COMPUTERISED APPROACH TO THE OPERATIONAL CONTROL
OF ELECTRIC POWER SYSTEM
(A case study of SCADA system for shiroro
132KV Area Control Centre)


BY


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MARCH, 1998

## CERTIFICATION

I hereby declare that this project has been written by me and that it is a record of my work it has not been submitted before for the award of Postgraduate Diploma in Computer Science at any level.

_____          _____
DR. Y. M. AIYESIMI                              DATE
   SUPERVISOR


_____          _____
DR. K. R. ADEBOYE                              DATE
HEAD OF DEPARMTMENT


_____          _____
EXTERNAL EXAMINER                              DATE

## DEDICATION.

This project is dedicated to my Mother Mallama **FATIMA ABDULLAHI.**

## ACKNOWLEDGEMENT

I indeed express my gratitude to God for sparing my life, provide all resources and successfully sailed me through to the end of this course.

I equally express my sincere appreciation to my Supervisor DR. Y.M. AIYESIMI for all his assistance in the course of this work. I as well convey my gratitude to the Head of Department DR. K. R. ADEBOYE for his contributions in one way or the other throughout the programme.

Others whose contributions I shall acknowledge too are all my lect urers in the department.

At my place of work are my boss (1) The Asst. General Manager (Gen), Shiroro Engr. E. A. Adeleye (FNSE) (2) The Principal Manager (Gen) Mr. G. A. Adeboye (3) Principal Manager (Elect) Engr. A. G. Raji.

Among my colleagues and friend are Patrick Osutuk, S.A. Shagwa, Idris Mohammed and Segun Akinola.

I thank you all.

## ABSTRACT

The project work gives a description of what a supervisory Control and Data Acquisition (SCADA) system in NEPA is and a more improved performance of the system (SCADA) in respect of Shiroro 132KV Area control centre (ACC) hitherto taken as case study.

SCADA, a method which enables the acquisition of information in real time for monitoring and control of the state of National Electricity Grid.

This role of the SCADA is soly achieved with the functions of its basic components, special computers for example, in areas of data acquisition, storage and retrieval, quick access telecommunication and data security all aimed at system stability and operational efficiency.

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## TABLE  PAGE

# CHAPTER ONE.

## 1.0    INTRODUCTION.

The National Electric Power Authority is Federal Government Parastatal charged with the reponsibility of maintaning an efficient, cordinated and economic system of electricity supply to all nooks and corners of the nation.

## 1.1    ESTABLISHMENT OF NEPA.

The National Electric Power Authority (NEPA) was established on the 6th January 1973 as a merger of Electricity Corperation of Nigeria (ECN) and Niger Dams Authority (NDA) under the decree No. 24 of 29th June 1972 of the Federal Military government.

The sources of power generation in Nigeria dated back to early 50s. This can be called first generation Era (ECN Days 1950 – 1972) The second generation Era which is NEPA Era (January 6th 1973 – to date).

### a)    FIRST GENERATION – ECN ERA (1950 – 1972).

Electricity development in Nigeria started with the installation of a small generator to serve the colonial masters dated back to 1898 in the city of Lagos.

Various generating sets were later installed in different towns as the imperial rule spread across the country. These plants were maintained by the individual undertakings set up by the colonial District offices. Later on Public Work Departments (PWD) and the Native Authoritys (NA) took over the running of these plants.

However in 1950, the then colonial Government integrated all these isolated power stations previously under the Electricity undertaking sections of the PWD under a new statutory body called Electricity Corporation of Nigeria. (ECN).

Government ordinance No 15 of 1950 therefore created 'ECN', ECN since then was charged with generation, transmission, distribution and sales of electricity in Nigeria.

b)      **SECOND GENERATION (JANUARY tTH 1973) NEPA ERA.**

The second generation was born with the fusion of the ECN with the Niger Dams Authority in September, 1973.  The Niger Dams Authority was established by act on Act of Parliament in 1962 for the construction and maintenance of dams on River Niger.  That is:

i)      Generating electricity by means of water (Hydro);

ii)     Improving Navigation on the Niger River and

iii)    Developing fisheries and irrigation on River Niger.

The second generation therefore gave birth to NEPA under the above mentioned decree of 1973 and its corporate objective remain the development and maintenance of an efficient power generation, transmission and distribution for all parts of the federation.

1.2.    **DEVELOPMENT AND GROWTH OF NEPA.**

The development and growth of NEPA after these Era were characterised by the growth of industries and rapid urbanisation which resulted into fast rising demand for electricity above the supply.

In order to meet this increasing demand for electricity a need to expand the power stations namely:

i)      Ijora Power Station

ii)     Delta Power Station

iii)    Afam Thermal

iv)     Kainji Hydro.

The total installed capacity of these power stations was serving about one million customers nation - wide.  That propelled the nation's technological and industrial take-off.

Other power stations were development of one after another which progressively add up to the nation's power (load) supply.  Other power stations that came on steam afterwards are as follows:

1)      Jebba Hydro                    = 1980 - 1984

2)      Lagos thermal                  ≈ 1980 - 1987

3)      Shiroro Hydro                  = 1978 - 1990

4)      Delta IV thermal               = 1988 - 1991

5)      Sapele thermal                 = 1976 - 1985

These stations could be classified into two main groups with regard to the source by which NEPA generates electricity.

1)      Hydro Generation - Kainji, Jebba, Shiroro

2)      Thermal Generation - Egbin, Sapele, Delta
                            Ijora, Afam and Oji.

A broader features of the power station is further enumerated below.

A broacher features of the power station is further enumerated below.

| No. | Commissioned period | Power station | Installed capacity | No of units | operation |
|-----|------|------|------|------|------|
| 1. | Ijora | Ijoro P.S. Lagos | 66.7MW | 3 | Gas |
| 2. | Oji | Oji River P. S. | 30 " | 4 | Coal |
| 3. | Afam | Afam T. P. O. | 700.9" | 18 | Gas |
| 4. | Kainji | Kainji H. P. S. | 760 " | 8 | Water |
| 5. | 1976 - 1985 | Sapele T. P. S. | 1020 " | 10 | Steam |
| 6. | Jebba | Jebba H. P.S. | 540 " | 6 | Water |
| 7. | Lagos | Egbin T. P.S. | 1320 " | 6 | Gas |
| 8. | Shiroro | Shiroro H. P. S. | 600 " | 4 | Water |
| 9. | Delta IV | Delta T. P. S. | 600 " | 6 | Gas |

The total installed capacity of these power station add up to approxmately 6000MW as at 1996 compared to 1972 with 540MW.

The system planning studies of the Authority has on its drawing board other proposed power projects beyond year 2000. Feasibility studies have been completed on some of the proposed projects. Examples:-

a) Zungeru Hydro — 1000MW

b) Makurdi Hydro — 1100MW

c) Onitsha thermal — 1200MW

d) Ikom Hydro — 700MW

b)      **TRANSMISSION VOLTAGE SYSTEM.**

Transmission hereby means transporting electricity from the generating stations to the load centres for distribution.

NEPA operates 3 main voltage levels in transmission namely:-

i)      66 Kilovolt (KV)

ii)     132      "       "

iii)    330      "       "

132KV and 66KV transmission voltage levels were common during the ECN days and 132KV was the highest transmission voltage level before 1972. The 66KV voltage level has been discontinssed. However with increase in demand and the need for long distance transmission of power, the the super grid system was introduced which requires operation at 330KV.

When NEPA was eventually formed in 1973, the need to transmit power from power stations, e.g. Kainji to major towns and cities like Lagos, Kaduna etc and to link other remote power stations to receive high voltage transmission at 330KV became necessary.

This necessitated the construction of Kainji — Jebba — Oshogbo — Lagos towards south and Jebba — Kaduna Kano — Jos up to Gombe northwards at 330KV transmission voltage levels.

In order to take care of other cities whose distances are not too high from each other, voltage levels of 132KV is used. Example of this is 132KV from Shiroro complex — Minna —Suleija — Abuja — Keffi — Akwanga. Another 132KV from Shiroro — Tegina — Pandogar —B/Gwari.

Today Nigerian transmission network system can be put at

i)       330KV lines (1996), 5000KM across the country as compared to to 1972 with 1,200KM.

ii)     132KV lines 6,000KM area coverage 1976 with 1000KM in 1972.

