RESCUE 991 :
THE MALAYSIAN CIVIL DEFENCE EMERGENCY SYSTEM

Prepared by :
Siti Azirin Abdul Aziz
WET 98131

Under the supervision of :
Puan Nornazlita Hussin

For :
Department of Information Technology
Faculty of Computer Science & Information Technology
University of Malaya
2000 / 2001

A project proposal and report in partial fulfillment of the requirements of the degree program of Bachelor of Information Technology, University of Malaya

With gratitude I dedicate this proposed project to both my families :

My father, Encik Aziz Hamid Khan;
My mother, Puan Faridah Haji Hamzah;
My siblings;

and

My fellow rescuers.

Abstract

The Rescue 991 Emergency Line has emerged since a few years back and has been reserved for the use of The Civil Defence Force of Malaysia, which was first brought forth in the year 1952. The Civil Defence Force of Malaysia is a government department which handles emergency cases especially those regarding with accidents, disasters and war. The Rescue 991 Emergency Line has been officially launched on the 20th May 1995 as the emergency line for The Civil Defence Force for Kuala Lumpur and Klang Valley. Because of the encouraging responses received in Klang Valley, the emergency line has widened its coverage throughout Malaysia by 1998. The latest addition to The Rescue 991 Emergency Line is the proposed system of The Rescue 991 Emergency System. Since the existence of The Rescue 991 Emergency Line, emergency cases have been handled manually. As with manually managed systems, problems and restrictions arise as part of the system. Part of the problems and restrictions, which arise, are that management of emergency cases have been slow and unproductive. The development of Rescue 991 Emergency System is anticipated to include the use of Information Technology in this important and essential service. The Rescue 991 Emergency System is designed in hope that it may generate an interest among users towards the modern technology with its attractive yet simple user interface. It is time for The Malaysian Civil Defence Force's rescue team to be in sync with the technologies of the new millennium.

Acknowledgements

I would like to express my deepest thanks and appreciation to my project supervisor, Puan Nornazlita Hussin for her continuing guidance, encouragement, advice and most of all, her persistent patience to all my shortcomings throughout the development of Rescue 991 Emergency System. I also thank her for trusting and having faith in my capabilities of designing and developing the system. Special thanks and appreciation to the Kuala Lumpur Civil Defence Force State Director, Kolonel (PA) Roslan Wahab, and the Kuala Lumpur Civil Defence Force Chief of Branch, Mejar (PA) Mohd. Nazri Hassan, who has participated in the emergency processes and system requirements interview and assisted in the preliminary design processes during the development of Rescue 991 Emergency System. My thanks also go to the personnel of the Malaysian Civil Defence Headquarters, who has provided vital information on the emergency service field throughout my observation and research done at their department. I would like to acknowledge all the staffs and rescuers of the Kuala Lumpur Civil Defence Force, for their assistance and co-operation throughout the development of Rescue 991 Emergency System. I also remember my parents, friends and course mates for sharing ideas and suggestions for the solutions to my project-related problems. I would not have successfully accomplished the completion of this project if not for the invaluable assistance of the people mentioned above. Thank you.

Siti Azirin Abdul Aziz

WET 98131

Table of Contents

Abstract i
Acknowledgements ii
Table of Contents iii
List of Figures vi
List of Tables vi

Chapter 1 Introduction 1
1.1 Project Overview 2
1.2 Objectives of the Project 4
1.3 Project Scope 5
1.3.1 Authentication Module 5
1.3.2 Rescuers Module 6
1.3.3 Allowances Module 6
1.3.4 Squads Duty Chart Module 6
1.3.5 Emergency Cases Module 7
1.3.6 Map Route Module 7
1.3.7 Inventories Module 8
1.4 Project Development Methodology 8
1.5 Project Schedule 11
1.6 Organization of the Thesis 13
Part 1 – Analysis, Design and Development 13
1.6.1 Chapter 1 – Introduction 13
1.6.2 Chapter 2 – System Initiation Research 13
1.6.3 Chapter 3 – Analysis of System Design and Development 14
1.6.4 Chapter 4 – System Design 14
Part 2 – Development and Evaluation 14
1.6.5 Chapter 5 – System Implementation 14
1.6.6 Chapter 6 – Evaluation and Debugging 15
1.6.7 Chapter 7 – Conclusion and Future Enhancements 15

Chapter 2 System Initiation Research 16
Part 1 – Review of Literature 17
2.1 Humanities Computing 17
2.1.1 The Emergency Service and Its Structure 18
2.1.2 The Need for Information Technology in the Emergency Service 19
2.1.3 The Implementations in the Emergency Service 20
2.1.4 Current Implemented Technologies 21

2.2 The Emergency Service and Its Process 21
2.2.1 Types of Emergency Services 23
2.2.2 The Functions of Emergency Services 24
2.2.3 Emergency Advisors – A New Role 25
2.3 Rescue 991 Emergency Processes 25
2.3.1 The Major Rescue 991 Emergency Processes 25
2.3.2 Emergency Processes Reengineering – Now and the Future 28
Part 2 – Existing System Analysis 29
2.4 Systems Study 30
2.4.1 Standard and Extended Features 30
2.4.2 Description of Analysed Systems 30
2.4.3 Features Description and Analysis of Studied Systems 31
2.5 To-Be-Adopted System Features 33

Chapter 3 Analysis of System Design and Development 35
3.1 Target Group Definition 36
3.2 Analysis of Interviews and Questionnaires Results 37
3.2.1 Questionnaire Results 38
3.2.2 Questionnaire Analysis 38
3.3 User Requirements Specification and Analysis – Functional and Non-Functional 41
3.3.1 Requirements Specification 41
3.3.2 Functional Requirements Analysis 42
3.3.3 Non-Functional Requirements Analysis 49
3.4 Proposed System Content 51
3.5 System Development Tools Analysis 52
3.5.1 User Interface and RAD tools 52
3.5.1.1 Microsoft® Visual Basic 6.0 53
3.5.1.2 Microsoft® Visual J++ 6.0 Professional 55
3.5.2 Database Development Tools 57
3.5.2.1 Microsoft® Access 97 57
3.5.2.2 Microsoft® SQL Server 6.5 64
3.5.3 The Tools of Choice 67
3.6 Development Operating System – Software and Hardware 67
3.6.1 The Software - Microsoft® Windows® 98 67

Chapter 4 System Design 70
4.1 The Architecture of Rescue 991 Emergency System 71
4.2 Database Design 72

4.3	Process Design	73
	4.3.1 Structure Charts	73
	4.3.2 Data Flow Diagrams (DFD)	74
4.4	User Interface Design	78
	4.4.1 Features of a Usable User Interface	80
	4.4.2 Type of User Interface in Rescue 991 Emergency System	82
4.5	Expected Outcome	83
Chapter 5	**System Implementation**	**85**
5.1	Introduction	86
5.2	Development Environment	86
	5.2.1 Software Tools Requirements	86
5.3	Development of Rescue 991 Emergency System	88
5.4	System Testing	90
	5.4.1 Unit Testing	91
	5.4.2 Integration Testing	92
	5.4.3 System Testing	93
Chapter 6	**Evaluation and Debugging**	**94**
6.1	Project Problems and Solutions	95
	6.1.1 During Project Studies and Analysis	95
	6.1.2 During Project Implementation and Testing	96
6.2	System Strengths	97
6.3	System Limitations	99
Chapter 7	**Conclusion and Future Enhancements**	**100**
7.1	Future Enhancements	101
7.2	Conclusion	103
Glossary		**vii**
Appendices		**xxii**
Appendix A	Emergency Processes and System Requirements Survey Form (English version)	xxiii
Appendix B	Emergency Processes and System Requirements Survey Form (Malay version)	xxv
Appendix C	Emergency Processes and System Requirements Interview	xxvii
Appendix D	User Manual	xxx

List of Figures

Figure 1.1	Software Development Life Cycle (SDLC) for Rescue 991 Emergency System	9
Figure 1.2	Project Schedule for Rescue 991 Emergency System	12
Figure 3.1	The Type of Services That Have Been Given by the Rescue 991	40
Figure 3.2	The Qualities That Should be Adopted by a Good System	40
Figure 4.1	The Login Section of The Structure Chart for Rescue 991 Emergency System	74

List of Tables

Table 2.1	Features Description and Analysis of Studied Systems	31
Table 3.1	Questionnaire Results	39
Table 4.1	The Data Flow Diagram Symbols	75
Table 5.1	Summary of Software Tools for the Development of Rescue 991 Emergency System	87

Chapter 1
Introduction

1.1 Project Overview

1.2 Objectives of the Project

1.3 Project Scope

1.4 Project Development Methodology

1.5 Project Schedule

1.6 Organization of the Thesis

Rescue 991 : The Malaysian Civil Defence Emergency System

1.1 Project Overview

In the year 1951, The Civil Defence Ordinance 1951 was created. In relation, a government department was created the year after with the name The Civil Defence Department. When the country gained independence in the year 1957, Civil Defence was managed under the Ninth Schedule of the Malaysian Constitution. Eight years later, in the year 1972, The Civil Defence Ordinance 1951 was revised by adding additional responsibilities of the department in times of peace by providing emergency services and disaster backup [Civil Defence Act, 1951].

Section 2 of The Civil Defence Act 1951 clarifies that Civil Defence is "... any form of action with the exclusion of actual combat to form a defence against any form of enemy attack, partial or overall, in the past, present or future ". Apart from that, in times of peace, section 8(i) and (ii) of the same act gives power to the Minister to command The Force or The Civil Defence Service to give disaster backup, shelter, and to take action to secure lives and assets of civilians in case of any disaster in the past, present or future [Civil Defence Act, 1951].

When the idea of activating The Rescue 991 Emergency Line was first thought of, one of its functions was to provide an ' on time ' or ' standby ' emergency service when an accident or disaster occurs. This allows rescuers and emergency backup squads to provide services 24 hours daily all year round. To support this need of continuous

emergency backup and rescue, an effective and systematic system is in need. This brings about the proposed system of The Rescue 991 Emergency System.

The Rescue 991 Emergency System is an integrated emergency management system, which caters for total emergency management. It provides comprehensive features and standard templates for the management of emergency cases and rescuers. It is to assist team managers and rescuers in maintaining and organising their emergency cases in a systematic and effective method, which will save countless hours of paperwork. This system has all its individual modules integrated to provide users with simple and easy database updating processes, which will increase efficiency and competitive edge.

The Rescue 991 Emergency System is also designed to provide rescuers with a search module based on the desired properties of an emergency case. Exclusive members ID, rank, date, and more can be used to track the rescuers and emergency database. Standard review reports regarding emergency cases can be automatically generated.

The Rescue 991 Emergency System is designed in hope that it will provide the solution to problems and restrictions in manually operated emergency management. It is also hoped that the system may generate an interest among users towards the Information Technology with its attractive yet simple user interface incorporated in its modules. It is time for The Malaysian Civil Defence Force's rescue team to implement high-end technologies in their services as we enter the new millennium.

1.2 Objectives of the Project

The Rescue 991 Emergency System is developed to benefit all personnel involved in the emergency management. The system integrates all its modules to provide a highly effective management solution to its users. The need for an integrated emergency management system fits with its objectives such as :

1. to support the continuous emergency backup and rescue services 24 hours daily all year round;
2. to provide efficient management and administration processes by implementing an integrated system;
3. to integrate the teams management module and emergency management module in one system;.
4. to provide rescuers with easy access to data and information for effective planning and decision making;
5. to implement Information Technology and an electronic solution to established emergency operations which still employ manual management processes; and
6. to increase the competitive edge and future prospects of the emergency field.

1.3 Project Scope

The most important goal of the development of The Rescue 991 Emergency System is to provide an integrated solution to problems and restrictions in manually generated emergency management. The system aims to employ simple interfaces yet comprehensive and effective features to increase the efficiency of emergency management through effective planning and decision-making.

The Rescue 991 Emergency System has seven integrated modules – Authentication, Rescuers, Allowances, Squads Duty Chart, Emergency Cases, Map Route and Inventories provide for the tracking and management processes of all emergency cases provided by The Rescue 991 Emergency Line.

1.3.1 Authentication Module

The Authentication module provides separate access types for team managers and rescuers. The differences are that only team managers are allowed to access administrative records, which may be on a private and personal basis. Rescuers will not be able to modify information entered into the management database. Rescuers will only gain access to the Squads Duty Chart, Emergency Cases, Map Route and Inventories modules. The sole purpose of this module is to restrict access on confidential records from the management database.

1.3.2 Rescuers Module

The Rescuers module is where details pertaining the Rescue 991 team members' details are displays and processed. It displays key descriptive data and property details about a rescuer. It allows rescuers grouping by any combination of criteria such as by rank, specialized sections or others. It may also generate report from the database. The properties included are Rescuers ID, Name, Rank, Specialized Skill, and Contact Number.

1.3.3 Allowances Module

The Allowances module displays and processes information and accounting data of each rescuer. Besides displaying the number of hours each rescuer is on duty, it also calculates how much allowance is due based on a per hour basis. It also generates reports and spreadsheets. It basically works as an account manager.

1.3.4 Squads Duty Chart Module

The Squads Duty Chart module displays and processes duty schedule automatically by a calendar. It provides information about which squad is on duty for the day in the particular month. It includes as worksheet for rescuers to sign-in and sign-out for each

squad. Information from the module will be transferred and entered into the Allowances module.

1.3.5 Emergency Cases Module

The main module in The Rescue 991 Emergency System is the Emergency Cases module. The Emergency Cases module includes all emergency cases records, past and present. As The Rescue 991 Emergency Line receives each emergency call, information such as Callers, Type, and Casualty can be entered into the Emergency Cases Record. It will then analyse the information and be able to advise rescuers on the appropriate actions. This Emergency Cases Record can be reviewed for future planning and decision-making.

1.3.6 Map Route Module

The Map Route module is a computerized information map route. It is an efficient route manager directly linked to the Emergency Cases module. The module will make accurate use of virtually any address entered into the Emergency Cases Record. It will then be processed and located on the map route. This will include a zoom-in feature, from city, to town, to the specific location.

1.3.7 Inventories Module

The Inventories module keeps details pertaining all inventories of the rescue team. It displays key descriptive data and property details about each vehicle and tool. It also records inventories activity within the emergency services by managing the available from the in-use. Users will have to sign-out each inventory when in-use and to sign-in when an inventory is made available for the next service. This will allow the module to allocate available inventory when the situation arises.

1.4 Project Development Methodology

A methodology is an organized, documented set of procedures and guidelines for one or more phases of the software life cycle, such as analysis or design. Many methodologies include a diagramming notation for documenting the results of the procedure; a step-by-step approach for carrying out the procedure; and an objective set of criteria for determining whether the results of the procedure are of acceptable quality. The Rapid Application Development (RAD) method is used to develop the Rescue 991 Emergency System. It is software life cycle (SDLC) designed to give faster development and better results and to take maximum advantage of recent advances in development software.

RAD is a broad strategy to use tools such as an interface designer and prototyping to speed up the design process. RAD tools have a direct connection from the interface design tool to the source code so that one can design a component such as a button and go directly to the event-handling code to make something happen when the button is clicked. An SDLC depicts the phases a software product goes through between when it is conceived and when it is no longer available for use. The development of Rescue 991 Emergency System is planned as in Figure 1.1.

Software Development Life Cycle (SDLC) for Rescue 991 Emergency System

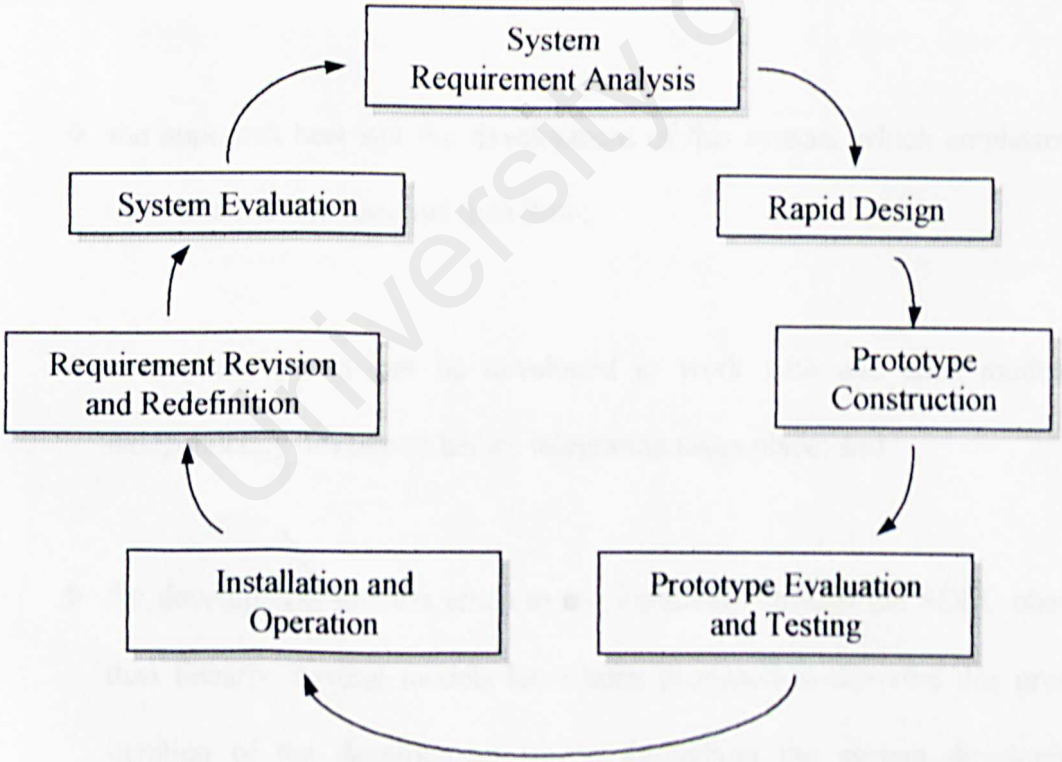


Figure 1.1 The SDLC for the development of Rescue 991 Emergency System.

The design stage is the approach that engineering disciplines use to specify how to create or do something. A successful design must satisfy a functional specification, conform to the limitations of the target medium and meet implicit or explicit requirements on performance and resource usage. A design may also have to satisfy restrictions on the design process itself, such as its length or cost, or the tools available for doing the design.

In the software life-cycle, design follows requirements analysis and is followed by implementation. Some of the current RAD techniques are iterative life cycles, prototyping, workshops, teams, time box development, and re-use of applications, templates and code. The prototyping approach is chosen for the following reasons :

- the approach best suit the development of this system, which emphasizes on the user interface and internal data flow;

- a tangible system can be developed to work with and each module can be independently developed before integration takes place; and

- the development process tends to run iteratively through the SDLC phases rather than linearly; several models have been proposed to describe this process. The iteration of the development stages throughout the system development time frame improves the quality of the final product.

1.5 Project Schedule

A project schedule is carefully planned and arranged to implement time management and systematic working throughout the system development time frame. This is to ensure achievement of the outlined project objectives at the end of the project development period. During the first part of the project development period, comprehensive systems study and literature reviews have been carried out to gather as much information as possible for the planning of a good development strategy.

After the studies, a project proposal is prepared and a viva session provides the opportunity for an extensive brainstorming and critical analysis on the suggested project. After the system requirement analysis has been done, the system is designed. The subsequent individual development stages of the system are divided among the period of four months during the second part of the project development. The Gantt chart shows the development schedule of the Rescue 991 Emergency System as in Figure 1.2.

Project Schedule for Rescue 991 Emergency System

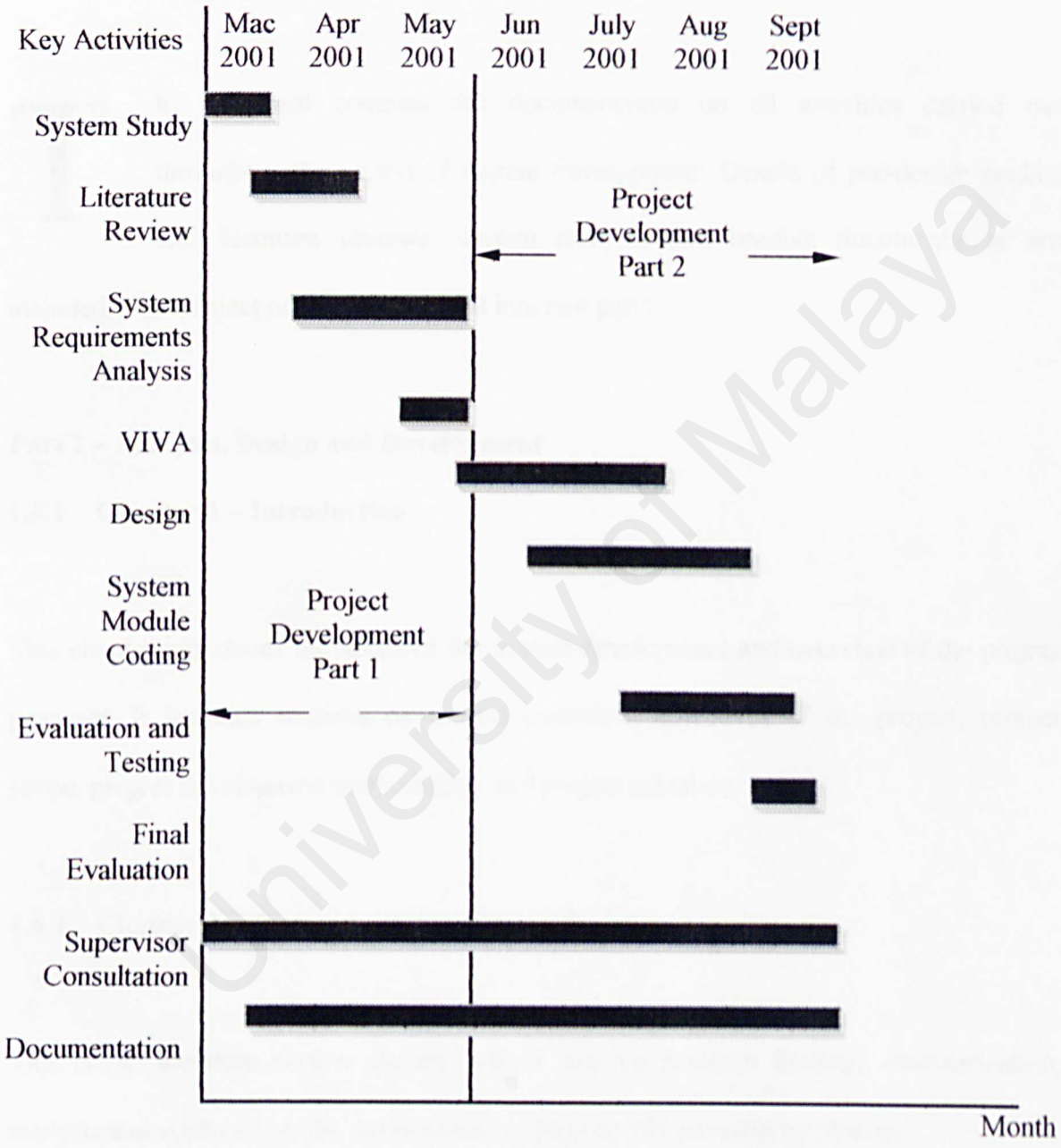


Figure 1.2 The Gantt chart for the Rescue 991 Emergency System development schedule.

