

SWANSEA UNIVERSITY

MENG COMPUTING

CSM14 - INDIVIDUAL PROJECT

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## **Interim Report**

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## 1 Introduction

The purpose of this document is to provide a progress report on the project. It will cover all progress that has been made since the submission of the *Methodology and Requirements Document* and the *Specification Document* on the 6th January 2012.

The application has been developed using a three-tier-architecture model. In doing so, the application is naturally modular in the sense that each of the tiers can be changed at any time without having great impact on the other tiers. Throughout this document I have used the word layer instead of tier to refer to each part of the application. The three layers of the application have been identified as the following:

- Data Layer
- Services Layer
- Presentation Layer

This report will cover each of the above mentioned layers and will discuss the progress that has been made on each. The first part of the report will concentrate on the data layer and how communication with the database is being handled. Following this, the focus will move on to the services layer. In this section, each of the services that have been created will be covered along with what still needs to be implemented. The third layer of the application, the presentation layer, will be covered next.

It is possible to see the current state of the project in the Project Progress section of the report. This section includes all the requirements that are present in the *Methodology and Requirements Document* and each item has been given an implementation status.

Following the Project Progress section of the report, a Risk Analysis section is provided. This will cover any planned risks that been encountered, any unplanned risks that have been encountered and an updated risk analysis.

At the end of the report, an updated time plan is provided which covers the remaining tasks that need to be completed. As well as this, the progress that has been made on the project in relation to the time plan in the *Methodology and Requirements Document* is included. Each of the tasks that are present on the original time plan will be listed along with a status description. At the end of the section, an updated time plan is included .

## 2 Data Layer

At the start of the implementation period for this project, it was necessary to decide how the application was going to interact with the database. It did not take long to decide that the best way forward was to use the Microsoft ADO.NET Entity Framework. The reason behind the decision was that it makes interacting with a data source extremely easy and requires very minimal to zero plumbing code. By not having to write any plumbing code, this will make my code a lot easier to read and understand. It also allowed me to concentrate mainly on the business logic of the application and less so on the data access logic. This is the first layer of the application, the data layer.

Once it was decided how the application will communicate with the database, the next phase was to create an ADO.NET Entity Data Model. During the creation of the data model a problem was encountered that I was previously unaware of. The problem was that the SQL database that is currently being used by the legacy application contained tables that do not have any primary keys defined. The screenshot provided in Figure 1 shows the warnings that were produced which clearly state that the tables do not have primary keys defined.

Error List		
0 Errors 56 Warnings 56 Messages		
	Description	File
57	Error 6002: The table/view 'GlimpseTest.dbo.Addresses' does not have a primary key defined. The key has been inferred and the definition was created as a read-only table/view.	RNADataModel.edmx
58	Error 6002: The table/view 'GlimpseTest.dbo.CommonItems' does not have a primary key defined. The key has been inferred and the definition was created as a read-only table/view.	RNADataModel.edmx
59	Error 6002: The table/view 'GlimpseTest.dbo.Customer_Locations' does not have a primary key defined. The key has been inferred and the definition was created as a read-only table/view.	RNADataModel.edmx
60	Error 6002: The table/view 'GlimpseTest.dbo.Customer_Rates' does not have a primary key defined. The key has been inferred and the definition was created as a read-only table/view.	RNADataModel.edmx
61	Error 6002: The table/view 'GlimpseTest.dbo.Customers' does not have a primary key defined. The key has been inferred and the definition was created as a read-only table/view.	RNADataModel.edmx
62	Error 6002: The table/view 'GlimpseTest.dbo.DBUpdates_Office' does not have a primary key defined. The key has been inferred and the definition was created as a read-only table/view.	RNADataModel.edmx

Figure 1: Warnings produced when creating a data model from a SQL database where no primary keys exist.

When a primary key is not defined on a table, Entity Framework infers a primary key and doesn't allow update operations to be performed on rows contained within said table. Thus, making it a read only table. Using read only tables for this application would not be possible as it must be possible to update records held in the database as well as retrieving them. So, to overcome this problem, I had to work my way through all of the tables and add primary keys where required.

After I had added the primary keys to the tables, I tried to update the data model from the database so that it would include the primary keys. However, instead of removing the existing inferred primary keys and adding the keys I had created, the update only added the keys I created to the keys that were inferred. By doing this, it meant that the tables in the database did not match the tables in the Entity Framework data model. This was expressed by the framework by displaying error messages similar to the one shown in Figure 2. To solve this problem I could either go through the data model and remove the inferred primary keys by deselecting the 'Entity Key' property, or I could delete the entire data model and create a new model from scratch. I settled on the latter as it seemed the simpler way to do it and would result in no mismatches between the model and the database.

*Error 4 Error 3002: Problem in mapping fragments starting at line 2057: Potential runtime violation of table JobsToDelete's keys (JobsToDelete.JobNo): Columns (JobsToDelete.JobNo) are mapped to EntitySet JobsToDeletes's properties (JobsToDeletes.JobNo) on the conceptual side but they do not form the EntitySet's key properties (JobsToDeletes.DriverNo, JobsToDeletes.JobNo).*

Figure 2: Update model error.

The graphical representation of the data model that was produced is quite large as there is over 50 tables in the database. In Figure 3, a section of the model has been included to provide an example of what gets produced by the Entity Framework. It is clear from the image that the primary keys are now present on the tables.

Apart from the minor problems discussed above, using the Entity Framework to handle communication between the application and the database has been straight forward. It has allowed me to use LINQ to issue queries to the database which returns strongly typed objects that can be manipulated and saved back to the database. This is in contrast to what I have done in past projects where it has been necessary to write the SQL statements to run against the database and do not return strongly typed objects. By using the Entity Framework and LINQ, I believe that it has enabled me to be more productive and to write much cleaner code.

### 3 Services Layer

The second layer of the application is the services layer. This will be the layer between the data layer and the presentation layer. It will handle requests made from the presentation layer, fulfil the request and provide a

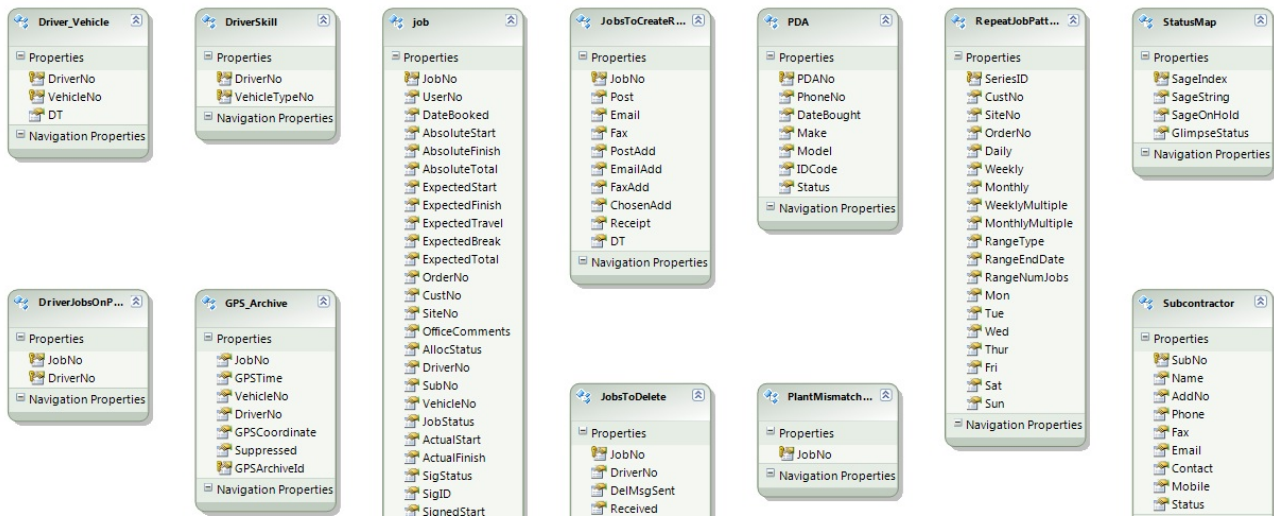


Figure 3: A section of the data model produced by Entity Framework.

response.

