Capstone Report

Student Statement:
I affirm that I applied ethics to the design process and in the selection of the final proposed design. And that, the designer has held the safety of the public to be paramount and has addressed this in the presented design wherever may be applicable.

Approved by the Supervisor
ACKNOWLEDGEMENTS

I would like to acknowledge Pr. Omar Iraqi Houssaini for proposing the idea of this project, and for his assistance and aid throughout the course of this project. I learned a great deal under his supervision, and hope to have met his expectations of this project. I thank my family for supporting me in my learning path, for a lot has been achieved thanks to them. I thank my friends who were there by my side in this eventful journey, and my Volleyball Team who were my family away from home. Finally, I thank Al Akhawayn University for allowing this colorful learning journey to take place, and help me grow as an individual.
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APPENDIX A: Capstone Specifications
ABSTRACT

The aim of this capstone project is to create a tool that allows people to access different locations and see what has happened and is happening there. It also allows to share your experiences and events with other users, such as showing the excitement in a concert, or advertising and attracting an audience to an event.

The initial idea of the project was one that Pr. Iraqi Houssaini proposed, and we looked for a way to modernize it and make it appealing to the general public. I believe that this application has a significant potential as a business idea, in the sense that it can be versatile in the way it can be used.

It was exciting to work on this project and see what it has developed to be, and I am also curious to explore its immense potential.

The report walks you through the process of creating the application ECHOES.
1 INTRODUCTION

ECHOES is an application that allows its users to share their experiences and most important moments, and communicate them to other users through videos, pictures and reviews. It is that companion who has been everywhere. You can tell the world through it what are doing, and it will echo back to you what your destination feels like, what your hometown looks like.

In more technical terms, this tool allows you to post pictures, videos and reviews about a location, and you can view what others post. The pictures and reviews appear in an ordered way from the most up-voted to the least. The map is displayed on a web page that shows user information, and their collection of pictures and reviews uploaded on the application. There is a time stamp on each picture and review, and the latter would be deleted after 24 hours to only show the most recent content about a location. This time limitation is a modern and creative way to maintain a fresh information base, to show the most pertinent and relevant information in the most recent times.

The user can register, then log in to see their user information, and their collection of uploads and reviews. The user can then proceed to adding a media to a location and giving it a title.

The search for a location can be done using the map or a search bar by entering the name of the location.

The application would be free and would be accessed from the web, and can be accessed from different platforms due to its favorable architecture.
2 STEEPLE ANALYSIS

2.1 SOCIAL IMPACT

ECHOES is expected to have a significant impact when it comes to Tourism. It will show the different locations where people have been, along with a review that describe the feeling, weather and situation at a specific location.

On one hand, the application would promote some remote locations that are otherwise only known to the locals, which would give more value and advertise these different locations, therefore attracting more people and enriching the tourism in said places.

On the other hand, these said places may not be able to survive a bigger load of people and may jeopardize its environment.

ECHOES may become a social network of users from around the world, and features for communication between different users can be implemented later on.

2.2 TECHNOLOGICAL IMPACT

With a portable map to explore a location that may be your destination, this application would allow you to share other people’s experiences in a location, and also share yours with them.

This application is a tool that uses existing technology, to provide new way of exploring the world.

2.3 ENVIRONMENTAL IMPACT

Some of the places featured in the application will be more known to the public, which is a double edged sword as it can lead to overpopulating a location and therefore damaging it by littering or other. With that idea in mind, ECHOES may add features accordingly to protect some places by tagging them as environmentally endangered, or vulnerable to overpopulation.

Although these measures are for unlikely events, but such feature is to be kept in mind for future needs, if the situation is extreme.

2.4 ECONOMIC IMPACT

The application in hand has a large economic potential, and said potential comes from its natural ability to influence the users’ perception about a location. The application therefore has an advertising opportunity, and said potential can be leveraged by different locations for a multitude of aims.
2.5 POLITICAL IMPACT
This application is not intended to affect the politics of a location, but it may become the case if the users decide to use it in that context.

2.6 LEGAL IMPACT
The application by nature would need to have a way to monitor the uploads of its users, as it may raise legal implications if some content uploaded is graphic or illegal.

