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NHS Movenet Database

Digital Media Project

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ABSTRACT

The Parkinson's Movement Disorder Service based at the James Cook University Hospital has requested a prototype database using MySQL to offer an improved service to their patients and team.

This database will enable the Movement Disorder Team to go paperless on patient visits saving time and money and producing a more efficient service. A user needs analysis is shown below to this report. The methodology we used consisted of structured one to one meetings with the sponsor, Dr Neil Archibald, a series of focus groups with the Movement Disorder Team and Consultant, patient observation.

This report will explore, explain and analyse the process in which Movenet EMR, a web application helping to simplify the lives of staff and patients at James Cook University Hospital, came into existence, as well demonstrating the justifications behind the project and the decisions made throughout.

The outcomes of the user requirements analysis suggest initial priorities for incorporation of the database are:

- Login portal
- Search Interface
- Patient Input Area
- Patient Record Area

ACKNOWLEDGEMENTS

CONTENTS

1   INTRODUCTION

The Movement Disorder service at The James Cook University Hospital provides care for 800 people living with Parkinson's disease (PD). The team includes neurologists, specialist nurses, physiotherapists, occupational therapists and speech and language therapists. Patients are seen either at James Cook University Hospital or in the community and are provided with a multi-disciplinary service of a very high quality.

The Client have requested Martin and myself working alongside the South Tees Trust, The trusts partners in the Pharmaceutical industry and leading Parkinson's charities, to develop the **NHS MoveNet database** to improve patient service, helping them to meet their aspirations for an efficient, high quality end product (online database) with enhanced audit and research capabilities.

Once in place, this Database will not only improve efficiency and productivity within the clinical service, it will also allow them an enhanced use of their audit and to develop a safe, high quality service.

1.1   Motivation and Rationale

This is a joint live venture between myself and Martin Kleis and we are both final year students at Teesside University. The rationale for taking on this project stems from a smaller project that Martin and I were asked to do during our second term at Teesside University.

Both Martin and I were approached by a Lecturer at Teesside and asked if we would be interested in developing an intranet web site (Walker 2015) for the NHS at James Cook Hospital, it was an offer that we both considered to be very interesting and perhaps lucrative down the road or future reference as demonstrated after Dr Neil Archibald, who is to be our main contact and "head Consultant Neurologist" at James Cook presented our work at a conference in London to an audience of over 2000 of his peers.

The feedback from the conference was very positive and it would seem most people were very impressed with the web site and its abilities, which is to

allow hospital staff to be able to assess possible Parkinson's sufferers who come into the out patients department, with or without family members thinking they may be a Parkinson's sufferer.

As of now there are no guidelines to follow and a lot of potential PD patients are misdiagnosed and of course given the wrong advice, which means follow-ups can be costly and time consuming. The website is a set of instructions for staff to follow "to the letter" and designed by Dr Neil Archibald.

After his success at the conference in London, Martin and I had another meeting with Dr Archibald at the University to discuss the progress, and it was here that he brought up his intentions and needs for a database to be used for patient input during Dr/Patient sessions, because as of now it is just a bunch of notes and scribbling's.

A light bulb came on in my head and it said, "Why don't you ask him if we could design that database for you", which I did, my thoughts were "This could be an excellent dissertation project" for Martin and myself, and to my surprise, Dr Archibald agreed to allow us to develop and design his database.

1.2   Area of Investigation

The NHS MoveNet Database will be created using MySQL as a backend and online database, it will utilize JSON, JQuery, AJAX and HTML5 (Hadlock, 2006) to display it on the NHS Trust's servers. Initial areas of investigation will be Data Modelling (Letkowski, 2012) and Large Data Schemas as needed for this project. The database will be complex and containing at least 8 tables with various degrees of normalization, at this point the tables and structures are ongoing and will undoubtedly change as we progress.

The database will consist of detailed areas such as Patient Demographics, Next Of Kin Demographics, General Practitioner details, Medications needed, both motor syndrome and non-motor syndrome categories. It will contain detailed areas of information collected such as, Tremor, Gait, Stiffness, Balance, Medical History, Sleep, Vision, Bladder Symptoms and Bowel Activity.

2 METHODOLOGY

2.1 Waterfall

The waterfall model is a popular version of the systems development life cycle model for software engineering. Often considered the classic approach to the systems development life cycle, the waterfall model describes a development method that is linear and sequential. Waterfall development has distinct goals for each phase of development. Imagine a waterfall on the cliff of a steep mountain. Once the water has flowed over the edge of the cliff and has begun its journey down the side of the mountain, it cannot turn back. It is the same with waterfall development. Once a phase of development is completed, the development proceeds to the next phase and there is no turning back.

2.2 Agile

Agile methodology is an iterative, and usually team based approach to relational database development which emphasises the rapid delivery of an application to its completion. While other methodologies create tasks and schedules, Agile is time capsule into phases called "Sprints" with each sprint having a defined duration with its own list of deliverables.
As work within a sprint is completed, the client will review and evaluate the end result, there for allowing the project to progress to the next sprint.

2.3 Scrum

Scrum is an agile methodology that can be applied to nearly any project; however, the Scrum methodology is most commonly used in software development. The Scrum process is suited for projects with rapidly changing or highly emergent requirements. Scrum software development progresses via a series of iterations called sprints, which last from one to four weeks. The Scrum model suggests each sprint begins with a brief planning meeting and concludes with a review. These are the basics of Scrum project management.

The Scrum model suggests that projects progress via a series of sprints. In keeping with an agile methodology, sprints are time boxed to no more than a month long, most commonly two weeks.

2.4   Conclusion

One of the primary features of agile methods is their attitude towards change. Most of the thinking about software process is about understanding requirements early, signing off on these requirements, using the requirements as a basis for design, signing off on that, and then proceeding with construction. This is a plan-driven cycle, often referred to (usually with derision) as the waterfall approach as described by Fowler and Sadalage, (2003)

> *"Such approaches look to minimize changes by doing extensive up-front work. Once the early work is done, changes cause significant problems. As a result such approaches run into trouble if requirements are changing, and requirements churn is a big problem for such processes.*
>
> *Agile processes approach change differently. They seek to embrace change, allowing changes to occur even late in a development project. Changes are controlled, but the attitude of the process is to enable change as much as possible. Partly this is in response to the inherent instability of requirements in many projects, partly it is to better support dynamic business environments by helping them change with the competitive pressures."*

It would seem that scrum and agile are very similar, although using agile is more flexible due to less time constraints than scrum and waterfall cannot work due to the initial development and testing of a new relational database.

3 BACKGROUND RESEARCH

Since acknowledging our commitment to this project, I have researched many resources including websites books and journals identifying the need for healthcare database usage amongst patient and Dr Interaction, after being invited to sit in as an observer for an actual Doctor/Patient session, I have found that at this time it is an area that needs to be addressed.

The main areas that need to be researched are data modelling, Database usage within the NHS, and any guidelines that may be in place within the NHS as well as some online technologies such as JSON, JQuery which will allow me to show the database online and to make changes to.

3.1 Literature Review

- The most important research at this point was on the subject of large relational database design and its architecture (Kaur and Rani, 2015) covers the area of the need for large data bases within the healthcare system and also various frameworks that can be used to store the data. It is essential to find an understanding of these procedures if this project is going to be a success.

- Fundamental Database design (Ambler and Sadalage, 2006) is important when choosing the type of database used as there are many, this journal points out the pros and cons of all databases available as the project would need a robust and fast online version to hold and store data of more than 800 patients and their doctors.

- New web technologies are making it easier and more secure (Hadlock, 2007) to display online databases, this book describes how to display detailed personal information within a database in a secure manner. It is imperative that the project database and web site is made secure as possible enabled by using the latest technologies available.

- Understanding how to create a database with many tables and to be able to connect all tables using "Data modelling" (Williams, 2009) gives examples on how to begin the design procedure and the questions you need to ask yourself on why these tables need to connect.

Electronic Health records are large, diverse and complex and provide an extremely rich and valuable source of data for Hospital staff and consultants, because of this, there are justifiable concerns about the privacy and security of this data, such as who can access it and for what purpose they are doing so. Simon and Unützer (2000) remark that "The same characteristics that make these clinical databases so valuable also make them a great cause of concern for potential privacy breaches".

One of the key challenges of working with e-Health data is reassuring patients of the medical gains whilst alleviating their fears of privacy breaches. Electronic health records are unique due to their confidential nature and incredible sensitivity must be shown when working with such data to keep it secure and prevent unintended disclosure. Patient identifiable data is subject to the Data Protection Act (1998) and those using or storing this sensitive information have a legal obligation to protect it. Support can grow rapidly if patients are able to see how their data being used can lead directly to improvements in their own healthcare provision. They may even wish to specify limitations in which their records may not be used (e.g. not for AIDS-related investigations). The patient may also wish to withdraw their electronic health records and this needs to be made possible even after anonymization has taken place.