As was previously stated in the *Specification Document*, the services layer will be implemented using WCF. Since the writing of that document this is still the case. Each section of the application will have its own WCF service that can be referenced to by the presentation layer to allow communication between endpoints. To date, a significant amount of these services have been completed or are near completion. To get more information on the completion status of each service, please take a look at section 5 of this document, Project Progress. The following subsections include a breakdown of each of the sections of the application and which services belong to them. The name of each of the subsections correspond to the sections identified in the *Specification Document*.

### 3.1 Diary

So far, no progress has been made in relation to the diary section of the application. At the start of the implementation period, this was going to be the focus of development. However, it was decided that it would be best to work on the other sections first as a solution needs to be found in regards to the drag and drop functionality currently provided by the legacy application.

### 3.2 Maintenance

The maintenance section provides a considerable amount of the functionality for the application. The list below covers the services that have been completed or are near completion. Listed alongside each service is a list of specifications that the service is intended to fulfil.

#### 3.2.1 Address Service

Specification: S-MAA-5, S-MAA-6, S-MAA-7, S-MAA-8, S-MAA-9, S-MAA-10

The main responsibility of this service is to provide CRUD operations for addresses held in the database. As well as this there are functions that return address details, a list of all addresses, a list of unlinked addresses and a list of address links. This service is considered complete in relation to the specification document.

### 3.2.2 Customers Service

Specification: S-MAC-1, S-MAC-2, S-MAC-3, S-MAC-4, S-MAC-5

The customers service has been deemed to be complete and it provides CRUD operations for customer records in the database. As well CRUD operations for customer records, CRUD operations have been implemented for customer rates.

### 3.2.3 Devices Service

Specification: S-MAF-1, S-MAF-2, S-MAF-3, S-MAF-4

The devices service is considered to be complete and it allows devices to be added, deleted and updated. It also provides functions that return the details of a device and a list of all devices held in the database.

### 3.2.4 Operators Service

Specification: S-MAW-6, S-MAW-7, S-MAW-8, S-MAW-9, S-MAW-10, S-MAW-11, S-MAW-12, S-MAW-13, S-MAF-5, S-MAF-6, S-MAF-7

The functionality exposed by this service includes CRUD operations for operators. As well as this, it allows operator details to be retrieved, a list of operators to be retrieved and operations for operator availability. Specifically it allows an absence to be added, updated and deleted. It is also possible to get a list of an operators absence details.

This service is not currently complete as specification item S-MAW-13 has not yet been fulfilled. This item requires communication between the services layer and the current middleware application being used.

### 3.2.5 Orders Service

Specification: S-MAA-1, S-MAA-2, S-MAA-3, S-MAA-4

The orders service is considered to be complete with regards to the service. However, not all of the functionality is exposed by the presentation layer yet. The service allows orders to be created, updated and deleted. It also provides functions that return the details of an order and a list of orders.

### 3.2.6 Other Service

Specification: S-MAO-1, S-MAO-2, S-MAO-3

The name of this service does not provide any insight into the functionality it provides. The reason for using the name 'Other' was to help in relating the sections in the legacy application to the web application. The service provides functions that can be used to manage jobs that have been completed and require a digital signature but have not yet recorded one. There are currently three functions exposed by the service. The first function returns a list of jobs that require signatures. The second allow jobs to marked as not requiring a signature and the last function makes it possible to assign the collection of a signature for a particular job to an operator. This service is also considered to be complete.

### 3.2.7 Plant Service

Specification: S-MAES-5, S-MAES-6, S-MAES-7, S-MAES-8, S-MAES-9, S-MAES-10, S-MAES-11, S-MAES-12, S-MAES-13

All but one of the specification items have been implemented in this service. The specification item that has not been implemented is S-MAES-12 which deals with communicating with the existing middleware. The plan is to implement this functionality in the coming weeks.

The functionality that is currently provided by this service includes CRUD operations for plant items, the ability to create a maintenance schedule for a plant item and assign events to plant items.

### 3.2.8 Plant Types Service

Specification: S-MAES-1, S-MAES-2, S-MAES-3, S-MAES-4

The plant types service is considered to be complete with regards to the specification items it needs to fulfil. The current functionality provided by the service allows plant types to be created, updated and deleted. It is also possible to retrieve all plant types that have been created and the details of a plant type.

### 3.2.9 Regional Office Service

Specification: S-MAC-6

The regional office service enables regional offices to be created, updated and deleted. It is also possible to get a list of all the regional offices that have been created and to get the details of a single regional office. This service is complete in terms with the specification item it must fulfil.

### 3.2.10 Service Types Service

Specification: S-MAES-14, S-MAES-15, S-MAES-16, S-MAES-17, S-MAES-18

The service types service is now complete. Using this service it is possible to create services, remove services and update services. It is also possible to get a list of all of the services that have been created and to get the details of a specified service.

### 3.2.11 Sites Service

Specification: S-MAC-7, S-MAC-8, S-MAC-9, S-MAC-10, S-MAC-11, S-MAC-12, S-MAC-13

All of the specification items that the sites service is required to fulfil have been implemented. The service allows sites to be created, updated and deleted. Other functions provided by the service include the ability to remove the link between a customer and a site, get the details of a site and get a list of all sites that have been created. It is also possible to only get sites that have been linked to a specific customer.

### 3.2.12 Subcontractors Service

Specification: S-MAW-14, S-MAW-15, S-MAW-16, S-MAW-17, S-MAW-18



Each of the above specified specification items have been fulfilled by the subcontractors service. It provides functions to create subcontractors, update subcontractor details and remove a subcontractor. The service also provides an operation that returns the details of a specific subcontractor and an operation that returns a list of all subcontractors that have been created.

### **3.2.13 User Details Service**

Specification: S-MAW-1, S-MAW-2, S-MAW-3, S-MAW-4, S-MAW-5, S-UI-2, S-UI-4

The functions provided by the user details service enable users to be created, edited and deleted. It is also possible to get a list of all users and the details of a single user. Other functions provided by this service deal with checking if log in details are correct and returning a users rights level. This service is considered to be complete.

## **3.3 Mapping**

All of the services covered in this section are been deemed to be complete. Each service will be covered independently in the following sections of this report. Alongside each service, a list of specifications that the service is intended to fulfil is provided.

### **3.3.1 Address Mapping Service**

Specification: S-MAP-11

The address mapping service contains one method that, when called, returns a list of all the addresses held in the database along with the GPS coordinates associated with each address.

### **3.3.2 Job Route Service**

Specification: S-MAP-9

The job route service contains one method that, when called, returns a list that contains all GPS coordinates associated with a single job. The method must be called passing in a job ID.

### **3.3.3 Operator Log Location Service**

Specification: S-MAP-10

Similar to the job route service, the operator log location service contains only one method. The method must be called with an operator ID, a from date-time value, a to date-time value and an integer specifying the log type. It returns a list of GPS coordinates that were recorded for the given operator between the specified dates where the user has logged in/ out of their PDA/smartphone. The log type specifies if the list should contain coordinates where the user logged in, logged out or both.

