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SOFTWARE TOOLS FOR CLIENT OF CATERING FACILITIES NETWORK SERVICE

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Abstract—Applications for scanning and reserving tables in catering institutions are analyzed and their main disadvantages are emphasized. Based on facility clusterization by type and price politics the improved client interactive system that give an opportunity to view rooms, reserve tables, order a food beforehand, choose an optimal route to establishment and evaluate facility is proposed. Based on highlighted problems of existing applications for catering facilities networks there is a need in creating an Android application that allow user order and do the search of places to eat or choose from list, build an optimal route to the chosen restaurant in real-time by using cartographical data from the Internet services, view photos of a restaurant's interior and menu, choose and reserve a table by using a table disposition scheme or by facility's photos, order a meal beforehand, choose a restaurant by price or users' reviews and leave a comment about facility. To interact with maps and to build optimal routes cartographical services Google Maps are used. To route the route to the institution the request is forming by Google Maps Directions application programming interface. In application that is being developed the three-tier "client-server" architecture is used. Next technologies for developing the software are using: Java, Google Maps, lighttpd, MySQL, "client-server" architecture.

Index Terms—Java; Android; online; reserve; order; optimal route; Google Maps; databases; client; server; cartographical services.

I. INTRODUCTION. THE PROBLEM STATEMENT

For country's economic development is essential to attract more and more tourists from different world countries. For tourists and city residents optimal rest we need a software that in the comfortable format allows a user to evaluate catering facilities and places for rest by price politics, kitchen type and menu. At the moment there are a lot of catering intitutions networks, for example, "Mafia", "Mister Cat", "L'Kafa Cafe" etc. But they are having their disadvantages. For example, "Mafia" doesn't have any complaint book, they gather reviews with calls. Table reservation happens with calls. Facility's information software has a directly influence on client's choice. Reviews about a quality of client service and their preferences is important for optimal running business and creating competitive advantages.

So, to solve the problem with bad service, searching establishment that has democratic prices, and to advance tourist sector we need to develop easy-to-use software applications for improving quality of guests and city residents service.

II. REVIEW OF EXISTING SOLUTIONS

There are many mobile applications that exist today and can give users an opportunity to reserve a table in restaurants or cafe, order a food right from the phone and find the nearest restaurant on the map. Applications for administrators which make the reservation easy for them also exist. Among them there are solutions that was made for America (OpenTable, Zomato), for Europe (Restaurant Bestenliste, Quandoo), for Russia and Far-Eastern countries (Afisha, Arb.uz, Stolik) and for Ukraine (EatSmart, Gusto). Some of them can be available for another countries. Let's take a look on features of applications that available for Ukraine.

EatSmart is the ukrainian online table reservation service with discount system. It was found in 2012 by Roman Mulyavka and Sergiy Lysuk. How is the application work: restaurants connect to the system, in them you can reserve a table by some steps and receive a discount up to 50% from bill. To get the discount you don't need to print any coupons or accumulate bonuses, how it happens often. The service works with facilities by the special partnership program: you reserve a table, go to the restaurant and get the discount right away. More than 350 restaurants are connected to that system and about new 20–30 connect everyday. This application is available for Kyiv, Kharkiv, Rivne, Dnipropetrovsk, Lviv and Odessa [1].

The mobile application is written in Java. For storing the data and cache MySQL and Redis is used.

The main disadvantages of this software are:

– no order food;

– no optimal routes to the chosen restaurant;

– no information about table status (all occupied or free) and their disposition scheme;

– no photos with numbered tables;

– no reviews.

Gusto is the service for client service in restaurants. It exists in two versions: Gusto (for clients) and Gusto Manager (for managers) (Figs 1 and 2). The features of application are [2]:

– photos of all meals from the menu;

– menu is available in 7 languages;

– conversion of all prices from the menu to any currency is available;

– searching restaurants by geolocation;

– photos of restaurant interior;

– ordering from menu via Gusto application;

– online table reservation in restaurant.

By ordering from menu via application means that client got to the restaurant and order the food via application. It gets rid of the paper menus and reduces the risk of misunderstanding between a client and a waiter. Also it makes the communication with foreigners much easier.

