

Material Control and Computerisation of Kardex

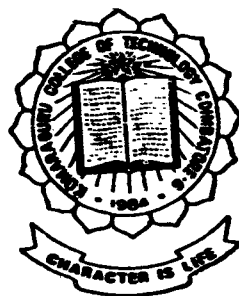
P-244

DISSERTATION SUBMITTED IN PARTIAL FULFILMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF COMPUTER APPLICATIONS
OF BHARATHIAR UNIVERSITY

By

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JUNE 1996

DECLARATION

I here by declare that this project work entitled

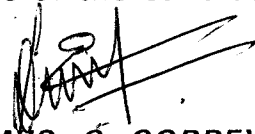
"MATERIAL CONTROL AND COMPUTERISATION OF KARDEX"

submitted to kumaraguru College of Technology, Coimbatore(affiliated to Bharathiar University) is a record of original work done by me under the supervision and guidance of Mrs. S. Devaki B.E.,M.S., LECTURER, Department of Computer Science and Engg, Kumaraguru College of Technology, Coimbatore and that this project work has not formed the basis for the award of any Degree / Diploma / Associateship / Fellowship / or similiar titile to any candidate of any University.

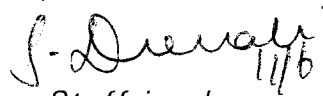
Place : Coimbatore.

Signature of the candidate

Date : 11/06/96


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THE FERTILIZERS AND CHEMICALS TRAVANCORE LIMITED
COCHIN DIVISION, AMBALABEDU

Certificate

This is to certify that the project work entitled MATERIAL CONTROL AND COMPUTERISATION OF KARDEX was carried out at Fertilizers and Chemicals Travancore Ltd., Cochin Division, Ambalamedu by Mr. Dennis Correya in partial fulfillment of requirement for the award of the degree of MASTER OF COMPUTER APPLICATIONS of BHARATHYAR UNIVERSITY, COIMBATORE.



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DENNIS C. CORREYA

S Y S N O P S I S

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The module entitled MATERIAL CONTROL AND COMPUTERISATION OF KARDEX is intended to automise the entries into the kardex from intending to receipts and there by issues of materials. The aim of the system is ti control the flow of items into FACT - CD plant with the help of information present in the Kardex. A systematic approach is done towards each transactions made during this course of operations.

This module helps the stores department to maintain the stock level from time to time and aims at optimizing the functioning of the store. The two kards comprising this system namely Topkard and Bottomkard helps to know the various stages of purchases, current position of stock of materials, yearly consumptions and details about Indents, Purchase Orders and Receipts aiding the Stores Manager and Inventory personnel in planning and optimizing the stores functioning suppling the necessary information.

Taking into consideration the essentialities of the above it was found that an RDBMS can provide much support. With its tools such as TABLES, FORMS, REPORTS, APPLICATIONS and QUERIES, and also the availability of the software INGRES was the best suited one.

This project with its INGRES support will be helpful to the stores department for maintaining and retrieving details about the various stages of indent processing. This module simultaneously helps an uninterrupted production and ready information about the stock level of material.

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1. INTRODUCTION

1.1 PROFILE TO THE ORGANIZATION

The FERTILISERS AND CHEMICALS TRAVANCORE LTD., popularly known as the first large-scale fertiliser factory in our country as early as 1944. FACT has through the years grown into a large multi-product, multi-divisional corporation. It has a capital investment of about 700 crores of rupees and sales turnover is around 900 crores of rupees.

The various divisions of FACT are Udyogamandal Division, Cochin Division, Petro Chemical Division, FACT Engineering Works (FEW), FACT Engineering and Design Organization (FEDO), and Marketing Division. There are three manufacturing divisions of FACT, two of which are at Udyogamandal and one at Ambalamedu.

FACT - Cochin Division is the second manufacturing division of FACT. The factory is situated at Ambalamedu, adjacent to Cochin Refineries

Ltd. The Division was formed to give greater scope to the use of indigenous technology in setting up large-sized fertiliser Plants. At present, the Division has six plants namely Ammonia Plant, Urea Plant, Sulphuric Acid Plant, Phosphoric Acid Plant, Complex Fertilisers plant and Thermal Plant.

The Phase- I of the Division, with facilities to produce 1,98,000 tonnes of ammonia and 3,33,000 tonnes of urea per annum, went into commercial production in 1973. Phase-II project conceived to manufacture complex fertiliser were commissioned in 1976.

The factory site is connected by rail, road and waterways which facilitates movement of raw materials and products. The site development includes the formation of an artificial reservoir stretching over 200 acres by the construction of a suitable earthen dam. The reservoir is supplied with water from the Periyar Valley Irrigation project through a canal.

1.2 PLATFORM

■ System Software:

Operating system	: UNIX system V (Rel 4.2, Ver 7).
Database	: Ingres RDBMS (Ver 6.4).
Programming Language	: Ingres 4GL and Embedded SQL in C.
Programming Tools	: Tables Utilities, VIFRED, APPLICATION BY FORMS, INGRES/MENU, INGRES VISION.

■ Hardware Configuration:

System	: DRS/NX 6000 Supermini
Processor	: SPARC RISC (DRS 6000 RISC chip)
Main Memory	: 64 MB
Hard Disk Drive	: 2 GB
Floppy Disk Drive	: 1.2 MB
Auxiliary Storage	: Catridge drive
Printer	: High speed Dot Matrix printer at 540 cps.

1.3 KARDEX SYSTEM

Management of materials is a high priority in order to avoid excessive accumulation of materials and hence effecting the economy of the company. This project MATERIAL CONTROL AND COMPUTERISATION OF KARDEX was developed in FACT - CD. The Kardex is used for stock verification . At present this is being done manually by the stores and department concerned with the issue items. This system is mainly meant for recording the details pertaining to the Indents, Purchase orders, Receipts, Issues and Returns from the user departments. The Kardex system provides the stores, the information regarding the stock balance of each material as and when required.

