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Name: Kostadin Valentinov Kolev

Signed: K.Kolev

Date: 10.12.2015

# “CO3016 Computing Project”

## INTERIM REPORT

## “Smart Shopping Cart”

## Created by: Kostadin Valentinov Kolev

## “Department of Computer Science, University of Leicester”

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## The Prototype

The prototype will allow our users to see select a shop from a list of all the available shops in the system and to see through the list of items which could be bought from the selected shop. Users will be shown the price of the item based on the type of item (kilograms or per unit) and also will be able to see a short description of each item. After doing this the system will calculate the price of the selected items and will ask the user if he/she will want to buy the items. After the confirmation of the user the system will check the balance of the user and the price of the items will be subtracted from it. In the end of the transaction the user will be notified.

#### Key aspects of the prototype

In order to outline the architecture approach used in the application an explanation about some of the key details of the implementation of the software need to be given. In both of the prototype and the final release of the application the communication between the different layers will be achieved sending HTTP POST to the server and receiving JSON arrays, as a result of a given database query. The following paragraph will give a simple definition about these two terms and will explain why they are used in the project as a way of communication between the different layers.

**HTTP POST/GET**

This is a method supported by the HTTP protocol for sending data from the client to the server. In the application the data received from the user will be send to the server using this method and will be processed by the server using HTTP GET method. This method will extract the user information which will be used in the database queries. In the early versions of the prototype these two methods were not implemented and the database queries were made by the client. However, it can be clearly seen that this is not a good practice because it can cause potential security threads such as data loss or data corruption. Because of this it was decided that the best practice will be to divide the presentation of the information from the actual database queries.

**JSON**

This is a format which gives a hierarchical information about a set of data. In the prototype this format will be used organize the fetched information from the database queries. This information will be received by the client-side of the software and will be parsed using ………

The following code will show the syntax of JSON:

{"id":"1","name":"myShop"}

From the example it can be seen that JSON is very similar to XML because it formats the information in a hierarchical order. Before the actual implementation of the prototype it was questionable whether to use XML as a way for formatting information. However, it was decided that JSON will be a better alternative because it provides a more understandable way to organize the data without the need to put a closing tag every time a new element is introduced.

#### Software architecture

The application will implement the three tier software architecture approach which will divide the functionalities in three distinct layers which will interact with each other through exchange of JSON arrays. The following list will give additional information about the different layers of the system

* **Presentation tier**

This is the topmost layer in the system. Its function will be to show the results of the user`s query using a graphical user interface. The communication with the other layers will be achieved by sending HTTP POST.

* **Logic tier**

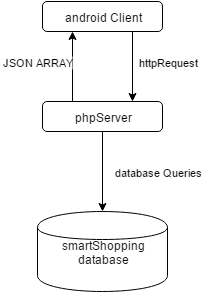
In this layer the user input from the presentation layer will be processed and the needed information will be fetched from the database through MySQL queries. The result of these queries will be either returned directly returned to the user (used in login functionalities) or will be encoded into JSON arrays which will be decoded by the presentation.

* **Data tier**

This tier will be the “storage” of the application. MySQL database will store the following information

* User credentials
* Shop data such as name of the shop and a unique ID for each shop
* List of available items in each of the shops

The following diagram will show how the “Client-Server” architecture is implemented in the prototype



## The final product

#### Software Architecture

The software architecture of the final product will remain the same as the one of the prototype. This means that the user of the Smart Shopping Cart will connect to the Server and will send HTTP requests for the necessary information. After that the server will fetch the information from the database using queries. The data collected from the queries will be encoded as an array of JSON objects and returned to the Client side. From there the JSON arrays will be decoded and parsed to the appropriate classes as array of objects.

**Benefits**

This particular software architecture will be reused because it gives the opportunity to separate the Client side from the Server side. This increases the security of the product because the client will not be able to view or manipulate important database queries which highly decreases the chances for data leaks or modification of important user information. Furthermore, by implementing the Client-Server logic the scalability of the project can be greatly increased. This is true because the data will be kept in servers where new data can be constantly added. Also the HTTP requests will create a new thread which will be executed in the server side. This provides the opportunity to reuse the already defined server and to provide different functionalities for different users. This means that in future the server side of the software can hold data for the functionalities provided for different users.

