Introduction

I am a student starting my second year of A levels at a College of Further and Higher Education and one of these A levels is ICT. The A2 part of the ICT A level consists of three modules, one of which is coursework and it is worth 40% of my overall A2 grade. The coursework requires me to identify and conduct research into an open-ended problem that exists for a real end-user. From results of this preliminary research, I must design an appropriate ICT-based solution for the problem using the skills and knowledge that I have acquired throughout the duration of my course. After designing such a solution, I will develop the actual software to be used to address the problem along with the technical documentation. This software will then undergo extensive testing so that I may identify and correct any bugs that may be present within the system. Plans on how the system will be implemented will then be made, including any training the staff will need and how existing data will be transferred into the new system. Finally, the User Documentation will be produced and I will evaluate the system on a number of various criteria to see if it meets the requirements outlined at the analysis stage.

Throughout the whole process, I will be using the skills and experience that I've acquired in the first year of the course (and what I will be learning this year) to incorporate a wide range of advanced features and functions into the system, and to complete the project to the best of my ability.

Background Information

The business that I will be developing a database for is a car rental firm known as *Fred's Car Rentals*. It is a small, family-run business that rents out automobiles to customers for a period of time in exchange for a fee. Its customers include travellers from other countries that need a set of wheels to get around for the duration of their stay and owners of destroyed or damaged vehicles that are waiting on repairs to be conducted or insurance compensation. On occasion, the business also serves the self-moving industry by providing them with large vehicles for transporting heavy items to new destinations, such as when people are moving house. The offices and garages of the business are situated in Portadown, and they have been providing a vehicle rental service to the town and surrounding areas since 1985.

The business is open from 9am to 5pm from Monday to Thursday, and it closes at 1pm on Fridays. On Saturdays it's open from 11am until 4pm, and it is closed on Sundays. The business six employees, including the manager, assistant manager, stock controller and floor staff.

Gantt Chart for Overall Project

Number of weeks

Tasks	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Analysis	■	■	■	■																			
Design					■	■	■	■	■	■													
Software Development and Technical Documentation							■	■	■	■	■	■	■	■	■								
Testing														■	■	■	■	■					
Implementation																			■				
User Guide																				■	■	■	
Evaluation																							■

Gantt Chart For Analysis

Number of Days

Tasks	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Identify Problem	■	■																												
Investigate Current System			■	■	■	■	■																							
Analyse Findings								■	■	■																				
Analyse Current Activities											■	■	■	■																
Analyse Problems															■	■	■	■												
Identify End-User Requirements																			■	■	■	■								
Identify System Requirements																							■	■	■					
Create Performance Criteria																										■	■	■	■	
Consult with User																														■

Systems Development

When there are problems or inefficiencies within an organization, new information systems are often developed as a solution to the problem. Often the way in which data is held and manipulated within an organization is inefficient or wasteful, so a computerized system is developed to replace a manual storage system, or to replace an inefficient computerized system. In other words, if there is a better and more cost-effective method of handling data, businesses will obviously want to use that method! For my coursework, I will be developing a computerized system tailored to the needs and requirements of *Fred's Car Rentals*. Of course, the development of such computerized systems is a costly venture, both in terms of time and money expenditure, so we use formal methods to streamline the process. These formal methods are referred to as "System development life cycle models", and the model that I will be following consists of five main stages: System Investigation, Analysis, Design, Implementation and Review

The first thing I will do for my project is the conduction of preliminary investigations into Fred's Car Rentals' current system. This stage involves identifying what the problems are with the current system, considering the various ways in which the problems could be addressed along with their feasibility, and possible implications of undertaking the project. It will begin with a system request, followed by the production of a feasibility report. The conduction of a feasibility report will give me an insight into the nature of the problem with the current system and whether or not the net benefit of the system will outweigh the net cost that will be incurred via the resources being consumed by its development. This feasibility report will be taking five factors into consideration: technical feasibility, economic feasibility, legal feasibility, operational feasibility and schedule feasibility. If the results of my feasibility report demonstrate that the business would benefit from a new information system, and that such a system is able to be developed given the time and money constraints, then I shall proceed to the analysis stage.

During the analysis stage, I will investigate in detail how the current system operates, its strengths and weaknesses, what can be improved and what will be required of the new system. It is through this stage that I will gain a thorough and comprehensive understanding of the current system so that I can design and produce a Requirements Specification. I will develop this Specification with the continuous correspondence, consultation and feedback of its intended users in the business. I will be utilizing a variety of data-collecting methods such as interviews, questionnaires, and direct observation. Things that I intend to investigate include, but are not limited to, the service the business offers, what tasks are carried out, the way in which these tasks are carried out, the frequency of their performance, the effectiveness of their performance, the staff's involvement in such tasks, faults in the system and how the system can be improved. All the data collected here will be used to gain a clear understanding of the present system and in developing the new one.

At the design stage of the life cycle, I will produce details on how I will meet the requirements that I set for the system at the analysis stage. I will specify what files will be required, their structures and storage method used for them. Validation checks will be outlined and I shall design a test plan that will be followed at the testing stage. All this information will be written in the form of tables, diagrams and reports. Output Designs, in which all output requirements will be defined, such as how many reports are required,

the frequency of their production, their layout and they data they will contain, will be included. Input Designs will be included, defining where all of the data is coming from, method of data input, data collection methods to be used, data-capture form design and input-form design. Process design will also be included, defining all of the processes to be performed on entered data such as sorting, summing, selecting, counting and merging. The database designs will also be shown, as will the security designs for the system, such as how data integrity will be protected, what access levels different users will have and the data-back-up procedures to be used. The hardware that the system is being designed for will also be included, as well as the software that will be used to create the computerized system itself.

The designs from the previous stage will then be used to construct the actual system. Existing commercial software may be purchased or it may be necessary to have software written for the purpose. Using existing software is a safe option, being relatively inexpensive and tried and tested, although in some cases in may not meet the demands of the proposed system, depending on what is required from it. Once the database is constructed and the system is completed, it must undergo rigorous testing. I will design attesting strategy and test the system according to that plan. I will be testing all of the parts of my program to ensure they perform according to specification. Data will be used to test extreme cases and invalid data to ensure it'll be rejected by the system. During testing, the results yielded will be compared with what is expected, and any anomalies will be investigated and if necessary corrected.

The system will then have to be installed after it's been thoroughly tested. This will include preparing the users for using the system, ensuring that the hardware is capable of running the software and converting the data from the old system into the new one. It is very important that all users of the system are trained to use the software confidently. Three common methods of installation are Direct conversion, Parallel running and Pilot conversion. In a direct conversion, the old system is replaced by the new one at a specified time and date. Whilst this is certainly the most speedy and inexpensive option, at the same time, it is also the riskiest having as the result of a system failure could be catastrophic, as no back-up of the system exists. With a parallel running changeover, both new and old systems run simultaneously for a period of time to compare and contrast the results of each system in terms of accuracy, speed, consistency and efficiency. This is a safe changeover method since if a failure arises in the new system; the old system is still there. However, running two systems simultaneously can put a tremendous strain on the business in terms of time, money and manpower. In a pilot conversion, the new system is implemented in one location or segment of the business before its full implementation throughout the organisation. This way, any problems or bugs can be corrected before full-scale implementation occurs. However, this is only possible in an organisation that has many departments or locations so obviously it's not going to be an option for the small family business that I'm looking at.

Even when a system is up-and-running and fully operational, unforeseen circumstances can cause problems to arise. I will therefore need to be capable of addressing any problems that may arise in the system, as well as being able to make modifications should circumstances change. Perfective maintenance is performed when the users of the system, through repeated use, become aware of certain changes that would enhance the performance of the system on one or more variables such as speed,

accuracy or consistency. Whilst a system does not require such modifications, and will run adequately without them, they do improve the system. Adaptive maintenance may be performed if needs of a company changes, or if new and improved hardware becomes available. Corrective maintenance is performed when a bug or an error is encountered in the system.

Feasibility of a Computerized Solution

There are certain factors that one needs to take into consideration when one is judging whether a computerized solution to a problem is feasible and worth going ahead with. The five main factors for consideration are technical feasibility, economic feasibility, legal feasibility, operational feasibility and schedule feasibility, and I will have to take these factors into consideration when designing a computerised solution for *Fred's Car Rentals*.

Technical feasibility refers to whether the technology exists to implement the new system, and the practicality of the proposition. It may be the case that the software may simply not achieve the desired response times with currently available equipment. For example, if I wanted to design a system based on voice recognition for this project, requiring the user to input data via speaking into a microphone; it would be feasible. This is because voice recognition software is not currently at an advanced enough level to ensure 100% accuracy in the conversion of voice to data. If the user speaks into the microphone, the software may convert it to a different, similar sounding word. This would be problematic for the system in the amount of time and money wasted from corrections and incorrect information. Thus, we would say that it is not technically feasible. However, in the future, when the voice recognition software becomes more advanced, it could well be a feasible option.

Economic feasibility refers to the cost-effectiveness of the system. Obviously, if the cost of designing and developing my system outweighs the benefits it confers to the *Fred's Car Rentals*, then it is not a good idea. The organization will not want such a system, and will reject it. Such costs include purchasing the hardware and software necessary for running the system, paying those who are developing the system, the cost and time taken transferring the current systems data into the new system, training personnel on how to use the system effectively and the cost of installing the system. There are other costs too, but these are more detrimental to the individual and society in general rather than the business itself. This includes workers being made redundant, deskilling, negative environmental effects and the loss of job satisfaction for certain employees. Benefits for the business include a reduction in staff costs, reduced running costs and increased level of customer satisfaction and hence more business as a consequence.

