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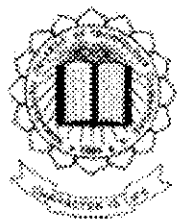

POWER DISTRIBUTION AND MONITORING SYSTEM

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Bonafide Certificate

Certified that this project report titled **POWER DISTRIBUTION AND MONITORING SYSTEM** is the bonafide work of **Ms. SENCY ZACHARIAS (Reg No. 71202621040)** who carried out the research under my supervision. Certified further, that to the best of my knowledge the work reported herein does not form part of any other project report or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

18/5/05

GUIDE

HEAD OF DEPARTMENT

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Internal Guide

External Guide 23/6/

ABSTRACT

The project entitled "Power Distribution and Monitoring System" is a reusable software component that supports wide variety of functionality and can be used to fit many software needs. This is a substation monitoring system and is based on the partial computerization of Kerala State Electricity Board.

Power Distribution and Monitoring System is developed with a view of connecting a particular substation and the control room. The client (staff) section can be controlled from a remote control room. Load on the feeders and other parameters like the oil temperature, winding temperature and oil level are monitored and controlled by the concerned engineers from the remote location. Employees in this section are Assistant Executive Engineer, Work Superintendent and Senior Clerk. All the abnormal conditions are updated to the database and actions are taken with immediate effect.

Billing is under the guidance of Senior Clerk and is as per the tariff of Kerala State Electricity Board. The history of the various transformer parameters is generated as reports. This system avoids the drawbacks of the existing one by replacing all the manual operations with automation.

The project has been developed using VB.Net as front end and Oracle 9*i* as back end.

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CHAPTER 1
INTRODUCTION

1.1 OVERVIEW OF THE PROJECT

The project entitled "Power Distribution and Monitoring System (PDMS)" is a reusable software component that supports wide variety of functionality and can be used to fit many software needs. This is a substation monitoring system and is based on the partial computerization of Kerala State Electricity Board (KSEB).

PDMS is developed with a view of connecting a particular substation and the control room. The client (staff) section can be controlled from a remote control room. Load on the feeders and other parameters like the oil temperature, winding temperature and oil level are monitored and controlled by the concerned engineers from the remote location. All the abnormal conditions are updated to the database and actions are taken with immediate effect.

Only numerical monitoring is being performed at the substation. Employees in this section are Assistant Executive Engineer, Work Superintendent and Senior Clerk. Any fault in the transformer /feeder will be updated to the error table. Work superintendent will perform the onsite remedy. Billing is under the guidance of Senior Clerk and is done for low tension supply for

Domestic Use, Supply for Colonies, Temporary Connection, Industrial, Agriculture, Non-Domestic, Commercial(Seven Categories). Billing is done as per the tariff from KSEB.

The history of the various transformer parameters is generated as reports. This system avoids the drawbacks of the existing one by replacing all the manual operations with automation.

1.2 OBJECTIVES OF THE PROJECT

The objective of the software is to provide computerization at both the ends that maintains effective communication and monitoring of the activities during the electricity distribution. Executive Engineer is entitled with the position of administrator who overlooks the functioning of the software. He is endowed with the power of entering or removing the details of substations, employees and is in-charge of monitoring the transformer conditions at various places through graphs. Staff utilizes the bill generation facilities that are included with this software. The selling point of this software is its online dynamic graph that displays the current transformer parameters. It warns the personnel involved of any abnormal conditions reached by the transformer during its operation and includes facilities for the proper reporting of errors occurred and actions taken.

1.3 ORGANIZATION PROFILE

INTRODUCTION

The NeST Group is an international systems engineering and application development group committed to delivering high quality, low cost solutions that fit customer's needs on time, every time. Bu continuously nurturing talent and technology Network Systems and Technologies (NeST) develop solutions that anticipate tomorrow's needs today and help customer productivity soar. A knowledgeable and trustworthy partner, the NeST Group develops long term relationships with it's clients and guides then through processes that define the most effective solutions to meet their needs. The NeSt Group's advantage is based upon the five foundation of our business. They are: Quality, Values, Technical Competencies, Customer Satisfaction and Global Presence.

ACHIEVEMENTS

-The NeST Group has had achievement over achievement since its inception. The lists of achievements are listed below.

-Incorporated in 1990 Within 10 years, the operations have expanded very fast to reach a turnover level of more than Rs. 300 crores.

-Numerous Awards and Accolades for NeST Group, including Best Regional Software Exporter in Southern India, 1999, 1998, 1997, 1996. Capability Maturity Model (CMM) Level 5 Accreditation, 2000 (the 19th company in the world to have so). The Award for Excellence in Electronics from the Department of

Electronics, Government of India, 1996, Best Entrepreneurship Award, 1997, ISO 9001 Certification from KPMG's Quality Registrar, 1997.

-More than 3000 employees in various units across the world- mostly technical professionals, out of whom more than 400 are highly skilled software engineers. Global operations are conducting with offices in US, Canada, Middle East, Japan, Australia and Europe.Client list includes top MNCs like Hitachi, Toshiba, Yamaha, Gould, HP, AMP, AM Communications etc.

CORPORATE OVERVIEW

Network Systems and Technologies is a part of the US$ 75 million NeST Group of 15 companies employing over 2000 people worldwide. Apart from the software development centers in India, the group has established a number of world-class manufacturing facilities and operations worldwide, with offices in the USA, Canada, Australia, Europe and Japan. Network Systems and Technologies have both ISO 9001 and SEI-CMM Level 5 certifications. A corporate-level quality assurance department caters to both units and Network Systems and Technologies is also geared up for achieving these certifications at the earliest. We have an open culture with a flat hierarchy, which facilitates free flow of ideas. Our employee-centric philosophy ensures synergy between corporate goals and the individual employee's aspirations. Network Systems and Technologies, through its international offices, provides onsite consulting and development services in the USA, Canada, Europe, the Middle East and the Asia Pacific region. Our development centers in India are staffed with over 500 engineers, consisting of both software professionals and application consultants.

CHAPTER 2
SYSTEM ANALYSIS

The life cycle of a software starts with the system analysis. It's a phase in which problems are identified, alternate solution systems are studied and recommendations are made about committing the resources required to design the system. A thorough initial investigation is performed on the existing system and the following details were drawn.

2.1 STUDY ON THE EXISTING SYSTEM

With the existing system, using LED displays connected with all sections of the plant performs the monitoring. The corresponding values are indicated in the LED displays as obtained. The parameter values are provided to the section engineer through the clerical staff along with the date and time of the data. There is no security to the data obtained and the time taken to obtain the data will affect negatively for a timely decision.

Also there is no provision for the consumers to know the details like bills, tariff, loadshedding etc and also to post their requests and suggestions. In the existing system, the consumers have to contact the staff directly to know the details about their bills and load

shedding, tariff etc. It is very inconvenient for both the staff and the consumers.

2.2 DEFINING THE PROBLEM

In the existing system all the monitoring process was done using LED (Light Emitting Diode) displays. Data were not accurate and were error prone. Also the availability of data for timely decisions was almost impossible. All because the data were taken manually from the sites. The calculation of bill was done manually. It was a time consuming process. There was no centralized control and it involved a lot of paper work. There was no effective communication between the staff. Maintaining the security of staff and consumer details was a complicated procedure.

The proposed system is designed to cope up with all these difficulties. Monitoring is made easier. Here user will be shown a visual presentation of the data involved. Bill preparation can be done easily and quickly. Communication between staff is made easier and the amount of paper work is reduced considerably.

2.3 STUDY ON PROPOSED SYSTEM

To improve the overall performance of the monitoring system with effective decisions, there comes the need of live data. Control room is linked to different feeders and so the administrator has a clear

idea about its functioning. At any time real time data is available for timely decisions and there is no work overhead required to copy the data for current and future needs. Executive Engineer is entitled with the position of the administrator who overlooks the functioning of this software. At any point, the administrator can guide the employees for better performance by the proposed system.

With the proposed system, consumers are allowed to get their details like bills, tariff, loadshedding timing etc without seeking help from the staff personnel. They can get the needed details from the system using their account. Also they can give their valuable suggestions and make requests, if any. This helps the electricity board to stay one step closer to them.

This system makes billing an easy process. Just by entering the meter reading, the bill can be calculated for each consumer. The proposed system provides more accuracy for the data since it doesn't require manual calculations. Also it avoids the problem in handling and storing the data.

The proposed system is expected to pave way for the computerization of the electricity board thus enhancing 100% efficiency. The most important aspect of this project is an inbuilt visual monitoring and warning system that monitors the current load parameter fed into the transformer and warns on meeting undesired conditions. This project intends to partially computerize these activities of the KSEB and to automate all manual operations as much as possible.

2.4 DEVELOPING SOLUTION STRATEGIES

The objective of the software is to provide computerization at both the ends that maintains effective communication and monitoring of the activities during the electricity distribution. The administrator makes use of the system mainly to monitor functioning of the transformer from a remote location. Staff utilizes the bill generation facilities that are included with this software. The selling point of this software is its online dynamic graph that displays the current transformer parameters. It warns the personnel involved of any abnormal conditions reached by the transformer during its operation and include facilities for corrective measures.

2.4.1 FEASIBILITY ANALYSIS

Feasibility analysis is the measure of how beneficial or practical the development of the software system will be to an organization. This analysis recurs throughout the life cycle. This analysis is to find out if a promise can be done or not with the client. After the study the possible alternative solutions are selected. Then the detailed information is provided to the management about the project.

TECHNICAL FEASIBILITY

Technical feasibility study is done to find out whether the proposed system could be built using the available alternatives and constraints. The factors like familiarity with application, familiarity with technology and project size are considered. Here the familiarity with Oracle and VB.Net is utilized to build this project. When taken the project size, it's very small. At present, the system is intranet environment. Future expansion is planned but will not affect this project, though business expansion may lead to subsequent project.

ECONOMIC FEASIBILITY

Economic feasibility is a judgment about the cost worthiness of the proposed system. After the specific requirement and solution have identified the cost and benefit of each alternative is assessed. Cost benefit analysis is done in order to find out the optimal solution in terms of cost from the possible alternatives. Here it is found that the system will be worthy since it reduces the workload of both the administrator and staff effectively. Also the system helps to make the work at much faster rates. The quality of service is improved by the use of real time data and more accurate figures. It uses VB.Net and Oracle 9i for its development. So it's found that the benefits outweigh costs.