### 3.3.4 Operator Tracking Service

Specification: S-MAP-1, S-MAP-2, S-MAP-5, S-MAP-7

The operator tracking service currently exposes four methods. The first of which returns GPS coordinates that give the most recent position of a specified operator. Another method takes two date-time values as well as an operator ID and it returns GPS coordinates that have been recorded between the given dates for the operator. The final two methods return GPS coordinates that concern all of the operators. One of the methods returns GPS coordinates for each operator which states the operators last known position. The other method takes a double value representing a number of hours and returns all GPS coordinates recorded for each operator if they were recorded within the given number of hours.

### 3.3.5 Plant Tracking Service

Specification: S-MAP-3, S-MAP-4, S-MAP-6, S-MAP-8

The methods exposed by the plant tracking service are similar to the ones exposed by the operator tracking service. The only difference lays in the resource that the GPS coordinates refer to. This service tracks plant items and the other tracks operators.

Again, this service exposes four methods. The first of which returns GPS coordinates that give the most recent position of a specified plant. Another method takes two date-time values as well as an plant ID and it returns GPS coordinates that have been recorded between the given dates for the plant item. The final two methods return GPS coordinates that concern all of the plant items. One of the methods returns GPS coordinates for each plant item which states the plants last known position. The other method takes a double value representing a number of hours and returns all GPS coordinates recorded for each plant item if they were recorded within the given number of hours.

## 3.4 Invoicing

There is currently only one service that covers all aspects of the invoicing section of the application. At present, the invoicing section is not 100% complete. A discussion of the service that has been created follows which states what has and has not been completed.

### 3.4.1 Invoicing Service

Specification: S-IN-1, S-IN-2, S-IN-3, S-IN-4, S-IN-5, S-IN-6, S-IN-7, S-IN-8, S-IN-9, S-IN-10

As it stands, all of the above specification items have been satisfied apart from S-IN-4 and S-IN-5. It is currently possible to create an invoice for a single job or for multiple jobs. Before multiple jobs can be invoiced together a check must be made to make sure the jobs can be invoiced together. A method is exposed by this service which returns a boolean that indicates whether two or more jobs can be invoiced together. The service also exposes a method that returns a list of all invoices that have been created. As well as that, it is possible to get a list of jobs that have not yet been invoiced. Another method that has been implemented in this service allows jobs to be marked as invoiced. This can be used if the job has been invoiced manually.

As well as being able to create invoices, this service exposes functions that enable payments to be recorded against an invoice. It is also possible to get all payments that have been made for an invoice, update an invoice payment and delete an invoice payment.

The first of the specification items that have not yet been implemented requires a signature capture to be returned, if one has been recorded for a job. The second item that needs to be fulfilled must create a PDF that displays the invoice details.

### 3.5 Settings

There is currently only one service that covers all aspects of the settings section of the application. At present, the settings section is not 100% complete. A discussion of the service that has been created follows which states what has and has not been completed.

#### 3.5.1 Settings Service

Specification: S-ST-1, S-ST-2, S-ST-3, S-ST-4, S-ST-5, S-ST-6, S-ST-7, S-ST-8, S-ST-9

All of the above specification items, apart from S-AT-9, have been fulfilled by the settings service that has been created. This service exposes functions that can be used to update the company details that have been stored. It also allows the company details to be retrieved. As well as company details, this service allows job settings to be updated. The job settings update things like minimum/maximum job duration and job time boundaries.

In addition to the above functions, the settings service provides the ability to retrieve all plant items that require maintenance to be carried out on them. As has already been mentioned, the specification item S-ST-9 has not yet been satisfied. This specification item deals with communication between the services layer and the current middleware that is being used.

### 3.6 Messaging

At present, the messaging section of the application is served by one service. The messaging service is considered to be complete in relation to the specification items it must fulfil. A discussion of the service that has been created follows.

#### 3.6.1 Messaging Service

Specification: S-MES-1, S-MES-2, S-MES-3, S-MES-4

The messaging service exposes all the necessary functions to handle sending and receiving messages to and from operators. A function is provided that enables new messages to be sent to an operator. In addition to this, the service provides an operation that can be used to delete a message. Other functions, among others, include getting an operators inbox messages and outbox messages.

### 3.7 Data Contracts

To enable data to be exchanged easily between the services layer and the presentation layer it is necessary to use data contracts. A WCF data contract is an abstract description of the data that is to be exchanged. It is a formal agreement between the service and the client which allows them to communicate using user defined objects.

The majority of the methods exposed by the services mentioned in the preceding sections of this report require the use of data contracts. Some of the methods require data contracts to describe their return type while

other methods require a data contract to describe an input parameter. Due to the amount of web methods that have been implemented and the different entities that require manipulating for this application, a considerable amount of data contracts have been created. There are currently just over 45.

Most of the data contracts that have been created mimic the entities that are being used in the database. As an example, there is a data contract called 'PlantTypeData', shown in Figure 4, which has three data members. One for the plant type Id, another for the plant type name and finally one for the description of the plant type. The database table that is used to store plant types also contains three fields. One for the plant type Id, another for the plant type name and finally one for the description of the plant type. It is clear that the data contract directly copies the table fields. Having said that, some of the data contracts that have been created contain additional information as well as the table fields. The common situation where this has been the case is where a record in the database contains an Id which is a foreign key reference to a record in another table. When this occurs, some of the details related to the referenced record are then included in the data contract.

```
[DataContract]
public class PlantTypeData
{
    [DataMember]
    public string PlantTypeId;
    [DataMember]
    public string PlantType;
    [DataMember]
    public string Description;
}
```

Figure 4: Plant type data contract.

## 4 Presentation Layer

The third and final layer of the application has been identified as the presentation layer. It is this layer of the application that a user of the system will interact with. When a user interacts with the presentation layer, requests will be directed to the services that have been created in the services layer. The technology that is being used to develop the presentation layer is ASP.NET MVC 3. This was decided during the creation of the specification document. As this is still the case, specification item S-UI-1 has been satisfied.

The MVC framework is made up using three different components. These are models, views and controllers. The models that are used in an MVC application typically implement an applications business logic and are used like objects to pass data between a view and a controller. However, in this application, the business logic has already been implemented in the services layer. The user interface (UI) for an application is displayed by the view components. A view is typically created using data that has been passed to a view contained within a model. This is the case for nearly all of the views that have been created for this application as they have been created as strongly typed views. This means that the model is expecting a specific model to be passed to it. Finally, the controller components are what handles the user interaction. When a request is made through the UI, it is the job of the controller to deal with that request and provide a response. In providing a response, the controller is also in charge of deciding which view gets rendered as a response to the request that was made.