Maintaining absolute patient confidentiality is of paramount importance for patient safety and it is therefore vital to collect end-to-end provenance data in order to track who has accessed what, when they did this and how it was done. Information should be captured for audit, with alerting mechanisms that are triggered in the event of suspected abuse. In addition to being a requirement for ethical approval, it is important for the provision of future data for research that the wishes of the patients are upheld at all times.

Another issue that requires careful consideration is how contextualised information associated with a patient record can remain intact whilst still ensuring the patient cannot be personally identified.

One method typically used in drug trials that provides good privacy protection (Ince, 2007) involves knowing the unique identification number of an individual rather than their name.

3.2   Project Plan

Below is the original gannt chart designed at the very beginning of this project which has allowed for full scrutiny at every stage of the process?
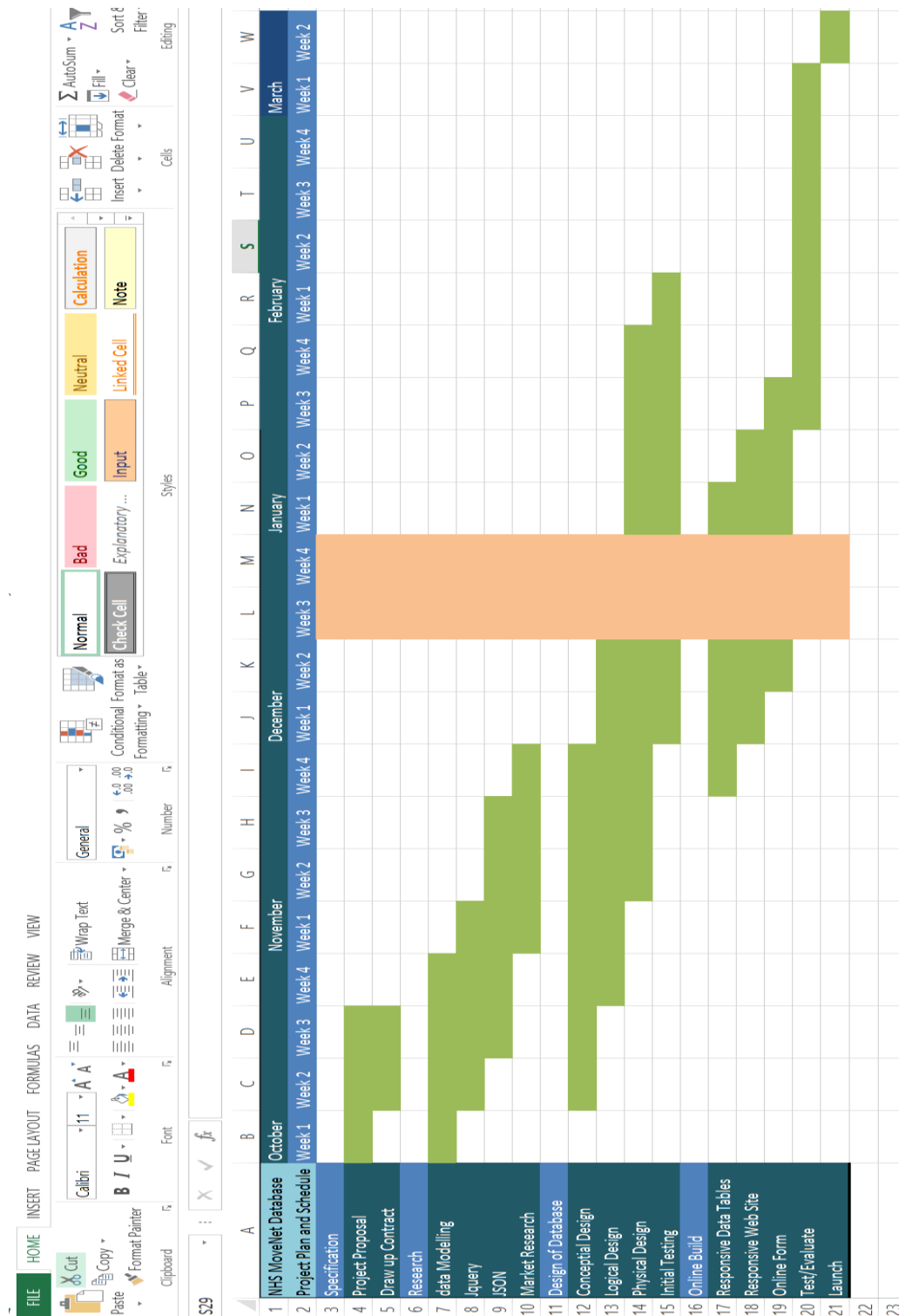

Figure 1 Gantt chart showing project progress

3.3   Project Review

A Project Review was designed to help understand the needs and time constraints within this project outlining the necessary tasks that lie ahead with a great deal of emphasis put on the research in Data modelling and Medical Database design. Other considerations were the implementation of the database and user interface within the NHS server system, whether it can handle the large data sets, or can it run smoothly and fast (As yet to be determined)
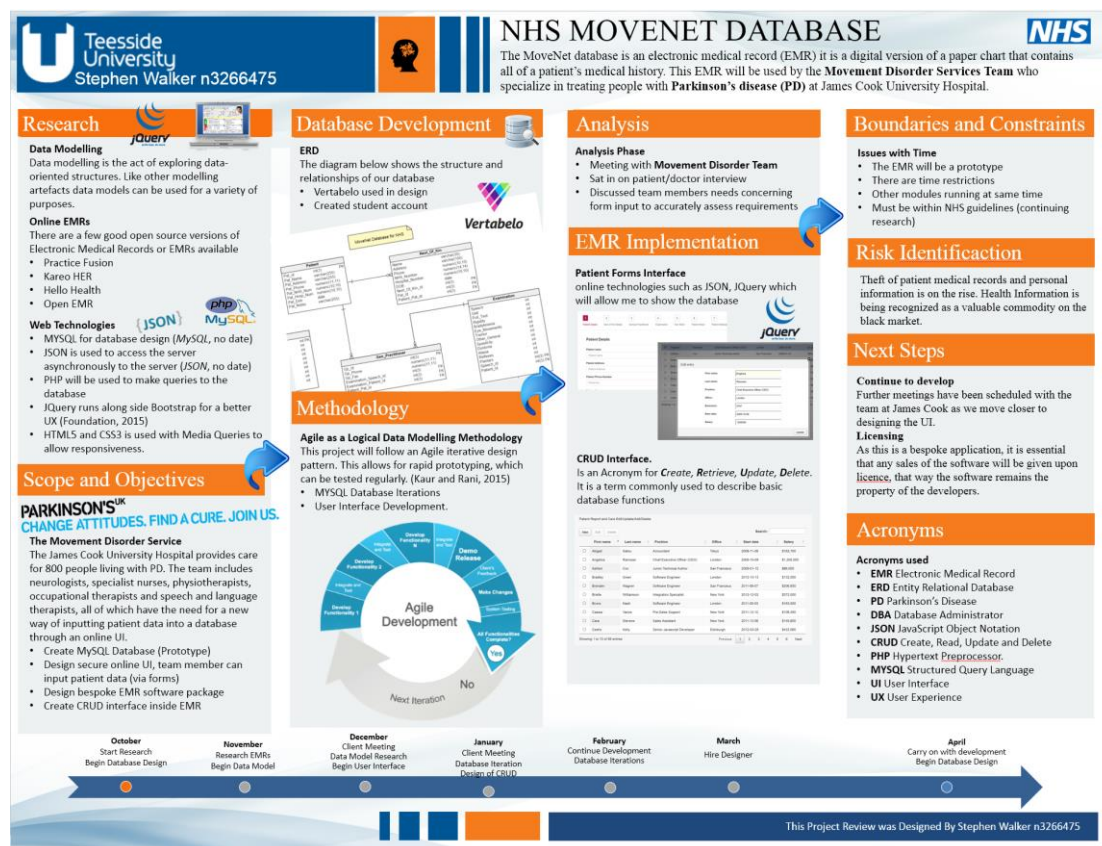

Figure 2 Project Review

3.4   Competitor Analysis

After extensive research into online EMRs it was found that there are a good many "bespoke" versions available and therefore cannot analyse these versions, but very few (less than ten) open source versions on the market place of which three of the best will be analysed.

Competitors

Research of similar websites to the one that is being developed, to analyse the ease of use for each website and also critical aspects such as performance and security.

- **Login page** – Check to see if the login page of the website is using secure user authentication methods.
- **Index page --** Check to see if the homepage of the website is clear and descriptive with critical information dynamically loaded.
- **Navigation –** The navigation of the website needs to be consistent on all pages, and needs to be placed in a clear and visible location.
- **Performance –** The pages and database tables need to load at a reasonable speed and any animations need to function properly.
- **Security –** The website should adhere to a secure format where a user can be tracked at all times.

