

Research Proposal

by Meher Arasada

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1. Introduction

This research proposal first introduces the research area of interest, which is a progressive web application (PWA) and the testing of its usability and performance. A mini literature review conducted to better understand the topic area is then described, along with the gaps identified from research conducted to date. This then leads to the aims and objectives of this research proposal which are linked to the development and testing (usability and performance) of a progressive web application named 'Odd 2 Even'. The significance of this research proposal is that the web application will be developed in the latest technology (PWA) with a plan to move the app to the cloud.

The web app has been named 'Odd 2 Even' (O2E) because it is aimed at helping people avail offers that are for an even number of people, such as 2 for 1 offer or offers such as '2 for £10'. It will aim to connect individuals who would like to avail such offers to other individuals who would like to do the same, thereby making an odd number into an even number. There is always a need for new, creative and innovative applications in this mobile world. There is a high usage of the smartphone. Nowadays, people look for applications which will not occupy much memory, are user-friendly and with high performance. Native web applications are not popular, especially due to the space that it occupies on the device; at the same time, because laptops/desktops may not always be easy to access, users may tend to open the same website in the mobile browser, leading to a poor user experience (not as great as native).

Google has come up with Progressive Web App (PWA) to overcome the limitations of a native web app and to give a rich experience to the users, similar to a native web app. PWA is compatible with all the devices like desktop, laptop, tablets, and mobile. PWA is developed using web technologies that act like a native app without having to install any application on the device. Unlike a native app, PWA is compatible with any mobile operating system (OS) which means that there is no need to develop an application against each mobile OS (i.e Android, iOS, etc).

The O2E application will be developed with the help of the researcher's supervisor, Prof. Gaynor Thomas, University of Wales Trinity Saint David, Swansea.

2. Background to the Proposed Research

The purpose of this research is to first develop a PWA for O2E and then evaluate and test its usability and performance,

2.1 Literature review

Literature search: [1] IEEE database was searched using search terms 'progressive web app*', 'usability testing', 'performance testing', 'cloud', and 'agile' and combining them with Boolean operators like 'and'/'or'. The search resulted in 67 articles that were relevant to the topic area. These were reviewed and below is a summary of the review, along with the key gaps identified.

2.1.1 Summary of review and gaps in the literature

Cloud-based usability testing advantages

- Provides the results much faster
- Enhanced delivering of testing services
- Reducing costs significantly

Challenges

Requires special technical skills in cloud-based testing.

Applying security and monitoring will be an additional cost.

Agile methodology is used commonly in the software development industry and this has been well researched. However, the research on usability testing using agile is limited.

From the above search and review, the key gap identified in the literature was that the research involving usability testing within Agile methodology has not been adequately and recently explored(ref). This proposal, therefore, includes this aspect as part of what it sets out to explore (see aims below).

3. Aims & Objectives

The overall aim of this research project is to develop a progressive web application and to test its usability and performance.

Specific objectives are:

- to develop a progressive web application called O2E

- to use HTML, CSS, JavaScript, and PHP for software development
- to test the usability of the application within the Agile methodology with end users and obtain feedback on the same through a survey
- to check the performance of the application by checking its speed, scalability, and stability

For this website, a simple web application is enough, but while performing the usability testing, people will try to open this application on a mobile where some features will not work. So, by developing as a PWA, it is possible to combine the web application features and some of the native app services, where usability and performance testing can be performed.

3.1. Expected outcomes

The outcome at the end of this research project will be:

- the O2E progressive web app
- results from the usability and performance tests
- recommendations for how the O2E app can be improved based on the results of the above tests

4. Research Methods

4.1 Philosophy and approach

In order to measure the proposed research, a positivism philosophy may be used where an organized methodology is suggested and a quantitative method counting data analysis [2].

A combination of inductive (bottom-up) and deductive (top-down) approaches will be undertaken by:

- Collecting the data by doing a survey and analyzing the data.
- Organizing the results and framing the solution in the form of visualization.
- Testing performance of the application with the help of appropriate testing tools.

The study will be conducted in three stages as described below.

4.2 Stage 1: Development of the O2E PWA

There are some prerequisites for developing a mobile website and for Progressive Web App (PWA).