SOCIAL FEASIBILITY

The various social costs must also be evaluated. These will include the costs of education and training, consultation, salary changes, job improvements and hidden costs like those caused by hostility, ignorance and fear. Here training to the users is required since the existing employees are of no exposure to computers. Since the population of staff at a particular substation is not very high, it's possible to convince them about the benefits of the system by conducting common seminars and meeting them individually if needed which will help them to come out of the false circle they would have created. For some there will be some reduction in their works which will reflect in their salaries also. For e.g. those who work in sites, the work will be reduced in considerable amounts due to the usage of online data.

2.4.2 SYSTEM SPECIFICATION

HARDWARE SPECIFICATION

Processor: Pentium III Processor
Memory: 20 MB RAM
Mouse: Standard Mouse
Keyboard: Enhanced Keyboard
Floppy Disc: 1.44 MB FDD
Hard Disc: 20 GB HDD
Printer: Laser Printer

SOFTWARE SPECIFICATION

Operating System: Windows 2000
Front End: VB.Net
Back End: Oracle 9*i*

VISUAL BASIC .NET

.NET: It is a framework, which supports multiple languages. Also it supports web applications. It helps us to create highly distributed applications. It provides a user-friendly development environment. To avoid separate runtime for each programming language, .NET framework provides a runtime environment called the Common Language Runtime (CLR)

DIFFERENCE BETWEEN VB 6.0 AND VB.NET

- VB.Net is object oriented, but VB 6.0 is object based
- Multithreading is possible in a better way in VB.Net than in VB 6.0
- .Net supports ASP.Net
- A new concept, name space is added
- VB.Net is platform independent
- Data types are considered as objects in VB.Net
- In VB.Net structured error handling is possible
- Option base statement is removed
- Unary operators are available
- In VB.Net arguments are passed as ByVal by default
- Instead of COM components there are .Net components in VB.Net. But it supports COM components of VB 6.0

ORACLE

Oracle is the most widely used database in the world. It runs on virtually every kind of computer, from PC's to Macintoshes to microcomputers to giant mainframe. It functions virtually identical on these entire machines. An oracle application to be built and used rapidly and effectively, the users and developers must share a common language and deep and common understanding of both the business application and oracle tools. Oracle is a powerful RDBMS that can be connected to any type of ODBC client system. It offers compatibility with both relational and object oriented database system. Oracle provides an effective solution for major database feature. Oracle products are based on a concept "client – server technology". This concept involves segregating the processing of an application between the two systems. One performs all the activities related to the database (server) and other performs activities that help the user to interact with the application (client).

FEATURES OF ORACLE

- Large database and space management control
- Many concurrent database users
- High transaction processing performance
- High accessibility
- Industry accepted standard
- Manageable security
- Database enforced integrity
- Client/server environment

- Distributed database system
- Compatibility
- Portability
- Connectivity

All these features work together to build up a very reliable and complete database which is a must of any application level project.

CHAPTER 3
SYSTEM DESIGN AND DEVELOPMENT

3.1 INTRODUCTION

The term design describes a final system and the process by which it is developed. The first step is to determine how the output is to be produced and in what format. Second, input data and master files (database) have to be designed to meet the requirements of the proposed output. The operational phases are handled through program construction and testing. The following are the important design constructs.

3.2 INPUT DESIGN

Input design is the process of converting the user oriented description of the input to a computer based format. Inaccurate input data are the most common cause of errors in data processing. The objective of the input design is to create an input layout that is easy to follow and prevents operator errors. It covers all cases of input from the creation of initial data to the actual entry of the data to the system for processing.

Errors entered by data entry operators can be controlled by input design. Input data are controlled and organized into groups of

similar data. Once identified, appropriate input data are collected and organized into groups of similar data. Only the essential data are selected for processing.

Input controls are provided to:

- Ensure that only authorized users access the system
- Guarantee that calculations are accurate
- Validate the data for processing
- Determine whether any necessary data have been omitted

During the input design, first design the source document that capture the data and then select the media used to enter them into the computer. Source data are captured initially on paper or source document. They initiate a processing cycle as soon as they are entered into the system. Source document may be entered into the system through punch cards, diskettes or even directly through the keyboard. A source document must be logical and easy to understand.

In the administration side, the registration form provides provision for the creation, updation and deletion of staff. All the fields must be entered. Special formats are given for dates which should be followed. Provisions are given for the administrator to enter error details. Also the real time data from the transformer which are displayed in the form of graph is also updated to the database. This includes details of oil temperature and winding temperature. Also details like input and output current, input and output voltage can be monitored and updated to the database. Chatting is also possible

which helps the administrator to provide timely instructions to the staff personnel.

In the client side, staff are given provisions to create, update and delete consumer records. Tariff details are also maintained by the staff which is used during bill generation. The loadshedding details are also maintained properly. They can chat with the administrator in case of any instructions needed. Staff can make use of the messaging service to send and receive messages among themselves. Also suggestions and requests are taken care by the staff personnel.

The consumer identification number (id) is given to the consumers to make use of the given facilities. The details like tariff, loadshedding etc can be viewed by the consumers using their accounts. They can also provide suggestions and make requests.

3.3 DATABASE DESIGN

The database design transforms the information domain model created during the analysis into the tables that will be required to implement the system or software. The application allows the user to insert, retrieve and update data stored in database. An important aspect of database design is normalization.

3.3.1 NORMALIZATION

The term normalization of data refers to the way data items are grouped together into record structures. Normalization is used to overcome the drawbacks like repetition of data, loss of information and inconsistency. Various normal forms that are followed commonly are:

FIRST NORMAL FORM (1NF)

A relation is said to be in first normal form (1NF) if and only if all underlying domains contains atomic values only i.e. only one value is associated with each attribute and the value is not a set or a list of values. All tables are in 1NF.

SECOND NORMAL FORM (2NF)

A relation scheme is in second normal form (2NF) if and only if it is in 1NF and all non- key attributes are fully functionally dependant on the primary key. All tables are in 2NF.

THIRD NORMAL FORM (3NF)

A relation scheme is in third normal form (3NF) if and only if it is in 2NF and all non-key attributes are non-transitively dependant

on the primary key. All tables are kept in 3NF to avoid redundancy to a maximal level.

3.3.2 TABLE STRUCTURE

Table Name: Administrator

Description: This table stores the login details of the Administrator

Field Name	Type	Description
Login	Varchar2(15)	Login name
Pwd	Varchar2(10)	Password

Table 3.3.2.1 Administrator

Table Name: Login

Description: This table stores the login details of the Staff

Field Name	Type	Description
Sid	Varchar2(8)	Client Id
Time	Date	Login Time
Systemid	Varchar2(20)	System Id
Conn_flag	Varchar2(1)	Connection Flag

Table 3.3.2.2 Login

Table Name: Staff

Description: This table stores all the information regarding Staff personals.

Field Name	Type	Description
Sid	Varchar2(8)	Client's Id
Pwd	Varchar2(10)	Client's Password
Name	Varchar2(30)	Client's Name
Dept	Varchar2(10)	Client's Department
Desig	Varchar2(10)	Client's Designation
Dob	Date	Client's DOB
Doj	Date	Client's DOJ
Address	Varchar2(50)	Client's Address
Phone	Integer(12)	Client's Phone
Systemid	Varchar2(8)	Client's Systemid

Table 3.3.2.3 Staff

Table Name: Consumer

Description: This table stores the necessary information of all the consumers

Field Name	Type	Description
Cid	Varchar2(10)	Consumer Id
Pwd	Varchar2(10)	Password
Name	Varchar2(30)	Name
Conn_no	Integer(10)	Connection No
Phase_ctg	Varchar2(15)	Phase Category
Bill_ctg	Varchar2(15)	Bill Category
Dob	Date	Date of birth
Address	Varchar2(50)	Address
Phone	Integer(12)	Phone no
Reg_date	Date	Registered Date

Table 3.3.2.4 Consumer

Table Name: IO

Description: This table stores the details of input and output current and voltage of transformers

Field Name	Type	Description
Tid	Varchar2(8)	Transformer Id
In_cur	Varchar2(6)	Input Current
Out_cur	Varchar2(6)	Output Current
In_volt	Varchar2(7)	Input Voltage
Out_volt	Varchar2(7)	Output Voltage
Viewed_date	Date	Viewed Date
Time	Varcahr2(15)	Time of viewing

Table 3.3.2.5 IO

Table Name: Error

Description: This table stores all the errors occurred and the actions taken during transformer monitoring

Field Name	Type	Description
Tid	Varchar2(8)	Transformer Id
Err	Varchar2(150)	Error Message
Err_date	Date	Date of error
Time	Varchar2(15)	Time of error
Action	Varchar2(100)	Action to be taken

Table 3.3.2.6 Error

Table Name: Transformer_details

Description: This table stores the location details of transformers

Field Name	Type	Description
Tid	Varchar2(15)	Transformer Id
location	Varchar2(25)	Location of transformer

Table 3.3.2.7 Transformer_details

Table Name: Transformer

Description: This table stores the details of various transformer parameters

Field Name	Type	Description
Tid	Varchar2(8)	Transformer Id
Oil_level	Varchar2(8)	Oil Level
Oil_temp	Varchar2(10)	Oil Temperature
Wind_temp	Varchar2(10)	Winding Temperature
Cur_date	Date	Current Date
Time	Varchar2(12)	Time

Table 3.3.2.8 Transformer

Table Name: Loadshedding

Description: This table stores the loadshedding details of various places

Field Name	Type	Description
Place	Varchar2(20)	Place Name
Start_time	Varchar2(15)	Starting Time
End_time	Varchar2(15)	Ending Time
Start_date	Date	Starting Date
End_date	Date	Ending Date

Table 3.3.2.9 Loadshedding

Table Name: Tariff

Description: This table stores the tariff for the electricity bills

Field Name	Type	Description
Phase_ctg	Varchar2(15)	Phase Category
Bill_ctg	Varchar2(15)	Bill Category
Duty	Number(10)	Duty Amount
Minimum	Number(10)	Minimum Amount
maximum	Number(10)	Maximum Account
rate	Number(10)	Minimum Amount
Fixed_charge	Number(10)	Fixed Charge
Energy_charge	Number(10)	Energy Charge