When analysing the website, they will be scored on each aspect as listed above. And analysed on a scale of 1 to 5:

1 = Bad   2 = Poor   3 = Satisfactory   4 = Good   5 = Excellent

A marking table will be created for each website and then divided by 5 as there are 5 criteria checkpoints. by doing this, it will be able to give an overall mark out of 5 to each website to analyse which website is more successful than others.

Example: 4 + 4 + 5 + 4 + 4 = 21

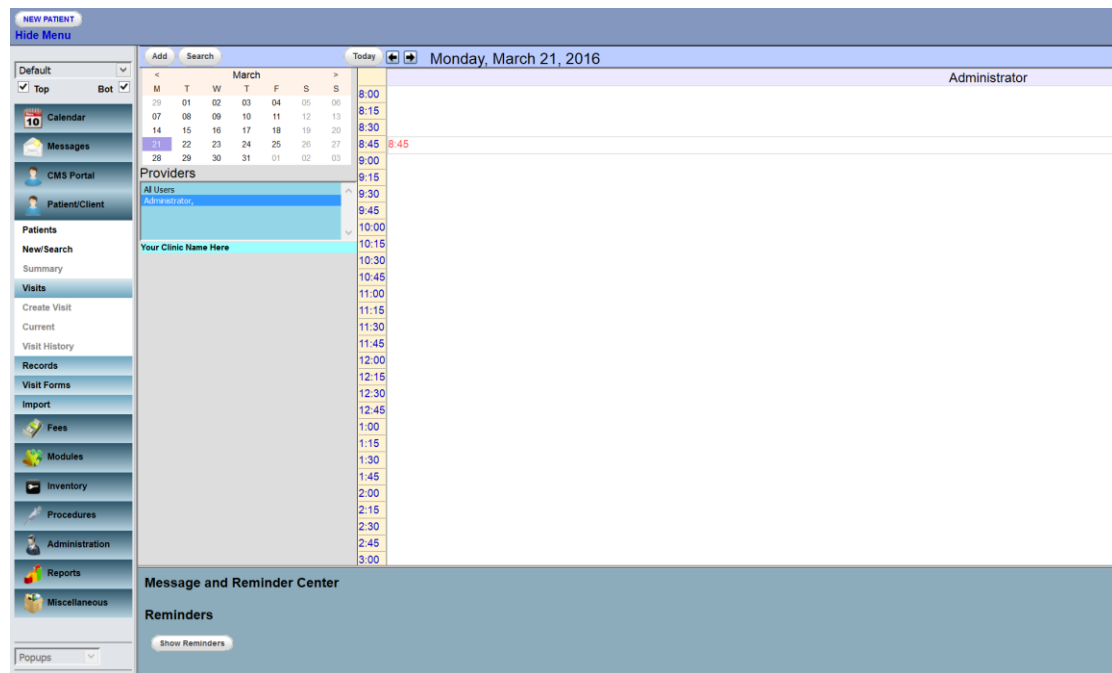21 $\div$ 5 = 4.2 Overall Website rating = **4.2**

Website: http://demo.open-emr.org:2101/

Figure: A Screenshot of open-emr website

Website Aspect	Mark	Review
Login page	5	The login page is simple and easy to understand, the user is asked for a username and password, if accepted will continue to index page. If fails the user will not continue.
Index page	3	The layout of the index page is very complex and confusing, maybe too much to take in.
Navigation	3	Navigation is simple to use and is placed vertically down the left side although outdated.
Performance	3	There is a performance issue here as the latest data binding methods have not been used therefore creating a lag in showing dynamic data.
Security	4	The security of the site is adequate but again needs to update technology used such as session cookies.

Overall mark = 3.6 – This website is a good example of an EMR site and has many positive features that make it a successful website. It has a good range of relevant content, however it can be improved by the addition of using latest responsive methods and JQuery and JSON to collect and view data in tables.
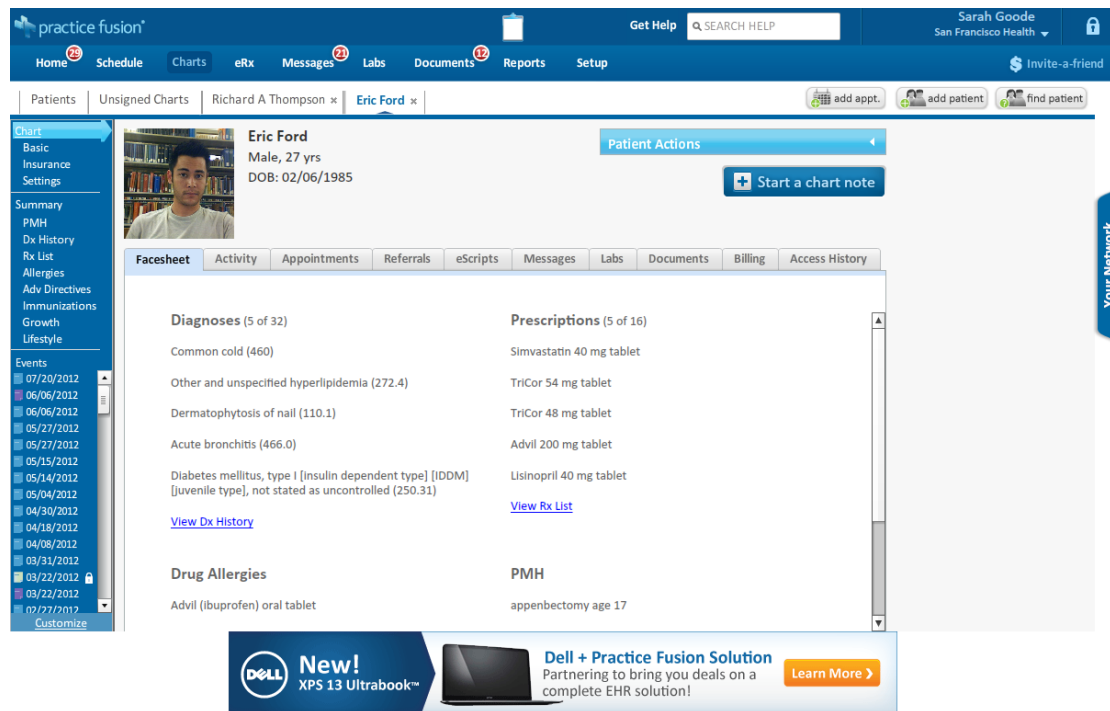
Website: https://www.practicefusion.com/

Figure: B Screenshot of PracticeFusion website

Website Aspect	Mark	Review
Login page	4	The login page is simple and easy to understand, the user is asked for a username and password, if accepted will continue to index page. If fails the user will not continue. I was able to login with a test username and password combo.
Index page	3	The layout of the index page is clean and simple with patient data ready to be accessed, Not a fan of ads that are necessary with open source version.
Navigation	4	Navigation is simple to use and is placed vertically down the left side although outdated with the use of a scrollbar, should be CSS3 dropdown.
Performance	2	There is a performance issue here as the latest data binding methods have not been used therefore creating a lag in showing dynamic data.
Security	4	The security of the site is adequate but again needs to update technology used such as session cookies.

Overall mark = 3.4 – This website has a modern interface and intuitive design. The software is easy to use and simple to get started on. It has been downloaded as an open source application over 10.000 times but falls short because of the advertising banner.
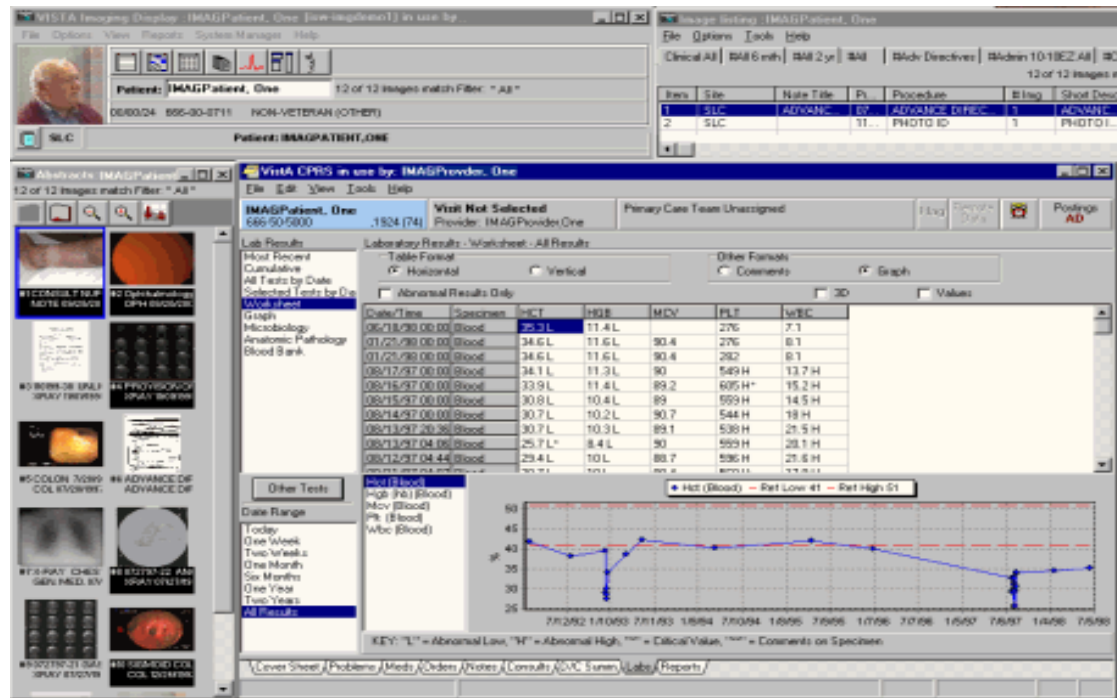
Website: http://www.ehealth.va.gov/VistA.asp

