

# THERMAL POWER PLANT MONITORING SYSTEM

PROJECT WORK DONE AT

NeST Cyber Campus

PROJECT REPORT

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS  
FOR THE AWARD OF THE DEGREE OF  
MASTER OF COMPUTER APPLICATIONS  
OF BHARATHIAR UNIVERSITY, COIMBATORE.

SUBMITTED BY

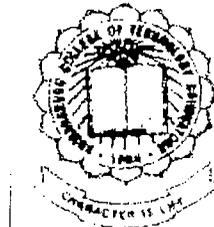
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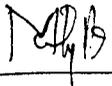
Department Of Computer Science & Engineering  
KUMARAGURU COLLEGE OF TECHNOLOGY

Coimbatore-641006

MAY 2002

## Certificate

This is to certify that *Ms. Suma Mathews*, student of Kumaraguru College of Technology, Chinnavedampatti, Coimbatore has done a project by designing and developing a software using VC++ titled **THERMAL POWER PLANT MONITORING SYSTEM** at NeST Cyber Campus, Thiruvananthapuram during the period December 2001 to April 2002 as a part of her partial fulfillment of the course, M.C.A. of Bharathiar University.



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Project Engineer  
For NeST Cyber Campus.



Date: 10<sup>th</sup> April 2002

Department Of Computer Science & Engineering  
**KUMARAGURU COLLEGE OF TECHNOLOGY**  
(Affiliated to the Bharathiar University)  
Coimbatore-641006

## CERTIFICATE

This is to certify that the project work entitled  
**THERMAL POWER PLANT MONITORING SYSTEM**  
Done by

Suma Mathews  
Reg. No. 9938M0646

Submitted in partial fulfillment of the requirements for the award of the degree of  
**Master of Computer Applications of Bharathiar University.**

  
Professor and head  
Department of Computer Science & Engineering  
22/4/02

  
Internal Guide

Submitted to university examination held on

10/05/2002

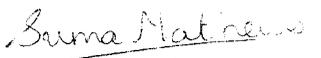
  
Internal Examiner  
10/5/02

  
External Examiner

## DECLARATION

I hereby declare that the project entitled 'THERMAL POWER PLANT MONITORING SYSTEM' submitted to Bharathiar University as the project work of Master of Computer Applications Degree, is a record of original work done by me under the supervision and guidance of Mr. Mohamed Riji .A, Project Engineer, NeST Cyber Campus, Thiruvananthapuram and Dr. S. Thangasamy Ph.D, Head of the Department of Computer Science & Engineering, Kumaraguru College of Technology, Coimbatore and this project work has not found the basis for the award of any Degree /Diploma/ Associateship/ Fellowship or similar title to any candidate of any university.

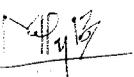
Place: Coimbatore

  
Suma Mathews

Date: 22/4/22

  
S. Thangasamy

Internal guide

  
External Guide

## ACKNOWLEDGEMENT

*I would like to take this opportunity to express my deep gratitude to all the people who have helped and guided me in the various stages of this project.*

*Firstly, I thank the Lord Almighty for his immense grace and blessings at each and every stage of this project.*

*I am extremely grateful to **Dr. K. K. Padmanabhan, Principal, Kumaraguru College Of Technology** who had given me a golden opportunity to serve the purpose of my education.*

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*I acknowledge my gratitude to **Mr. Sunderesan, Director, NeST Cyber Campus**, for permitting me to do the project and providing all facilities that made the experience a pleasant one.*

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## SYNOPSIS

Electricity is one of the most indispensable items in day-to-day life. Human tendency to invent more equipment and machineries to make life more comfortable will all be in vain without electricity. There are many ways to generate electricity like thermal power plant, hydro power plant etc. Computerizations of thermal plants are of great importance as it helps to monitor the plant efficiently.

The project entitled 'Thermal Power Plant Monitoring System' has been developed for Nest Cyber Campus, Thiruvananthapuram. This is aimed to monitor the performance of a local thermal power plant. The plant has got different sections like turbine section, generator section and transformer section. Each section has got authorized persons and they only are allowed to monitor the parameters belonging to that section. They must prove their authority by entering the name and password assigned to them by overall administrator. The officials can view the current values in different boxes and can also view the graph representing the variations in the parameter values against time. Since the actual implementation is done only at power plant, we have used a simulator program to generate values for the various parameters pertaining to each section. The overall administrator is allowed to view the overall performance of the system and has the authority to create and delete users. This system has been implemented in Visual C++ and Oracle 8 working under the platform Windows 2000.

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# 1. INTRODUCTION

## 1.1 PROJECT OVERVIEW

The project is aimed to monitor the performance of a thermal power plant from a local network. The plant has different sections like turbine, generator and transformer. The system has two types of users: Administrator and other officials of the system. The Administrator is the super user and has authority over the entire system. Each section of the plant has got authorized users who can monitor the parameters belonging to that section.

A simulator program is used to generate the parameter values of the plant. Simulator updates the database tables at each time instant. Each section has its own set of parameters, whose values are adequately generated by the simulator program. The services available for the users are data monitoring, view graph, data query, change password, chatting. In data monitoring, the values are monitored by providing danger level indications. In view graph the current values as well as the previous values are plotted. In data query each user can view the current values of the parameters of their respective sections. The user is given the privilege to change the password. The user has also got the facility to communicate with a particular user or with the administrator.

Administrator has got the special privileges of new user registration, viewing, updating and deleting the user details, in addition to data monitoring, view graph, data query, change password, chatting.

## 1.2 ORGANIZATION PROFILE

NeST is a provider of high value information technology to companies of all sizes. NeST has been creating and delivering innovative software solutions in engineering and business domains. In the core competency area, a well-planned methodology for technology change management is present to be always technically agile. Their quality and service standards ensure that the solutions are developed and delivered to the complete satisfaction of the customer.

The institutional equality policy is “We are committed to excellence in quality to exceed customer expectations. Our goal is to meet the stated and implied needs of the customer”.

Being the most preferred software service provider in Techno Park, the center has bagged the “Best Regional Software Explorer Award” for the last three years running. NeST cyber campus is a training division of NeST, based at Techno Park. NeST cyber campus provides high quality training on latest know-how in the field of Information Technology.

The technology competency is translated to customer solution making use of a wide skill base. This skill set encompasses multi-platform skills spanning UNIX, Windows NT, and IBM operating systems, and Real time operating systems. They have an experience base in networking environments such as TCP/IP, Net BIOS, SNA, IPX/SPX, and ATM. The database development area includes RDBMS like Oracle, Sybase and MS-SQL server and front tools like Power Builder, Visual Basic, Visual C++, Developer 2000 and Borland Delphi.

The implementation skill base is well supported by the state-of-the-art computing infrastructure at the west development center in India. This center is staffed with over 200 engineers consisting of software professionals and application experts. The center is well connected with customer sites all over the world through high-speed satellite links. The close associations with leading R&D centers and academic institutions in India further augment the infrastructure.

The NeST group places prime importance on customer services standard. To maintain high services standard, training is imparted in areas like communication skills, interpersonal skills and project management and human resource management skills. Being a global market player, NeST also emphasizes training on culture. NeST also emphasizes training on culture application for engineers operating in new cultural environment with the international presence through customer interface offices and with continued commitment to achieve timely response. With the state of the art, technical and customer services capability, NeST firmly believe that they can be a valuable software service provider.

## **2. SYSTEM STUDY AND ANALYSIS**

### **2.1 EXISTING SYSTEM**

The thermal plant has got the following main sections:

- Turbine Section
- Generator Section
- Transformer Section

In the existing system, monitoring of each of the parameter values of the machinery is performed by using LED displays connected to each part of the plant like turbines, generators, and transformers in the respective sections of the plant. The corresponding readings are indicated on the LED display as they are obtained. The danger level alarms are set in order to avoid any chaos and confusion. The readings are to be maintained and hence retained by paper works done manually by the clerical staff. These details are provided to the concerned section engineer along with the recorded date and time. All the section engineers forward the readings to the overall plant engineer.

#### **Limitations**

The limitations spotted in the existing system are

- Lack of accuracy of data.
- Lack of security of data.
- Time consumption.
- More storage area.
- Consumes more volume of paper work.
- More manual calculations are required.

The major drawback of the existing system is that the authorities cannot get the live data from the plant sections unless they go to the site and watch the readings recorded using the LEDs. Effective decision-making using the existing system is very tedious and also the maintenance of records is too cumbersome. The security and privacy of the existing system is not adequate since the reading is taken by the clerical staff to be promoted to the authorities. It consumes much time to acquire the parameter values and forward it to the

authorities. The worst part is for the engineers who experience a very hard time assessing the consequences or the fallout of the data coming from the plant.

## **2.2 PROPOSED SYSTEM**

The main objective of the proposed system is to perform the monitoring of various sections of the plant from a local network. This system is meant exclusively for the officials of the thermal power plant. The system should consist of three modules – simulator, administrator and user.

Simulator is used for generating random values to attain functionality close to the real life data of various controls of the plant. The data generated is constantly used for updating the database. The updating is done every second.

On the user side, only valid users should be allowed to monitor the performance of the plant. They should be provided with the facility of monitoring the current values of their respective sections. Here the values should be displayed in different boxes and normal values should be indicated by green color. When the value reaches the limit it should be shown in yellow color. When the value crosses the limit red color should be used for display and then an alarm should be raised. They should also be given the facility of plotting graphs against time for the parameters, current as well as previous values, within their access limits. Danger level indications should also be provided in the graph. The previous as well as current values of the parameters should be listed by giving the query such as section code, date and time by valid users. The user can communicate with other users as well as with administrator if any emergency arises.

Administrator should be given the privileges to create a new user and he can delete a particular user from the database. He can also view the details of the user selected. He has the authority to monitor and view all three sections of the plant. He has the facility to view the values of the parameters. He has also given the privilege to chat with the users if any emergency arises.

### **Characteristics of the proposed system**

- Easily accessible.
- Online monitoring performance.
- Comparative study easier.
- Accuracy.
- User friendly.

- Secure.
- Increased speed.

### **Advantages Of Proposed System**

- It helps to support efficient operation.
- It is meant to evaluate the plant by real-time monitoring.
- Timely maintenance.
- Improvement in reliability of the system.
- Decreased response time.
- Paper work is avoided.

## 2.3 SYSTEM REQUIREMENTS

This section gives clear definition and specification of the functionality of the system. It allows the developer or the analysts to understand the system and the functions to be carried out. The requirements are:

- Only valid officials are allowed to monitor the performance of the following sections of the plant, namely
  - Turbine Section
  - Generator Section
  - Transformer Section
- Electrical Section Engineers are allowed to view the parameters of both generator and transformer
- The plant has two turbines, two generators and three transformers
- The parameters of the plant to be monitored are:
  1. **Turbine** – output power, steam pressure, steam temperature, speed, quantity of steam flow, bearing temperature, condenser vacuum pressure.
  2. **Generator** – output power, reactive power, frequency, voltage, current, winding temperature, air temperature.
  3. **Transformer** – output power, winding temperature, oil temperature.
  4. **Electrical** – all the parameters of generator and transformers.
- Plant Engineer(Administrator) can monitor overall performance of the plant.
- Need a facility to check the username and password to determine the type of access.
- Need a simulator for generating random numbers to attain functionality close to real life data of various controls of the plant. The data generated is used for constantly updating the database. The updating is done in every second.
- Need a server for supplying the data required by the supervisor from the database.