Legal feasibility refers to whether the proposed system adheres or conflicts with any laws. The contractual and legal ramifications of the system must be understood fully, such as copyright law, code ownership, and the Data Protection Act of 1998. If going ahead with a project means breaking the law, then it is said to be lacking in legal feasibility. As well, if the only way it would be economically feasible for my client to implement the system would be for it to be designed and used on illegal pirated copies of software then it would also lack legal feasibility.

The Operational feasibility of a project pertains to whether the current work procedures and practices will be capable of supporting the new system. If the organizations current practices and procedures will not be capable of this, then they will either have to be altered or there will be no point developing the system. If work practices have to be altered too drastically that the organization will not be able to comply, then we say that the project lacks operational feasibility and the project will not go any further. Obviously

I don't expect my client to turn his business upside down and inside-out in order to accommodate my system.

Schedule feasibility pertains to the amount of time that will be taken to develop the system relative to the time the organization would like it completed. Obviously if my system is going to require six months to be constructed and my client wants it completed in one month, it will not be possible. This is an example of a project lacking in schedule feasibility.

My Knowledge and Experience

At GCSE level, I created a spreadsheet, a website, a slideshow and used publishing software for the coursework, and learned some basic ICT theory. Whilst the use of the various software and information learned from the theory was fairly basic, it provided some foundation and framework in the subject that could be expanded upon.

I have gained much more knowledge and experience from last year's AS level ICT that will be of help to me this year. In the theory last year I covered topics such as Data, Information Systems, Relational Databases, Software and System Development life cycles, which are very relevant to the coursework. Last year I achieved 82/90 in my first exam and 90/90 in my second, so I feel confident that I know these topics well and am ready to apply this knowledge confidently. I will be taught ICT theory in conjunction with producing this piece of coursework, so I will be learning new things relevant to the project as the year goes on. Also, last year I produced a computerized solution for AS level coursework, so I'm hoping some of the principles and strategies learned in designing a database will come in helpful this year too.

In the summer of 2007, I was selected to represent my country at the NASA International Space School in Houston, Texas. At the school, students from all over the world were placed in teams and had to tackle various aspects of a hypothetical journey to Mars. At the end of two weeks of work, we had to present the fruits of our labour to an audience including NASA officials and university professors. Part of this presentation involved presenting a slideshow containing information pertaining to our ideas to accompany our speeches. One of the responsibilities I had on my team was to use my ICT skills to design the slideshow using Presentation software (Microsoft PowerPoint), which I succeeded at doing.

Breakdown of Tasks

Description of Task	Expected Date of Completion
Identify Problem	20th September
Investigate Current System	25th September
Analyse Findings	30th September
Analyse Current User Activities/Data	2nd September
Analyse Problems with Current System	6th September
Identify End-User Requirements	8th September
Identify System Requirements	12th October
Cerate Performance Criteria	17th October
Consult with User	18th October

Investigation Techniques

In order to gain a clear and comprehensive understanding of the way in which the current system operates and thus calculate will be required of the new one, several methods can be used to obtain facts regarding the system. These methods include structured interviews, unstructured interviews, questionnaires, a study of all forms and documents, an examination of records and procedure manuals and direct observation.

The structured interview consists of a series of pre-prepared, precisely defined questions. It is the rigidity and inflexibility of the structured interview that is both its greatest strength and greatest weakness. On one hand, it is from this structure and order that objective precise data will be able to be obtained from Fred, unclouded by the interviewee's interpretation of subtle cues on the part of the interviewer. However, on the other hand, though, this rigid structure will not allow potentially interesting lines of inquiry to be pursued or followed up on. This means that important data could be missed.

The unstructured interview can be summarised as an open-ended discussion. It is a more casual and conversational approach than the aforementioned structured approach, and for this reason, greater volumes of data will be able to be extracted from Fred. Also, interesting lines of enquiry can be pursued. However, whilst the greater volume of data is obtained via this interview technique, a lot of the information will not be as relevant and as precisely defined as that produced from a structured interview.

One can study all the forms and documents in a business to discover what information will be required by the new system. A thorough examination of the documents in *Fred's Car Rentals* will ensure that each of the documents actually fulfils a purpose and that the information that is recorded or transmitted is actually used at some stage. These documents can include things such as source documents, customer invoices and delivery notes, which will enable me to construct an image of the information flows between input and output.

The records and procedure manuals of the business can also be examined. If existing procedures are well established already, then the study of the procedure manuals will provide a perfect source of information on how procedures should be carried out. It is not likely that such procedures would be documented for smaller businesses like *Fred's Car Rentals*.

The last data-collection method I could potentially use is direct observation which would provide a unique insight into the system that would be unattainable via other means. Procedures can be observed as they are carried out, so that any problems and irregularities can be noted. Some things to look out for during a direct observation include the layout of the offices, work load, work methods, delays and office conditions.

For my project, I will use interviews, a study of all the documents and direct observation. I will conduct a semi-structured interview with the manager Fred. I will also request access to all the documents and records of the business to find out what information is required from the system. Lastly, I will request permission to perform a direct observation in the office of the business.

Interview Questions

These are the set of questions that will comprise the semi-structured interview that I will be holding with Fred, the manager of *Fred's Car Rentals*, in a few days. It will be semi-structured in the sense that if I feel that if something interesting arises from a response to one of my questions, I will pursue that line of enquiry but that is the only circumstance under which I will digress from my main list of questioning. I will take a notepad with me during the interview to record his answers to my questions.

1. How many personnel are currently in your employ?
2. What details do you hold about your employees?
3. Do your employees have any qualifications in ICT?
4. Do your employees have any past experience working with computerised systems?
5. Do you expect staff to welcome a computerised system or are you expecting some resistance to such a system?
6. Do you store information about your customers? If so, how and what is it stored in?
7. Do the customers have unique customer identification numbers? If they do not, would you like the new system to do this?
8. On average, how many customers do you have a week?
9. What time of year is the busiest for your business?
10. How many vehicles does the business have?
11. What details do you hold on your vehicles?
12. What details are recorded when a rental is made, and where is this data stored?
13. Do the vehicles have unique identification numbers? If they do not, would you like the new system to do this?
14. What firms supply the business with the vehicles?
15. Do you store details on the suppliers? If so, what details and how are they stored?
16. What is the average rental price for a vehicle?
17. What is the lowest rental price, and the highest rental price?
18. Do you have an overdue fee system in place for late rentals?
19. What type of information would you like to be extracted from the new system?
20. How long would you like the system to hold records before they are deleted?
21. Under what circumstances is a letter sent out to a customer?
22. What would you say the main problems are with the current system?
23. Will I be able to observe the current system in operation from within the offices for a few hours?
24. Will I be allowed access to all of the documents and records your business uses to store and transmit information?
25. Do you have a back-up strategy for your data?
26. Are there any other factors that are taken into consideration when calculating the total price of the vehicle rentals

Direct Observation Aims

Providing that question 21 in the interview with Fred yields a positive result and I am permitted to do so, I will observe the office environment of *Fred's Car Rentals* for a few hours one day in order to gain some understanding into the way in which procedures operate. During my observation in the office, I will take care not to behave in any way that might distract staff members to ensure that the working environment being observed is as close to a naturalistic situation as possible. Things that I hope to observe include:

- The work load on the employees
- If there are any unnecessary delays between the performance of various processes
- The methods of working
- The nature of the tasks being performed by staff
- The frequency at which these tasks are performed
- The interactions between the different staff members
- The flow of information in the system and the efficiency of this flow

General Findings about Current System

Fred's Car Rentals currently has six members of staff, consisting of including the manager, assistant manager, stock controller and floor staff. The members of staff have a little experience in ICT. One of the floor staff members has an A level in the subject and one of the assistant managers has previous experience working with a computerised system in a previous job of his. The summer months are the busiest times of year, as that is when the town gets most of the travellers that need a vehicle for the duration of their stay in Portadown or surrounding areas.

One important discovery is that all of the storage and manipulation of data within the office is conducted by hand. For example, when a new customer enters the shop, they are asked to fill out a form by the manager. Once they have completed this form, it is filed away in a filing cabinet with other such forms. All such data regarding the business is stored on paper, in filing cabinets, including staff details, supplier details, Vehicle details and Rental details. I get the impression that all of the paperwork that needs to be completed each time data needs to be recorded or manipulated can be a time-consuming process.

Keeping all of the files updated and accurate can be a hassle, as a member of staff has to search through a filing cabinet full of records before locating the required one. This wastes unnecessary time. Also, when making amendments to a record, the employees have to manually erase the previous information on the record using either tip-ex or a rubber, before they can transcribe updated information to the document. Upon viewing these corrected records, I noticed that they look very messy and in some cases illegible due to these corrections. In some cases, Fred noted that staff members just fill out a new record rather than correct the original to avoid such messy-looking records, which is obviously very time-consuming.

Another issue that was raised by the manager during the interview was that of human error occurring within the system. Due to the heavy amounts of paperwork involved, the employees sometimes make typographical errors during the recording or editing of data, which can merely be something as innocuous as a mis-spelt name but can on occasion result in something a little more serious such as an incorrect telephone number or the date at which a vehicle is due to be returned.