In addition to those features it can be said that a manager can send a message about the time when he can accept a client if he reserved a table but the manager can't give him it in a dedicated time.

The mobile application is written in Java. For storing the data MySQL is used.

The main disadvantages:

– no order food;

– no table disposition scheme;

– no photos with numbered table;

– no facility search;

– no map for all restaurants;

– no searching of the nearest places and optimal routes to the chosen restaurant building;

– no information about table status (all occupied or free).

Fig. 1. "Gusto" graphical user interface

In addition to this services there are some loyalty programs (Casta, 3bCafe, KFC club) and food delivery services (Mister Cata, Domino's Pizza, Eda.ua) which give the opportunity to buy a meal or drink with some discount by bonus system.

With analyzed solutions that exist we can emphasize next problems:

– the absence of the fee for reserving a table;

– no meal order beforehand and prepayment;

– lack of the table disposition scheme;

– no opportunity to choose the facility type from the list;

– some applications have a map with restaurant location;

– no photos with numbered tables;

– some establishments have interior photos;

– the search of the nearest places is absent;

– applications can't build optimal routes to the chosen facility;

– not all institutions have a electronic complaint book in which you can leave a review about restaurant, waiter or food.
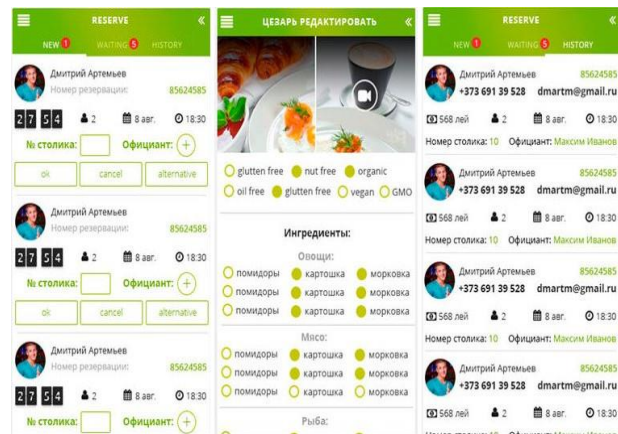

Fig. 2. "Gusto Manager" graphical user interface

Below there is a Table I of general information about examined solutions.

TABLE I. GENERAL INFORMATION ABOUT EXAMINED SOLUTIONS

Application	EatSmart	Gusto
Written on	Java	Java
Database	MySQL	MySQL
OS	App: Android	App: Android
Server	–	–
Other technologies	Redis	–
Additional applications	–	Gusto Manager

III. FEATURES OF THE WORKABLE SOFTWARE

Based on highlighted problems of existing applications for catering facilities networks there is a need in creating an Android application that allow user:

– order and do the search of places to eat or choose from list;

– build an optimal route to the chosen restaurant in real-time by using cartographical data from the Internet services;

– view photos of a restaurant's interior and menu, choose and reserve a table by using a table disposition scheme or by facility's photos;

– order a meal beforehand;

– choose a restaurant by price or users' reviews;

– leave a comment about facility, waiters or meals in electronic complaint book.

To solve tasks above we need to choose a technology stack that contains a programming language, server and platform on which it would be based, database and cartographical services. Furthermore the network architecture is necessary (Fig. 3).
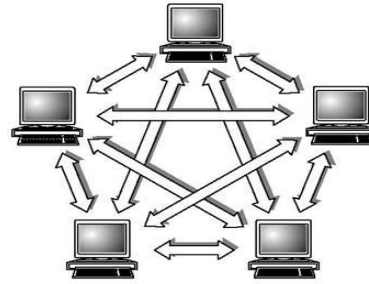

Fig. 2. Peer-to-peer architecture

Let's take a look on types of network architecture [5]:

– peer-to-peer (Fig. 4);
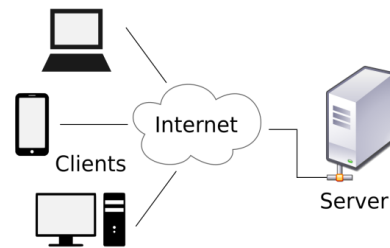
– client-server (Fig. 5).