- Supervisors are connected to the server by entering the user name and password.
- Authorized supervisors are provided with the facility of plotting graphs against time for various parameters of the plant within their access limits. Facility to provide danger level indications in the graph is also given.
- Supervisors are also provided with the facility of monitoring the values which are displayed in different boxes. Danger level indications are given with the help of color variations and also with an alarm.
- Supervisors can view a particular day's output, if chosen.
- In case of any emergency, the supervisor can discuss with the other supervisors as well as with the administrator.

## 2.4 USER CHARACTERISTICS

There are two types of users in the system.

### i. Valid Users:

They are allowed to monitor the performance of their respective sections of the plant.

Different valid users are:

- a) *Turbine section Engineer* is allowed only to monitor the performance of the turbines.
- b) *Generator section Engineer* is the only authorized person to monitor the performance of the generators.
- c) *Transformer section Engineer* is the authority to monitor the parameters of the transformers.
- d) *Electrical section Engineer* is the authorized person to view the electrical parameters of the plant.

### ii. Administrator:

The main job of the administrator(*Plant Engineer*) is to authenticate the other users. He is also given the responsibility to monitor the overall performance of the plant.

### 3.PROGRAMMING ENVIRONMENT

#### 3.1 HARDWARE CONFIGURATION

The following are the hardware requirements of the new system.

PROCESSOR	:	Intel Pentium III 500 MHz
BASE MEMORY	:	64 MB SDRAM
EXTENDED MEMORY	:	15360 SDRAM
CACHE MEMORY	:	512 KB
PORTS	:	1 Parallel and 2 Serial
FLOPPY DRIVE	:	1.44 MB
HARD DISK	:	8.4 GB
DISPLAY TYPE	:	TRIDENT 3D-IMAGE 9750 AGP V 4457H
MONITOR	:	SAMSUNG SAMTRON 40Bn
KEYBOARD	:	SAMSUNG SOFT TOUCH KEY
NETWORK CARD	:	ETHERNET 10/100

### **3.2 SOFTWARE SPECIFICATION**

A major element in building a system is the selection of compatible software since the software in the market is experiencing a geometric progression. Selected software should be acceptable by the firm and the user as well as it should be feasible for the system.

The configuration of the system :

LANGUAGE : Visual C++.  
OPERATING SYSTEM : Windows 2000.  
DATABASE PACKAGE : Oracle 8.0.

#### **VISUAL C++**

VC++ 6.0 is a product from Microsoft. It has a sophisticated and very rich IDE (Integrated Development Environment) for C++, an object oriented programming language, along with the built-in MFC support that encapsulates the windows API functions. There are more than 350 MFC classes. It has powerful wizards, which are used to construct the applications without time and resources along with the source documentation.

#### **Win Main Function**

This is the entry point for the program. It is the windows equivalent of the C language's function main. The windows program starts with and ends with the Win Main Function.

#### **Windows Application Programming Interfaces (API)**

An API is a set of function calls in one program that a programmer uses to create other programs. Since windows is a Graphical User Interface, their implementations are coded and kept in the form of functions which are called API functions. The windows API are of two basic varieties:

- 1) API for 16-bit windows (Win 16 API)
- 2) API for 32-bit windows (Win 32API)

Dealing with API requires extra knowledge and detailed understanding of the arguments to be passed and the return of values. Thus to avoid this over work load , MFC was designed. But still there are many situations to deal with API functions, in case of absence of required MFC. API functions are implemented at low level.

## **COMPONENETS OF VISUAL C++**

### **Visual C++ Developer Studio**

The developer studio is the core of VC++ product. It is an integrated application that provided a complete set of programming tools. The developer studio includes a project manager for keeping track of your program source title and a set of resource such as menu, dialog box and icons. It also provides programming wizards (application wizard and class wizard), which helps us to generate the basic code for the program, defines c++ class handle window messages and perform other task. We can build and execute the program from within the developer studio, which automatically runs the optimizing compiler, the incremental linker and any other requested to build tools. We can also debug programs using integrated debugger and we can view and manage program symbols and c++ classes using the class view windows.

### **Visual C++ Runtime Libraries**

The Visual C++ runtime libraries provide standard function such as string copy (strcpy) and printf for printing the string, which can call from either C or C++ program.

### **Visual C++ MFC**

The MFC library is a C++ programming language framework that is designed primarily to create Microsoft window based application. The Microsoft foundation classes are tied to the concept and practices of object-oriented programming. The Microsoft foundation classes provide a framework for a basic windows application. The entire collection of Microsoft foundation class library makes up the framework from which the application can be made and defines the basic set of windows user interface implementations that the application will require. By overriding the framework function, one can respond to any message one wants, but any messages we explicitly handle are taken care of by the framework. The Microsoft Foundation Class are built-in classes and are provided along with

VC++ IDE. There are about 250 built-in MFC available. The MFC simplifies writing these programs and it provides many high level features that can save considerable coding template based C++ classes.

## **Graphics**

This component consists of graphics elements metafiles, bitmaps, cursor, and icons as well as video clips that we can add to program.

## **Tools**

The main tools used in 'Thermal Plant Monitoring System' are:

- Class Wizard
- AppWizard

## **Class Wizard**

The most powerful feature of VC++ is a class wizard. It makes easy to do certain routine tasks such as creating new classes, defining message handlers, overriding MFC functions and gathering data from controls in a form view or record view. Class wizard works only with the application that gives MFC classes. With class wizard, we can:

- Create new classes derived from many of the main frame work base classes that handle window messages.
- Map messages to functions associated with windows, dialog boxes, controls and menu items.
- Create new message-handling member functions.
- Delete message-handling member functions.
- See which messages have message handlers already defined and jump to the message handler program code.
- Define member variables that automatically initialize, gather and validate data entered into form views.

For example, suppose we have visually placed a push button in the application window. Once we have placed a push button, we want to write code that is executed when the user click the button. This is the time to use the class wizard. By choosing various options in the class wizard window, we tell class wizard to prepare all the overhead code. The class wizard responds by preparing all the overhead code and then showing us where to insert the code.

## AppWizard

It generates a complete suite of source files and resource files based on classes from the MFC library. There are two versions of this wizard, one that helps us create an MFC executable program and one that helps us create an MFC DLL. When we use the MFC AppWizard to create an MFC program, we get a working starter program. This program has built-in functionality that when compiled, will implement the basic features of a Windows executable (.EXE) program. The MFC starter program will include C++ source (.CPP) files, resource (.RC) files, header (.H) files, and a project (.DSP) file. The code generated in these starter files is based on MFC.

There are three steps to creating an MFC EXE program. First, following the steps and choosing the options provided by the MFC AppWizard, define the features of the program. Next, compile and link the starter program. Finally we can add code to the starter files that AppWizard created.

## Base Class Structure:

The most important classes in MFC are

- **CObject** – The **CObject** class is a base for most other MFC classes. This class provides some common overhead functions that are required by all objects. **CObject** class provides the following important services: object diagnostics, runtime class information and object persistence.
- **CcmdTarget** – This serves as the base class for all class that can receive and process message.
- **CWinApp** – This is the base class from which we derive the windows application object. The application object provides member functions for

## **ODBC interface**

It defines a library of function calls that allows an application to connect to a DBMS, execute SQL statement and retrieve results. The ODBC interface defines possible interaction between the user application and the driver manager.

## **Windows 2000**

Windows2000 uses a NT (New Technology) Kernel. It is more compatible and more powerful than any work station used previously.

## **Features**

- Easier to manage.
- Easier to use.
- More compatible.
- More powerful.

## **4. SYSTEM DESIGN AND DEVELOPMENT**

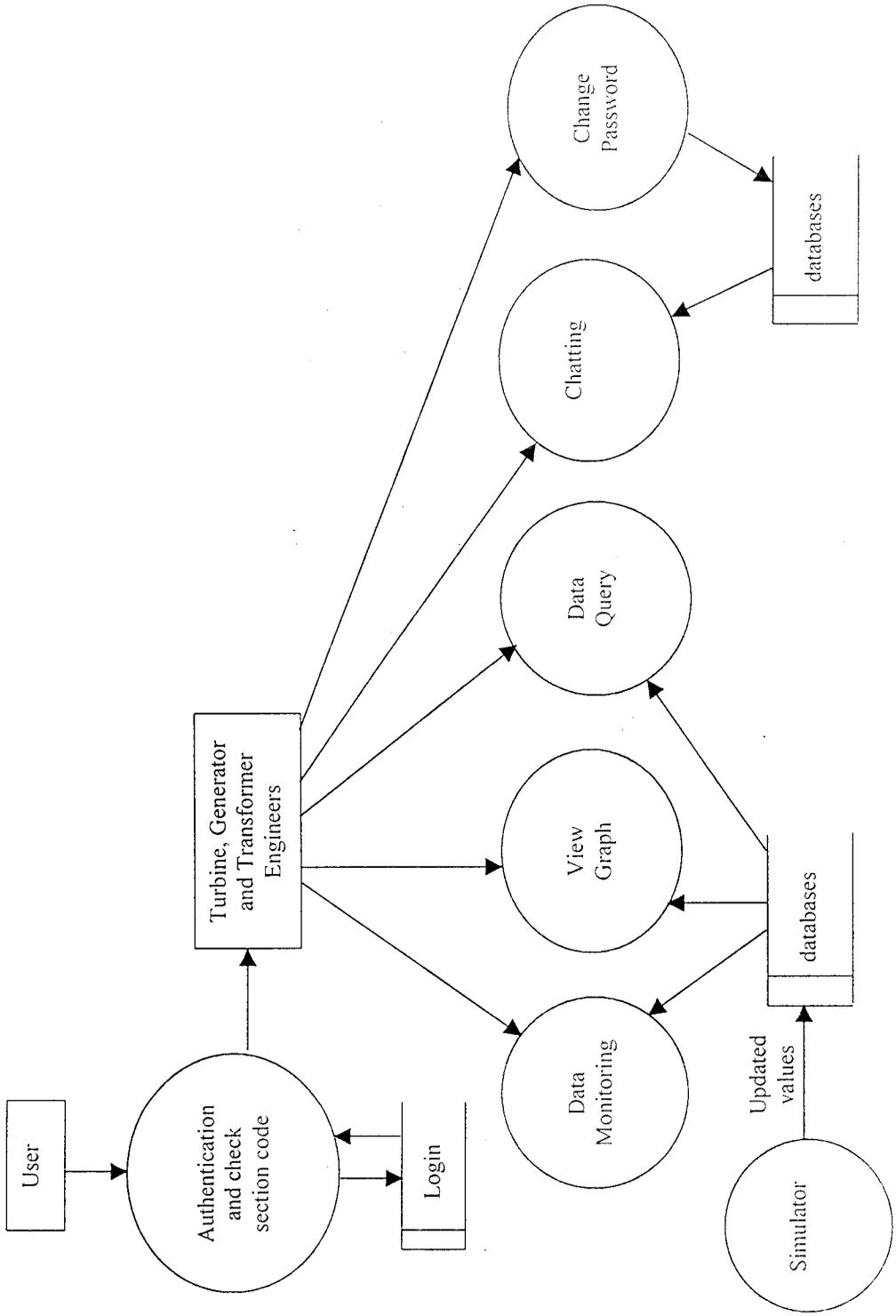
The term **design** describes a final system and the process by which it is developed. It refers to the technical specifications that will be applied in implementing the candidate system. It also includes the construction of programs and program testing. System designing transforms a logical representation of what a given system is required to do into the physical specification. The specifications are converted into a physical reality during development. The designing phase proceeds according to an orderly sequence of steps beginning with review and assignment of task and ending with package design. The system design also describes the data to be input, calculated and stored.