Prerequisites for PWA [3]:

4.2.1 Web app manifest file: manifest.webmanifest:

This file is the root of the web app which is in the format of JSON. It contains meta-data of the website such as icons, colour themes and standalone displays as PWA. This file contains all the information regarding the installation and configurations. After installation, it checks the appearance of the website. The recommended file type is Web manifests but browsers will accept JSON files too.

4.2.2 Service Worker

Service worker delivers reliability and performance which the user normally experiences in a native app. It handles the requests and responses accurately. It is a JavaScript file that lies between the server and the browser. It provides main features such as offline capabilities, push-notifications, and periodic background sync. There are few libraries and toolkits available that will help in developing the service worker file.

4.2.3 HTTPS

The application must be served over HTTPS as the service worker requires it. An SSL [4] certificate needs to be installed. Secure Socket Layer (SSL) will encrypt all transmitted data. It creates a secured connection between the client and the server over which the operation of data will be performed.

4.2.4 App icon

All the applications are required to have an icon to launch it from the desktop screen, devices and to show on the splash screen. The size of the icon is just 512 x 512 pixels (px) that will satisfy these needs. There are some recommended sizes for all the devices.

4.2.5 HTML page with PWA tweaks

Finally, put it all together and run the application on an HTML page because that is the actual web app. It registers the service network, points at the manifest and tries to deliver features that are more like a native app and it sets the viewport size and theme-colour.

4.2.6 Prerequisites for a Website:

For building a website, the basic requirements are to have hardware, software and a server. Hardware like desktops or laptops with the appropriate operating system is needed. Now software like, for this application, HTML, CSS, JavaScript, and PHP are required. HTML and CSS are required to develop the

front-end; JavaScript is required to communicate with the server for some services and PHP is used for server-side scripting.

A domain is required for hosting the web application and make it live. Hosting servers will not support all kind of applications, so it is better to choose appropriate hosting server and that lasts for a long period of time. MySQL database is widely used for a website that is developed using PHP.

4.3 Stage 2: Usability testing using surveys

Usability testing is about knowing the effectiveness, efficiency and overall satisfaction of a web application. Many companies will perform the usability testing before taking it to the next level like hosting in the server and making it live. Initially, usability testing is done at the time of prototype and later a midlevel assessment will be performed before it goes live.

The main purpose of usability testing is to figure out how to navigate a website quickly, otherwise, people will leave the site immediately. Some companies will hire employees for testing purpose.

4.3.1 Survey questionnaire:

An appropriate and structured software application will be developed. Research work that will be carried out is to test the usability of this application. The appropriate questionnaire will be prepared which starts with an open-ended question and ends with a couple of closed-ended question.

Every researcher ensures to ask a good question so that it leads the researcher to productive research [5]. Unfortunately, some questions will not lead to good results. Some people prefer to fill the questionnaire rather than speaking. But some people feel like asking and knowing the things immediately like in interviews.

After receiving the results/feedback from the users, usability fixes or changes must be applied and needs to be tested again. It's a never-ending process and people can still find some issues even if it's the world's number one website.

Using questionnaires are three basic types of the questionnaire they are

There are three basic types of questionnaires:

- close-ended
- open-ended and
- combination of both [6].

Close-ended questionnaires generate statistics in quantitative research as these types of questionnaires will follow multiple choice or tick box format. This, for example in retail, will provide us with stats on the shopping habits of a customer.

Whereas Open-ended generates qualitative research and it's meant to get accurate values which helps to develop the research. This, for example, will tell us how many customers are using the service.

Combining both will let the researcher know about the number of users using the service and at the same time getting their feedback about it. It starts with tick-boxes and ends with questions where the testers will write their opinion.

- Are the activities clearly structured?
- Is the content being clear and relevant?
- Is the practice of exercise being easy to understand?
- Is the delivery system is well organized?

4.3.2 Study population and sample

Usability testing for this application will be performed with the real-time users so that the errors can easily be captured, and task success can easily be predicted. The study population is anyone who can potentially use the application. For ease of access, the sample will be people from within the university, who will be approached for participation in the survey. It is expected that approximately 30 people will take part in the survey (sample size).

4.3.3. Below are some usability testing methods that are commonly used [7]:

4.3.3.1 Hallway Testing:

It is a common usability testing method and a popular method among developers and testers. This technique can be implemented with less cost and can provide valuable insight into the application. It helps in identifying the issues at the right place or location, explain the purpose, rectify issues and test it again. Advantages of using this type of testing are saving time, money and in-depth knowledge of the application is not required for these users. Improves user experience as the errors reduce and the usability of the application.