1.6 Organization of the Thesis

This proposal contains the documentation on all activities carried out throughout the period of system development. Details of pre-design studies and literature reviews, system analysis and product documentation are included. This project proposal is divided into two parts.

Part 1 – Analysis, Design and Development

1.6.1 Chapter 1 – Introduction

This chapter introduces the needs of the system development and overview of the project proposal. It includes sections on project overview, objectives of the project, project scope, project development methodology and project schedule.

1.6.2 Chapter 2 – System Initiation Research

This is the literature review chapter, which indicate research findings, summarization, analysis and synthesis on the development of Rescue 991 Emergency System.

1.6.3 Chapter 3 – Analysis of System Design and Development

Chapter 3 discusses and analyses details of functional and non-functional system requirements. Several development approaches are studied and the proposed methodology, mechanism and approach is explained and justified.

1.6.4 Chapter 4 – System Design

This chapter describes the planning, development, and management of Rescue 991 Emergency System. System design, interface considerations and service process flows are included. Additional reports are on system development environment and system development tools.

Part 2 – Development and Evaluation

1.6.5 Chapter 5 – System Implementation

The system is developed according to the designed blueprints under the specified design and development operating environment. It is then implemented in the typical user environment with real-time data to prepare for evaluation and debugging.

1.6.6 Chapter 6 – Evaluation and Debugging

The approaches used to debug and test the system are described here. Achieved and unachieved objectives are outlined and considerations of future work are proposed. Problems encountered and solutions taken during the development period are highlighted.

1.6.7 Chapter 7 - Conclusion and Future Enhancements

After the conclusion on the finished system is made, the strengths and limitations of the final product are confirmed. A proposal for future enhancement is also forwarded.

References

Section 2, The Civil Defence Act, 1951.

Section 8 (i) & (ii), The Civil Defence Act, 1951.

Chapter 2
System Initiation Research

Part 1 – Review of Literature

2.1 Humanities Computing

2.2 The Emergency Service and Its Process

2.3 Rescue 991 Emergency Processes

Part 2 – Existing Systems Analysis

2.4 Systems Study

2.5 To-Be-Adopted System Features

Rescue 991 : The Malaysian Civil Defence Emergency System

Part 1 – Review of Literature

Research and surveys have been done on writings on the particular subject of the process of emergency service, and the information and computer technologies related to it or used in it. Materials such as Internet articles, periodicals, conference proceedings and journal, and past dissertations on this topic have been studied to assist in the development of Rescue 991 Emergency System. However, writings on this particular subject have been scarce, thus disabling a full literature review. Most of the information in this chapter is based on observation and research done on the current system.

The areas covered during the survey include the following :

1. Humanities Computing
2. The Emergency Service and Its Process
3. Rescue 991 Emergency Processes

2.1 Humanities Computing

Disasters caused by human action can be heard daily. Not one country in the world can run from disasters. Our country, Malaysia, is considered very fortunate, as there are no great disasters such as earthquake, volcano eruption

or typhoon. However, we still cannot run from natural disasters such as flood, heavy wind and also from disasters caused by human action such as road accidents, soil erosion, fire and others.

All types of disasters mentioned above result in lost of assets, injury and even lives. Disasters can be curb and should be curb. That is the duty and responsibility of emergency service teams such as the Civil Defence Emergency Backup Squad. In the act of rescuing disaster victims, emergency services should be able to take action immediately and effectively [Norhafifi, 1994].

2.1.1 The Emergency Service and Its Structure

As with the police force, hospital and fire brigade, a specific emergency number has been reserved so that the people can contact these agencies when an emergency occurs. This is also true for the Civil Defence Force especially in major cities so that disaster cases could be handled more efficiently. As of today, every city in Malaysia has an operation centre where emergency service teams are ready to give backup service 24 hours daily.

In developed countries such as America, France, German and even Singapore, the Civil Defence Emergency Team plays an important role in helping the people when a disaster occurs. In America, the famous Rescue 911 Emergency Line shows the high quality of its rescue and emergency unit handling various emergency cases. Their quality is an important component to be adopted.

Many among Malaysians feel that our rescue team is not up to its standard. This is because many are still shadowed by what we see on television. Many feel that we are nothing compared to the Rescue 911. However, we should realize that the quality shown by the Rescue 911 is the result of years of training and high technology applications.

The time is now if we are to be as excellent as they are. Although there are many weaknesses in our emergency management, yet actions have been taken to examine these weaknesses and improve on it.

The existence of the Civil Defence Emergency System is a good start. Now, with the dawn of the new era, it is time for us to implement high-end technologies into our emergency management system by implementing an integrated emergency management system. A good system combined with the effort of our rescuers, we may save many lives in the future [Norhafifi, 1994].

2.1.2 The Need for Information Technology in the Emergency Service

The use and implementation of computers and Information Technology in the emergency service have been slow and unproductive. However, it has been increasingly active since the rapid growth of computer systems development in the 1990s. The increased complexity of the emergency service therefore calls for the use and implementation of Information Technology to assist in and improve the day-to-day emergency processes. While the use of computers and its technology is at high speed in other industries, the

emergency service is clearly not lacking behind despite slower developments [991 Manual, 1997].

There are several driving factors behind the encouragement, development and growth of humanities computing :

- the fact that the emergency service is important to the welfare of the country;
- the increasing need of emergency coverage in times of peace;
- more and more people have begun to lean on emergency help;
- the emergency service at present has become more complicated and complex than before, involving more entities and processes; and
- technologies from the science aspect of humankind are to be implemented into the humanities and intellectual areas if one desires to reap maximum benefits.

The goal of all current efforts is to come up with solutions, which solves management and service problems and at the same time are not too complex for users to use on a daily basis.

2.1.3 The Implementations in the Emergency Service

Many will have the picture that the Information Technology implementation in the emergency service would be limited to something like the green-screen character-based management system. That is no longer true today. Alongside the development of high-

end technologies and applications, almost everything in the service can be assisted, if not totally managed by the use of computer systems.

2.1.4 Current Implemented Technologies

Some uses of Information Technology in the emergency service include :

1. Documentation, including rescuers registration, management and others;
2. Financial procedures, management and planning;
3. Human resources records, management and planning;
4. Word-processing and file of general correspondence;
5. Word-processing and file of administrative and clerical procedures;

2.2 The Emergency Service and Its Process

An emergency system is an important system for the welfare of a country. Regardless of the size or population of the country, all emergency services play one major role – to handle emergency cases when the situation arises. Although it is known that the emergency service is a non-profit organization, nonetheless its existence is crucial to our well being [Abidin, 1991]. This is because of several factors :

- emergency services need to keep a continuous 24 hours backup service so as to save the people's anxiety when an emergency occurs;
- emergency services are able to make the people feel safe and comfortable. They are able to answer questions and show the people what to do;
- one of the emergency services' function is to educate the people about saving themselves and others;
- emergency services brings confidence as people will see that emergency rescue teams are capable of handling virtually any emergency situation;
- emergency services are more sensitive to the people's needs compared to the private health service sector;
- emergency services cater for the rich and the poor as there are no charge accompanied;
- the people are encouraged to seek help and educate themselves in helping the emergency services when backup service is in need; and
- emergency services provide the people, the government and the media with full coverage of any emergency case by written statements, documentations, and explanations that gives them insight into the real emergency service.

Although emergency services can now be found simply anywhere, but the best service to call for is the governmental service provided for the people and not only for selected individuals such as the private emergency services. These government

emergency services include the emergency line 999 for general cases, 994 for fire cases, and 991 for emergency and disaster cases [Roslan Wahab, 2001].

2.2.1 Types of Emergency Services

One may not realize it, but there exists three types of emergency services :

1. The general emergency services. These emergency services provide an emergency line, which enable the people to contact the agency when an emergency occurs. However, these emergency services do not handle emergency cases. As emergency calls are received, the emergency services will analyse the calls and situation, and refers them to the appropriate agency such as the Fire Brigade or the Rescue 991.
2. The Fire Brigade – the Fire Brigade handles fire cases, and the latest addition to their service includes rescue of victims when a road accident occurs. Their function is to mobilize the victims from crushed vehicles. However, they do not handle first aid and emergency procedures.
3. The Rescue 991 – the Rescue 991 specializes in disasters; from human action to natural causes. This includes emergency cases regarding road accidents, soil erosion, fire, flood, heavy wind and others.

2.2.2 The Functions of Emergency Services

The fundamental element of emergency itself does not change. It is the emergency service, in the reflecting political and economic pressures and intense internal competition that has become increasingly more intricate as a service. Emergency services function to confront this intricate service. The function of an emergency service are :

1. To establish and provide emergency service systematically and effectively;
2. To represent the government and the people for services of emergency and subsequently build human relations;
3. To manage its organization and relations by creating documentation, and finally the database;
4. To set standards of providing valuable emergency service according to the people's needs and the emergency organization agreement.
5. To establish itself in the local community by recognizing the people's needs;
6. To be responsible for the preservation and safety of lives and assets;
7. To hold and sponsor related activities such as exhibitions, shows, and collaborations with other emergency organizations and programs related in order to educate the community;
8. To promote and advertise the importance of emergency backup; and
9. To educate the public on the appreciation, understanding and growth of the emergency service.

2.2.3 Emergency Advisors – A New Role

It is interesting to see that emergency advisors have been able to establish themselves in the emergency service. These emergency advisors are well qualified and have been established in the course of time a good vision of the need and future of the emergency service. The quality of emergency service depends on these people [Abidin, 1991].

2.3 Rescue 991 Emergency Processes

Over time, the issue of emergency management has involved more than mere record keeping. The diverse ways in which an emergency could occur and the intense activities of a modern and well-established emergency system would result in more emergency processes to be involved.

2.3.1 The Major Rescue 991 Emergency Processes

With reference to the Rescue 991 main entity – the operation centre itself, its building and location, its rescuers, and its associated emergency cases, some major processes can be derived and described as follows [Ariffin, 2001] :

1. Call in

Call in comes from the public, rescuers or other emergency agencies. The operator on duty receives the cases conveyed. Emergency cases details such as callers, location and casualty are recorded for analysis.

2. Documentation and Report

Each emergency case has important documented attributes like its details of caller, location, type of casualty, time, date, description and others. All these details are documented and reported to the commanding officer on duty. If it is accepted for operation, it will be given a pass on by the commanding officer and operation starts. Every emergency case will be given an exclusive ID number for record purposes.

3. Operation

All emergency cases covered by the Rescue 991 emergency service is operated according to its value of importance. For critical cases, as many as more than one rescue vehicle with all the rescue gadgets, and more than one ambulance will depart to the casualty location. For non-critical emergency cases, normally one ambulance will depart to the location.

4. Cataloguing

Creating documentation entries like cataloguing can replace standard records. Cataloguing is essential for future reference. By cataloguing, future cases could be referred against for effective planning and decision-making.

5. Activity Planning

Activities include all emergency service events held by the Rescue 991. These activities include exhibitions, shows, collaborations with other emergency organizations and programs related for the education of the community.

6. Maintenance and Examination

After every emergency operation, the inventories' condition has to be preserved responsibly by the Rescue 991 team. Some maintenance activities include providing protection and preservatives from environmental harshness and cleaning. The condition of each inventory is to be examined periodically by qualified quality controllers to maintain efficiency of each emergency operation.

7. Establishing and Maintaining Relationships

Relationships to be established by the Rescue 991 are those with the rescuers and the rest of its external service entities. These include the government, community and other emergency agencies. Records containing information of contacts must be stored and managed.

8. Sign out

As all emergency operation ends, the Rescue 991 teams will sign out and be passed on the next squad on duty. Information on the previous case and operation handled must be effectively recorded and kept.

2.3.2 Emergency Process Reengineering – Now and the Future

The major processes involved in the Rescue 991 emergency service have been outlined. The purpose of implementing an emergency management system is to reengineer the emergency processes so that existing management problems can be solved and efficiency and productivity can be improved.

Some of the many problems faced by a growing emergency service are that of management – physically in rescuers and in inventory. The reengineering process will address these problems and do more than just emergency management automation.

Part 2 – Existing System Analysis

There has been effort to develop emergency management systems in The Malaysian Civil Defence Force. However, these developed systems are different in features and scope of management in the sense that these systems work as an automated unit and not as a user system. Nonetheless, these systems have several good features, which are studied and described in detail. At the end of this analysis, some of the best and most useful features will be picked and adopted into the development of Rescue 991 Emergency System. The goal of the development of Rescue 991 Emergency System is to include all standard modules and useful features.

2.4 Systems Study

2.4.1 Standard and Extended Features

An efficient and effective emergency management system should be easy to use, keeps all records, provide no hard coding values and simple screens, powerful, fast, user friendly and very comprehensive to be able to solve emergency management problems of its users. It is to assist rescue team managers to be better organized and save countless hours of paperwork.

2.4.2 Description of Analysed Systems

The emergency management systems studied during the research are [Ariffin, 2001]:

1. Communication Logging System (C.L.S.)
2. Data Logging System (D.L.S.)
3. Computerized Information Map Route

2.4.3 Features Description and Analysis of Studied Systems

System Name	Reference	Features	Comments
Communication Logging System (C.L.S.)	Kuala Lumpur Civil Defence Department	Provides tracking ability of all emergency calls received by the Rescue 991 Emergency Line. It automatically counts each number of received calls and records them in the audiocassette recorder. It does not generate reports.	This system is an automatic counter and recorder system. However, as it is not a user system, it does little for the implementation of Information Technology in the Rescue 991.
Data Logging System (D.L.S.)	Kuala Lumpur Civil Defence Department	This system also consists of automatic counter and recorder capabilities. The addition of this system is that it also creates	This is a higher-end system, which uses a database. Although it is simple in design, it is able to perform simple

		standard reports of summaries for group of records. Number code system tells the line code, call area, number of calls received, date, time, and duration of call.	recording processes automatically, without many extra features. However, the only user intervention needed is maybe the print function.
Computerized Information Map Route	Kuala Lumpur Civil Defence Department	Includes a Map Route with useful tools such as : ❖ locate by address ❖ locate by telephone number ❖ print function The Map Route shows the map of the Klang Valley and locates the specific location on map using a browser. Provides shortcut and function keys.	This system is considered a good system. It breaks down the processes into three functions : record, locate and print. One good feature is that virtually any address can be located on the Map Route.

Table 2.1 The description of analysed existing emergency management system features.

2.5 To-Be-Adopted System Features

After an analysis of the existing system have been completed, a conclusion has been derived that the Map Route module will be included in Rescue 991 Emergency System. This module can help the emergency management scenario and will be dynamically linked with the implementation of a database. The Authentication module is separated for security purposes.

One of the goals of the development of Rescue 991 Emergency System is to provide rescue team managers with tools that allow them to focus on building and expanding their service rather than maintaining the operating aspect of it. It is anticipated that the resulting system of Rescue 991 Emergency System will strike a balance between high-end, complicated systems and less effective and efficient entry-level systems, which will solve emergency managerial problems as well as meeting the emergency processes needs.

References

991 Manual. (1997). Talian Kecemasan Pertahanan Awam Malaysia. Kuala Lumpur : Percetakan Nasional Malaysia Berhad.

Abidin Ismail, The Malaysian Civil Defence Chief Director. (1991). Kualiti Teras Kejayaan. *Berita Pertahanan Awam*. Bilangan 1/ 91 : 3.

Ariffin, Ltm. (PA), The Malaysian Civil Defence Headquarters Personnel. (2001). *quoted.*

Norhafifi Ismail, The Malaysian Civil Defence Headquarters Personnel. (1994). Talian Kecemasan JPA3. *Berita Pertahanan Awam*. Bilangan 3 / 94 : 2.

Roslan Wahab, Kolonel (PA), Kuala Lumpur Civil Defence State Director. (2001). *quoted.*

Chapter 3
Analysis of System Design and Development

3.1 Target Group Definition

3.2 Analysis of Interviews and Questionnaires Results

3.3 User Requirements Specifications and Analysis – Functional and Non-Functional

3.4 Proposed System Content

3.5 System Development Tools Analysis

3.6 Development Operating System – Software and Hardware

Rescue 991 : The Malaysian Civil Defence Emergency System

In the process of designing and developing the Rescue 991 Emergency System, which will be able to cater the needs of rescue team managers, an in-depth study and analysis of the system and user requirements is carried out.

Potential users are targeted and interviewed to discover their needs, potential problems and expectations related to the emergency management system. The vital key features are then identified to overcome the lack and weaknesses of existing systems. The goal of this project is to produce a system, which will free rescue team managers of day-to-day managerial operations and problems to enable them to concentrate on building and expanding their services.

3.1 Target Group Definition

Rescuers involved in the emergency service may be the potential users of Rescue 991 Emergency System. These are defined as the target population. The targeted user group is the largest group of the target population [Kingsman, 1994].

Therefore, the target group of Rescue 991 Emergency System will explicitly specified as emergency management users. In any way, all rescuers are trained to have complete understanding of the emergency service and its processes. These individuals may or may not be computer educated and technology savvy.

3.2 Analysis of Interviews and Questionnaires Results

An information-gathering interview is a directed conversation with a specific purpose that uses a question-and-answer format [Kendall, 1996]. The opinions of the interviewee and his / her feelings about the current state of the system, or the expectations of the new system, organizational and personal goals and informal procedures can be discovered.

Questionnaires are an information gathering technique used to study attitudes, benefits, behaviours and characteristics of several key people in an organization who may be affected by the current and / or proposed system. Attitudes are what people in the organization say they want; beliefs are what people think is actually true; behaviour is what organizational members do; and characteristics are properties of people and things [Kendall, 1996]. Through the use of questionnaires, what was found in interviews may be quantified. Questionnaires are also used to determine how widespread or limited a sentiment expressed in an interview really is. A large sample of potential system users may be surveyed to sense problems or raise important issues before interviews are scheduled [Kendall, 1996].

In the development of Rescue 991 Emergency System, interviews have been carried out with several identified people from the emergency service through pre-interview questionnaires who may be the potential users of the system. Questionnaires have been distributed to all 30 rescuers under the survey. Kindly refer to the questionnaire at the Appendix section of this proposal.

3.2.1 Questionnaire Results

Table 3.1 outlines the overall results of the questionnaire survey on the 30 rescuers. Only quantifying questions are analysed. Non-quantifying questions are used to obtain information about the emergency service. For multi-category questions, the listed categories are the major categories involved.

3.2.2 Questionnaire Analysis

The results of the questionnaire shows that 50% of the surveyed rescuers are of the private rank and have established themselves as a rescuer for less than 2 years of service. Rescuers are mostly in the fire brigade (43%) and the first aid & ambulance (37%) section. All of the surveyed rescuers have rescue experience with 30% tending and sending accident and disaster victims to the hospital, 18% search and rescue flood victims, 17% search and rescue flood victims, while others with experience in search and rescue drift and drown victims, catching poisonous animals and handling forest search and rescue.

On the technological front, 100% of the surveyed rescuers agree that the current manual system has many weaknesses and effort to integrate the current system is highly supported. According to survey, the major weakness in the current system is that it is unsystematic and it uses too much manpower. The proposed integrated system is highly supported, as management is willing to put aside a budget for an emergency management system, provided it is effective and can live up to its value paid.

Table 3.1 Questionnaire Results

Question Number	Answer								
2	Officer	Warrant Of. / Sergeant	Corporal	L/Corporal	Private				
	17%	10%	17%	6%	50%				
3	FA & Ambulance	Fire Brigade	Rescue	Charity					
	37%	43%	20%	0%					
4	Bantuan Pagi	Alpha	Bravo	Charlie	Delta	Echo	Foxtrot	Pro	Others
	17%	13%	27%	3%	7%	10%	10%	0%	13%
5	0 - 2 years	2 – 4 years	4 – 6 years	6 – 8 years					
	30%	27%	27%	16%					
*6	S1	S2	S3	S4	S5	S6	S7		
	17%	30%	8%	13%	18%	7%	7%		
7	Manual	Computerized							
	100%	0%							
10	Good	Not Good							
	100%	0%							
11	Attractive	Simple to use	Overall	Effective					
	17%	31%	27%	25%					

Figure 3.1 and 3.2 depict the type of services that have been given and qualities that should be adopted by a good system according to survey.

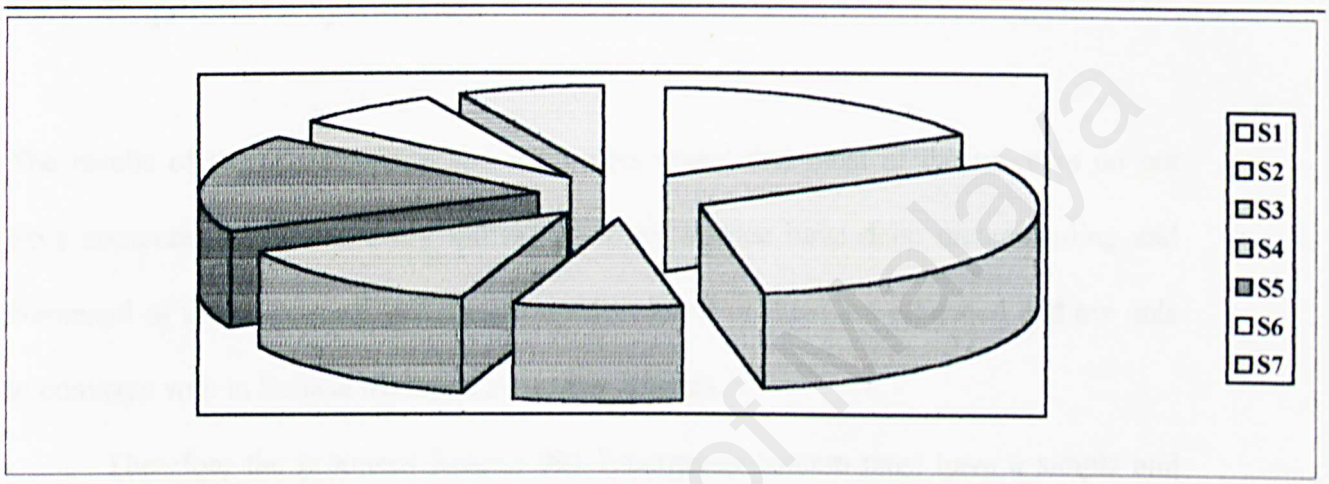


Figure 3.1 The type of services that have been given.

