ITS-Parking – Solutions for Parking Areas

We are a maintainer of parking areas and we want to establish a new parking solution for improved handling and maintenance of our parking areas. Create and provide an extensible server centered solution which supports any number of parking gates and cash devices. Each gate works individually and interacts with the server. Each gate will

- Ask the server for free slots
- Notifies the server when car drives in
- Ask for billing information before car exits
- Notifies the server when car drives out

Each gate is equipped with a video camera, so the car's identification number is known to the gate and will be used with every communication to the server. The camera is also in a position to detect "handicap markers" when they are visible in the front shield of a car. As we know from earlier approaches, drivers with a handicap may use special slots of the parking area. The parking server will have to maintain the actual state (free/occupied) for the parking area and additionally has to

- Provide status information of free and occupied parking slots
- Provide billing information
- Provide statistics on the usage of the parking area for a given period of time (e.g. day, month or year).

Details concerning the new solution and provided services are given below.

Products

Simple Parking Slot

A simple parking slot is a "normal" slot for standard-size cars and drivers without any handicap. This is the cheapest box since it occupies less space than other boxes.

Extended Parking slot

Opposite to the simple parking slot, the extended parking slot provides slightly more place than the simple slot. All parking slots dedicated for cars/drivers with handicap are "extended" slots. Whilst handicap drivers have to pay the "simple fee", the extended slots are also offered to the other drivers/cars at an "extended fee" price.

Oversize slots

Sometimes, celebrities and/or other VIP's have oversize limousines. For them we offer (very limited, but very expensive) oversize parking slots.

Customers

We want to offer our versatile services to customers. To archive best acceptance from the customers we offer customized services to them. Our field research department identified the following types of customers.

Regular Customer

The first type of customers is the known (or regularly) customer who has a time limited contract for a reserved parking slot. Regular customers are allowed to drive in and out as often they want. However, whilst we track all movements, they are not charged at the movement level but on the (pre-paid) time frame.

Occasional Customer

The second type of customers is occasional customers who just want to use the parking area for a short period of time. Since we are able to detect the car identification number it is possible to track the movements of occasional customers at any time. The services we are offering to our customers are as follows:

- Drive in, Drive out
- Billing for occasional customers for every usage of the parking area, based on their used parking slot (simple, extended, oversize) and car type (handicap yes/no)
- Provide statistics of the slot usage for regular customers (for administrators)
- Billing for regular customers

We additionally want to empower our marketing department with data of occasional customers who are eligible “regular” customers. To improve customer retention we offer regular contracts in case the occasional usage of the parking area exceeds the costs for a regular contract. Payment is done at cash devices “before” exiting the area (Occasional Customers). When leaving the area, the gate detects the car id and may request the billing state for this car’s movement!!! Regular customers are billed electronically.

Constraints & Rules

The system to create has to take into account some constraints and rules:

- Each parking area has a given number of parking slots. The number of slots is merely fixed but – who knows – may be increased or reduced.
- Each parking slot is marked as “simple”, “extended” or “oversize”.
- Each usage of any parking slot must be tracked with car id, start and end time (or duration respectively).
- Each usage of any parking slot requires a valid parking ticket.
- Each ticket may have one (occasional customer) or more (regular customer) movements, e.g. drive-in and drive-out.
- The price of the ticket is computed based on the
  - parking-duration (occasional customer)
  - ticket validity (regular customer)
- Each ticket must be paid before the car leaves the parking slot. Whenever a ticket is no longer valid (maximum parking duration expired), the occasional customer has to pay a penalty fee. The regular customer however is allowed to leave the parking slot.
- Each “drive-in” action requires a valid ticket and is accompanied with car type (handicap), car id, timestamp and the used gate. The car driver is allowed to pick a parking slot of the requested type by himself.
- Each “drive-out” requires a valid ticket and is accompanied with car type (handicap), car id, timestamp and the used gate. A “drive-out” is only allowed when the ticket is paid.

To be continued by you …

Overall Objective

Analyze the system which is to be created. Design and implement a simple parking management system which allows executing the following tasks:

- Create/Add regular customers
- Create the area with all (typed) parking slots
- Assign a parking slot to regular customers
- Track all movements of all (regular/occasional) customers
- Compute billing for regular customers based on the ticket duration
- Compute billing for occasional customers based on the movement (duration of parking)

- Consider different usages of the central server (gate, management, cash device)

Expected Results

We expect to see a working Parking Area Management System Solution along with a flexible number of gates.

ITS-Bank - Financial Products and Services

We are an institution in the field of banking & finance. Up to now, our main business was the B2B market by dealing with shares and by having bank-to-bank transactions with exclusive commercial customers. However, due to a new strategy of the company, we are now opening our house to the private public by offering new products and services:

- Private account for day-to-day transactions
- Private savings account, with reference account for all (pay-out) transactions.
- Private custody account for stock transactions.

