ParkEZ Automated Parking Garage

Project Proposal

CSCI 441 Software Engineering

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Project URL:

https://fhsu-park-ez.vercel.app/

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Proposed Project Description:

Problem Diagnosis:

Traditional parking systems are plagued by inefficiencies, long waiting times, and manual processes that lead to customer dissatisfaction and underutilization of parking spaces. Key problems include:

1. **Inefficient Space Utilization:** Conventional parking garages often struggle to optimize parking space usage, leading to wasted profits.
2. **Manual Entry and Exit:** Manual ticketing systems cause congestion and delays at entry and exit points.
3. **Limited Visibility:** Customers lack real-time information on parking space availability, leading to parking garage congestion during high traffic hours and frustrated parking garage customers.

Parking garages are not only supposed to provide parking for customers, but are supposed to provide a positive parking experience. One of the biggest factors leading to a positive parking experience is being able to find an available parking space in a reasonable amount of time. Recently a member of our group used a parking garage and ended up spending twenty frustrating minutes just finding a parking space. This simple task was made significantly more difficult due to the lack of proper signage directing customers to other wings of the garage with extra parking available. Most parking garages are currently run in such a way that the sole responsibility for finding available parking spaces falls on the customers or paid parking attendants at the time that a space is needed. No parking garage maps, or other types of parking aids are provided.

Some parking garages might give a customer the number of vacant parking spaces in the garage or on each floor with little to no other information, forcing the customer to drive around in search of an available parking space. In many instances there are multiple vehicles driving around the parking garage levels looking for spaces at the same time. This causes increased traffic in the garage, increased time searching for available spaces and customer anxiety. Leaving the parking garage does not get any better due to confusing two-way traffic routes, leading to vehicles commonly going the wrong way, and lack of proper signage telling customers how to exit each garage level. In the case of our team member, it was stated that while exit signs were visible, they did not provide adequate directions on where to actually go to get to the exit.

Proposed Treatment: Our Automated Parking Garage System aims to address these problems with the following solutions:

1. **Efficient Space Utilization:** Implement dynamic parking allocation algorithms to maximize space usage.
2. **Automated Entry and Exit:** Utilize License Plate reader technology and automated gate systems to streamline vehicle entry and exit.
3. **Real-time Information:** Deploy sensors and a robust backend system to provide customers with real-time parking space availability updates via a web app and digital displays within the garage.
4. **Managing Unreserved Customers:** Reserve the ground floor specifically for walk-in customers, providing easy access to available spaces for those without reservations. Also, limit the number of roaming cars allowed.

5. **Elevator:** Elevator displays assigned spaces for registered customers with reservations and direct access to chosen floors one car at a time.

Functional Features:

- Customer registration and profile management.
- Real-time parking space availability updates.
- Automated entry and exit for vehicles.
- Ground floor display notifying potential customers if the parking lot is full or if there are vacancies.
- Payment processing and billing.
- Reservation system with confirmation.
- Integration with security and surveillance.
- Elevator

Metrics for Success: Our metrics for success in this Parking Garage System will be based on the successful testing of the critical functions:

- Customers must be able to create and retain a profile, manage their reservations, and have their vehicle correctly noted for occupation and vacancy within the garage.
- The database must be able to retain, remove, or alter the information of the ParkEZ customers with proper security.
- The garage's tracking system must be able to correctly interpret data to keep an accurate track of available parking and display vacancies correctly to users of the web app.

- The real-time garage interface must be able to process payments and bill customers, as well as correctly interpreting who does and does not have a registration for a space inside of the garage. It must also be able to direct the customer to their vacant parking space with accuracy.
- For all of these successes to be considered, the security and surveillance system must be able to relay infallible information to the garage's system and from there to the web application.
- Success can also be measured by increased parking garage profits and parking space utilization.

Scenario 1:

Current practice: Customers arrive at a parking garage without knowing if any space is available, which leads to congestion and frustration.

Proposed System: Paul reserves a spot on the ParkEZ web app, which assigns him a space and guides him directly to it using elevator integration.

Advantages:

Paul saves time and reduces frustration.

Elevator integration improves efficiency.

Scenario 2:

Current practice: Walk-in customers struggle to find a parking spot.

Proposed System:

Lisa, without registration, is directed to an available parking spot by the web app.

Advantages:

Lisa finds parking quickly, reducing congestion.

Improved experience for walk-in customers.

Plan of Work and Product Ownership: We will split our team into three pairs of students, each responsible for specific functional features of the system:

Team Pair 1:

Functionality: Customer registration and profile management.

Qualitative Property: Develop an intuitive and user-friendly online registration process that securely stores customer data and reservation data in a database.

Treatment: Address the problem of user registration complexity and ensure a seamless onboarding experience.

Team Pair 2:

Functionality: Real-time parking space availability updates by integrating parking space sensors, license plate cameras and customer check-in software.

Qualitative Property: Ensure system performance to display availability within seconds.

Treatment: Alleviate the problem of customer frustration due to inefficient parking space searches.

Team Pair 3:

Functionality: Automated entry and exit for vehicles using license plate recognition camera system.

Qualitative Property: Develop and evaluate a user-friendly interface for the entry and exit process.

Treatment: Resolve the issue of congestion and delays at entry and exit points.

Additionally, we will collectively work on payment processing, billing, and the reservation system to enhance overall system efficiency.

Product Ownership:

Benjamin Bylsma - Customer registration and profile management.

Christopher Smith - Real-time parking space availability updates.

Geoffrey Sarpong - Automated entry and exit for vehicles.

Mikael Mikaelian - Payment processing and billing.

Adrian Elgin - Reservation system with confirmation.

Phongsavanh Mongkhonvilay - Integration with security and surveillance.