Figure: C Screenshot of ehealth website

Website Aspect	Mark	Review
Login page	2	The login page is simple and easy to understand, the user is asked for a username and password, if accepted will continue to index page. If fails the user will not continue. I was able to login with a test username and password combo.
Index page	3	The layout of the index page is clean and simple with patient data ready to be accessed, Not a fan of ads that are necessary with open source version.
Navigation	3	Navigation is simple to use and is placed vertically down the left side although outdated with the use of a scrollbar, should be CSS3 dropdown.
Performance	2	There is a performance issue here as the latest data binding methods have not been used therefore creating a lag in showing dynamic data.
Security	3	The security of the site is adequate but again needs to update technology used such as session cookies.

Overall mark = 2.6 – VistA is an older program, so it's not as user-friendly or easy to maintain as some of the more modern solutions out there. It also is a "megasuite" product where you get all the functionality of a "Groupware" application in one product.

4   SCOPE AND OBJECTIVES

The client was keen to see a MySQL database built with a responsive front end to enable his team to use on either tablet or desktop versions. The software once produced will reside on the secure NHS servers with a front end interface for authenticated team members to log in and use.

Key priorities were that the software should be easy to use, different aspects of research activity were prioritised as follows:

- Database security protocols, using individual login details for each team member.
- Table Structure and linking.
- Individual team member access requirements.
- Close liaison with team to ensure goals are met.
- Collaborating with Teesside University for guidance.

Within these activities, the client flagged up the following issues:

- Client requires a simple tool to bring up a patients record with past appointments and medication shown.
- Client requires a print facility at end of input to pass to patient and patient's doctor.
- Client requires the database to have an operational search facility to check various usages of medications.

The outcomes of the user requirements analysis suggest initial priorities for incorporation of the database are:

- Login portal
- Search Interface
- Patient Input Area
- Patient Record Area

5 DESIGN

This section covers the initial and final design concepts for the database as well as the front end for the web site, including user authentication and database editing.

5.1 Data Physical Model

The initial data model was very scares and had limited relationships needed to join one table to another, an example would be that an authenticated user may want to see a patient record and his medication prescribed and his doctor that prescribed it.

Physical ERD (see acronym's page) represents the actual design blueprint of a relational database. It represents how data should be structured and related in a specific DBMS so it is important to consider the convention and restriction of the DBMS you use when you are designing a physical ERD. This means that an accurate use of data type is needed for entity columns and the use of reserved words has to be avoided in naming entities and columns. Besides, database designers may also add primary keys, foreign keys and constraints to the design.
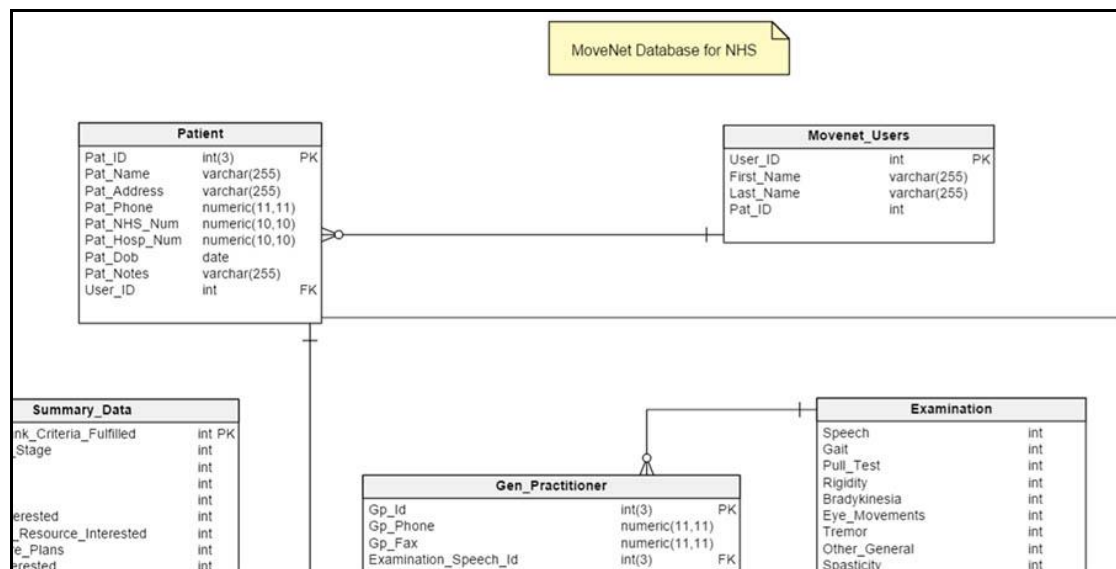
Figure 3 Physical ERD

5.2   Data Physical Model (amended)

The data model was changed dramatically on Jan 15th 2016 to allow more entities to be developed, the model needed a "users" entity with relationships to "patients" and "patient medication" because the users consisted of 6 different areas of research and therefore when access was gained into the website, only patients connected to that particular area will be displayed.
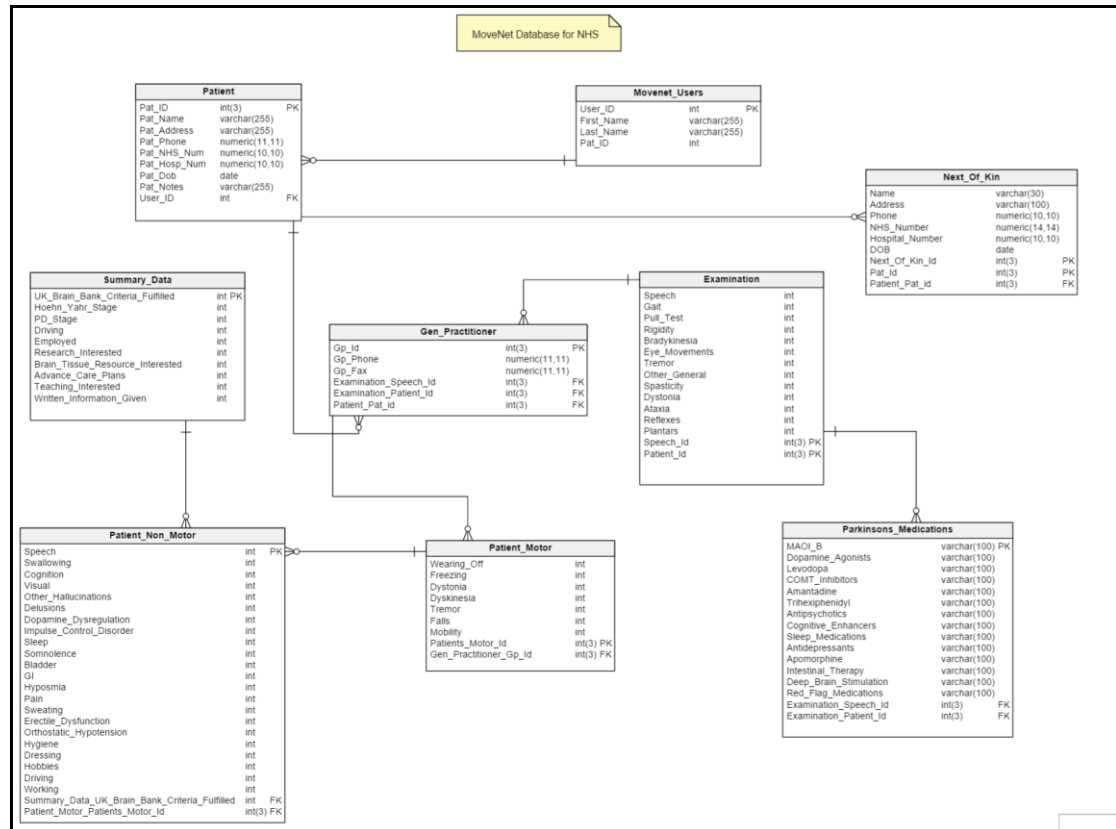

Figure 4 Physical ERD Amended

6   WEB TECHNOLOGIES

6.1   DataTables

DataTables is a plug-in for the jQuery JavaScript library. It is a highly flexible tool, based upon the foundations of progressive enhancement, and adds advanced interaction controls to any HTML table within it. It uses extensions which are also plugins available within DataTables. One particular extension that has been chosen for this project is the "Responsive" to allow the site to be viewed on all handheld devices.