The models that have been created for this application are very similar to the data contracts created during the services layer. Most of the models contain the same fields as its corresponding data contract, but include extra annotations that are used by the views and the controllers for validation purposes. This is illustrated in Figure 5. It is clear that both the model and the data contract contain identical fields however some of the fields

in the model have been annotated. The ‘Required’ attribute has been used to annotate the ‘CustomerName’ field. This specifies that when creating a new customer or updating an existing customer, a customer name must be provided. If a customer name is not present then an error message gets displayed to the user interacting with the system. It also possible to ensure that input by a user meets a certain format. This has been done for the phone number, fax number and email address fields. If the user input for one of these fields does not match the specified regular expression, an error message is returned to the user.

```
[DataContract]
public class CustomerData
{
    [DataMember]
    public string CustomerId { get; set; }

    [DataMember]
    public string CustomerName { get; set; }

    [DataMember]
    public string AddressId { get; set; }

    [DataMember]
    public string PhoneNumber { get; set; }

    [DataMember]
    public string FaxNumber { get; set; }

    [DataMember]
    public string Email { get; set; }

    [DataMember]
    public string Contact { get; set; }

    [DataMember]
    public int CustomerStatus { get; set; }

    [DataMember]
    public string SageId { get; set; }

    [DataMember]
    public int SageStatus { get; set; }
}

public class CustomerModel
{
    public string CustomerId { get; set; }
    [Required]
    [DisplayName("Customer Name")]
    public string CustomerName { get; set; }
    [Required]
    public AddressModel Address { get; set; }

    [RegularExpression(RegularExpressions.PhoneNumberPattern,
        ErrorMessage = RegularExpressions.PhoneNumberErrorMessage)]
    public string PhoneNumber { get; set; }

    [RegularExpression(RegularExpressions.FaxNumberPattern,
        ErrorMessage = RegularExpressions.FaxNumberErrorMessage)]
    public string FaxNumber { get; set; }

    [RegularExpression(RegularExpressions.EmailPattern,
        ErrorMessage = RegularExpressions.EmailErrorMessage)]
    public string Email { get; set; }

    public string Contact { get; set; }

    public int CustomerStatus { get; set; }

    [ScaffoldColumn(false)]
    public string SageId { get; set; }

    [ScaffoldColumn(false)]
    public int SageStatus { get; set; }
}
```

Figure 5: A data contract (left) and its corresponding MVC model (right).

The controllers and views that have been created were developed in parallel with the services. So, as a service was completed, the functionality offered by that service was exposed by a controller and multiple views. The development was undertaken in such a way to ensure that any functions provided by the service were accessible and were not forgotten. As this is the case, any specification items that have been satisfied at the services layer have also been satisfied at the presentation layer.

In the specification document, there were items that can only be satisfied by the presentation layer. These items are identified as S-UI-3 and S-UI-5 which state ‘a logout button will be provided’ and ‘restrictions based on a users rights level will be placed on certain functionality’ respectively. The first of the aforementioned specification items has been satisfied, but the second item is currently work in progress. At present, to access any part of the application a user is required to log in. Beyond that restriction not a lot has been done. The main reason for this is that I would like to have a meeting with Nick Beckett, of RNA Plant, to discuss what parts of the application should be accessible to the different rights levels.

## 4.1 Application Look and Feel

Throughout the development of the presentation layer it has been important that the look and feel of the application has been kept consistent. I believe that all the views that have been created to date satisfy this condition. To illustrate this, two screen shots of different parts of the application have been taken and are shown in Figures 6 and 7.

Figure 6: The customers view.

Figure 7: The users view.

There are also a few non-functional specification items that must be satisfied by the presentation layer of the application. These items are identified as S-NF-5, S-NF-6 and S-NF-10. The first of these items requires adequate error handling and helpful error messages to be displayed to a user to be satisfied. As it stands, this item has been satisfied by all work that has been completed. However, as the application is not complete, this item is still considered as incomplete. This is also the case with the other two specification items. Even though they are currently satisfied by all work that has been completed, they are considered to be incomplete as the application is still being developed. The items state that ‘The UI screens will be easy to navigate and not over cluttered’ (S-NF-6) and ‘the colour scheme will be kept consistent throughout the application’ (S-NF-10).

## 5 Project Progress

### 5.1 Diary

ID	Requirement Description	Status
R-DI-1	The system must allow the user to create new jobs.	Not Started
R-DI-2	When creating a job it must be possible to assign a job to a customer.	Not Started
R-DI-3	The system must allow a job to be allocated to a site. Only sites related to the assigned customer may be chosen.	Not Started
R-DI-4	It must be possible to assign an order to a job.	Not Started
R-DI-5	The system should allow a job to be set as requiring or not requiring a signature.	Not Started
R-DI-6	It must be possible to assign a job booked job times and actual job times.	Not Started
R-DI-7	When a job is being created, the system should allow a booked site start time to be assigned.	Not Started
R-DI-8	A job must also have a booked site finish time.	Not Started
R-DI-9	It must be possible to assign booked travel time for a job.	Not Started
R-DI-10	The system must allow a job to be allocated booked break time. Break time can be assigned a maximum value of 60 minutes and a minimum value of 0 minutes. 15 minute intervals between these values can also be used.	Not Started
R-DI-11	It must be possible to set a job rate for a job. The system must set this value using the rate from the order assigned to the job. The value can also be overwritten manually.	Not Started
R-DI-12	If a job has been completed, the system must allow the actual site start and site finish times to be adjusted manually.	Not Started
R-DI-13	It needs to be possible to set a job as a "one off" or as a repeating job. A job must be able to repeat daily, weekly or monthly.	Not Started
R-DI-14	The system must allow an allocation status to be set for a job. A job can either be allocated to an operator or subcontractor or can be unallocated.	Not Started
R-DI-15	If a job has been allocated to an operator then the system needs to allow an operator to be chosen along with the plant that is to be used for the job.	Not Started
R-DI-16	If a job has been allocated to a subcontractor then the system needs to allow a subcontractor to be chosen, the plant type to be chosen, an agreed price for the job and an order number to be specified.	Not Started
R-DI-17	If a job has been created with an unallocated status it should be possible to assign an operator or subcontractor at a later point.	
R-DI-18	The system must also allow comments to be wrote against a job.	Not Started
R-DI-19	It must be possible to delete a job.	Not Started
R-DI-20	The details of a job must be editable.	Not Started
R-DI-21	The system should provide a search feature that makes it possible to find specific jobs.	Not Started
R-DI-22	If a job has been completed then it should be possible to print a receipt locally or send a receipt via email.	Not Started

### 5.2 Maintenance

ID	Requirement Description	Status
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R-MAES-1	The system should allow the user to create 'Plant Types'. A 'Plant Type' should be seen as a general object, rather than an actual object, that could be instantiated to create an real object. so, a <i>car</i> could be a general object, as it could refer to any car. But, when the registration of a car is know it can be classed as a real object.	Complete
R-MAES-2	It must be possible to give a 'Plant Type' a name (mandatory) and a description (optional).	Complete
R-MAES-3	The system must also allow the details of created 'Plant Types' to be retrieved.	Complete
R-MAES-4	It must be possible to edit the details of 'Plant Types'.	Complete
R-MAES-5	The system should provide a way of deleting 'Plant Types'.	Complete
R-MAES-6	It will be necessary for the system to be able to create instantiations of the general objects. The instantiations will be the actual pieces of equipment, vehicles or plant the company has available to use. These will be referred to as 'Plant'.	Complete
R-MAES-7	A 'Plant' must be assigned a Registration/ID.	Complete
R-MAES-8	A 'Plant' must refer to a 'Plant Type'.	Complete
R-MAES-9	A 'Plant' must also have a status. The status of a 'Plant' can either be available, unavailable or retired.	Complete
R-MAES-10	It must also be possible for a 'Plant' item to have several other optional fields. These are year, make, model, VIN, colour, date purchased, purchase price and current value.	Complete
R-MAES-11	The system should also allow a 'Plant' item to be assigned to a particular operator.	Complete
R-MAES-12	It should be possible to assign a 'Plant' item a maintenance schedule. This will include dates for the next MOT, next service, next check and road tax expiry. It must also be possible to add comments to the maintenance schedule.	Complete
R-MAES-13	It must be possible to record events concerning a particular item of 'Plant' so its history can be viewed at any time.	Complete
R-MAES-14	The system must allow 'Plant' items to be edited	Complete
R-MAES-15	The system must also allow the details of a 'Plant' item to be retrieved.	Complete
R-MAES-16	When new items of 'Plant' have been created, 'Plant' details have been changed or a 'Plant' item has been removed, the system must be able to send an updated 'Plant' list to each PDA/smartphone.	Not Started
R-MAES-17	It must be possible to remove a 'Plant' item.	Complete
R-MAES-18	The system must allow a 'Service' to be created. A 'Service' is something that the organisation will carry out using a 'Plant' item or multiple 'Plant' items.	Complete
R-MAES-19	It is required that a 'Service' must have a name and a brief description.	Complete
R-MAES-20	It must be possible to assign a charge to a 'Service'. Either by the hour or in units.	Complete
R-MAES-21	A 'Service' that is to be charged by the hour needs to have three different rates. Namely, a standard hourly rate, an evening hourly rate and a weekend hourly rate.	Complete
R-MAES-22	If a 'Service' is to be charged per unit then it must have a standard unit rate and a weekend unit rate. It must also be possible to describe the unit type.	Complete
R-MAES-23	It must be possible to assign a minimum hire duration value for each service.	Complete