In the present day of commercialised NEPA, the new plan for power transmission explansion, just as was said for power generation, include the following lines (1990 - 2000)

i)       330Kilovolt lines

      a)      2nd Benin - Onitsha (Single circuit)

      b)      Eungu - Makurdi - Jos (Single circuit)

      c)      Shiroro - Abuja (Double cricuit) etc.

ii)     132KV lines

      a)      Aiyetoro - papa lanto (Single circuit)

      b)      Akure - Adekiti       "      "

      c)      Okene - Kabba - Isanlu   "     " etc.

c)      **NEPA DISTRIBUTION SYSTEM.**

NEPA distributes its electricity power at voltage levels of 415V, 11KV and 33KV.

The 415V lines are used mainly for residentail/domestic power supply.

The 11KV lines are used inmeduim size industrial setups and also for city distribution systems before the power is step down to 415V for residential houses 33KV lines are used for large industrial setups and for distribution of power supply to towns which are 100KM and below from injection substations.

As of the end of 1996, Nigeria has a total of 56,000 kilometres of 415v distribution lines.

The distribution systems continue to increase day in day out as new local government headquerters are connected to NEPA systems,

Formerly all remote towns were connected to REB but are now being connected to NEPA systems. These connections continue to increase the length of the 415V, 11KV and 33KV distribution lines.

**1.3**    **SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA) SYSTEM IN NEPA.**

**a)**    **INTRODUCTION.**

The purpose of a Supervisory Control and Data Acquisition (SCADA system) is to gather information about the status of the switch gear, the (alarm) condition of the equipment and the loading of circuits, transformers and generators at various widely separated stations of the Authority. Transfering this information to the National Control Centre NCC and display it  for the system operator.

Facility for the control centre to actually control switch gear or transformer tap changer at the remote substation or power station may also be provided.
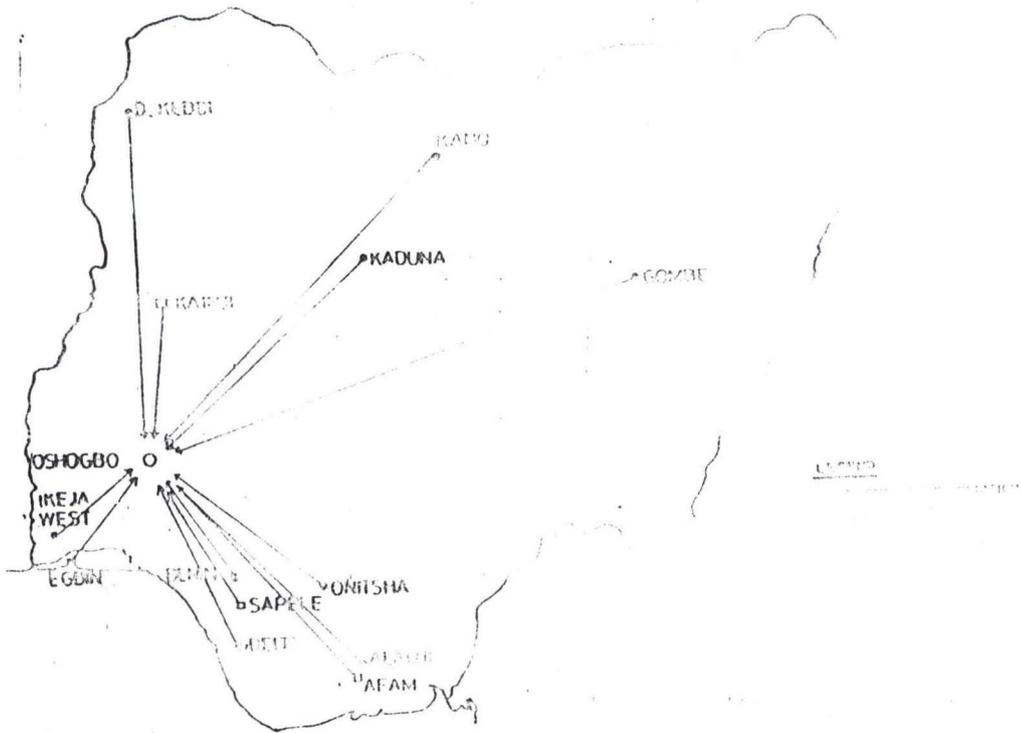
FIGURE 1

The diagram in figure 1 illustrates the widely geographical coverage of NEPA's

NCC SCADA.

About 22 substations (transmission) and generation station are incorporated

into the system.

Stations elisted in the diagram above examples of the scope of coverage of the

SCADA system. It can be seen that the system has widely has widely spread to every

part of authority's network around the country.

INPUT
INFORMATION
ABOUT
SWITCHGENT
STATUS
METERING
ALARM

SCADA REMOT
TERMINAL UNIT.

PLC TRANSMITTER
TERMINALS AT
DIFFERENT SUBSTATION
AND POWER STATION.

PLC RECEIVER
TERMINAL
AT NCC

SUBSTATION
AND
POWER STATION

NCC
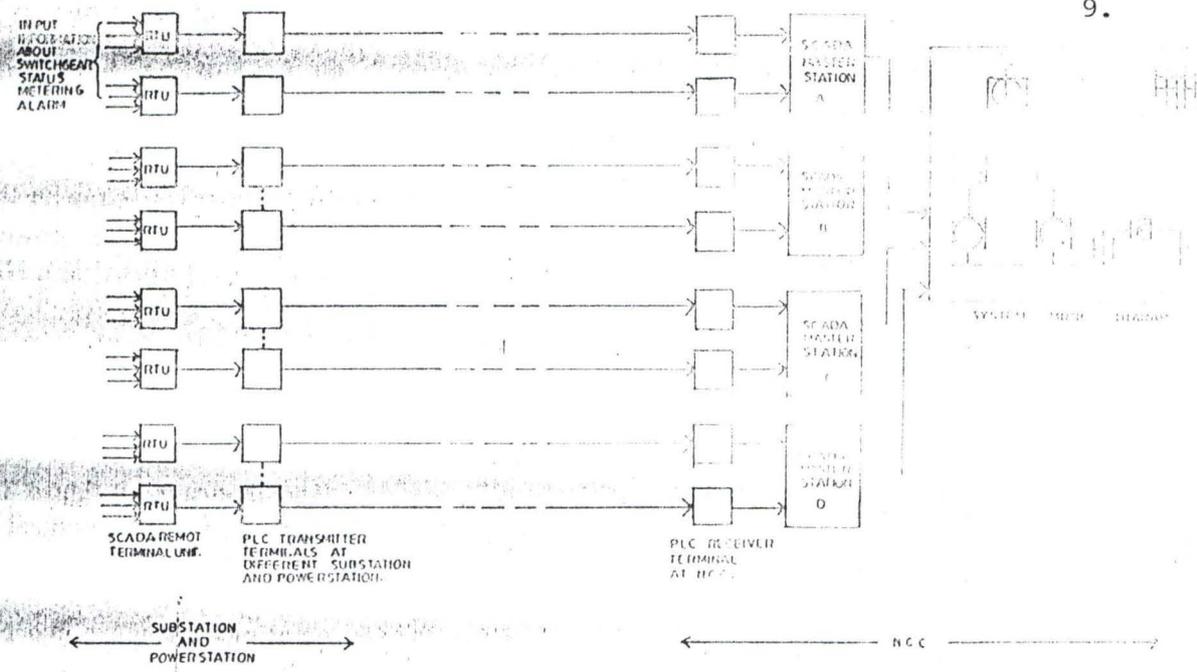
FIG - 2   SCADA SYSTEM   ASIC   LAYOUT

i)        **Remote Terminal Unit (RTU).**

RTU is a device into which information from or about, the monitored

equipment and switch gear at the substation or power station is fed and

processed information is transmitted further to the control centre in a sequence

which will permit recognition and proper addressing when it arrives at it.

ii)       **Telecommunication link.**

This is a transmission device over which the processed information is

carried to the control centre.  The telecommunication links used in the existing

NEPA's SCADA are power line carrier (PLC) channels.  Others like Radio, optic

fibre, etc could also be used.

iii)      **Master station.**

A master station is located at the control centre, which received

the sequence of processed information from the RTU.  It extracts the original

information and associates it with a representation (Mimic) of the original

equipment switch gear or meter.  Usually one master station receives information

from a group of RTU's.

iv)       **Display Unit.**

A display unit which may be a ward wired minic diagram display board

e.g Video display unit (VDU) is located of the control centre.  Information

received are displayed on it for the operator to see and hear.

v)        **Vedio display unit (VDO).**

The modern method of recapturing the status of the SCADA network

is the video display unit.

This method is computer based and offers compact display of the national

grid and flexible operation.  The information received by the master station

is processed by special computer system unit and present visually on the computer

monitor.

