Automated Parking Management System

Functional Requirements

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# Introduction

## Project Purpose

* + 1. Vehicle parking in places such as crowded cities and airports has become an issue for many drivers. Limited parking spaces arising from shortage of real estate, increased population and more automobile use have resulted in a great demand for efficient parking management systems. Delays in finding a parking spot can be reduced with an intelligent system to monitor and provide feedback on the availability of parking space in real-time. In this project, wireless sensing and reporting capabilities along with central server/processor and intelligent decision making will be used to develop an efficient parking space management system.

## Project Scope

* + 1. This project aims to develop a general system model for parking management that can be scaled and applied to a real-life scenario. This includes a user interface application that allows users to book parking spots, a central hub of servers that store data, provide authentication for users, monitor and collect data for each parking lot. This system is used to automate management of parking lots. Security and maintenance of parking lots is not included in this project.

# Document Description

* 1. This document shall describe the functional requirements created by the development that should describe the implementation strategy of this project. It should describe the design and architecture of each high-level subsystem.

# Functional Requirements

## Parking Lot

### Entrance

* + - 1. The entrance of the parking lot shall have a gate to authenticate users.
      2. Users are required to stop at the entrance and successfully scan their QR code to enter the parking lot.
      3. Gate shall open once the QR code scan is successful.
      4. Users that are unsuccessful in their attempt to scan QR code must exit through the exit route.

### Parking

* + - 1. Each parking spot must be labeled with text to indicate the type of parking.
      2. Regular booking users shall be able to park at any spot that is indicated as a “regular” spot.
      3. License plate detection using cameras is performed on cars at special spots for verification.
      4. Users are required to park such that license plates are detectable by the camera.
      5. An alarm should sound when an unauthorized vehicle parks in a special spot.
      6. System shall have a physical indicator in the parking lot to indicate that a spot is occupied.
      7. Vehicle length and width shall not exceed parking spot length and width.
      8. Weight sensors are used to detect the presence of a parked vehicle at a parking spot.
      9. Sensor data shall be transmitted through the internet to a remote server.

### Exit

* + - 1. Users must scan their QR code at the exit of the parking lot.
      2. Alarm shall be triggered in the parking lot if a user does not exit the parking lot within the boundaries of the booked parking time.
      3. A gate shall regulate the exit scanning procedure.

## Frontend Application

### Authentication

* + - 1. Users shall be able to register an account.
      2. Registered users shall be able to login.
      3. Logged in users shall be able to logout

### Features

* + - 1. Logged in users shall be able to book a parking spot.
      2. Logged in users shall be able to cancel a parking spot booking.
      3. Logged in users shall be able to see the real-time occupancy of parking spots for a parking lot.
      4. Logged in users shall be able to see the parking occupancy statistics for a parking lot.
      5. Logged in users shall be able to see parking lot guidelines, restrictions and information.
      6. Logged in users shall be able to change user information
      7. User shall be able to change their license plate information
      8. User shall be able to change their username
      9. User shall be able to change their password
      10. User shall be able to change their email address

## Backend Server

### Real-time Database

* + - 1. System shall be able to track parking spot occupancy in real-time.
      2. The real-time data shall be accessible to the end-users on the Frontend Application.

### Database

* + - 1. Database shall store the booking information for all users.
      2. Database shall store the parking occupancy data collected from each parking lot.
      3. Database shall store user information
      4. Database shall store parking lot information

### Functions

* + - 1. Server shall authenticate QR code scan attempts at entrance and exit.
      2. Server shall operate gates at the entrance and exit.
      3. Server shall operate lights at each parking spot.
      4. Server shall handle all backend api requests from Frontend application.