R-MAES-24	It must be possible to specify which equipment or 'Plant' are required to carry out the 'Service'. A 'Service' may require more than one piece of equipment or 'Plant'. In this case each item needs to be specified.	Complete
R-MAES-25	Each service is required to have a flag that denotes if a service requires, or does not require, multiple pieces of equipment or 'Plant' (Multi-plant).	Complete
R-MAES-26	The system should allow a 'Service' to be removed.	Complete
R-MAES-27	It must be possible to edit the details of a 'Service'.	Complete
R-MAES-28	The system must also allow the details of a 'Service' to be retrieved.	Complete

ID	Requirement Description	Status
R-MAW-1	It must be possible to create users than can use the system.	Complete
R-MAW-2	A user is required to have a first name, surname, login name and a password.	Complete
R-MAW-3	Each user must be assigned one of three levels of rights to the system. These are full, read only and read and write.	Complete
R-MAW-4	It needs to be possible to assign a user a mobile number and a land line number, email address and home address. These are optional.	Complete
R-MAW-5	The system must provide a way of retrieving user details.	Complete
R-MAW-6	The details of a user must be editable.	Complete
R-MAW-7	It must be possible to remove users.	Complete
R-MAW-8	The system must provide a way creating operators.	Complete
R-MAW-9	It is required for an operator to have a first name, surname, nickname, login name and a password.	Complete
R-MAW-10	The system must also allow an operator to be assigned an employment status. The status can either be available (employed by the organisation) or left (no longer works for the organisation).	Complete
R-MAW-11	There must also be a way of setting an operator as unavailable for certain dates. Comments about why the operator is unavailable will also need to be recorded.	Complete
R-MAW-12	It will be necessary to retrieve details about an operators' unavailability.	Complete
R-MAW-13	The system must provide a way of assigning an operator a licence number, email address, land line number and mobile number and an address. These fields are optional.	Complete
R-MAW-14	It is important that the skills of each operator are recorded. A skill refers to which 'Plant Types' the operator can use.	Complete
R-MAW-15	The system must provide a way of retrieving an operators details.	Complete
R-MAW-16	It must be possible to edit the details of an operator.	Complete
R-MAW-17	It must be possible to remove an operator.	Complete
R-MAW-18	When new operators have been created, operator details have been changed or an operator has been removed, the system must be able to send an updated operator list to each PDA/smartphone.	Not Started
R-MAW-19	The system must provide a way of creating subcontractors.	Complete
R-MAW-20	A subcontractor must have a name, contact name and a status (active or inactive).	Complete
R-MAW-21	It needs to be possible to assign a subcontractor an email address, mobile number, fax number and land line number.	Complete
R-MAW-22	A subcontractor must have an address associated with it.	Complete
R-MAW-23	It is important that the skills of each subcontractor are recorded.	Complete
R-MAW-24	It must be possible to retrieve the details of a subcontractor.	Complete

R-MAW-25	It must be possible to edit the details of a subcontractor.	Complete
R-MAW-26	A subcontractor needs to be deletable.	Complete

ID	Requirement Description	Status
R-MAC-1	It must be possible to create a customer account.	Complete
R-MAC-2	A customer must have a name, status and an address associated with it.	Complete
R-MAC-3	The customer account status can either be OK, caution, stop or unknown.	Complete
R-MAC-4	It should also be possible to assign a customer account a phone number, fax number and an email address.	Complete
R-MAC-5	The system should provide a way of setting custom rates for the services a customer will receive. By default the standard rates will apply.	Complete
R-MAC-6	The system must allow customer account details to be edited.	Complete
R-MAC-7	The system must provide a way of retrieving customer account details.	Complete
R-MAC-8	It must be possible to delete a customer account from the system.	Complete
R-MAC-9	The system must provide a way of assigning a regional office to a customer account.	Complete
R-MAC-10	The regional office needs to have an address.	Complete
R-MAC-11	A regional office can also have an email address, office contact name, office phone number, office fax number and a contact phone number.	Complete
R-MAC-12	It needs to be possible to create sites.	Complete
R-MAC-13	A site needs to have an address associated with it.	Complete
R-MAC-14	It is also important that a site has contact details when linked to a customer. These can be an email address, contact name, site phone number, site fax number and contact phone number.	Complete
R-MAC-15	It is important to be able to link a site to a customer, but a site does not need to be linked to a customer when being created. The link between a customer and a site should be able to be broken without removing the site.	Complete
R-MAC-16	It needs to be possible to edit all parts of a site.	Complete
R-MAC-17	The system must provide a way of retrieving site details.	Complete
R-MAC-18	It must be possible to delete a site.	Complete

ID	Requirement Description	Status
R-MAA-1	The system must provide a way of creating orders.	Complete
R-MAA-2	An order must have a date and a reference name. The reference name is mainly for the customer so that they can easily refer to an order. The same reference name can be used multiple times as each order has a unique internal reference. If a customer uses the same reference name, it allows jobs to be grouped for costing.	Complete
R-MAA-3	An order must have a customer assigned to it as well as one of their sites.	Complete
R-MAA-4	It must be possible to assign a service to an order.	Complete
R-MAA-5	Two optional fields that an order can have are a contact name and a description.	Complete
R-MAA-6	An order should be able to have limits assigned to it. The limits can be set either by a maximum value, number of jobs or an end date.	Complete
R-MAA-7	It should also be possible to create an order that is open ended so it does not have limits.	Complete
R-MAA-8	The system should provide a way of editing order details.	Incomplete

R-MAA-9	The system must provide a way of retrieving order details.	Complete
R-MAA-10	It should be possible to delete an order.	Complete
R-MAA-11	The system must provide a way of adding addresses.	Complete
R-MAA-12	It should be possible to edit the details of an address.	Complete
R-MAA-13	The system should provide a way of retrieving all the addresses in the system.	Complete
R-MAA-14	If an address is linked to a customer, site etc, then it should be possible to retrieve the address associations.	Complete
R-MAA-15	It should be possible to retrieve only the addresses that are not linked to a customer, site etc.	Complete
R-MAA-16	It should be possible to delete an address as long as it is un-linked.	Complete
R-MAA-17	The system should allow GPS coordinates to be associated with an address.	Not Started