6.2   Bootstrap version3

Bootstrap is an open-source JavaScript framework developed by the team at Twitter. It is a combination of HTML, CSS, and JavaScript code designed to help build user interface components. It has a great grid system typically designed and used for responsiveness as we get into smaller handheld devices, it also has an excellent looking navigation or menu system which toggles when needed.

6.3   JSON

This project uses JSON because, the use of JSON within the MVC framework is very much used today as a secure and easy method of loading server side data dynamically or without the need to refresh the page. The technology is used to link the client side data to the server side data in an asynchronous way, meaning that the browser does not need to be refreshed. The diagram below shows how the MVC pattern is used.

6.4   MVC Framework

MVC was conceived as a general solution to the problem of users controlling a large and complex data set as Delamore, (2012) puts it:

> *"The hardest part was to hit upon good names for the*
> *different architectural components. Model-View-Editor was*
> *the first set. After long discussions, particularly with Adele*
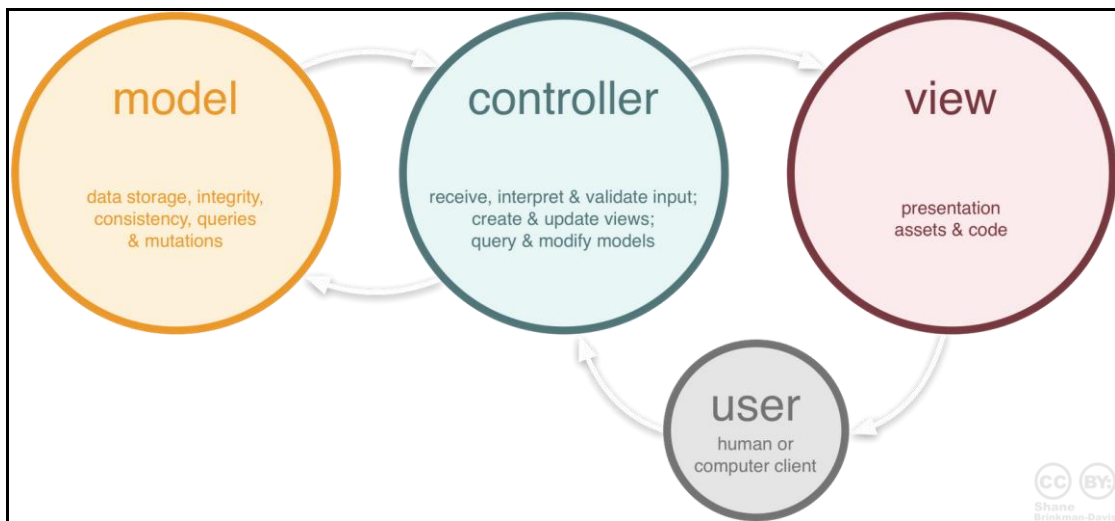> *Goldberg, we ended with the terms Model-View-Controller."*

Figure 5 MVC Model

6.5   Ajax

In the following Ajax script we will be sending **fetchdata** as method name.
When data is returned from process.php in JSON format it is processed by
JavaScript to separate the arrays. You can have a check in the console of
your browser for the data structure. We fire the load on a click event of
attribute **id="load"** of the button.

```javascript
$('#load').on('click',function(){
var user = $(this).attr('id');
if(user != '')
{
$.ajax({
url: 'process.php?method=fetchdata',
dataType: 'json',
success: function(s){
console.log(s);
oTable.fnClearTable();
for(var i = 0; i < s.length; i++) { oTable.fnAddData([ s[i][0], s[i][1], s[i][2], s[i][3],
s[i][4] ]); } // End For }, error: function(e){ console.log(e.responseText); } }); } });
```

Figure 6 Ajax Process

6.6   PHP

This is a very simple process. I have simply fetched each row of the table and
fed them into an array ($output). Finally encoded them to json using
json_encode ()

```php
require_once('config.php');
$query = mysql_query("select * from json");
while($fetch = mysql_fetch_array($query))
{
$output[] = array ($fetch[0],$fetch[1],$fetch[2],$fetch[3],$fetch[4]);
}
echo json_encode($output);
```

Figure 7 Simple PHP require statement

6.7   JQuery

The use of JQuery has overtaken JavaScript in today's online applications and is used within the application as a third party process along with JSON to access the Model within the MVC framework. With the use of JQuery libraries, one can configure the default look of the table carrying the data. There are a lot of options that can be passed to the table's initialization function, such as Pagination and Filtering and sorting the table, also filtering the search function.

6.8   HTML5

The latest release of html has many more elements available from previous versions that in combination with CSS3 and bootstrap3 enable our application to use data attributes. In the diagram below we use the table id to initiate the data and place it in the table.

```html
<table id="jsontable" class="display table table-bordered" cellspacing="0" width="100%">
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Office</th>
<th>Extn.</th>
<th>Start date</th>
<th>Salary</th>
</tr>
</thead>
//Do not insert thead tag here. Javascript will take care of it.
<tfoot>
<tr>
<th>Name</th>
<th>Position</th>
<th>Office</th>
<th>Extn.</th>
<th>Start date</th>
<th>Salary</th>
</tr>
</tfoot>
</table>
```

Figure 8 Sample HTML5

Now that we have set our HTML properly let us covert the static table into a datatable by initializing the **datatable()** function on the table **id** attribute.

Note that we have used **id="jsontable"** in the table element.

We include this jQuery variable to initiate the table and its entities.

<Script>

var oTable = $('#jsontable').dataTable();

</script>

24

7   INTERFACE DESIGN

The initial login to the application was designed within a responsive bootstrap framework and consisted of three pages using session variables to allow a secure user authentication.

7.1   Initial Login Interface Design

The image below shows the use of PHP $SESSION variables using the users "id" taken from the database which is accessed through the "require" statement.

```php
<?php
    require("model/class.model.DBConnect.php");
    if(empty($_SESSION['id']))
    {
        header("Location: admin_login.html");
        die("You are not permitted here without logging in");
        exit;
    }
?>
```

Figure 9 Sessions with UID

This screenshot shows the first attempt at the login page using a bootstrap navigation bar and the use of a dropdown form. The form was written in HTML and utilized a JavaScript to access a server side php script.
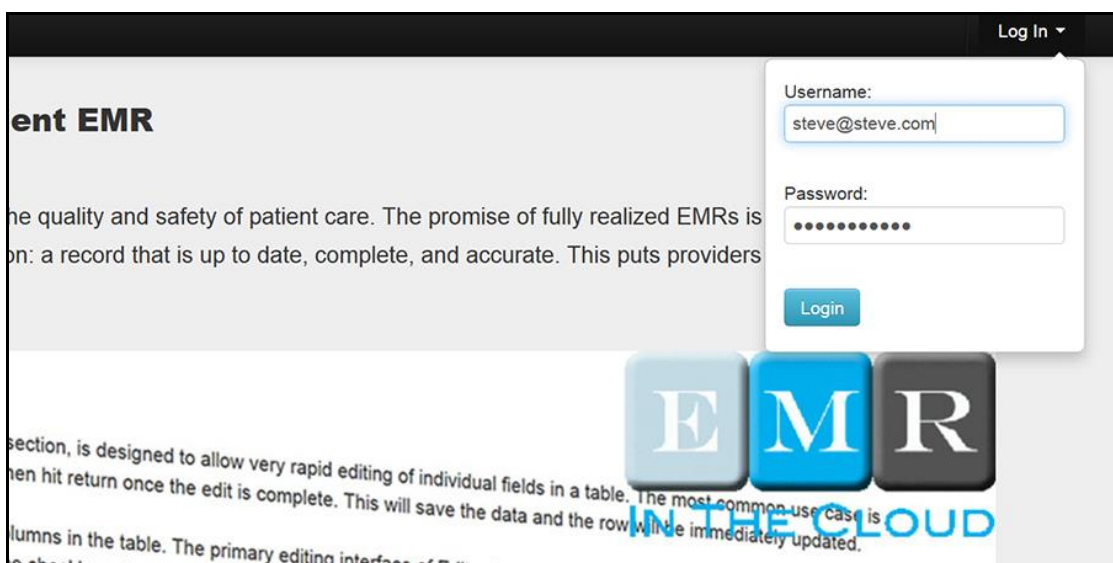
Figure 10 Initial Login