**1.4     INTRODUCTION AND OBJECTIVE OF SCADA SYSTEM FOR SHIRORO 132KV AREA CONTROL CENTRE (ACC).**

The Shiroro ACC SCADA system installed and commissioned by SIEMENS-AG in 1991 is fully computerized and first of its kind to be procured by NEPA. The SCADA concept is based on the effective control of several substations (in this case 132KV) which are coupled together by a network the tasks and functions of which are executed by computers at the master station - Shiroro.

The objective of the SCADA include the following:-

i)      Stations Data Acquisition.

ii)     Handling of momentary processes such as alarms and indications.

iii)    Processing variables and display.

iv)     Boundary conditions.

v)      Monitoring of Remote Terminal Units (RTU).

vi)     Archivering functions.

vii)    Dialogue for emergency operations etc.

**1.5     ORGANISATION AND METHODOLOGY OF SHIRORO ACC 132KV SCADA SYSTEM.**

The operational functions for the effective control of shiroro, Minna, Bida, Suleja, Abuja and fire other outstanding 132KV substations are distributed as follows:-

a)      **The Master STations.**

The Master station based in Shiroro is the heart of the SCADA system. This is called SNAUT 8 FW 1024 FWA parel comprises of all the electronics that handles the following:

- Telecontrol messages to RTU

- The mimic board displays

- The alarms

- Telecontrol interface (TCI)

b)      **Computer Discription.**

The scada computers are all SNAUT PC 32 and they are IBM compartable. The SNAUT PCs are all DOS operating system. (MS – DOS version 5.0). All the computers are equiped with the following features.

    a)      70 MB Hard Disk

    b)      4 MB main memory

    c)      20 MHZ central processing unit CPU

    d)      60 MB magnetic tape streamer

    e)      20 rich coloured monitor

    f)      A clock card

    g)      Key board and mouse

    h)      3 nos printers.

c)      **The Remote Terminal Unit.**

The remote terminal unit or RTU for short comprizes of the following

1)      SNAUT – 8 FW64 as the main electronic

2)      VFT 2000 as the voice frequency telegraphic card

3)      24 volts interposing relays for the required input output signals.

4)      Catlings to switch equipment.

Every station has an individual RTU that communicates with the master station.

d)      **The Communication Equipment.**

The vital communication  link is provided by the ESB 500 Plc equipment. This is an equipment installed roly in the master slation – shiroro.

e)      **The on time computer level 1.**

    i)      The on line computer is connected to the telecontrol inter-
            face (TCI) over a telecommunication line (in this case a PLC)
            monitors and controls all the remote stations via RTUs.

ii)   **On line computer level 2.**

This monitors level 1 and also acts as a standby computer in  case of any failure of 1.  It takes over the operations automatically via a tokenning network.

iii)   **Dialogue computers.**

There are 2 nos dialogue computers whose function are mainly for new entries and system overviewing and functions outside the network.

f)   **The power supply unit.**

The SIEMENS unintermptable power supply unit UPS type - 105 provides the 5KVA power supply equipment for the system.

g)   i)   **The main menu.**

The main menu displays in summary. all the functions the computer can carry out upon pressing the function keys.  The computer takes the operation to the corresponding events.

ii)   **The submenu.**

For each function of the main menu, these are  corresponding menu peculiar to that functions.

## CHAPTER TWO.

### 2.0.   LITERATURE REVIEW.

The scada system is employed world wide in supervision and control of Transportation, industrial processes, oil and gas, electricity industries inclusive.

In NEPA system, SCADA installations could be found in Area (132KV) and National control centre (330KV).

All SCADA systems are presently computer based i.e all SCADA operations are carried out via computer work stations or servers. Recent development in SCADA technology include EMS or Energy management system, ECANSE expert system etc.

The application of the SCADA system brought changes for flexibility in the operating network of the Authority. There are both human and technical problems associated with the existing system performance.

Such areas as manual operation of electrical devices or switch gear, data archieves and security etc. Human problem such as maintenance and repairs works associated with planned and forced outages, operational messages with communication links to substation are identified.

The SCADA system computer software are developed for management of a wise range of operational data through the work station computers at the master station. By this therefore the status guo of all substations is obtained at a glimpse.

The operational software is simply MS DOS version 3.0 and later updated to version 5.0. The SINAUT is application software.

# CHAPTER THREE.

## SYSTEM ANALYSIS AND DESIGN.

### 3.1 PROBLEM DEFINITION.

It is a process which involves determining the nature and scope of problem upon which new changes are intended. That is, when a problem exist or newly discovered in a particular system which requires removal or redress upon innovation for improved performance, the need to clearly define this motive therefore arises.

Problem definition allows for re-evaluation of the existing problem in the old system which could be real or imaginary, major or minor, capital intensive or not etc, and how effeciently the problem will be alleviated.

Consedering the Shiroro 132KV Area control centre, the associated problems with manual (popularly called local) power operational proceedures have earlier been identified, studied before the recommondation for the introduction of SCADA system. Some of these associated problems are enumerated in the next page.

### SYSTEM ANALYSIS.

In the analysis of a system, full details of the problems associated with the existing system, its weakness and strength is investigated and obtained in the preliminaries. Equally therefore, full details of the current system (new intended system) including its proceedures, information flow, method of working, organisation and control are all worked out.

Upon this analysis, NEPA management become informed of the idea of introducing SCADA system for Shiroro ACC in seing to the improvement of operational and data acquisition method within these substations.

This brings us to the next state:

3.2 **Feasibility Studies:** Is the feasibility analysis of the preliminary investigations embacked upon to determine the potentials or the diserability of the proposed system SCAFA to in offering adequate solutions to the old system having identified its associated problems.

However some of the advantages in the old system are equally identified and incorporated inot the new system.

Below are some of the identified associated problems of the existing system within the substations.

1)      Mal. Operation:- Resulting from faulse commands. These are faulty command sgnals. Situations where breaker indicator show's green' for open but yet closed. The SCADA has facilities for displaying the current situation indicater of equipment on the mimic boards at the master station, Shiroro control room.

2)      The new system has facilities for accurate recording of events and associated data required promptly. This improves the existing manual practice of calling for data far ahead of events period resulting into discrepancies in actual time of say disturbance between two substations.

3)      Posses high level data storage capacity and data bank. Of course, the old system is that all operational information and data acquision are hand written resulting into stock of voluminous document. Quick access or reference to a particular data because a constraint. Man hour loss in so doing becomes considerable.

4)      The new system possesses that high capability to cope with and process large data within a given time. This allows for prompt and accurate availability of printout (outputs) for management analysis.

In the old system, operators have stay behind a given working period to make out for the report of given operations say tripping repot. These are sometimes not available in the next few hours before the daily brardcast which is a printout of the network equipment situation repot.

## 3.3.    SYSTEM DESIGN.

The next step in this proceedure is the designing of the new (intended) system.  However this follows only after the approval and as will as the recommend of the analyst.

Designing application package for a computer require that a festidous care be taken in establishing the specifications for both data to be processed by the computer and the programme that is to instruct the computer for that task.

Once an alternative has been selected, the purpose will be to work from requirement specifications to produce a system specification.  This will include detailed set of imput documents, forms, report layouts etc which provides details features of the  system.

# SYSTEM STRUCTURE

```
                              ┌──────────────────┐
                              │   ACC            │
                              │   SUBSTATIONS.   │
                              └──────────────────┘
```