A similar issue is the way in which the differing writing styles of the staff can lead to confusion and erroneous readings of records. During my inspection of the files and records, I noticed that the handwriting appeared to be barely readable in certain instances. And it wasn't just I who thought so. The manager could recall an anecdote about how the business were trying desperately to get into contact with one of their customers regarding an overdue vehicle, but their efforts to contact him via telephone all yielded no answer on the customer's end of the line for days. Due to the messiness and illegibility of the handwriting on the customer's record, the employee that was trying to contact the customer read one of the digits wrongly on the telephone number, and thus it turned out was dialling the wrong telephone number the whole time!

The back-up of the current system consists of photocopies of all of the files and records. These photocopies are stored in separate filing cabinets. However, this is extremely wasteful of paper not to mention ink, and thus is not very economically sound for the business and certainly doesn't help the environment with a modest contribution

towards deforestation rates! Also, these photocopied back-ups are contained within the same office, which strikes me as a silly decision. If a fire were to ravage the offices, the back-ups would be burned along with the originals. The manger would like me to be able to archive records in the new system, so I'll need a strategy for backing up the data.

Information that Fred would like to be able to extract from the new system include an easy way to monitor and produce reports on the rental status of each vehicle, as this will save time when a customer wants to make a rental. He would also like to be able to produce a report of all the cars of a certain category, so he can immediately bring up a list of all of the available vans or family cars or the kind of vehicle that the customer wants to rent. He comments that he often gets customers that would like a particular type of vehicle, so it would be very helpful to be able to bring up a list of all the available vehicles of that type to help them make their decision.

He informed me that, in addition to the rental price for the number of days that the vehicle has travelled, there is also an additional charge for the miles travelled by the customer during the rental. In the past this has been calculated manually by the staff members, so a formula that would calculate this value automatically in the new system would be a good addition to reduce the likelihood of human error. He also told me that overdue vehicles cost the business a fair value of money each year, so we I discussed with him the possibility of implementing an overdue fine system that calculates the fine exponentially to the number of days overdue.

I was permitted by the manager to observe the working environment of the business for a few hours on a typical day. I found the offices of the business to be fairly tidy, and all of the different files were clearly labelled and arranged in filing cabinets in an organised and methodical manner. Inside the filing cabinets there was an index system that sorted the records in alphabetical order, so to reduce the time it would take an employee to find the required record. However, one thing that I did notice was that although the offices were tidy and all files were arranged methodically, they seemed quite cramped. The offices are quite small to begin with but this is exacerbated by the filing cabinets that take up a fair amount of space. I feel this poses some manoeuvrability issues for the staff members, as they have to be careful when walking around the offices as to not bump into things.

As time progressed though, the offices did get a little messier with all the paperwork. I also noticed that the filing cabinets were not regularly locked after use, probably for the convenience of not having to turn a key every time a record is required. This is a lazy oversight, as theoretically anyone could just dander into the office and look at their records! From my study of the staffs' working methods, I observed that they spend most of their time handling paperwork. I feel that without all this paperwork to do, they will either be free to perform more constructive tasks or may not have much of a job left!

Overall, the system is well-run, but it has its short-comings and limitations due to its manual nature. The system could be speedier, more accurate, more consistent, securer and more cost-effective if they were to implement a well-designed computerised system.

Details held in current system

In the current system, details are held about the customers, staff, vehicles, rentals and manufacturers in filing cabinets. The customer details are collected by an available staff

member when a person first wants to rent a vehicle. The details collected are Customer Name, Street Address, Town, County, Nationality, Sex, Postcode, Telephone Number, Mobile Phone Number and Date of Birth. The staff details are collected by the manager when a person first becomes a staff member. The details collected are Staff Name, Street Address, Town, County, Postcode, Telephone Number, Mobile Phone Number, Working Hours, Job Description and Date Employed.

The vehicle details are collected by the vehicle controller from the manufacturer when a new vehicle is ordered. These details are Model, Manufacturers Code, Registration Number, Current Mileage, Engine Size, Daily Rental Price and Class. The rental details are collected by an available staff member when a customer rents a vehicle. These details are Model, Customer, Date of Rental, Date to be Returned, Number of Days, Daily Rental Price and Price of Rental. The manufacturer details are collected by the vehicle controller when a vehicle is ordered from a new manufacturer. These details are just the Manufacturer's name and the telephone number of the contact within the manufacturer.

Details to be held in new system

The new system will mostly consist of the details held in the old system, with a few new helpful fields created in addition to one new file. From the interview with Fred, it has been decided that unique identification numbers will be assigned to each record in the Customer, Staff, Vehicle, Rental and Manufacturer files. The customer, staff and manufacturer files will also have an e-mail address field, because internet communication is becoming more widespread in recent years and that additional avenue of contact will be useful. The vehicle file will have a new availability field, so that the user will be able to monitor the rental status of that vehicle. This will be linked to the rental and returns files.

A new file will also be created for returns. This is so that returned vehicles can be taken into account by the system. This file will be linked to the rental and vehicle files, so that they can be kept-up-to-date regarding what vehicles have been returned. This new file will also enable overdue fees to be calculated automatically, as opposed to mentally.

Types of information to be extracted from the new system

Information that will be extracted from the new system include automatic calculations of the ages of both customers and employees, automatic calculation of the date a rental is due back as well as the total price of the rental, and overdue fees will be calculated automatically and exponentially, with an additional charge for the number of miles of travelled. Queries will be able to be performed on the system for things such as a list of vehicles due back on a certain day, a list of all overdue vehicles, the contact details of a particular customer, staff member or manufacturer contact and whatever else is considered during the design of the system.

Problem with Current System

After a careful analysis of the results from the interview with Fred, the direct observation performed in the offices and the study of the files and documents currently held by the current system, I have decided to create a computerised system for *Fred's Car Rentals*, which focuses specifically on the recording and manipulation of customer, vehicle, supplier, rental and possibly staff details for the car hire business. The data collected in my preliminary analysis reveals shortcomings in the system currently in use. In certain instances, information that should be easily accessible and readily apparent is not and wading through the filing system for records takes an unnecessary amount of time. The system is susceptible to inaccuracy and inconsistency stemming from human error and ambiguous hand-writing. The storage of a large volume of files in the offices takes up a lot of space, leading to restricted mobility for staff in the offices.

This information is of great importance to the business and so it should be held in a more efficient, accurate and consistent way. Holding information in such a system will lead to a better, speedier service and thus increased customer satisfaction as a consequence. This could attract more customers, and hence more money can be made.

I intend for the new system to be capable of archiving records, for both accounting and statistical purposes and so that they can be used by the manager for to identify trends.

Current User Activities

The staff that are involved with the current system are:

- The Manager
- Two Assistant Managers
- A Vehicle manager
- Three floor staff

The responsibilities of the manager (full-time) include:

- Dealing with new customers and helping them to fill out a form
- Issuing new customers with a rental card
- Recruiting new staff via interview and issues them with a staff form to complete
- Dealing with suppliers when they contact the business
- Maintaining an updated account of the rental status of all of the vehicles
- Writing letters to customers with overdue vehicles
- Updating rental prices for vehicles
- Taking telephone calls
- Ensuring back-ups are taken of new and amended records
- Ensuring that all details are up-to date
- Storing all of the information in the appropriate files
- File and record organisation

The responsibilities of the assistant managers (part-time) include:

- Dealing with customers renting out a vehicle
- Dealing with customers returning a vehicle
- Dealing with overdue customers
- Taking telephone calls
- Dealing with suppliers when they contact the business
- Ensuring back-up copies are taken of new and amended records
- Ensuring details are up-to-date

The responsibilities of the Vehicle manager (full-time) include:

- Dealing with vehicle suppliers when they contact the business
- Dealing with ordering new vehicles
- Dealing with the delivery of new stock
- Dealing with any delivery problems
- Dealing with ordering parts for the repair of vehicles
- Maintaining an updated account of all of the vehicles hired out
- Taking phone calls only on the condition that no managers are available
- Dealing with customers only on the condition that no managers are available

The responsibilities of the floor staff (part-time) include:

- Dealing with customers renting a vehicle
- Dealing with customers returning a vehicle
- Dealing with overdue customers
- Looking up the rental status of a particular vehicle to ascertain its availability
- Hiring mechanics for the maintenance and repair of the vehicles

Data Held

In the current system, details are held about the following:

- Customers
- Staff
- Vehicles
- Rentals
- Manufacturers

Data Sources

Customer Details come from the customers; a form used to record this information when they first join and it is either the manager or one of the assistant managers that collects this data depending on who is available at the time. Staff details come from the members of staff, a form is used to record this information upon their recruitment and it is the manger of the business that collects this information. The vehicle details come from the vehicle suppliers, and it is collected using a Vehicle form when a new vehicle is ordered and it is the vehicle manager that collects this data. Rental details come from the customers and they are recorded on a rental form when a customer makes a rental by an assistant manger or floor staff. The Supplier details come from the Suppliers and are recorded on a Supplier form when a vehicle is ordered from a new supplier by the Vehicle manager.

Data Structures

    All of the data in the current system is stored on forms, which are in separately labelled filing cabinets. Within each filing cabinet, the records are arranged according to an index system on the basis of some variable (such as alphabetical order or date) depending on what file it is. I will now give examples of the layout of these forms used to hold the data, with a brief annotation.

Customer Record
Customer Name: Street Address: Town: County: Nationality: Sex: Postcode: Telephone Number: Mobile Phone Number: Date of Birth

The customer records are stored in a locked filing cabinet with the clear label attached on the front, "Customer Records". The records are arranged alphabetically within the index system of the filing cabinet.