**Disadvantages**

Probably the only disadvantage of using this approach is the fact that the functionalities of the software are greatly dependent to the “health” of the server. This means that users will be able to access the provided functionalities only if the server is online. This fact hides a lot of future challenges such as maximizing the uptime of the server or securing the server from potential attacks such as DDOS (distributed denial of services). This danger will be noticeable in a future increase of the scale of the product when lots of users can be involved in using the server at the same because in a potential DDOS attack the server might get overloaded by hacker requests which will result in a denial of services to clients.

**Solutions**

As seen from the previous paragraph the rapid expansion of the software might cause overload of requests which will affect the overall performance of the program. However, this danger can be reduced by implementing one of the following approaches

* **Multiple servers**

Different servers can be created for supporting different user requests. For example, the login functionalities can be physically separated on a different server from the shop functionalities. This will greatly increase the amount of requests which can be handled by the particular server. Furthermore this will limit the impact of a particular server downtime

* **Backup servers**

Separate servers can hold sensitive user information such as credentials or payment details. In this way even if a server is offline users will be able to access the main functionalities provided by the product. Furthermore, if some information is lost or deleted by malware it can be easily be recovered by these servers.

#### Functionalities

The efforts in the creation of the final version of the software will be primarily concentrated on the implementation of the “Smart” functionalities and GPS navigation. The “Smart” functionalities will consist of providing a customized suggested list of items to the client. This list will consist of items selected by one of the following criteria: user rating, user popularity. In other words, “the Smart” functions of the project will involve in giving a list of items that the user has bought in the past. Furthermore the final version of software will implement the navigation functionalities which will involve in showing the shops in the provided by the user radius.

#### Algorithms

In order to implement the given functionalities two different algorithms will be created which will ensure that the needed functions will be presented to the user.

* “Smart” algorithm

This algorithm will concentrate on producing a list of groceries which satisfy a specific criteria. It will be used after a user buys a given set of items. Then the names of the items will be saved in the user`s device in a database which will hold the number of times the user has bought the given item or the given rating of the particular grocery item. Furthermore in order to keep the data in the user`s database accurate this algorithm will be issued every time an user buys items. This algorithm is appropriate because it will decrease the data saved in the database servers which will immediately result in increasing the amount of connections to the server at a particular time. Moreover, by implementing this algorithm it will be guaranteed that user information will be stored on the device of the user. This fact will increase the security of the data and will also limit the impact of a future server downtime because the user will still be able to access the lists of popular items even if the server is offline.

* Navigation algorithm

This algorithm will concentrate on showing the shops in the given radius. In order to implement this algorithm me user`s navigation functionalities of the device will be reused, in particular the user location. First of all, the user location will be used to specify the longitude and the latitude of the user. These co-ordinates will be used to create a “circle” with a given radius. The centre of this “circle” will be the co-ordinates of the user. Then the co-ordinates of the shops stored in the database will be used to see whether they lie in the outlined “circle”

**Risks**

The main problem which might arise is the consistency of data in the two databases (the user database and the mysql server database). The following scenario is very likely to happen if the risk is not eliminated in time:

1. The user buys a list of items from a shop
2. The user is encouraged to give rating to each item
3. The list is written in the user database
4. MySQL data is changed
5. The user chooses to use the Smart functionalities and a list of the best rated items or the most frequently bought items is produced. However the list will not be consistent with the database because the mysql data has been changed

It can be clearly seen that this risk will be the primary target of the debugging process and that solution for it need to be created. Apart from this, there might be some user concerns about the privacy of their location or in other words if their location is stored in a database or written somewhere.

**Solutions**

The most important problem which needs to be handled is to ensure that the data in the user database is consistent with the MySQL database. This will be achieved by comparing the grocery list from the database with the saved items in the user database. If some differences are found it will be assumed that the data in the MySQL database is correct and the particular item of the grocery list will be showed in the created by the Smart function array of grocery objects. After the payment is issued the differences in the user database will be corrected. This approach will ensure the consistency of data in the user database.