The user department, by means of a purchase requisition request the stores for the issue of materials. The purchase requisitions or the Indents are forwarded by stores to purchase department, if only sufficient quantity is not available or there are no dues- in quantity. Dues-in quantity indicates materials yet to be received by the stores. The purchase department places the purchase orders to the vendors for the corresponding incoming indents. The ordered goods will be received by the inspection department. The Goods Receiving Note (GRN) will be forwarded to the stores after the inspection . The details pertaining to the

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receipts are entered in both Top Kard and Bottom Kard.

The Kardex system has two main components

I. TOP KARD

II. BOTTOM KARD

TOP KARD

Top kard contains the Material code, Kardex no, Transaction no, Transaction date, Quantity and reference. The transaction type can be of three types viz.

- a) Indent
- b) Purchase Orders
- c) Receipts

One indent can have any number of purchase orders and a single purchase order can have any number of receipts. Therefore, when a receipt arrives a back traversal is needed to indent and to purchase order. From this we can find out the corresponding indent for which the receipt has been arrived. The indent is raised by the user department and will

be activated only when the item has reached the ROL level. Although the item has reached its ROL the indent cannot be produced if there is a dues in quantity. Therefore the back traversal done above is useful for the dues in quantity calculation.

BOTTOM KARD

The bottom kard contains the Material code, Transaction type, Transaction no, Quantity, Bin balance, Sheet no, Line no. Here the transaction types are as follows

- a) Receipts
- b) Issues
- c) Return from department
- d) Clerical corrections

The receipts of goods from the suppliers are entered along with other details and supplied to the user departments which raised the request for the materials. Bin balance is an important field which plays a vital role in helping the stores manager to verify issues. When an issue or return takes place, the bin balance field which indicates the quantity on hand should be updated simultaneously. Sheet no and Line no are used

2 SYSTEM ANALYSIS

2.1 INTRODUCTION

System Analyses aims at the identification of the system requirements and specifications, a study of the existing system and its drawbacks, and the proposal for improved system.

The method used for carrying out the System Analysis was the Classical System Life Cycle

Method. The feasibility study was not important since the need for computerisation of the Kardex System for stores management of FACT was inevitable.

Stores Management is of very high priority for the company due to the fact that all plants are continuously working 24 hours a day. Thus, in order to prevent uninterrupted production the departments need to be furnished with various consumable and other materials. The principal aim of the new system is to bring this about by effectively controlling the store's dealings with its dependent entities with the help of computerised Kardex system.

2.2 PROBLEM STATEMENT AND PURPOSE

The existing system of Material control uses manual methods of data entry into the two kards. The objectives are as follows ,

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- Store details regarding Indents, Purchase Orders, Receipts and Issues.
 - Updating the Top Kard, Bottom Kard details.
 - Aid in decision making for the Inventory Control personnel.
 - Aid in raising requisitions of material by the user departments.
 - Effective storage of materials in the stores based on their priority.
 - Help in various Inventory parameter calculations pertaining to Re-order Level, Economic Order Quantity, Minimum & Maximum level, yearly consumption etc. of the material.

2.3 CONSTRAINTS

At present Kardex Controlling system of the company is being done manually by stores personnel which is a tedious for a company with a consumption of forty thousand items. The details for each steps from purchase requisition is written and stored in the files. When need arises for some later references it becomes a tedious task to search through all these files to retrieve the necessary details. Human errors in data entry are inevitable. Decision making involves serious and laborious work from the part of the inventory personnel. Specific and collective report generation takes substantial time. The files holding the Kardex information currently occupies a decent amount of the stores total area pre-

venting the stores primary function to effective utilisation of space.

2.4 SPECIFIC OBJECTIVES OF PROPOSED SYSTEM.

Computerisation of Kardex system aims at achieving the following objectives besides eliminating all the above mentioned difficulties of the existing system.

- Timely and accurate information of stock in stores.
- Greater accuracy in analysis calculation and decision making information in stores thereby effective control and management of stores.
- Generating various reports such as format for Top Kard and Bottom Kard, Dues-in items report, ROL reached items report, EOQ of items, Non-moving items report etc.
- Repeated entry to Kards can be avoided and errors due to manual entry is eliminated as the stock is automatically updated whenever there is inflow and outflow of items.
- Insertion, Updation, Retrieval, Correction and Deletion are possible without data inconsistency along with speedy completion of work.
- Data storage is safer with error checking capability of the package maintaining integrity and security.

2.5 FEASIBILITY STUDY

A special feasibility study was not found necessary since the need for such a system in the Stores Department was evident, on account of the time consumed and the manual effort needed for the

Various aspects involving inventory and its effective running. The existence of a computer network along with the suitable software tools further simplified the problem of capital investment towards acquiring one.

2.6 PERFORMANCE SPECIFICATION

The proposed system was definitely to aid to better performance of the store's functioning. At present Kardex Controlling system is being done manually by stores personnel. The details for each steps from purchase requisition is written and stored in the files can be avoided by computerisation. When need arises for some later references it becomes easier since searching through computer maintained files is much easier and human errors in data entry can be eliminated. Decision making is enhanced by computerisation of the system. Specific and collective report generation becomes a task for the computer. The files holding the Kardex information occupies negligible space consisting of a few terminals. Timely and accurate information of stock in stores, greater accuracy in analysis calculation and decision making information in stores thereby effective control and management of stores, generating various

reports such as format for Top Kard and Bottom Kard, dues-in items report, ROL reached items report, EOQ of items, Non-moving items report etc., errors and data inconsistencies due to manual entry is eliminated.

2.7 LANGUAGE CHOSEN

WHY INGRES?

When the integrity and accessibility of any company's data resources are the top priority, Ingres (INteractive GRaphics and REtrieval System) is the best Relational Data Base Management System we can come across.

Ingres supports all major software platforms including more than 40 versions of UNIX and DEC VAX/VMS. It is the number one database for the open system strategies that include UNIX, VMS and PCs. It also offers a complete array of highly efficient end user tools specifically designed for use on IBM PCs and larger systems.