Table 3.3.2.10 Tariff

Table Name: Bill

Description: This table stores the details if bills generated

Field Name	Type	Description
Cid	Varchar2(10)	Consumer ID
Billno	Integer(10)	Bill No
Start_date	Date	Start Date
End_date	date	End date
Initial_rd	Integer(8)	Initial Reading
Final_rd	Integer(8)	Final Reading
Total_units	Number(10)	Total no of units
Amount	Float(12)	Amount
Due_date	Date	Due Date
Paid_date	Date	Paid Date
Fine	Float(8)	Fine if any
Net_Amt	Float(14)	Net Amount

Table 3.3.2.11 Bill

Table Name: Message

Description: This table stores the details of messages sent and received by the staff

Field Name	Type	Description
Sender	Varchar2(8)	Sender's Cid
Receiver	Varchar2(8)	Receiver's Cid
Subject	Varchar2(30)	Subject
Message	Varchar2(150)	Message
Send_date	Date	Date of sending

Table 3.3.2.12 Message

Table Name: Request

Description: This table stores the details of requests and suggestions made by the consumers

Field Name	Type	Description
sender	Varchar2(10)	Sender
Send_date	Date	Date of sending
Subject	Varchar2(25)	Subject
Request	Varchar2(150)	Matter
Flag	Varchar2(1)	Flag indicating R/S

Table 3.3.2.13 Request

3.4 CODE DESIGN

The goal of coding or programming phase is to translate the design of the system produced during the design phase into code in a given programming language, which can be executed by a computer. For a given design the aim is to implement the design in the best possible manner.

The coding phase affects both testing and maintenance profoundly. There are many different criteria for judging a program, including reliability, size of the program, execution time and required

memory. The main objectives of the coding activity are: minimize the effort required to complete the program, minimize the number of statements, minimize the memory required and maximize the program clarity. Coding should be done in such a way that it's simple, easy to test and easy to understand and modify. Simplicity and clarity are the properties a programmer should strive for.

CODING STYLE

Some styles that are followed in coding which resulted in producing simple readable code in the proposed system are:

NAMES

Variable names closely are related to the entity they represent and module names reflect their activity. The use of meaningful names helps much to understand and debug easily.
For e.g. the use of variables like bill_ctg for bill category and sid for staff's identification number.

CONTROL CONSTRUCTS

Single entry, single exit constructs are used in the system. The absence of complex constructs helps to keep the system simple.

For e.g. almost all the sub procedures are written as single entry-single exit and use of "goto" statement is avoided for simplicity.

MODULE INTERFACE

Modules with complex interface are broken into modules with simple interfaces. Software with effective modularity is easier to develop because functions may be compartmentalized and interfaces are simplified.

For e.g. here all the possible modules are identified i.e. modules for validation, registration, monitoring, chatting, messaging and a lot more.

PROGRAM LAYOUT

Proper indentation, blank spaces and parenthesis are used to enhance the readability of the program. Proper comments are provided for better understanding. Modularity along with proper program layout makes a program intellectually manageable.

For e.g. comments are given for every sub procedures showing its use in the program.

SIDE EFFECTS

The side effects of modifying the program state beyond the modifications of the parameters listed in the module interface definitions are avoided to the maximum extent possible. Side effects are not welcomed.

For e.g. if there is any change in registration module, it should be reflected in display module.

ROBUSTNESS

A program is robust if it does something planned even for exceptional conditions. A program should check for the validity of inputs where possible and should check for possible overflow of the data structures. The proposed system won't crash or core dump, it produces some meaningful message and exit gracefully.

For e.g. if you try to monitor a particular feeder which is not functioning at that time, it will produce some meaningful message and exit gracefully.

3.5 OUTPUT DESIGN

The computer output is the most important and direct source of information to the users. Output design is an organizing activity during the study phase. The objective of output design is to define the

content and format of all documents and reports in an attractive and useful format. Other reasons for output generation are:

- To provide proper sharing of updated information which will help in further processing
- To provide permanent storage

Major forms of output are hard copy from the printer and soft copy from the CRT display unit. The output also provides a means of sorting a copy or results for later reference and consultation. Output generally refers to the result and information that are generated by the system. It can be in the form of operational documents. Since some of the end users will not actually operate the information system or input data through work station but will use output from the system, the output design specification is carried out with maximum friendliness. Output definition considers the type of output, its contents, formats, its frequency and its volume. The appropriate media is influenced by the following consideration suitably of the device.

- Need for a hard copy
- Response time of software and hardware availability
- Cost

Once the output medium is chosen, the detailed specification of the output document is carried out. In the proposed system the user can directly communicate with his co-workers, get information needed from other sections, calculate and issue bills, monitor the various parameters graphically and is an excellent way to control the activities of the organization. Monitoring is done using graphs which will be

shown in the screens; for this the size of the screen is taken into consideration along with other details. Because one can't go scrolling through it.

In the system there are reports for:

- Bills
- Staff Details
- Consumer Details

Reports are generated as per the requirements. For e.g. to generate reports for bills one can select bills for a period, for a particular consumer etc. this makes reports more useful.

3.6 DEVELOPMENT APPROACH

The program specification is itself a design. It describes how to transform the system design specification for input to output. The process of identifying the users need and designing the system that meets those needs through implementation is called system development.

The main activities of the system development phase are program designing, debugging, personnel training and system testing. A major element in system development is selecting compatible hardware and software. The system analyst has to determine what software package is best for the specified system and where software is not an issue, the kind of hardware and peripherals needed for the final conversion.

Designing of computer software is implemented to ensure that

- Actual program produced perform the entire tasks in the manner intended
- The structure of the software module permits suitable testing and validation to make sure that procedures are correct
- Future notification can be made in an efficient manner and with a maximum description to the design to the system

VALIDATION RULES AND CHECKS

While entering data to the table, the correctness should be assured. The input entry is checked for the presence of correct data. The validation checks used in this system assure that no information is left out and the information entered is accurate. It checks for the authorization of its users, also for the validity of inputs from the users. For e.g. all of its users whether administrator, staff or consumer should go through the validation process first to start working with the system. Also the inputs to other modules like billing should be correct and checks are provided at certain places. It checks for the company norms for entering the codes of the project, employees and tasks. It also checks for the uniqueness of the codes by setting it as primary key.