Staff Record
Staff Name: Street Address: Town: County: Postcode: Telephone Number: Mobile Phone Number: Working Hours: Job Description: Date Employed:

The staff records are stored in a locked filing cabinet labelled "Staff Records". The records are arranged alphabetically within the index system of the cabinet.

Vehicle Record
Model: Manufacturers Code: Registration Number: Current Mileage: Engine Size: Daily Rental Price Class:

The vehicle records are stored in a locked filing cabinet labelled "Vehicle Records". The records are arranged alphabetically within the index system of the cabinet.

```
Rental Record

Model:
Customer:
Date of Rental:
Date to be Returned:
Number of Days
Daily Rental Price
Price of Rental:
```
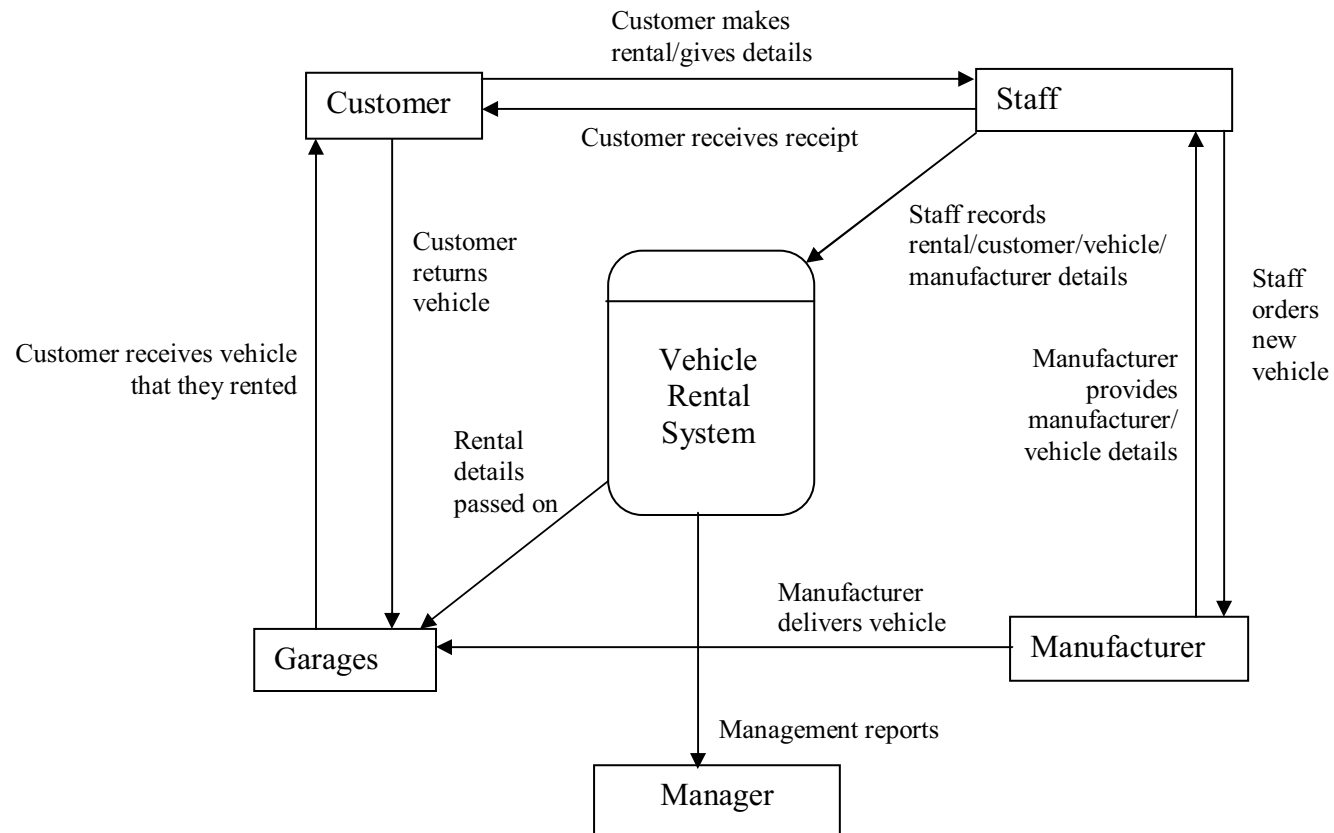
The rental records are stored in a locked filing cabinet labelled "Rental Records". The records are arranged by Date of Rental within the index system of the cabinet.
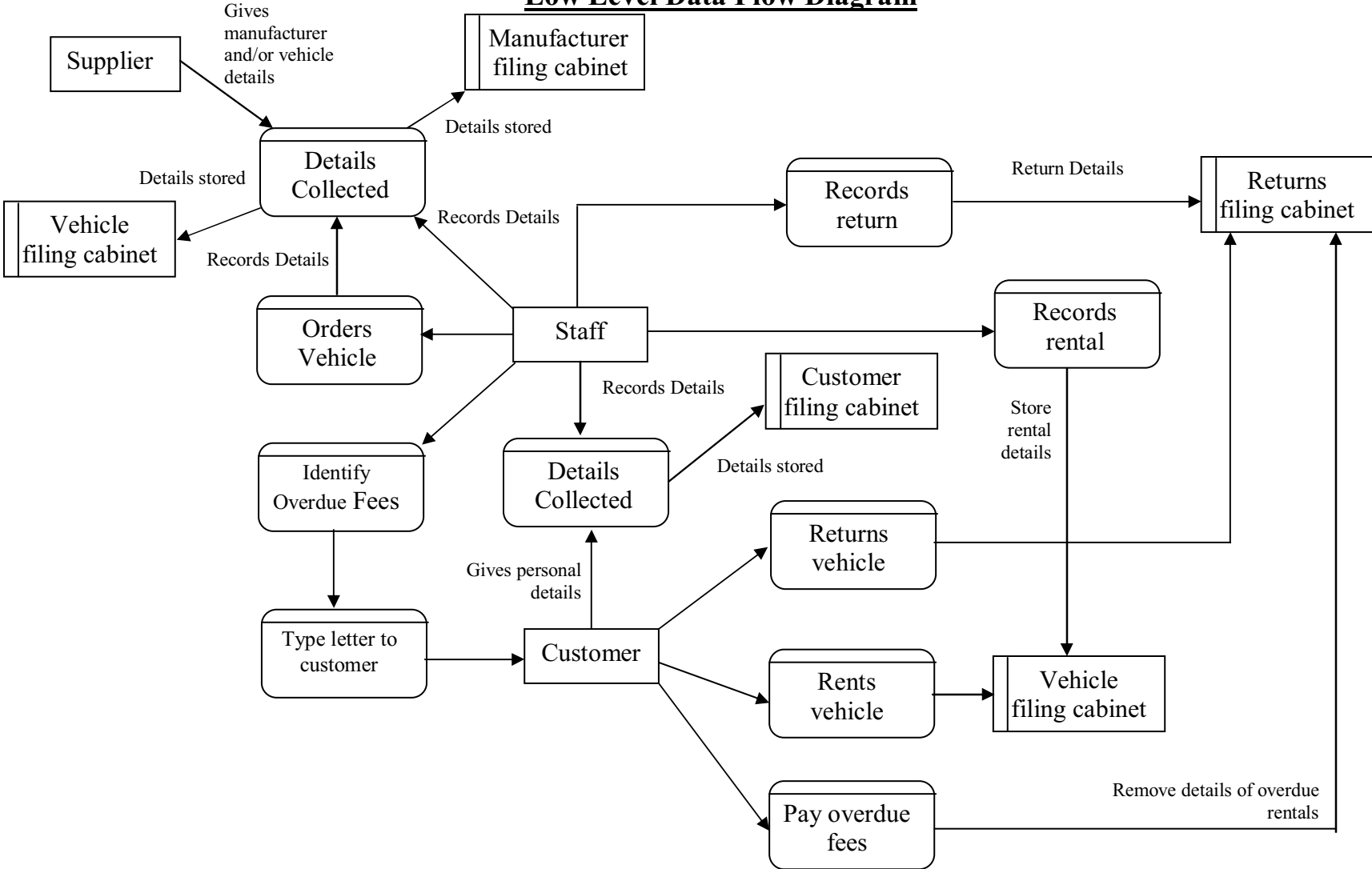
```
Manufacturer Record

Manufacturer Name:
Telephone Number of Contact:
```

The manufacturer records are stored in a locked filing cabinet labelled "Manufacturer Records". The records are arranged by alphabetical order within the index system of the cabinet.