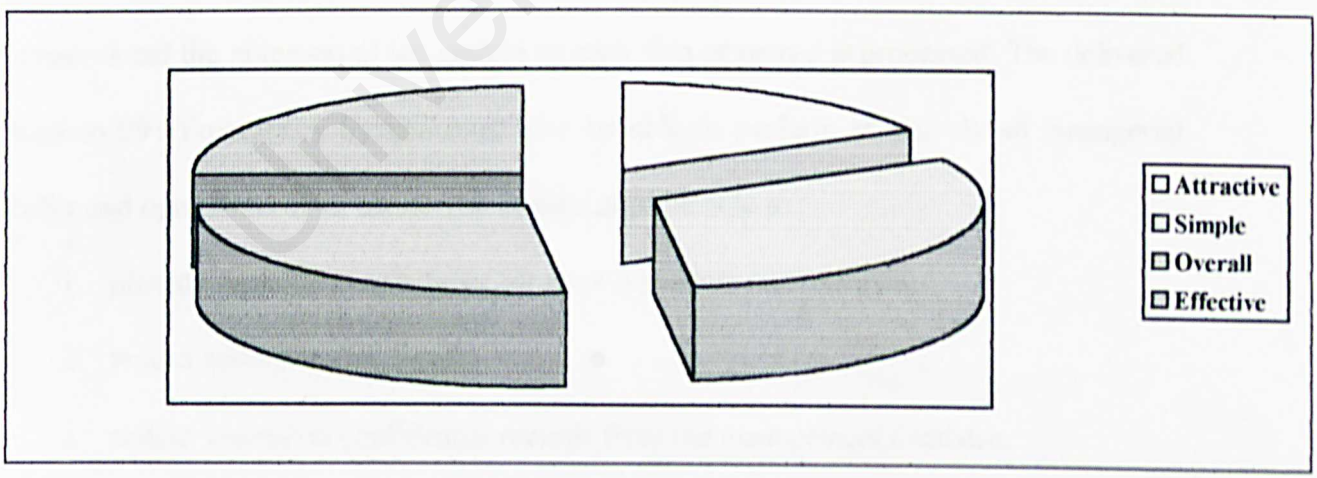


Figure 3.2 The qualities that should be adopted by a good system.

3.3 User Requirements Specifications and Analysis – Functional and Non- Functional

3.3.1 Requirements Specification

The results of the questionnaire and interviews reveal that most of the rescuers do not have computer skills, but every individual in the service have deep understanding and command of the emergency service knowledge. Most of them are educated and are able to converse well in Bahasa Malaysia as well as English.

Therefore the proposed Rescue 991 Emergency System must have a simple and direct user interface design, using easy-to-understand dual language – Bahasa Malaysia and English as well as user friendly features. Complicated field linkage, unclear functions and nested processes must be avoided so that users will be able to completely comprehend the going-on of the system as each data or record is processed. The delivered Rescue 991 Emergency System must also be able to perform effectively all managerial tasks and operations of its users. The system must be able to :

1. provide separate access types for team managers and rescuers;
2. record administrative details;
3. restrict access on confidential records from the management database;
4. display and process rescuers details;
5. process and calculates information and accounting data;

6. process duty schedule;
7. record all emergency cases details;
8. locate location on the map route;
9. track all inventories availability; and
10. generate any report, information sheet or label.

3.3.2 Functional Requirements Analysis

Functional requirements are system services expected by the user [Sommerwille, 1995]. During the analysis of functional requirements, modules must be incorporated and integrated into the system with details. There are seven modules in the Rescue 991 Emergency System, including the Authentication module. Each module will provide several functions.

3.3.2.1 The Authentication Module

The Authentication module provides separate access types for team managers and rescuers. The differences are that only team managers are allowed to access administrative records, which may be on a private and personal basis. Rescuers will not be able to modify information entered into the management database. Rescuers will only gain access to the Squads Duty Chart, Emergency Cases, Map Route and Inventories

modules. The sole purpose of this module is to restrict access on confidential records from the management database. Users will be requested for login ID and password.

1. **The Login function**

   Allows users to login to the system with their login ID (user name) and password.

2. **The New User function**

   Allows new users to enter their personal details such as name, login ID and password. Password will be conformed for authentication.

3. **The Change Password function**

   Allows users to change their login password periodically.

3.3.2.2 The Rescuers Module

The Rescuers module is where details pertaining the Rescue 991 team members' details are displays and processed. It displays key descriptive data and property details about a rescuer. It allows rescuers grouping by any combination of criteria such as by rank, specialized sections or others. It may also generate report from the database. The properties included are Rescuers ID, Name, Rank, Specialized Skill, and Contact Number.

1. **The Rescuers ID property function**

Allows rescuers details to be located by the specific Rescuers ID.

2. **The Name property function**

Displays information of rescuers by name.

3. **The Rank property function**

Displays a list of rescuers by a particular rank, such as officer, warrant officer, sergeant, corporal, lance corporal or private.

4. **The Specialized Skill property function**

Displays a list of rescuers by a particular specialized skill, such as fist aid and ambulance, fire brigade, rescue or charity.

5. **The Contact Number property function**

Displays all rescuers emergency contact number for easy access when a situation arises.

3.3.2.3 The Allowances Module

The Allowances module displays and processes information and accounting data of each rescuer. Besides displaying the number of hours each rescuer is on duty, it also calculates how much allowance is due based on a per hour basis. It also generates reports and spreadsheets. It basically works as an account manager.

1. **The Hour property function**

   Keeps records of the number of hours each rescuer is on duty.

2. **The Allowance property function**

   Calculates how much allowance is due based on a per hour basis.

3.3.2.4 The Squads Duty Chart Module

The Squads Duty Chart module displays and processes duty schedule automatically by a calendar. It provides information about which squad is on duty for the day in the particular month. It includes as worksheet for rescuers to sign-in and sign-out for each squad. Information from the module will be transferred and entered into the Allowances module.

1. The Duty Schedule property function

Accommodates a duty schedule in the form of a calendar. It provides information on the squad, squad members and date of duty.

2. The Attendance property function

Users may sign-in and sign-out by using this function.

3. The Transfer property function

This function tracks the number of hour each rescuer is on duty and relates it to the Hour property function in the Allowances Module.

3.3.2.5 The Emergency Cases Module

The main module in The Rescue 991 Emergency System is the Emergency Cases module. The Emergency Cases module includes all emergency cases records, past and present. As The Rescue 991 Emergency Line receives each emergency call, information such as Callers, Type, and Casualty can be entered into the Emergency Cases Record. It will then analyse the information and be able to advise rescuers on the appropriate actions. This Emergency Cases Record can be reviewed for future planning and decision-making.

1. **The Emergency Cases Record function**

Provides a form where rescuers can record all emergency cases details such as Callers, Type, and Casualty as each emergency call is received.

2. **The Analysis function**

Provides quick reference to any previous record similar to the input case. It will also analyse the input details and give advice on the appropriate actions.

3. **The Report function**

Users can print out reports for any chosen emergency case.

3.3.2.6 The Map Route Module

The Map Route module is a computerized information map route. It is an efficient route manager directly linked to the Emergency Cases module. The module will make accurate use of virtually any address entered into the Emergency Cases Record. It will then be processed and located on the map route. This will include a zoom-in feature, from city, to town, to the specific location.

1. The Locate function

Address information entered into the Emergency Cases Record will automatically be entered into the Locate function of the Map Route module. It will then be processed and located on the map route.

2. The Zoom function

There are two zoom functions. One is to zoom-in, and the other is to zoom-out. This will allow users to locate a bigger perimeter before locating the specific location.

3.3.2.7 The Inventories Module

The Inventories module keeps details pertaining all inventories of the rescue team. It displays key descriptive data and property details about each vehicle and tool. It also records inventories activity within the emergency services by managing the available from the in-use. Users will have to sign-out each inventory when in-use and to sign-in when an inventory is made available for the next service. This will allow the module to allocate available inventory when the situation arises.

1. The Inventories property function

Displays information of all inventories within the rescue team.

2. The Availability property function

Keeps track on the availability of each inventory – vehicle and tool. Availability can be converted to in-use when a user signs-out an inventory

3. The Allocate function

This function tracks any available inventory and allocates it to an emergency case when the situation arises.

3.3.3 Non–Functional Requirements Analysis

Non–functional specifications are the constraints under which a system must operate and the standards which must be met by the delivered system [Sommerwille, 1995]. The concluded non–functional requirements of Rescue 991 Emergency System are user–friendliness, flexibility, efficiency and reliability.

3.3.3.1 User–Friendliness

The system is required to have a user–friendly interface because the majority of the potential users are not technology savvy or highly computer and IT–skilled people. They are non–technical and will be easily frustrated with complicated computing features and commands. Therefore, the design of the user screens must include :

- Attractive, simple toolbars and icon buttons and direct, short menu options;

- A systematic standard Windows Graphical User Interface (GUI)
- Field description where necessary; and
- Module browser to allow users to shift between the main modules.

3.3.3.2 Flexibility

The system must possess the capability to take advantage of new technologies and resources, and can be implemented in changing environments. It must be able to cater for all types and levels of the emergency service.

3.3.3.3 Efficiency

Efficiency in the computer world is understood as the ability of a process or procedure to be called or accessed unlimitedly to produce similar performance outcomes at an acceptable or creditable speed [Sommerwille, 1995]. With thousands of records involved in processing and analysing, it is vital that the system will not add to the agony of users but solve their problem in handling huge data and information under time constraints.

3.3.3.4 Reliability

A system is reliable if it does not produce dangerous or costly failures in the typical user environment and data integrity is preserved. This definition recognizes that a system may

not always be used in ways of which its designer expects. Rescue 991 Emergency System must be a reliable system because it manages not only the emergency cases, but also the emergency management. Any lack of system security and stability can cause damage to data integrity and prove chaotic for the emergency teams involved. All potential and possible failures and errors must be taken into account during the design and development stage.

3.4 Proposed System Content

After an analysis of the functional and non–functional systems requirements, it is concluded that six standard modules – Rescuers, Allowances, Squads Duty Chart, Emergency Cases, Map Route and Inventories will be included in Rescue 991 Emergency System. These modules can cover the whole emergency service. The Authentication module is separated for security purposes.

Aside from the main modules, several important features can be incorporated into the standard modules as sub–modules. They are the report and information sheet generation and simple word processor sub–modules.

3.5 System Development Tools Analysis

The next step following systems requirements analysis in system analysis and design is the analysis and search for the system's development tools. An analysis has been carried out on several selected system development tools to discover and study the offered features and capabilities for use with the Rapid Application Development (RAD) method.

These tools include the user interface design and RAD tool and the database development tool. The tools are checked for suitability in the aspects of simplicity to learn, the ease–of–use and comprehensiveness in features. In the analysis for the entire platform, Microsoft® products are used as the main technology producer because they can work together effectively in a given environment.

3.5.1 User Interface and RAD Tools

Two development tools are analysed to select the better user interface and RAD tool. They are Microsoft® Visual Basic 6.0 and Microsoft® Visual J++ 6.0 Professional.

3.5.1.1 Microsoft® Visual Basic 6.0

This is concluded to be the most effective and productive tool for creating high-performance applications and application components. Many improvements over the years have raised VB to the level of a real knockout contender. It is easy to use and provides the most interesting yet simple GUI compared to other tools such as Lotus Notes and Visual J++.

3.5.1.1.1 Benefits

Visual Basic 6.0 (VB6) is bundled with Visual Studio 6.0, which includes many fine tools for enhancing productivity, both with stand–alone and Web applications. In the early years of VB, one had to rely heavily on programming experience. VB6 has incorporated so many enhancements that even the novice can be up and developing applications in a short period of time. Visual Basic 6.0 is by far one of the most productive tools for creating fast business solutions for Windows and the Web [Heller, 2000]. Server–side Web applications that are easily accessible from any browser on any platform can be easily built with the VB6 Web Classes. Highly interactive Web pages can be programmed as easily as a Visual Basic form with the new Dynamic Hypertext Mark-up Language (DHTML) Page Designer.

3.5.1.1.2 Standard Features

Some standard and new features include [Heller, 2000] :

- the quick deployment and access to data using the Microsoft Data Engine (MSDE);
- the full compatibility with large Structured Query Language (SQL) Server databases;
- the Report Writer, which allows development of very sophisticated, hierarchical reports with drag-and-drop ease;
- the new Data Environment, which automatically allows for data binding to easily build applications for mobile users and client/server applications on a LAN or Web;
- the support for Microsoft universal data access using ActiveX Data Objects;
- the enhanced FlexGrid control; this enhancement will allows one to expand, collapse, hide or show various information sets;
- the ability to view tables, modify data and create SQL queries for any Open Database Connectivity (ODBC) or OLE DB-compliant database;
- the ability to visually design and modify live database schemas and other objects for Microsoft SQL Server 6.5 and Oracle 7.3.3 databases;
- the " retain-in-memory " option, which keeps component structures cached in memory for server–distributed applications.

VB6 comes in three editions – Learning Edition, Enterprise Edition and Professional Edition. Visual Basic 6.0 will work with Win95 / 98 / 2000 / NT.

3.5.1.2 Microsoft® Visual J++ 6.0 Professional

The Microsoft® Visual J++ Professional allows users to harness the productivity of the Java programming language and the power of Windows to build and deploy high–performance client–server solutions for Windows and the Web. Users can visually design, debug and deploy data–driven applications from within the high–productivity RAD environment [Moss, 2000].

3.5.1.2.1 Benefits

The high–productivity RAD environment offers two–way visual design of high–performance, feature–rich Windows and Web applications. The Windows Foundation Classes (WFC) may be used to rapidly create applications, components and middle–tier business objects [Moss, 2000]. Powerful database applications with access to a wide variety of data can be built and the Visual Database Tools can quickly create, update and view database tables and graphically design SQL queries. Software distribution and configuration can be simplified with one-button package, sign and deployment tools that deliver entire applications to remote file and Web servers.

3.5.1.2.2 Standard Features

Some standard and new features include [Moss, 2000] :

- the Visual Form Designer with drag–and–drop properties to assist in building Window–based applications and components;
- the Visual HTML Designer which simplifies the development of thin–client Web applications with integrated What–You–See–Is–What–You–Get (WYSIWYG) HTML authoring and scripting tools;
- the ability to create reusable components which can be installed on the toolbox and used to visually construct Windows and Dynamic HTML applications and other components;
- the Visual Component Manager to find, track, catalogue and reuse components using the Visual Component Manager;
- the Data Form Wizard which quickly construct powerful database applications using;
- the Visual Database Tools to design and modify database tables and schemas directly within the development environment, and easily create complex SQL statements for any database through the drag–and–drop Query Designer;
- the Flexible Packaging Options which easily package, sign and deploy complete applications into file formats such as Windows .exe, .com, .dll, .zip, .cab and more, and

- Remote Debugging where client–server solutions are debugged with cross–process and remote debugging, easily stepping from client code to server processes running on remote machines.

3.5.2 Database Development Tools

Two database development tools are analysed to choose the better tool. They are Microsoft® Access 97 and Microsoft® Visual J++ 6.0 Professional.

3.5.2.1 Microsoft® Access 97

Microsoft® Access 97 provides features a lot of features to make designing and using a database easier and produce more powerful databases. It provides the relational database power to provide information to users for decision making. It integrates data from spreadsheets and other databases, and is the easy way to find answers, share information over Intranets and the Internet and build faster business solutions.

3.5.2.1.1 Benefits

Access 97 allows users to generate, analyze and create reports within hours of work. It integrates ease–of–use from the data entry point to printing in HTML. It also provides

high–level data security features to secure and protect databases. Access 97 provides the Performance Analyzer, which analyze the database and then suggest the best ways to optimize its speed and performance before automatically making necessary changes as requested, something which other database development tools such as the Microsoft® SQL Server 6.5 are yet to come up with [Rendall, 2000].

3.5.2.1.2 Standard Features

Some standard and new features include [Rendall, 2000] :

- ❖ New Database Design features to make designing and using a database easier and produce more powerful databases;

– Run Database Utilities on an Open Database

Users can use the Compact Database and Repair Database sub–commands on the current database.

– Database Splitter Wizard

The front–end–back–end application is an application consisting of two database files. The "back–end" database files contains the tables. The "front–end" database files contains all other database objects (queries, forms, reports, macros and modules) and links to the tables in the back–end database. Typically the back–end database is located on a network server, and copies of the front–end database are installed on individual users' computers. The Database Splitter Wizard creates

a front–end–back–end application, splitting a database into a back end containing data and a front end containing all other objects and links to the tables in the back end. The original database remains unaltered.

- Database Wizard

  The Database Wizard creates a wide variety of complete databases for tasks ranging from household inventory to event management. Users can then add their own data.

- Performance Analyser

  Users can optimise the performance of some or all of the objects in a database. The Performance Analyser will analyse the database, suggest the best ways to optimise its speed and performance, and then automatically makes the necessary changes as requested.

- Database Properties

  From the Database Properties command, users can view, change and define database properties, such as title, subject, author and creation date for use in locating and identifying the database.

- Start-up Dialog Box

  User can customize an application easily in the Start-up Dialog Box by specifying the database's start-up form, and whether custom or built–in menus, the database window, or status bar are displayed. Users can also make customisation options unavailable to database users.

❖ Permanently Move Microsoft® Excel data into Microsoft® Access

When a spreadsheet is no longer the appropriate tool for data, users can create a database from the spreadsheet by clicking Convert to Access on the Data menu in Excel.

❖ Filter by Selection

Filters data according to the values selected by the users, presenting only the information that corresponds to the user selections.

❖ Tracking Database Activity in the Outlook Journal

Users can use the Outlook Journal to track when a database file was opened or closed, or when an object was printed.

❖ Simple Query Wizard

Create a select query that retrieves data from one or more tables and calculates sums, counts or other types of totals.

❖ Datasheet Filtering

Apply filters to the data in query Datasheet view to isolate a subset of records within the query's results. The filter criteria are not added to the query criteria. Users apply the filter criteria after running the query.

❖ Hyperlink Data Type

Access is one of the first desktop database developers to support the storage of hyperlinks as a native data type.

❖ Database Size

The size of one database file is one gigabyte. However, because the database can include linked tables in other files, its total size is limited only by available storage capacity.

❖ Output to Internet Database Connector (IDC)

Leveraging the IDC functionality native to Microsoft® Internet Information Server and Personal Web Server, Access 97 provides an easy way for users to share their structured data in a workgroup or over the Internet.

❖ Parameterised Queries

Extending this paradigm to the Web results in a data source that is not only dynamic, but also interactive. Users can request only the information relevant to them, and can be certain that they receive the most up–to–date response to their queries.

3.5.2.1.3 Improved Features

Some improved features include :

❖ Table Analyser Wizard

Automatically identifies the relationships in unstructured data, such as a flat–file database, and then recognizes the information into a relational database.

❖ Improved Form and Report Wizards

Users may generate forms and reports, specifically adapting the options offered to accommodate the data that they plan to include.

❖ Auto Conversion

Option that allows users to migrate existing Access databases to the latest version. As users open a database created with an earlier version, they are prompted to convert to the current format.

❖ Automation Object and Controller

Developers can take programmatic control to product functionality, such as the reporting engine, from outside of Access.

❖ Partial Table Replication

Pioneered desktop database replication, in which replication of database object across a corporate network is easy. Users can specify subsets of their data to replicate. Provides extensions for partial table replication through Data Access Objects.

❖ Improved 32–bit Performance

Access 97 is much faster and more responsive with smaller forms, better compilation and faster 32–bit data manipulation.

3.5.2.1.4 Database Security Features

Access 97 provides two traditional methods of securing a database [Rendall, 2000] : setting a password for opening a database, or user–level security, which can be used to limit the portions of the database accessible for users to read or modify. In addition to these methods, users can remove editable Visual Basic code from the database and prevent modifications to the design of forms, reports and modules by saving it as an MDE file.

- Setting a Password

The simplest method is to set a password for opening a database. Once a password is set a dialog box prompting the password will be displayed whenever the database is opened. Only users with the correct password entry will be allowed to open and access the database. This method is secure (Access 97 encrypts the password so that it cannot be accessed by reading the database file directly), but it only applies the process of opening the database. Once a database is opened, all its objects are available to the user unless user–level security has already been defined. For a database that is shared among a small group of users, or on a single computer, setting a password is often all that is required to secure it.

- User–Level Security

The most flexible and extensive method of securing a database is called user–level security. This form of security is similar to methods used in most network systems.

Users are required to identify themselves and type a password when launching Access. Within the workgroup information file, they are identified as members of a group. Access provides two default groups – administrators (named the Admins group) and users (the Users group), but additional group can be defined. Permissions are granted to groups and users to regulate how they are allowed to work with each object in a database.

3.5.2.2 Microsoft® SQL Server 6.5

Microsoft® SQL Server 6.5 combines the best of traditional mainframe computing – centralized security, data integrity and control – with the best of today's PCs – ease–of–use, rich user interface, and a variety of off–the–shelf productivity tools [Wynkoop, 1997]. It makes it possible for multiple front ends to share information, enabling the developer to choose the most appropriate tool for the job. SQL Server makes the efficient use of network; because database queries are processed at a centralized server, network traffic is reduced. SQL Server can comfortably handle database of 200GB of data today, and the number is expected to grow between 500GB and one terabyte with upcoming versions.

3.5.2.2.1 Benefits

SQL Server incorporates a world–class feature set for distributed client–server computing. Customers using SQL Server will enjoy benefits in these key areas [Wynkoop, 1997] :

- reliable distributed data and transactions;
- centralized control of distributed servers;
- very high performance and scalability;
- support for very large databases;
- full programmability and standards support;
- rich desktop integration; and
- open interoperability.

3.5.2.2.2 The SQL Server Database

A database is a collection of tables containing related information. This information can be user data as well as data required by the Database Management System (DBMS) to perform its regular functions. A SQL Server consists of multiple databases. Some of the databases are user databases and some are system databases required by the SQL Server to perform its own operations. The SQL Server can hold up to 32,767 databases. The server consists of the following databases [Wynkoop, 1997] :

- the master database – controls the SQL Server operations;
- the model database – provides a template for a user database;
- the tempdb database – provides a scratchpad area to hold temporary objects;
- the msdb database – used by the scheduler component (SQL Executive) of SQL Server;
- the distribution database – required to provide replication functionality in SQL Servers;
- the pubs database – a demo database, which is not required for the working of the SQL Server, but is provided mainly as a sample database for educational purposes; and
- the user–defined databases - consisting of a number of tables holding important information, created to support development, testing or production environments for business applications.

The master database is critical to the operation of the SQL Server. A disk failure may result in a damaged or corrupt master databases on a server, rendering all the other databases useless on that particular server. Therefore, it is important to have an up–to–date backup copy of the master database to handle such possible disasters.