3.7 DATA FLOW DIAGRAMS

DFD: Level 0

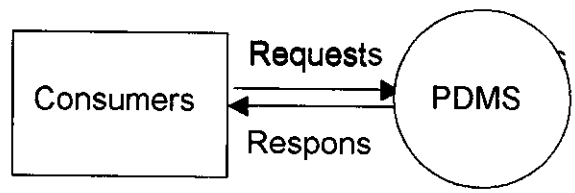


Figure 3.7.1 DFD: Level 0 PDMS

DFD :Level 1 Administrator

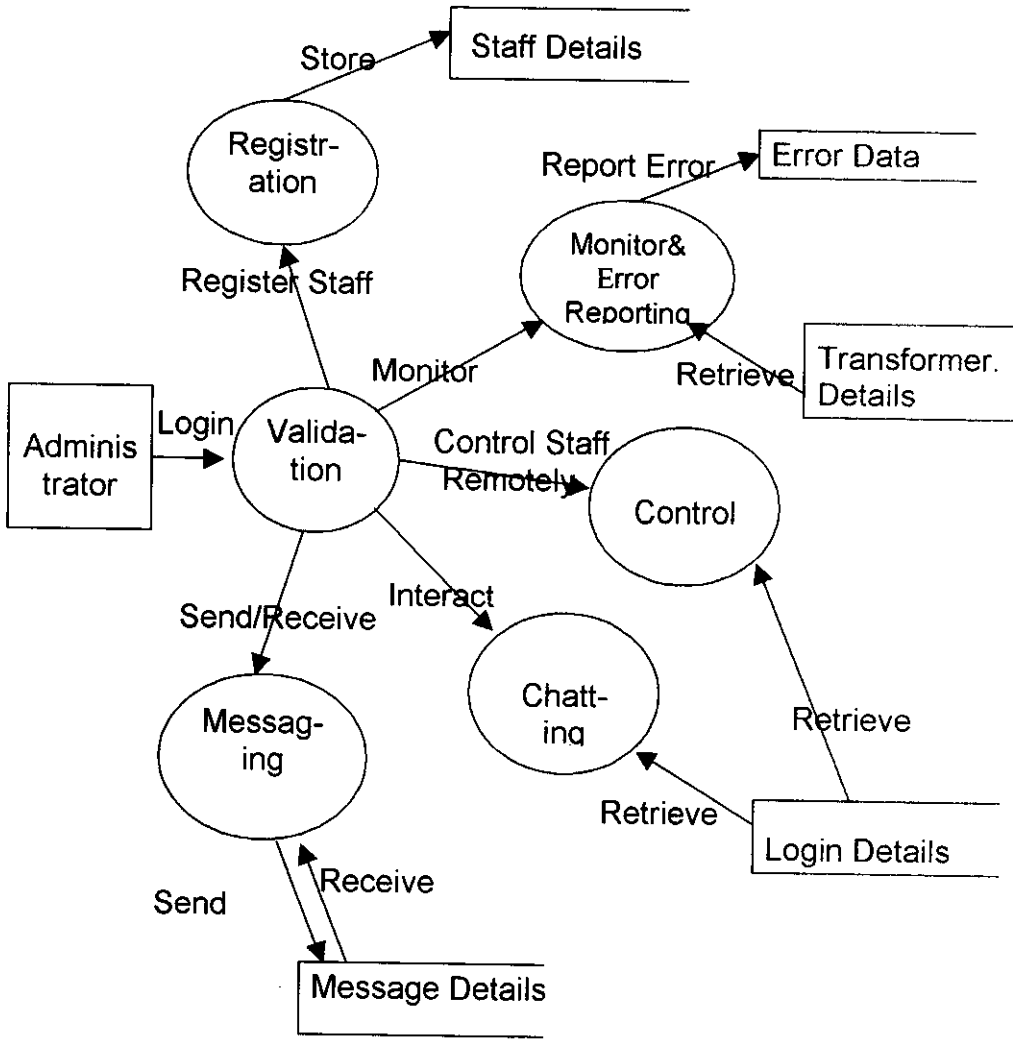


Figure 3.7.2 DFD: Level 1 Administrator

DFD: Level 2 Administrator / Control

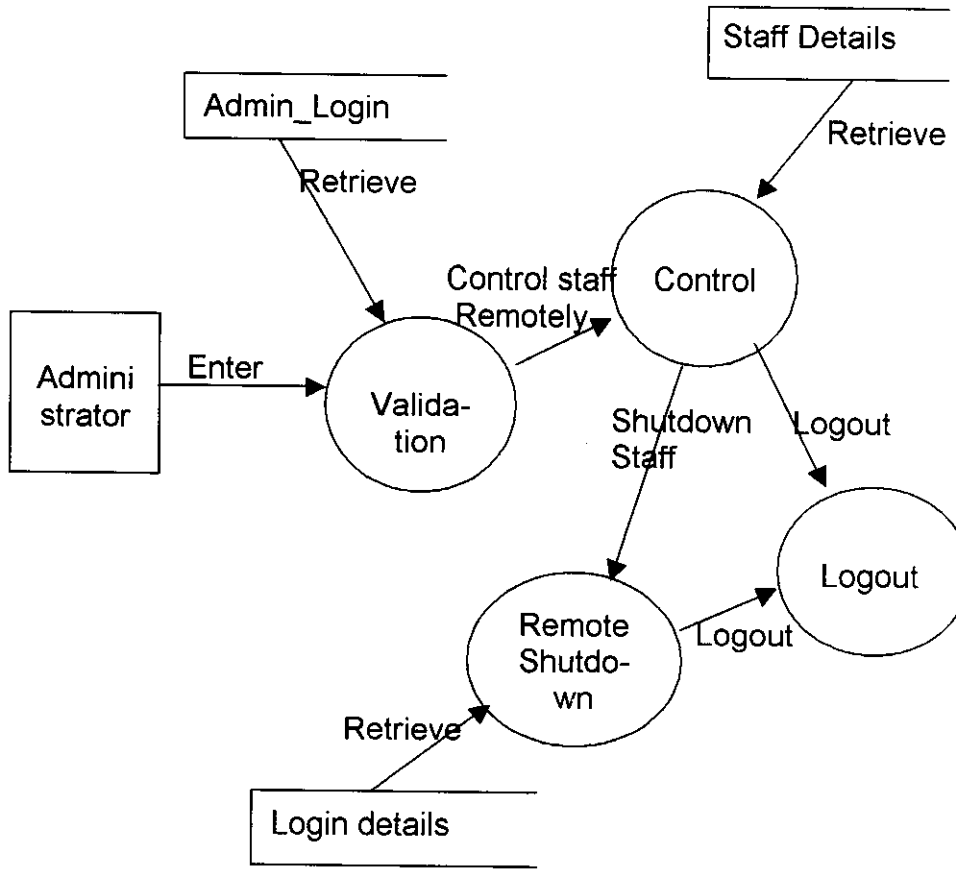


Figure 3.7.3 DFD: Level 2 Administrator/ Control

DFD: Level 1 Staff

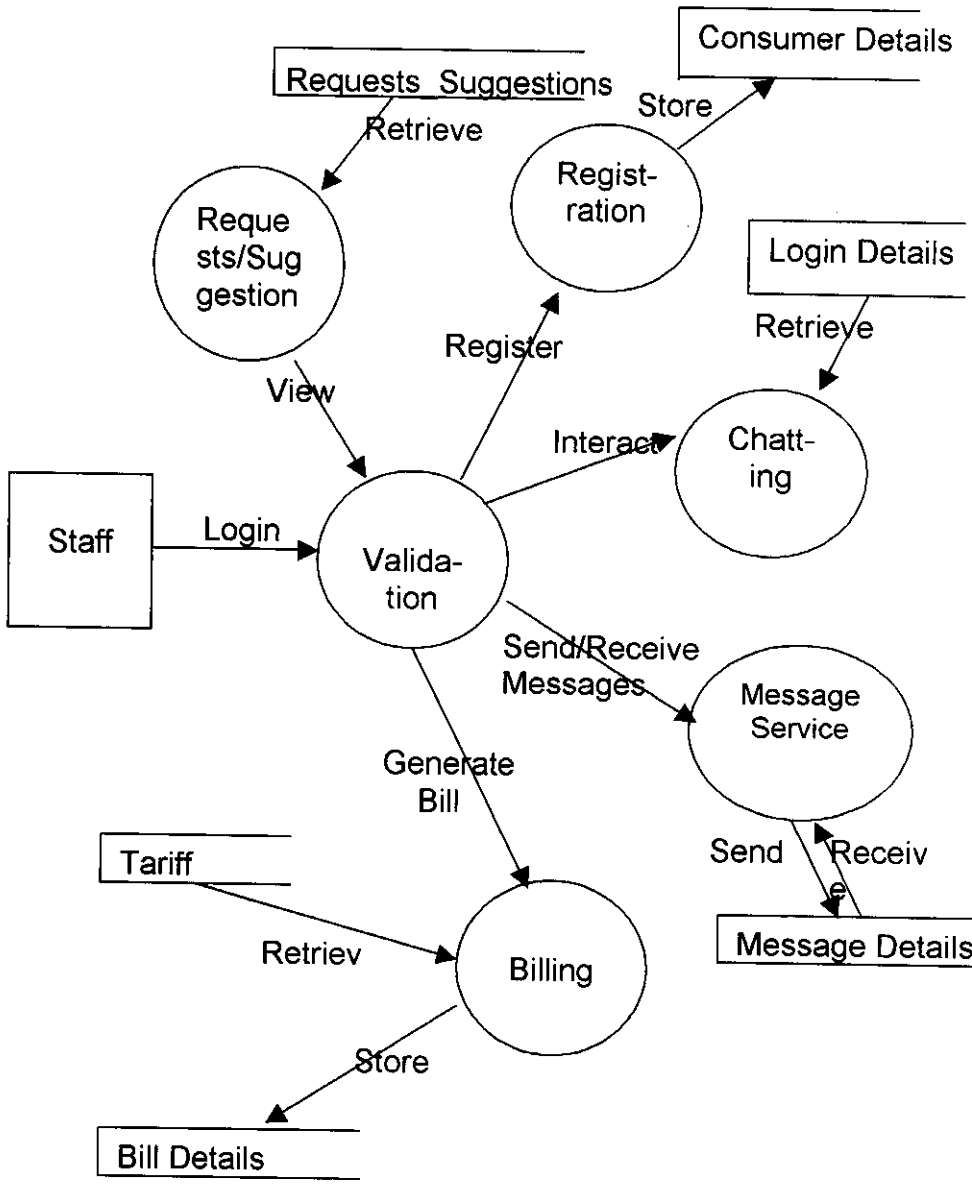


Figure 3.7.4 DFD: Level 1 Staff

DFD: LEVEL 2 STAFF/BILLING

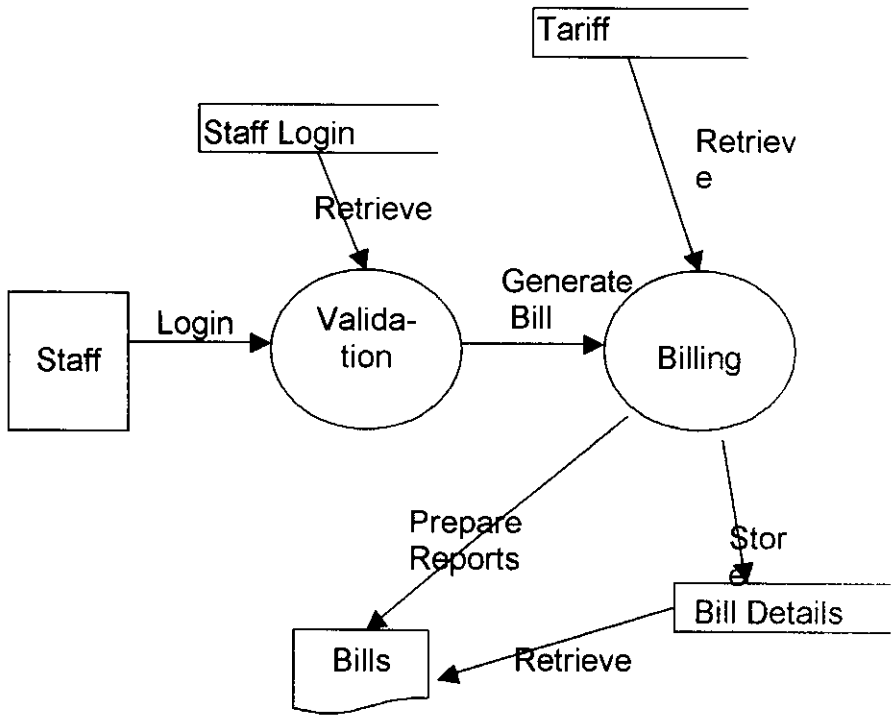


Figure 3.7.5 DFD: Level 2 Staff/Billing

DFD: Level 1 Consumer

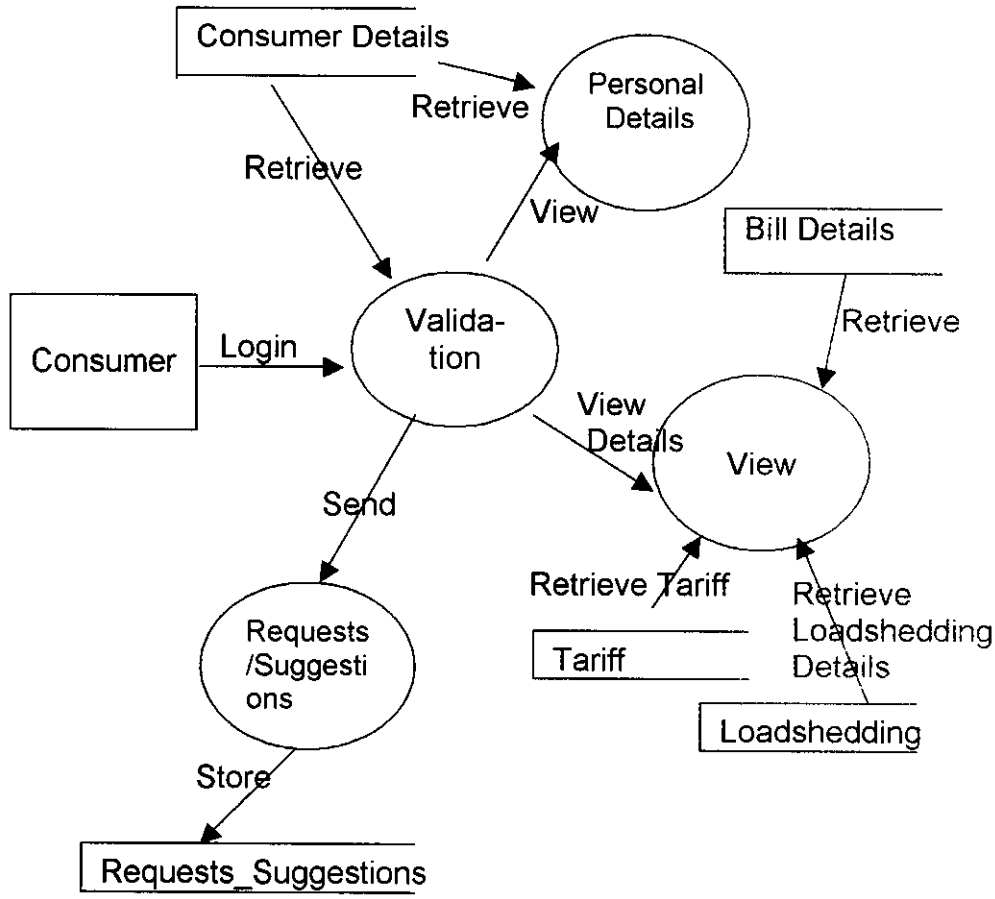


Figure 3.7.6 DFD: Level 1 Consumer

CHAPTER 4
SYSTEM TESTING AND IMPLEMENTATION

4.1 SYSTEM TESTING

In system testing, the software and other elements are tested as a whole. Software, once validated must be combined with other system elements (e.g. hardware, people, database). System testing verifies that all elements mesh properly and that overall system function/performance is achieved.

System testing is designed to uncover weaknesses that are no found in earlier tests. This includes forced system failure and validation of the total system as its user(s) in the operational environment will implement it. Generally it begins with low volume of transaction based on live data. The volume is increased until the maximum level for each transaction type is reached. The total system is also tested for recovery and fall back after various major failures to ensure that no data are lost during the emergency.

4.1.1 TESTING METHODOLOGIES

Testing is a set of activities that can be planned in advance and conducted systematically. Testing is vital to the success of the

system. System testing makes a logical assumption that if all of the parts of the system are correct, the goal will be successfully achieved. Inadequate testing is leads to errors that may not appear even after months. This creates two problems:

- The time lag between the cause and the appearance of the problem
- The effect of the system error on the files and records within the system

A small program error can conceivably explode into a much larger problem. Effective testing early in the leads to long term cost savings from a reduced number of errors. For e.g. if there is an error in the registration module, it will lead to cascaded errors in the other modules also. Another reason for system testing is its utility; a user oriented approach can be followed to test user satisfaction. Even the best programs are worthless if it does not meet user needs. Here the graphs and reports are specially tested for user satisfaction.

The first test of a system was to see whether it produces the correct outputs. Here all the needed outputs for monitoring, chatting, messaging etc were tested for its correctness. No other test can be more crucial. Following this test, a variety of other tests were conducted.

Volume Testing: In this testing, as many records as would normally be produced were created to verify that the hardware and software will function correctly. The user was asked to provide test

data for volume testing. Here the important data were records of staffs and consumers and other various records of transformer details.

Stress Testing: The purpose of stress testing is to prove that the candidate system does not malfunction even under peak loads. Unlike volume testing where time is not a factor, the system was subjected to high volume of data over a short time period. Mainly the check involved continuous monitoring of the transformer details to see whether it can withstand that stress.

Recovery and Security: A forced system failure was induced to test a backup recovery procedure for file integrity. Inaccurate data were entered to see how the system responds in terms of error detection and protection. This included checking the system for multiple registrations, login etc.

Usability Test: The usability test verifies the user friendly nature of the system. This relates to normal operating and error handling procedures. All the real time monitoring and communication modules like chatting, messaging and controlling functions like shutdown were tested. One aspect of user friendliness is accurate and complete documentation. All the exceptional matters like side effects were documented.

TESTING STRATEGIES

A strategy for software testing must accommodate low level tests that are necessary to verify that a small source code segment has been correctly implemented as well as high level tests that validate major system functions against customer requirements.

Different testing strategies are listed below:

- Unit Testing
- Integration Testing
- Validation Testing
- System Testing
- Acceptance Testing

UNIT TESTING

Unit testing concentrate on each unit of the software as implemented in source code. This test focuses on each module individually, assuring that it functions properly as a unit. Hence that name unit testing. Unit testing makes heavy use of white box testing techniques exercising specific paths in modules control structure to ensure complete coverage and maximum error detection. To make it clear, in the validation module all the variables and conditions used were checked to see that no invalid entry is possible.

INTEGRATION TESTING

In integration testing the focus is on design and the construction of the software architecture. So modules must be assembled or integrated to form the complete software package. Integration testing addresses the issues associated with the dual problems of verification and program construction.

Black box test case design techniques are the most prevalent during integration, although a limited amount of white box testing may be used to ensure coverage of major control paths. After the software has been integrated (constructed) ,a set of high order tests were conducted. For e.g. the login module is connected with chatting module since only the logged in users can chat with the administrator.

VALIDATION TESTING

The requirements established as part of software requirements analysis were validated against the software that has been constructed; this is validation testing. It provides final assurance that software meets all functional, behavioral and performance requirements. Black box testing techniques were used exclusively during validation. For e.g. the billing module was tested to see whether it functions as per the tariff given from KSEB.