ID	Requirement Description	Status
R-MAF-1	It needs to be possible to add a PDA/smartphone (device) to the system.	Complete
R-MAF-2	A device needs to have a unique reference ID and an ID code. Preferably, these should be the same.	Complete
R-MAF-3	The system must record the devices phone number, along with the date it was bought, the manufacturer and the model of the device.	Complete
R-MAF-4	A device also needs a status which can either be set to available or unavailable.	Complete
R-MAF-5	It should be possible to edit the details of a device.	Complete
R-MAF-6	A device must also be deletable from the system.	Complete
R-MAF-7	It needs to be possible to retrieve details about a device.	Complete
R-MAF-8	The system must provide a way of allocating a device to an operator.	Complete
R-MAF-9	It must be possible to change the device-to-operator allocation.	Complete
R-MAF-10	It must also be possible to unallocate a device from an operator.	Complete
R-MAF-11	The system must provide a way of allocating a 'Plant' item to an operator.	Complete
R-MAF-12	It must be possible to change the plant-to-operator allocation.	Complete
R-MAF-13	It must also be possible to unallocate a 'Plant' item from an operator.	Complete

ID	Requirement Description	Status
R-MAO-1	It must be possible of retrieving all jobs that require a digital signature but have not had one allocated.	Complete
R-MAO-2	It should be possible to assign any of the jobs that require a digital signature to an operator. This is so that the operator can collect a signature.	Complete
R-MAO-3	The system must also allow jobs to be set as not requiring a signature. This may be done if manual paperwork has been completed.	Complete

### 5.3 Mapping

ID	Requirement Description	Status
R-MAP-1	It should be possible to retrieve the most recent GPS coordinates of an operator.	Complete
R-MAP-2	It should also be possible to retrieve an operators GPS coordinates that lay between two times.	Complete

R-MAP-3	It should be possible to retrieve the most recent GPS coordinates of a 'Plant' item.	Complete
R-MAP-4	It should also be possible to retrieve GPS coordinates of a 'Plant' item that lay between two specified dates and times.	Complete
R-MAP-5	The system should allow the GPS coordinates of the last known location of each operator to be retrieved.	Complete
R-MAP-6	The GPS coordinates of the last known location of each 'Plant' item should also be able to be retrieved.	Complete
R-MAP-7	The system should allow the current GPS coordinates of each operator to be retrieved. The term 'current' means up to 24 hours ago.	Complete
R-MAP-8	The system should allow the current GPS coordinates of each 'Plant' item to be retrieved.	Complete
R-MAP-9	It should be possible to retrieve all GPS coordinates that refer to a particular job.	Complete
R-MAP-10	The GPS coordinates of where an operator has logged in or out of the application, on their PDA/smartphone, should be retrievable. This should be between two dates.	Complete
R-MAP-11	If an address has GPS coordinates associated to it, then the system must allow the coordinates to be retrieved.	Complete

## 5.4 Invoicing

ID	Requirement Description	Status
R-IN-1	The system must allow an invoice to be created for a single job.	Complete
R-IN-2	It must be possible to create an invoice that contains multiple jobs. An invoice can only contain multiple jobs if the customer and the order number are the same.	Complete
R-IN-3	It must be possible to find jobs in the system that need to be invoiced.	Complete
R-IN-4	An invoice must be assigned to a customer. The customer will be the same as the one assigned to the job/s on the invoice.	Complete
R-IN-5	An invoice requires a date stamp, values for total net cost, VAT and grand total.	Complete
R-IN-6	It should be possible to apply a discount to an invoice total. This can either be as a percentage or a fixed value.	Incomplete
R-IN-7	The system should allow comments to be wrote against an invoice.	Complete
R-IN-8	If a signature has been captured for a job, then it should be possible to include that signature on the invoice.	Not Started
R-IN-9	If GPS data has been collected for a job, then it should be possible to include a map showing the data collected.	Not Started
R-IN-10	If a invoice has been prepared then it should be possible to send the invoice via email or print locally.	Not Started
R-IN-11	The system must provide a way of retrieving details of an invoice.	Complete
R-IN-12	It should be possible to mark a job as invoiced in cases where a manual invoice has been completed.	Complete
R-IN-13	It should be possible to register payments against an invoice.	Complete
R-IN-14	An invoice payment must have a date stamp, payment reference and the amount paid.	Complete
R-IN-15	It should be possible to edit an invoice payment.	Complete
R-IN-16	The system must allow an invoice payment to be deleted.	Complete

## 5.5 Settings

ID	Requirement Description	Status
R-ST-1	The system must allow the company details to be changed. Here, 'the company' refers to the company using the application e.g. RNA Plant.	Complete
R-ST-2	It should be possible to change the company name, phone and fax number, email address, mobile number, website URL and address.	Complete
R-ST-3	It should also be possible to change the value used for VAT.	Complete
R-ST-4	The system must allow minimum and maximum job duration values to be set.	Complete
R-ST-5	It must be possible to set time boundaries for evening and weekend work.	Complete
R-ST-6	The system must be able to retrieve a list of 'Plant' items which require maintenance to be carried out on them within a set number of weeks.	Complete
R-ST-7	The system must be able to communicate with the current database and middleware application that is being used.	Incomplete

## 5.6 Messaging

ID	Requirement Description	Status
R-MES-1	The system must allow messages to be sent to operatives.	Complete
R-MES-2	It should be possible to send a new message to one, many or all operatives.	Complete
R-MES-3	Each message must have a date-time stamp.	Complete
R-MES-4	The system should provide a way of retrieving all messages that have been sent to operatives.	Complete
R-MES-5	It should also be possible to retrieve all messages that have been sent from operatives to the office.	Complete
R-MES-6	The system must allow messages to be deleted.	Complete

## 5.7 User Interface

ID	Requirement Description	Status
R-UI-1	A user must be able to interact with the system through a web browser.	Complete
R-UI-2	It is necessary for a user to login before they can use the system.	Complete
R-UI-3	A user must be able to exit the system.	Complete
R-UI-4	Certain functionality must only be available through the UI to users who have the required permissions level.	Incomplete
R-UI-5	The user interface must allow a user to perform any of the functions mentioned in the previous sections.	Incomplete

## 6 Risk Analysis

### 6.1 Planned Risks Encountered

This section will provide the details of the risks that have been encountered during the development of the application. These are risks that were identified during the initial risk analysis and are covered in the Risk Management section of the *Methodology and Requirements Document* for this application.

#### 6.1.1 Impractical Time Plan

ID	Risk	Probability	Impact	Total
1	<p><b>Impractical time plan</b> Due to being relatively inexperienced in undertaking large software development projects, there is a risk that the time plan is unrealistic. If this is the case then there is potential for not all of the requirements to be met.</p> <p><b>Contingency plan</b> To reduce this risk, a lot of time and careful thought went into creating the time plan. However, if certain parts of the project overrun their allocated time slots then it will be necessary to look over the remaining work and re-engineer the time plan. As the project progresses this risk should be reduced as my ability to estimate time requirements will be improved.</p>	3	4	12

Although the vast majority of the application has been completed, one of the remaining tasks is anticipated to be a large amount of work. The task is implementing the diary functionality and could take more time than it has been allocated. I think I might have been slightly unrealistic with the amount of work I thought I could do within the time that was available. To compensate for overlooking this, I have had to work on the project for longer hours than was initially planned and also reducing the amount of time I spent on other activities was required.

Having said that implementing the diary functionality may take more time than it has been allocated, I still feel confident that there is little risk in this occurring. The main reason for this is that I have more experience using the technologies that are being used to develop the application.