Furthermore, users will be ensured that their location will remain private by implementing already created APIs such as the Android Location API. This and some other tools will be discussed in the next section of this deliverable

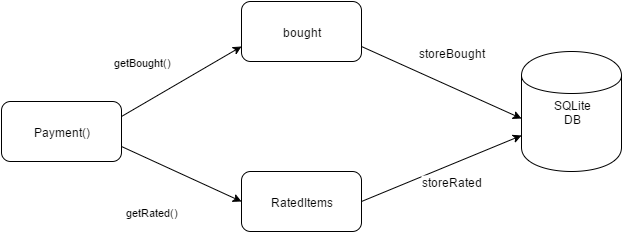
#### Tools

**T**he final version of the software will provide the tools used in the prototype such as JSON and http request. However, by implementing new functionalities more tools need to be used. This list will provide an initial idea about different approaches which will be used to ensure that the needed functionalities are provided

* **SQLite**

SQLite will be used to store the user data needed for the smart functionalities. According to the main page of this database it is referred as” self-contained” and “zero-configurational”. This means that it is very appropriate to store user data in the device of the user without the need to connect to a database or send data to a server. Furthermore, if we take into consideration the main disadvantage of creating software with client-server architecture it can be seen that the client is very dependent to the server and that a potential crash in the server might affect the overall performance of the system. However, SQLite gives the opportunity to store data locally which will greatly lower the impact of a potential problem with the server because users will still be able to access the “smart” functionalities in the system but will not be able to issue payments.

The following diagram shows how the “smart” classes will be able to store the selected items in the user database:



* **Google location services API**

This is the official API which provides location functionalities for Android applications. It can be used to retrieve the location of the user. This functionality will be used for getting the shops in the defined perimeter around the user. The following steps will be taken for implementing the provided functionalities of this API

1. **A new activity will be created for the functionality. This activity will implement the Google maps activity. This activity will consist of a map fragment which will show the position of the user and the nearby shops on a mini map.**
2. **Google play services will be configured for the software. This means that an unique API key will be obtained which will allow the functionalities to be implemented**
3. **The provided key will be added to google-maps-api.xml which will collect all the important options for this functionality**
4. **Permissions for getting the current location of the users will be added to the manifest.xml file which records permissions such as connection to the internet.**

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# CO3015/CO3016/CO3120 Career Plan

## Kostadin Kolev

### 1. Where do I want to go after graduation?

During my studies in the University I managed to successfully pass a placement program where I had to work in a relative small company in the creation of a client-server application using Java. This program helped me to increase my skills in programming and more precisely on the creation of distributed applications. However, after graduation I will try to apply to larger companies where I will be able to understand how large scale applications are created. This will give me the opportunity to practice some of the valuable skills that I have learned in university such as: Agile software development. Furthermore, by applying to larger companies I will be able to give me a better understanding on the software development cycle and more importantly on the most suitable role for me in this cycle.

### 2. What will I do this academic year to get there?

In order to accomplish this goal I will start with researching the market. In this way I will be able to decide which companies suit my interests and where I will be able to use my full potential. After the initial research I will list the companies where I want to apply. In the meantime, I will update my CV and write a motivational statement template which will be checked by the Career Development. When the documents are ready, I will try to apply to ten large companies and will expect response from at least half of them. In this way I will make sure that I will be able to attend at least five interviews after my graduation.

Apart from creating the necessary documents for applying I will make another research on the most recent trends in the industry. In this way I will be able to practice the methodologies which are used by large companies.

### 3. How does my project contribute to my career?

Before the start of the project a research on android applications and client server architecture for Android has to be carried. It helped me to get the necessary skills to implement the requested functionalities. This research gave me a very good understanding on the newest trends which are used in Android development.

Apart from the benefits from carrying an research, I was able to understand more about the my strong sides in developing an application. After starting the creation of the code I was sure that Back end development is the part of the software development that I feel comfortable to work on. However, apart from showing me this I was able to understand that I find it hard to create the front-end part of the application.

The methods and algorithms used in the project are different than the one which I have learned during my degree. For example, instead of parsing an xml file to the client JSON was chosen as a way for the client to receive data from the server. Also, instead of using Java servlets to handle client requests PHP is used. Using unknown technologies for the creation of a project is a risky approach. However, I have chosen to take the risk because the benefits of these approaches are more than the risks that I will take while implementing them. For example, by implementing this, I was able to learn more about PHP which is a very widely used language. Also, by learning JSON I was able to understand more about exchange of information between the client and the server and to make a comparison between the implemented technology and the XML.

Also, I strongly believe that a project of this type (online shopping) can greatly increase my chances in either applying for a job in a company specializing in online shopping or a company which concentrates on Android development.

In conclusion, I can clearly state that the project will help towards my professional development. Apart from this, the project helped me gain a better understanding on some of the commonly used techniques for developing client/server mobile applications.