High Level Data Flow Diagram

Customer makes
rental/gives details

Customer

Staff

Customer receives receipt

Staff records
rental/customer/vehicle/
manufacturer details

Customer
returns
vehicle

Staff
orders
new
vehicle

Customer receives vehicle
that they rented

Vehicle
Rental
System

Manufacturer
provides
manufacturer/
vehicle details

Rental
details
passed on

Manufacturer
delivers vehicle

Garages

Manufacturer

Management reports

Manager

Low Level Data Flow Diagram

Supplier — Gives manufacturer and/or vehicle details → **Details Collected**

Details Collected — Details stored → **Manufacturer filing cabinet**

Details Collected — Details stored → **Vehicle filing cabinet**

Orders Vehicle — Records Details → **Details Collected**

Staff — Records Details → **Details Collected**

Staff → **Orders Vehicle**

Staff — Records Details → **Details Collected**

Staff → **Identify Overdue Fees**

Staff → **Records rental**

Records return — Return Details → **Returns filing cabinet**

Details Collected — Details stored → **Customer filing cabinet**

Identify Overdue Fees → **Type letter to customer**

Type letter to customer → **Customer**

Customer — Gives personal details → **Details Collected**

Customer → **Returns vehicle**

Customer → **Rents vehicle**

Customer → **Pay overdue fees**

Returns vehicle → **Vehicle filing cabinet**

Rents vehicle → **Vehicle filing cabinet**

Records rental — Store rental details → **Returns filing cabinet**

Pay overdue fees — Remove details of overdue rentals → **Returns filing cabinet**

23

Problems/Inefficiencies with the Current System

The results of the preliminary analysis of Fred's Car Rentals current system have revealed some flaws and problems with the current system that leave much room for improvement. These problems include:

- *Illegible handwriting*: - The current system stores all details on paper forms that are arranged in separate files. Due to the different writing styles of the staff and the haste with which employees sometimes transcribe the data to paper, the data contained on the forms can be hard to read. This can lead to incorrect readings of the data, and thus incorrect decisions being made as a consequence, as Fred's anecdote regarding the telephone illustrates. In a computerised system, data is stored in a uniform, universal textual style of great clarity, perfectly comprehensible for any reader of the English language.

- *Time-efficiency*: - As details are stored in a filing cabinet, it takes an unnecessarily long amount of time to retrieve the required document from a file, due to the time it takes flicking through the other documents. Granted, the filing system is arranged methodically according to an index system, but this still involves opening the cabinet and manually searching. This can take upwards of ten seconds each time, which may not sound like a lot but if we feed this into the equation $10*n*365$, n being the number of times a record is searched for every day, we discover that large numbers of hours are wasted per year simply searching for records! In a computerised system, a competent typist would be capable of locating a record in a few seconds

- *Problematic Back-up system*: - All the back-ups are currently stored as photocopies in separate filings cabinets within the office. One reason why this is a problem is that it takes up a lot of space in the small office, which seem quite cramped as a result. Another reason is that because the back-up files are stored internally, if the offices were to go on fire, then both the original and the back-up copies would be burnt. Lastly, backing-up all of the data with photocopies is just plain wasteful of paper and ink. In a computerised system, back-ups would be stored electronically on a memory stick, USB pen or on a separate computer at the manager's home. This would make the office more spacious, storing the data electronically external to the office would mean that all the data would not be lost in the event of a fire and no paper or ink would need to be wasted.

- *Office Space*: - As mentioned above, office space is truly at a premium. I actually believe it to pose a health and safety issue for the members of staff navigating the offices on a daily basis. In a computerised system, all of the data would be stored inside the memory of a computer, which is obviously takes up a very small amount of physical space in comparison the huge, hulking filing cabinets currently in use. This would free up a large amount of office space, relative to the size of the offices.

- *Low level of File Security*: - It would appear that the staff has the security all under control. After all, there are locks on the filing cabinets containing the data. However, a careful analysis of the staffs working methods reveals that the filing cabinets are not regularly locked after their use. They appear to be left unlocked throughout the day, probably so the staff does not need to waste the time turning a key every time they need a record. However, this means that theoretically anyone could just walk in and help themselves to the company's data. Furthermore, in the event of a break-in, a criminal with appropriate tools would not have much of a problem breaking through a flimsily locked filing-cabinet. However, with a computerised system, the criminal would have to guess a password and username, which, whilst there are ways it can be done, is significantly more difficult than smashing a lock.

- *Inaccurate Data*: - For a multitude of reasons (many of which are mentioned above) data in this system can be inaccurate. One reason that data can be inaccurate is due to plain human error. Although we have come along leaps and bounds since our tree swinging days, and achieved so much collectively as a species; the human animal is fundamentally flawed as an information processor. This is because we make mistakes, varying in folly and severity, on a regular basis. Mistakes such as transcription errors, or the misreading or mishearing of information when recording data lead to inaccurate data being entered into the system. In a computerised system, these mistakes can be minimised using data validation methods that narrow the field of acceptable data that can be entered into the system.

- *Inconsistent and Redundant Data*: - Data in the current system can be inconsistent and redundant, because the same data may have been entered into the system more than once. In a computerised relational database system, data has only to be entered once and then linked to the other entities via relationships between the files.

End-User Requirements

During the interview with Fred, and my hours of observing the working environment of *Fred's Car Rentals*, a number of user requirements have been identified, which I shall now list below. The system must:

UR1: enable manufacturer details to be added/edited/deleted/ displayed onscreen/printed;
UR2: enable staff details to be added/edited/deleted/ displayed onscreen/printed;
UR3: enable the return date of the rental to be calculated automatically;
UR4: enable rental details to be added/edited/deleted/ displayed onscreen/printed;
UR5: enable customer details to be added/edited/deleted/ displayed onscreen/printed;
UR6: enable returns details to be added/edited/deleted/displayed onscreen/printed;
UR7: enable old customer information to be moved to an archive file;
UR8: enable old rental details to be moved to an archive file;
UR9: enable old staff details to be moved to an archive file;
UR10: enable the total price of vehicle rental to be calculated automatically;
UR11: enable vehicle details to be added/edited/deleted/ displayed onscreen/printed;
UR12: enable the age of a customer to be calculated automatically, taking miles travelled into account;
UR13: enable the age of a staff member to be calculated automatically;
UR14: enable overdue fees to be calculated automatically, exponential to the number of days overdue;
UR15: display/print a list of vehicles on rental;
UR16: display/print a list of all vehicles to be returned that day;
UR17: display/print a list of all overdue vehicles;
UR18: display/print a list of customers' contact details;
UR19: enable user to search for a particular customer's details;
UR20: enable user to search for vehicle details;
UR21: enable user to search for a particular manufacturer's details;
UR22: enable the above user requirements UR15-18 to be displayed onscreen or printed;
UR23: enable user to create a letter to be used via the mail merge function;
UR24: allow customer details to be mail merged into a letter;
UR25: be user-friendly;
UR26: be menu-driven;
UR27: increase the amount of office space by reducing the amount of storage space required;
UR28: reduce data duplication;
UR29: increase the level of security;
UR30: comply with the Data Protection Act 1998;
UR31: have a user guide for the instruction of users on how to use the system;
UR32: hold data of a high level of accuracy by using data validation methods;
UR33: be speedier than the previous system;
UR34: use a password system for security;
UR35: be easy to understand for the user.
UR36: be able to back-up data
UR37: have a disaster recovery plan management strategy

Information Requirements

In addition to the end-user requirements, I have also been able to discern the information that the new system will hold and use.

Customer Details

The following details are going to be held in the customer file:

- Customer ID
- Forename
- Surname
- Street Address
- Town
- County
- Nationality
- Sex
- Postcode
- Telephone Number
- Mobile Number
- E-mail Address
- Date of Birth
- Age
- Date of Membership
- Date of last Rental
- Anything else I feel is necessary as I design the system

These details will be collected from a new customer when they first want to rent out a vehicle. The new customer will be given a form to fill in, and this completed form will be collected by a member of staff who will then input the details into the computer system at a convenient time that day.

In the interview, Fred made clear that he wanted a unique customer identification number assigned to each customer. This Customer ID is going to consist of the first three letters of the customers surname followed by three random digits. The customer's age will be calculated automatically by the system by using the customers Date of Birth field and subtracting it from today's date. The date at which the customer last rented a vehicle is include so that customer's that have been inactive for a long time can be archived to a customer file containing records of currently inactive past members.

The Customer Details file will be used in searches such as locating a specific customer's phone number, the date they last made a rental to determine whether their record should be archived or their address and postcode in order to send them a letter if they have overdue items or for the sending of promotional material. These details will also be provided to the police in the event of a customer not returning a vehicle.

Staff Details

The following details are going to be held in the staff table:

- Staff ID
- Forename
- Surname
- Street Address
- Town
- County
- Postcode
- Telephone Number
- Mobile Number
- E-mail Address
- Date of Birth
- Age
- Working Hours (part-time or full-time)
- Job title
- Job description
- Employment began
- Employment terminated
- Anything else I feel is necessary as I design the system

These details will be collected from a new staff member when they are recruited. They are given a form to fill in by the manager and it is the manager who collects the form. The manager, and only the manager, then enters these details into the computer system later that day at a suitable time.

Fred made it clear in the interview that he would like a unique staff identification number assigned to each employee. This staff ID number will consist of the first three letters of the employee's surname followed by three random digits. The customer's age will be calculated automatically by the system by using the customers Date of Birth field and subtracting it from today's date. An employment terminated field is to be included so that a record is made and kept of past employees in an archive file. When this field is filled out, the staff member's record can be moved to an archive file containing details of past employees and deleted from the current system.

The staff details file will be used in searches such as locating a specific staff member's telephone number in the event of them not turning up for work, the date their employment terminated so that their record can be moved to an archive file.

Vehicle Details

The following details will be held in the vehicle table:

- Vehicle ID
- Model
- Manufacturers Code
- Registration Number
- Current Mileage
- Daily Rental Price
- Class
- Colour
- Availability
- Anything else I feel is necessary as I design the system

These details will recorded by the vehicle controller onto a form, either copied from a vehicle specification document issued by the manufacturer or from a telephone call with the business's contact within the manufacturer.

In my interview with the manager, he specified that he would like a unique vehicle identification number assigned to each vehicle in the system. This vehicle ID number will consist of the first two letters of the vehicle's manufacturer, followed by the first two letters of the vehicle model and ending in two random digits.