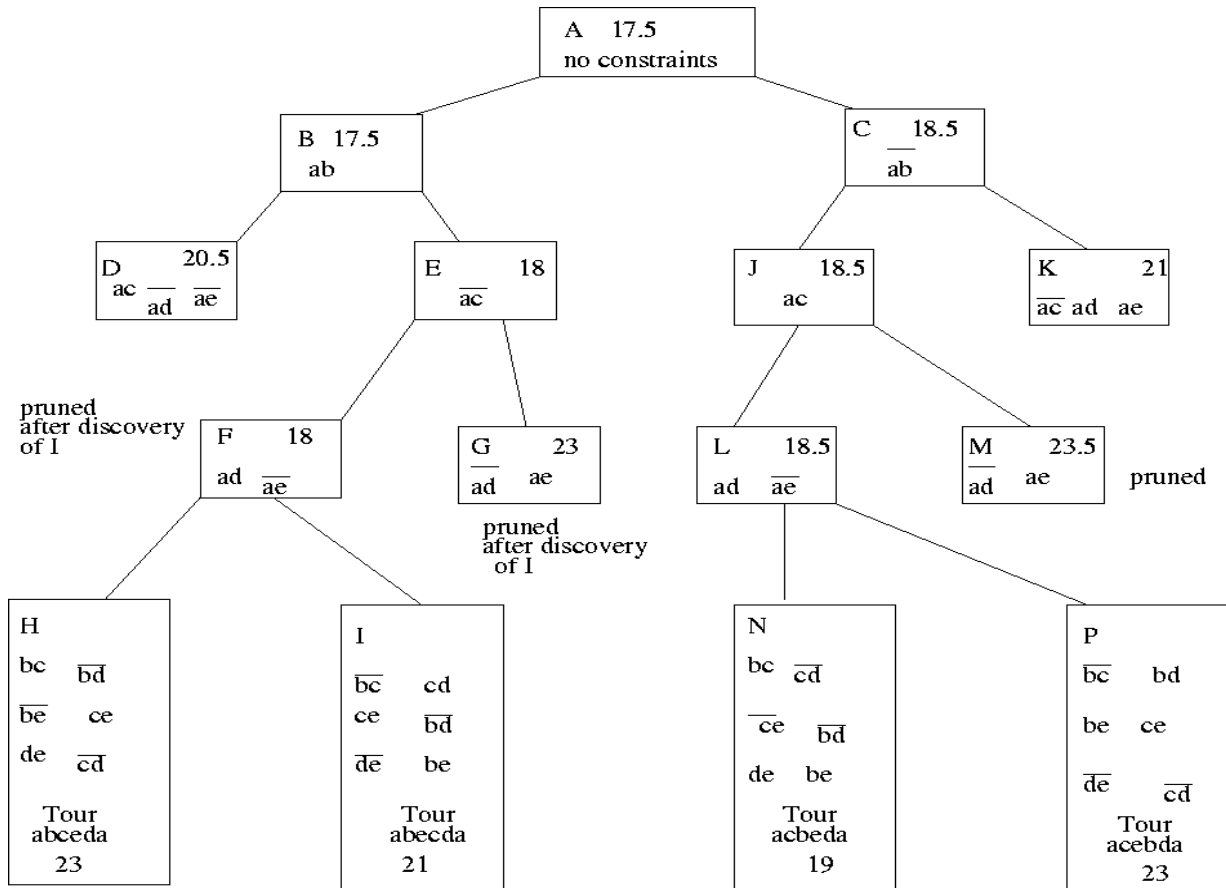Fig. 3. "Client-server" architecture

Fig. 4. A solution tree with applied branch and bounds algorithm [5]

In peer-to-peer architecture all resources are distributed by all systems. In this architecture all systems are equal in rights. Peer-to-peer networks have advantages like:

- easy to use and setup;
- separated PCs are independent of server;
- users can control their resources;
- low cost and easy in running;
- no need in administrator;
- good for networks in which amount of users isn't greater than 10.

The disadvantage of this architecture is the lack of central administration.