#### 6.1.2 Underestimating Total Workload

ID	Risk	Probability	Impact	Total
2	<p><b>Underestimating total workload</b> During the duration of this project, there will also be other work that will need to be completed. It is possible that the workload will be underestimated and therefore reduce the amount of time available for working on this project.</p> <p><b>Contingency plan</b> This risk will be reduced by my experience gained during my Level 3 project.</p>	3	3	9

During the creation of the initial time plan for this project I only had a rough idea of the amount of coursework I was going to receive from the other modules I had taken this semester. This was especially the case for *EG-M85 Strategic Project Planning*. I was unaware that I would be required to partake in another group project as the coursework for this module. As this was the case, I had to spend a considerable amount of time attending,

travelling to and from group meetings. This time had not been catered for in the original time plan, so it was essentially reducing the amount of time I had available to develop the application.

To try and reduce the effect of the above problem, I plan on reducing the number of activities I undertake during the Easter break. If I feel it to be necessary I will not undertake any other activities during the break and solely concentrate on this project.

### 6.1.3 Complex Features

ID	Risk	Probability	Impact	Total
7	<p><b>Complex features</b></p> <p>It is possible that some of the functionality that is required may be complex to implement. If this has not been taking into consideration in the time plan then extra time will have to be spent on the complex feature to get it implemented or it will have to be left out. Spending more time on the feature may cause other features to go unimplemented.</p> <p><b>Contingency plan</b></p> <p>Depending on the importance of the feature, will depend whether or not extra time is spent implementing it. If it is not an important feature then time will be focused on other parts of the system first to ensure other features are not compromised.</p>	2	4	8

The initial time plan stated that the first features that should get implemented are those related to the *Diary* section of the application. This was soon decided against as I felt some of the features required to complete this section were considered to be complex features and required more research. To be exact, it was finding a drag-and-drop schedule component that offered the same functionality to what is being used now that was the problem.

The diary section is an essential part of the application and therefore a solution must be found. If it is not possible to find an adequate component then a different solution will be found. As long the solution provides all the functionality required by the specification document then it will be acceptable.

## 6.2 Unplanned Risks Encountered

During the development of the application so far, no other risks have been encountered apart from the ones mentioned in the previous section of this report, *Planned Risks Encountered*. Therefore, no unplanned risks have been encountered.

## 6.3 Updated Risk Analysis

As it stands, I feel that the initial risk analysis sufficiently covers all possible risks that could occur between now and the final project submission date of the 4th May 2012. The initial risk analysis has been included below so the reader can view the possible risks that could occur during this final development period without having to look back at the *Methodology and Requirements Document*.

ID	Risk	Probability	Impact	Total
1	<b>Impractical time plan</b>	3	4	12

Due to being relatively inexperienced in undertaking large software development projects, there is a risk that the time plan is unrealistic. If this is the case then there is potential for not all of the requirements to be met.

**Contingency plan**

To reduce this risk, a lot of time and careful thought went into creating the time plan. However, if certain parts of the project overrun their allocated time slots then it will be necessary to look over the remaining work and re-engineer the time plan. As the project progresses this risk should be reduced as my ability to estimate time requirements will be improved.

2	<p><b>Underestimating total workload</b></p> <p>During the duration of this project, there will also be other work that will need to be completed. It is possible that the workload will be underestimated and therefore reduce the amount of time available for working on this project.</p> <p><b>Contingency plan</b></p> <p>This risk will be reduced by my experience gained during my Level 3 project.</p>	3	3	9
3	<p><b>Short term illness</b></p> <p>It is possible that during the duration of the project I pick up some form of short term illness. This may prevent me from working on the project as much as I would like to for a short period of time. If this is the case, time may be lost and I will have to find some time to catch up.</p> <p><b>Contingency plan</b></p> <p>To reduce the impact short term illness has on the project, I will not let the project drop behind schedule. Therefore, when I am ill the backlog of work will only be minimal and catching up should not be a problem.</p>	4	2	8
4	<p><b>Long term illness</b></p> <p>It is possible that during the duration of the project I pick up some form of long term illness. This may prevent me from working on the project for a long period of time. If this is the case, time will be lost and may prevent the project from being completed.</p> <p><b>Contingency plan</b></p> <p>The probability of long term illness affecting the project is considerably low. There is not much that can be done to reduce the impact of long term illness should it occur. The best that can be done is to hope that it doesn't occur.</p>	1	5	5
5	<p><b>Chosen technologies may be insufficient</b></p> <p>It is possible that certain functionality cannot be implemented using the chosen technologies. This is due to being relatively unfamiliar with the technologies being used in this project and not completely finding out their deficiencies.</p> <p><b>Contingency plan</b></p> <p>A lot of time has been spent researching the technologies that will be used for the project to ensure that they can provide the necessary functionality that is required. If a part of the project cannot be implemented using the chosen technologies then it may be necessary to re-engineer the project using different technologies or to remove the feature if it isn't a major part of the system.</p>	3	5	15



6	<b>Feature creep</b> At some stages during project development, I may see the possibility to add new features to the application that weren't originally specified. If this happens it will reduce the amount time available to work on the specified functionality. Potentially causing some specified features to not get implemented. <b>Contingency plan</b> To prevent feature creep, the specification will be followed strictly and only when the specification has been met will extra features be added.	2	4	8
7	<b>Complex features</b> It is possible that some of the functionality that is required may be complex to implement. If this has not been taking into consideration in the time plan then extra time will have to be spent on the complex feature to get it implemented or it will have to be left out. Spending more time on the feature may cause other features to go unimplemented. <b>Contingency plan</b> Depending on the importance of the feature, will depend whether or not extra time is spent implementing it. If it is not an important feature then time will be focused on other parts of the system first to ensure other features are not compromised.	2	4	8
8	<b>Loss of work</b> Throughout the development of the project it is possible that some or all of the work gets lost. This may be because of deleting files by accident or file corruption. <b>Contingency plan</b> To reduce this risk I will be taking regular backups of all my work. I will keep a copy on an external hard drive, a copy on Dropbox and a working copy on my computer.	3	5	15
9	<b>Computer failure</b> It is possible that at any stage during the project, the computer that I am developing the application on becomes faulty. This will cause development work to stop until a solution is found. <b>Contingency plan</b> As well as my main computer I also have an old laptop. As I will be taking regular backups of my work computer failure should not be a major problem as I will be able to transfer my work onto my laptop and carry on working.	2	5	10
10	<b>Final product doesn't meet the specification</b> Once the application has been developed it may not meet the specification. <b>Contingency plan</b> This risk should not be a major problem as I will always be working against the specification. I will also try to provide the client with the ability to test the application as it is being developed so they can provide me with feedback.	2	5	10
11	<b>Code may be inadequately tested</b> It is possible that, inadequate test cases are created. If this is the case then the results of the tests may be misleading and provide false positives. <b>Contingency plan</b> I will create a detailed test plan that involves unit tests and functional tests. This will ensure that the application is thoroughly tested and it meets the clients requirements.	2	4	8