| SHIRORO | MINNA | BIDA | SULEJA | ABUJA | K/GORA | TEGINA | B/GWARI | YELWA | AKWANGA | KEFFI |

```
        ┌─────────────────────┐     ┌──────────────┐        ┌─────────────────────┐
        │   SUBSTATIONS        │     │  SUBSTATION  │        │   SUBSTATIONS        │
        │   COMMISSIONED       │     │  NOT         │        │   UNDERCONSTRUCTION. │
        └─────────────────────┘     │  COMMISSIONED│        └─────────────────────┘
                                    └──────────────┘
```

```
    ┌──────────┐     ┌──────────┐
    │  ALARM   │     │  DIAG.   │
    │ ANALYSIS │     │ STATION  │
    └──────────┘     └──────────┘
                          │
                     ┌──────────┐
                     │  ALARM   │
                     │  LIST    │
                     └──────────┘
                       │      │
             ┌──────────┐   ┌──────────┐
             │ STATION  │   │ FEEDER   │
             │ ALARM    │   │ ALARM    │
             └──────────┘   └──────────┘

                ┌─────────────┐
                │ ERROR LIST  │
                └─────────────┘
                 │           │
       ┌──────────┐      ┌──────────┐
       │  FROM    │      │  FROM    │
       │ SUBSTATION│     │ F.W.A.   │
       └──────────┘      └──────────┘
```
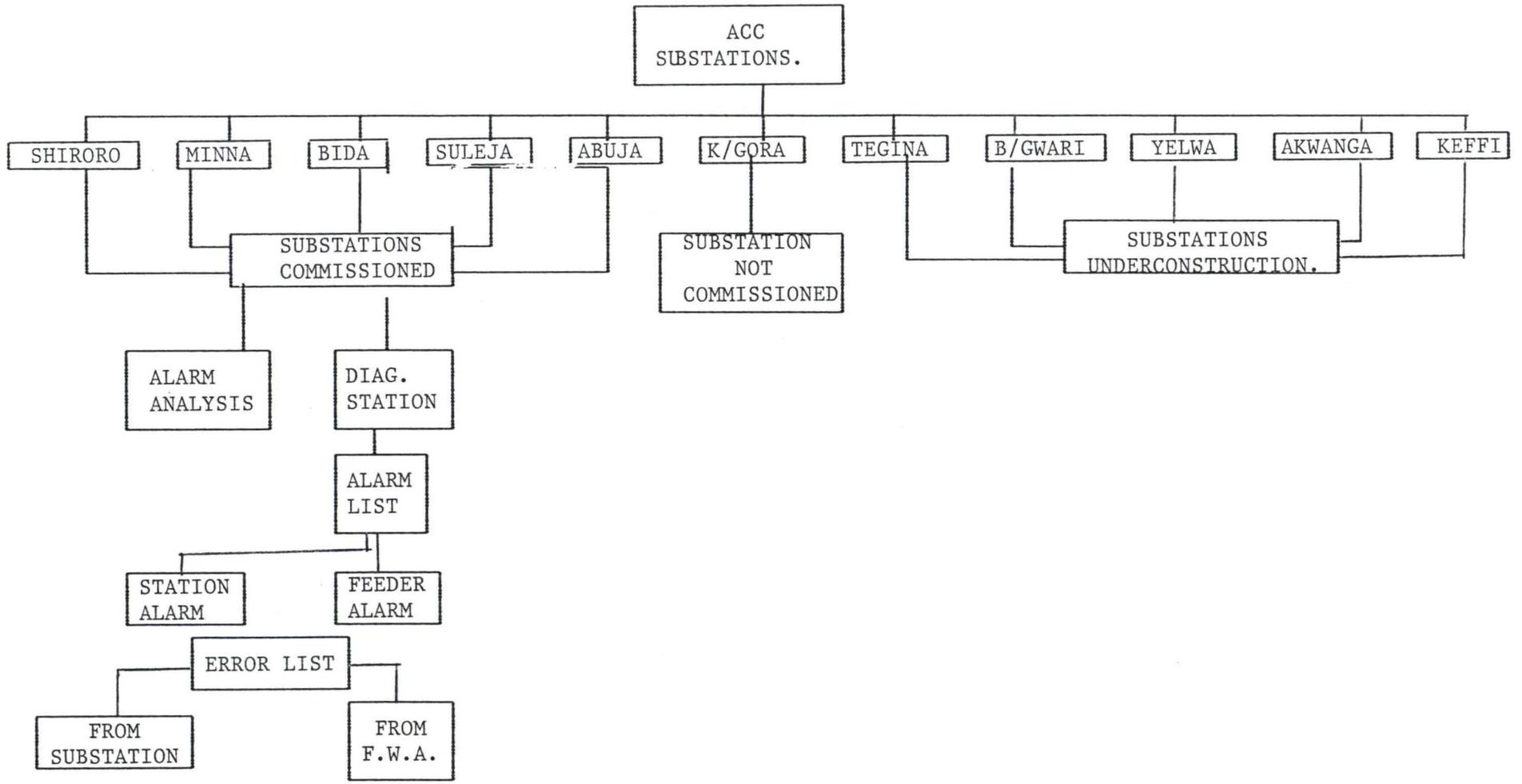
# STRUCTURE FOR DATABASE COMMISSIONED

## STATION DBF

### SHIRORO:

| FIELD | FIELDNAME | TYPE | WIDTH | DEC. |
|-------|-----------|------|-------|------|
| 1. | NAME | C | | |
| 2. | NATURE | C | | |
| 3. | STDIAG | C | | |
| 4. | STALLIST | N | 12 | |
| 5. | FDALLIST | N | 8 | |
| 6. | SUBSTERL | N | 12 | |
| 7. | FWAERL | N | 13 | |
| 8. | ANALYSIS | C | 26 | |

### MINNA:

| FIELD | FIELDNAME | TYPE | WIDTH | DEC. |
|-------|-----------|------|-------|------|
| 1. | NAME | C | | |
| 2. | NATURE | C | | |
| 3. | STDIAG | C | | |
| 4. | STALIIST | N | 12 | |
| 5. | FDALIIST | N | 10 | |
| 6. | SUBSTERL | N | 12 | |
| 7. | FWAERL | N | 13 | |
| 8. | ANALYSIS | C | 17 | |

**BIDA:**

| FIELD | FIELDNAME | TYPE | WIDTH | DEC |
|-------|-----------|------|-------|-----|
| 1. | NAME | C | | |
| 2. | NATURE | C | | |
| 3. | STDIAG | C | | |
| 4. | STALLIST | N | 12 | |
| 5. | FDALLIST | N | 7 | |
| 6. | SUBSTERL | N | 12 | |
| 7. | ANALYSIS | C | 15 | |

**SULEJA:**

| FIELD | FIELDNAME | TYPE | WIDTH | DEC |
|-------|-----------|------|-------|-----|
| 1. | NAME | C | | |
| 2. | NATURE | C | | |
| 3. | STDIAG | C | | |
| 4. | STALLIST | N | 12 | |
| 5. | FDALLIST | N | 13 | |
| 6. | SUBSTERL | N | 12 | |
| 7. | ANALYSIS | C | 28 | |

**ABUJA::**

| FIELD | FIELDNAME | TYPE | WIDTH | DEC |
|-------|-----------|------|-------|-----|
| 1. | NAME | C | 15 | |
| 2. | NATURE | C | 12 | |
| 3. | STDIAG | C | 14 | |
| 4. | STALLIST | N | 12 | |
| 5. | FDALLIST | N | 12 | |
| 6. | SUBSTERL | N | 12 | |
| 7. | ANALYSIS | C | 18 | |

**KONTAGORA:**

| FIELD | FIELDNAME | TYPE | WIDTH | DEC |
|-------|-----------|------|-------|-----|
| 1. | NAME | C | 19 | |
| 2. | NATURE | C | 12 | |
| 3. | STDIAG | C | 14 | |
| 4. | STALLIST | N | 12 | |
| 5. | FDALLIST | N | 72 | |
| 6. | SUBSTERL | N | 12 | |
| 7. | ANALYSIS | C | 08 | |

## STRUCTURE FOR DATABASE FOR STATIONS NOT COMMISSIONED.

| FIELD | FIELDNAME | TYPE | WIDTH | DEC |
|-------|-----------|------|-------|-----|
| 1. | TEGSUBST | C | 16 | |
| 2. | YELSUBST | C | 15 | |
| 3. | BGWSUBST | C | 21 | |
| 4. | AKGWSUBST | C | 17 | |
| 5. | KEFSUBST | C | 15 | |