### **4.1 DATA FLOW DIAGRAMS**

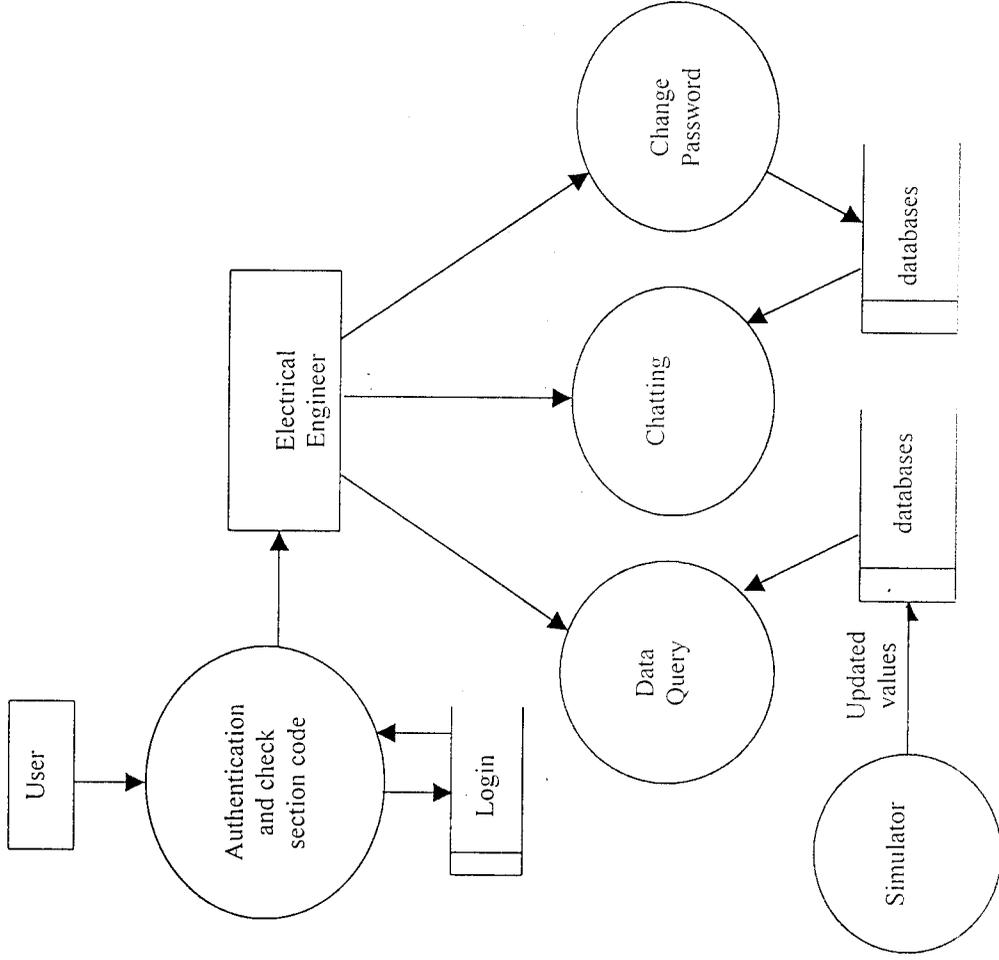
A Data Flow Diagram is a structured analysis and design tool that depicts information flow and the processes that change or transform data through out the system. DFD may be used to represent a system at any level of abstraction. It has the purpose of clarifying system requirements and identifying major transformations. It is the starting point of the design phase that functionally decomposes the requirement specification down to the lowest level of detail. DFDs may be partitioned into levels that represent increasing information flow and functional details. DFD serves two purposes – to provide an indication of how data are transformed as they move through the system and to depict the functions that transform the data flow. It depicts information flow without explicit representation of procedural logic.

In 'Thermal power Plant Monitoring System' DFDs are drawn which describes the overall process of turbine, generator, transformer, electrical and plant engineer. Then each process in the system is also described in detail by drawing separate DFDs.

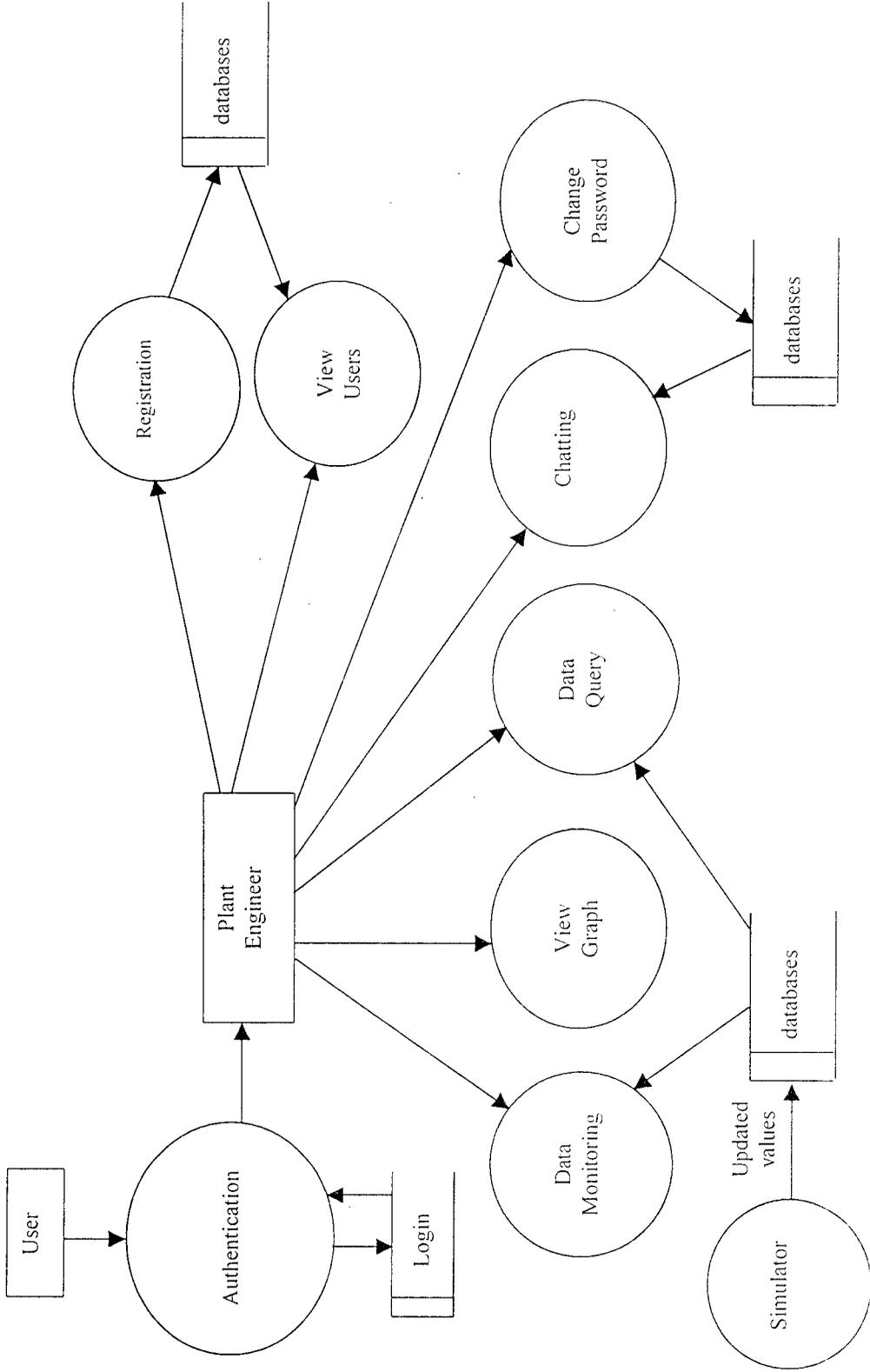
Overall Process of Turbine, Generator and Transformer Engineers



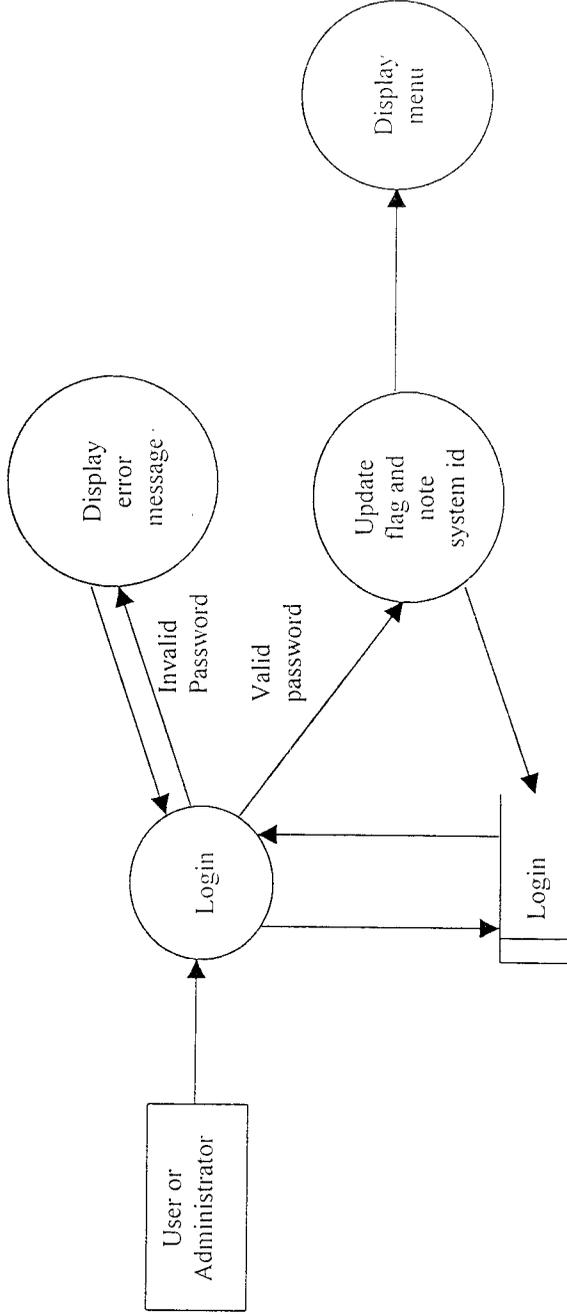
# Overall Process of Electrical Engineer