2.7 ETHICAL IMPACT
This application would have ethical implications in various aspects, due to the freedom it gives to its users to upload and review the locations, but the manner in which the application is designed minimizes such issues. Similarly, ECHOES can be used to raise awareness for the situation in a specific location, and try to help the people in that region, and that may be this application’s greatest impact.
3 METHODOLOGY

The methodology followed in the creation of this application is Agile Scrum, which is a methodology that is based on iterative development, meaning that it follows a cyclic pattern to improve the different aspects of the project as it evolves. The requirements and vision of what the idea is required to do may change, or a change in the understanding of the requirements of the application may happen. Thus, the use of such methodology is deemed suitable, if not necessary for the case of this project.

The methodology starts from the overview of the idea, followed by an analysis of the different aspects of the project and its impact on the social, technological, economic, environmental, political, legal, and ethical domains. Then comes a study of the feasibility of the project to evaluate the likelihood to succeed at achieving the goals and requirements of the application. After that, a structure of the application is to be set to have an idea about the architectural model to be used, and the tools needed accordingly.

Next comes the major step that is the design, which focuses on different components and shows the characteristics and behavior of their building blocks. The design phase is a critical one as it outlines the main purpose of each entity, and changes at the level of this stage may change the following steps drastically. That is why this step requires several attempts and an extended amount of time.

The implementation step is one that follows the design, and it is the realization of the functionalities of the application, and meeting the functional and non-functional requirements set at the beginning of the project.

Testing and maintenance come after to complete the cycle and perhaps iterate back to modify and enhance some aspects of the project to keep the project relevant and up-to-date.
4 FEASIBILITY STUDY

4.1 TECHNICAL FEASIBILITY

For this application to be useful, or any application for that matter, there has to be a need for such tool in the market. Such need is established as the current tools may not offer a similar way of navigation and sharing of images, experiences and feel of different locations.

The feasibility study for the project ECHOES is divided into a number of steps that evaluate the different aspects of the project.

First, the technical feasibility of the project is investigated to evaluate the possibility for such application to be created and to which extent it can serve its purpose. There are existing tools that can be used in the context of this application. Hence the project is made more doable and interesting as it encourages reuse of existing solutions (perhaps optimal), as well as it merges in aspects such as mapping and location information using existing databases and APIs.

Second, the evaluation of availability of the data. Google offers tools useful to the project in hand, in the sense that it provides some Application Programming Interfaces that ease the use of existing data such as a map of the region covered. The use of such APIs is necessary to meet the requirements of the project.

Only then, the production techniques to be used are evaluated. There are different manners to achieve the qualities required in the application. The language to be used in the development of this project is mainly Java, along with other languages that may be used for some specific tasks such as HTML and JavaScript and XML for the implementation of the views. It is not to be excluded that the application could display the current status of the location, by means of streaming if a user is describing it by video, or voice recording for example, and it is part of the work to be done in the future as the time frame would not allow it.

Finally, the feasibility of the schedule to be set. The respect of the duration of each step is critical and plays a vital role in the completion of the project on time. The design phase in itself is a critical phase and can take up to a week. The more time invested in the design phase the more time is saved over the course of the future development steps.
### 4.2 SCHEDULE

The project is deemed feasible under the schedule specified below:

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<thead>
<tr>
<th>Task</th>
<th>Due date</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Specification</td>
<td>26th January</td>
<td>3</td>
</tr>
<tr>
<td>Feasibility Study and Analysis</td>
<td>2nd February</td>
<td>7</td>
</tr>
<tr>
<td>Diary 1</td>
<td>5th February</td>
<td>3</td>
</tr>
<tr>
<td>Diary 2</td>
<td>13th February</td>
<td>7</td>
</tr>
<tr>
<td>Diary 3</td>
<td>21st February</td>
<td>7</td>
</tr>
<tr>
<td>Diary 4</td>
<td>28th February</td>
<td>7</td>
</tr>
<tr>
<td>Interim Report</td>
<td>2nd March</td>
<td>2</td>
</tr>
<tr>
<td>Diary 5</td>
<td>7th March</td>
<td>5</td>
</tr>
<tr>
<td>Diary 6</td>
<td>7th March</td>
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<td>7</td>
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<td>Diary 9</td>
<td>28th March</td>
<td>7</td>
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<tr>
<td>Final Report</td>
<td>16th April</td>
<td>15</td>
</tr>
<tr>
<td>Updated Final Report</td>
<td>3rd May</td>
<td>5</td>
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5 REQUIREMENT SPECIFICATION

5.1 FUNCTIONAL REQUIREMENTS

- The user shall be able to review a location and rate it
- The user shall be able to upload an image about a specific place
- The user shall be able to see what other users upload in the past 24 hours
- The reviews and uploads shall be rated by other users
- The highest rated reviews and uploads appear first

5.2 NON-FUNCTIONAL REQUIREMENTS

5.2.1 Access requirements

- The application is web based and therefore shall be accessed through different channels and platforms.