With strong commitment to open system technology and industry standards, Ingres provides the most capable and comprehensive data management solutions available today, along with full protection of the already existing investment in computer hardware and software.

Ingres includes several powerful application development tools. These

tools provide complete facilities that system analysts and developers can use to design, develop and test S/W products, whose engine is the Ingres Relational Management System. SQL, the standard language for RDBMS access is widely accepted for data manipulation, data definition, data protection, data transaction and data control. Applications written in SQL can be easily moved from one computer platform to another. It also supports 4GL and embedded SQL in host languages like Basic, Pascal, C, Cobol etc.

Professionally, Ingres is a comprehensive operating system environment that packs the power of a mainframe relational management system into your minicomputer. It provides a set of functional programs that the user can use as tools to build structures and perform tasks. Because the applications developed on professional Ingres are completely portable to other versions of compilers, the user can create a complex application on a single user environment and then move it into a multiuser platform.

Ingres manages data in a database on the basis of relations. This allows the use of three fundamental operations on the relations such as Selection, Projection and Join. In Ingres data are stored in a table, equivalent to the fields in conventional programming languages. Each table consists of several related data and an application may consists

of one or more tables

The tables in a single application are related to each other on the basis of one or more fields in the tables. A single field or a combination of fields can be used to retrieve records. INGRES consists of the following tools each of which may be accessed independently.

INGRES TOOLS

TABLES

FORMS

REPORTS

APPLICATIONS

QUERIES

A table is a two dimensional structure made up of rows and columns. Each row in a single record column are fields. The number of rows are limited only by available disk space. Tables can be created using SQL or Table utility of the INGMENU tool of Ingres.

QBF is an acronym for Query By Forms. It is basically a Forms based tool, used to retrieve, update and append data in a particular table. The data manipulation capabilities of QBF are less powerful and also less wide ranging as compared to those of SQL/QUEL.

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Forms created through JOINDEF can be run from QBF's various options like append, update and retrieve. For data to be retrieved from multiple tables, it now becomes necessary to establish a relationship between the tables. JOINDEF subsystem of Ingres allows a relationship to be defined between the tables.

Report By Forms (RBF) is an interactive visual oriented, forms based module for creating reports from the database. A report can be designed in RBF from only a single table. In order to generate report from more than one table, a 'view' has to be defined using SQL. A view is a template which allows RBF to treat the fields occurring in different tables as they were from one table.

Application-By-Forms (ABF) uses standard Ingres forms and menus to access a database table and perform a series of operations. Applications are composed of a set of defined objects such as frames, forms, procedures and tables. An application in Ingres consists of one or more module called frames. A frame has two components, a Form and Ingres 4GL code containing set of Menu items.

Ingres VISION is another tool which aids in the fast developments of an application through Frames. Various queries can be specified using the Visual Query Editor to the default frames generated by the Vision. The source code generated can be further customized.

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ISQL (Interactive Structured Query Language) is a tool for organizing, managing and retrieving data stored in a database. ISQL or SQL works with one specific type of database, called relational database. When the need to retrieve data from the database arises, the SQL language makes the SQL request. The RDBMS processes the SQL request, retrieves the requested data and returns.

FACILITIES OF INGRES IN MULTIUSER SYSTEM

If you are working with a local database, the INGRES tools and the Ingres data manager, as well as the database, reside on your PC.

Through INGRES your PC's sophisticated workstation lets you retrieve and update data on other computers just as if that data were on your PC. In such cases, you access a remote database using INGRES tools on your PC with a data manager residing on another computer.

INGRES SUPPORTS APPLICATION DEVELOPMENT

INGRES forms is an excellent and user friendly tool for quickly creating forms. The user can start with extremely simple default forms or use the full screen painting function to create detailed screens for accessing and updating multiple tables for controlling and editing data as it is entered.

Rather than forcing the user to program in the procedural language that comes with the product, INGRES provides pre compilers that enable the user to incorporate SQL commands into their favorite procedural languages. With the help of INGRES menu user can link all the Programs, Forms and Queries in an easily maintained, secure menu structure. The user can include other package and Operating System Commands too.

Advantages of Ingres

- The most important advantage is that the system can be distributed across a network.
- It can be switched on from one database to another.

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- Applications developed using 4GL require fewer lines of code than conventional programs and can be easily maintained.

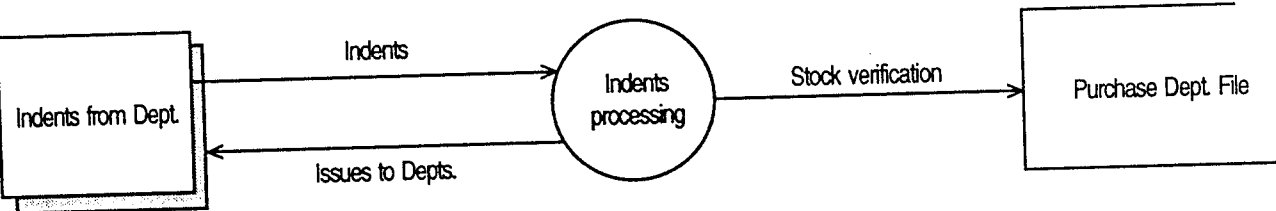
 - Ingres has more flexibility than any other RDBMS product such as to handle the maximum and the minimum fields per database.

 - In contrast to 3GLs such as COBOL, FORTRAN and PASCAL which require extensive programming experience to be used effectively, the Ingres 4GL allows the user to create forms-based applications with minimum knowledge.