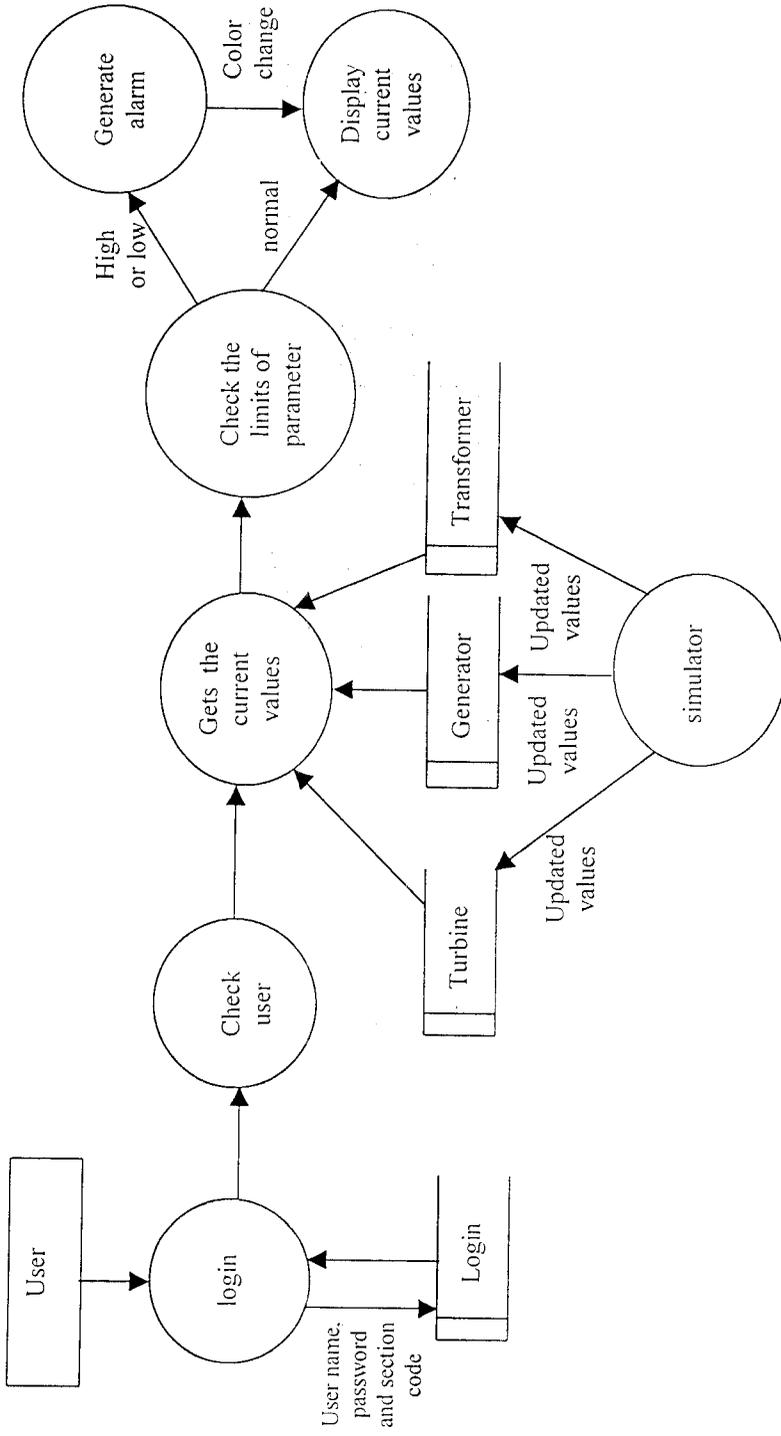
Overall Process of Plant Engineer



# Authentication

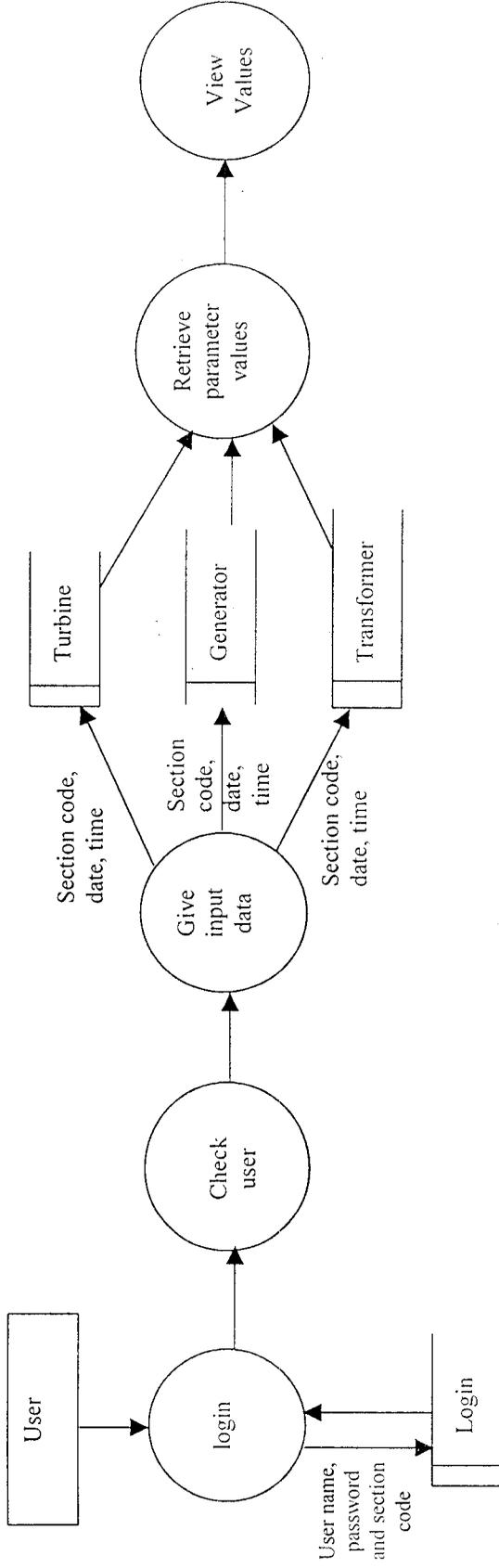


## Data Monitoring



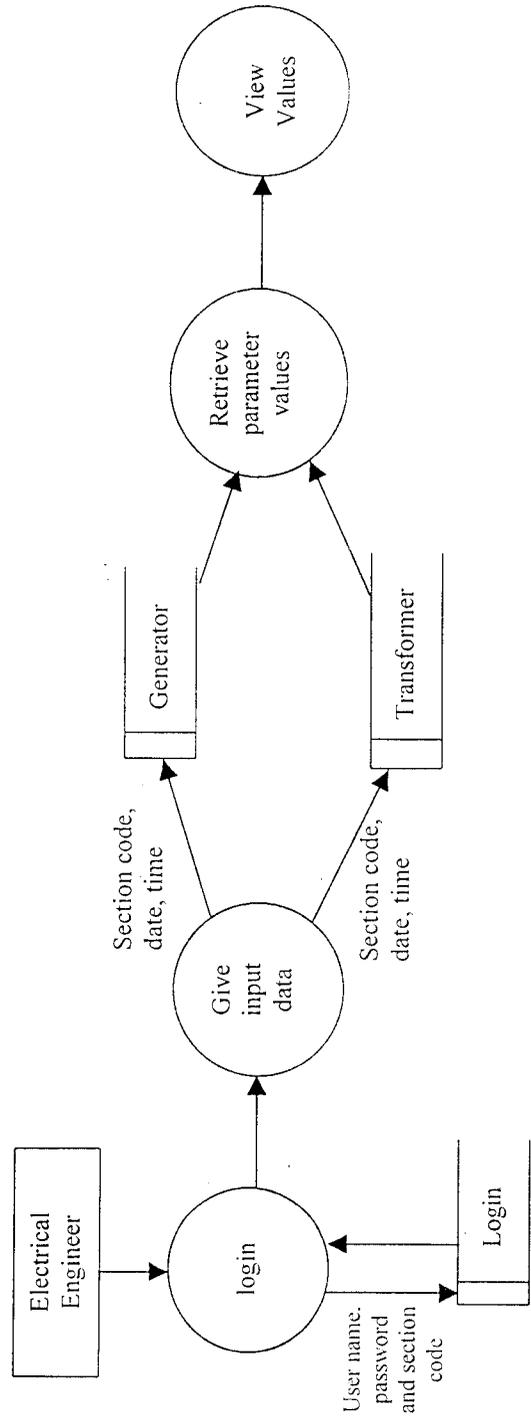
The turbine, generator and transformer engineers can monitor only their respective sections. Plant Engineer can monitor all the sections.

## Data query for Turbine, Generator, Transformer and Plant Engineer

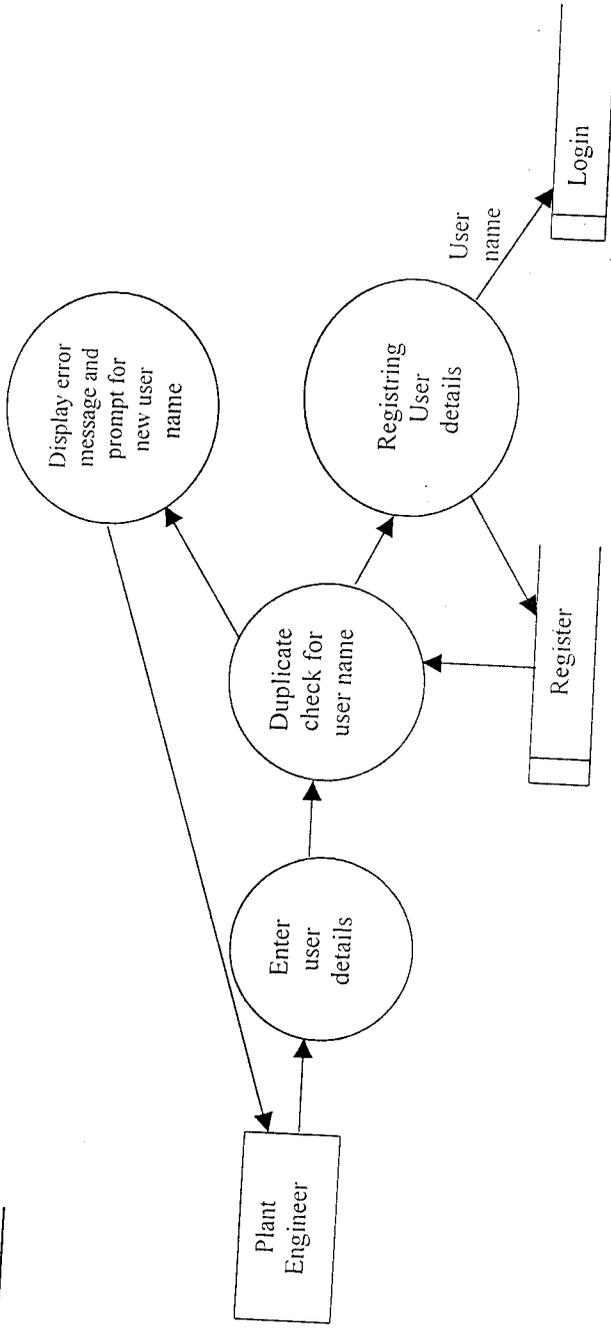


The turbine, generator and transformer engineers can view the parameters of their respective sections only. The plant engineer can view the parameters of all sections.