5.2.2 Security requirements

- The user shall be able to create an account and log in using his credentials.
- The application shall preserve confidentiality of the user, integrity of the information uploaded, and availability of information once provided.

5.2.3 Integration requirements

- The application shall enforce integration by using existing technologies (Google maps, Google geolocation…)

5.2.4 Extensibility requirements

- The application shall be designed for extensibility as the functionalities to be implemented may be modified or enhanced.

5.2.5 Performance requirements

- The application should provide low response time for review, images and videos.

5.2.6 Scalability requirements

- The application is to sustain good performance with high loads and users.
Figure: Use Case Diagram
6 TECHNOLOGICAL ENABLERS

6.1 LANGUAGE AND TOOLS

- LANGUAGE
  Java as an Object Oriented programming language, is multi-purpose and intuitive when it comes to the separation of entities, and thinking of the different components that make up the business logic of the application. It is supported by the Java Runtime Environment which supports the execution of the code and manages the objects and their lifetimes in runtime.

- TOOLS
  - **Data Side**
    MySQL / Workbench: is used for creating the database along with the tables needed using the IDE
  - **Server Side**
    - Glassfish 4.0: A performant Open-Source application server started by Sun Microsystems
    - Netbeans 8.0: An IDE that facilitates coding and allows the developer more support from the RE
    - Java Development Kit 1.8: Includes the Java Runtime Environment used for making Java programs

6.2 APIs AND FRAMEWORKS

6.2.1 Google Maps API
It is an Application Programming Interface that allows your website to have a Google map, that is already populated with information for each known location. To be able to add such feature to a view, one needs to register his project in the Google Developers Console, and request a key for that API, then plug a code snippet containing that key in the web page to be able to view it. The map is customizable and different features can be added or changed depending on the requirements.

Note: An Open Source alternative is OpenLayers, but this tool lacks in the information it provides about the locations.
6.2.2  **Google Places API**
Is a tool that allows the user to search for a location, get information in an easy way, by providing a request prediction service and other tools. It works hand in hand with the other APIs to provide a user friendly environment.

6.2.3  **Google Geolocation API**
Is an API that is used to retrieve the location of the user in a safe manner, as it transfers the data under a safe method being POST, and abiding by the secure web protocol HTTPS. The location of the user can then be used to determine a distance, or trajectory to another location.
7 SOFTWARE ARCHITECTURE

When evaluating the architecture that is most suitable for the project, the three tier architecture MVC proved to be the most suitable, and therefore the one used to construct this application. MVC is an architectural model that divides the application into three main components: Model, View and Controller. The model being the component that encapsulates the business logic of the application, the view is what the user would see upon sending a request or receiving one, and the controller is the one that monitors the interaction between the model and the view. It is an architecture that enforces code reuse, and the clear separation between these components eases maintainability and testing.

Moreover, the architecture used in this application creates an independence of the core functionalities of the application from the Database Management System (DBMS), and also the access channel that is in this case the web. Different access channels can be added without needing to change the core of the application. The diagram below shows this separation between the different components.

- **Client Side** is going to rely on a browser to send HTTPS requests to then have these requests processed by the server side, then get a reply through the same protocol and display that information in the correspondent view.

- **Server Side** consists of the application server, in this case Glassfish, and the business components being the Plain Old Java Classes, and the Entity Java Bean components managed by the EJB framework. The interaction with the data side in terms of getting the information needed from the database then creating the corresponding object is maintained by the Object Relational Mapping framework (ORM), which works hand in hand with the Java Persistence API (JPA) to persist those objects back in the database.

- **Data Side** is mainly composed of the database that is managed by the Database Management System, that is MySQL DBMS in this project. The IDE used for managing the database is MySQL Workbench.
The following figure represents the different actors in the application and shows the interaction between them.

As shown in this figure, the client would send an https request to the server through the View, and this request is processed at the level of the controller to format it in a way that the Model can understand, then the latter uses the information passed to it in order to apply the business logic to needed components, and sends feedback to the user through the corresponding view.
8 DESIGN

The design phase is an important step of the process of software development, which often requires a number of attempts before reaching the desired design.