## PROGRAM CODING

```
*      Program:        Control of Electric Power System Operation
*      User:           National Electric Power Authority
*      Author:         Baba M. Abdullahi
*      Dept:           Maths/Computer
*      Date Written:   1st February 1998

Set Bell Off
Set Dell On
Set Talk Off
Set Echo Off
Set Stat Off
Set Scor Off
Set Proc To EMS
Set INTE Off
Set Del To '<>'
Clea All
Do Cover
Publ I,M,C CShiroro, Nminna, MBida, MSuleja, MAbuja
     Do Passw
       Set Colo To G+R,N,C
   Do Menu
         Set Proc to
* ............. Password Module ..........*
         Proc Passw
             Do while .T.
         Clea
     Rest from Mem Var Addi
Pw = Spac (8)                            && Password Var
Mpwspac (8)                              && Real Password
PW = ABDULLAH
DO WHILE MPW = SPAC (8)
     @ 10,20 SAY " ENTER PASSWORD"
     @ 10, 38 GET MPW PICT '!!!!'
     SET COLO TO N/N, R,R
     READ
ENDDO
     SET COLO TO W
     IF MPW <>'ABDULLAH '
         ?CHR(7)
     DO WHILE .T.
         @ 14,20 SAY " INVALID PASSWORD -[R]E-ENTER,
[E]ND...(R/E) "GET I PICT '!'
         READ
     IF I='R'
         EXIT
     ENDIF
IF I='E'
     CLEA
         QUIT
ELSE
         ?CHR(7)
     @ 16,20 SAY " WRONG KEY.........."
     CEA
      LOOP
ENDIF
ENDDO
ENDIF
```

```
EXIT
ENDDO
RETURN

*.......... ACC/ST COMP. MENU MODULE ..........*
PROC COMPMENU
CLEAR ALL
REST FROM MEM VAR ADDI
@ 10,20 SAY "[C] - COMPUTE SUBSTATIONS COMMISIONED"
@ 12,20 SAY "[N] - COMPUTE SUBSTATIONS NOT COMMISSIONED"
@ 14,20 SAY "[I] - COMPUTE SUBSTATION UNDER CONSTRUCTION"
@ 16,20 SAY "[E] - RETURN TO MENU"
J=0
DO WHILE J=0
     J=INKEY ()
     IF UPPER (CHR(J)) & "CNIE"
          EXIT
     ENDIF
      J=0
ENDDO
DO CASE
     CASE CHR(J) & "eE"
          DO MENU
     CASE CHR(J) & "cC"
          DO COMP1
     CASE CHR (J) & "nN"
          DO COMP2
     CASE CHR (J) & "iI"
          DO COMP3
ENDCASE
RETURN
*.......... ACC/SST. MODULE
PROC COMP1
CLEA
SET COLO TO /GR+/B*
@ 12,15 SAY "PS WAIT..........! ACC SUBSTATION IS LOADING
SET COLO TO G+R,N,G
SELE 2
USE ACC
DELE ALL
PACK
SELE 3
     USE MASTER
     GO TOP
     MACC = MSUBST
     MCOM = SSTCOM
     MNOTCOM = STNOTCOM
     MUDCONS = STUNDCON
DO WHILE .T.
     SELE 1
GO I
DO WHILE .NOT EOF()
     IF MACC = MSUBST
          MCOM = STCOM
     IF STCOM=CSHIRORO, MMINNA,MBIDA, MSULEJA,MABUJA
ENDIF
SKIP
ENDDO
```

```
              SKIP
              SELE 3
                  APPEND BLANK
                  REPL OP1 TO 5 FOR MMINNA, MBIDA, MSULEJA, MABUJA
                  MENU MODULE
               ENDIF
          ENDDO
          RETURN
          *.......... SHIRORO DATA STRUCTURE MODULE..........*
          PROC COMP1.2
          CLEA
          SET COLO TO /GB+/B+
          @ 12,15 SAY "SHIMENU IS BEING DISPLAYED....."
          SET COLO TO G+R,N,C
          @15,15 SAY "STATION DATA STRUCTURE"
          @17,15 SAY "NAME"
          17,27 SAY "SHIRORO"
          19,15 SAY "NATURE OF STATION"
          19,27 SAY "COMMISSIONEN"
          21,15 SAY "STATION DIAGRAM"
          21,27 SAY "AVAILABLE"
          ENDIF
                SKIP
                 SELE 4
                    REPL SHIMENU FOR MINMENU, BIDAMENU, SULEMENU, ABUMENU
          ENDIF
          ENDDO
          RETURN
          IF MACC = MSUBT
              MCOM = STCOM
              SELE 2
              APPEND BLANK
                    REPL SHIRORO WITH CSHIRORG MINNA WITH MMINNA, BIDA WITH
              MBIDA, SULEJA WITH MSULEJA, ABUJA WITH MABUJA
          ENDIF
          SKIP
          ENDDO
          REST FROM MEM.VAR ADDI
          @ 10,10 SAY "5 SHIRORO DATA STRUCTURE"
          @ 12,10 SAY "6 MINNA DATA STRUCTURE"
          @14,10 SAY "7 BIDA DATA STRUCTURE"
          @16,10 SAY "8 SULEJA DATA STRUCTURE"
          @18,10 SAY "9 ABUJA DATA STRUCTURE"
          ENDIF
          ENDDO
          RETURN
          *..........SHIRORO MENU MODULE..........*
          PROC COMP 1.1
          CLEA
          SET COLO TO /GR + /B*
          @2,5 SAY "SHIRORO STATION ALARM LIST"
                OP=0
          @5,5 SAY "1 STATION ALARM LIST"
          @7,5 SAY "2 FEEDER ALARM LIST"
          @9,5 SAY "3 SUBSTATION ERROR LIST"
          @11,5 SAY "4 FWA FEEDER ALARM LIST"
          @13,5 SAY "5 ANALYSIS"
          ENDIF
```

```
ENDDO
*..........REPORT MENU MODULE..........*
PROC REPORT
CLEA
CLEA ALL
@2,5 TO 23,70 DOUB
@4,28 SAY REPORT MENU
@5,28 TO 5,48 DOUB
@7,30 SAY "ON SCREEN DISPLAY"
@9,15 SAY "[1] SHIRORO ACC COMMISSIONED SUBSTATIONS"
@10,15 SAY "[2] STATION ALARM LIST"
@11,16 TO 11,69
@12,30 SAY "PRINTER OUTPUT"
@13,6 TO 13,69
@ 14,15 SAY "[3] FEEDER ALARM LIST"
@15,6 TO 15,69 SAY "PRINTER OUTPUT"
@16,6 TO 16,69
@17,16 SAY "[4] SUBSTATION ERROR LIST"
@18,6 TO 18,69
@19,30 SAY "PRINTER OUTPUT"
@20,6 TO 20,69
@21,17 SAY "[5] FWA ERROR LIST"
@22,15 TO 22,69
@23,35 SYA "PRINTER OUTPUT"
@24,30 TO 24,69
@25,40 SAY "[6] ANALYSIS"
@25,6 TO 25,69
@26,6 SAY "PRINTER OUTPUT"
@27,6 TO 27,69
@28,6 SAY "[7] RETURN TO MAIN MENU"
@29,15 TO 21,69
@30, 25 SAY "PICK CHOICE..........*
            R=0
            DO WHILE R=0
                R=INKEY ()
                    IF UPPER (CHR(R) & "1234567"
                EXIT
            ENDIF
     ENDDO
DO CASE
CASE CHR(R) "7"
CLEA ALL
DO MENU
            CASE CHR(R) & "1"
                DO SUBCOM
            CASE CHR(R) & "2"
                DO STALLIST
            CASE CHR(R) & "3"
                DO FDALLIST
            CASE CHR(R) & "4"
                DO SUBSTERL
            CASE CHR(R) & "5"
                DO FWAERL
                CASE CHR(R) & "6"
                    DO ANALYSIS
*..........SUBSTATION COM ON-SCREEN DISPLAY..........*
PROC SUBCOM
CLEA
```

```
REST FROM MEM.VAR ADD1
@10,20 SAY "SHIRORO"
@12,20 SAY "MINNA"
@14,20 SAY "BIDA"
@16,20 SAY "SULEJA"