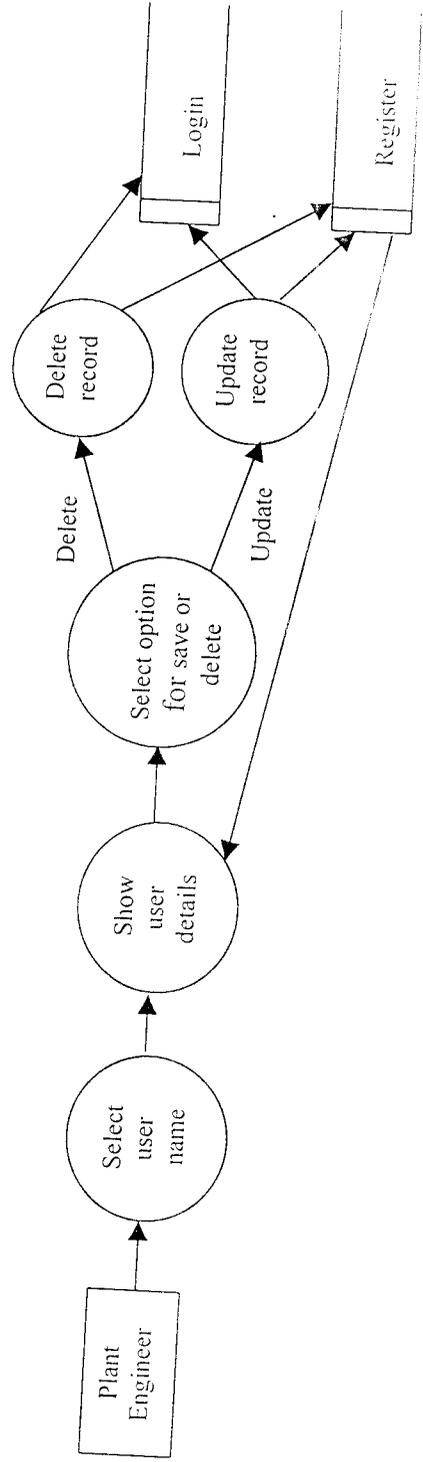
DataQuery for Electrical Engineers



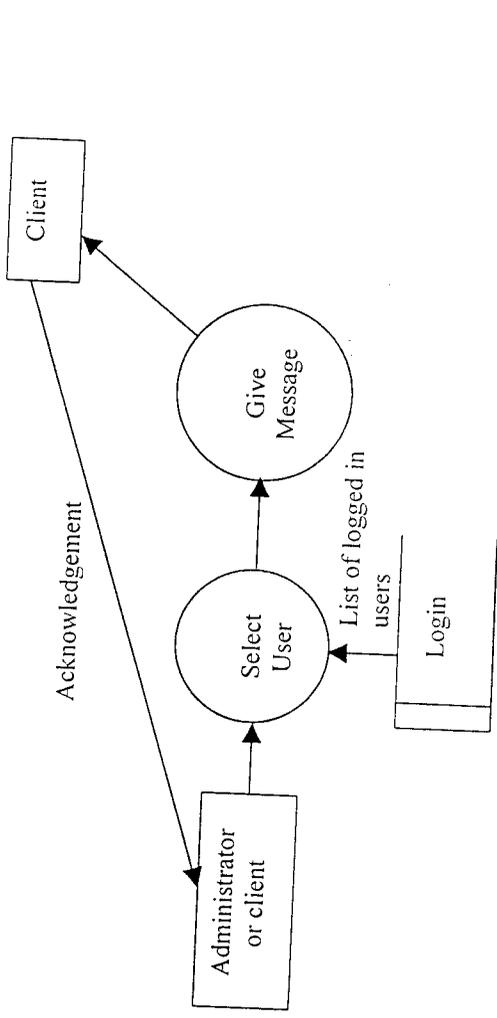
## Registration



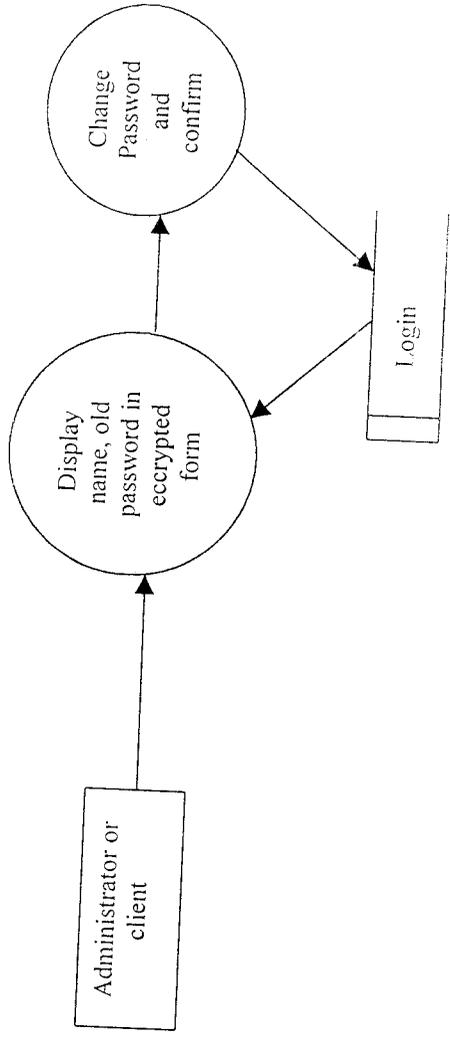
## View user



## Chatting



## Password change



## 4.2 INPUT DESIGN

Input design is the process of converting user-originated inputs to a computer-based format. It is the most important part of overall system design, which requires very careful attention. It is the link that ties the information system in to the world of its users. Input design consists of developing specification and procedures for data preparation. Often the collection of input data is the most expensive part of the system. Many errors may occur during this phase of the design, so to make the system study, the inputs given by the user is strictly validated before making a manipulation with it. Thus by validation it is possible to produce a cost effective method of input, achieve highest possible level of accuracy and ensure that input is acceptable to and understood by the user staff.

The goal of designing input data is to make data entry easy, logical and free from errors. When we approach input data design, we design the source documents that capture the data and then select the media used to enter them into the computer. It is concentrated on estimating what the inputs are and how often they are to be arranged on the input screen, how frequently the data are to be collected etc.

'Thermal Power Plant Monitoring System' is mainly concerned with monitoring the working of the machineries in the corresponding sections of the thermal plant. So the primary input data to the system include the parameter values expected from the plant. Here the parameter values are to be directly fed to the system. This is not attainable while the system is being developed. So the plant environment is to be simulated. This is achieved by developing a simulator module – a program that generates values and enters inputs to the tables for turbines, generators and transformers. It includes the parameters which have to be monitored. Thus the user is not concerned with entering any of the data necessary for the working of the system. The whole of this data is provided by the simulator module.

The users can enter the thermal plant monitoring system through signup option. This option is provided in the home page of the system. The administrator is prompted for the name and the password. The input from other users has an additional field for the section code.

**LOGIN FORM**

USER NAME	<input type="text" value="gigep"/>
PASSWORD	<input type="password" value="*****"/>
SECTION	<input type="text" value="Turbine"/>

On successful logging in, the user is provided with a list of options for data monitoring, viewing the graph, query, chatting and for changing the password. The administrator is provided with the additional options for adding, deleting and modifying user details. The user is allowed to select the option that he is interested in and the functioning of the software proceeds accordingly.

Every user is allowed to change his or her password through the change password form. The user is prompted for the old password and is asked to enter the new password. A confirmation is done by prompting the user to retype the password.

**CHANGE PASSWORD**

User Name	<input type="text" value="gigep"/>
Old Password	<input type="password" value="*****"/>
New Password	<input type="password" value="*****"/>
Confirm Password	<input type="password" value="*****"/>

The administrator has the authority to add new users on to the system. He has to enter the details of the new user, like his name, address, mail id etc. The employee id is automatically generated. A unique user name is also assigned during registration.

thermalplant12

**REGISTRATION FORM**

<b>Name</b>	Raeja Mathew	<b>Phone No.</b>	0484-234126
<b>Employee Id</b>	111	<b>Email id</b>	reejam@yahoo.com
<b>Sex</b>	Female	<b>Section</b>	Electrical
<b>Date of birth</b>	24-03-1967	<b>User Name</b>	reejam
<b>Address</b>	karimattom, Ruby Nagar, Chengamoor-12		

### 4.3 OUTPUT DESIGN

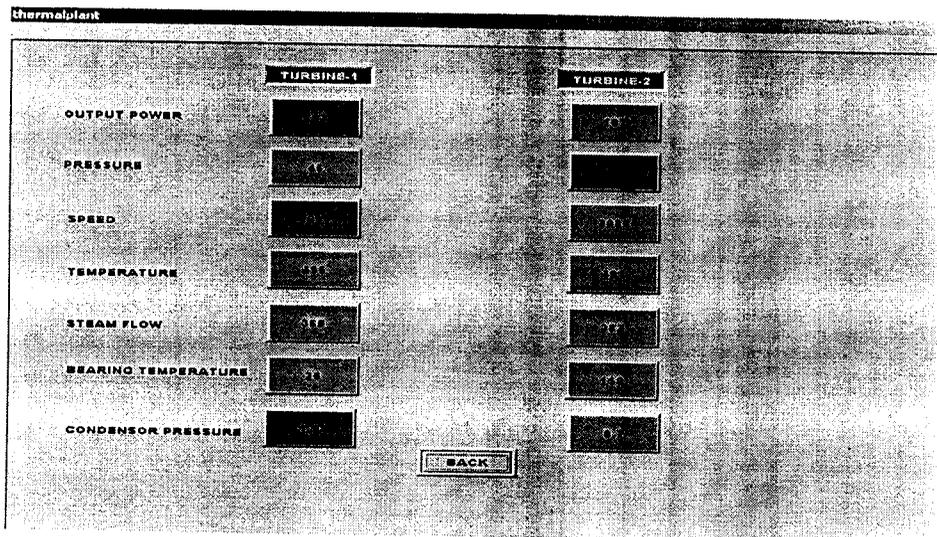
The outputs are mainly designed to communicate with the user, processing the input data. The output screens are designed in very simple and easily understandable format. The quality, urgency and frequency of output must be taken into consideration.

