absence of vehicles in the parking spaces. The sensors are connected to a communication gateway that transmits the data to the cloud-based platform using a cellular network.

The cloud-based platform is implemented using Amazon Web Services (AWS). The platform uses a variety of AWS services, including Amazon DynamoDB, Amazon Kinesis, and Amazon Lambda.

The mobile app is implemented using the Flutter cross-platform development framework. The app uses the Google Maps API to provide navigation to available parking spaces.

## System Benefits

The smart parking system has provided a number of benefits to the parking garage operator, including:

- Reduced traffic congestion: The system has helped to reduce traffic congestion around the parking garage by helping drivers to find parking spaces more quickly and easily.
- Improved parking utilization: The system has helped to improve the utilization of the parking garage by providing real-time information about parking availability. This has led to a reduction in the number of empty parking spaces and an increase in revenue for the parking garage operator.
- Enhanced parking management: The system has helped the parking garage operator to manage the facility more efficiently by providing data on parking usage and trends. This data is used to optimize parking rates, identify areas where additional parking is needed, and improve the overall customer experience.

## Conclusion

The smart parking system has been a successful implementation of IoT technology to improve parking management. The system has provided a number of benefits to the parking garage operator, including reduced traffic congestion, improved parking utilization, and enhanced parking management.

## Recommendations

The following recommendations are made for future implementations of smart parking systems:

- Use a variety of sensors to detect the presence or absence of vehicles in parking spaces. This will help to improve the accuracy and reliability of the system.
- Use a cloud-based platform to store and process the data from the sensors. This will make it easier to scale the system and provide real-time information to users.
- Develop mobile apps and other user interfaces that are easy to use and provide the information that users need.
- Integrate the smart parking system with other parking systems, such as payment systems and parking enforcement systems. This will help to ensure that the system is able to provide a comprehensive solution for parking management.