@18,20 SAY "ABUJA"
READ
USE ACC
LOCATE FOR STATION
IF EOF ()
                @20,20 SAY "INVALID STATION .... PRESS ANY KEY"
                            SET CONS OFF
                            WAIT
                            SET CONS ON
                      RETURN
                      ENDIF
CNAME=TITLE
L=1
SN=1
CLEA
SELE 1
USE DATA STRUCTURE
GO TOP
DO WHILE .T.
IF L=1
@L,20 SAY " NATIONAL ELECTRIC POWER AUTHORITY"
@L+2,17 SAY " SHIRORO AREA CONTROL CENTRE"
@L+3,12 SAY " STATION DATA STRUCTURE'
@L+4,10 SAY "CNAME"
@L+5,10 SAY "NATUREST"
@L+6,10 SAY "STDIAG"
@L+7,10 SAY "STALLIST"
@L+8,10 SAY "FDALLIST"
@L+9,10 SAY "SUBSTERL"
@L+10,10 SAY "FWAERL"
@L+11,10 SAY "ANALYSIS"
@L+12,10 SAY "REPL ('-'78)
ENDIF
DO WHILE .NOT. EOF ()
IF ALARMLIST=N
@L+4,10 SAY "SHIRORO"
@L+7,10 SAY "12"
@L+8,10 SAY "8"
@L+9,10 SAY "12"
@L+10,10 SAY "13"
@L+11,10 SAY "26"
ENDIF
                DO WHILE .NOT. EOF ()
                    @L+4,10 SAY "MINNA"
                        IF ALARMLIST=N
                    @L+7,13 SAY "12"
            @L+8,13 SAY "10"
      @L+9,13 SAY "12"
@L+10,13 SAY "13"
@L+11,13 SAY "17"
ENDIF
DO WHILE .NOT. EOF ()
IF ALARMLIST=N
```

```
@L+4,16 SAY "BIDA"
@L+7,16 SAY "12"
@L+8,16 SAY "7"
@L+9,16 SAY "12"
@L+10,16 SAY "13"
ENDIF
DO WHILE .NOT. EOF ()
@L+4,19 SAY "SULEJA"
IF ALARMLIST=N
@L+7,19 SAY "12"
@L+8,19 SAY "13"
@L+9,19 SAY "12"
@L+10,19 SAY "28"
ENDIF
DO WHILE .NOT. EOF ()
@L+4,21 SAY "ABUJA"
IF ALARMLIST=N
            @L+7,21 SAY "12"
      @L+8,21 SAY "12"
            @L+9,21 SAY "12"
      @L+10,21 SAY "18"
ENDIF
ENDDO
RETURN
*..........SUBSTATIONS ALARM LIST ON-SCREEN DISPLAY...........*
PROC STALLIST
CLEA
REST FROM MEM.VAR ADDI
IF L=0
@L+1,6 SAY "SHIRORO"
@L+2,6 SAY "DCF"
@L+2,8 SAY "BEF"
@L+3,6 SAY "BCHF"
@L+3,8 SAY "CUF"
@L+4,6 SAY "LVAF"
@L+4,8 SAY "RTUMCB"
@L+5,6 SAY "BBPT"
@L+6,6 SAY "PROTT"
@L+6,8 SAY "WARN"
@L+7,6 SAY "ESBF"
@L+7,8 SAY "TROS"
ENDIF
DO WHILE .NOT. EOF ()
      IF MINNA=MMINNA, BDIA WITH MBIDA, SULEJA WITH MSULEJA,
                ABUJA WITH MABUJA
      REPL CSHIRORO WITH MMINNA, MBIDA, MSULEJA, MABUJA
ENDIF
ENDDO
RETURN
*..........SUBSTATION FEEDER LIST ON-SCREEN DISPLAY...........*
PROC FDALLIST
CLEA
REST FROM MEM.VAR ADD1
IF ALARMS = C
@2,6 SAY "SHIRORO FEEDER ALARMS"
@4,6 SAY " E1102"
@6,6 SAY "PROTT"
@6,8 SAY "WARN"
```

```
@8,6 SAY "E1108"
@10,6 SAY "PROTT"
@10,8 SAY "WARN"
@12,6 SAY "E1114"
@14,6 SAY "PROTT"
@14,8 say "warn"
@16,6 SAY "E1202"
@18,6 SAY "PROTT"
@18,8 SAY "WARN"
@20,6 SAY "E1208"
@22,6 SAY "PROTT"
@22,8 SAY "WARN"
@2,16 SAY "E1214"
@4,16 SAY "PROTT"
@4,18 SAY "WARN"
@6,16 SAY "E1302"
@8,16 SAY "PROTT"
@8,18 SAY "WARN"
@10,16 SAY "E1308"
@12,16 SAY "PROTT"
@12,18 SAY "WARN"
ENDIF
DO WHILE .NOT EOF ()
@3,7 SAY "MINNA FEEDER ALARMS"
@5,7 SAY " E1.A"
@5,7 SAY "PROTT,WARN"
@9,7 SAY "E1.B"
@10,7 SAY "PROTT,WARN'
@11,7 SAY "E1.C"
@12,7 SAY "PROTT,WARN"
@14,7 SAY "E2.A"
@15,7 SAY PROT,WARN"
@17,7 SAY "E2.B"
@18,7 SAY "PROT,WARN"
@20,7 SAY "E2.C"
@21,7 SAY "PROT,WARN"
@23,7 SAY "E3.A"
@24,7 SAY "PROT,WARN"
@2,9 SAY "E3.B"
@3,9 SAY "PROT,WARN"
@5,9 SAY "E4.A"
@6,9 SAY "PROT,WARN"
ENDIF
DO WHILE .NOT. EOF()
@2,20 SAY "FEEDER"
@4,20 say "e1a"
@4,22 SAY "E1B"
@5,20 SAY "E1C"
@5,22 SAY "E2A"
@5,24 SAY "E2B"
@6,20 SAY "E3A"
@6,22 SAY "E3B"
@6,24 SAY "E3C"
@7,20 SAY "E4"
@8,20 SAY "E5
@9,20 SAY "E6"
@10,20 SAY "E7"
ENDIF
```

```
DO WHILE .NOT. EOF()
@12,25 SAY "BIDA FEEDER"
@13,25 SAY "E2A"
@14,25 SAY "E2B"
@15,25 SAY "E2C"
@16,26 SAY "E3A"
@17,25 SAY "E3B"
@18,25 SAY "E4"
@20,25 SAY "E5"
ENDIF
DO WHILE .NOT. EOF()
@1,3 SAY "ABUJA FEEDER"
@2,3 SAY "E2A"
@3,3 SAY "E2B"
@4,3 SAY "E2C"
@5,3 SAY "E3A"
@6,3 SAY "E3B"
@7,3 SAY "E3C"
@8,3 SAY "E4A'
@9,3 SAY "E4B"
@10,3 SAY "E4C"
@11,3 SAY "E5A"
@12,3 SAY "E5B"
@13,3 SAY "E5C"
ENDIF
ENDDO
                            CONT ( )
                    DO WHILE .NOT. EOF()
                          CONT & 'Yn'
        @15,3 SAY "DO YOU WANT TO CHECK SUBSTATION FEEDER ALARMS
                                (Y/N)"
                            GET CONT PICT 'Y'
                        READ
                    ENDDO
                IF UPPER (CONT)='Y'
                    DO FDALLIST
                ENDIF
ENDDO
RETURN
*..........SUBSTATION ERROR LIST ON-SCREEN DISPLAY..........*
PROC SUBSTEL
CLEA
REST FROM MEM.VAR ADD1
@2,5 SAY "SHIRORO ERROR LIST"
@4,5 SAY "01 INDICATION FAULTY"
@5,5 SAY "02 MEASURED VALUE FAULTY"
@6,5 SAY "03 COMMAND OUTPUT FAULTY'
@7,5 SAY "04 PULSE ERROR COMMAND"
@8,5 SAY "05 COMMAND DIRECTORY FAULTY"
@9,5 SAY "06 CYCLIC OPERATION AFTER RESTART"
@10,5 SAY "07 COMMAND OUTPUT ERROR"
@11,5 SAY "08 COMMAND NOT EXCEEDED"
@12,5 SAY "09 EXT SYNCHRONISATION MISSING"
@13,5 SAY "10 BATTERY OPERATION"
@14,5 SAY "11 BACK UP BATTERY FAULTY"
@15,5 SAY "12 VOLTAGE INDICATION OUTPUT DISTURBED"
ENDIF
SKIP
```

```
REPL CSHIRORO FOR MMINNA, MBIDA, MSULEJA, MABUJA
ENDIF
ENDDO
RETURN
*..........SUBSTATION FWA ERRO LIST..........*
PROC
CLEA
REST FROM MEM.VAR ADD1
@1,2 SAY "SHIRORO FWA ERRO LIST"
@3,2 SAY "01 ERROR DURING TRANSFER TO VES TRANS"
@4,2 SAY "02 CHANNEL FAILURE"
@5,2 SAY "03 HW FAULTY VES/COMM PROCESSOR"
@6,2 SAY "04 RECEIVED MESSAGE OVERWRITTEN"
@7,2 SAY "05 CYCLE ERROR"
@8,2 SAY "06 COMMAND NOT TRANSMITTED"
@9,2 SAY "07 TELECONTROL TEST MESSAGE ERROR"
@10,2 SAY "08 STATION BLOCKED"
ENDIF
ENDDO
RETURN
*..........SUBSTATION ANALYSIS ON-SCREEN DISPLAY..........*
PROC
CLEA
REST FROM MEM.VAR ADD1
@1,3 SAY
@3,3 SAY "DIFPT/DEFPT"
@4,3 SAY "BHT/THPT"
@5,3 SAY "BFPT/PCBT"
@6,3 SAY "PCBCD/OCHL"
@7,3 SAY "OCHL/WDHT
@8,3 SAY "OHT/OLL"
@9,3 SAY "BHGA/FANF"
@10,3 SAY "TCLP/TCOLL"
@11,3 SAY "TRLDC"
@12,3 SAY "E1108"
@14,3 SAY "PCBT'
@15,3 SAY "PCBLD"
@16,3 SAY "BFPT"
@18,3 SAY "E1114'
@19,3 SAY "PPTT/BUPT"
@20,3 SAY "BFPT/ARLO"
@21,3 SAY "PCBT/PCBLD"
@22,3 SAY "CRTR/LOPDC"