"Client-server" architecture is the most popular architecture in which part of resources is located on servers that serve their clients. In this case a server is an object that give services to another network objects by their requests. Clients are workstations that use server's resources and give an comfortable user interface. User interfaces are procedures of user interaction with system or network.

Advantages of that architecture are:

- allows to organize networks with a large number of users;
- provides a central user account control, security and access that makes the network administration easy;
- effective access to resources.

Disadvantages of architecture are:

- high cost
- requires a high qualification of staff for administration;
- out of order server can make the network unable.

So, the peer-to-peer architecture can be used when the amount of users isn't greater than 10, no need in central server and in central administration. The "client-server" architecture can be used when there is more than 10 users, the central security control, backup and resource control are necessary, having a central server is necessary, there is a need in access to the global network and resources should be distributed on the user level. So, based on that the number of users will be more than 10, an access to the global network is necessary and resources should be distributed on the user level, the "client-server" architecture will be used.

To interact with maps and to build optimal routes cartographical services, like Google Maps or OpenStreetMap, are necessary. Let's view an user interaction with maps by the example of Google Maps and algorithms of evaluating and building optimal routes to facilities.

When user pushes the "Set the route" button the HTTP-request is forming by Google Maps Directions API [4]. There are required and additional request parameters. Required parameters are:

- origin – source address;
- destination – destination address;
- key – application API key.

The additional parameters are:

- mode – types of moving like driving, walking and transit. By default it's driving;
- waypoints – array of waypoints. Those points allow change the route so it moves through dedicated places. It sets like coordinates or address;
- alternatives – if this parameter is set true the route service gives alternative routes in response;
- avoid – what to need to avoid. Next arguments is supported: tolls, highways, ferries, indoor;
- language – in which language will be the output;
- traffic_model – gives assumptions that are used in calculating travel time. This parameter takes effect on the value of duration_in_traffic field which means expected travel time with taking into account average statistical values. Possible values are: best_guess (the best expected time in road), pessimistic (the value of duration_in_traffic is greater than actual travel time), optimistic (the value of duration_in_traffic is less than actual travel time). By default it's best_guess;
- transit_mode – gives one or some ways to go. Possible values are: bus, subway, train, tram, rail.

Also there are more parameters like unit, region, arrival_time, departure_time.

By default Directions service is calculating routes by waypoints in order that they was set. If in this parameter set the first argument optimize: true, this service will optimize the route by redistributing waypoints in more effective way. Travel time is the main criteria for optimization but when the optimal route is being chosen another factors like distance, number of turns etc can be taken into account.

Exact algorithms of building the optimal route will find the absolutely optimal route but they need more time for calculate. Heuristic on the other hand for a short time will find "good" solutions which can be worse than optimal. Branch and bounds method is the example of exact algorithms. The result of it is finding the maximum of function in possible set. Two operations is being done while the algorithm is working: dividing the input set by subsets (branches) and finding estimates (bounds) (Fig. 6).

The algorithm is next:

1) the record set is dividing by subsets;

2) find upper and lower estimates for new subsets;

3) find the maximal lower estimate among the subsets;

4) delete subsets that have upper estimate less than the maximal lower estimate;

5) find the maximal upper estimate among the subsets and assume it record;

6) if no discretion was reached, or essential accuracy, then go to the 1st point.

The record set has the biggest upper estimate. At the beginning all set is record. Upper estimate is the point that absolutely no less than maximum on the dedicated subset. Lower estimate is the point that absolutely no more than minimum on the dedicated subset.

The nearest neighbour algorithm starts at the random point and it's visiting ther every nearest point that wasn't visited step by step. Plan bypass points include to route serially, and every point that includes to route should be the nearest to the last chosen point among the others that still aren't in the route. The algorithm ends when all points are visited. The last point connects with the first.

Estimating and building the optimal route in this service looks like solving the travelling salesman problem by heuristic methods.

On the Fig. 7 is the example of how routes is built by the Internet service.