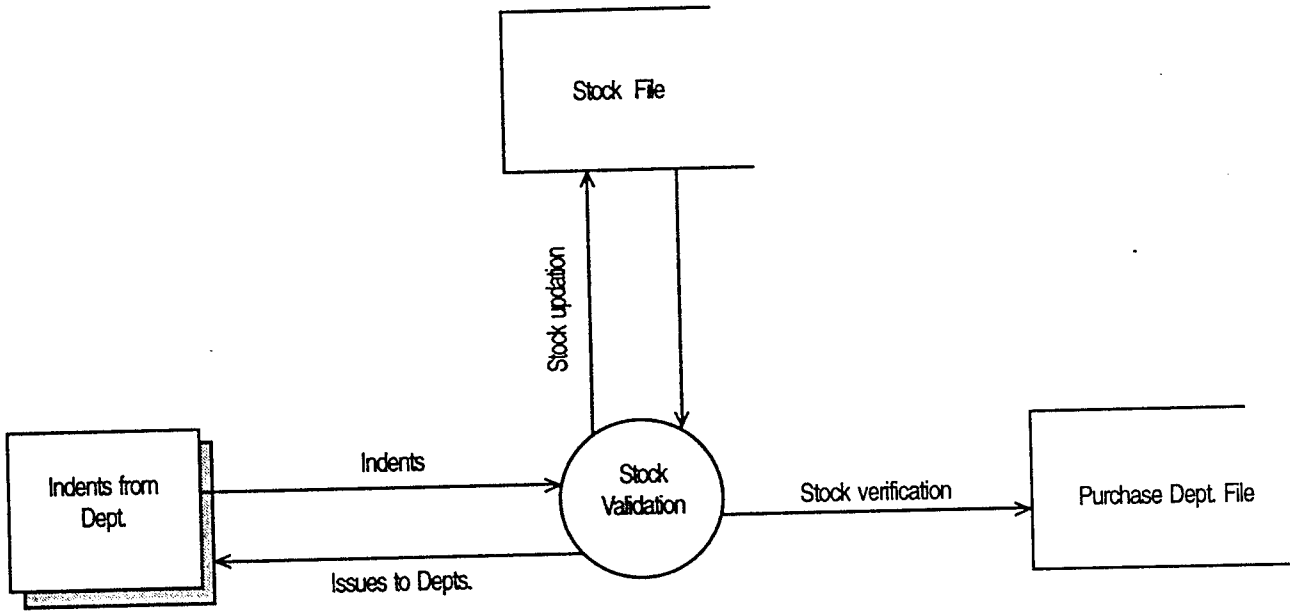
 - Ingres stores the source file in a directory that the user designates and incorporates it with the compiled version into the system catalogues. Thus, any time the source file can be edited, Ingres automatically recompiles before the application is run.