@23,3 SAY "LOBDC/VTFL"
@1,5 SAY "E1202"
@3,5 SAY "PPTT//BUPT"
@4,5 SAY "BFPT/ARLO"
@5,5 SAY "PCBT/PCBLD"
@6,6 SAY "VTFL"
@7,5 SAY "E1208"
@9,5 SAY "PCBT/PCBCD"
@10,5 SAY "BFPT"
@12,5 SAY "E1214"
@14,5 SAY "DIFPT/DEFPT"
@15,5 SAY "BHT/THPT"
@16,5 SAY "BFPT/PCBT"
@17,5 SAY "OCHL/WDHT"
@18,5 SAY "OHT/OLL"
```

```
@19,5 SAY "BHGA/FANF"
@20,5 SAY "TCLP/TCOLL"
@21,5 SAY "TRLDC"
@1,7 SAY "E1302"
@3,7 SAY "PPTT/BUPT"
@4,7 SAY "BFPT/ARLO"
@5,7 SAY "PCBT/PCBLD"
*..........ACC/SST NOT COM..........*
PROC COMP2
CLEA
SET COLO TO /GR + /B*
@12,8 SAY "  PLS  WAIT  ...........!  ACC  SST  NOT  COM  IS  BEING
                            DIPLAYED"
                                SET COLO TO G+R,N,G
                    SELE 5
                            USE ACC
                DELE ALL
            PACK
SELE 3
          USE MASTER
      GO TOP
MACC=MSUBST
MCOM=SSTCOM
MNOTCOM=SSTCOM
MUDCONS=SSTUNDCONS
      DO WHILE .T.
                    SELE 1
            GO 1
      DO WHILE .NOT. EOF(0
IF MACC=MSUBST
MNOTCOM=SSTNOTCOM
IF STNOTCOM=MK/GORE
ENDIF
SKIP
ENDDO
          IF MACC=MSUBST
MNOTCOM=SSTNOTCOM
      SELE 2
                  APPEND BLANK
REPL K/GORA WITH MK/GORA
ENDIF
SKIP
          REST FROM MEM.VAR ADD1
                    @10,12 SAY "10 K/GORA DATA STRUCTURE'
ENDIF
ENDDO
RETURN
*.......... K/GORA MENU ON SCREEN DISPLAY"
PROC COM2.1
CLEA
                    SET COLO TO /GR + /B
      @2,7 SAY "K/GORA STATION ALARM LIST"
                OP=0
      @5,7 SAY "1 STATION ALARM LIST"
@6,7 SAY "2 FEEDER ALARM LIST"
@7,7 SAY "3 SUBSTATION ERROR LIST"
@8,7 SAY "4 FWA ERROR LIST"
@9,7 SAY "5 ANALYSIS"
```

```
ENDIF
ENDDO
SKIP
APPEND BLANK
*..........K/GORA DATA STRUCTURE MODULE"
PROC COMP2.2
CLEA
                        SET COLO TO /GB + /B
                @12,17 SAY K/GMENU IS BEING DISPLAYED..........."
                SET COLO TO G+R,N,G
@15,17 SAY "STATION DATA STRUCTURE"
@16,17 say "NAME"
@16,21 SAY "K/GORA"
@17,17 SAY "NATURE OF STATION"
@17,21 SAY "NOT COMMISSIONED"
@18,1 SAY "STATION DIAGRAM"
@18,2 SAY "AVAILABLE"
ENDIF
SKIP
SELE 5
REPL KGMENU FOR MK/GORA
ENDIF
            DO WHILE .NOT. EOF
                IF ALARMLIST =N
        SELE 1
            USE DATA STRUCTURE
        GO TOP
DO WHILE .T.
IF L=1
@L+4 SAY "K/GORA"
@L+7,10 SAY "12"
@L+8,10 SAY "7"
@L+9,10 SAY "12"
ENDIF
ENDDO
DO WHILE .NOT. EOF()
IF CNAME=TITLE
CSHIRORO=CSHIRORO
K/GORA=MK/GORA
REPL CSHIRORO WITH MK/GORA
*..........ACC/SST UNDERCONS MODULE..........*
PROC COMP 3
CLEA
SET COLO TO /GR + /B*
@8,20 SAY 'PLS WAIT..........! ACC SST UNDERCONS IS DISPLAYED"
SET COLO TO G+R,N,G
SELE 6
USE ACC
DELE ALL
PACK
SELE 4
USE MASTER
GO TOP
MACC=MSUBST
MCOM=SSTCOM
MNOTCOM=SSTNOTCOM
MUNDCONS=SSTUNDCONS
DO WHILE .T.
```

```
SELE 1
GO 1
DO WHILE .NOT. EOF()
IF MACC-MSUBST
MUNDCONS=SSTUNDCONS
IF MUNDERCONS=TEGINA, B.GWARI, YELWA, AKWANGA, KEFFI
REPL TEGINA WITH NTEGINA, B/GWARI WITH NB/GWARI, YELWA WITH
NYELAW, AKWANGA WITH NAKWANGA, KEFFI WITH NKEFFI
APEND BLANK
ENDIF
SKIP
REST FROM MEM.VAR ADD1
@10,16 SAY "STATION UNDER CONSTRUCTION'
@12,16 SAY "TEGINA"
@13,16 SAY "B/GWARI"
@14,16 SAY "YELWA"
@15,16 SAY "AKWANGA"
@16,16 SAY "KEFFI"
READ
USE ACC
LOCATE FOR STATION
IF EOF ( )
@12,20 SAY "INVALID STATION..........PRESS ANYKEY
SET CONS OFF
WAIT'SET CONS ON
RETURN
*..........SUBSTATIONS UNDCONS MENU..........*
PROC COMP 3
CLEA
REST FROM MEM.VAR ADD1
@1,4 SAY "SSTUNDECONS COMB MENU"
@3,4 SAY "STATION DATA STRUCTURE"
@3,10 SAY "NIL"
@5,4 SAY "NATURE OF STATION"
@5,10 SAY "UNDER CONSTRUCTION"
@7,4 SAY 'STATION DIAGRAM"
@7,10 SAY "NIL"
@9,4 SAY "STATION ALARM LIST"
@9,10 SAY "NIL"
@11,4 SAY "STATION FEEDER ALARM"
@11,10 SAY "NIL"
@13,4 SAY "STATION ERROL LIST"
@15,4 SAY "NIL"
@17,4 SAY "ANALYSIS'
@17,10 SAY "NIL"
ENDIF
IF EOF ()
EXIT

*..........ACC SUBSTATIONS OPERATION (HARDCOPY)..........*
PROC OPER
CLEA
REST FROM MEM.VAR ADD1
@10,20 SAY "ENTER AUTHORITY    :    "GET NEPA PICT "@!" 11
@12,20 SAY "ENTER SUBSTATIONS :    "GET MACC RANGE" 11
@14,20 SAY "ENTER SUBSTATION COM:  "GET MCOM RANG" 5
@16,20 SAY "ENTER SUBSTATION NOTCOM:GET MNOTCOM" 1
@12,20 SAY "ENTER SUBSTATION UNDERCONS: GET MUNDCON RANG 5
```

```
@20,20 SAY " ENTER SUBSTATION COM DATA: GET LIST PIC "@"
READ
     USE ACC SUBSTATIONS COM
          IF EFO ( )
               ? CHR(7)
          @22,10 SAY INVALID STATION .......... PRESS ANY KEY
          SET CONS OF
               WAIT
          SET CONS ON
               RETURN
          ENDIF
CNAME=TITLE
L=1
SN=1
CLEA
USE MASTER
     GOTOP
DO WARNING
SET DEVI TO PRN
DO WHILE .T.
IF L=1
     @L,20 SAY "NATIONAL ELECTRIC POWER AUTHORITY"
     @L+2,17 SAY "SHIRORO ACC"
     @L+4,1 SAY "SUBSTATION: "+CNAME+"COM:
               "+CNAME+"NOTCOM:"+CNAME+"
                    UNDCON:"+CNAME+"
     @L+5,1 SAY REPL('-',78)
     @L+6,1 SAY "NAT OF STATION"
     @L+6,10 SAY "STATION DIAG"
     @L+6,20 SAY "STALLIST"
     @L+6,30 SAY "FDALLIST"
     @L+6,40 SAY "SUBSTERL"
     @L+6,50 SAY "FWAERL"
     @L+6,60 SAY "ANALYSIS"
     @L+7,70 SAY "REPL('-',78)
     L=8
ENDIF
ENDDO
RETU

*..........PRINTER SET UP WARNING MODULE..........*
PROC WARNING
CLEA
?CHR(7)
@1,5 TO 21,71 DOUB
@4,24 TO 4,50 DOUB
@5,10 TO 16,66
@18,10 TO 20,66
@3,24 SAY "REPORT PRINTING"
@7,15 SAY "1. MAKE SURE THE PRINTER IS PROPERLY CONNECTED"
@9,15 SAY "2. FIX PAPER INTO THE PRINTER PROPERLY"
@11,15 SAY "3. SWITCH ON THE PRINTER"
@13,15 SAY "4. IF THE PRINTER IS ON LINE THEN"
@15,15 SAY "5. PRESS ["+CHR(17)+CHR(196)+CHR(217)
                    +"] TO START.........."
     G=0
     LMT=9000
     DO WHILE U<LMT
```

```
        G=INKEY ()
        @15,44 SAY "   "
        IF CHR(G)
            EXIT
        ENDIF
        G=G+1
ENDDO
PRINTING="PLS. KEEP OFFF!        -      PRINTING......."
SET COLO TO /GR+/B*
 @19,15 SAY PRINTING
   SET COLO TO G+R,N,G
      RETU
```