In the developing of improved software next technologies is used:

− Java for Android platform;

− "client-server" architecture because there will be more than 10 users, the global network is essential and resources should be distributed on the user level;

− Google Maps and its Google Maps Directions API allows to build some routes and choose the optimal;

− lighttpd server [6] because it's easy in setup and can make with large number of users;

− MySQL [7] is easy to use, provides the high level of security, can process the big amount of data and it's faster than other relational databases.
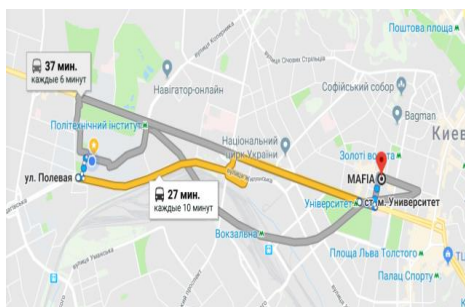

Fig. 7. Built routes to the chosen facility

In application that is being developed the three-tier "client-server" architecture is used, so the server is working with database (Fig. 8).
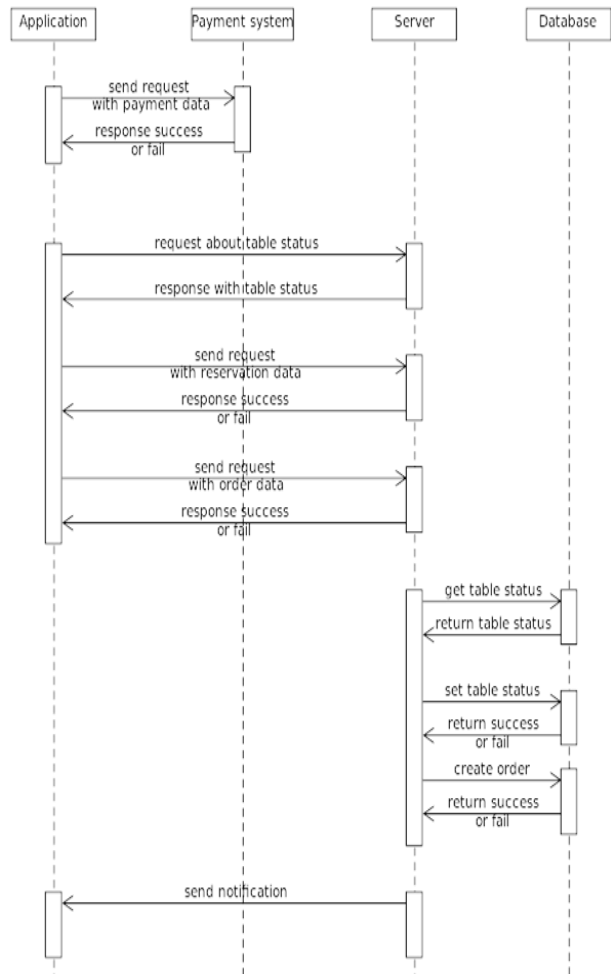

Fig. 8. Scheme of the interaction between client application, server, payment system and database

IV. CONCLUSIONS

Applications for scanning and reserving tables in catering institutions are analyzed and their main disadvantages are emphasized. Based on facility clusterization by type and price politics, also on an opportunity to view rooms, reserve tables, order a food beforehand, choose an optimal route to establishment and evaluate facility the improved system of interaction between client and catering facility is proposed. The chosen technology stack allows to implement the data collection about clients' preferences for administration, optimize the menu, client service, placement of catering facilities and settle the price politics of establishments and use competitive advantages.

This application is for tourists and city guests who can plan their rest in the unknown for them city with this proposed solution.

REFERENCES

[1] Eatsmart.ua updated mobile application drastically [Online] https://itc.ua/news/servis-eatsmart

[2] Gusto Production [Online] https://thegustoapp.com/ua/mobile.

[3] Network architectures [Online] http://gos-it.wikia.com/wiki/

[4] Google Developers. Google Maps Directions API [Online] https://developers.google.com/maps

[5] Optimal Solution for TSP using Branch and Bound [Online] http://lcm.csa.iisc.ernet.in/dsa/node187.html.