7.2   Final Login Interface Design

The login form was changed to add session cookies on Jan 15th 2016 to allow more security, but that meant the index page had to be PHP extension.
The image below shows the use of PHP $SESSION variables using the users "id" taken from the database which is accessed through the "require" statement. To allow for a more secure session, a timeout script has been added to all pages which will automatically log the user out and back to the admin_login.html page after a period of inactivity, the session here is set for 300 seconds.

```php
<?php
require("model/class.model.DBConnect.php");
//session_start();
 if(empty($_SESSION['id']))
    {
        header("Location: admin_login.html");
        die("You are not permitted here without logging in");
        exit;
    }

// set time-out period (in seconds)
$inactive = 300;

// check to see if $_SESSION["timeout"] is set
if (isset($_SESSION["timeout"])) {
    // calculate the session's "time to live"
    $sessionTTL = time() - $_SESSION["timeout"];
    if ($sessionTTL > $inactive) {
        session_destroy();
        header("Location:admin_login.html");
    }
}
$_SESSION["timeout"] = time();
?>
```

Figure 11 Sessions showing timeout

The screenshot below shows the final rendition of the login page, it uses bootstrap framework with data binding on the forms div elements to access a server side script which in turn attempts to locate the username and password within the database, if the combo are found the user will be directed to the index page where the user first and last name will be used within a PHP session cookie. The page is also fully responsive.
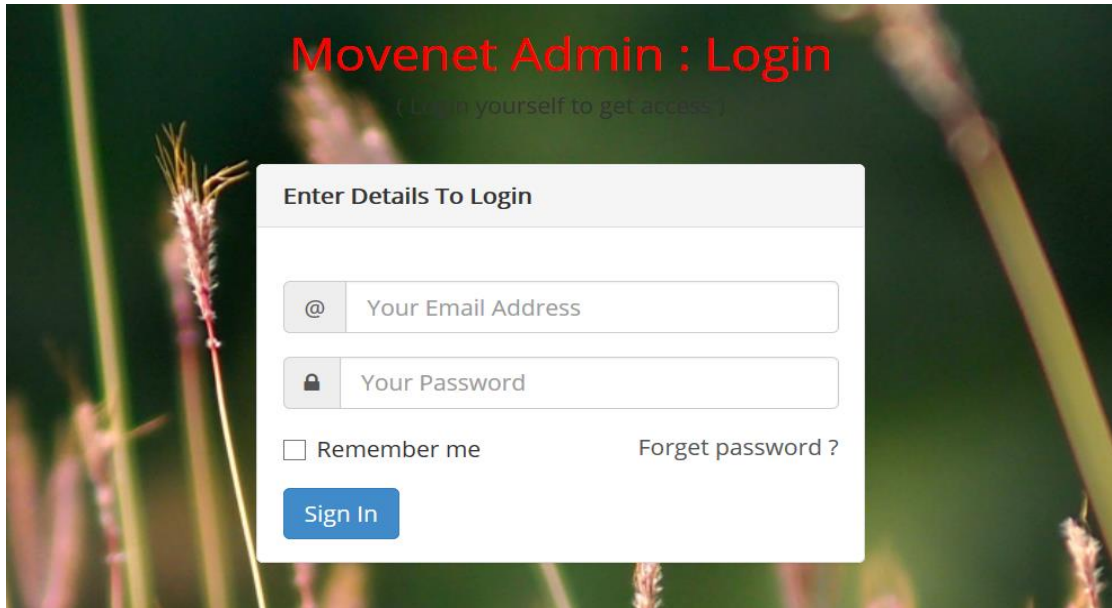
Figure 12 Final Login

7.3   Initial Application Interface Design

The concept of using Bootstrap and MVC framework together was always intended as the first iteration below shows. The application is fully responsive on all browsers.
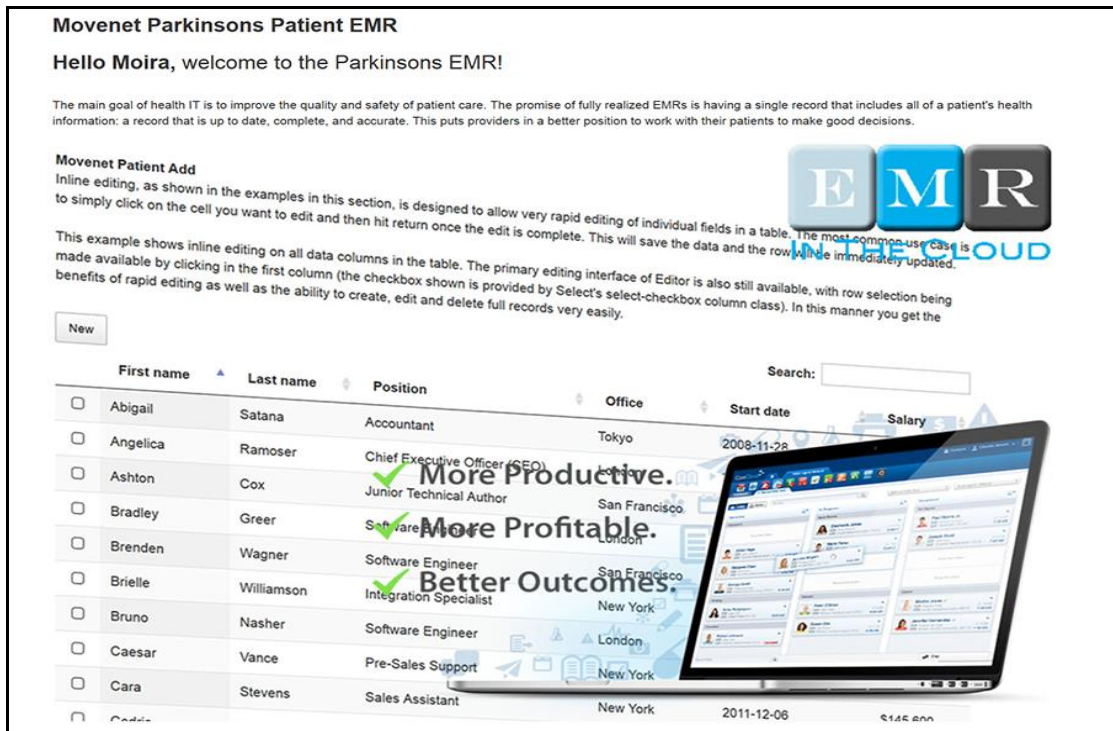
Figure 13 Initial Interface

Initial view of Patient Report page showing table data.

Figure 14 Initial Patient Report

Initial view of site navigation within the application, developed with bootstrap framework and using PHP session variables, as can be seen "Hello Moira" greeting the logged in user.