12	<b>Social events</b>	2	3	6
	During the duration of the project it is very likely that I will be dedicating some of my time to social events. If I give too much of my time for these occasions the project may fall behind schedule.			
	<b>Contingency plan</b>			
	To prevent this, I will be very strict about the time I spend on social events.			
13	<b>Failure to correct known problems</b>	1	4	4
	During testing, problems with the system may be brought to light. If problems that are found are not corrected, this may cause problems with the system and may prevent it from working as desired.			
	<b>Contingency plan</b>			
	No extra functionality will be added to the application until the problems are corrected. This means fixing them as soon as they are found.			
14	<b>Bad naming conventions used</b>	3	3	9
	It is very likely that during development bad names will be chosen for variables, classes and methods. This is likely to be down to laziness. If this happens then the code will become harder to comprehend.			
	<b>Contingency plan</b>			
	During development I will constantly look over code to ensure no bad naming conventions are used. I will not deem a class to be complete until I'm satisfied that good naming conventions have been used throughout the class.			
15	<b>Failure to document methods and classes</b>	3	2	6
	It is possible that I forget to document some classes and methods as I am developing the application. If this happens then, when looking back at written code I may not be able to understand the code straight away.			
	<b>Contingency plan</b>			
	To make sure methods and classes are documented, I will not deem a class to be complete until I'm satisfied that the class and its contents are well documented.			
16	<b>Being unfamiliar with the programming languages</b>	3	2	6
	I have had limited experience with the programming languages being used to develop this project. Therefore, coding may take longer than expected at the start of the project as I am getting used to the languages.			
	<b>Contingency plan</b>			
	The effect of this risk should be minimal as I have spent time learning the programming languages. Also, the languages I will be using are similar to languages that I have used in the past.			

## 7 Time Plan

Covered in this section is the progress that has been made on the project in relation to the time plan that was included in the *Methodology and Requirements Document*. Each of the tasks that are present on the original time plan will be listed along with a status description. At the end of the section, an updated time plan is included which covers the remaining tasks that need to be completed.

On the original time plan there are 17 tasks that needed to be completed between the 10th October 2011 and the 27th April 2012. So far, excellent progress has been made on these items and the majority of them were either completed early or on time. There are only two tasks that are really behind schedule. The list of tasks that are present on the original time plan is shown below, each with a status description.

- Methodology and Requirements - Complete - On Time
- Specification Document - Complete - On Time
- Implement diary functionality - Not Started - Late
- Milestone 1 Submission - Complete - On Time
- Implement maintenance functionality - Complete - On Time
- Implement mapping functionality - Complete - On Time
- Implement invoicing functionality - In Development - Late
- Write interim Report - Complete - On Time
- Milestone 2 Submission - Complete - On Time
- Implement settings functionality - Complete - Early
- Implement messaging functionality - Complete - Early
- User Manual - Not started - Neither early or late as start date not yet reached
- Testing Document - Not Started - Neither early or late as start date not yet reached
- Design Document - Not Started - Neither early or late as start date not yet reached
- Narrative and Reflective Account - Not Started - Neither early or late as start date not yet reached
- Poster Production - Not Started - Neither early or late as start date not yet reached
- Milestone 3 Submission - Not Started - Neither early or late as start date not yet reached

As some of the items in the above have been completed there is a need to include in an updated time plan. However, it is necessary to include extra items that were not previously included on the original time plan. These items were previously contained within other tasks but I feel it is necessary to expose these as tasks in their own right. The consolidated list of tasks, which also includes the extra tasks that have been identified, is shown below.

- Write interim Report
- Milestone 2 Submission
- Implement diary functionality
- Complete remaining invoicing items
- Add rights level restrictions
- Implement communication with middleware
- User Manual
- Testing Document
- Design Document
- Narrative and Reflective Account

- Poster Production
- Milestone 3 Submission

As has already been mentioned, it has been necessary to create an updated time plan. The time plan is depicted in the form of a Gantt chart in Figure 8 and it includes the tasks from the original time plan that have not yet been completed. As well as these tasks, the extra tasks that have been identified are also included in the time plan.

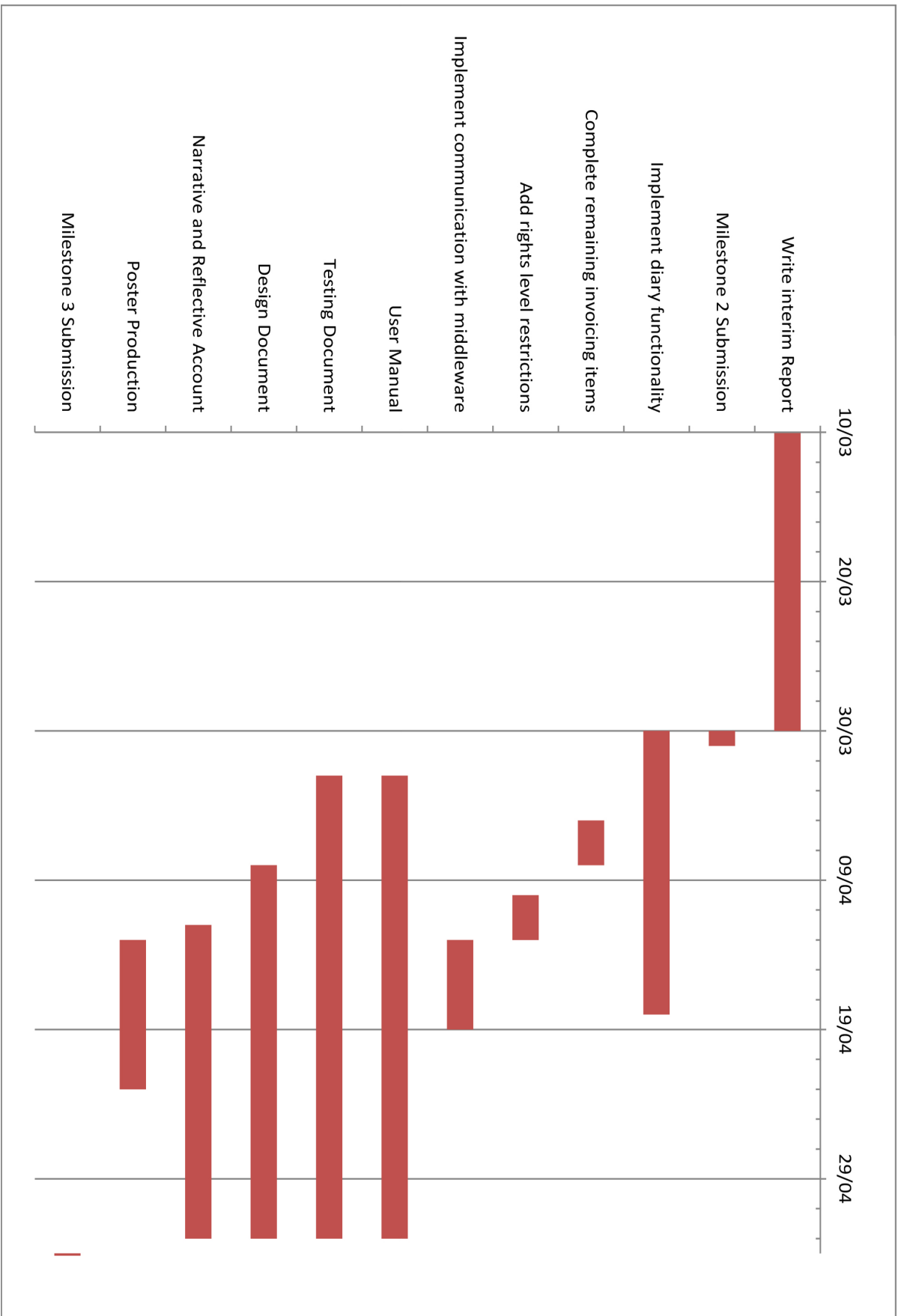


Figure 8: Updated Time Plan.