Autopark

Group 3
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Overview

The purpose of this project is to design a completely automated parking system with no need for parking garage employees to manage the customers of the parking garage. This system is intended to create a more efficient parking process while increasing revenue and cutting costs of the garage.

Novel Features:

1. Smart Pricing System

2. Spot Viewing Interface

3. Congestion Control

4. Automatic Security

Register and Login

For our website, we utilize Javascript to provide a user-friendly interface. In addition, we use Nodejs for the logic to generate queries to communicate and modify our MySQL user database.

On the website, users can update their personal information and make reservations for parking spots which is then updated to the database.

Reservation and Ad-hoc Parking

- Normal reservation: customers can view and reserve spots ahead of time using the website via the reservation system
- Ad-hoc parking: customers can also come in off the street for unreserved parking (based on the availability of spots)
- On-the-fly changes
- Reservations and spot status are stored in a database for easy access and organization
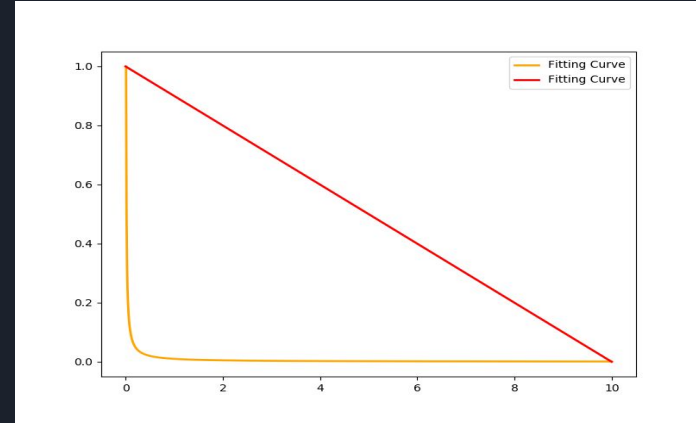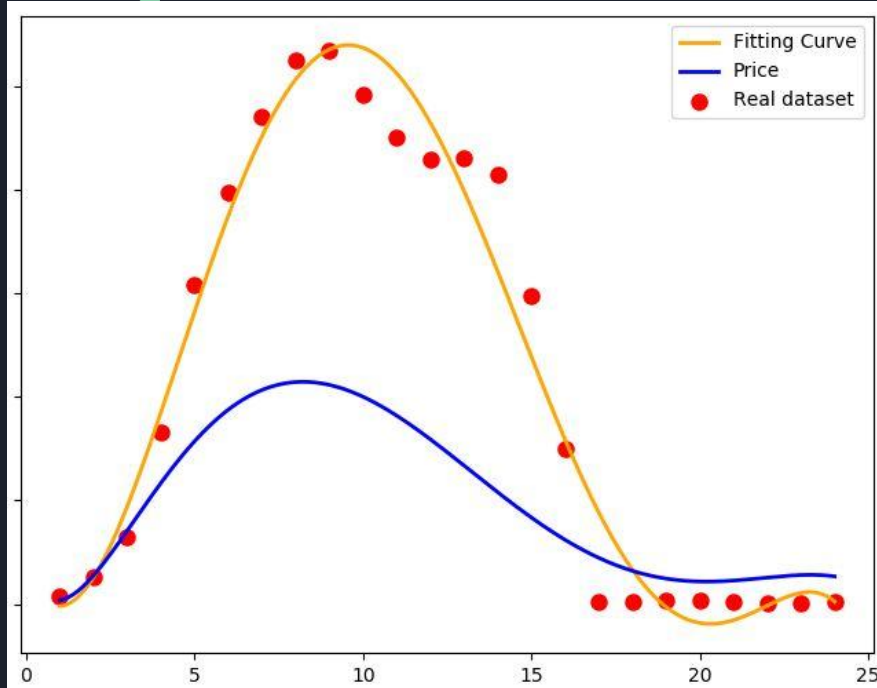
Smart Garage Systems

To improve the efficiency of the garage system and reduce traffic and wait time for customers, various automated systems have been implemented:

- **License Plate Reader** to quickly identify customers
- **Spot Verification System** to ensure customers park in the correct spot
- **Traffic Control System** to limit the number of cars driving on each floor
- **Notification System** to send messages and alerts to customers
- **Smart Security System** to provide access in and out of the garage to verified customers only

Dynamic Pricing Algorithm

Parking fitting curve: N=f(t)
Demand & price: De=d(p)
Dynamic Price: Max{N(t)*De(p)*p}

Other demand function:

$$\lambda_{[u,\,v]}^{t}\left(X^{t},\,P^{t}\right)=A_{[u,\,v]}^{t}\left(X^{t},\,P^{t}\right)\left(a_{[u,\,v]}^{t}-b_{[u,\,v]}^{t}\times\sum_{s=u}^{v}p_{s}^{t}\big/(u-v+1)\right)$$

Future Plans

- Improve the website to make it more user-friendly
- Allow garage managers to login and change pricing or reservation options
- Allow customers to view spots on a visual interface on the website (a "map" of parking spots)
- Implement dynamic pricing algorithms with a billing system that keeps track of time spent parking and rates
- Track customer statistics and report activity trends to garage owner