The output designing of the system was done in an efficient and user-friendly manner. The objective of the system is monitoring the performance of the different parts of the plant such as turbine, generator and transformer. These are to be viewed by the officials. The output is designed in three modes:

- 1) Data Display
- 2) Graphical Display
- 3) Data Query
- 4) View User

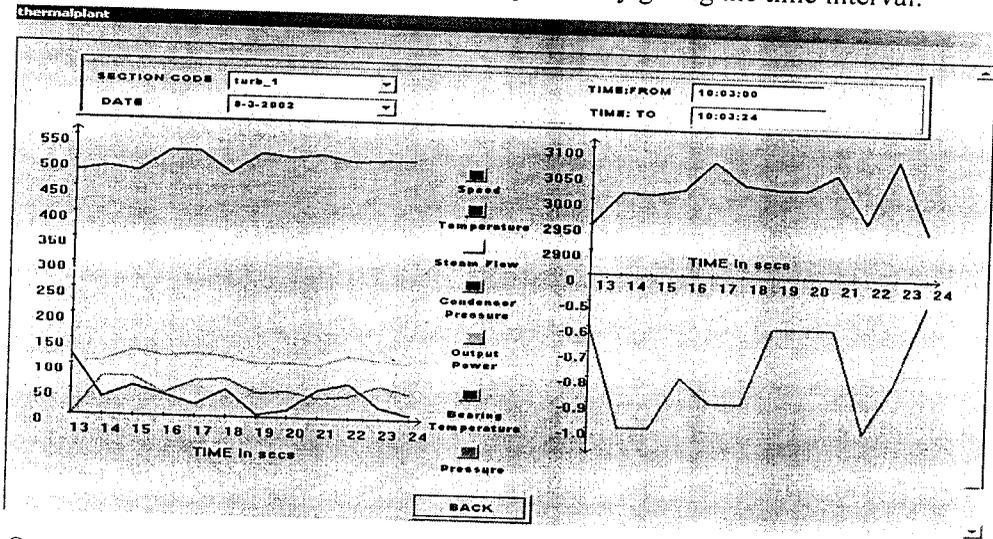
#### Data Display

In data display the user can view the current values of the parameters, which are displayed in different boxes. Each user is allowed to view the details of his corresponding section. But the administrator is allowed to view the details of all the sections.



## Graphical Display

Graphs can be plotted for any parameter measured. In graphical display the graph is plotted with time as x-axis and the values corresponding to the parameters as the y-axis. As the input values change, the graph is also modified to depict the current situation, that is the graph is constantly refreshed along with the data displayed which also keeps changing. It helps to compare the current values with the previous values. The graph corresponding to the previous data can also be plotted by giving the time interval.



## Data Query

Data query is used for retrieving data stored in the database. Here, the user can view the up-to-date values and these are displayed on the screen. The user can give a section code along with the date and time interval, and the data obtained within that time gap is displayed on to the screen.

Thermalplant

**TURBINE VIEW**

SECTION CODE:

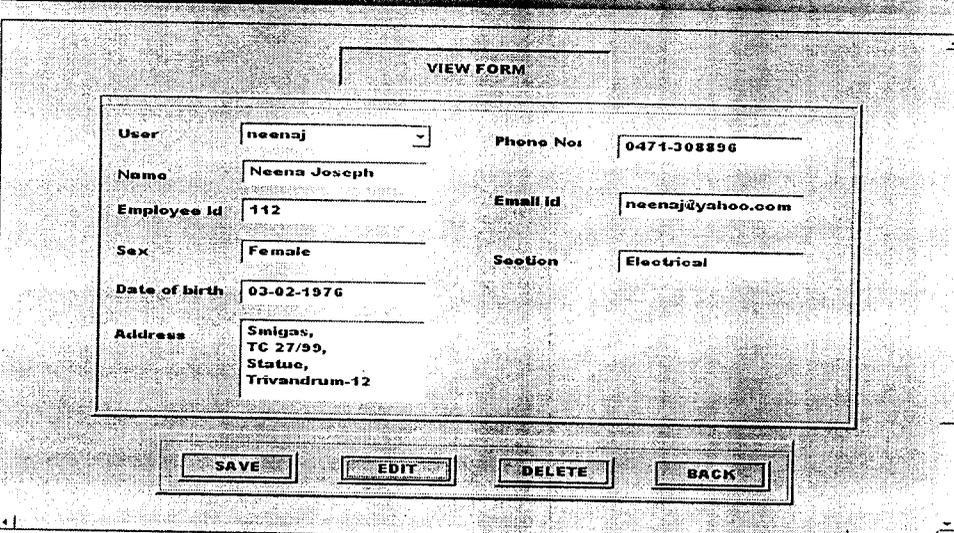
DATE:

Time	Output Power	Speed	Pressure	Temperature	Steam Flow	Bearing Temperature	Condenser Pressure
10:03:00	124	3078	69	486	352	11	0.6
10:03:01	106	2921	79	486	358	86	0.5
10:03:02	107	3009	59	519	295	83	0.7
10:03:03	111	3020	58	478	323	4	0.8
10:03:04	105	2913	36	491	363	92	1.0
10:03:05	122	3015	48	497	294	107	0.6
10:03:06	112	2982	64	494	301	113	1.0
10:03:07	128	3084	70	483	325	23	0.7
10:03:08	131	3067	79	479	305	21	1.0

RETURN      BACK

## View User

This option displays the details of a user. This accepts the user name as the input and after searching the database returns the details corresponding to that particular user. There are options available for modifying and deleting user details. Only the administrator is allowed to view this form and do the modifications.



The screenshot shows a web browser window titled "thermalplant12" containing a "VIEW FORM" window. The form displays the following user details:

User	neenaj	Phone No:	0471-308896
Name	Neena Joseph	Email Id	neenaj@yahoo.com
Employee Id	112	Section	Electrical
Sex	Female		
Date of birth	03-02-1976		
Address	Smigas, TC 27/99, Statue, Trivandrum-12		

At the bottom of the form, there are four buttons: SAVE, EDIT, DELETE, and BACK.

## 4.4 DATABASE DESIGN

A database is a collection of interrelated data stored with minimum redundancy to serve many users quickly and efficiently. The general objectives are to make the information access easy, inexpensive and flexible to user. In database design data independence, accuracy, privacy and security are given higher priority. While designing the database the redundancy should be reduced and it should be more consistent.

Database design is used to define and then specify the structure of objects within a system. It is an activity concerned with making major decisions, often of a structural nature. It shares with programming, a concern for abstracting information representation and processing sequences.

In Thermal power plant monitoring system, the tables designed are login, register, turbine, generator and transformer. The description of each of the table is given as follows:

### Login Table

Name	Type	Size	Description
UNAME	Varchar2	10	Name allotted to each Official
UPASS	Varchar2	10	Password of each official
SECTION	Varchar2	15	Name of section
CFLAG	Varchar2	3	Represents whether the user is logged in or not
SYSTEM_ID	Varchar2	15	Name of the computer

### Registration Table

Name	Type	Size	Description
ENAME	Varchar2	50	Name of the official
EID	Varchar2	4	Employee id
EMAIL_ID	Varchar2	50	Email-id of each official
DOB	Varchar2	10	Date of birth
SEX	Varchar2	6	Sex
ADDRESS	Varchar2	30	Address of each official
PHONE	Varchar2	12	Phone number
UNAME	Varchar2	10	Name allotted to each Official

### Turbine Table

<b>Name</b>	<b>Type</b>	<b>Size</b>	<b>Description</b>
TURB_CODE	Varchar2	10	Code of the turbine
TURB_DATE	Varchar2	10	The date at which values are generated
TURB_TIME	Varchar2	10	The time at which values are generated
TURB_OP_POWER	Varchar2	6	Output power of the turbine
TURB_PRESS	Varchar2	6	Pressure of the steam
TURB_TEMP	Varchar2	6	Steam temperature
TURB_SPEED	Varchar2	6	Speed of turbine
TURB_STEAM_FLOW	Varchar2	6	Quantity of steam flow
TURB_BEAR_TEMP	Varchar2	6	Bearing temperature
TURB_COND_VACUUM	Varchar2	6	Condenser vacuum pressure

### Generator Table

<b>Name</b>	<b>Type</b>	<b>Size</b>	<b>Description</b>
GEN_CODE	Varchar2	10	Code of the generator
GEN_DATE	Varchar2	10	The date at which values are generated
GEN_TIME	Varchar2	10	The time at which values are generated
GEN_OP_POWER	Varchar2	6	Output power of the generator
GEN_REACT_POWER	Varchar2	6	Reactive power of the generator
GEN_FREQUENCY	Varchar2	6	Frequency of rotator in generator
GEN_VOLTAGE	Varchar2	6	Voltage
GEN_CURRENT	Varchar2	6	Current
GEN_WIND_TEMP	Varchar2	6	Winding temperature
GEN_AIR_TEMP	Varchar2	6	Cooling air temperature

### Transformer Table

<b>Name</b>	<b>Type</b>	<b>Size</b>	<b>Description</b>
TRANS_CODE	Varchar2	10	Code of the transformer
TRANS_DATE	Varchar2	10	The date at which values are generated
TRANS_TIME	Varchar2	10	The time at which values are generated
TRANS_OP_POWER	Varchar2	6	Output power of the transformer
TRANS_WIND_TEMP	Varchar2	6	Winding temperature
TRANS_OIL_TEMP	Varchar2	6	Oil temperature

## 4.5 PROCESS DESIGN

The main process expected of the system is monitoring the parameters of different sections of the plant. There is no data input directly. All the necessary data is to come directly from the plant. This is at present facilitated through the simulator program.

In order to use the system, the user has to first log into the system with a valid user id, password and the section code. On logging in, the user is provided with services like monitoring the data, viewing details in the form of a graph, querying, chatting etc. The users are divided into different sections like Turbine, Generator, Transformer and Electrical. Each user is allowed to monitor and view the details of his section only.

When the data monitoring option is selected, the user is provided with a listing of parameter values corresponding to his section. The user is provided with a multi colored display depending upon the levels these values fall. The normal values are shown in green color. When the value reaches a specified limit, the color changes to yellow. The values are displayed in red color when the values cross the limit.

On selecting the view graph option, the user is provided with a space to input the section code, date and time limits. On submission, a graph corresponding to the values are plotted against varying time. Here the current as well as the previous values can be plotted by giving the appropriate date and time.

On the selection of data query option, the user is prompted to input the section code, date and time intervals. On opting to view the results, a list of parameter values corresponding to the details given is displayed. In the case of the Electrical section, a secondary option is provided to select from the Generator and Transformer section, and the results are displayed accordingly.

Chatting requires both the users concerned to have logged in. When the user is logged in, a flag is set so as to describe his availability. Any user can select the person to chat to from the list of users already logged in. Chatting can be done between peers and also between a user and the administrator.