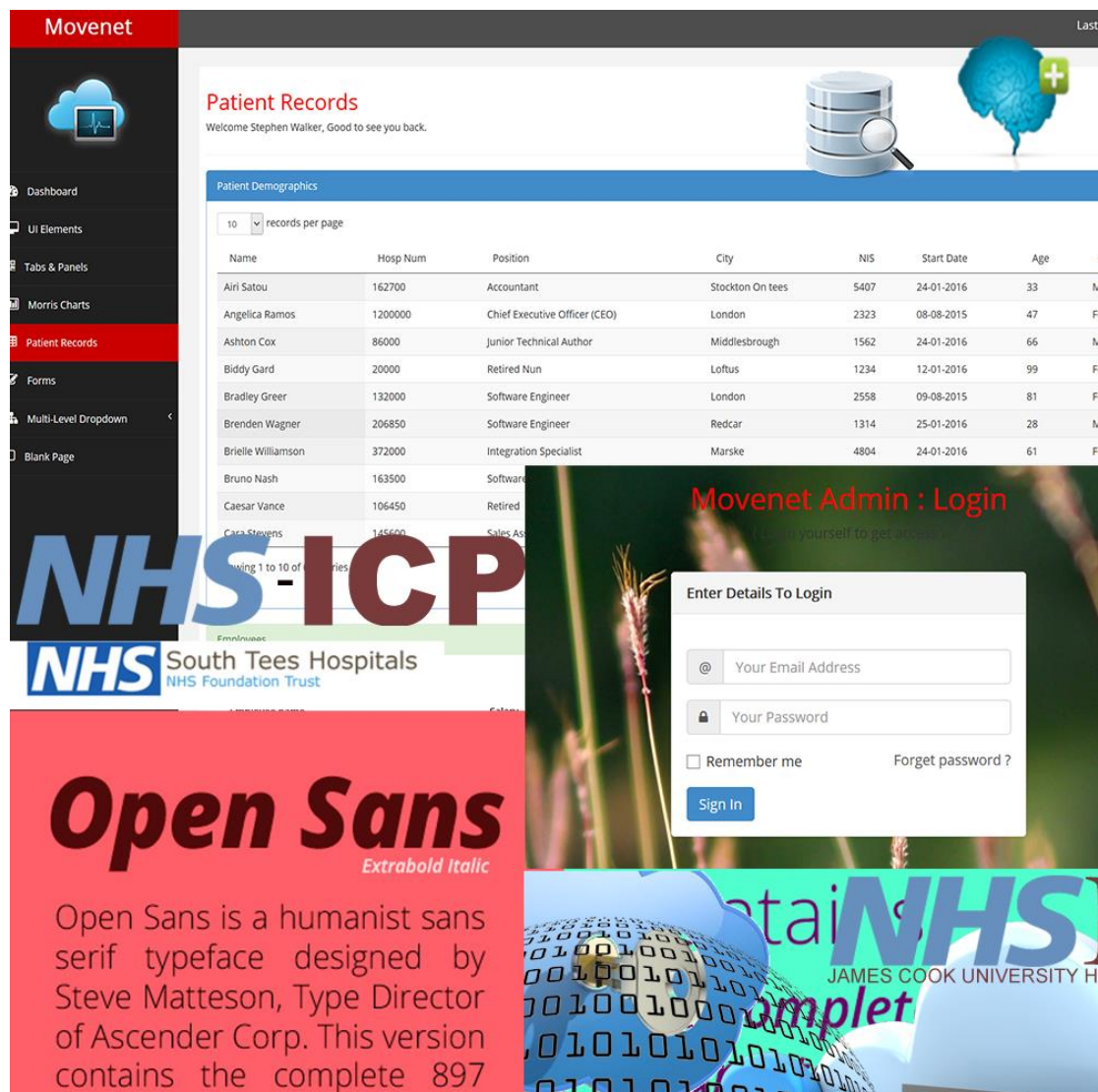*Figure 15 Initial Navigation*

7.3.1 The Moodboard

Figure 16 the Moodboard

7.3.2 Branding

The branding chosen was the Parkinson's brain image as it felt more to the point, although no discussion has taken place amongst the Parkinson's team as to it being appropriate.

Figure 17 the Branding

7.3.3 Final Interface

The second and final iteration of the application uses the same bootstrap and MVC framework as the first attempt, and after consultation with the MoveNet team and my team mate, it was decided that we should commence on developing this edition. The image below shows the Homepage of the application.

Figure 18 Final Interface

The final iteration of Patient Report page showing patient data inside a table, the table also has a search feature or filter, enabling the user to search for a specific name or city.
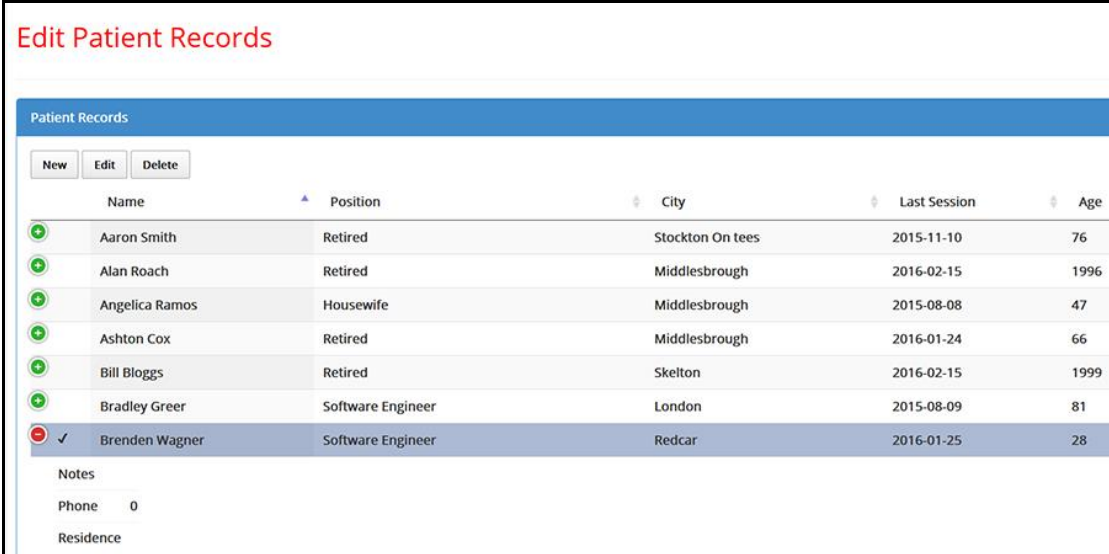
Figure 19 Final Interface Admin Page

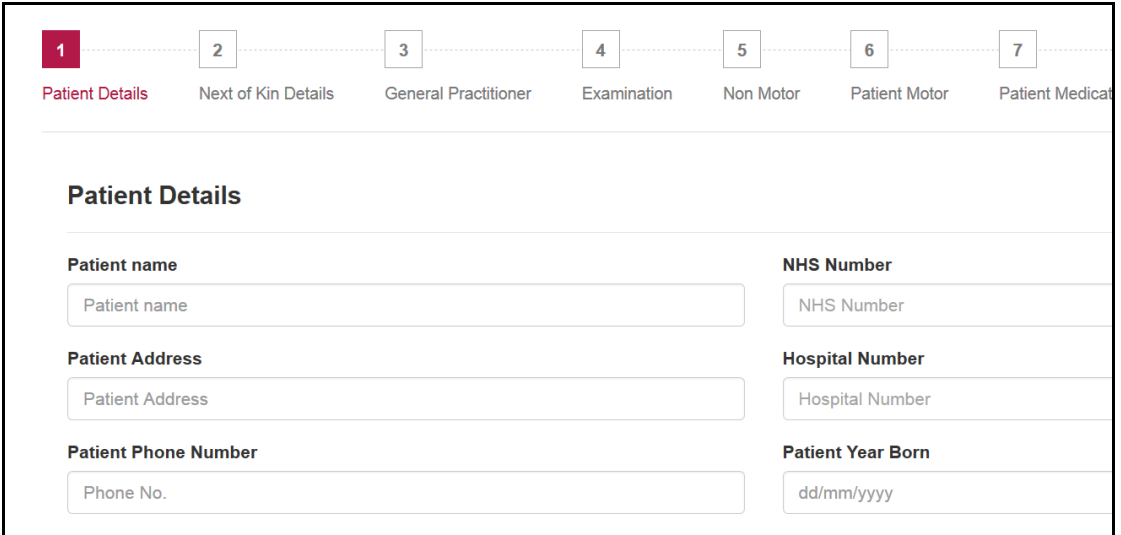The view below shows the patient edit records page

Figure 20 Showing Final Edit Patient Record

The Patient Form page is a multi-step form allowing the user to input patient details to the database.

Figure 21 Showing Final Patient Form

8 IMPLEMENTATION

This project is and has always been a Prototype design to ask the question on whether it would be possible to create an EMR system using students from Teesside University.
Based on the complexity of the project at hand and after initial discussions with the client at James Cook Hospital, it was decided that the project would be developed and designed on a server other than the hospital.

8.1 Initial Implementation

As to where the project was to be designed and developed was never discussed and as such was an option left open to the team. As I have 10 domain names all hosted with just one Web Hosting Company, it was easy for the team to develop on one of them. The database has been created using the latest version of MYSQIi and MySQL server version: 5.5.46, the website developed on the account http://walkerdesigns.ca/movenet/admin-login.html

8.2 Final Implementation

I am told that the Final implementation of the database and the website will be hosted on the NHS servers at James Cook University Hospital. As of yet this is still unclear and no discussion has taken place between the Parkinson's team or myself and Martin Kleis. There are questions still to be asked

8.3 Deliverables

Not all deliverables have been met at this time and will not be fully implemented upon the Final Year Project hand in dates. The client fully expects a prototype version with all criteria recently discussed to be delivered, but unfinished elements will be addressed after the project hand in date.