o

## TESTING

When the Dbase III+ is loaded in the hardisk or inserted in floppy diskettes labelled I and II. After booting the system in case the Dbase III+ is in the harddisk, the system will get the C promp, **ie** C:\>

1. Type
   CD Dbase (press return key)
   dbase

   When the Assit menu is shown on the screen, then,

2. Press ESCAPE key to take you to the DOT prompt.
3. Put the diskette containing the system A and type
   **SET DEFAULT TO A**
   A message will appear on the screen as shown below
   **OPERATIONAL CONTROL OF ELECTRIC POWER SYSTEM**
   **SHIRORO AREA CONTROL CENTRE**

   Press any key to continue.........

4. Press any key and another scren will appear requesting for a password.

**3.5.** **CHANGE OVER PROCEEDURE.**

This change over from the old to the new system may take place when

1) The system has been proved to the satisfaction of the system analyst and other implimentation activities have been completed.

2) User organisations are satisfied with the results of the system tests.

The changeover may then be achieved in a number of ways some of which are:-

Direct, parallel running, Pilot running and staged changeover.

a) **Direct Changeover:-** This method is the complete replacement of the new in one move. It isabold move, which should be under taken only when everyone concerned has confidence in the new system. It is protentially the least expernsive but most risky.

b) **Paralled Running:-** This means processing current data by both the old and new systems to cross check the results. Its main attraction is that the old system is kept alive and operational until the new system has been proved for at least one system circle. It involves extra cost.

c) **Pilot Running:-** This is similar in concept to parallel running. But it is not discriptive as parable operation.

d) **Staged Changeover:-** This involves a series of limited size direct changeovers, the new system being introduced piece-by-piece. A complete part, or logical section, is committed to the new system while the remainning parts or sections are processed by the old system. It reduces the risks inherent in a direct changeover of the whole system.

**3.6**                     <u>**COST BENEFIT ANALYSIS.**</u>

In the cost benefit analysis of this new system (SCADA) to the management, though cost analysis is often a deterring factor in the approval or disapproval of new system proposals.  By management, NEPA Authority stand to save much cost in

i)      Transportation of the Area control supervisors in going round all substations for some operational data which could be relayed.

Stock pile of voluminous reading sheets and log entries with respect to paper and printing cost could be saved since such operational information could be input in the hardisks, stored and even copied into diskettes.

## CHAPTER FOUR.

### PROGRAMMING CONCEPT.

Dbase 3+ use a structured language because it is easier for the program to be read, debuyged and changed. The program that forms the applications are.

### ENVIRONMENTAL SET-UP

### 4.1.   FEATURES OF THE LANGUAGE.

The following dbase 3+ set commands control contain settings of the operating environment for the program.

**SET BELL ON/OFF:** Determines whether or not the bell sounds when a field is
    field on an A.

**SET TACK ON/OFF:-** Determines whether or not dbase displays a response to
    various commands.

**SET PROCEEDURE TO:** Advanced programming technic already sub-programmes
    are combined into a single file and  assigned proceedure
    names.

**SET PRINT ON/OFF:-** Determines whether displays will be echoed to the printer.

Dbase 3+ can as well operate in three modes thus:

a)    The ASSIST MENU

b)    The DOT PROMPT MENU

c)    The PROGRAMMING MODE.

### DESIRABILITY OF THE LANGUAGE.

A database management system (DBMS) is a computer based system to manage-databased or a collection of database or files.  It enables users to access and manipulate the database.  It provides a building block in constructing

data precessing systems for applications requiring database access.

It helps database administrators perform certain managecial duties.

Most data processing system require access to a master file. If move than one program had to use the same fields of data, those fields often were stored in more than one file. This practical causes a great deal of duplicated data to be stored.

Descrepancies normally occur among reports procedured form different fields because files containing duplicate data usually was not updated at the same time.

Data base management system that can provide the same data storage and management system that can provide the some to many programmers.

In DBMS files are designed to allow many programs to share fileds or allow many different types of access by students name, number etc. The desirability of DBMS therefore in program writing is tremendous in its ability to manipulate the database.

## CHAPTER FIVE.

### 5.1.    SYSTEM RECOMMENDATION.

From the information generated in the operation of the old system
on the control of electric power system, it has become partinent for National
Electric Power Authority to adopt the use of computers (SCADA) in its power
operations for the purpose of efficiency, reliability o out put ie power stabilit
and maintanance of data intergrity.

This however will evolve the purchase of computer though very expensive
and maintenance is relatively costly.  It's advantages over the manual system
cannot be over empliasivel.  These include its high sped of execution which
makes it to communicate faster and respond very quickly to any given situation.
It has facility for handing large volume of data more efficiently with high
degree of accurracy and at relatively  low cost.

For there resons, it is recommended that personnal computers PC.
should be used.  It only involves a simple sequence of key board operations
as most of the operations are programme controlled.  Only the services of
competant  operations are needed.

### 5.2.    SUMMARY.

We can summary our topic of recommendation in the method of conversion.
The three general methods of conversion are paralled conversion, Direct and
Phase conversion.

The phase in conversion is chosen for this system since it is the
most effective method of changing over to a new system.  Gradual charge over
can be achieved by operating the new system with increasing volumes of data
and/or introducing parts of new system and replacing the corresponding part
in the old system by then as they are checked out under actual operating
conditions.

## 5.3.    CONCLUSION.

We can as well conclude this work by method of achievement of the new system. Due to many problems associated with the manual control of electric power system operations, which includes discrepancy in data and time of operation between master and substations, NCC and major stations, inadequacy reunity and privacy of files, show access of files and owing to the enormous advantages of computer such as it's high speech of execution, high degree of accuracy, ability to handle large volumes of data and guaranteed security and privacy of files; the computerized controls of electric power operations for NEPA generating and transmission stations.

## RESULT OF THE NEW SYSTEM.

The result of the new system (SCADA) therefore will modify the overall operation of the Electrical Power System, in ways such as,

1)      Enables the master station, Shiroro ACC, to have the overview
        of the performance of the equipment in all its associated
substations.

2)      Send to the mimic board of the master station control room, the
        station and feeder alams of the faults associated will the
        substation equipment.

3)      This thus enables the information of the status of substations at
        any given time. This is with respect to which equipment are out
        of service and while ones are not.

4)      Prompt and accuracy of data flow regarding the performance of any
        particular equipment at any given time in any substation to the
        master station. This allows for planning of required maintenance
        and repair works on faulty equipment.

5)      The result also proves the relliability of the system, SCADA
        interconnection, to relay information as at when due.

# APPENDIX

| | |
|---|---|
| **APPEND** | Add records to the end of Database |
| **BUG** | An error usually used in relation for safeware problem |
| **CLEAR** | Erase the screen |
| **DELETE** | Erase |
| **DISPLAY** | Display funds, field or record structures |
| **DO** | Begin execution. |
| **DATA** | Facts or information used by the system. |
| **DATABASE** | Information stored in computerised form. |
| **EDIT** | Editing of Database. |
| **EXIT** | End a "do while" without halfing execution. |
| **GO TOP/BOTTOM** | Mover record pointer to a specified position. |
| **LIST** | List record in current database. |
| **READ** | Permit data entry. |
| **QUIT** | Close all files of database and return to operating system. |
| **RETURN** | Ends execution. |
| **SEEK** | Look for a particular record. |

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