4.3.3.2 Remote Usability testing:

Usability testing of the website will be performed by using people who are located in different places. It is an asynchronous method where more time is

consumed, and a smaller number of usability problems are identified as a result still testing need to be performed [8].

4.4 Stage 3: Performance Testing:

Performance testing will be done simultaneously with usability testing. Performance testing is done to provide information regarding the speed, scalability, and stability to the client. This application deals with customers as it is service oriented where performance plays a vital role in testing techniques. Performance testing is generally required for all types of business as they need to maintain the speed and load because customers don't like buffering.

4.4.1 Load Testing:

Load testing will be performed on this application because further, it is going to be alive application. Where there is a chance of an increase in the users and multiple users access this application, so it helps in finding the performance of the application and helps the researcher to fix the issues if any.

4.4.2 Stress Testing:

As the traffic load increases, the application works well above its expected limit. Stress testing helps in understanding the scalability of workload. It also puts pressure on the processor, memory and solid-state drive to identify the potential breakdown point of the application on their defined resource.

There are tools to perform different types of testing. Some IT teams will make use of these tools to know the overall performance of their applications. Tools are Jmeter, LoadRunner, NeoLoad, etc. [9], which helps the developer to perform testing and know the results in less amount of time.

4.5 Testing the application:

Lighthouse is an open-source automated testing tool with an audit tool which is in-built within the web browser. It is a simple process of testing the application. Open the console of the web browser and make sure that the progressive web app is checked and then hit run audit. After a short period of time, the results can be seen on the screen.

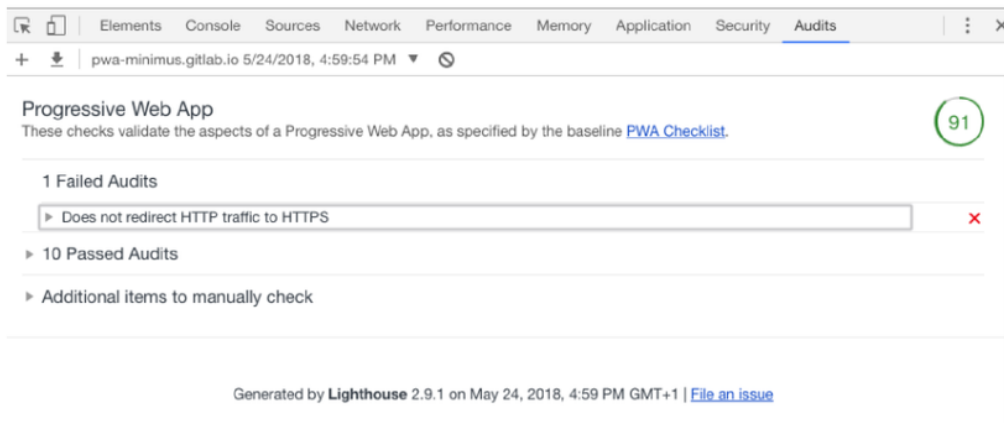


Figure 1: Result of PWA

The above figure is an example, showing the results after performing an audit on a website. Based on the results, the application can be enhanced and modified as required.

4.6 Data analysis

Data analysis of the survey data will be done using simple descriptive statistics using Excel.

Approach one user at a time [10] and make sure that the participant agrees to participate. Then start explaining about the project and purpose of the survey. In this way, participants will not influence each other. The survey will be conducted with multiple users and the total number of users will be around 10 to 15.

It is better to note the comments as they say so that key points will not be missed in the questionnaire. The most useful part of this survey will be to audio record the session provided participant agrees for that. There are no specific tools for usability testing of a website.

Performance testing will be done by using a tool called LoadRunner which is a software testing tool to measure system behavior and application performance under load. Customer's reaction will be captured if there is a delay in application response. Nowadays high-speed internet is available, so if there is any delay in application response then end users might immediately close that website and might not even revisit the website again. CRUD (Create, Read Update, Delete) operations should work effectively under any load.

5 Research ethics

There are some basic policies which must be obeyed before conducting academic research. As part of this research, no sensitive data will be collected such as age, colour, race/ethnicity, nationality, disability, religion, sex, gender, sexual orientation, personal medical records, and policy benefits.