9   TESTING THE WEBSITE

Testing Information	
Tester:	**Stephen Walker n3266475**
Work being tested:	**Movenet Final Year Project**
Link to site testing:	**http://walkerdesigns.ca/movenet/admin-login.html**
Browser used:	**Mozilla Firefox 44.0.2**
Computer used:	**MacBook Pro 2.00Ghz Mem 8.0 GIG ram**
Monitor size used:	**20in Display 2880x1824**

Verify hyperlinks on website

Test	Action	Expected	Pass / Fail	Amendments
admin-login.html	Enter username and password	On success: will take user to index.html On failure: will give an error message: Your Email Address or Password was not recognised, please try again!	pass	No amendments needed
Index.php	The navigation has many links to other pages	Takes the user to other pages	pass	All links working
Patients.php	The navigation has many links to other pages	Takes the user to other pages	pass	All links working and correct
gp.php	The navigation has many links to other pages	Takes the user to other pages	pass	No amendments needed
patient-med.php	The navigation has many links to other pages	Takes the user to other pages	pass	Works well
Kin.php	The navigation has many links to other pages	Takes user to contact page	pass	Working well, no amendments needed
Calendar.php	The navigation has many links to other pages	Takes user to private area	pass	No amendments needed
form.php	The navigation has many links to other pages	Navigate to other pages	pass	No amendments needed

Screen Resolution Responsiveness

Test	Action	Expected	Pass / Fail	Amendments
Desktop version works	Keep at desktop resolution	Everything displays as normal	pass	Could use 1044px width
Tablet version works	Resize to a tablet screen size	UI objects realign and resize to fit the smaller screen	pass	Text could be smaller
Mobile version works	Resize to a mobile screen	UI objects realign and resize and menu adjusts	pass	No amendments needed

Readability of Text

Test	Action	Pass / Fail	Amendments
Is page text clear and readable against background	Get group feedback on readability	pass	Possible amendments are to use different font
Header and Footer content text clear and readable	Get group feedback on readability	pass	No amendments needed
Does text resizing work	Get group feedback on readability	pass	Works well
Does text in menu bar stand out clear	Get group feedback on readability	pass	Works well against background

Graphic Formats and UI Objects

Graphics Used	Comments
Image aligned left with text to the right	Graphics used are appropriate for web use
Image aligned right with text to the left	Looks good and works well when viewed on smaller devices
Image Formats Used	JPG, PNG formats have been used in the web site
Broken Graphics or Links	No broken graphics found

10 EVALUATION

The project has shown to be very important to the James Cook Parkinson's team as it was very evident during our weekly meetings with them.

10.1 Initial Evaluation

The research and surveys undertaken shows significant improvement in the way patient data is collected and stored on the NHS servers and then easily accessed.

10.2 Final Evaluation

The Movenet Database project would be a great asset the Parkinson's team simply because it will keep an accurate record of all relevant patient data in a secure online environment, but will it be implemented? I am not sure that all necessary security criteria has been met by the Parkinson's team, as I have questions that have not been answered as to whether the team will be allowed to initiate the Movenet database within the NHS servers without any scrutinization from NHS top brass or security analysts.

11 RECOMMENDATIONS

The Movenet Database Project is to be a prototype upon the completion of the project as discussed at the very beginning and as such all data used within the database is fictitious, but there are some issues that need to be addressed.

11.1 Initial Recommendations.

- It was recommended that the authenticated user admin password into the website be encrypted (within the database) as it has always been a major concern from the beginning owing to the sensitivity of patient demographics and other information relating to the patient and the fact the data is being made available online.
- The website should be fully responsive and display in a pleasing way on all hand held devices.
- The database and the online interface should be made available or linked to other interested third parties.

11.2 Change to Recommendations

- The initial recommendations for the authenticated user password to be encrypted within the database has been upgraded to using a stronger encryption method.
- The authenticated user password and name combination should both be encrypted with the highest possible encryption method available.
- It is highly recommended to also encrypt all patient data within the database as well as Next of kin demographics, General practitioners details.
- The authentication method would need to be changed to allow for an ACL (see acronyms) system or setup, which would give authenticated users certain levels of administration or permissions, this is a complicated "Role" based authentication system designed with PHP (see acronyms) this could be implemented at a later date but is not within the scope of the project at this point.

12 ACRONYNS USED

- **ACL** Access Control List
- **EMR** Electronic Medical Record
- **ERD** Entity Relational Database
- **PD** Parkinson's Disease
- **DBA** Database Administrator
- **JSON** JavaScript Object Notation
- **CRUD** Create, Read, Update and Delete
- **PHP** Hypertext Pre-processor.
- **MYSQIi** Structured Query Language
- **UI** User Interface
- **UX** User Experience
- **JQuery**
- **HTML5** Hypertext Markup Language version 5
- **CSS3** Cascading Style Sheet version 3
- **NHS** National Health System
- **MVC** Model, View, Controller

13 CONCLUSION

In conclusion the Prototype Movenet Database has a lot of positives, one being, it takes away the need for paper or a note pad to collect patient data during a patient/doctor session or consultation simply because the data collected at this point is put directly into the database instead of being put on a piece of paper with the possibility of being lost or mislaid.

It is clear from our meetings with the Movenet team the need for a "Role" based user authentication method to enter the application would have to be implemented, as yet this has not been added due to time restraints on the project, at this point the users are all "Admins" meaning once logged in the user can see all data, which clearly needs to be developed further.

The results of the survey showed the Movenet Team were pleased with the system in place (see survey results in appendix) although very basic in its ability.

From the outset this project was going to be extremely demanding on my knowledge of Relational Databases and Entity Relationships within a database model, in fact it would push me to my limits and beyond to try to understand how and why certain entities needed to be in place within the database
In order to establish a prototype MoveNet Database, the project embarked on a requirements gathering exercise.

LIST OF FIGURES

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APPENDIX A

The project embarked on a survey given to the Movenet Team at James Cook University Hospital and were asked to complete as accurately as possible.

Did you find the patient form suitable for your requirements ? *

	1	2	3	4	5	6	7	8	9	10	
Not satisfied	○	○	○	○	○	○	○	○	○	○	Very satisfied

Was the patient form easy to enter data? *

	1	2	3	4	5	6	7	8	9	10	
Not satisfied	○	○	○	○	○	○	○	○	○	○	Very satisfied

Did you find the drop down menus appropriate for your use? *

	1	2	3	4	5	6	7	8	9	10	
Not satisfied	○	○	○	○	○	○	○	○	○	○	Very satisfied

Overall, did you find the database easy to use? *

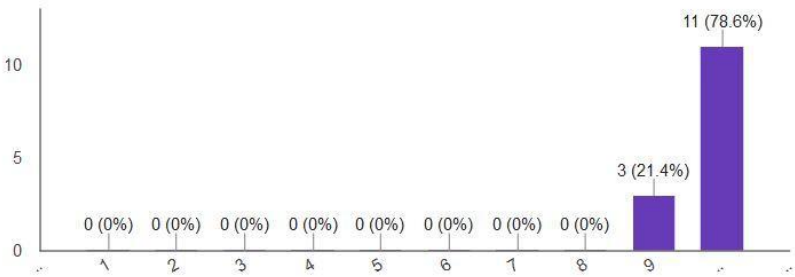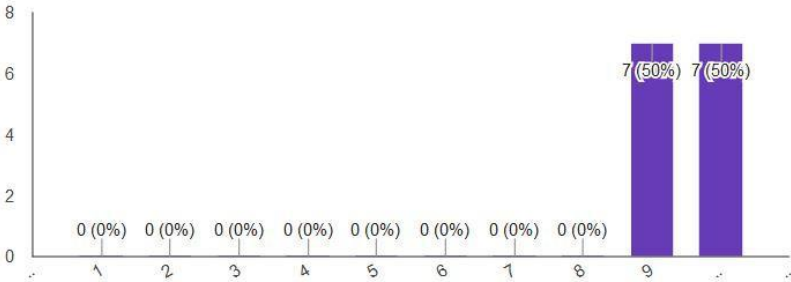|	1	2	3	4	5	6	7	8	9	10	
Not satisfied	○	○	○	○	○	○	○	○	○	○	Very satisfied

The Results show 2 participants selected 9 and 12 participants chose to give 10 out of 10.
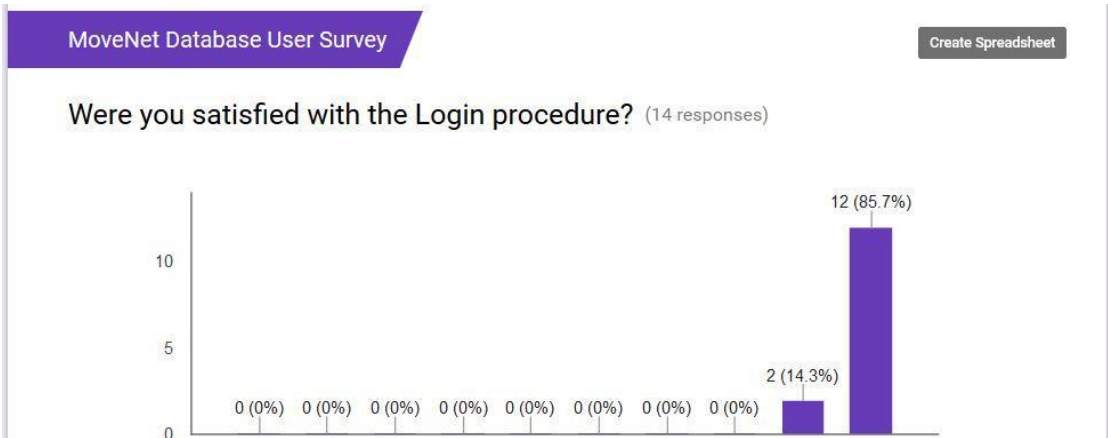
Did you find the patient form suitable for your requirements ? (14 responses)