The user is also given a provision to change his password. This option is also given in the main screen. The user is prompted to enter his existing password and the new password. A confirmation is also taken in from the user. The appropriate changes are made in the table to reflect the change.

The Administrator is the super user who has the authority to monitor and view all the plant values. In addition to that he is also authorized to create a new user, modify the details of an existing user and also to delete a user. When creating a new user, the details of the user like the name, address, email id, user name etc are entered. The employee id is generated automatically by the system. User name is set to be unique.

## **5. SYSTEM IMPLEMENTATION AND TESTING**

### **5.1 SYSTEM IMPLEMENTATION**

Implementation is the stage of the project where the theoretical design is turned in to a working system. If the implementation is not carefully planned and controlled it can cause chaos and confusion. Implementation includes all those activities that take place to convert from the old system to new one. The new system may be totally new, replacing an existing manual or automated system or it may be a major modification to an existing system. Proper implementation is essential to provide a reliable system to meet the organization requirements.

The process of putting the developed system in actual use is called system implementation. This includes all those activities that take place to convert from the old system to new system. The system can be implemented only after thorough testing is done and if it is found to be working according to specifications. The more complex the system being implemented, the more involved will be the system analysis and design effort required just for implementation.

The project “Thermal Power Plant Monitoring System” is to undergo the formal process of implementation in the same manner as every other system would undergo.

The implementation stage involves the following tasks:-

- Careful planning.
- Investigation of system and constraints.
- Design of methods to achieve the changeover.
- Training of the staff in the changeover phase.
- Evaluation of the changeover method.

The ‘Thermal Power Plant Monitoring System’ is a part of the overall plant automation project, of which other parts are under development. Full implementation of the project requires the successful completion of the other modules as well. Once successfully implemented, the system gathers the real time plant details directly from the site and fills in the database. The monitoring is done on these data stored.

The method of implementation and the time scale to be adopted are found out initially. Next the system is tested properly and the users are trained in the new procedures.

## 5.2 SYSTEM TESTING

System testing is the stage of implementation which is aimed at ensuring that the system works accurately and efficiently before the live operation begins. During the development of a software project, errors of various types can occur at any stage. At each phase, different techniques are used to detect the errors. The first major hurdle in the process of implementation is the period of testing the system. The debugging process is the most unpredictable part of testing procedure.

To make the system developed here to be reliable and accepted, various testing methods were used, the most basic of them being the 3 mentioned below.

- (a) Running the program to identify any errors (whether syntactic or semantic) that might have occurred while feeding the programs into the system.
- (b) Applying the screen formats to regular users to gauge the extent to which the screen was comprehensible to the user.
- (c) Presenting the format to the administration for the purpose of obtaining approval and checking if any modifications have to be done or whether the proposed system serves their purpose accurately.

Further testing methods were implemented to make the software developed here completely error-free and reliable. The types of tests conducted are described below followed by the testing strategies adopted.

### **Black Box Testing:**

Knowing the specified function that a product has been designed to perform, test can be conducted that each function is fully operational. Black box test are carried out to test that input to a function is properly accepted, and output is correctly produced. A black box test examines some aspects of a system with little regard for the internal logical structure of the software.

Errors in the following categories were found through Black box testing:

- Incorrect or missing functions.
- Interface errors.
- Errors in database structure or external database access.
- Performance error.

- Initialization and termination errors.

Each of the modules were exhaustively tested for code correctness and found to work in a perfect way.

### **White Box Testing**

White Box testing of software is predicted on a close examination of procedural detail. The status of the program may be tested at various points to determine whether the expected or asserted status corresponds to the actual status. Using this the following test cases can be derived.

- Exercise all logical conditions on their *true* and *false* sides.
- Execute all loops within their boundaries and their operational bounds.
- Exercise internal data structures to ensure their validity.

The overall functionality of the system was tested and found to meet the user requirements in a considerable manner.

The other testing methods used for testing the system are:

### **Unit Testing:**

This test focuses verification effort on the smallest unit of software design – the module. It is the set of tests performed by an individual programmer prior to the integration of the unit into a larger system. The unit testing is normally white box oriented and the step can be conducted in parallel for multiple modules. The tested modules must be assembled to form the complete software package. According to the test plan for this system, each and every module that comprises has been unit tested and the errors were eradicated.

Individual modules of the system were tested for functionality and each of the modules were found to perform the desired function.

### **Integration Testing**

Integration testing is a systematic technique for constructing the program structure at the same time conducting tests to uncover errors associated with interfacing. Unit tested modules were taken and a single program structure was built that has been dictated by design. Incremental integration was adopted here. The entire software was developed and tested in small segments, where errors were easy to locate and rectify. Program builds (group of modules) were constructed corresponding to the successful testing of user interaction, data manipulation and analysis.

After connecting all the sub-modules into the whole module, the connections between the modules are correctly established. The back-end and front-end are working as a whole module and the data entered in the front-end once submitted were entered successfully into the database. On request the data was retrieved successfully.

The overall system was tested after the integration of the independently developed modules and they were found to complement each other in an efficient way. The functionality expected of the whole system was found to be met.

## 6. CONCLUSION

The project work titled 'Thermal Power Plant Monitoring System' has been done successfully and this software is satisfying all the requirements specified. This system is meant exclusively for the officials of the thermal power plant so that they could make the energy production and distribution effective by monitoring the plant. This system generates regular and accurate outputs as per the requirements. In comparison with the manual system, the benefits of this computerized system were considerable in saving of manpower, working hours, effort, accuracy and the capability to obtain live data.

The system can be used to understand the variation of the values associated with the various units of the plant like turbine, generator and transformer. By using this system the engineers of the thermal power plant can view the varying parameters of their section. If any value goes above or below the critical level an alarm will be heard. This helps in providing live data to the authorities and helps in decision making without wastage of time. Since the values are displayed graphically, the comparative study between the parameters can be done easily.

The system is portable and flexible for further enhancement. Another advantage is that the system is accurate and fast compared to the existing system. Adequate security has been provided to prevent unauthorized use of the system. The system is also provided with user-friendly screens.

## **7. SCOPE FOR FUTURE DEVELOPMENT**

The scope for any future development refers to the modifications or improvements of the currently developed system. The enhancements may be required if there is any change in the requirements, user environment or priorities. To carry out these changes, the system may have to be re-evaluated, programs may have to be changed or modified and then tested for user acceptance. This process may have to be repeated until the system fully confirms to the requirements. This system is designed in such a way that addition of new modules can be done without much difficulty.

There are some additional facilities that can be added to this project:

- The system can be enhanced to provide controlling of the parameters.
- Other sections of the plant can be considered such as boiler, condenser etc. This will help to find out the values of parameters more accurate.

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2. System analysis and Design

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3. Visual C++ Programming Handbook

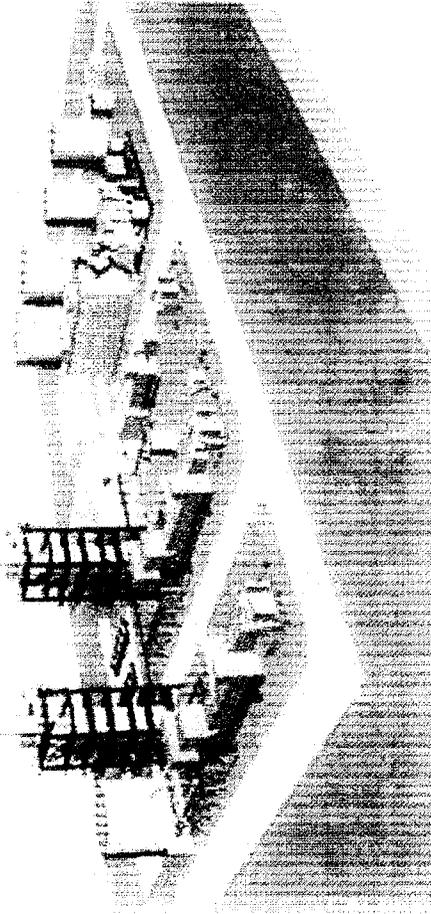
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4. Oracle - The Application Development Handbook

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thermalplant12

# Thermal Power Plant Monitoring System



SIGN IN

EXIT

LOGIN FORM

USER NAME	gigap
PASSWORD	*****
SECTION	Turbine

OK CANCEL

USERS FORM

DATA MONITORING

VIEW GRAPH

DATA QUERY

CHANGE PASSWORD

DISCUSSION ROOM

LOGOUT

OUTPUT POWER

PRESSURE

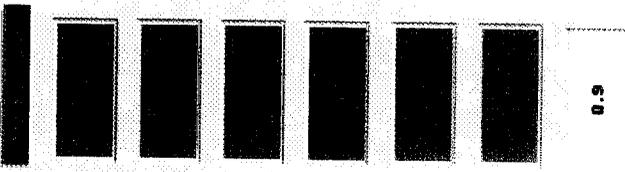
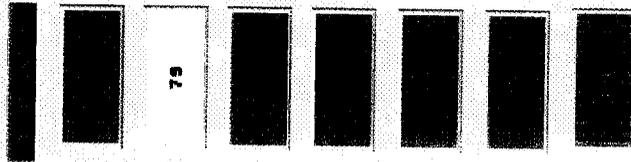
SPEED

TEMPERATURE

STEAM FLOW

BEARING TEMPERATURE

CONDENSOR PRESSURE



BACK

**GENERATOR-1**

**OUTPUT POWER**

**REACTIVE POWER**

**VOLTAGE**

**CURRENT**

**FREQUENCY**

**WINDING TEMPERATURE**

**AIR TEMPERATURE**

**GENERATOR-2**

9

47

**BACK**

TRANSFORMER -1



OUTPUT POWER



WINDING TEMPERATURE



OIL TEMPERATURE

TRANSFORMER -2



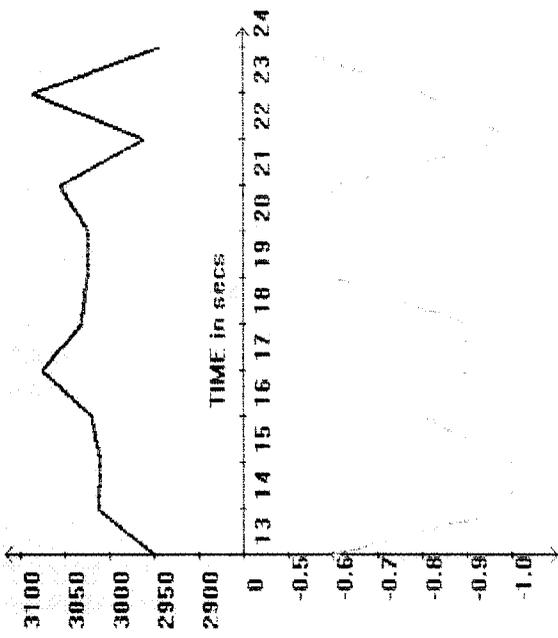
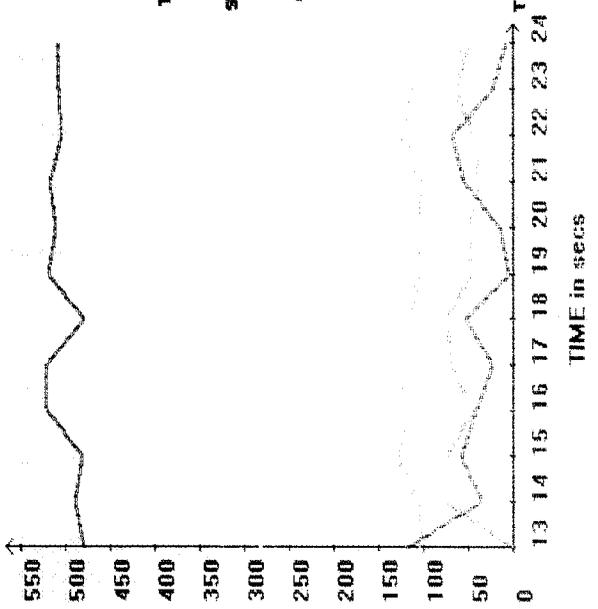
BACK