3.5.3 The Tools of Choice

The choices have been made and the RAD tool decided on is Microsoft® Visual Basic 6.0 and the database development tool is Microsoft® Access 97. Microsoft® Visual Basic 6.0 is chosen over Microsoft® Visual J++ because of its ease–of–use, simple programming language, attractive user interface outcomes and comprehensive features. By adopting Java as its programming language, Microsoft® Visual J++ proves to be more useful in the development of Web–based systems or applications. Microsoft® Access 97 is decided on over Microsoft® SQL Server 6.5 because the proposed system is an independent single desktop system, not a client–server or network–enabled application. Therefore, the features of SQL Server will not benefit the development of Rescue 991 Emergency System even if it is used as the database development tool.

3.6 Development Operating System – Software and Hardware

3.6.1 The Software – Microsoft® Windows® 98

The platform for this system is Windows® 98. This OS provides a good working base for Visual Basic applications and high system performance for the Access developed database. It also promises simple system diagnostics and performance maintenance. With

supports like Plug and Play and USB (Universal Serial Bus) device mounting, this platform is great for Rescue 991 Emergency System users to perform easy connection and usage of extra image processing devices i.e. digital cameras, scanners, special printers and others. The use of the Windows® 98 platform is decided based on the objective of this project to develop a simple and user-friendly system. Since Windows 98 is a common user environment, new users will not need to learn and adapt to a new OS and end up frustrated. Users will also be comfortable with this platform as it supports many other management–related applications that may be used alongside Rescue 991 Emergency System.

References

Heller, Martin (2000). Visual Basic 6.0 Delivers a Great RAD Tool. *WinPlanet.* http://www.winplanet.com/winplanet/reviews/1433/1/

Kendall, Kenneth E. and Kendall, Julie E. (1996). *System Analysis and Design*. 4th Edition. California : Prentice–Hall, International, Inc.

Moss, Stewart. (2000). Microsoft® Visual J++ 6.0. *Microsoft Corporation.* http://www.microsoft.com/catalog/display.asp?site=729&subid=22&pg=1

Rendall, James. (2000). Microsoft® Access 97. *Microsoft Corporation.* http://www.microsoft.com/catalog/display.asp?site=3&subid=22&pg=1

Sommerwille, I. (1995). *Software Engineering.* 5th Edition. Reading : Addison–Wesley Ltd.

Wynkoop, Stephen. (1997). *Using Microsoft® SQL Server 6.5.* 2nd Edition. New York : Que Corporation. 15–112.

Chapter 4
System Design

4.1 The Architecture of Rescue 991 Emergency System

4.2 Database Design

4.3 Process Design

4.4 User Interface Design

4.5 Expected Outcome

Rescue 991 : The Malaysian Civil Defence Emergency System

After carrying out thorough analysis on the potential users and system requirements, the design phase is next where the system will be developed by translating gathered system requirements into system characteristics.

4.1 The Architecture of Rescue 991 Emergency System

Rescue 991 Emergency System is developed using an " architectural approach " which consists of three different layers – the data layer, the transaction layer and the user interface layer. A layered paradigm has many benefits that assist in meeting the objectives of the development of the Rescue 991 Emergency System.

The benefits are summarized as :

- Maintainability

Program code is organized in a recognized manner. Task oriented code is centrally located.

- Reusability

Task oriented code is easily developed for reuse, specifically for tasks that cross application boundaries.

- Testability

Module can be tested easily. Modularisation breaks up the code converging tasks into smaller manageable units.

❖ Speed

Individual modular programs can be optimised without affecting the calling procedures.

4.2 Database Design

Several tasks must be performed when implementing a relational database. First, the structure of the database must be defined to the Database Management System (DBMS). To do this, data definition language (DDL) or some other equivalent means (such as a graphical display) is used. Then the database is allocated to physical storage media and filled with data [Worboys, 1989].

The use of the entity–relationship model (E–R Model) was introduced by Peter Chen in 1976 [Chen, 1976]. In addition, the E–R model has been part of a number of Computer Aided Software Engineering (CASE) tools, which also have modified it. His model have since been extended and modified by himself and others. Today, there is no single generally accepted E–R model, but instead a set of common constructs from which most of the variants are derived [Kroenke, 1998].

4.3 Process Design

Rescue 991 Emergency System is designed based on the structured design technique. Structured design is a task or process–oriented approach for breaking up a large application program into a hierarchy of structure chart of the systems modules, which results in the entire completed systems. The structured technique is easy to implement and maintain. After the structure chart is developed, the system's data flow and main processes will be defined in comprehensive data flow diagrams (DFDs).

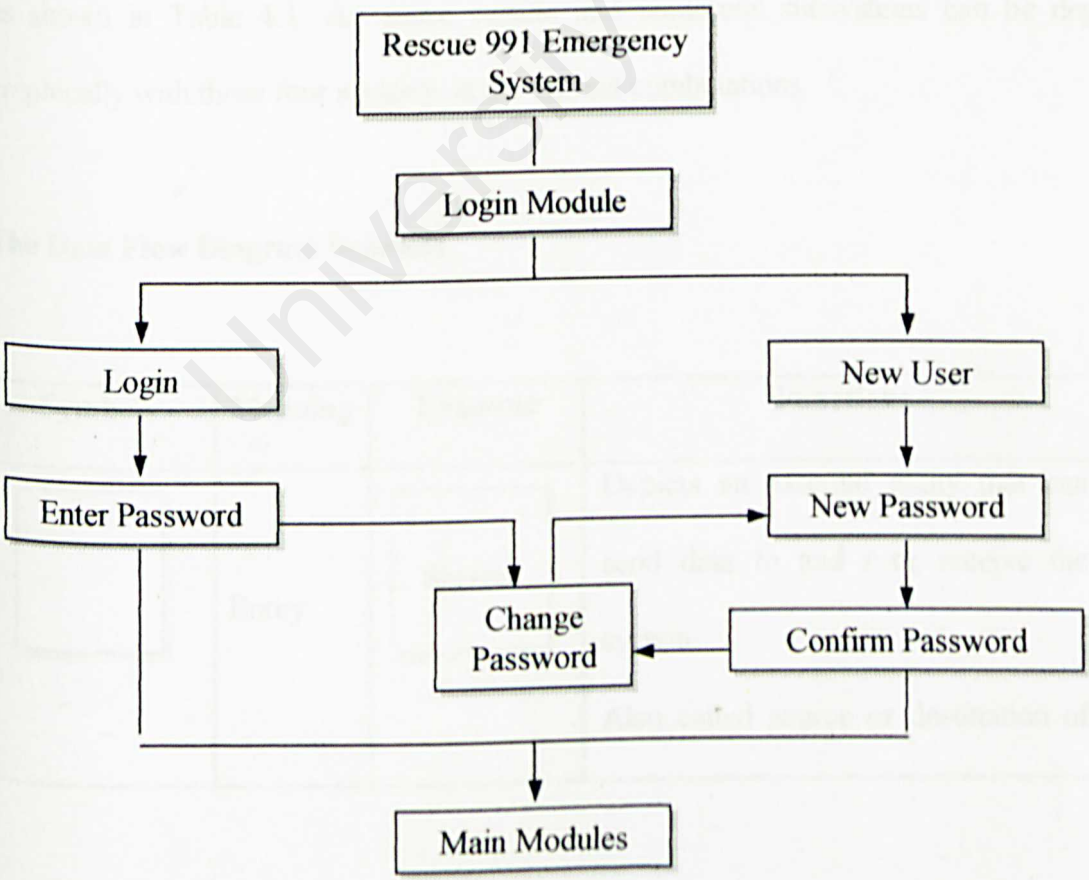
4.3.1 Structure Charts

A structure chart is a type of tree chart. Structure chart modules are depicted by named rectangles. Modules are factored, using the top–down approach, into sub–modules. The structure chart is derived from studying the flow of data through the system. Figures 4.1 depict the Rescue 991 Emergency System structure chart.

4.3.2 Data Flow Diagrams (DFD)

Through a structured development and design technique called data flow diagrams, (DFD), a graphical representation of data processes throughout the Rescue 991 Emergency System can be put together. The data flow approach emphasizes the logic underlying the system. By using the combination of only four symbols, a pictorial depiction of processes that will eventually provide solid system documentation can be created [Kendall, 1996].

Figure 4.1 The Login Section of the Structure Chart for Rescue 991 Emergency System

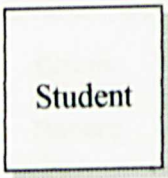


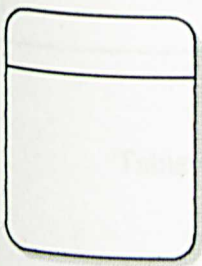
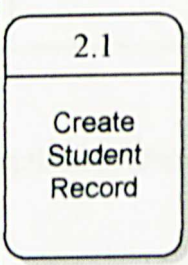
The data flow approach has four chief advantages over narrative explanations of the way data moves through the system. The advantages are [Kendall, 1996] :

- ❖ freedom from committing to the technical implementation of the system too early;
- ❖ further understanding of the interrelatedness of systems and subsystems;
- ❖ communicating current system knowledge to users through data flow diagrams; and
- ❖ analysis of a proposed system to determine if the necessary data and processes have been defined.

Four basic symbols are used to chart data movement on data flow diagrams. They are a double square, an arrow, a rectangle with rounded corners and an open–ended rectangle as shown in Table 4.1. An entire system and numerous subsystems can be depicted graphically with these four symbols in the correct combinations.

The Data Flow Diagram Symbols

Symbol	Meaning	Example	Functions
	Entity		Depicts an external entity that can send data to and / or receive the system. Also called source or destination of

			data, considered as outside of the boundaries of the system.
→	Flow of Data	New Student information →	Represent the flow of data or information from one point to another. Arrow describes the directions of data flow, with the head of the arrow pointing toward the data's destination. Each data flow is labelled with the name or details of the data or information represented by the data flow. Data flows occurring simultaneously can be depicted doing just that through the use of parallel arrows.
	Process		Used to show occurrences of a transforming process. Processes always denote a change in or transformation of data. Processes represent work being performed within the system. The rounded

			rectangle consists of two sections : 1. the top section contains the unique identifying number indicating its level within the diagram, and 2. the lower section contains a description of the process.
	Data Store	D3 Student Master	Represents data store and holds data for a given time within the system. May represent manual store, such as filling cabinets or computerized files or databases. Comprises of two sections: 1. identifier reference number, and 2. description of the data stored.

Table 4.1 Descriptions of functions of the data flow diagram symbols.

4.4 User Interface Design

User interface design describes how software communicates with the human user who uses it [Mundher, 1994]. The Rescue 991 Emergency System user interface design focuses on the effective general interaction between its user and the system. It also takes into account development of complete, unambiguous and easy–to–understand information displays. A user–friendly data input medium is also important [Nilakanta, 1989].

The interface is the system for most users. However well or poorly designed, it stands as the representation of the system, and by reflection, the system developer's competence as a system analyst [Kendall, 1996]. The goal of good interface design is to produce an interface that helps users and get the information they need in and out of the system by addressing the following objectives :

- effectiveness as achieved through the design of interfaces that allow users to access the system in a way that is congruent with their individual needs and capabilities;
- efficiency as demonstrated through interfaces that both increases the speed of data entry and reduces errors;
- user consideration as demonstrated in the design of suitable interfaces and by providing appropriate feedback to users from the system; and

- productivity as measured by ergonomically sound principles of designs for user interfaces and workspaces.

To be usable, an interface must let users, working in their own physical, social and cultural environments, accomplish their goals and tasks effectively and efficiently [Hackos, 1998]. To be usable, an interface must also be perceived as usable by those who must use it or choose to use it. They must be pleased; made comfortable and even amazed by how effectively their goals are supported by the system's design. In the best case, they will be oblivious to the design – it simply works so well that they do not notice it. The truly usable interface is transparent to the work the user is trying to accomplish. Usable interfaces have certain characteristics in common :

- they reflect the workflows that are familiar or comfortable;
- they support the users' learning style;
- they are compatible in the users' working environment;
- they encompass a design concept that is familiar to the users;
- they have a consistency of presentation that makes them appear reliable and easy to learn; and
- they use languages and illustrations that are familiar to the users or are easy to learn.

In short, usable interfaces fit in, simply and elegantly, with users' life and work needs. If not immediately obvious to the users, they are quickly learnable. Such usable interfaces rarely happen by chance.

4.4.1 Features of a Usable User Interface

4.4.1.1 Consistency

The Rescue 991 Emergency System user interface design takes into consideration the consistency of the interface for menu selection and design, command input, toolbar buttons and functions, data display and others. A particular button used to represent a simple function preserves the same representation throughout all system modules and objects. The goal of consistency is to develop a system, which is easy to learn and apply.

4.4.1.2.1 Feedback

All systems require feedback, in order to monitor and change behaviour. Feedback usually compares current behaviour with predetermined goals and gives back information describing the gap between actual and intended performance. The system provides feedback to its users after a process is either successfully or unsuccessfully performed. Feedback is vital to inform users the status and achievement of particular processes.

When human users interfaces with machines, they still need feedback about how their work is progressing. As designers of user interfaces, system developers need to be aware of the human need for feedback and build it into the system. Although text is typically referred to as online systems feedback, standardized icons can often be used to supply feedback. For example, displaying an hourglass while the system is processing

encourages the user to wait for some time, rather than repeatedly hitting keys to try and invoke another screen or response. Feedback is basically needed to :

- ❖ acknowledge acceptance of input;
- ❖ recognize that input is in the correct form;
- ❖ notify that input is not in the correct form;
- ❖ explain a delay in processing;
- ❖ acknowledge that a request is completed;
- ❖ notify that a request was not completed; and
- ❖ offering the user more detail feedback.

4.4.1.3 Error Checking and Handling

The system protects itself from the erroneous operations that may cause fatal failures. The system provides substantial error checking on the user–input level and further actions, which may cause errors. Error messages will be displayed whenever an error has been detected. The design also focuses on providing meaningful error messages, which describe problems in jargon, that layman and non–technology savvy users may comprehend and understand. In addition, error messages are not just informative, but are also designed to provide constructive advises for error recovery.

4.4.1.4 Minimization of the Number of Input Actions

Minimum amount of typing and data entry can be accomplished by exploiting the functions of the mouse to select from predefined sets of inputs and providing default entry values from frequently–used data sets.

4.4.2 Type of User Interface in Rescue 991 Emergency System

The type user interface employed in the development of Rescue 991 Emergency System is the form–fill interface. Form–fill interfaces consist of on–screen form or web–based forms displaying fields containing data items or parameters that need to be communicated to the user [Kendall, 1996]. The form often is a facsimile of the paper form already familiar to the user. This interface technique is also known as a form–based method and input/output forms. On–screen forms are set up to show what information should be input and where. Blank fields requiring information can be highlighted with inverse or flashing characters. The user moves the cursor from field to field by a single stroke of the tab or arrow key, for instance. This arrangement allows movement one field backward and one field forward by hitting the arrow key.

Form input for screens can be simplified by applying default values for fields and then allowing users to modify default information if necessary. For example, a database management system designed to show a form for inputting checks may supply the next

sequential check number as a default when a new check form is exhibited. If checks are missing, the user changes the check number to reflect the actual check being input.

4.5 Expected Outcome

It is anticipated that the Rescue 991 Emergency System will be able to effectively and efficiently provide solutions to rescue team managers to accelerate managerial and operational emergency processes by adopting an intelligent relational database, integrated process flows and a usable user interface design. Team managers will finally be able to focus more on the really important thing – planning and making decisions for handling numerous emergency cases, using Rescue 991 Emergency System as a tool to increase their competitive edge in the emergency service.

References

Chen, P.P. (1976). The Entity-Relationship Model: Toward A Unified View Of Data. *ACM Transactions on Database Systems*. Volume 1 (1) : 9 – 36.

Hackos, JoAnn T. and Redish, Janice C. (1998). Introducing User and Task Analysis for Interface Design. *User and Task Analysis for Interface Design*. Toronto : John Wiley & Sons, Inc. 1 – 19.

Kendall, Kenneth E. and Kendall, Julie E. (1996). Using Data Flow Diagrams. *System Analysis and Design*. 4th Edition. California : Prentice–Hall, International, Inc. 235 – 296.

Kroenke, David M. (1998). Database Processing: Fundamentals, Design and Implementation. 6th Edition. California : Prentice–Hall, International, Inc.

Mundher, G. (1994). The Design of the User Interface for an Information System. *Information and Software Technology*. Volume 36 (12) : 773 – 742.

Nilakanta, S. (1989). Developing User Interfaces in Relational Database Management Systems. *Information and Software Technology*. Volume 31 (6): 395 – 438.

Worboys, M. (1989). Relational Database: A Theoretical Primer. *Information and Software Technology*. Volume 31 (3) : 115 – 122.

Chapter 5
System Implementation

5.1 Introduction

5.2 Development Environment

5.3 Development of Rescue 991 Emergency System

5.4 System Testing

Rescue 991 : The Malaysian Civil Defence Emergency System

5.1 Introduction

System implementation is the construction of the system and the delivery of that system into production. System implementation includes building and testing system, which is also called the construction phase. Construction phase of the system involves the conversion of the system requirements and designs into program codes.

5.2 Development Environment

Using suitable hardware and software can speed up system development or construction. The software tools used to develop and documented the entire system is as discussed below.

5.2.1 Software Tools Requirements

1. Software tools for design and report writing

The term design refers to drawing of structured chart, data flow diagrams, entity-relationship diagrams and others that serve as the basic of the development of The

Rescue 991 Emergency System. The tools used are Microsoft Word 97 and Microsoft PowerPoint 97.

2. Software tools for development

There is a vast array of software tools used in the development of Rescue 991 Emergency System. Table 5.1 depicts the software used to develop the system.

Software	Usage	Description
Microsoft Windows 98	System Requirement	Operating System
Microsoft Visual Basic 6.0	System Development	System Coding
Microsoft Access 97	Database	Build the database to store and manipulate the data
Microsoft Paint	Image Design	Image Design
Presto ! PageManager 2.30	Image Design & Contents Design	Scan Images

Table 5.1 Summary of Software Tools for the Development of Rescue 991 Emergency System

5.3 Development of Rescue 991 Emergency System

At the initial stage of the development phase, the developer is required to create a windows-based system using Visual Basic 6.0 (VB 6). Rescue 991 Emergency System appropriately uses some of the VB 6 features and technology in creating, editing, deploying and managing the system. It combines a rich set of database connectivity tools, wizards, and design-time controls to increase the functionality and decrease the development time to build the system.

Visual Basic 6.0 is chosen to develop the Rescue 991 Emergency System due to the following reasons :

1. Tools to create windows application

VB 6 is a visual programming language that enables the development to rapidly create a windows-based application. It provides a complete set of building windows objects such as buttons, text boxes, list boxes, scroll bar, etc.

2. Easier to learn

VB 6 code is based on the BASIC programming language (Beginners All-purpose Symbolic Instruction Code). This means that the code written in VB 6 is easy to read, write and understand. Therefore, the time needed to learn this language is shorter.

3. Support database connectivity

VB 6 application can be used to access the database that is built in the Microsoft Access 97. VB 6 application will act as a front-end tool for the user to add, modify, delete and view the contents of the database.

Besides, Presto ! PageManager 2.30, and Microsoft Paint are used for beautifying The Rescue 991 Emergency System. Presto ! PageManager is used to scan pictures and Microsoft Paint is a tool used for drawing and editing images.

Program optimisation is a process of improving the efficiency of the system. Rescue 991 Emergency System is a Graphical User Interface based program, the speed at which information appears on the screen gives user the impression on how well the program will perform. Therefore, this process is advisable to be carried out. There are 2 ways in doing so, the first is to increase the execution speed of the program and second is to decrease the amount of memory using to run the program.

- Increasing execution speed

Some of the steps taken to increase the execution speed are as follows :

- Avoid using variant data types because it requires additional internal program standards to identify the information being stored.
- Minimize the amount of program initialisation when the form is being loaded. This makes the user perceive that the program is running faster.

- Decreasing program size

The steps taken to reduce the program size are :

- Reviewing codes for unused variables, constant and remove it from the program codes.

5.4 System Testing

Software testing is a critical element of software quality assurance and represents the ultimate review of specification, design and coding. Rules that can serve well as testing objectives are :

- Testing is a process of executing a program with the intent of finding an error.
- A good test case is one that has a high probability of finding an undiscovered error.

- A successful test is one that uncovers a yet undiscovered error.

A software module is exposed to testing both during the development phase and during the test and integration phase. During the development phase, each function or procedure that is a part of a module is independently developed and thoroughly tested until the entire module is complete. The major difference between testing a module during its development phase and testing it during the test and integration phase is that, during the development phase, errors are fixed as they are found. While during the test and integration phase, failures, if any, are recorded and the failed module returned to the development phase along with an explanation of failures experienced. The Rescue 991 Emergency System has undergone 3 stages of testing before it was considered as a completed system. They are Unit Test, Integration Test, and System Test.

5.4.1 Unit Testing

Quality software relied on testing each function, module or class (in object-oriented programming). This practice called unit testing, which is effective, is extremely time-consuming and labour intensive. Using the detail design description as a guide, important control paths are tested to uncover errors within the boundary of the module. The relative complexity of tests and errors detected as a result is limited by the constrained scope established for unit testing. Unit testing is also referred to as module testing, and is usually performed by the software developer.

For Rescue 991 Emergency System, unit testing was done during coding phase. After the source codes of a module has been developed, reviewed and verified for the correct syntax, unit-testing case was designed. The module was tested to ensure that it operates correctly.

5.4.2 Integration Testing

Testing a specific feature together with other newly developed feature is known as integration testing. Testing the interface of two components explores how components interact with each other. Integration testing inspects the variables passed not only between two components, but also the global variables. This test phase assumes the components and the object they manipulate have their entire local unit test.

Previously captured unit test scripts can be combined to create a variety of integration test cases, with minimum effort. For instance, a unit test script that tested on an ADD function can be scheduled with other tests for DELETE and UPDATE to create an integration test of the entire module in Rescue 991 Emergency System.

Incremental integration approach was applied during the development of Rescue 991 Emergency System. The system was constructed and tested in small arguments, where errors were easier to isolate and correct. Error will be corrected before proceeding to the next integration.

5.4.3 System Testing

System testing is designed to reveal bugs that cannot be attributed to individual components, or to the interaction among components and other objects. System test studies all the concern issues and behaviours that can only be exposed by testing the entire integrated system or a major part of it. System testing includes testing for performance, stress, security, configuration sensitivity, usability, data integration, start-up and recovery. System testing verifies that the overall system performance, the Rescue 991 Emergency System is functioning properly and ensures all objectives are achieved.