Research data will be kept safe on a laptop which has encrypted password and SSL will be used to develop the application. Proper confidentiality will be maintained regarding the research data. There will be no harm to the participants as concerned with this research. No funds will be raised or donated or demanded or paid for this research.

Anonymity survey will be performed as part of usability testing. We ensure that participants will not be troubled. Application is developed for a good cause.

British Computer Society (BCS) [11] is the best code of conduct to follow. It ensures that the legal, ethical and social issues within the IT industry are followed in the UK [12].

6 Risks & Limitations

Project Risks:

- With the improper questionnaire, expected results will not be seen.
- Unrealistic schedule leads to delay in project delivery.
- Designing the wrong interface
- Developing the wrong prototype
- Developing wrong functionality
- Mid-level change in requirements
- Integration complexity
- Lack of communication

These are the possibilities of risks associated with this project.

Project Limitations:

- The application runs slow due to the volume of data. However, appropriate testing will be done in regards to scalability.
- Creating multiple databases and duplicate data entry.
- Lack of accountability for control and security leads to a problem. Proper monitoring is required.

- Requirements approval must be done before development gets started.
- Prior discussion about how the application to be developed to be performed.
- Design approvals are required in advance to avoid any design changes during the development which will have an impact on the integration.
- To survey the above 18 years of age group.

5. Development Methods

5.1 Software Development Methodology

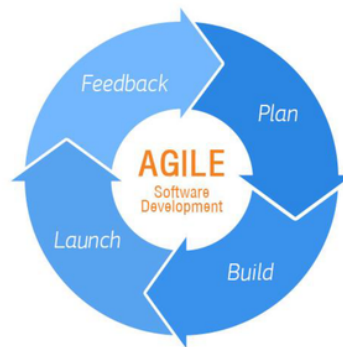


Figure 2: Agile Methodology

Agile software development

Our team will be self-directing and motivated which is important. Team members will be briefed on the project plan, individual tasks, and tools that are available to build the application. Detailed project document will be prepared and handed over to the client which will be useful to the client as well as for the project team. This will provide them with the technologies that were used and how the application was developed. There will be regular communication with the client regarding the requirements. Because in this process, time and resources are fixed and the application features may vary but not to a huge amount.

The project manager will ensure that the technical developers, business analysts, and business representatives communicate regularly and work

together. In this process, new ideas are also invited for better progress in the project work. It will be a proactive approach because all the care will be taken at initial stages rather than waiting to react after the release. Team members will be kept stable and there will not be much shuffling between the teams as it will have an impact on the development.

There are 12 principles [13] that will be followed as part of this project implementation:

Customer Satisfaction: Delivering the software/application on time. Meeting all the deadlines at every stage of the project and in-time delivery will satisfy the customer provided it should be useful. Because of this, there will be progress in the process.

Changing Requirements: Always invite the changes in the requirements, even late in the development process. We cannot say no to the client regarding the change in the requirements. It can be a risk, but the process has been designed for support.

Frequent Delivery: Plan frequent deliveries of the work, at least once in two weeks for every couple of months. Because there will not be any problems at the end time of the project.

The measure of Progress: Base on the delivery of work. More deliveries will show the huge progress in the work or else quite opposite. The measure is calculated upon deliveries and deficit-free product.

Sustainable Development: Development can sustainable or feasible only when the developers, users, and sponsors maintain a constant pace of communication forever.

Close Cooperation: Both the developer and client should work together all the days of development. The project manager should also monitor them and participate accordingly.

Motivated Individuals: Make sure that individuals are self-motivated. Because self-motivation gives good results which are required for the organization. Show trust and ensure that the team knows it. It reduces stress and works effectively.

Face-to-Face Conversation: The best method of conveying message or instruction to a team is by face-to-face communication. It will solve the problems and confusions if any.

Technical Excellence: A good design and technical excellence should be maintained throughout the project. Developer should be technically perfect to give best results.

Simplicity: Making thing easy by keeping the work simple. A simple amount of work will minimize in solving the issues if any.

Self-organizing teams: Team must be self-organized to get good architecture, design, and requirements. Organized teamwork will give good results and delivers the correct software to the client.

Regular Adaptation: Team always tries to adapt and adjust accordingly with the changes. Because every team wants to become more effective, so try to adapt to the surroundings and progress their work.