2.8 DATAFLOW DIAGRAMS

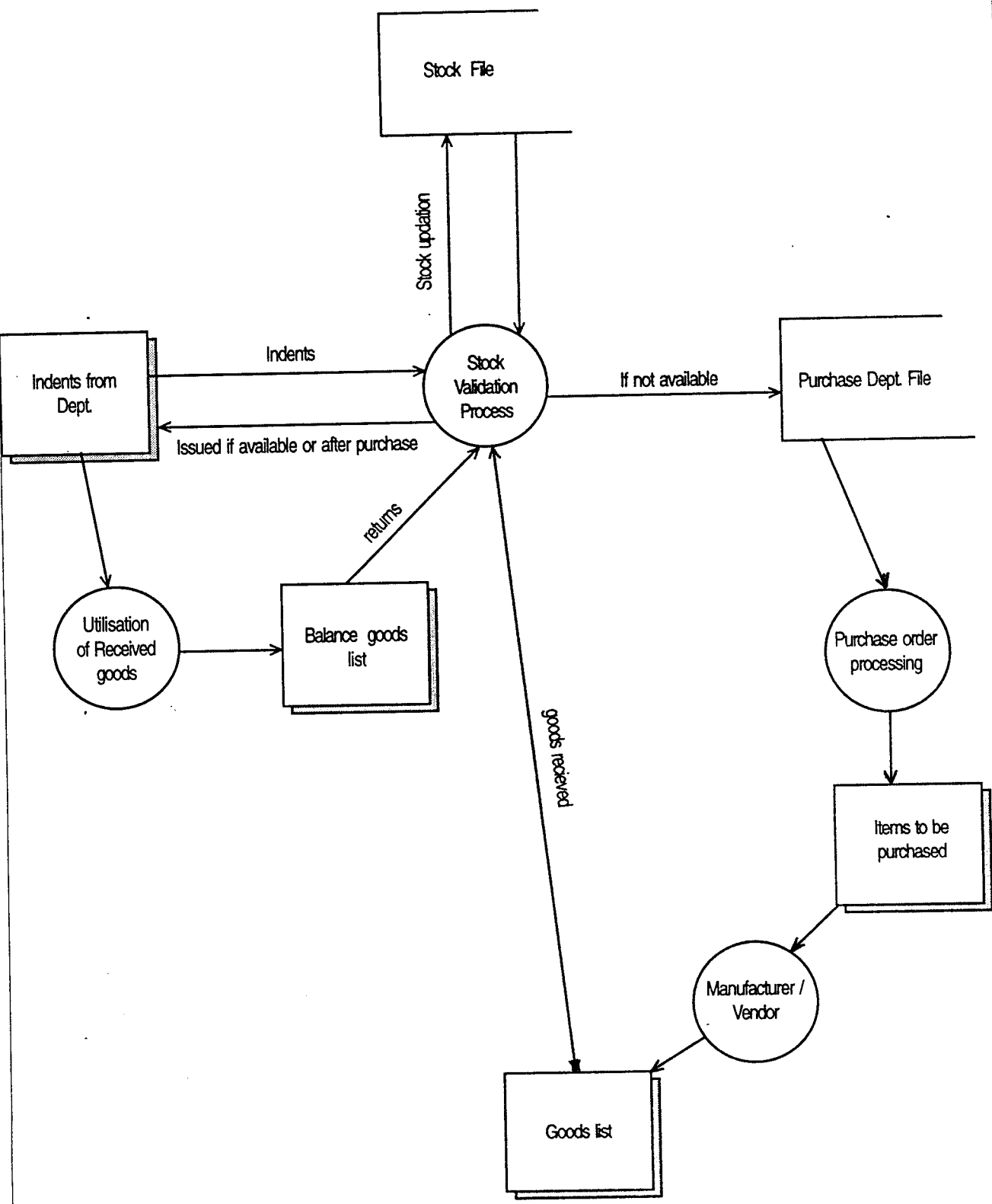
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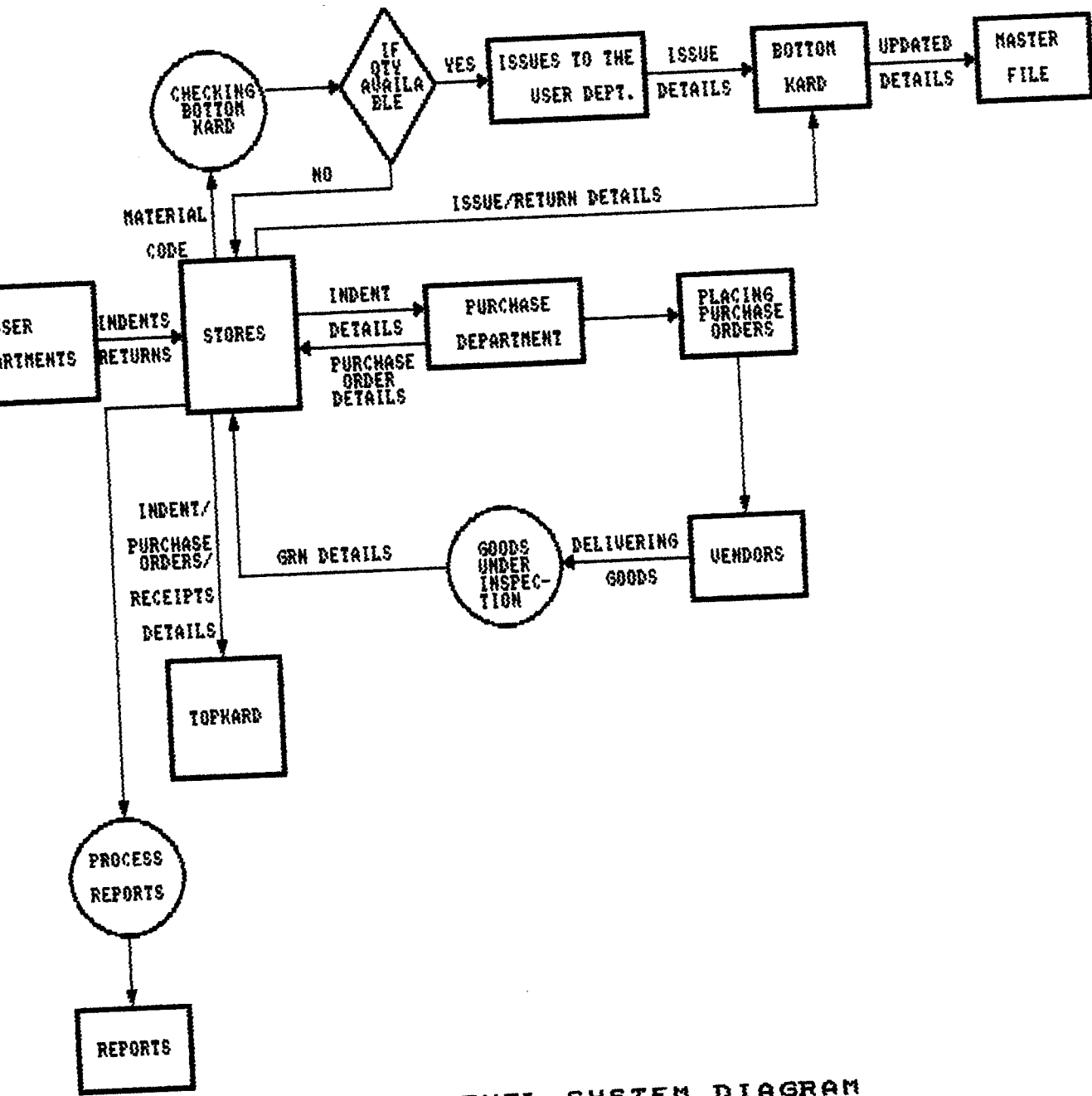


IInd level DFD



IIIrd level DFD





LOW LEVEL SYSTEM DIAGRAM OF KARDEX SYSTEM

3 SYSTEM DESIGN

3.1 INTRODUCTION

With the approval of the proposed system by the management, the system designing was started. The purpose of system design stage is to develop a complete working system from the specifications produced in the analysis stage. The system design is composed of several steps. The system design includes the following,

- Input Design
- Output Design
- Process Design
- Database Design
- Menu Organization

Three major modules were identified for the system. Each modules were further subdivided into submodules.

3.2 INPUT DESIGN

All data entry screens are of interactive nature so that the user can directly input data. In most cases, amount of data exceeds the screen size. As a result, automatic scrolling of the fields is provided. Extensive care has been taken to ensure validity of input data. The data can be updated or cancelled during an operation. Codes are all internally generated. On-line error messages are displayed on the message line: The facility for adding / deleting / updating master data tables is also provided. Provision for entering repeating data is also provided.

The general features of the screen are :-

- Columnised data entry for ease.
- Well defined messages.
- Clear labels for menu items and fields.
- Clutter free screens.
- Pop-up list field values were ever necessary.
- On-line help for all screens.

Sample screens are given in the sample report section.

3.3 OUTPUT DESIGN

Depending on the nature and the future use of the output required, they are either displayed on the monitor for immediate need or a print file is created. The output screens are clutter free and provision is provided for multiple page browsing. The output module for this system is obtained in the form of reports. The reports are provided for the purpose of reference, on details of material which are dues-in, list of items that have reached the ROL, Age-wise report, Top kard and Bottom kard reports, and also on minimum level, EOQ etc.