Chapter 6
Evaluation and Debugging

6.1 Project Problems and Solutions

6.2 System Strengths

6.3 System Limitations

Rescue 991 : The Malaysian Civil Defence Emergency System

6.1 Project Problems and Solutions

Some problems were encountered throughout the development of Rescue 991 Emergency System. These problems with the approaches taken to solve them are documented into two separate sections :

i. Project studies and analysis

ii. Project implementation and testing

6.1.1 Problems and Solutions during Project Studies and Analysis

Project studies and analysis with respect to windows-based system are needed. These studies could help the developer to have a basic knowledge to develop The Rescue 991 Emergency System. The major problems encountered during system studies and analysis was choosing the software development kits.

Rescue 991 Emergency System is a front-end user database system. There are many programming languages and tools that can be used as the development tool for the system. Choosing a suitable programming language as a main development tool is an essential process. All programming tools have their own individual strengths and weaknesses. Limitation of the knowledge about the programming tools has caused the programming tools selection process to become more critical.

There are two ways to overcome this problem; retrieving information from the Internet and reading the features on the programming tools. Reading up on relevant materials and most importantly, advice and guidance from course mates and the project supervisor resolve most of the ambiguities.

6.1.2 Problems and Solutions during Project Implementation and Testing

Some problems were faced during project implementation and testing process. Inconsistency and bugs in certain development tools and programming languages caused most of these problems. Those problems encountered during these phases are explained below.

- **Lack of Knowledge in Writing SQL Statements**

  Microsoft Visual Basic 6.0 links to Microsoft Access at Design phase using the Active Data Control RecordSource. This RecordSource uses the SQL Statement procedure. Problem arises when linking the database to VB 6 using the Master / Details design. In this design, the Master record will display only distinct selected fields, while the Details record will display all records based on these distinct selected fields. To overcome this problem,

manipulation of SQL Statements was studied to result in the appropriate outcome.

- **Loading Image Files in Microsoft Access**

In the Duty Chart module, images are loaded based on the search command. To be able to use this search command, image files must be loaded into the database beforehand.

Microsoft Access solves this problem by using the OLE Object method to load image files into the database. This will then enable the search command from VB 6 to search the database for images.

6.2 System Strengths

The Rescue 991 Emergency System has several features of qualities that are listed as below.

1. Provide An Easy Tool

The command and the layout of The Rescue 991 Emergency System are easy to use, simple to learn and understandable. Normal users who have some experiences in using software in the market will find The Rescue 991 Emergency System easy to use.

2. User Friendly

Rescue 991 Emergency System is developed based on GUI. It has a very user friendly and consistent environment that is similar to other window applications. This user-friendly interface and predictable control object will shorten the learning period.

3. Computer v. Paper

Rescue 991 Emergency System allows users to store as many data and records in one system compared to paper. It also allows retrieval of records with ease with its search command.

6.3 System Limitations

Rescue 991 Emergency System is a front-end user database system. However, just like any other systems, it has its limitations. The following are the limitations of The Rescue 991 Emergency System.

1. **Can't Support Multi-user Environment**

Rescue 991 Emergency System is a stand-alone system and can't support multi-user environment. All users will have to install the system in their own computer to run The Rescue 991 Emergency System.

2. **Animation and Sound**

The Rescue 991 Emergency System does not provide animation and sound. It will be more attractive if it were provided with animation and sound.

Chapter 7
Conclusion and Future Enhancements

7.1 Future Enhancements

7.2 Conclusion

Rescue 991 : The Malaysian Civil Defence Emergency System

7.1 Future Enhancements

The system limitation should be improved and corrected to enhance the functionality of The Rescue 991 Emergency System in the future. There are some suggestions to add more values to the current version of Rescue 991 Emergency System.

1. Implement The Rescue 991 Emergency System in a Multi-user Environment

To benefit all users, the system will be modified to enable network accessing. This can be achieved by using the LAN environment. In a multi-user environment, Rescue 991 Emergency System is needed to be installed only in a server and other machines that are connected to the server can gain access to the system. Every user has their own account to access the system through the network system. This is useful, as not many workstations need to be installed to allow users to use this system.

2. More Interesting Animation and Interactive Application

More interesting animation and interactive applications will provide a more attractive and efficient system.

3. Digital Video

Documentary movies will be available to enhance a user's interest in the system. The movie format will be saved as .avi files and running in full screen and digital sound.

4. Report

The Rescue 991 Emergency System report function will be fully enhanced. The report may be generated based on a database query. This will allow users to generate report on selected data and records.

7.2 Conclusion

The Rescue 991 Emergency System has been successful in attaining its objective of developing an effective management and administration process by implementing an integrated system. Rescue 991 Emergency System was found to be user-friendly, easy to understand and effective.

However, minor limitations still exist in the system. For example, the current implementation of Rescue 991 Emergency System is limited to a single computer. In the future, the scope of implementation will be extended to include multiple users. All this limitation will be enhanced to make the system more powerful and useful.

Building a windows-based application is a challenging task. A lot of research, time, and effort have been taken in making this project successful. A lot of valuable knowledge has been gained throughout the development of this project, which includes the whole development process in building a system, window-based programming techniques, concepts and developing application using Visual Basic 6.0.

Throughout this project, a lot of experience has been gained. New knowledge has been acquired and more importantly, there has been an improvement in project management. Having an up-to-date knowledge and information becomes important in keeping up with the fast and ever changing fields in the information technology edge.

After all, it is time for us as the new generation to be in sync with the technologies of the new millennium.

Glossary

Rescue 991 : The Malaysian Civil Defence Emergency System

Glossary

ActiveX

Microsoft's answer to Java. ActiveX is a stripped down implementation of OLE designed to run over slow Internet links.

ActiveX Data Objects (ADO)

The objects that allowed the programmer to access any type of database needed by the application.

Advanced Interactive eXecutive (AIX)

IBM's version of Unix, taken as the basis for the OSF standard.

application program

A complete, self-contained program that performs a specific function directly for the user. The term may be used to distinguish programs which communicate via a graphical user interface from those which are executed from the command line.

Application Program Interface (API)

The interface by which an application program accesses operating system and other services. An API is defined at source code level and provides a level of abstraction between the application and the kernel to ensure the portability of the code.

architecture

Design, the way components fit together. The term is used particularly of processors, both individual and in general. It may also be used of any complex system, e.g. "software architecture", "network architecture".

back–end

Any software performing either the final stage in a process, or a task not apparent to the user. A common usage is in a compiler. A compiler's back-end generates machine language and performs optimisations specific to the machine's architecture.

client–server

A common form of distributed system in which software is split between server tasks and client tasks. A client sends requests to a server, according to some protocol, asking for information or action, and the server responds.

Computer Aided Design (CAD)

The part of CAE concerning the drawing or physical layout steps of engineering design. Often found in the phrase " CAD / CAM " for " ...manufacturing ".

Computer Aided Software Engineering (CASE)

A technique for using computers to help with one or more phases of the software life–cycle, including the systematic analysis, design, implementation and maintenance of software.

database

One or more large structured sets of persistent data, usually associated with software to update and query the data. A database is one component of a database management system.

Data Definition Language (DDL)

1. A language enabling the structure and instances of a database to be defined in a human–, and machine–readable form.
2. A specification language for databases, based on the entity-relationship model.

Database Management System (DBMS)

A suite of programs, which typically manage large structured sets of persistent data, offering ad hoc query facilities to many users. A DBMS can be an extremely complex set of software programs that controls the organization, storage and retrieval of data in a database and controls the security and integrity of the database. The DBMS accepts requests for data from the application program and instructs the operating system to transfer the appropriate data.

Data Flow Diagram (DFD)

A graphical notation used to describe how data flows between processes in a system. An important tool of most structured analysis techniques.

drag and drop

A common method for manipulating files and sometimes text under a graphical user interface. The user moves the pointer over an icon representing a file and presses a mouse button. He holds the button down while moving the pointer to another place, usually a directory viewer or an icon for some application program, and then releases the button.

entity–relationship model

An approach to data modelling proposed by P. Chen in 1976. The model says that you divide your database in two logical parts, entities and relations. Entity–relationship diagrams can be used to represent a model.

front–end

An intermediary computer that does set-up and filtering for another (usually more powerful but less friendly) machine (a " back end ").

Graphical User Interface (GUI)

The use of pictures rather than just words to represent the input and output of a program. A program with a GUI runs under some windowing system. The program displays certain icons, buttons, dialogue boxes etc. in its windows on the screen and the user controls it mainly by moving a pointer on the screen and selecting certain objects by pressing buttons on the mouse while the pointer is pointing at them.

hardware

The physical, touchable, material parts of a computer or other system. The term is used to distinguish these fixed parts of a system from the more changeable software or data components which it executes, stores, or carries. Computer hardware typically consists chiefly of electronic devices with some electromechanical parts for input, output, and storage, though completely non-electronic computers have also been conceived of and built.

Hypertext Markup Language (HTML)

A hypertext document format used on the World-Wide Web. HTML is built on top of SGML. " Tags " are embedded in the text.

Intel Corporation

A US microelectronics manufacturer. They produced the Intel and Pentium microprocessor families as well as many other integrated circuits and personal computer networking and communications products.

International Business Machines (IBM)

The best known American computer manufacturer, founded by Thomas J. Watson. IBM makes everything from mainframes to personal computers (PCs) and has been immensely successful in selling them, chiefly to business.

IBM PC

International Business Machines Personal Computer. IBM PCs and compatible models from other vendors are the most widely used computer systems in the world. They are typically single user personal computers, although they have been adapted into multi-user models for special applications.

Internet

The Internet is the largest internet in the world. It is a three level hierarchy composed of backbone networks (e.g. ARPAnet), mid-level networks, and stub networks. These include commercial, university and other research networks and military networks and span many different physical networks around the world with various protocols, chiefly the Internet Protocol.

local area network (LAN)

A data communications network which is geographically limited (1 km radius) allowing easy interconnection of terminals, microprocessors and computers within adjacent buildings. Ethernet is an example of a standard LAN. Optimizations can be made in the network signal protocols that permit data rates up to 100Mb/s.

Linux

(" Linus Unix ") An implementation of the Unix kernel originally written from scratch with no proprietary code. The kernel runs on Intel and Alpha hardware in the general release, with SPARC, PowerPC, MIPS, ARM and SGI in active development.

network

Hardware and software data communication systems. The OSI seven layer model attempts to provide a way of partitioning any computer network into independent modules from the lowest (physical) layer to the highest (application) layer.

Object Linking and Embedding (OLE)

A distributed object system and protocol from Microsoft, also used on the Acorn Archimedes. OLE allows an editor to " farm out " part of a document to another editor and then import it.

Open DataBase Connectivity (ODBC)

A standard for accessing different database systems. There are interfaces for Visual Basic, Visual C++, SQL and the ODBC driver pack contains drivers for the Access, Paradox, dBase, Text, Excel and Btrieve databases. An application can submit statements to ODBC using the ODBC flavour of SQL. ODBC then translates these to whatever flavour the database understands. ODBC is based on Call-Level Interface and was defined by the SQL Access Group. ODBC drivers and development tools are available now for Microsoft Windows, Unix, OS/2, and Macintosh.

personal computer (PC)

A general–purpose single–user microcomputer designed to be operated by one person at a time. This term and the concept has been successfully hijacked by IBM due to the huge market share of the IBM PC.

process

An executing program. A process consists of the program code (which may be shared with other processes which are executing the same program), and some private data. It may have other associated resources such as a process identifier, open files, CPU time limits, shared memory, child processes, and signal handlers.

random–access memory (RAM)

A data storage device for which the order of access to different locations does not affect the speed of access.

Rapid Applications Development (RAD)

A loose term for any software life-cycle designed to give faster development and better results and to take maximum advantage of recent advances in development software. It is associated with a wide range of approaches to software development : from hacking away in a GUI builder with little in the way of analysis and design to complete methodologies expanding on an information engineering framework.

relational database

A database based on the relational model developed by E.F. Codd. A relational database allows the definition of data structures, storage and retrieval operations and integrity constraints. In such a database the data and relations between them are organized in tables. A table is a collection of records and each record in a table contains the same fields. Certain fields may be designated as keys, which means that searches for specific values of that field will use indexing to speed them up. Where fields in two different tables take values from the same set, a join operation can be performed to select related records in the two tables by matching values in those fields. Because these relationships are only specified at retrieval time, relational databases are classed as dynamic database management system.

Requirements Analysis

The process of reviewing a business's processes to determine the business needs and functional requirements that a system must meet.

software

The instructions executed by a computer, as opposed to the physical device on which they run (the " hardware "). Software can be split into two main types – system software and application software or application programs.

Software Life–Cycle

The phases a software product goes through between when it is conceived and when it is no longer available for use.

Solaris

Sun Microsystems, Inc.'s version of the Unix operating system. As well as the core operating system, Solaris includes networking software, the Java Virtual Machine, the CDE / Desktop that includes an X11-based windowing environment and graphical user interface.

source code

The form in which a computer program is written by the programmer in some formal programming language which can be compiled automatically into object code or machine code or executed by an interpreter.

spreadsheet

A type of application program which manipulates numerical and string data in rows and columns of cells.

structured analysis

One of a number of requirements analysis methods used in software engineering.

structured design

One of a number of systematic top-down design techniques used in software engineering, usually after structured analysis.

structured programming

Any software development technique that includes structured design and results in the development of a structured program.

Structured Query Language (SQL)

An industry-standard language for creating, updating and, querying relational database management systems. IBM developed SQL for use as the de facto standard as well as being an ISO and ANSI standard. It is often embedded in general purpose programming languages.

Super Video Graphics Array (SVGA)

A video display standard created by VESA for IBM PC compatible personal computers. The resolution is 800 x 600 4-bit pixels.

system software

Any software required to support the production or execution of application programs but which is not specific to any particular application. System software typically includes an operating system to control the execution of other programs; user environment software; development tools for building other programs; debugging, profiling and monitoring tools; and utility programs.

top–down design

The software design technique, which aims to describe functionality at a very high level, then partition it repeatedly into more detailed levels one level at a time until the detail is sufficient to allow coding.

Universal Serial Bus (USB)

An external peripheral interface standard for communication between a computer and external peripherals over an inexpensive cable using bi-serial transmission. USB works at 12 Mbps with specific consideration for low cost peripherals, supports up to 127 devices, and both isochronous and asynchronous data transfers. Cables can be up to five meters long and it includes built–in power distribution for low power devices. It supports daisy chaining through a tiered star multi–drop topology.

user–friendly

Programmer–hostile. Generally used to describe systems that hold the user's hand so obsessively that they make it painful for the more experienced and knowledgeable to get any work done.

Windows NT

Microsoft's 32-bit operating system developed from what was originally intended to be OS/2 3.0 before Microsoft and IBM ceased joint development of OS / 2 for high end workstations, servers and corporate networks. Windows NT is a complete operating system.

Window System

Software which allows a workstation's screen to be divided into rectangular areas which act like a separate input/output devices under the control of different

application programs. This gives the user the ability to see the output of several processes at once and to choose which one will receive input by selecting its window. Examples are the X Window System, and proprietary systems on the Macintosh and NeXT, NeWS on Suns and RISC OS on the Archimedes.

word processor

A program used to create and print (chiefly textual) documents that might otherwise be prepared on a typewriter. The key advantage of word processor is its ability to make changes easily, such as correcting spelling, changing margins, or adding, deleting, and relocating entire blocks of text. Once created, the document can be printed quickly and accurately and saved for later modifications.

Appendices

Appendix A	**Emergency Processes and System Requirements Survey Form (English version)**
Appendix B	**Emergency Processes and System Requirements Survey Form (Malay version)**
Appendix C	**Emergency Processes and System Requirements Interview**
Appendix D	**User Manual**

Rescue 991 : The Malaysian Civil Defence Emergency System

BACHELOR OF INFORMATION TECHNOLOGY
FACULTY OF COMPUTER SCIENCE &
INFORMATION TECHNOLOGY
UNIVERSITY OF MALAYA
2000 / 2001

SURVEY FORM
for
RESCUE 991 : THE MALAYSIAN CIVIL DEFENCE EMERGENCY SYSTEM
by
SITI AZIRIN ABDUL AZIZ

Sir / Madam / Mr. / Ms.,

Please fill in the blanks and tick (√) in the appropriate ☐. For your cooperation, I thank you.

1. Name : .....

2. Rank : ☐ Officer ☐ Warrant Of. / Sergeant ☐ Corporal
☐ L/Corporal ☐ Private

3. Section : ☐ FA & Ambulance ☐ Fire Brigade ☐ Rescue
☐ Charity

4. Squad : ☐ Bantuan Pagi ☐ Alpha ☐ Bravo ☐ Charlie
☐ Delta ☐ Echo ☐ Foxtrot ☐ Pro
☐ Others (please specify) : .....

5. Duration of service in Rescue 991 :

☐ 0 – 2 years ☐ 2 – 4 years ☐ 4 – 6 years ☐ 6 – 8 years

6. Type of services that have been given :

☐ Search and rescue disaster victims

☐ Tending and sending accident and disaster victims to the hospital

☐ Catching poisonous animals

☐ Search and rescue drift and drown victims

☐ Search and rescue flood victims

☐ Forest search and rescue

☐ Others (please specify) : .....

7. What type of system is being used now ?

☐ Manual / Written ☐ Computerized

8. State the good qualities of the current system :

.....

9. State the weak qualities of the current system :

.....

10. What do you think of changing the current system to an integrated computerized system ?

☐ Good ☐ Not good

Reason : .....

11. Suggest the qualities that should be adopted by a good system :

☐ Attractive

☐ Simple to use

☐ Overall coverage

☐ Effective

☐ Others (please specify) : .....

SARJANA MUDA TEKNOLOGI MAKLUMAT
FAKULTI SAINS KOMPUTER &
TEKNOLOGI MAKLUMAT
UNIVERSITI MALAYA
2000 / 2001

BORANG SOAL SELIDIK
untuk
RESCUE 991 : SISTEM KECEMASAN PERTAHANAN AWAM MALAYSIA
oleh
SITI AZIRIN ABDUL AZIZ

Tuan / Puan / Encik / Cik,

Sila isi pada ruang kosong dan tandakan (√) dalam ☐ yang telah disediakan. Segala kerjasama yang diberikan saya dahului dengan ucapan ribuan terima kasih.

1. Nama : .....

2. Pangkat : ☐ Pegawai ☐ P. Waran / Sarjan ☐ Koperal
☐ L/Koperal ☐ Prebet

3. Seksyen : ☐ PC & Ambulan ☐ Bomba ☐ Penyelamat
☐ Kebajikan

4. Skuad : ☐ Bantuan Pagi ☐ Alpha ☐ Bravo ☐ Charlie
☐ Delta ☐ Echo ☐ Foxtrot ☐ Pro
☐ Lain-lain (sila nyatakan) : .....

5. Tempoh perkhidmatan dalam Rescue 991 :

☐ 0 – 2 tahun ☐ 2 – 4 tahun ☐ 4 – 6 tahun ☐ 6 – 8 tahun

6. Jenis perkhidmatan yang pernah diberikan :

☐ Mencari dan menyelamat mangsa bencana

☐ Merawat dan menghantar mangsa kemalangan dan bencana ke hospital

☐ Menangkap binatang berbisa

☐ Mencari dan menyelamat mangsa hanyut atau lemas

☐ Mencari dan menyelamat mangsa banjir

☐ Mencari dan menyelamat di hutan

☐ Lain-lain (sila nyatakan) : .....

7. Apakah jenis sistem yang digunakan sekarang ?

☐ Manual / Bertulis ☐ Berkomputer

8. Nyatakan kebaikan sistem yang sedia ada :

.....

9. Nyatakan kelemahan sistem yang sedia ada :

.....

10. Apa pendapat anda bertukar dari sistem yang sedia ada kepada sistem berkomputer ?

☐ Baik ☐ Tidak Baik

Alasan (sebab) : .....

11. Cadangkan perkara yang perlu ada dalam suatu sistem yang baik :

☐ Menarik

☐ Mudah digunakan

☐ Menyeluruh

☐ Efisien

☐ Lain-lain (sila nyatakan) : .....

BACHELOR OF INFORMATION TECHNOLOGY
FACULTY OF COMPUTER SCIENCE &
INFORMATION TECHNOLOGY
UNIVERSITY OF MALAYA
2000 / 2001

EMERGENCY PROCESSES AND SYSTEM REQUIREMENTS INTERVIEW
for
RESCUE 991 : THE MALAYSIAN CIVIL DEFENCE EMERGENCY SYSTEM
by
SITI AZIRIN ABDUL AZIZ

---

1. Rank & Name : .....

2. Team Position : .....

3. How long have you been involved in the :

   Civil Defence Force : .....

   Rescue 991 : .....

4. What is the difference between the Civil Defence Force and the Rescue 991 ?

.....

.....

5. What are the major disasters that has been handled by the Rescue 991 ?

.....

.....

6. How was The Rescue 991 Emergency Line received by the people ?

.....

.....

7. Has the people's response result in the increase of new volunteer rescuers ?

.....

.....

8. On average, what is the annual intake of new volunteer rescuers ?

.....

9. What is the system that is being used by the Rescue 991 ?

.....

.....

10. What are the procedures that the Rescue 991 has to go through before an emergency case is handled ?

.....

.....

11. What do you think of integrating the Rescue 991 system ?

.....

.....

12. Has there been any effort to integrate the current Rescue 991 system ?

.....

.....

13. What is the Communication Logging System (C.L.S.) ?

.....

.....

14. What is the Data Logging System (D.L.S.) ?

.....

.....

15. What is the Computerized Information Map Route System ?

.....

.....

16. In your opinion, is the current system highly effective or is there room for improvement ?

.....

.....

17. What do you suggest to improve the current system ?

.....

.....

18. What components and characteristics should be adopted to improve the current system ?

.....

.....

19. In your opinion, is it a good effort to integrate both the team management and emergency management in one system ?

.....

.....

20. How do you see the Rescue 991 in the future ?

.....

.....