Risk Management:

One of the ongoing processes in management is a risk. It should be analysed at the initial stage of the project and try to continue the same throughout the project lifecycle. It threatens in such a way that the project will be closed or cancelled. It happens only when a sudden quit or fire a team member which is big threatens which cause project failures. There will be minor threatens which can be manageable. But all these threatens should be identified and take the appropriate countermeasures and plan accordingly. Here are some of the countermeasures:

Prevention: Preventing something may lead to costly afire. Estimating that more salary will retain the employee which is not possible. Good working environment and filling confidence by trusting will retain or chance of holding the employee.

Reduction: Trying to reduce the risk only by regular monitoring. Frequent interaction, solving the issues immediately and appreciation at regular intervals. Handling the mid-level requirements and implementing accordingly without any distraction in the team.

Acceptance: In some circumstances, nothing can be done rather than accepting the risk. Despite taking all the measures, there is a chance of unforeseen situations where management must accept the risk.

Contingency Plan: Associating with one or more of the above plans and preparing this plan.

Agile methodology in a cloud can be implemented using Microsoft's Visual Studio Team Services (VSTS) that is available in DevOps services.

The agile manifesto is based on the above principles, which leads to quality software for the clients. As there are no communication and monitoring problems in the process. The daily stand-up meeting will always help and make sure that all the team members participated actively.

6. Resources & Planning

6.1 Resources Required

Infrastructure as a service: Microsoft Azure

Platform as a Service : Windows, HTML, CSS, PHP and PhpMySQL

Survey: University students and lectures (Age: above 18 years)

Testing : Automated tools

6.2 Gantt Chart

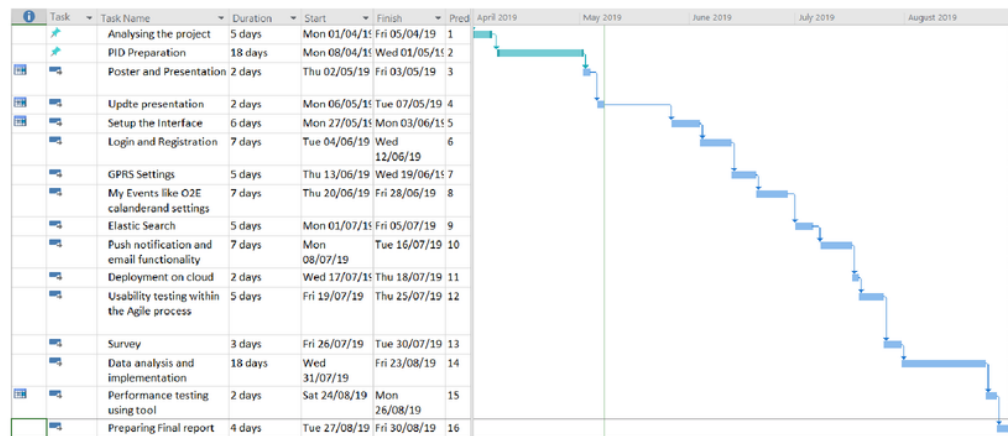


Figure 3: Gantt Chart

Figure 3 shows the planner of the proposed research. Above mentioned are the approximate time estimates and may vary as the research moves on.