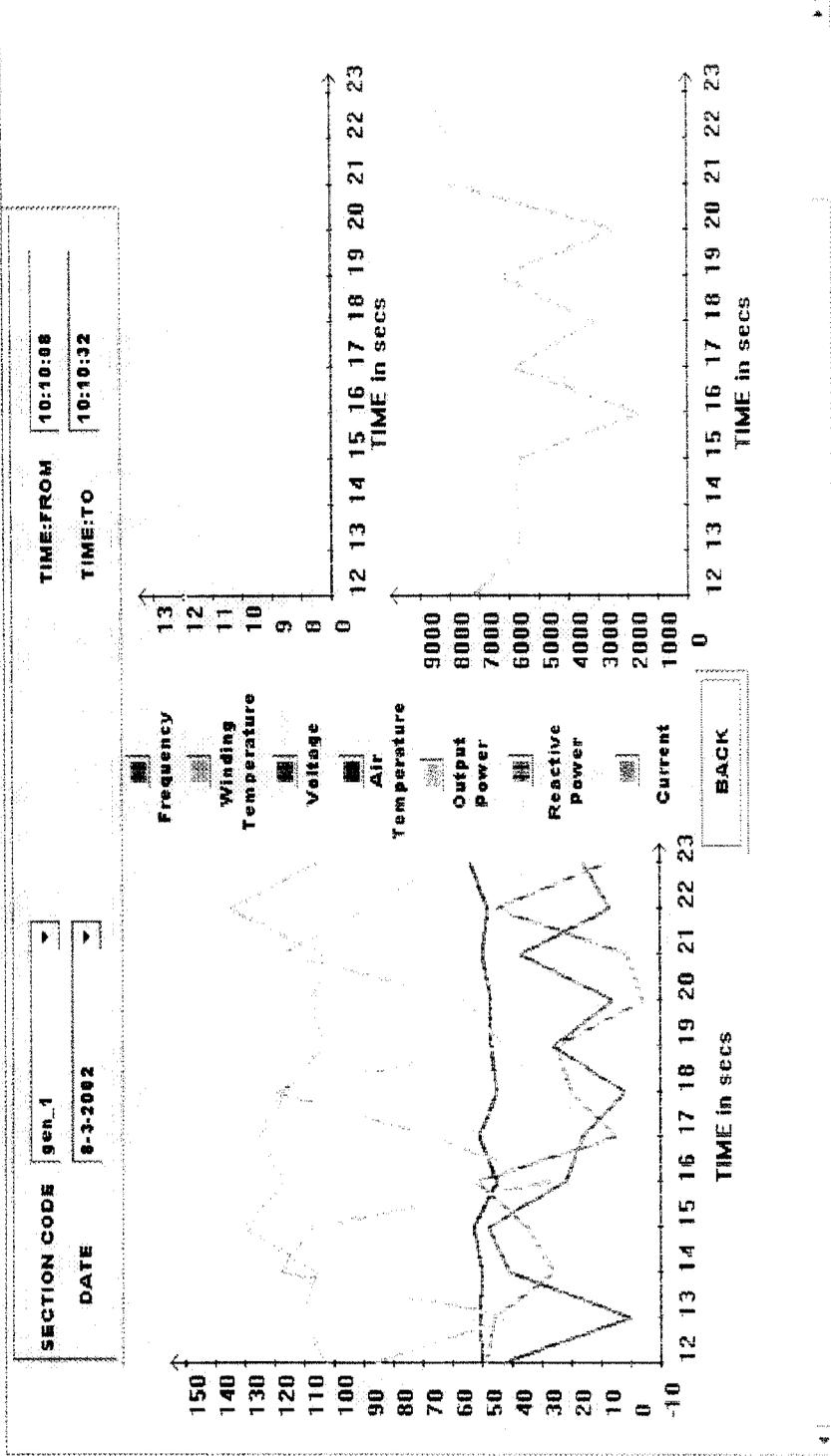
TRANSFORMER -3



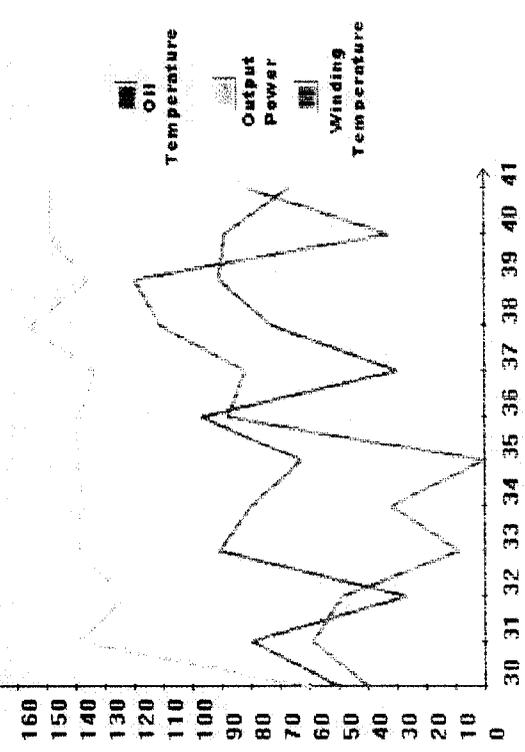
SECTION CODE    
DATE

TIME: FROM   
TIME: TO





SECTION CODE	tran_1	TIME:FROM	10:12:30
DATE	8-3-2002	TIME:TO	10:12:41



BACK

TURBINE QUERY

SELECT CODE	turb_1
DATE	4-3-2002
TIME:FROM	10:03:00
TIME:TO	10:03:14

VIEW

BACK

TURBINE VIEW

SECTION CODE turb\_1

DATE 4-3-2002

Time	Output Power	Speed	Pressure	Temperature	Steam Flow	Bearing Temperature	Condensor Pressure
10:03:00	154	3078	59	491	362	14	0.5
10:03:01	106	2921	79	486	358	86	0.5
10:03:02	107	3009	59	519	295	4	0.7
10:03:03	111	3020	58	478	323	83	0.8
10:03:04	105	2913	36	491	363	92	1.0
10:03:05	122	3015	48	497	294	107	0.6
10:03:06	112	2982	44	494	301	113	1.0
10:03:07	128	3084	70	483	325	23	0.7
10:03:08	131	3067	79	479	305	21	1.0

RETURN

BACK

**GENERATOR QUERY**

<b>SELECT CODE</b>	gen_1
<b>DATE</b>	11-3-2002
<b>TIME:FROM</b>	10:10:12
<b>TIME:TO</b>	10:10:24

**VIEW**

**BACK**

GENERATOR VIEW

SECTION CODE

gen\_1

DATE

11-3-2002

Time	Output Power	Reactive power	Voltage	Current	Frequency	Winding Temperature	Air Temperature
10:10:12	119	28	11	6052	53	24	22
10:10:13	137	33	13	6926	46	114	33
10:10:14	109	33	12	4428	52	56	40
10:10:15	107	25	8	1604	49	75	5
10:10:16	110	59	9	2480	48	67	19
10:10:17	135	45	8	8034	48	89	7
10:10:18	106	8	12	8515	54	63	16
10:10:19	133	25	8	4894	48	7	9
10:10:20	134	35	12	1506	53	101	48
10:10:21	174	77	8	7877	46	87	22

RETURN

BACK

**TRANSFORMER QUERY**

<b>SELECT CODE</b>	<input type="text" value="tran_1"/>
<b>DATE</b>	<input type="text" value="11-3-2002"/>
<b>TIME FROM</b>	<input type="text" value="10:12:12"/>
<b>TIME TO</b>	<input type="text" value="10:12:24"/>

**VIEW**

**BACK**

TRANSFORMER VIEW

SECTION CODE tran\_1

DATE 11-3-2002

Time	Output Power	Winding Temperature	Oil Temperature
10:12:12	125	46	55
10:12:13	137	39	20
10:12:14	144	58	34
10:12:15	132	61	36
10:12:16	132	8	49
10:12:17	157	89	74
10:12:18	151	2	77
10:12:19	125	64	72
10:12:23	146	15	3
10:12:27	154	42	44

RETURN

BACK

ELECTRICAL SECTION

Generator

Transformer

SECTION CODE

gen\_1

DATE

8-3-2002

TIME FROM

10:10:08

TIME TO

10:10:32

VIEW

BACK

**CHANGE PASSWORD**

<b>User Name</b>	<input type="text" value="gigasp"/>
<b>Old Password</b>	<input type="password" value="****"/>
<b>New Password</b>	<input type="password" value="*****"/>
<b>Confirm Password</b>	<input type="password" value="*****"/>

**SAVE**

**BACK HOME**

CHAT

Select User

administrator

Enter Message

No,it is working properly.

Reply

Is the speed of turbine crossing the limit?

SEND

BACK



ADMINISTRATIVE FORM

REGISTER NEW USERS

VIEW USERS

DATA MONITORING

VIEW GRAPH

DATA QUERY

CHANGE PASSWORD

DISCUSSION ROOM

LOGOUT

REGISTRATION FORM

Name	Reeja Mathew	Phone No:	0481-234126
Employee id	111	Email id	reejam@yahoo.com
Sex	Female	Section	Electrical
Date of birth	24-03-1967	User Name	reejam
Address	karimattom, Ruby Nagar, Chenganoor-12		

SAVE

BACK

VIEW FORM

User	neenaj	Phone No:	0471-308896
Name	Neena Joseph	Email id	neenaj@yahoo.com
Employee id	112	Section	Electrical
Sex	Female		
Date of birth	03-02-1976		
Address	Smigas, TC 27/99, Stature, Trivandrum-12		

SAVE

EDIT

DELETE

BACK

CHAT

Select User

gigap



Is the speed of turbine crossing the limit?

Enter Message

No, it is working properly.

Reply

SEND

ALL

BACK