USER ACCEPTANCE TESTING

An acceptance test has the objective of selling the software to the user on the validity and reliability of the system. It verifies that the system's procedures operate to system specifications and that the integrity as vital data is maintained.

Performance of an acceptance test is actually the user's choice. User motivation and knowledge are critical for the successful performance of the system. Then a comprehensive test report is prepared. The report indicates the system's tolerance, performance range, error rate and accuracy. Here the main check was done for monitoring and billing modules.

4.1.2 QUALITY ASSURANCE

The security concerns in the system assured that only authorized users are allowed to view, edit and add information. Login id and password are provided to each user so that intruders are not allowed. VB.Net and Oracle 9i provides good security since VB.Net codes cannot be viewed from browser. So the data are well secured.

In Oracle as there is an option for using the foreign key, the particular field in the database cannot be deleted /updated without the knowledge of the corresponding primary key.

SECURITY ASPECTS

The security concerns in this system assured that only authorized users are allowed to view, edit and add information. Login id and password are provided to each user so that intruders are avoided. Also system is developed so that each category of users is provided with relevant information and with little possibility of accessing other user's privileges. For e.g. the consumers can only view their bill details, any modifications if required are done by the staff personnel.

4.2 SYSTEM IMPLEMENTATION

Implementation means converting a new or revised system design into an operational one. During implementation there should be a strong interaction between the developer of the software and the users. Implementation involves installing hardware terminals and training the operating staff.

In his phase, user training is critical for minimizing reluctance to change and giving the new system a chance to prove its worth. The new system may be totally new replacing an existing system or it may be the modification to the existing system. Here it comes in the second category. In either case proper implementation is essential to provide a reliable system to meet organizational requirements.

Major steps involved in the implementation of the system are as follows:

-Installation of the hardware required for the developed system, PDMS. Here the mainly needed component was the chip which is to be embedded to make the real time values from the transformer available through ports. No other components were needed in special.

-The power distribution and monitoring system could work on any PC, which works on Windows 2000 or any other higher version of it with .Net framework installed on it.

-Before the installation of the software all the hardware interfaces for the monitoring system were developed and the software was connected with the interfaces.

In this step of implementation, the developed software was installed to ensure that the software is working in accordance with the new and existing hardware components.

TRAINING TO THE USERS

After installing the software the most important thing is to train the users how to make use of the installed software. It is the users who use the software, not the developer.

Each step of operation was explained to the users. Training was given separately to each category of users. The administrator and

staff were given different kinds of training. Demonstrations to users by entering test data and taking the output were given. Working of the system was explained in a detailed manner. For PDMS, explanation regarding how the monitoring of substation parameters was given to the administrator. Staff were given details about the billing and issuing of bill and how payment of bill is made by the consumers. Also thorough explanations were given for like chatting and messaging modules. The use of the system by the consumers was explained to the staff and they are responsible to teach the consumers as and when needed.

4.3 SYSTEM MAINTENANCE

Maintenance is the enigma of system development. Analysts and programmers spend far more time maintaining programs than they do writing them. Maintenance accounts for 50 to 80 percent of total system development. This problem occurs across industry largely because software is a handmade product designed in an ad hoc fashion with few standards; it comes out late; is poorly documented and therefore is difficult to maintain. On the horizon we can for see "maintenance bound" software development organizations that can no longer produce new software because all available resources are expended maintaining old software.

The ambiguous nature of change underlies all software work. Change is inevitable when computer based systems are built; therefore we must develop mechanisms for evaluating, controlling and making modifications.

Software maintenance is of course far more than "fixing mistakes". We can define software maintenance by describing four activities.

- Corrective Maintenance
- Adaptive Maintenance
- Perfective Maintenance or Enhancement
- Preventive Maintenance or Reengineering

CORRECTIVE MAINTENANCE

Even with the best quality assurance activities, it's likely that the customer will uncover defects in the software. Corrective maintenance helps the software to correct defects. Some small defects could be corrected using the document provided. But in case of major errors, the developer has to go to the site for correction.

ADAPTIVE MAINTENANCE

Over time, the original environment (e.g. CPU, OS, Business rules etc.) for which the software was developed is likely to change. Adaptive maintenance results in modification to the software to accommodate changes to its external environment. If compared, adaptive maintenance is easy mainly because VB.Net is platform independent. This makes the system run able on many platforms.