RESCUE 991 :
THE MALAYSIAN CIVIL DEFENCE EMERGENCY SYSTEM

USER MANUAL

Department of Information Technology
Faculty of Computer Science &
Information Technology
University of Malaya
2000 / 2001

Run Rescue 991 Emergency System

1. From the Desktop, search for the Rescue 991.exe
2. Click on it to run The Rescue 991 Emergency System

(A) The Introduction Screen

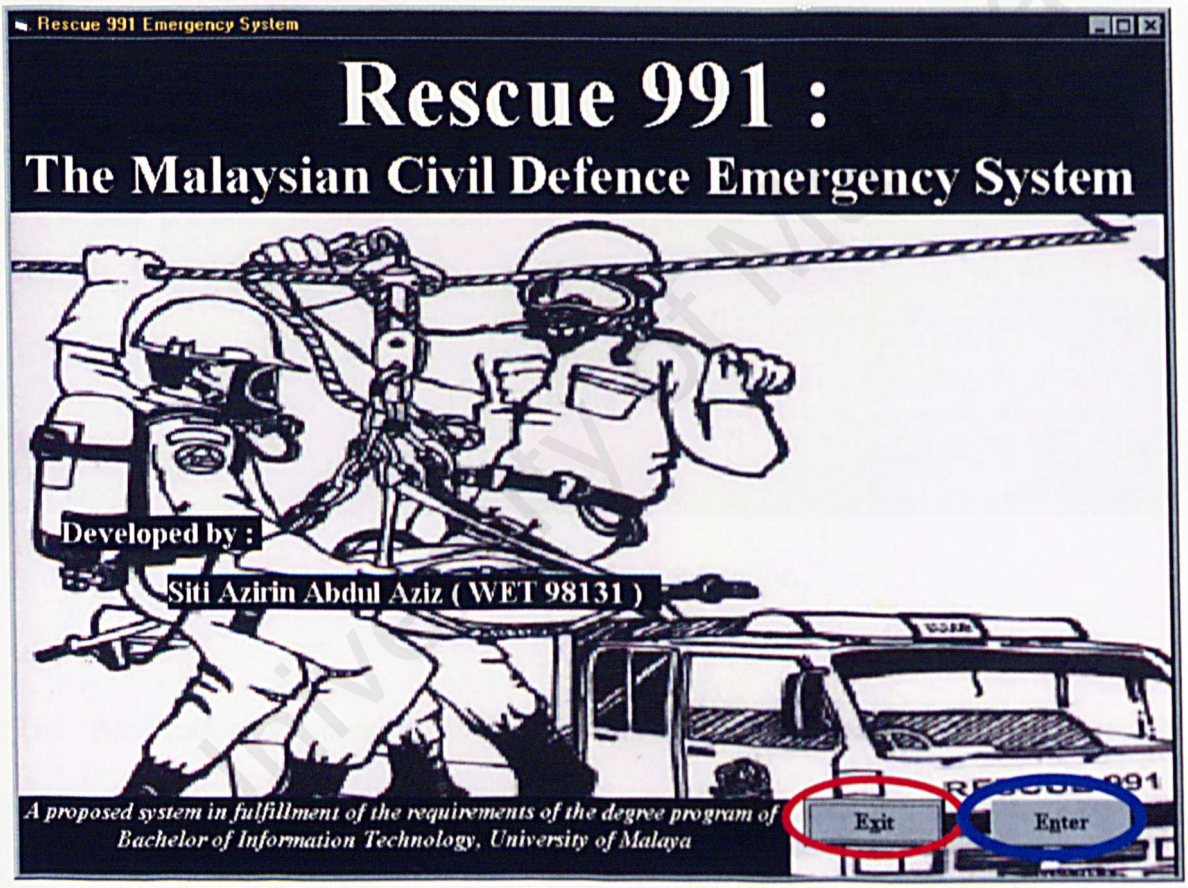


Figure 1 : The Introduction Screen

Click the Exit button to exit

Click the Enter button to run Rescue 991 Emergency System

(B) The Authentication

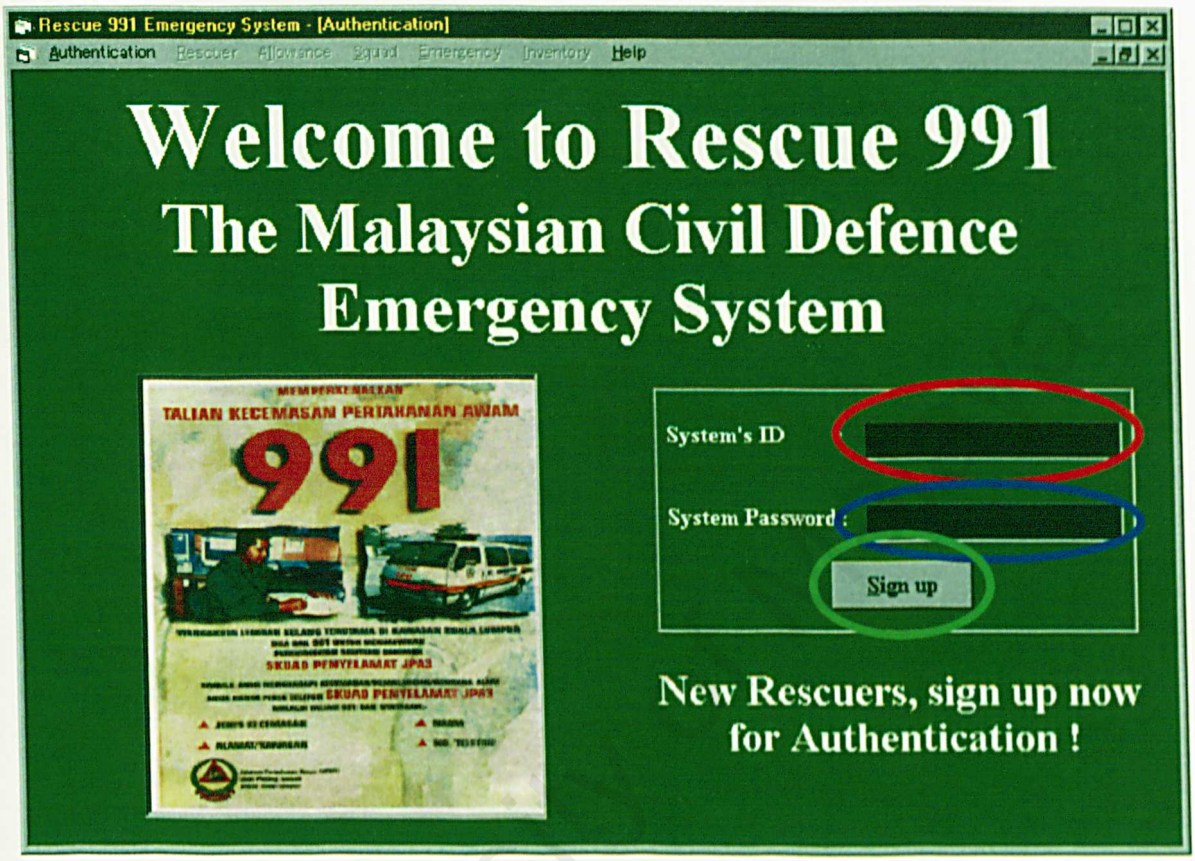


Figure 2 : The Authentication

The Authentication uses a system's authentication. There are two types of authentication; the Officer's or Maintenance Authentication, and the Rescuer's Authentication. The System's ID and Password for both types are available with the accompanying CD.

Enter the System's ID

Enter the System Password

Click the Sign up button : to login to Rescue 991 Emergency System

(C) The Main Screen

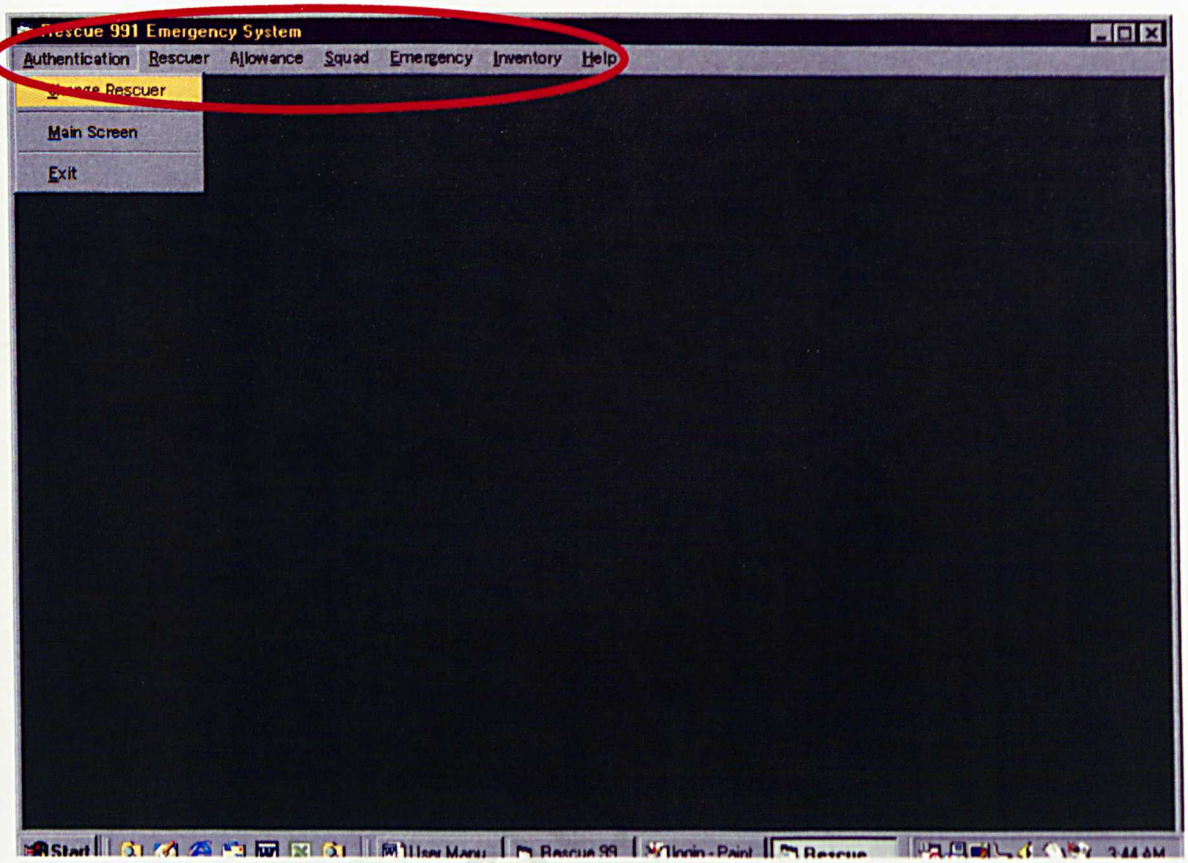


Figure 3 : The Main Screen

The Main Screen allows users to select the menu and submenus under it. Click the menus and submenus under it to run a particular module. The menu and submenus are as follows :

Authentication	: Change Rescuer, Main Screen, Exit
Rescuer	: Rescuer's Access, View Table, Search
Allowance	: Personnel Form, Allowances' Access
Squad	: Duty Chart, Attendance Form, Attendance Sheet
Emergency	: Operation Form, Operation Report
Inventory	: Vehicle Inventory, Tools Inventory, Borrower's Log
Help	: About Rescue 991

(D) Rescuer

(i) Rescuers' Access

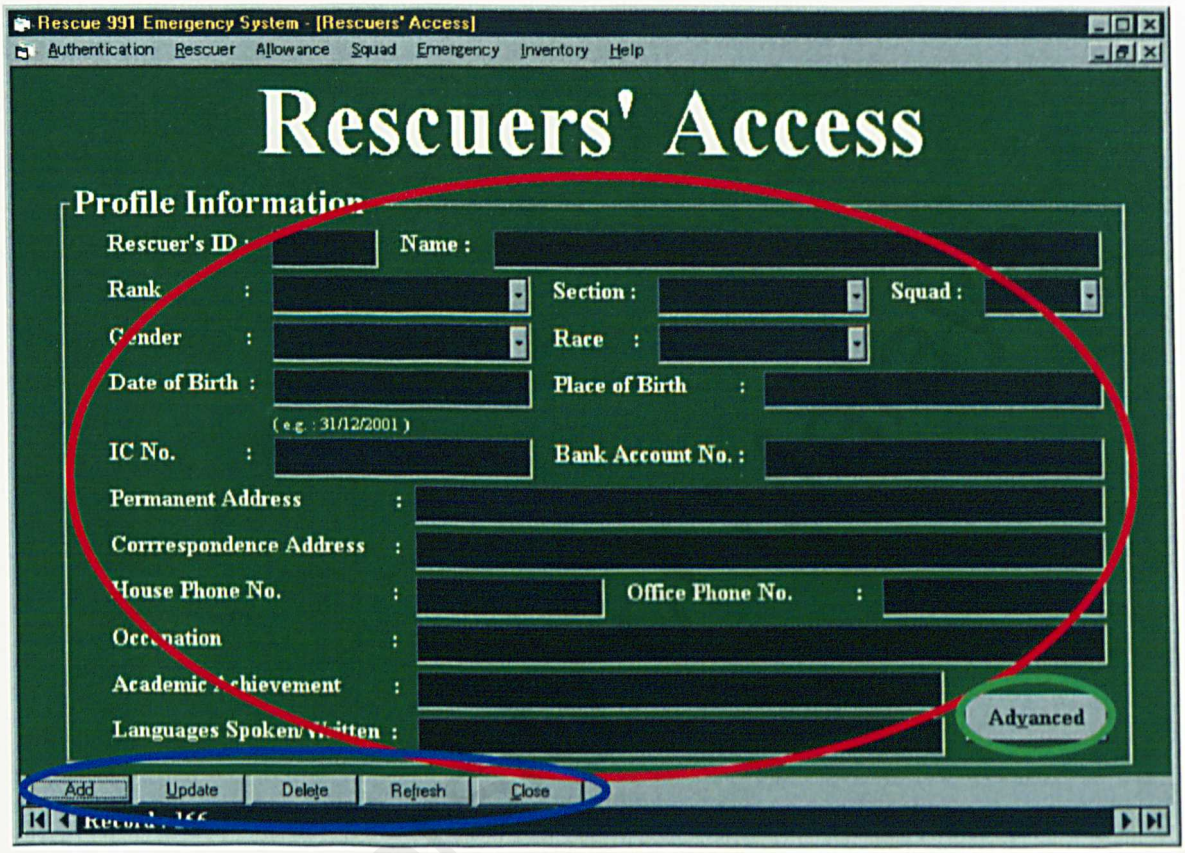


Figure 4 : Rescuers' Access

Click the ADD button : to add a new record

Enter Rescuer's profile information

Click the UPDATE button : to update change in a record

Click the DELETE button : to delete a particular record

Click the REFRESH button : to return to the first record

Click the CLOSE button : to exit Rescuers' Access

Click the Advanced button : to run Rescuers' Access Advanced Profile Information

(ii) Rescuers' Access : Advanced Profile Information

From Rescuers' Access, click the Advanced button to run the Advanced Profile Information.

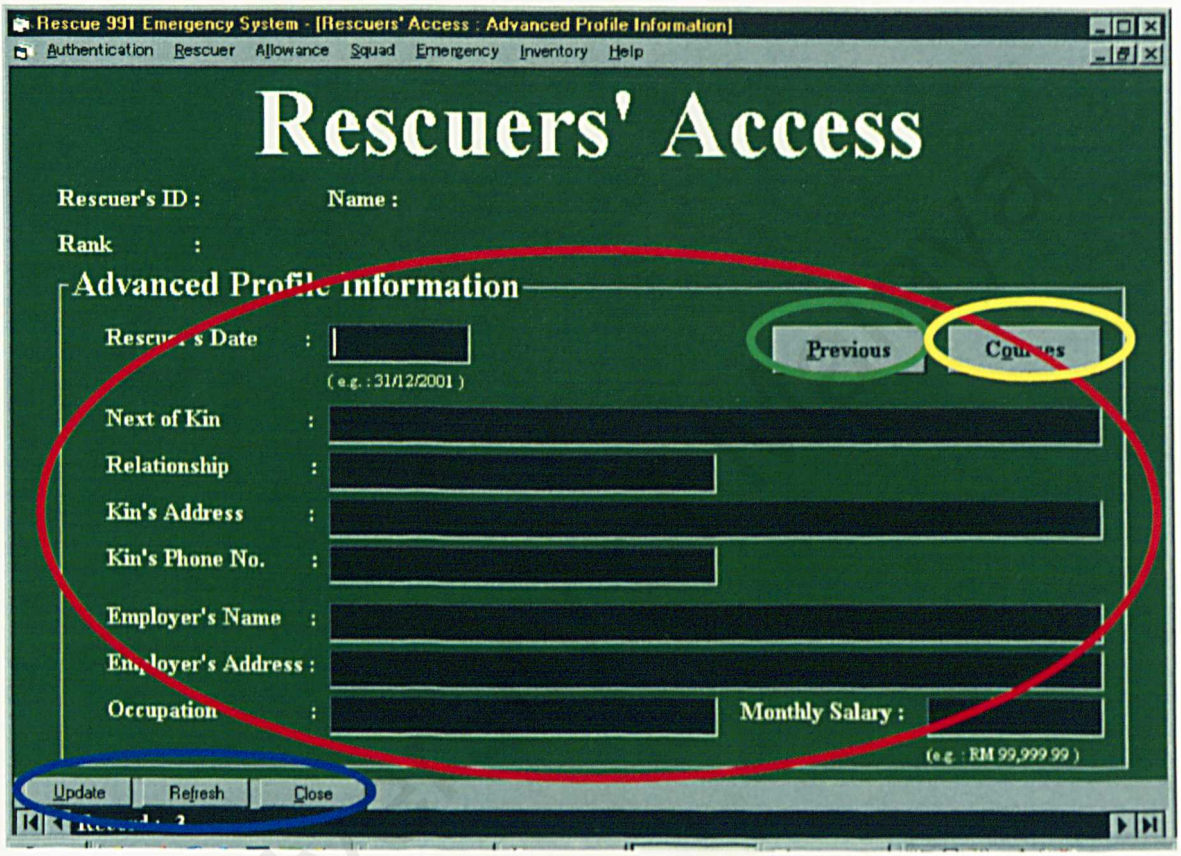


Figure 5 : Rescuers' Access : Advanced Profile Information

Enter Rescuer's advanced profile information

Click the UPDATE button : to update change in a record

Click the Previous button : to return to Rescuers' Access

Click the Courses button : to run Rescuers' Access Rescue Qualification

(iii) Rescuers' Access : Rescue Qualification

From Rescuers' Advanced Profile Information, click the Courses button to run the Rescue Qualification.

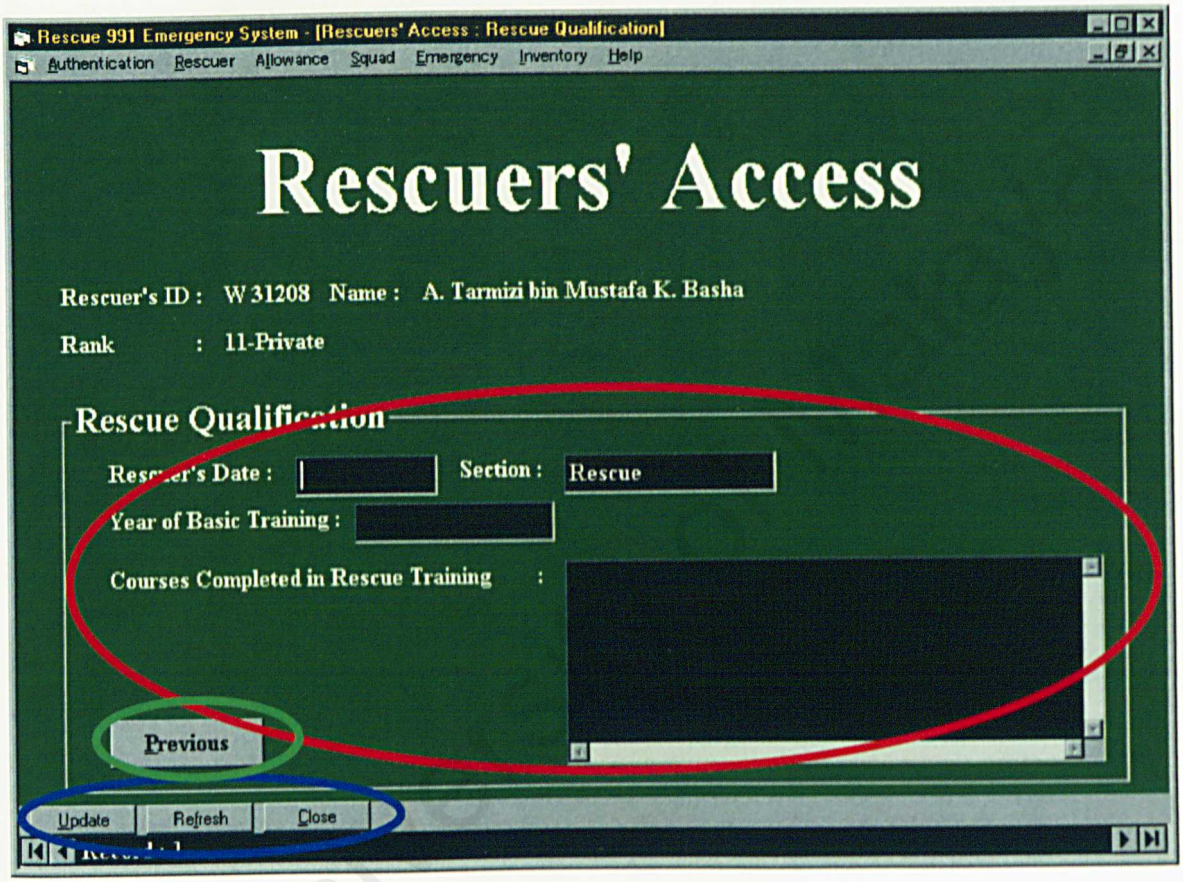


Figure 6 : Rescuers' Access : Rescue Qualification

Enter Rescuer's Rescue Qualification

Click the UPDATE button : to update change in a record

Click the Previous button : to return to Rescuers' Access Advanced Profile Information

(iv) View Table

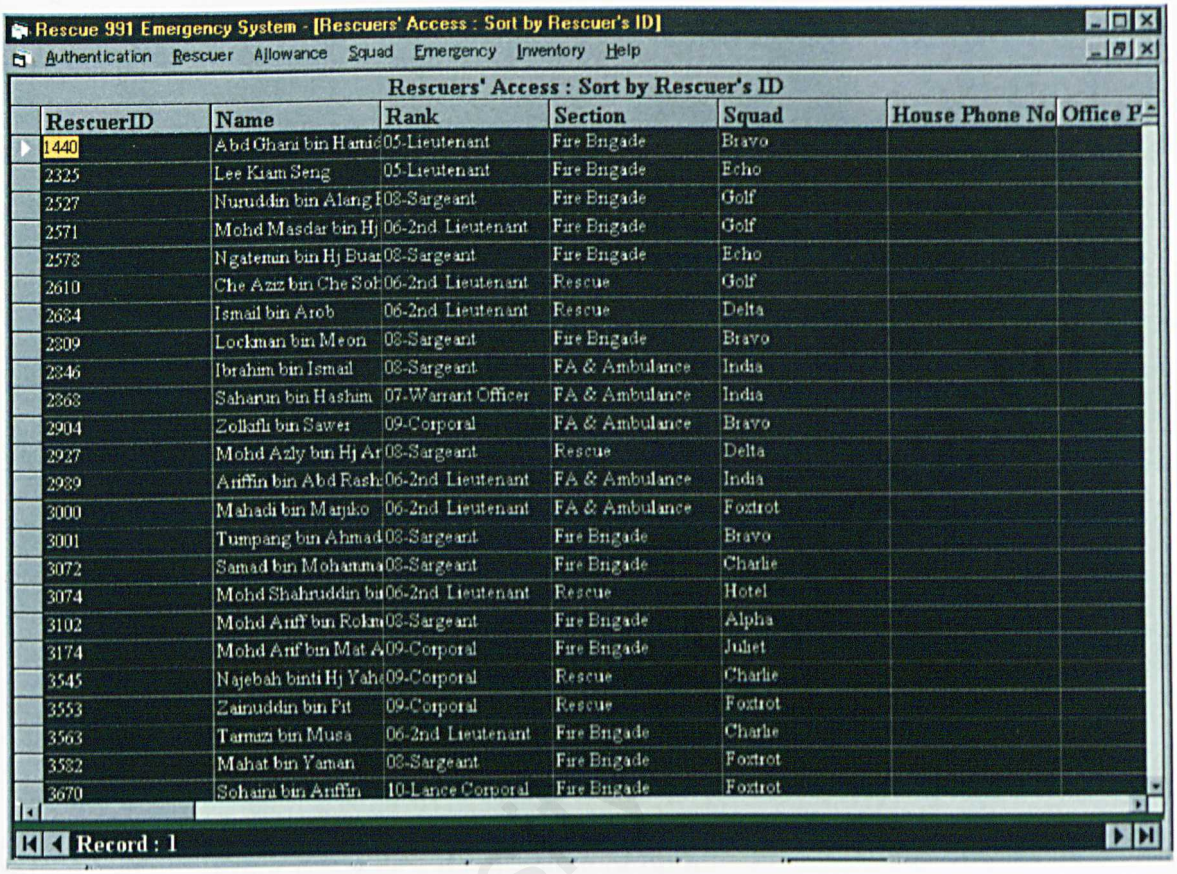


Figure 7 : View Table

The View Table allows users to view records from the Rescuers' Access by 5 order : Sort by Rescuer's ID, Sort by Name, Sort by Rank, Sort by Section, and Sort by Squad.