8.1 ENTITY RELATIONSHIP DIAGRAM

The main component in the application are the User, who will choose which location to manipulate, then write a review or upload a media that refer to that location. The relationships between these entities is as follows:

Figure: Entity Relationship Diagram
8.2 CLASS DIAGRAM
The class diagram went through iterations of attempts as it evolved with the application to adapt to the required changes, and show a correct representation of characteristics of the classes and the relationships between them.

Figure: Class Diagram
8.3 SEQUENCE DIAGRAM

Figure: Sequence Diagram
9 IMPLEMENTATION OVERVIEW

The implementation of the application starts with creating the tables that would need to be persisted in the database, then generating the equivalent classes thanks to the wizard provided by the IDE. Next, the development of Plain Old Java Objects (POJOs) is to be done, and these classes reflect the business logic of the application independently of the UI or DBMS.

Java Persistence API (JPA) is used to save the information coming from the view onto the database when adding a media or writing a review are requested.

Entity Java bean entities (EJBs) are generated and optimized under the scope of the EJB framework. It is a framework that supports annotations to provide a higher level of abstraction and reduce redundancy and coding time.

The EJBs extend the POJOs, which allows a more significant independence between the business logic and actual implementation, as we could have different implementations of the service beans.

Figure: Implementation overview
The views are implemented using HTML, PHP, CSS and JavaScript, along with the different APIs such as Google Maps API and Google Geolocation API.

```javascript
function downloadUrl(url, callback) {
    var request = window.ActiveXObject ?
        new ActiveXObject('Microsoft.XMLHTTP') :
        new XMLHttpRequest;

    request.onreadystatechange = function() {
        if (request.readyState == 4) {
            request.onreadystatechange = doNothing;
            callback(request.responseText, request.status);
        }
    }

    request.open('GET', url, true);
    request.send(null);
}

</script>
<script async defer src="https://maps.googleapis.com/maps/api/js?key=AIzaSyBNe2Jf4S" />
</script>

<!-- Can add more under the map -->
```

Figure: Adding the Google Maps API to the view
10 RESULTS

Figure: The different uploads in the area

Figure: Adding a media to the Location
11 CONCLUSION AND FUTURE PERSPECTIVES

All in all, there are still functionalities to be implemented as the time constraint did not allow me to complete them on time, but the core functionality of the application is apparent and will be enhanced over the course of next few months, as it was a fulfilling and rewarding experience in terms of knowledge and skill. And so, the aspects of the projects that are to be covered in the future are the following:

- Including video and live feed in the medias
- Assembling medias that are close to each other in one set of displays
- Adding features of communication between users
- Showing some locations as hotspots depending on the number of uploads in said location
- Implementing the 24-hour lifespan of uploads if it is necessary
- Adding a mobile access channel
- Adding the possibility for an Admin to delete medias and reviews of other users

Other features can be added as the application grows, and there will be a need to do so if the application were to go further, to be able to differentiate itself from its major competitors in the market who never quit improving.
12 REFERENCES


APPENDIX A

Requirement Specification

ABDELLAOUI Ibrahim
CSC
ECHOES – AN EXPLORING TOOL
IRAQI HOUSSAINI Omar
SPRING 2018

The aim of this capstone project is to create an application that allows the user to share images and videos, and see what others have uploaded. The first step in the analysis is to evaluate the possibility for such application to be created, and how feasible the requirements for such application are. The user would log in and authenticate himself. It is evident that the application would need to have a map to choose a location, then add an image or video the location. The video or image should be evaluated by other users to ensure the quality of the content. These functionalities may be subject to change after conducting the feasibility study for the project. The second step of the analysis is to identify the manner in which the data will be stored, and the construction of a database for the different shops and selling points.

The next step of the process being the design of the application is a critical one, and will depend primarily on the results of the feasibility study which may affect the functionalities of the application. The implementation is directly related to the choice of which functionalities can be implemented using already existing tools to maximize reusability, functionalities that need to be hard coded, and others that may be a mix of both. Testing goes along with implementation in the development phase, and will be enforcing a correct functioning as well as the accuracy of the decisions proposed by the application.

Each of the steps presented above will be documented and explained in details. The software will adhere to the requirements of enterprise class applications.