PERFECTIVE MAINTENANCE

As software is used, the customer/ user will recognize additional functions that will provide benefit. Perfective maintenance or enhancements extends the software beyond its original functional requirements. This might be in the form of new type of reports or online billing. Whatever it is, it will take time since it needs to got through all the life cycle stages.

PREVENTIVE MAINTENANCE

Computer software deteriorates due to change and because of this preventive maintenance, often called software reengineering must be conducted to enable the software to serve the needs of its end users. In essence, preventive maintenance makes changes to computer programs so that they can be more easily corrected, adapted and enhanced.

This needs through understanding of the existing system i.e. PDMS to correct any errors that can occur, and also to enhance it with new functionalities like chatting among staff, online bill payment etc. This mainly takes the form of add ups to the existing ones to make it more usable, like monitoring the work of the staff remotely by the administrator, not just shutting down the system.

Only about 20 percent of all maintenance work is spent "fixing mistakes". The remaining 80 percent is spent adapting existing systems to changes in their external environment, making enhancements requested by users and reengineering an application for future use. When maintenance is considered to encompass all of these activities, it is relatively easy to see why it absorbs so much effort.

CHAPTER 5
CONCLUSION

5.1 CONCLUSION

By taking up this application level project for KSEB titled as PDMS, I attained an extensive knowledge of how to use the existing technologies to create a system based on the client's requirements.

Monitoring is essential for the efficient management and controlling of the system. PDMS is used to enhance the service reliability of electricity board. The primary aim of the project is to develop software which enables the administrator to perform real time monitoring of the system. Also all the other basic requirements like registering and updating staff details, updating error details, chatting, shutdowning etc are provided to the administrator.

Staff has the options for registering consumers, preparing bills, chatting with the administrator and to send messages to other staff. Also proper actions are taken with respect to the suggestions and requests from the consumers.

Consumers are allowed to view the general details and personal details. This mainly includes their bill details. They can also post their suggestions/ requests if any.

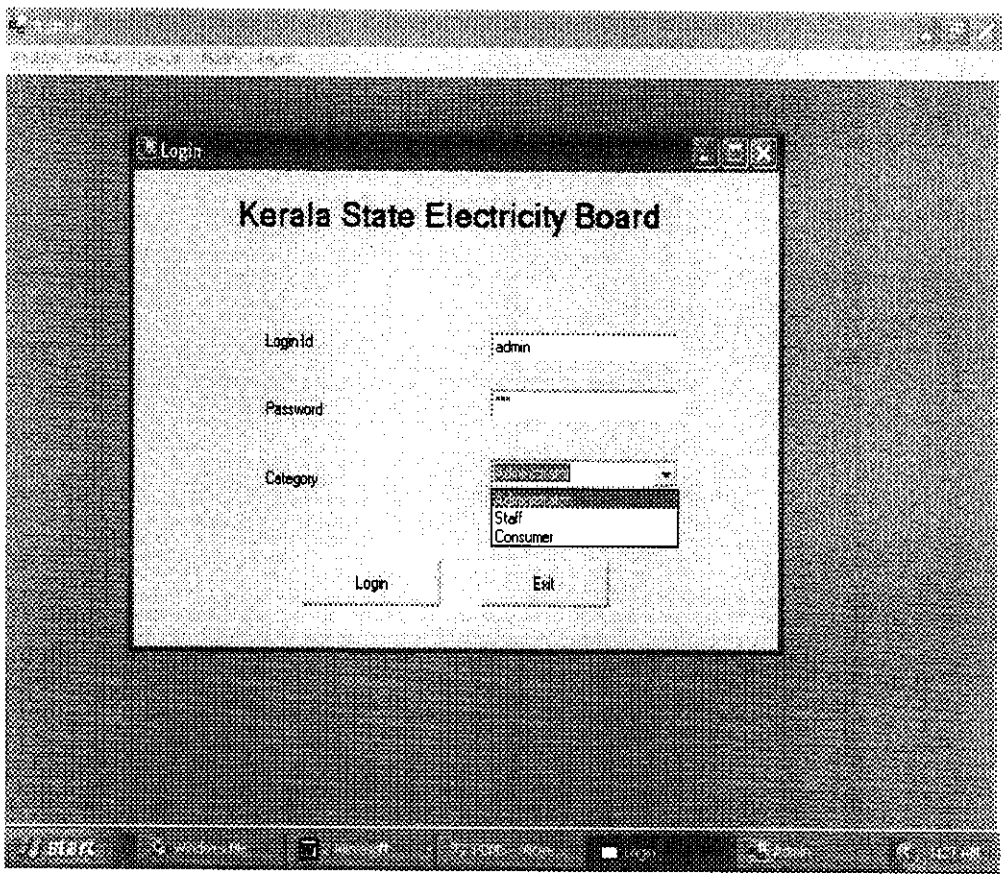
5.2 SCOPE FOR FURTHER ENHANCEMENT

The following is the list of features that could be added to the current system.

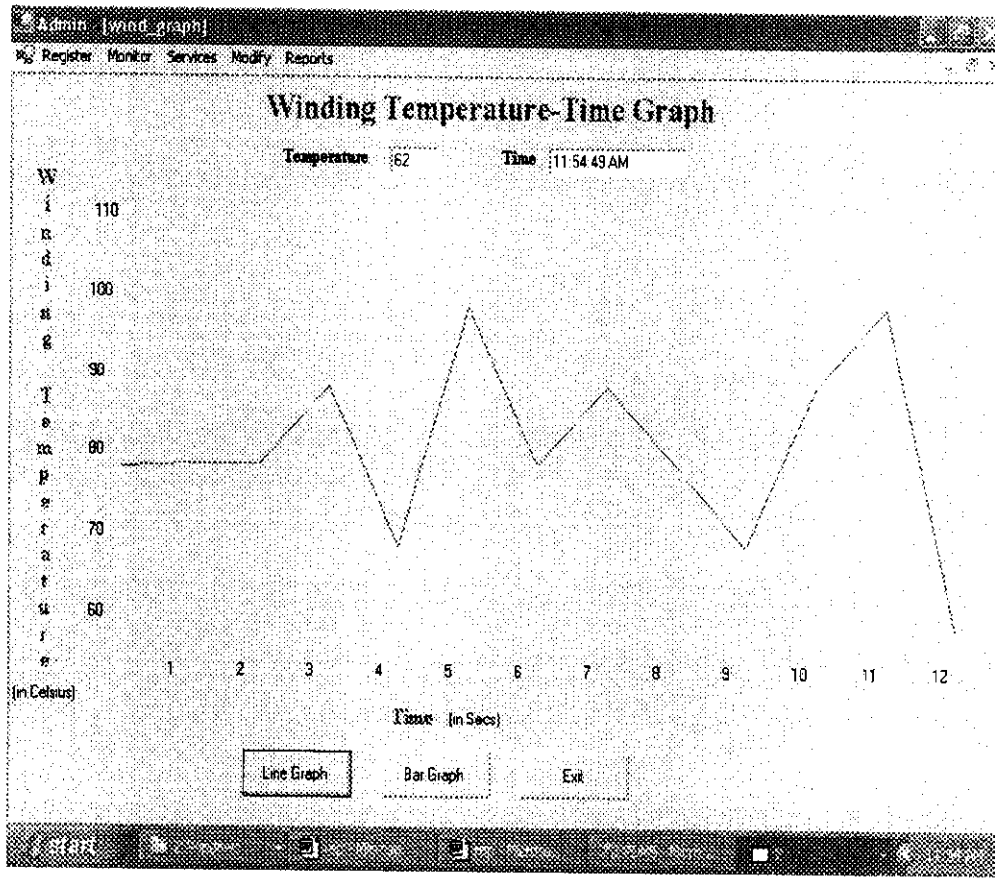
- Online payment of bills by consumers on registering to a site that is controlled by this system
- Since this system is designed for operations concerning low tension users, it's high time that we extend its capability for the high tension users.