3.4 PROCESS DESIGN

Process design is the process of manipulating the input data in the tables for the required output. The three modules viz the Top kard, Bottom kard and reports further consists of submodules. Both the main modules are not entirely independent. The first two modules are further divided into Appending, Editing and Queries.

The details about a material is entered into the Kardex system through the Top kard data entry form. Correspondingly certain fields in the

Bottom kard is also updated if there is inflow or outflow of material. Such repeated entries are automated. The entry corresponding to a material present in the master table is made specifying the transaction type which can be Indents, Purchase Orders or goods received. Extensive checking is included for data validation where ever necessary. In case of a receipt of material, provision is made for entry of supplier name along with the updation of stock balance for the above into the bottom kard. The various Queries required are that of Dues-in of a particular material given its code, Top kard details for Indents against Purchase Orders, Purchase Orders against receipts and yearly consumption which is necessary for the stores manager for decision making. The user departments may also make use of the above facilities before they raise their indents.

The second module also comprises of appending, editing and querying the bottom kard. Issues to user department are taken care in this module. The receipts of material is already done by the first module. In case of issues the department to which issue is made is stored here along with other details such as material requisitions number. Clerical corrections and Physical verifications are all done here. Only the balance field need be modified by physical corrections. Queries on the stock balance and details about to which material requisition the issue was made are

provided here. The materials whose stock which have gone below the ROL level is pushed into report for reference silently.

All the necessary reports pertaining to stores are clubbed into the third module. The reports include Dues-in of materials, materials that have reached the ROL, Age-wise non-moving items, EOQ and minimum quantity of materials, Annual Stock report etc. Options are included to produce hard copy and soft copy of reports or to simply display them on the screen.

Necessary help screen and extensive validation are accommodated in the system. A list of valid field entries is also provided where ever need arises. Much effort was put to make the system user-friendly.

3.5 DATABASE DESIGN

Database design is a two phased process. First, the logical database design is made, where a conceptual database structure is built based on the user's requirement. The second phase, called physical database design, is the process of formulating the logical design in terms of DBMS facilities.

Database Modelling

Database modelling is a vocabulary for describing the structure and processing of a database. It is an important design tool for designing the logical and physical database. The Relational Model

was used to design the logical database. The relational model organizes data in one uniform representation. All data in a relational database is represented in the form of two-dimensional tables related together by common attributes. The relational data model consists of at least three components namely data structures, operators and integrity rules.

i) Data Structures :

All data is organized into two-dimensional tables called relations. The rows are referred to as tuples and the columns are called attributes of the relation. The tables are constrained in the following ways.

- All entries in a column are of the same kind
- All columns are assigned distinct names
- Ordering of columns is not significant
- Duplicate rows are not allowed in any relation
- Each column-row intersection contains a single value
- Ordering of rows is not significant

Each tuple in a relation can be identified by the value of its attributes. In some cases, just one attribute can uniquely identify the tuple. In others, a combination of attributes may be defined as a key. These attributes are called the primary key. A relation may also contain foreign keys that reference other relations in a database.

ii) Operators :

Three fundamental operations can be performed on the relations namely:-

- Selection : Create a subset of all rows in a table
- Projection : Create a subset of all columns in a table
- Join : Combine two tables on a common column.

iii) Integrity Rules :

Integrity rules are designed to protect the database from unauthorized users to maintain its logical consistency. Two such rules are important.

They are :-

- Entity Integrity : There must always be a primary key in any relation.
- Referential Integrity : A foreign key must either be null or the value of the primary key of an associated table.

NORMALISATION

Normalisation is a step-by-step technique for transforming data subject to a whole range of file maintenance problems into an organised database free from such problems. Normalisation can be done by directing tables through a number of levels of normalisation. It is carried out in four steps:-

- Represent the data as an unnormalised table or relation.
- Transform the unnormalised tables to the 1st normal form (1NF).
- Transform the 1NF tables to 2nd normal form (2NF).
- Transform 2NF tables to 3rd normal form (3NF).

First Normal Form:

Unnormalised data is reduced to first normal form by removing repeating groups and turning such groups into separate relations.

Second Normal Form:

When we remove part-key dependencies from first normal form, we get the second normal form. Relations having a compound key are examined. If an attribute can be identified solely through part of the compound key, then a separate relation can be formed.

Third Normal Form:

Third normal form can be obtained by removing inter-data and inter-key dependencies. If the values of the fields are independent of each other, then we can split off the relevant fields into their own separate relations.

Three tables are used in the development of the system. The table containing the material code, Description, EOQ, ROL, Minimum level, Maximum level etc., are only modified once in many years and only if need

arises so is considered to be the master table. The remaining two are used to recording the details pertaining to Indents, Purchase Orders, Receipts, Issues and Returns. The Receipt dates in the material master are updated from the top kard table when ever there is a receipt. The Quantity on hand, Issue date, sheet no and line no for each material are updated from he bottom kard. The sheet no and line no are in the bot- tom kard are used for accounting purposes. To avoid confusion during data entry these two fields are automatically generated. Tables are cre- ated using Ingres Table Utility.

There are three main tables used in this application along with some other tables to assist these tables. The tables used are listed as follows:

3.6 DATA DICTIONARY

DATABASE : **Jute**

TABLES

Name : **Materialmaster**

COLUMN NAME	DATA TYPE	LENGTH	NULLS	DEFAULTS	KEYSEQ
matcode	char	11	no	no	1
matdes	char	50	no	yes	
matuom	integer	2	no	yes	
matqoh	float	4	no	yes	
phybal	float	4	no	yes	
matissdt	date	8	no	yes	
matrecdt	date	8	no	yes	
mateoq	float	4	no	yes	
matrol	float	4	no	yes	
matmax	float	4	no	yes	
matmin	float	4	no	yes	
matshno	integer	2	no	yes	
matlnno	integer	2	no	yes	
matkardex	integer	11	no	yes	
consc	float	4	yes	no	
cons1	float	4	yes	no	
cons2	float	4	yes	no	
cons3	float	4	yes	no	