The vehicle details file will prove very useful in the event of a non-return. The vehicles model, Registration Number and colour will be provided to the police in the event of a customer not returning their vehicle, enabling the authorities to track down that particular automobile. Also, staff will be able to search this file for the availability of a certain vehicle for a customer by looking at the availability field to check if the vehicle in question is currently out on rental or undergoing repairs.

Manufacturer Details

The following details will be held in the manufacturers table:

- Manufacturer Code
- Manufacturer Name
- Name of Contact
- Contact Telephone Number
- Contact Mobile Number
- Contact E-mail Address
- Manufacturer Description
- Anything else I feel is necessary as I design the system

These details are recorded by the vehicle controller onto a form. Manufacturer details will be collected when ordering a vehicle from a new manufacturer or before ordering a vehicle from a new manufacturer. They will be recorded by the vehicle controller from a telephone call with an industry contact.

Fred made it clear that he would like each manufacturer to be assigned its own unique manufacturer code. The manufacturer code will consist of the first three letters of the manufacturers name followed by two random digits. The manufacturer details file will be used in searches by the vehicle controller to obtain the contact details of the contact person within that manufacturer so that an order can be made for a new vehicle from that particular manufacturer.

Rental Details

The following details will be held in the rentals table:

- Rental ID
- Customer ID
- Vehicle ID
- Model
- Daily Rental Price
- Date Rented Out
- Number of Days
- Date Due Back
- Total rental price
- Anything else I feel is necessary as I design the system

These details will be recorded by an available staff member when a customer rents out a vehicle. The member of staff will record these details on a form, and then entered into the computer system either directly following this recording of data or at a later more suitable time that day. They could also just enter the data into the system when the rental is made, if a computer is available.

During the interview, Fred specified that he would like a unique rental identification number assigned to each rental. This number will consist of the first three digits of the customer's surname, followed by the first three digits of the vehicles model and ending in that days date. For example, if a customer of the name Bill Wilson rented out a Renault Clio on the 17th of October 2007, the rental number would be WILCLI171007.

The date due back will be calculated automatically by the system, by using a formula that will add the number of days to the date of the rental. The total rental price will also be calculated automatically by the system by utilizing a formula that will multiply the daily rental price by the number of days the vehicle is to be rented out for.

When the vehicle is returned the rental record will be archived to a separate rental archive file that holds records of all past rentals, and the record will be deleted from the current system. Such archived records will be useful for the manager to analyse trends in the business, and for producing end of year statistics.

<u>Returns Details</u>

The following information will be held on video returns:

- Rental ID
- Customer ID
- Vehicle ID
- Vehicle Name
- Date to be Returned
- Actual Date Returned
- Daily Rental Rate
- Overdue Fee Charged
- Anything else I feel is necessary as I design the system

These details will be recorded by an available staff member when a customer returns their vehicle. The staff member will enter the data into the system as soon as a vehicle is returned. If there are any overdue fees to be charged, this will be calculated and displayed by the system immediately. The employee can then request the overdue fee (if applicable) from the customer returning their vehicle.

During my observation of *Fred's Car Rentals*, one thing I noticed was that all the overdue fees are calculated manually by the employees. The calculation of overdue fees manually by the employees means that there is room for human error to raise its ugly head. This was also a topic breached upon during my interview with Fred, and he agreed that he would like overdue fees to be calculated automatically by the new system.

The overdue fees will be calculated by the system by subtracting the date the vehicle is returned from the date it was supposed to be returned, and then multiplying this number by the sum of the daily rental rate multiplied by 1.25.

Why ICT Provides a Suitable Solution

A business is simply an organisational entity and with the aim of selling goods or services to consumers in order to generate profit. The degree of this profit margin is the factor that determines whether a business is successful or not, so obviously any step a business can take to increase this profit margin is a step worth taking. The implementation of an ICT system is one of these obvious steps a business can take to increase their profit margins. There are many reasons why ICT systems confer such an advantage to organisations that are willing to implement them, and these reasons include:

- *Increased Security*: - Data held within a well-designed ICT system is more secure than data held using traditional methods. Standard physical locks can be broken easily by any criminal with the appropriate tools. Such locks can be picked open, smashed into pieces or cut in two by any criminal that carries a simple tool box. If such a criminal were to break into the offices of a business who stored their data in locked filing cabinets, like in Fred's Car Rentals, the data would be theirs for the taking. To break into a computer system, however, would require the criminal to enter a correct password and username, which is much more difficult. Whilst there are ways in which computer hackers can break into systems, it requires much more from the criminal than simply bludgeoning a lock with a hammer. The digital age requires a smarter breed of criminal. The more secure data is within a system, the more money that is saved from not having data stolen. Different access rights can also be assigned to employees within an organisation of a hierarchal structure. This means that only data appropriate to an employee's role in the business is accessible by them.

- *Increased storage capacity*: - The hard disk of a computer can store an incredible amount of data in such a small volume of space. One could fill many standard offices top to bottom, wall to wall, with paper documents and the amount of information stored on these documents still wouldn't come close to the amount of information that can be stored on a hard drive inside a computer. The great advantage of this is that the amount of space occupied within the offices of a business by paper files, records and books is drastically reduced.

- *Increased Accuracy*: - The data contained with an ICT system is much more accurate than data held in traditional paper-based systems. In paper-based information systems, there is nothing to prevent a human making a mistake when recording data, or performing mental calculations. In a computerised system, there are data validation methods in place to minimise the likelihood of incorrect data being entered into the system by imposing strict parameters on what data is acceptable for the field. In regards to arithmetic calculations, computers are 100% correct 100% of the time. This is not true for humans. Much time and money is saved by this increased accuracy of data, as the accuracy of the data within a system determines the quality of all subsequent business decisions made from it.

- *Speed of Processing*: - The speed at which a computer processes data is incredible in comparison to the speed at which humans process sensory input from their environment. For all but the most lengthy and arduous of tasks, the response time of a computer can be viewed as virtually instantaneous. For instance, an employee searching for a particular record within a traditional paper-based system will have to flick through all the records contained within the book or file before they locate the desired record. On the other hand, a computer can locate a record contained within the system in a manner of nanoseconds. The speed and expediency in which data is transmitted and processed within a computerised system saves much time and therefore money for the organisation.

- *Manipulation of Data*: - The manipulation of data within a paper-based system requires the record to first be located. The data contained within the field to be amended must then be deleted by either crossing out the data with a pen or using tip ex to cover it up. The new data is then transcribed to the record beside the crossed old data or over the tip ex. Alternatively, the record that needs amending will be written up again so the amended record won't look messy. Both these methods are wasteful and inefficient. In a computerised system, the required record can be located instantaneously and altered easily by clicking on the required field, deleting the obsolete data and entering the up-to-date data. There is no trace of the obsolete field at all. When a record has to be deleted within a paper-based system, the record needs to be located, removed from the file and binned. In an ICT-based system, that record can be located instantaneously and deleted via clicking on the delete button. Hence, an ICT based system is much more efficient at manipulating data held within a system.

- *Improved Communication*: - The implementation of a computerised system within a business can improve the level of both business-to-customer and business-to-supplier communication. Mail-merged letters can be sent to all the customers who have overdue items or for promotional purposes, as well as e-mails. These promotional letters and e-mails will keep the customer well-informed about any special offers in the shop and thus will increase the level of customer service. In turn, suppliers will be able to send e-mails to the business informing them of any new items of stock that they may be interested in ordering.

- *Improved Company Image*: - The above advantages may also have the knock-on effect of improving the company's image, due to the increased levels of customer service afforded by improved communication with the customer.

Data Dynamics

Within the dynamic world of the modern-day business environment, the needs of the shop, customers, and manufacturers are continuously changing due to a multitude of factors. As such, it is very important that the business keeps track of these changes and amends existing data structures and records as appropriate.

There are many instances in which details held by the system will have to be amended. If a customer or a member of staff moves house, for instance, their street address, postcode and telephone number fields will have to be amended, as may their town and county fields. Also, if a female customer or employee gets married, their Surname field may have to be amended along with their customer or staff identification numbers. Other instances in which existing data will have to be altered is if an employee or customer purchases a new mobile phone (the mobile number field will require updating) or gets a new e-mail address (the e-mail address field will have to be amended), and if an employee gets promoted or demoted to a different job in the shop, in which case the job title, job description and perhaps the working hours fields will need updating.

With regards to vehicles within the system, their availability will constantly be changing so this must be recorded in the availability field, and they will always be constantly accumulating more mileage as they are rented out, so this will have to be recorded in the Current Mileage field upon the return of a vehicle. In relation to the manufacturers of the vehicles, if the contact person within a manufacturer changes telephone number, mobile number or e-mail address, this will also have to be updated.

The information held by the proposed system must be updated regularly, or risk breaching the Data Protection Act 1998, which would be very expensive for *Fred's Car Rentals*.