[6] Pti_the_Leader. Apache + nginx? Thanks, there is a lighttpd [Online] http://www.ptipti.ru/apache-nginx-lighttp/

[7] Devacademy. SQLite vs MySQL vs PostgreSQL: comparison of database control system [Online] http://devacademy.ru

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Є. М. Глінська, Л. М. Олещенко. Програмні засоби обслуговування клієнтів мережі закладів харчування
У статті проаналізовано програмні засоби для перегляду та бронювання місць у закладах громадського харчування, виділені їх основні недоліки. Запропоновано вдосконалену систему взаємодії з клієнтами на основі кластеризації закладів за типом та ціновою політикою, а також можливістю переглядати зали, бронювати столи, замовляти страви, вибирати оптимальний маршрут до закладу та оцінювати заклад. На основі виділених проблем існуючих додатків для мереж закладів громадського харчування виникає необхідність у створенні додатку на платформі Android, що дозволяє користувачу робити замовлення, виконувати пошук закладів або обирати з категорії, будувати оптимальний маршрут до обраного закладу у режимі реального часу, використовуючи картографічні дані інтернет-сервісів; переглядати фотографії інтер'єрів закладів та меню, обирати та резервувати столик, використовуючи схему розміщення столиків або переглядаючи зображення інтер'єру обраного закладу; замовляти страви наперед; обирати заклад за ціновою політикою або відгуками користувачів; обирати страви на основі оцінок користувачів, залишати відгуки та оцінки закладу. Для взаємодії із картами, а також оцінювання та побудови оптимальних маршрутів використано картографічний сервіс Google Maps. Для прокладання маршруту до закладу використовуються запити сервіса Google Maps Directions application programming interface. У розроблюваному додатку використовується трьохрівнева клієнт-серверна архітектура. При побудові удосконаленого програмного продукту також використано технології: Java, lighttpd, MySQL, архітектура «клієнт-сервер».
Ключові слова: Java; Android; онлайн; бронювання; замовлення; оптимальний маршрут; Google Maps; бази даних; клієнт; сервер; картографічні сервіси.

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Напрям наукової діяльності: програмування, розробка додатків на платформі Android.
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Освіта: Чернігівський державний педагогічний університет ім. Т. Г. Шевченка, Чернігів, Україна, (2008).

Напрям наукової діяльності: гравітаційні моделі, інформаційні технології в транспортних системах, математичне моделювання, комп'ютерні мережі.

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Е. М. Глинская, Л. М. Олещенко. Программные средства обслуживания клиентов сети заведений питания

В статье проанализированы программные средства для просмотра и бронирования мест в заведениях общественного питания, выделены их основные недостатки. Предложена усовершенствованная система взаимодействия с клиентами на основе кластеризации заведений по типу и ценовой политикой, а также возможностью просматривать залы, бронировать столы, заказывать блюда, выбирать оптимальный маршрут до заведения и оценивать заведение. На основе выделенных проблем существующих приложений для сетей общепита возникает необходимость в создании приложения на платформе Android, которое позволяет пользователю делать заказ, выполнять поиск заведений или выбирать из категории, строить оптимальный маршрут до выбранного заведения в режиме реального времени, используя картографические данные интернет сервисов; просматривать фотографии интерьеров заведений и меню, выбирать и резервировать столик, используя схему размещения столиков или просматривая изображения интерьера выбранного заведения; заказывать блюда заранее; выбирать заведение за ценовой политикой или отзывами пользователей; выбирать блюда на основе оценок пользователей, оставлять отзывы и оценки заведения. Для взаимодействия с картами, а также оценки и построения оптимальных маршрутов использовано картографический сервис Google Maps. Для прокладки маршрута в заведение используются запросы сервиса Google Maps Directions application programming interface. В разрабатываемом приложении используется трехуровневая клиент-серверная архитектура. При построении усовершенствованного программного продукта также использованы технологии: Java, lighttpd, MySQL, архитектура «клиент-сервер».

Ключевые слова: Java, Android, онлайн, бронирование, заказ, оптимальный маршрут, Google Maps, базы данных, клиент, сервер, картографические сервисы.

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Направление научной деятельности: гравитационные модели, информационные технологии в транспортных системах, математическое моделирование, компьютерные сети.

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