APPENDIX

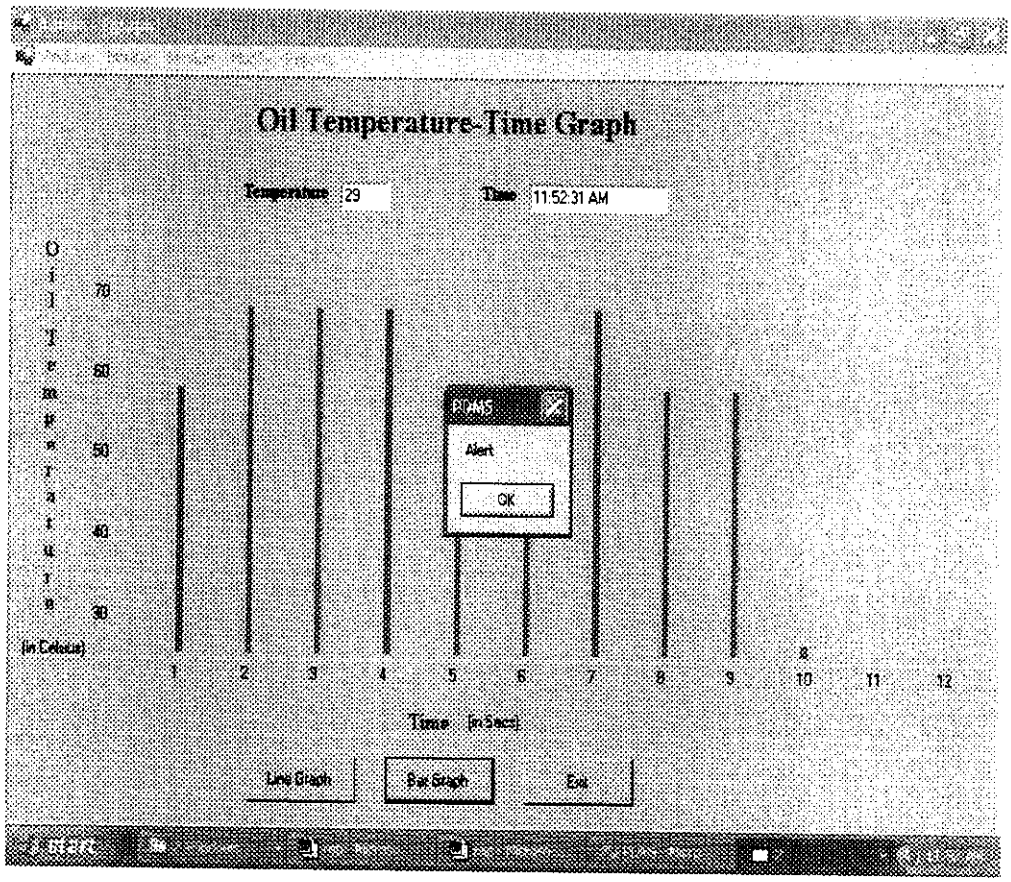
Login Page



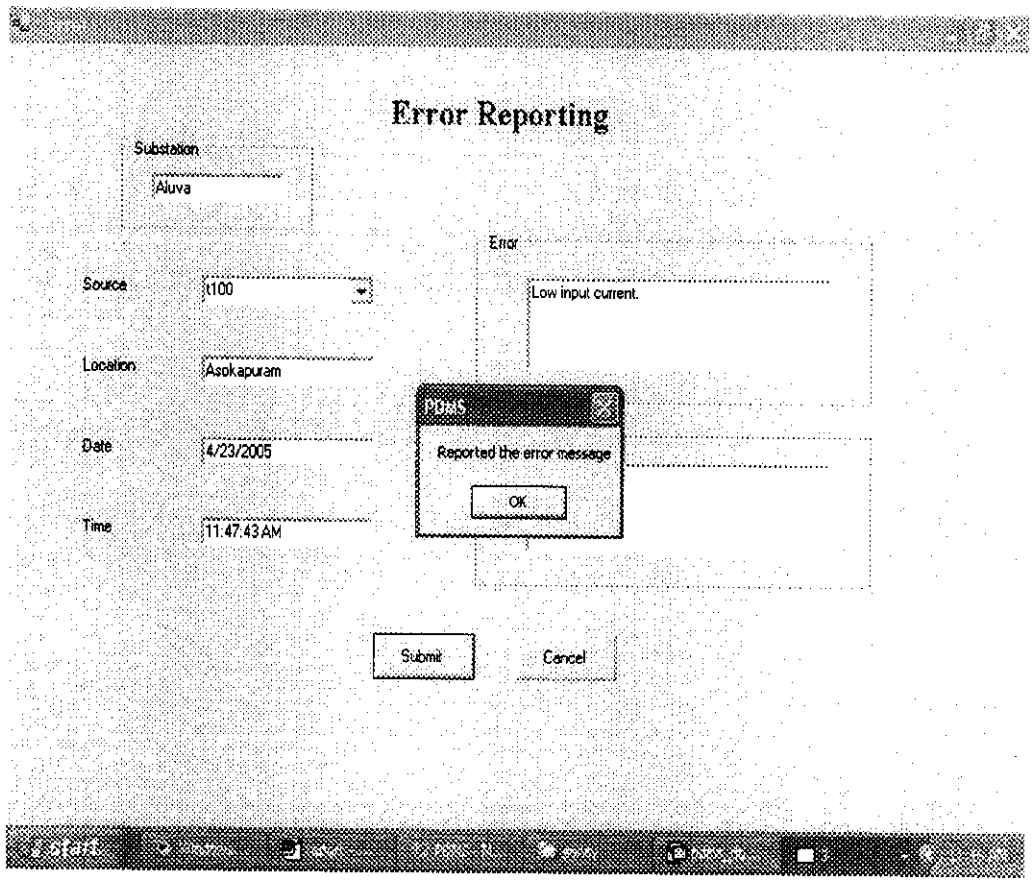
WINDING TEMPERATURE- TIME GRAPH



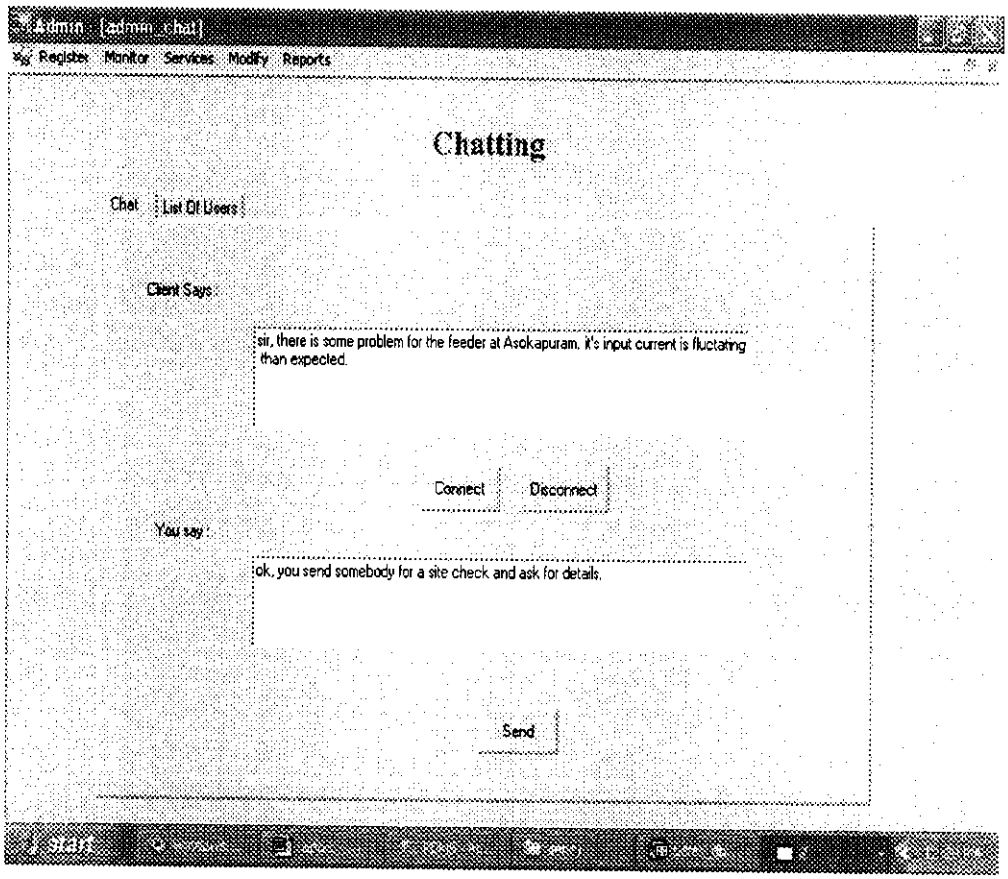
ALERT MESSAGE



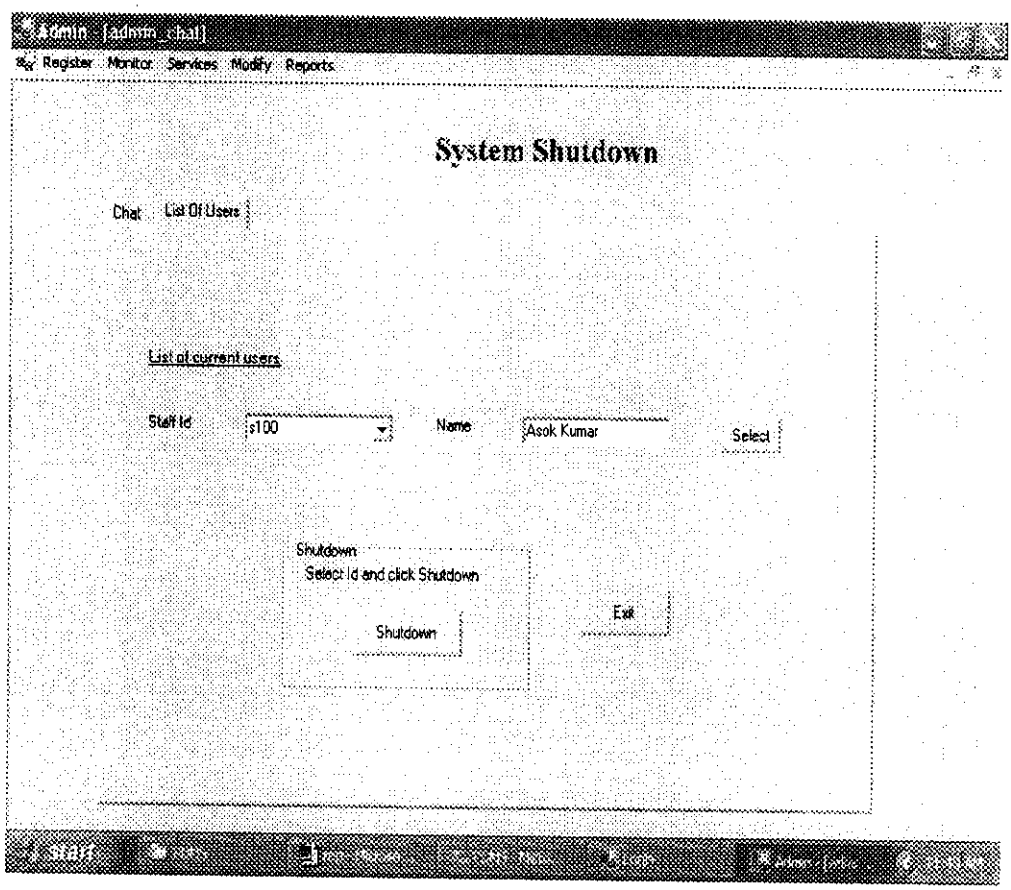
ERROR REPORTING



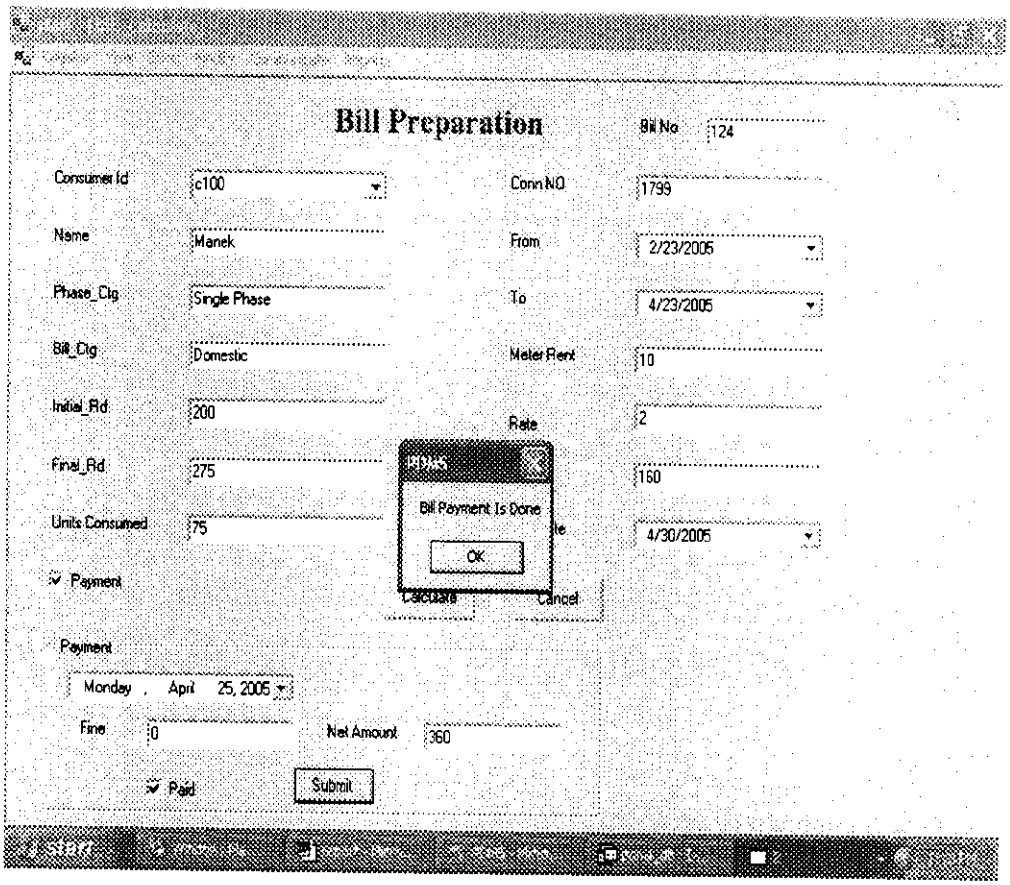
CHATTING


Admin [admin_chat]
Register Monitor Services Modify Reports
Chatting
Chat
List Of Users
Client Says:
sir, there is some problem for the feeder at Asokapuram. it's input current is fluctating than expected.
Connect
Disconnect
You say:
ok, you send somebody for a site check and ask for details.
Send

SHUTDOWN


Admin [admin chat]
Register Monitor Services Modify Reports
System Shutdown
Chat List Of Users
List of current users
Staff Id
s100
Name
Asok Kumar
Select
Shutdown
Select Id and click Shutdown
Shutdown
Exit

BILLING


Bill Preparation
Bill No
124
Consumer Id
c100
Conn NO
1799
Name
Manek
From
2/23/2005
Phase_Ctg
Single Phase
To
4/23/2005
Bill_Ctg
Domestic
Meter Rent
10
Initial_Rd
200
Rate
2
Final_Rd
275
160
Units Consumed
75
4/30/2005
Payment
Bill Payment Is Done
OK
Cancel
Payment