System Requirements

The following is a list of what will be required of the proposed system:

1. Onscreen form for storing manufacturer details;
2. Onscreen form for storing rental details;
3. Onscreen form for storing returns details;
4. Onscreen form for storing customer details;
5. Onscreen form for storing staff details;
6. Onscreen form for storing vehicle details;
7. Archive form for customer details;
8. Archive form for staff details;
9. Archive form for rental details;
10. Age of customer calculated automatically;
11. Age of staff member calculated automatically;
12. The total price of the rental will be calculated automatically;
13. The return date of the rental will be calculated automatically;
14. Overdue fees will be calculated automatically, and exponential to the number of days overdue;
15. List of vehicles due back on a particular day displayed onscreen/printed;
16. List of vehicles currently rented out displayed onscreen/printed;
17. List of overdue rentals displayed onscreen/printed;
18. List of all vehicles of a particular class displayed onscreen/printed;
19. Details of particular customer displayed onscreen;
20. Details of particular vehicle displayed onscreen;
21. Details of a particular manufacturer displayed onscreen;
22. Customers file updated along with date of last rental;
23. Miles travelled in vehicle by customer during rental calculated automatically;
24. Miles travelled in vehicle by customer during rental to be taken into account when calculating total price

1. Onscreen form for storing manufacturer details

Inputs: - All of the manufacturers details. Manufacturer Code, Manufacturer Name, Name of Contact, Contact Telephone Number, Contact Mobile Number, Contact E-mail Address, Manufacturer Description.

Data collection: - The manufacturer details will be collected from the manufacturer when the business wants to order a vehicle from a manufacturer for the first time. The vehicle controller will collect these details from the manufacturer over the phone or else the details will be sent to the business via mail or e-mail. These details are then entered into the system by the vehicle controller.

Processes: - The original creation of the onscreen form and the entering of a manufacturer's details into the system.

2. Onscreen form for storing rental details

Inputs: - All of the rental details. Rental ID, Customer ID, Vehicle ID, Model, Daily Rental Price, Date Rented Out, Number of Days, Date Due Back, Total rental price.

Data Collection: - These details are collected from the customer when they rent a vehicle, by an available member of staff, and then entered into the system.

Processes: - The original creation of the onscreen form and the entering of the rental details into the system.

3. Onscreen form for storing returns details

Inputs: - All of the returns details. Rental ID, Customer ID, Vehicle ID, Vehicle Name, Date to be Returned, Actual Date Returned, Daily Rental Rate, Overdue Fee Charged.

Data Collection: - These details are collected from the customer when they return a vehicle, by an available member of staff, and then entered into the system.

Processes: - The original creation of the onscreen form and the entering of returns details into the system.

4. Onscreen form for storing customer details

Inputs: - All of the customer details. Customer ID, Forename, Surname, Street Address, Town, County, Nationality, Sex, Postcode, Telephone Number, Mobile Number, E-mail Address, Date of Birth, Age, Date of Membership, Date of last Rental

Data Collection: - The customer's details will be collected from the customer when they want to rent their first vehicle. An available staff member will give them a form to fill in, and this information will then be transferred onto the system either right away or at a later, more suitable time. Some of the fields, such as the age field, will be obtained by the computer by performing calculations on the other values entered into the system.

Processes: - The original creation of the onscreen form and the entering of a customer's details into the system.

5. Onscreen form for storing staff details

Inputs: - All of the staff details. Staff ID, Forename, Surname, Street Address, Town, County, Postcode, Telephone Number, Mobile Number, E-mail Address, Date of Birth, Age, Working Hours, Job title, Job description, Employment began, Employment terminated.

Data Collection: - The staff member's details will be collected from them when they are recruited. Fred, the manager, will give them a form to fill in, and this information will then be transferred to the system by the manager. Some of the fields, such as the age field, will be obtained by the computer by performing calculations on the other values entered into the system.

Processes: - The original creation of the onscreen form and the entering of the staff member's details into the system.

6. Onscreen form for storing vehicle details

Inputs: - All of the vehicle details. Vehicle ID, Model, Manufacturers Code, Registration Number, Current Mileage, Daily Rental Price, Class, Colour, Availability.

Data Collection: - The vehicle details will be collected from the vehicles manufacturer when a new vehicle is ordered. The vehicle controller will collect these details from a contact within the manufacturer over the phone or else the details will be sent to the business via mail or e-mail. Either way, these details are then entered into the system by the vehicle controller.

Processes: - The original creation of the onscreen form and the entering of a vehicle's details into the system.

7. Archive form for customer details

Inputs: - Any customer records over ten years old

Data Collection: The data is automatically placed into an archive customer file whenever a customer does not rent out a vehicle for ten years.

Processes: - Any records of customers that have been inactive for ten years will automatically be placed into customer archive file

8. Archive form for staff details

Inputs: - Any staff record

Data Collection: The data is automatically placed into an archive staff file when a member of staff is sacked or resigns.

Processes: Any records of a staff member whose employment is terminated will automatically be placed into the staff archive file.

9. Archive form for rentals

Inputs: - Any rental record of vehicle rentals

Data Collection: - The data is placed into a rental archive file when a vehicle rental has been returned to the shop and overdue fees have been charged.

Processes: - All records of returned rentals will be placed into the rental archive file automatically file automatically.

10. Age of customer calculated automatically

Inputs: - Date of Birth, today's date.

Data Collection: - Date of birth is collected from the customer when they join and today's date is obtained from the computer's internal clock.

Processes: - The computer uses a formula to calculate the age of the customer. This formula will be something along the lines of today's date minus the customer's date of birth.

11. Age of staff calculated automatically

Inputs: - Date of Birth, today's date.

Data Collection: - Date of Birth is collected by the manager when a new person joins the staff. Today's date is obtained from the computer's internal clock.

Processes: - The computer uses a formula to calculate the age of the employee. This formula will be something along the lines of today's date minus the employee's date of birth.

12. The total price of the rental will be calculated automatically

Inputs: - Number of Days, Daily rental price.

Data Collection: - The number of days that the vehicle will be rented for will be specified by the customer when they make a rental. The daily rental price is obtained from the vehicle file, and all of these daily rental prices have been entered by the manager who decides what they should be.

Processes: - The computer uses a formula to calculate the total rental price. This formula will consist of the number of days the vehicle is to be rented for multiplied by the daily rental price.

13. The return date of the rental will be calculated automatically

Inputs: - Date Rented Out, Number of Days.

Data Collection: - The date that a vehicle has been rented out is recorded whenever a customer makes a rental, along with the number of days the vehicle is to be rented for.

Processes: - The computer uses a formula to calculate the return date of the rental. This formula will consist of the Date Rented Out added to the Number of Days.

14. Overdue fees will be calculated automatically, and exponential to the number of days overdue the vehicle is

Inputs: - Date to be Returned, Actual Date Returned, Daily Rental Rate.

Data Collection: The date a vehicle is to be returned is obtained via the calculation in the above system requirement 13. The actual date returned is collected by staff when a customer returns their rented vehicle. Daily rental rate is collected from the vehicle file, and these rental rates are decided by the manager.

Processes: - The system will use a formula to calculate the overdue fees required from the customer, exponentially to the number of days overdue. This formula can be summed up nicely in the notation $(D - B)^2 * R$. D in this formula refers to the Actual Date returned, B refers to the Date to be Returned and R refers to the Daily Rental rate of the vehicle. The reason why (D-B) is squared is so that the longer overdue a vehicle is, the more severe the overdue fee will be.

15. List of vehicles due back on a particular day displayed onscreen/printed

Inputs: - Vehicle ID, Model, Manufacturers Code, Registration Number, Current Mileage, Daily Rental Price, Class, Colour, Date to be Returned.

Data Collection: - All of the details, asides from Date to be Returned, are collected from the vehicle manufacturer by the vehicle controller when a new vehicle is ordered. Date to be returned is obtained via the calculation outlined in system requirement 13.

Processes: - A query will be performed in which all of the vehicles on rental are displayed on the condition that Date to be Returned = Today's Date.

16. List of vehicles currently rented out displayed onscreen/printed

Inputs: - Vehicle ID, Model, Manufacturers Code, Registration Number, Current Mileage, Daily Rental Price, Class, Colour, Date to be Returned

Data Collection: - All of the details, asides from Date to be Returned, are collected from the vehicle manufacturer by the vehicle controller when a new vehicle is ordered. Date to be returned is obtained via the calculation outlined in system requirement 13.

Processes: - A query will be performed in which all of the current rental records are displayed

17. List of overdue Rentals displayed onscreen/printed

Inputs: - Rental ID, Customer ID, Vehicle ID, Model, Daily Rental Price, Date Rented Out, Number of Days, Date Due Back, Total rental price.

Data Collection: - These details are collected from the customer when they rent a vehicle, by an available member of staff, and then entered into the system.

Processes: - A query will be performed displaying all of the overdue items. All rentals will be displayed in which Today's Date > Date Due Back.

18. List of all vehicles of a particular class displayed onscreen/printed

Inputs: - Vehicle ID, Model, Manufacturers Code, Registration Number, Current Mileage, Daily Rental Price, Class, Colour, Availability.

Data collection: - The vehicle details will be collected from the vehicles manufacturer when a new vehicle is ordered. The vehicle controller will collect these details from a contact within the manufacturer over the phone or else the details will be sent to the business via mail or e-mail. Either way, these details are then entered into the system by the vehicle controller. The data to be searched for in the query is entered in by an available staff member, although the data being searched for is determined by the customer.

Processes: - A query is performed by the user, in which they type in a particular class of vehicle, and all vehicles of that class are then displayed onscreen and can be printed if desired.

19. Details of a particular customer are displayed onscreen

Inputs: - Customer ID, Forename, Surname, Street Address, Town, County, Nationality, Sex, Postcode, Telephone Number, Mobile Number, E-mail Address, Date of Birth, Age, Date of Membership, Date of last Rental.