7. Conclusion:

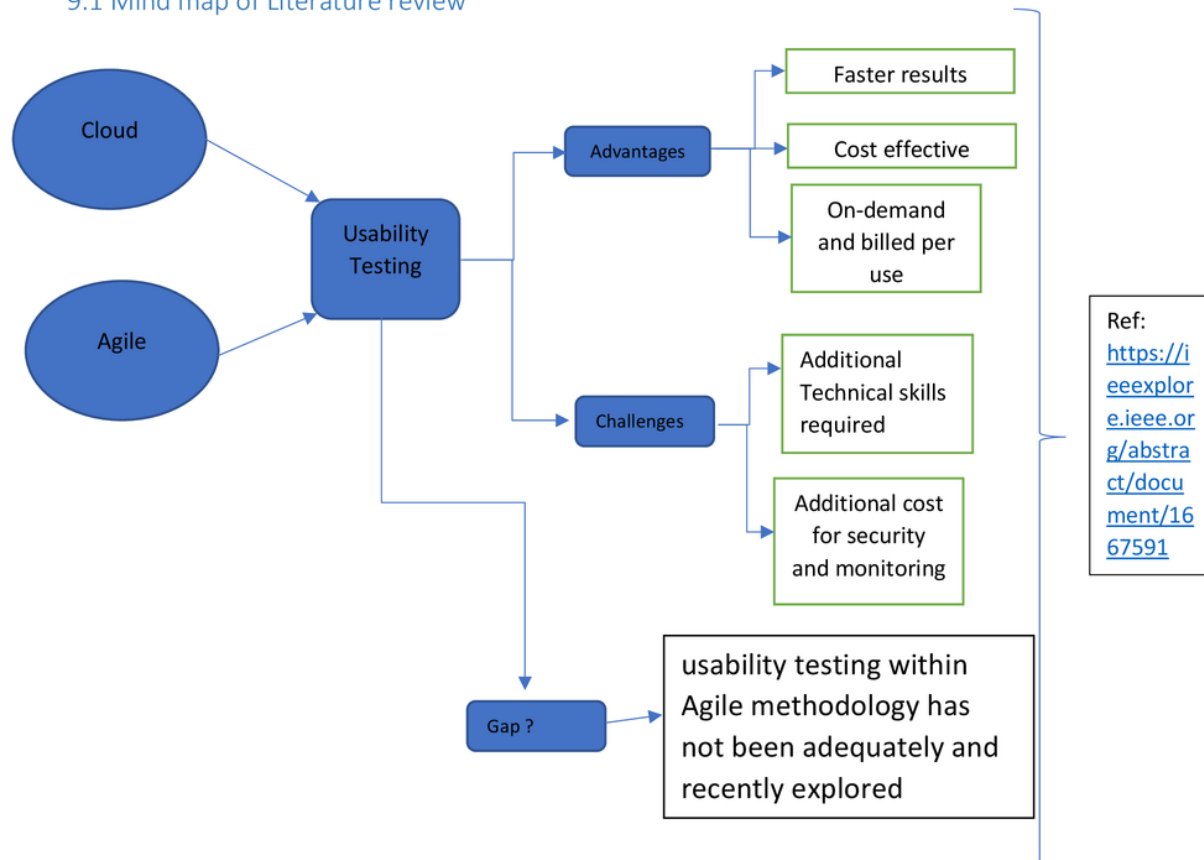
The proposed research includes a software application will be developed in progressive web application with an appropriate agile methodology. As a part of the literature review based on the IEEE database, usability testing within Agile methodology has not been adequately and recently explored. A questionnaire-based survey was proposed regarding the usability testing and data will be analysed. Work planner was created in MS Project and some proposed resources. Ethics will be followed as part of developing the research.

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9. Appendix 1

9.1 Mind map of Literature review



Research Proposal

GRADEMARK REPORT

FINAL GRADE

GENERAL COMMENTS

Instructor

55/100

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GRADING FORM: NEW ASSESSMENT

MEHER ARASADA**55****ENGAGEMENT WITH LITERATURE**

Literature review section is very short - you state that there are 67 articles, but more detail is need of the major literature for the area. What do they say about the area of study. A summary is not enough on its own. Are there any other systems out there that have similar traits to your own? 5/15

5**KNOWLEDGE AND UNDERSTANDING**

Introduction puts the background of the problem into context fairly well. Be careful, Google did not actually invent the PWA, but they did set down requirements - the technologies are not necessarily created by Google. 5/9 Conclusion - A little short and I'm not sure usability testing with agile is the main thrust of the project, more a side observation to the implementation proposed. 3/6

8**COGNITIVE, INTELLECTUAL SKILLS**



Development methods are clear and it is some clear benchmarks for assessing success have been established. 13/15

13

PRACTICAL SKILLS



Research methodologies selected are clear. Good consideration of survey-related issues. Be careful on your sample that you do not use only people from the School of Applied Computing in your sample of "people from the University" as this may skew your results (as these people are highly computer literate already) 16.5/25 Planning are quite clear - Gantt Chart is OK but there are a lot of tasks happening sequentially - some of these at least will be in parallel, unless you are really planning on writing your entire report in 4 days! (I'd suggest that is ambitious!) You have not included the viva/exhibition board preparation in your chart. resources are a bit light on detail, you need to consider what is needed for servers, contingency plans etc. What automated tools are you planning to us for testing? 6/10

22.5

TRANSFERABLE SKILLS



Report structure is OK and word limits have been adhered to. Text would look nicer is was justified. Some parts of it seem a bit confused (especially the lack of literature review in the literature review section) 6.5/10

6.5