Details concerning the new products and services are given below.

Products

The private checking account

The simple private account is an opportunity for private customers to have an account for all day-to-day transactions. The account has a balance which is computed based on the opening balance and on the transactions. It is possible to deposit money to the account and also to withdraw money from the account. Since this is a checking account, the balance may also become lower than zero. Each transaction for this checking account must refer to a second account where the money goes to (withdrawal) or comes from (deposit). Generally spoken: each transaction affects exactly two accounts; first the local account from our system and secondly the account which is identified by the bank identification code and the account number. In case of cash deposit in our office, you may create dummy account information with our local bank identification number and a number identifying the customer. This checking account also offers the possibility for cash dispenser transactions. The customer therefore may use the cash dispenser for withdrawals.

The private savings account

The private savings account is only available for existing customers. Transactions from and to this account are restricted to the reference account which must be a checking account. Since this is a savings account, the balance must not become lower than zero. In addition, this account must not be available for cash dispenser transactions.

The private custody account

The private custody account is an option for all customers to participate in the stock exchange. Similar to the savings account, transactions refer to the checking account. Additionally, transactions with this account are restricted to two distinct types: Buy: Allows adding stocks to the custody account. Each transaction is identified by the name of the stock, the number of stock shares and the actual stock exchange rate. Buying stocks reduces the balance of the referenced checking account. The reduction is computed by the number of shares and the exchange rate. The customers are allowed to sell stocks. Selling stocks is only possible for available stocks, meaning only those previously added to our custody account. Each transaction is also identified by the name of the stock, the number of stock shares to sell and the actual stock exchange rate. Selling stocks results in a deposit to the checking account whereas the deposit is again computed by multiplying the number of shares by the exchange rate. The custody account provides the possibility to list all contained shares and to provide information on their value based on actual stock exchange rates.

Services

The services we are offering to the customers are as follows. Opening accounts of the different types. Opening an account for the first time requires the addition of the customer to our customer list. Opening an account is only possible from within the office. Create transactions either from

within the office or by using a cash dispenser. Creating a transaction is limited by the constraints which apply either to the chosen account, for example savings account usage is limited to transactions from and to the checking account. Cash dispenser usage implies selecting the bank institution which holds the selected account to withdraw money.

Overall Objective

Analyze the system which is to be created. Design and implement a simple account management system which allows executing the following tasks:

- Create a bank
- Create/Add a customer
- Open checking account for existing customer
- Add transactions to the checking account
- Open savings account with reference to the checking account
- Add transactions to the savings account
- Open custody account
- Allow transactions (Buy/Sell) of stocks (Try/Check utilizing a Web Service to obtain
- the name of the stocks and the exchange rate)

Constraints & Rules

The system to create has to take some constraints and rules:

- The bank institution has to take care of the customers and their accounts.
- A financial institution (We) are identified by a name and a bank identification number.
- A customer is identified by a name, an address and a customer number (within the financial institution).
- Each customer may have zero or more checking or savings accounts.
- Each customer may have zero or one custody account (not more!)
- Each customer may request account balances based on distinct accounts and an overall balance by collecting all distinct accounts.
- An account is identified by the account number, the customer owning the account and an opening balance. The combination of the bank’s identification number and the account number is the required information when referring to an account in transactions.
- Each transaction belongs to a bank institution, a customer, an account and a foreign account
- Each transaction is either of type deposit or withdrawal
- Each transaction must be authorized by the customer with his/her personal identifying number (PIN).
- The account balance is computed by opening balance and by collecting all transactions for the account.
- Savings accounts must not have a balance lower than zero.
- Custody accounts must not allow selling shares which are not listed in the custody account.
- Custody accounts can report their value based on the number of stock shares multiplied by their actual exchange rate.
- Transactions executed by means of cash dispenser are allowed only for checking accounts.

To be continued …

Expected Results

We expect to see a working Client-Server Banking Solution meeting the constraints.

ITS Beach – Manage the Beach Chairs

The maintainer of all FHS facilities are responsible for renting beach chairs. You might think “there is no beach”. Anyways, with the extension of the building, a new leisure area including a small pool along with a beach area will be created. (Yippie) This requires a flexible, transactional and simple-to-use management system for the beach chairs since there are multiple study programs at the university. Each course of studies may access the pool and reserve chairs for rent. There are different kinds of clients for the system (applications, web) which are to be connected. The system also must provide interfaces to be integrated in other applications easily. Analyze the system to be created and provide an extensible server centered solution which supports any number of beach chairs and allows for any number of distinct clients. Note that our chairs are “intelligent” and are aware of the fact that they are reserved. Illegal use will lead to electrical punishment. The clients are used for reservation and will interact with the server. The chairs will also have to interact with the server in order to ask for illegal usage.