Data collection: - The customer's details will be collected from the customer when they want to rent their first vehicle. An available staff member will give them a form to fill in, and this information will then be transferred onto the system either right away or at a later, more suitable time. The Customer ID or name entered into the query is determined by the staff member operating the system at that time.

Processes: - The staff member enters a Customer ID or name into the system, and a query is performed in which the customer's record with that particular ID or name will be displayed onscreen.

20. Details of a particular vehicle displayed onscreen

Inputs: - Vehicle ID, Model, Manufacturers Code, Registration Number, Current Mileage, Daily Rental Price, Class, Colour, Availability.

Data Collection: - The vehicle details will be collected from the vehicles manufacturer when a new vehicle is ordered. The vehicle controller will collect these details from a contact within the manufacturer over the phone or else the details will be sent to the business via mail or e-mail. Either way, these details are then entered into the system by the vehicle controller. The Vehicle ID or model entered into the query is determined by the staff member operating the system at that time.

Processes: - The staff member types a particular Vehicle ID or model into the system, and a query is performed in which the record of the vehicle of that particular ID or model is displayed onscreen.

21. Details of a particular manufacturer displayed onscreen

Inputs: - Manufacturer Code, Manufacturer Name, Name of Contact, Contact Telephone Number, Contact Mobile Number, Contact E-mail Address, Manufacturer Description.

Data Collection: - The manufacturer details will be collected from the manufacturer when the business wants to order a vehicle from a manufacturer for the first time. The vehicle controller will collect these details from the manufacturer over the phone or else the details will be sent to the business via mail or e-mail. These details are then entered into the system by the vehicle controller. The Manufacturer Code or name typed into the query is determined by the staff member operating the system at that time.

Processes: - The staff member types a particular manufacturer code or name into the system and a query is performed in which the record of the manufacturers of that particular code or name is displayed onscreen.

22. Customers file updated with date of last rental

Input: - Date of Last Rental

Data Collection: - This date is entered when a customer makes a rental.

Processes: A method will be utilized that will duplicate the Date of Last Rental into the customer file.

23. <u>Miles travelled in vehicle by customer during rental to be calculated automatically</u>

Inputs: - Mileage Upon Return, Mileage

Data Collection: – Mileage is measured by vehicle controller upon the vehicle being returned to the store.

Processes: – A formula will be used to calculate miles travelled during the last rental by subtracting Mileage from Mileage Upon Return.

24. <u>Miles travelled in vehicle by customer during rental to be taken into account when calculating total price</u>

Inputs: - Miles travelled

Data collection: - This input is calculated in the formula outlined in the previous system requirement.

Processes: - A formula will be used that will multiply each mile travelled by a fixed price in order to charge a monetary value per mile the customer has travelled during their last rental.

Performance Criteria

I shall now set out a list of objectives that will be used to evaluate the system when it is completed. These will be separated into quantitative and qualitative objectives.

Quantitative Objectives

- System will hold details of customers;
- A new customer can be entered into the system in less than 2 minutes;
- Customer records can be located in less than 10 seconds;
- System will automatically identify customers to be archived;
- Customer records can be located and amended in less than 1 minute;
- Customer records can be located and deleted in less than 30 seconds;
- The age field will be automatically calculated from the Date of Birth field and today's date;
- The customer file will be automatically updated with the date of last rental;

- System will hold details of staff members;
- A new staff member can be entered into the system in less than 2 minutes;
- Staff records can be located in less than ten seconds;
- System will automatically identify staff records to be archived;
- Staff records can be located and amended in less than 1 minute;
- Staff records can be located and deleted in less than 30 seconds;
- The age field will be automatically calculated from the Date of Birth field and today's date;

- System will hold details of vehicles
- A new vehicle can be entered into the system in less than 2 minutes;
- Vehicle records can be located in less than 10 seconds;
- Vehicle records can be located and amended in less than 1 minute;
- Vehicle records can be located and deleted in less than 30 seconds;
- The availability field will be automatically updated from data from the returns file when a vehicle is returned

- System will hold manufacturer details
- A new manufacturer can be entered into the system in less than 2 minutes;
- Manufacturer records can be located in less than 10 seconds;
- Manufacturer records can be located and amended in less than 1 minute;
- Manufacturer records can be located and deleted in less than 30 seconds;

- System will hold rental details;
- A new rental can be entered into the system in less than 2 minutes;
- Rental records can be located in less than 10 seconds;
- System will automatically archive rental records when a rental is returned;

- Rental records can be located and amended in less than 1 minute;
- Rental records can be located and deleted in less than 30 seconds;
- Date to be returned will be calculated automatically from the fields Number of Nights and Date of Rental;
- Total price of the rental will be calculated automatically from the fields Number of Nights and Daily Rental rate, taking into account the miles travelled by the customer;

- System will hold returns details;
- A returned vehicle can be entered into the system in less than 2 minutes
- Return records can be located and amended in less than 1 minute;
- Return records can be located and deleted in less than 30 seconds;
- Overdue fees will be calculated automatically, from the fields Date to be returned, Actual Date Returned and Daily Rental Rate, exponential to the number of days overdue the vehicle is.

<u>Qualitative Objectives</u>

- System will be more efficient than previous system;
- System will be user-friendly;
- System will be more secure;
- System will have a better back-up system;
- Errors within the system will be reduced;
- System will occupy less space in the shop;
- More effective and speedier searching for data;
- Less redundant data;
- More cost-effective;

Differences and Similarities between Current System and Proposed ICT Solution

I will now outline some of the differences and similarities between the current system and the proposed solution.

- *The recording of information*: - In the current system, all of the information is recorded to paper based forms. In the proposed system all of the information will be recorded to onscreen forms. Both systems involve recording information to forms, however, the nature of the forms differ. In the current system, there is nothing in place to minimise any errors made by the member of staff entering the data onto the paper. Due to the computerised nature of the proposed system, there will be data validation methods in place to minimise data entry errors by having strictly defined parameters in place to determine whether the data entered is acceptable or not.

- *The modification of information*: - In the current system, if a record has to be modified, it must first be located in the appropriate filing cabinet, then the data that needs amending is crossed out using a pen or blotted over using correctional fluid before the new data is to be put in. In the proposed system, if a record has to be modified, it is located on the computerised database and then the data in the field to be amended is deleted and the new data entered.

- *Erasing Information*: - In the current system, if a record is to be deleted, it is first located by the staff member, withdrawn from the file and placed in the bin. In the proposed system, the record is located in the computerised database and the user clicks a "Delete" button, which removes that record from the system.

- *Information storage*: - In the current system, all of the records are held in filing cabinets, arranged methodically according to an index system. In the proposed system, the records are stored and arranged within a computerised relational database within the hard drive of a computer.

- *Queries*: - In the current system, if a member of staff had to find something like all the vehicles due back that day, or a list of all overdue items, they would have to manually sift through all of the records contained within the files to discern that information. In the proposed system, queries can be performed in all of that information can be displayed onscreen instantaneously and printed at the touch of a button.

- *Archiving records*: - In the current system, old records that are to be kept are manually moved into an archive file. In the proposed system, records are automatically archived if they data contained within them meets certain conditions.

- *Data Back-Up*: - In the current system, data is backed-up by photocopying the data once a week and these photocopies are moved to separate back-up data filing cabinets in the offices. In the new system, data will be backed-up electronically using a data stick or a CD-ROM stored externally to the offices.

- *Security*: - In the current system, all the filing cabinets that store the data are to be locked when they are not in use. The offices are also locked when not in use. In the proposed system, data held within the database will be protected by a username and password system. The offices will still be locked when not in use.

Consideration of Staff Training

From the interview with Fred regarding the ICT skills of the staff members, I have found out that he has considerable experience working with computerised systems in the past. The other members have less experience with ICT than the manager, but they do have a rudimentary understanding of how computer systems work. This level of knowledge should be enough to enable them to be taught how to operate the data input forms and reports. I will leave the decision of staff training in the usage of ICT systems up to the manager, though I suspect that it would be sufficient for him to teach them himself.

There will be a user guide produced at a later stage in this project that will assist the users in their understanding of how the system works and the acquisition of the skills necessary to operate it. This will include step by step instructions on how to perform reports, queries and input data into the system via forms as well as a troubleshooting section to assist the user with commonly encountered errors. In the event that the user guide is not sufficient in teaching the users how to use the system, or that the basic ICT skills of the staff are simply not up to scratch, it has been arranged with Fred that a series of one day training sessions will be provided at a cost of £500 per day.

Description of Task	Date of Completion
Identify Problem	20th September
Investigate Current System	25th September
Analyse Findings	30th September
Analyse Current User Activities/Data	2nd September
Analyse Problems with Current System	6th September
Identify End-User Requirements	8th September
Identify System Requirements	12th October
Create Performance Criteria	17th October
Consult with User	18th October

Breakdown of Completed Tasks

Breakdown of Completed Tasks

Analysis Agreement with End-User

Now that the analysis stage has been completed, I am presenting it to Fred, the manager of *Fred's Car Rentals*, so that he can inspect it to see whether it meets the standard that he expects. If Fred does not agree that this section is completed to the standard that he expects, then my assignment will end here.

Having studied the analysis:

☐ I agree that the analysis section of the project is completed to my satisfaction and to the standard that I expect, with all of the features included. I want you to design this system for *Fred's Car Rentals*.

☐ I am unsatisfied with the analysis part of the project and I don't feel that it has been completed properly. I do not want you to design this system for *Fred's Car Rentals*.

Signed: _____   Date: _____
          Manager of Fred's Car Rentals