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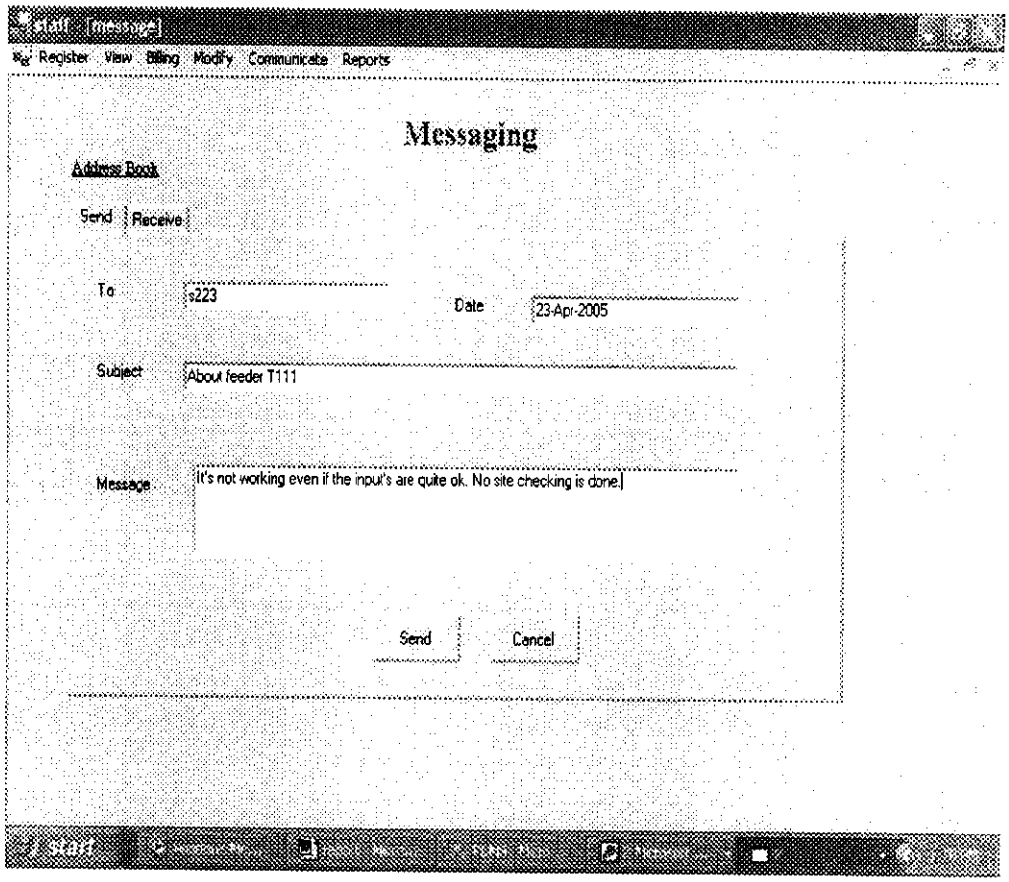
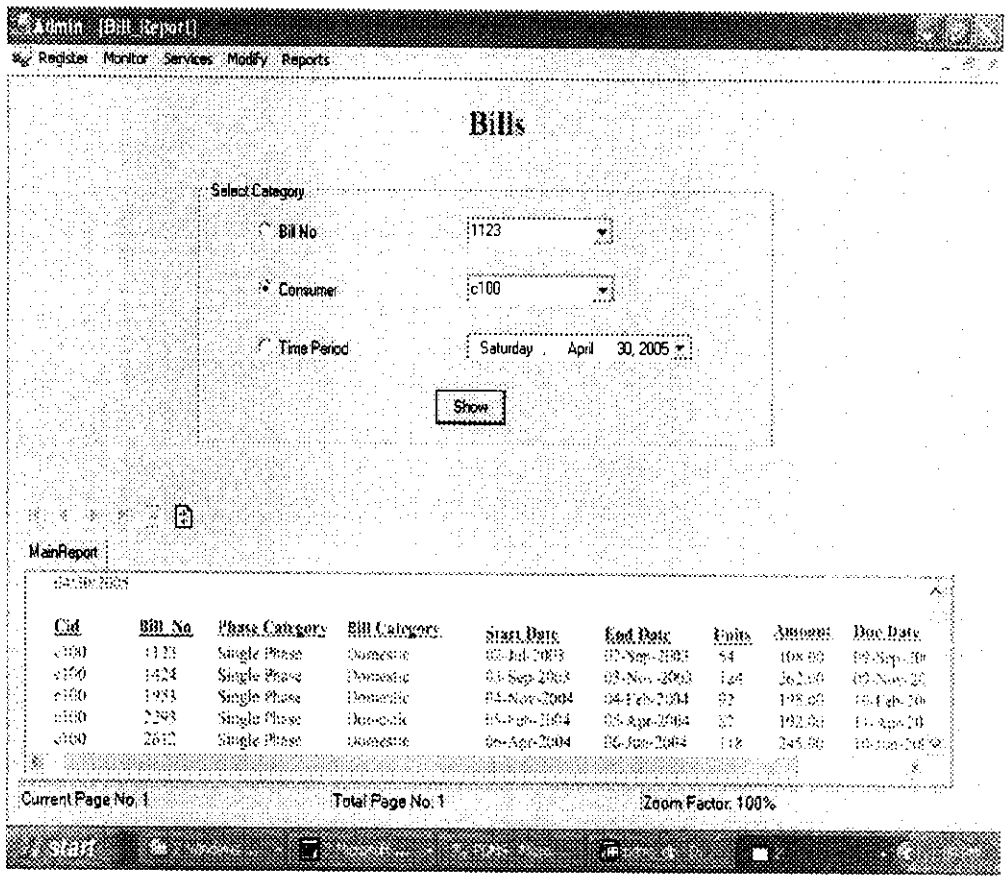
Fine
0
Net Amount
360
Paid
Submit

MESSAGING


Register View Billing Modify Communicate Reports
Messaging
Address Book
Send Receive
To
s223
Date
23-Apr-2005
Subject
About feeder T111
Message
It's not working even if the input's are quite ok. No site checking is done.
Send
Cancel

BILLS


Admin [Bill_Report]
Register Monitor Services Modify Reports
Bills
Select Category
Bill No
1123
Consumer
c100
Time Period
Saturday , April 30, 2005
Show
MainReport
Cid
Bill_No
Phase Category
Bill Category
Start Date
End Date
Units
Amount
Due Date
Current Page No: 1
Total Page No: 1
Zoom Factor: 100%

REFERENCES

1. Evangelos Petrostsos (2002) 'Mastering Visual Basic .Net' , Tata McGraw-Hill

2. George Koch and Kevin Honey (2003) 'Oracle 9i' , Tata McGraw-Hill

3. Roger S Pressman (1997) 'Software Engineering, a practitioner's approach' , Tata McGraw-Hill

4. Steve Holznes (2002) 'Visual Basic .Net Programming', Pearson Education Asia

5. MSDN Library Visual Studio 6.0 Release

6. www.google.com