(v) Search

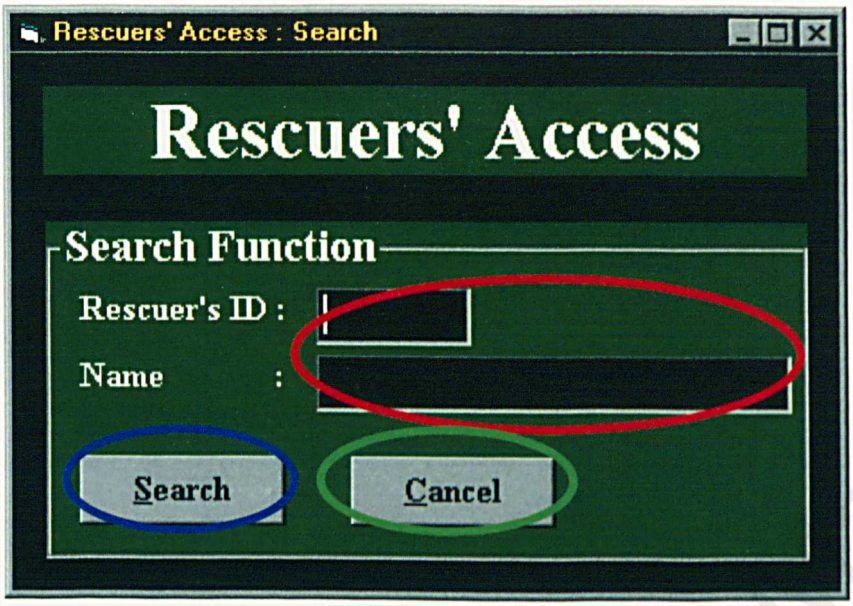


Figure 8 : Search

Enter Rescuer's ID or Name or both

Click the Search button : to search the Rescuers' Access database

Click the Cancel button : to exit Search

(E) Allowance

(i) Personnel Form

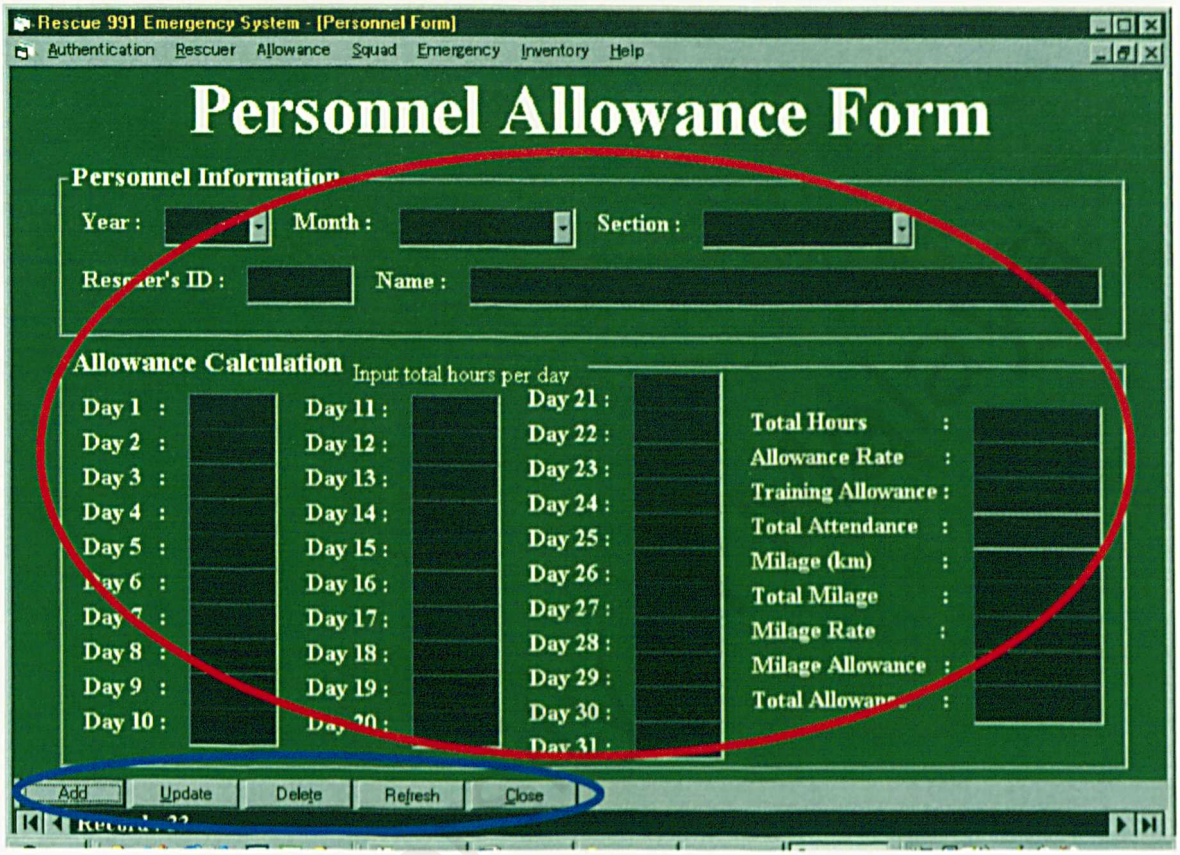


Figure 9 : Personnel Form

- Click the ADD button : to add a new record
- Enter Personnel Allowance for automatic calculation
- Click the UPDATE button : to update change in a record
- Click the DELETE button : to delete a particular record
- Click the REFRESH button : to return to the first record
- Click the CLOSE button : to exit Personnel Allowance Form

(ii) Allowances' Access

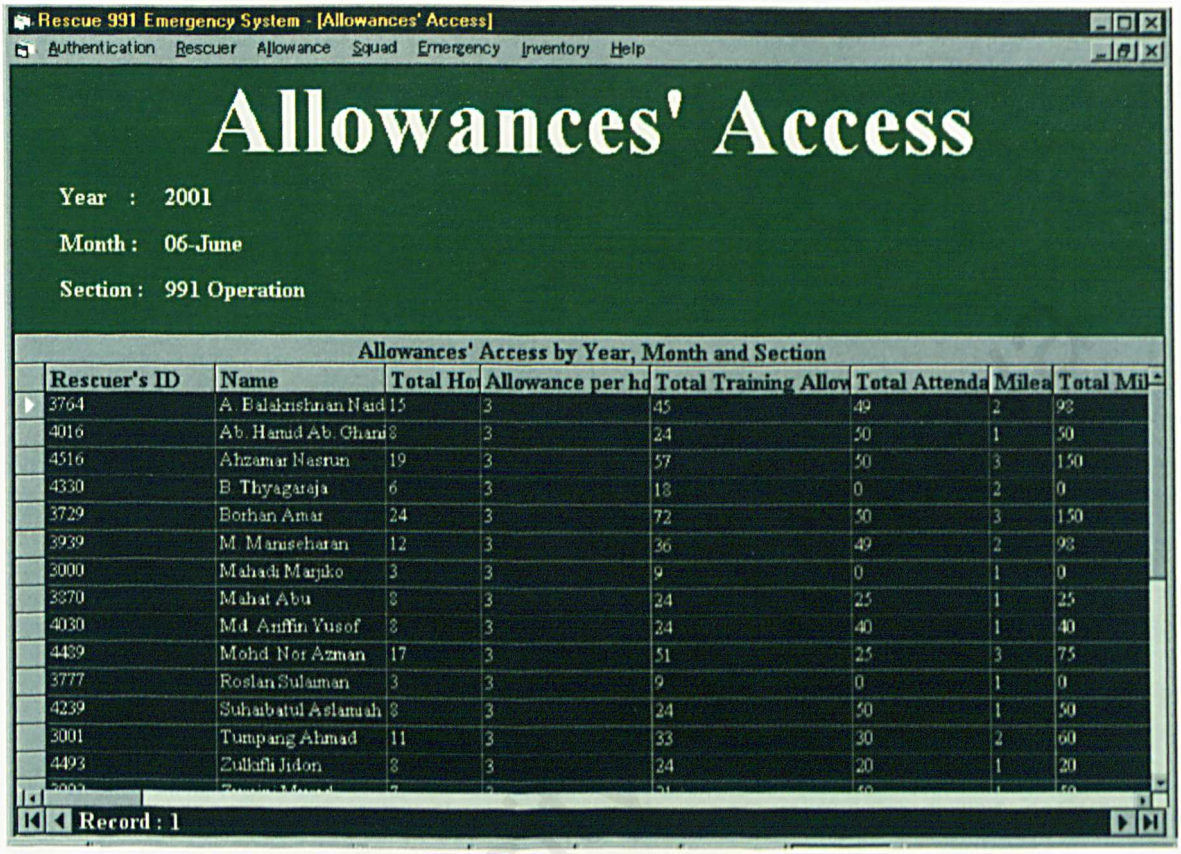


Figure 10 : Allowances' Access

The Allowances' Access displays all the records for a particular year, month, and section.

(F) Squad

(i) Duty Chart

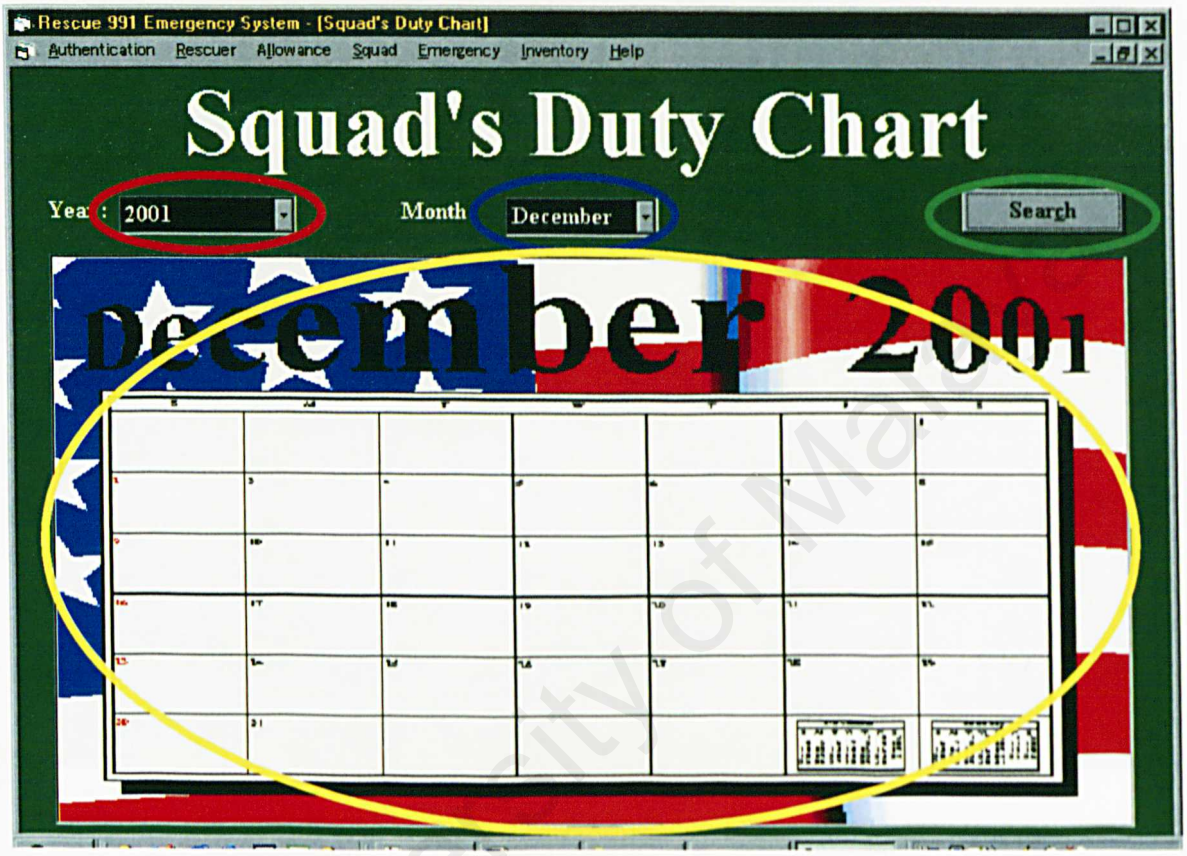


Figure 11 : Duty Chart

Enter the Year

Enter the Month

Click the Search button : to search the database for images

Double-click on the Image : to edit image using Microsoft Paint

(ii) Attendance Form

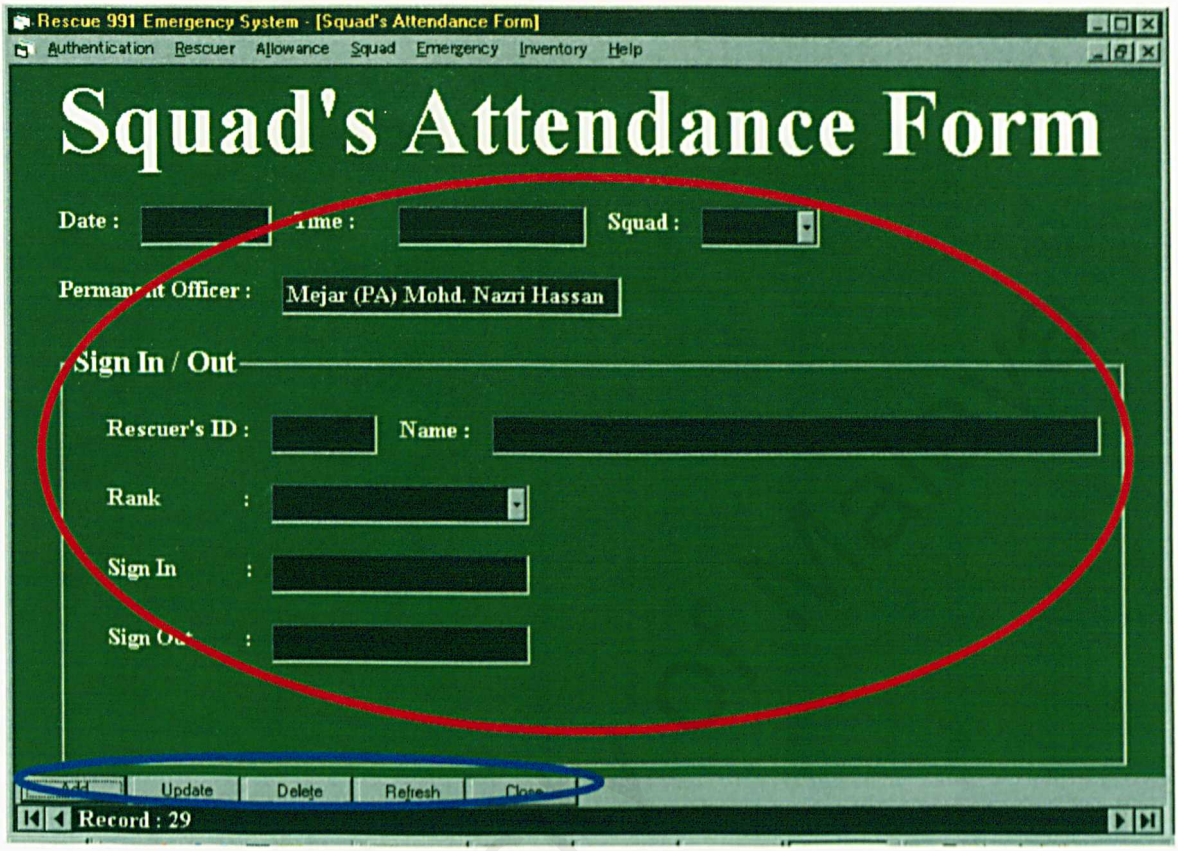


Figure 12 : Attendance Form

- Click the ADD button : to add a new record
- Enter Rescuer's attendance
- Click the UPDATE button : to update change in a record
- Click the DELETE button : to delete a particular record
- Click the REFRESH button : to return to the first record
- Click the CLOSE button : to exit Attendance Form

(iii) Attendance Sheet

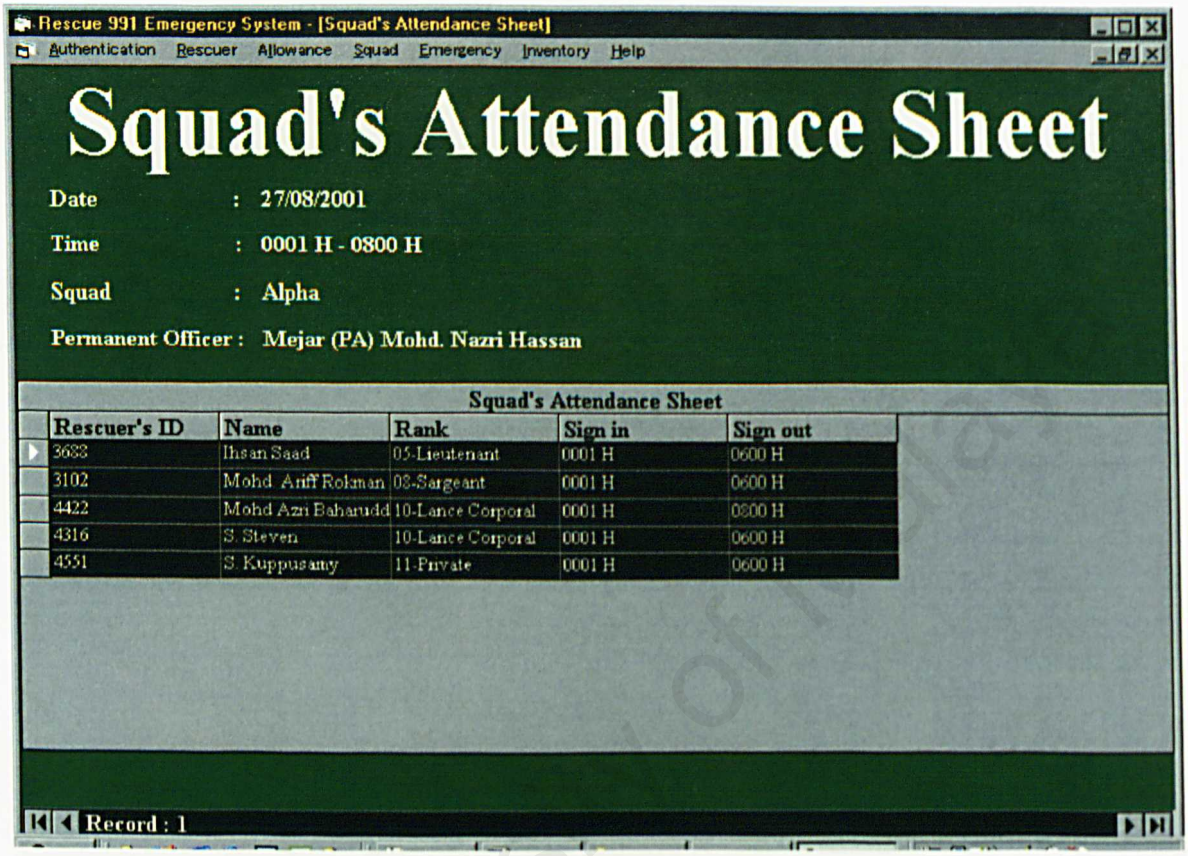


Figure 13 : Attendance Sheet

The Attendance Sheet displays all the attendance record for a particular date, time and squad.