Each (web) client will

- Ask the server for free chairs
- Provide interface to reserve chairs
- Send reservation requests (returning unique reservation number)

The server will

- Accept reservation requests and provide a unique reservation number
- Keep the reservation state for each chair
- Answer the chairs request whether the chair is reserved or not

The chair will

- Ask the server for its free/reserved status at a given time.
- Punish illegal visitors

Each chair is also equipped with additional services (costs apply), such as ice cream and sun shelter. During beach volleyball tournaments, however, we will also offer the chairs usage with a minimal fee. Details concerning the new solution and provided services are given below.

Products

Beach chair

A beach chair may be used at no charge for a predefined period of time. The user will have to provide the reservation number for “authentication”. During beach tournaments however, the usage of the chairs will be charged.

Sun shelter

Our beach chair is equipped with a sun shelter which secures from ultra violet sunbeams. This service may be booked additionally.

Ice Cream & Soft drinks

Each chair is equipped with a refrigerator and offers (limited) ice cream and soft drinks to the user. This service may be booked additionally.

Constraints & Rules

The system to create has to take some constraints and rules:

- The reservation is accepted in the order of requests.
- A user must not reserve chairs permanently.
- Each user must be identified by a name and the study program.

To be continued by you ...

Expected Results

Create a Chair Reservation System along with a standalone client which denotes the chair and uses the remote web service to verify that the user is allowed to use the chair at a given time. The server application must allow the reservation of chairs & services but also the management of chairs (add new, enable, disable, remove).

ITS Electric Cars – Solutions for eMobility Provider

We are an eMobility Provider and do have a huge number of electronic vehicles of any kind (eBike, Mini-Car etc. up to Tesla) available for rent. We are going into the market with a (growing) number of rent stations, starting at several academic locations in Salzburg City, Puch Urstein, Kuchl etc. For processing all the rentals, we do need a server centric solution where our customers may

- Search for vehicles (online, mobile)
- Rent vehicles (online, mobile)
- Get vehicles (once rented) and
- Drop vehicles after usage

Customers should get access to the eMobility Services via a public web page, and – once registered – by a personalized site showing their past rentals, customer state, personalized offerings etc. The personalized site should be available by a eMobility App (mobile) as well. For our rental stations it is important to know the

- upcoming rentals (starting at a particular station),
- upcoming vehicle drops, in order to organize vehicle cleaning, preparation for the next rental.
- the degree of vehicle utilization, a vehicle has to be replaced after a certain amount of time (age) rentals (mileage)
- the degree of rental station usages, vehicles should be on the way more or less all the time, high rental station usage requires more space for vehicles and causes

The rental stations require managerial access to the eMobility Services with limited scope (rentals, vehicles of the station). They should get access via a secured web page and/or a dedicated desktop solution with a more user friendly GUI. Finally, we as the owner/maintainer of all the vehicles and rental stations will need managerial access to all data which no limits. Details concerning the new solution and provided services are given below.

Services

(Single) Vehicle Rental

Our vehicles are available for rent. A customer may get a vehicle from a rental station and drop it after the rental at any of our stations. The return stations may not be the same as the rent station.

eMobility Pass

We want to have customers who pay for a eMobility Pass. eMobility Pass customers will get easy access to vehicles at any station and will get a significant discount (increasing with their mileage). The eMobility Pass is similar to the Miles & More programs of airlines.

Constraints & Rules

The system to create has to take into account some constraints and rules:

- Vehicles are identified in some way
- Vehicles can be used by one or more persons (e.g. road bike vs. tandem)
- For utilization, costs can apply
- A license might be used to drive a vehicle
- Each car has a home location
- Each location is identified by an address and an operator
- Locations “know” the cars which are available at the specific and other locations
- A rental-process is identified by a vehicle, a renter, a starting and end date (what happens if the vehicle is returned too late?)
- Costs apply partly before and partly after rental

- There can be a kilometer-dependent fee

To be continued by you ...

Overall objective

Analyze the system which is to be created. Design and implement a simple rental car management system which allows executing the following tasks:

- Create the rental stations with all vehicles of different types
- Create/Add regular customers
- Allow searching for vehicles (time based, station based)
- Allow rent of vehicles including payment before drop
- Compute billing for customers based on (example) rental time, mileage, energy consumption and other influencing details (eMobility Pass)
- Provide efficiency statistics for rental stations based on station usage (vehicles are in), car usage (vehicles are out) etc.
- Compute the reduction of CO2 emissions caused by the usage of our electronic cars.

Expected Results

We expect to see a working eMobility Management System Solution along with a flexible number of rental stations, available cars and increasing number of customers.

ITS-Football Stadium – Solution for a ticket shop

We are a premiere league Football club and own a 32,000 all-seater stadium. This season, we are qualified (for the first time in our long history) for the UEFA champions league. Therefore we want to establish an extensible server centered solution for a ticket shop system.