Name : Topkard

COLUMN NAME	DATA TYPE	LENGTH	NULLS	DEFAULTS	KEYSEQ
kardmatcode	char	11	no	no	1
kardno	integer	2	no	yes	
kardtrtype	char	1	no	yes	
kardtrdt	date	8	no	yes	
kardtrno	char	5	no	yes	
kardqty	float	4	no	yes	
kardref	char	20	no	yes	

Name : BottomKard

COLUMN NAME	DATA TYPE	LENGTH	NULLS	DEFAULTS	KEYSEQ
kardmatcode	char	11	no	no	1
kardtrtype	char	4	no	yes	
kardtrno	char	5	no	yes	
kardtrdt	date	8	no	yes	
party	char	30	no	yes	
kardqty	float	4	no	yes	
kardbinbal	float	4	no	yes	
kardshno	integer	2	no	yes	
kardlnno	integer	2	no	yes	
kardref	char	20	no	yes	

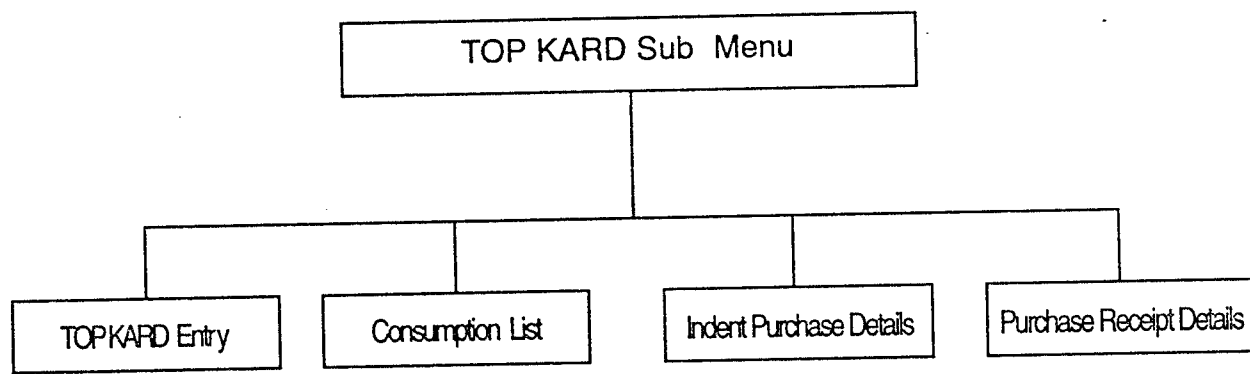
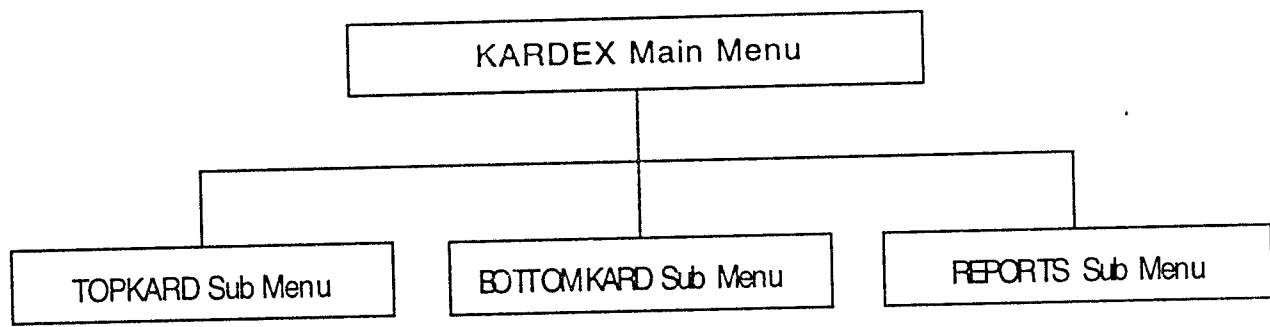
3.7 MENU ORGANISATION

The system is totally menu-driven. The menu structure is designed in such a way that the user can navigate with ease across the menus either by pressing the needed cursor keys or the keys corresponding to the starting alphabet of the needed option.

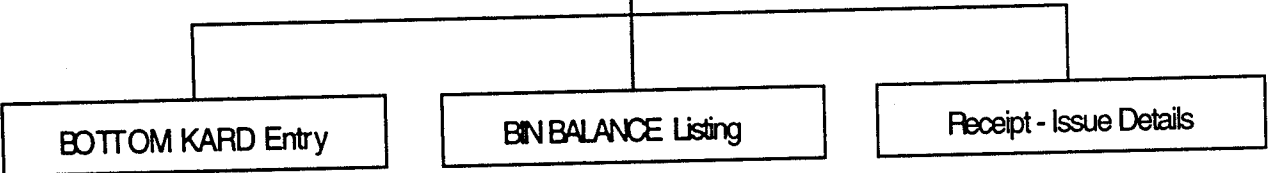
Sample menu screens are given in the sample reports section.

4 SYSTEM DEVELOPMENT AND TESTING

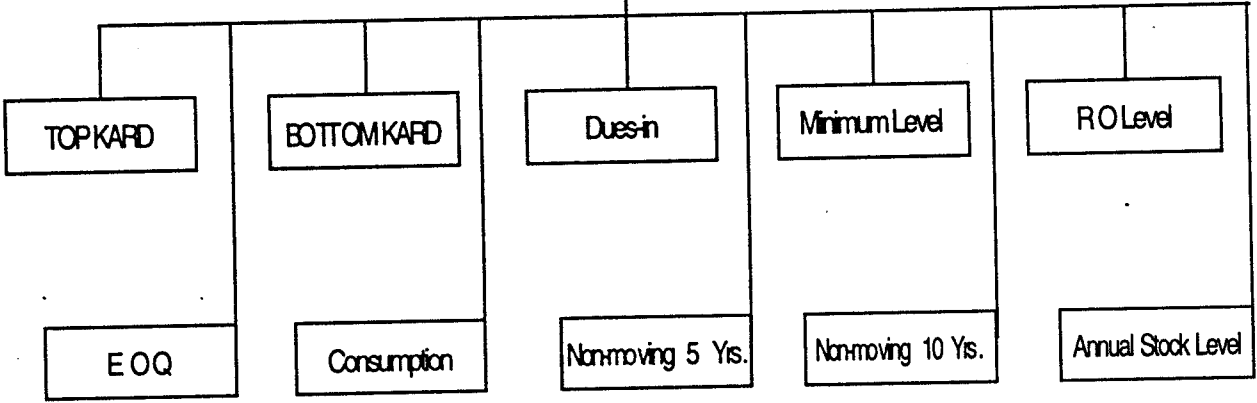
4.1 DIAGRAMS SHOWING VARIOUS MENU OPTIONS