(G) Emergency

(i) Operation Form

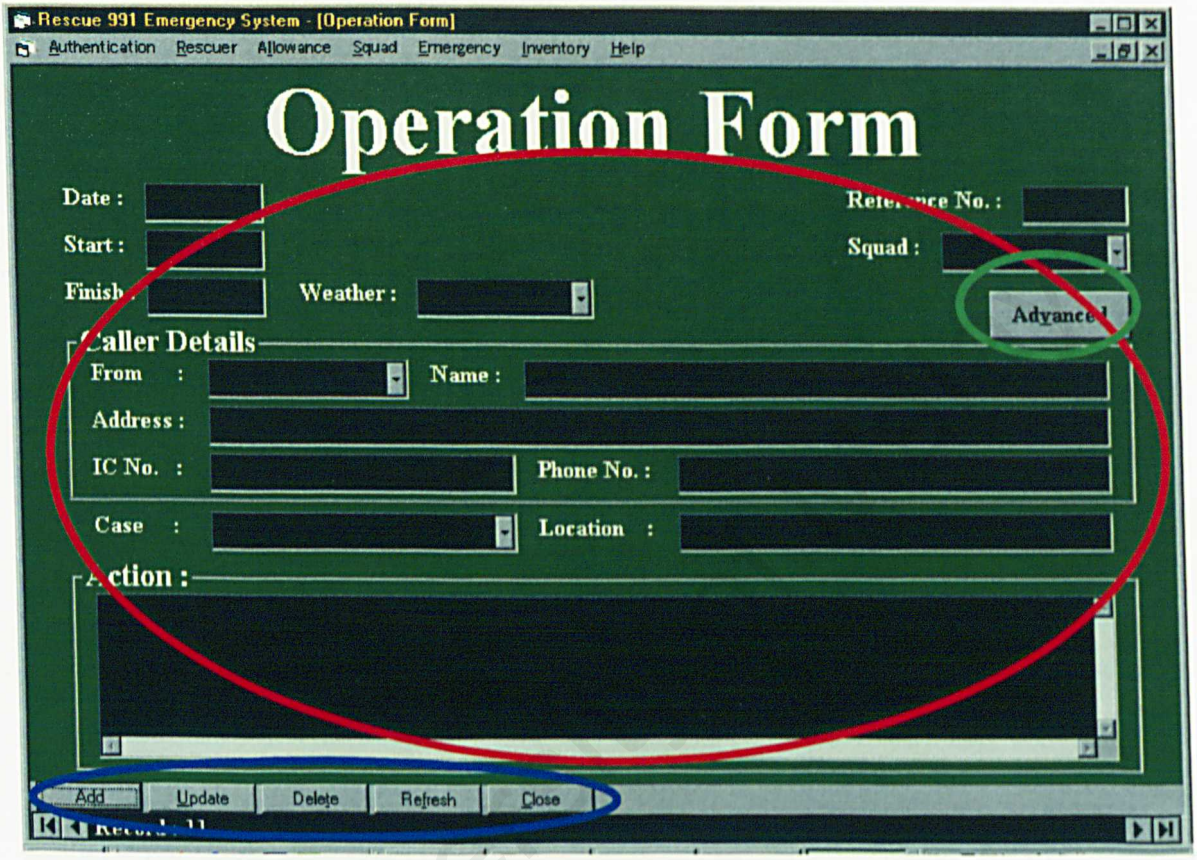


Figure 14 : Operation Form

Click the ADD button : to add a new record

Enter Operation record

Click the UPDATE button : to update change in a record

Click the DELETE button : to delete a particular record

Click the REFRESH button : to return to the first record

Click the CLOSE button : to exit Operation Form

Click the Advanced button : to run Advanced Operation Form

(ii) Advanced Operation Form

From the Operation Form, click the Advanced button to run the Advanced Operation Form.

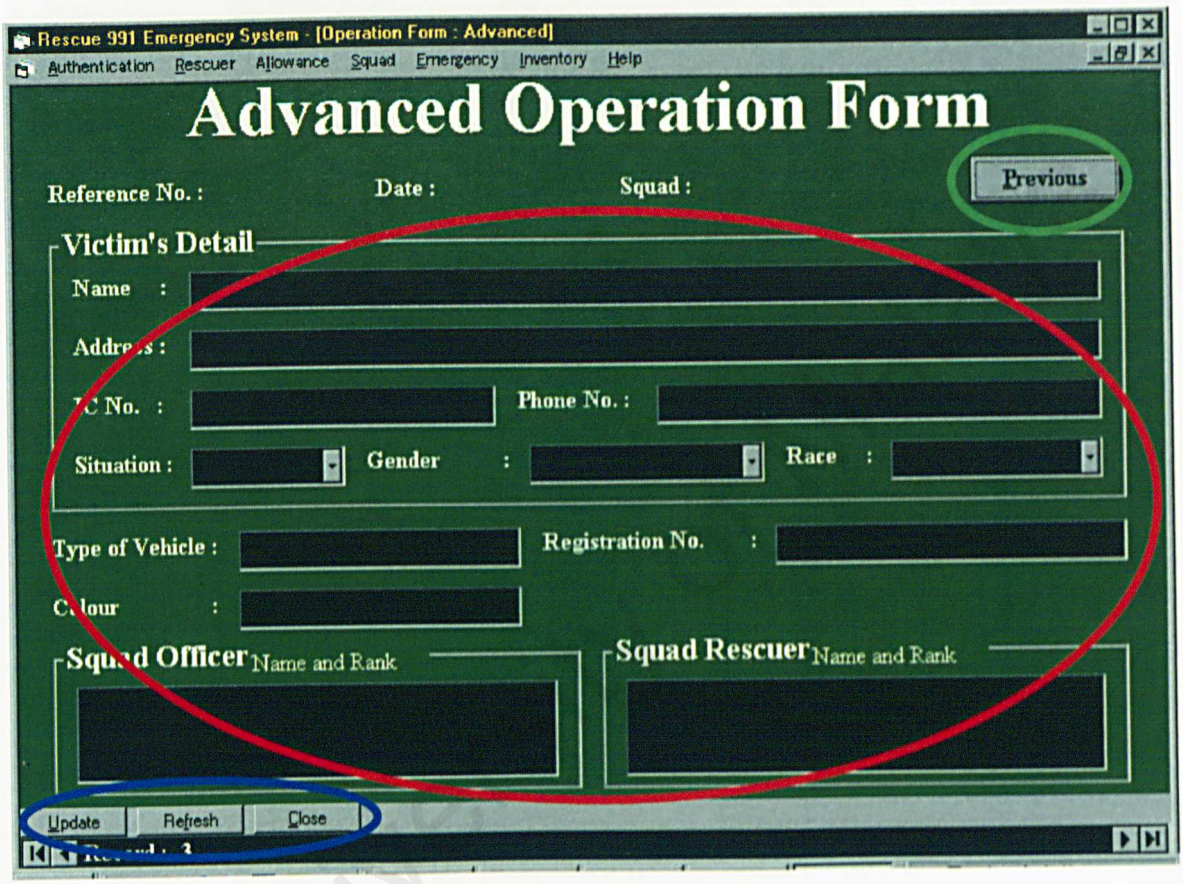


Figure 15 : Advanced Operation Form

Enter Advanced Operation record

Click the UPDATE button : to update change in a record

Click the Previous button : to return to Operation Form

(iii) Operation Report

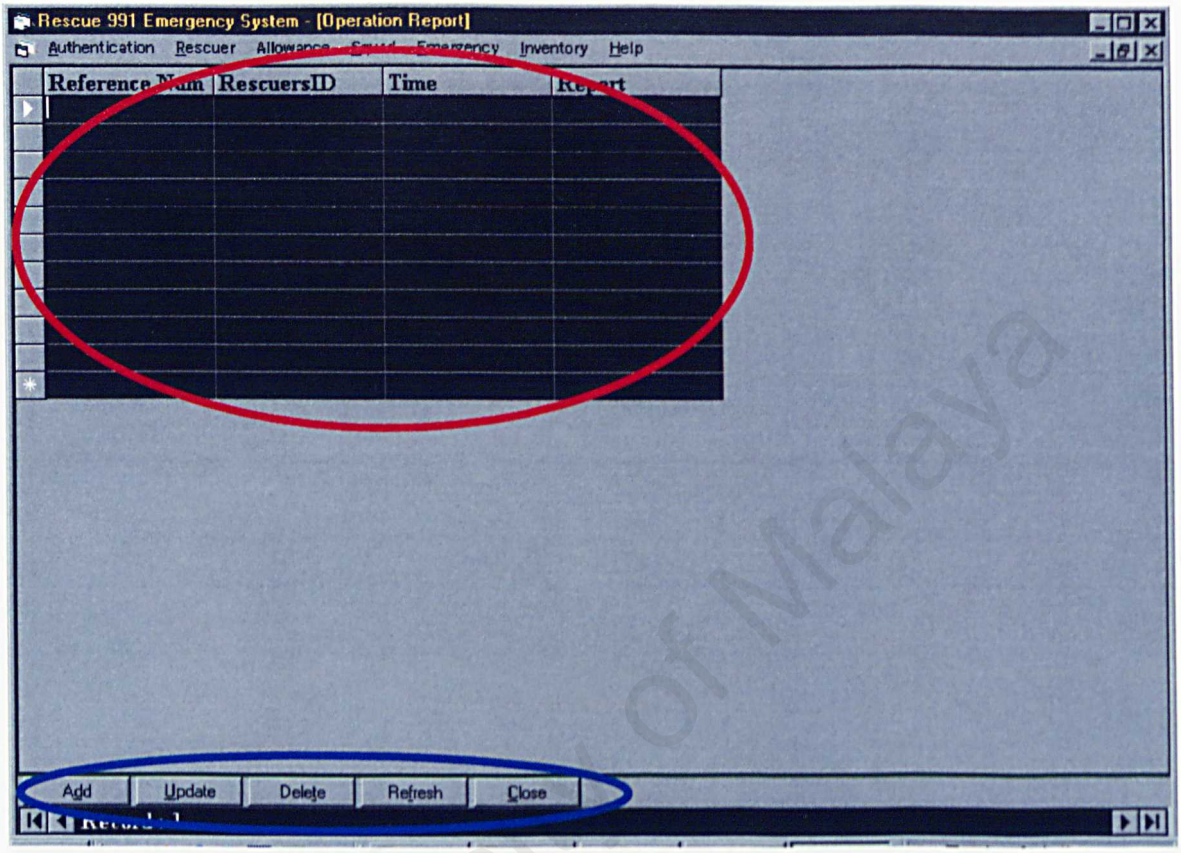


Figure 16 : Operation Report

Click the ADD button : to add a new record

Enter Operation report

Click the UPDATE button : to update change in a record

Click the DELETE button : to delete a particular record

Click the REFRESH button : to return to the first record

Click the CLOSE button : to exit Operation Report

(H) Inventory

(i) Vehicle Inventory

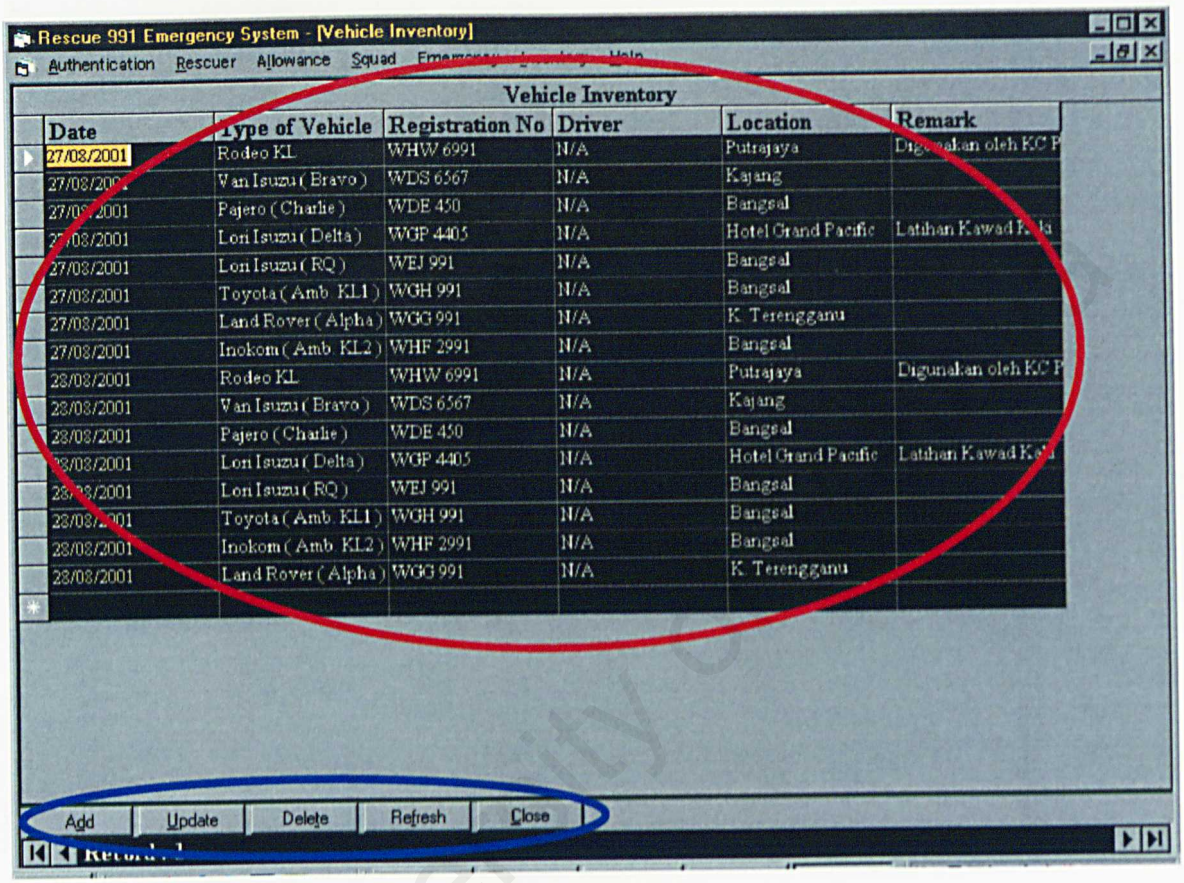


Figure 17 : Vehicle Inventory

- Click the ADD button : to add a new record
- Enter Vehicle Inventory record
- Click the UPDATE button : to update change in a record
- Click the DELETE button : to delete a particular record
- Click the REFRESH button : to return to the first record
- Click the CLOSE button : to exit Vehicle Inventory

(ii) Tools Inventory

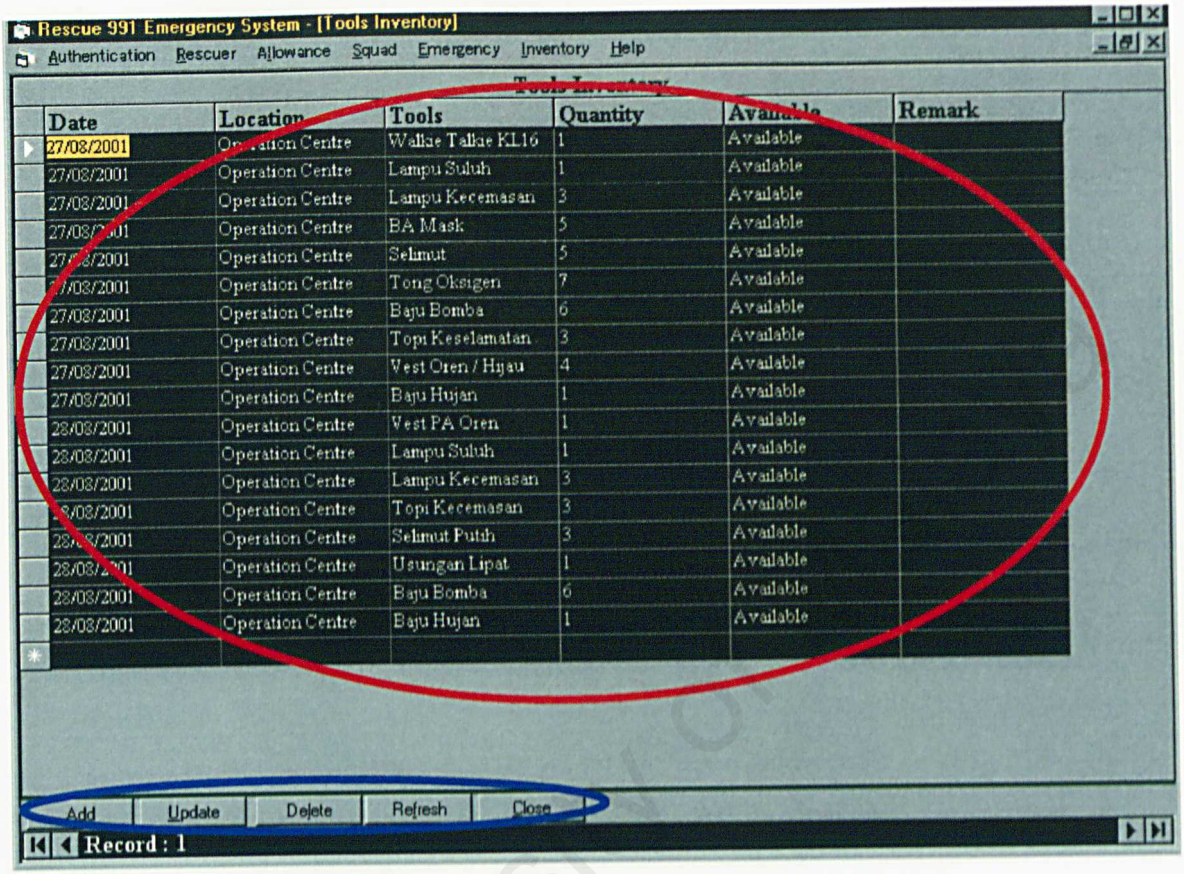


Figure 18 : Tools Inventory

Click the ADD button : to add a new record

Enter Tools Inventory record

Click the UPDATE button : to update change in a record

Click the DELETE button : to delete a particular record

Click the REFRESH button : to return to the first record

Click the CLOSE button : to exit Tools Inventory

(iii) Borrower's Log

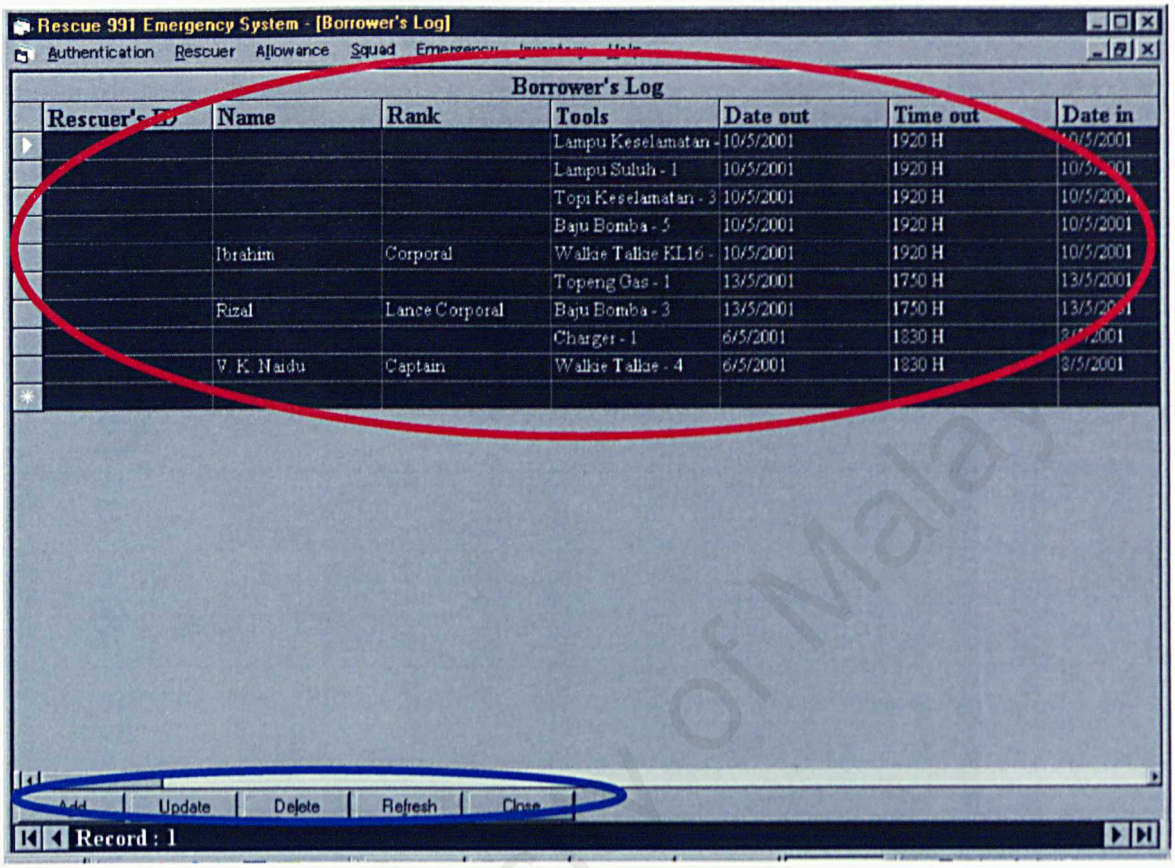


Figure 19 : Borrower's Log

Click the ADD button : to add a new record

Enter Borrower's Log record

Click the UPDATE button : to update change in a record

Click the DELETE button : to delete a particular record

Click the REFRESH button : to return to the first record

Click the CLOSE button : to exit Borrower's Log

(I) Help

(i) About Rescue 991

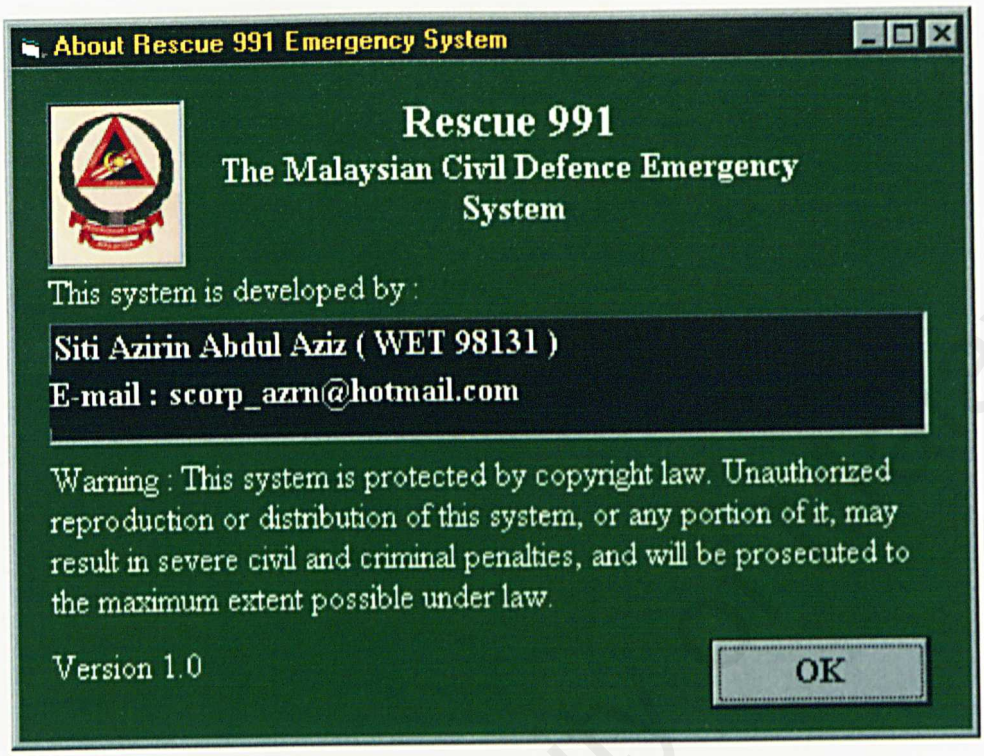


Figure 20 : About Rescue 991

About Rescue 991 displays basic information about the developer, the system's version, and most importantly the copyright.