Task

Create and provide a server centered ticket shop system which provides following features:

- Customers should be able to buy tickets (max. 4 per person)
- Owner of season cards should be able to reserve tickets (max. 4 per person)
- It should be possible to cancel reserved tickets
- It should be possible to pay in cash (only at a stall) or with credit card

Each client works individual and interacts with the server. Each client

- will ask the server for free places in a sector
- notifies the server if a ticket/place is sold
- notifies the server if a ticket/place is reserved
- notifies the server if a reserved ticket/place is canceled
- asks the server for billing information

So the server will have to provide following information:

- Status information about free and occupied(sold or reserved) places
- Billing information
- Statistics about the utilization for a given period (e.g. game, season, winter season, spring season, champions league games etc...)

Products

Our stadium is divided into 8 sections and 4 different price categories. The different sectors has following capacity:
sector A: 8000, sector B: 8000, sector C: 4000, sector D: 4000, sector E: 2000, sector F: 2000, sector G: 2000, sector H: 2000

Following price categories exists:

- Category 1 A, B €€€
- Category 2 D €€€
- Category 3 E, F, G, H €€
- Category 3 C (Fan sector) €

Regular Ticket

This is just a normal ticket for one game.

Season Ticket

This is a ticket for a whole season. Owners of season card can also reserve normal tickets.

Champions league Ticket

This is a ticket for games of the UEFA champions league.

Fan Ticket

This is ticket for the fan sector and is cheaper as tickets for other sectors. This ticket is only available for members of the FC ITS-Fanclub.

Customers

We divide into different types of customers.

Regular customer

This is a regular customer which has to pay the regular price for each sector.

Reduced price customer

These are customers which has to pay just the half price for each sector. These customers are children (<16) and handicapped persons.

FC ITS-Fanclub members

Members of the FC ITS-Fanclub are entitled to buy tickets for the fan-sector C.

Overall Objective

Analyze the system which has to be created. Design and implement a simple ticket shop system which allows executing the following tasks:

- Create the stadium with all seats
- Create customers
- Assign seats to customers
- Compute billing for customers
- Consider different usages of the central server (sell tickets, management, etc..)

Constraints & Rules

- Each sector has a given number of seats
- Each sold seat has to be tracked with a customerID and a timestamp
- Only fan club members are allowed to buy tickets for sector C

To be continued by you ..…

Expected Results

Create a Ticketing System along with a standalone client which denotes the turnstile and uses the remote web service to verify that the ticket is valid. The server application must allow the management of the stadium (sectors, seats) and also the management of seasons and matches. The latter are required to sell/reserve tickets. The turnstile app is to be seen as a contact-less device which is capable of reading an identifying ticket id (or the like) from the passing customer.

ITS-Library – Management System

We are a public library and we want to establish a new library management solution for improved handling of our library.

Task

Create and provide a server centered library management system which provides following features:

- Customers should be able to loan medias
- Customers should be able to return medias
- Customers should be able to reserve medias.
- Customers should be able to cancel reserved medias.
- Customers should be possible to ask for the availability of a specific media
- Customers should be possible to ask for the physical position of a specific media
- If a customer has exceed the max. loan time (4 weeks), the customer has to pay a penalty fee for every additional day

For simplicity of the administration and the convenience of the customers, the library offers several return stations where the customers may drop the books. Each return station has to communicate with the library whether to accept the book or not. Each client works individual and interacts with the server.

Each client will

- ask the server whether to accept a book or media respectively and
- notifies the server if a media is returned.

Products

we provide following products:

Simple books

These are normal books like novels etc.

Specialized books

These are books which are specialized to a particular subject.

Music CD's

Theses a normal Music CD's

Movies

These are normal movies without any age restriction.

Movies for adults

Theses are movies with special content (violent or erotic) which has an age restriction.

Customers

We divide between different type of customers.

Adult customers

These are regular customers which are allowed to loan all kinds of medias.

Children/youth customers

These are customers between 10 and 18 years, which are not allowed to loan movies for adults.

Students

Students are allowed to lean specialized books form a longer period (6 weeks).

Overall Objective

Analyze the system which has to be created. Design and implement a simple library management system which allows executing the following tasks:

- Create the library with all medias
- Create customers
- Assign medias to customers
- Compute billing for customers
- Consider different usages of the central server (loan medias, management, etc..)

Constraints & Rules

- Each media is marked as a specific categories
- Each media is marked with a number
- Each media which is loan has to be tracked with a customerID and a timestamp

To be continued by you ..…

Expected Results

Create a Library System along with a standalone client which denotes the return station and uses the remote web service to verify that the book is owned by the library, thus is valid. The server application must allow the management of the library (adding media) and also the management of customers and reservation and loan of books, videos an the like. The return station uses the book to determine the actual customer and to terminate the loan.