BOTTOM CARD Sub Menu



REPORTS Sub Menu



4.2 INTRODUCTION

Kardex system is interactive, menu driven, user friendly system to exercise effective control in the stores management and material control. Stores management is of high priority for the whole company due to the fact that all plants are continuously working twenty four hours a day. Thus in order to prevent interruption of production, there should be effective management of the stores. Computerisation of Kardex system helps effective management of stores by providing the accurate information at the right time.

4.3 HOW SYSTEM WAS DEVELOPED

1. The Hardware

The system was developed on DRS/NX 6000 Supermini. The configuration is as follows :-

64 MB RAM

2 GB Hard Disk

1.2 MB Floppy Disk Drive

2. The Software

The system was coded using Ingres 4GL and embedded SQL in C language. The user interface was developed using the Ingres tools, Application By Forms and Ingres Vision. The application programs use these menus and forms as the user interface. The reports were done using Report-by-forms, Report writer and embedded SQL in C language.

To determine the system requirement, the present system was studied. The methods used were interviews with the staff of stores department, FACT , examination of the various data entry forms and reports, observation of the manner in which related reports were handled etc. gave an insight to the present system. Since the system developed uses computers the task of inventory personnel is much simplified as repeated entry to corresponding fields were automated.

This was followed by database design. Tables were created in the unnormalised form and were normalised to the required format. The interaction with the users of the system was maintained throughout the development and their opinion were given importance as to how they

wanted the system to function. The order of the data entry is preserved as was in the old system. Certain fields were clubbed together and assigned flags, in order to reduce complication.

4.4 SYSTEM TESTING

The system was tested with sample data. It was found that the system was working satisfactorily. The accuracy of the systems functioning was checked and was found to be much better than the old system. The sample reports generated were also found to be accurate.

Some sample reports are given in the sample report section.

4.5 FUTURE ENHANCEMENT

The system can be expanded to include more options of queries and reports based on the data already stored. The kardex data entries can be totally automated and necessary reports can be generated as and when required. A computerised Kardex system was long overdue for the stores and will definitely enhance the management of stores.

4.6 SAMPLE REPORTS

The following pages contain some of screens and reports used in the system for various operations.

THE FERTILIZERS AND CHEMICALS TRAVANCORE LTD
COCHIN DIVISION

DATE
5/31/96

KARDEX SYSTEM MAIN MENU

0 MENU
0 MENU
MENU

menu options for top kard
menu to Botomkard
menu for reports

Press MENULINE Key to activate corresponding Action.
Press F1 to scroll MENULINE

(F6) Help (AltF5) End (F3)

THE FERTILISERS AND CHEMICALS TRAVANCORE LTD
COCHIN DIVISION

DATE
5/31/9

MENU OPTIONS FOR TOPKARD

NS	FUNCTONS
RD ENTRY	Data entry to top kard
MPCTION LIS	List of Items and Consumption rate
URCH DETAI	Indent to Purchase order listing
H-REC DETAI	Purchase Reciept Details

Press key on MENU LINE to activate corresponding function.
Press F1 to scroll MENULINE

ct(F6) Help(AltF5) TopFrame(AltF3) End(F3)

Data entry to top kard

: 5/31/96

Description :

A/C Unit:

Q O H :

E O Q :

M A X :

ance:

D L :

I N :

Kard No	Trans No	Trans Dt	Quantity	Trans type	Reference

Clear(AltF2) ListChoices(AltF10) Help(AltF5) >

Data entry to top kard

: 5/31/96

e : 04161226647

Description : pressure gauge

A/C Unit: 1

Q O H : 50.000

E O Q : 50.000

M A X : 60.000

Balance: 500.000

O L : 25.000

I N : 20.000

Kard No	Trans No	Trans Dt	Quantity	Trans type	Reference
3	5438	18/03/96	10.000	r	p005
3	9087	29/02/96	3.000	r	p002
3	1854	28/02/96	3.000	r	p003
3	1090	28/7/95	12.000	r	p003
3	1008	20/6/95	10.000	r	p001
3	p005	15/2/95	10.000	p	i001
3	p004	14/2/95	15.000	p	i001
3	p003	13/2/95	15.000	p	i001

(F6) Save (F10) RowInsert (AltF3) ListChoices (AltF10) >

LIST OF ITEMS AND CONSUMPTION RATE

31/5/96

de:

Description:

A/C Unit :

R O L :

Maximum Qty:

Minimum Qty:

CONSUMPTION RATES FOR THREE CONSICUTIVE YEARS

Current year:

Last year:

Second last :

3rd last :

Kard No	Trans Type	Trans dt	Trans No	Quantity	Reference

) Clear(AltF2) ListChoices(AltF10) Help(AltF5) >

LIST OF ITEMS AND CONSUMPTION RATE

31/5/96

de: 04161226647

Description: pressure gauge
A/C Unit : 1

Maximum Qty: 60.000

R O L : 25.000
Minimum Qty: 20.000

CONSUMPTION RATES FOR THREE CONSICUTIVE YEARS

Current year: 32.000
Second last : 34.000

Last year: 40.000
3rd last : 45.000

Kard No	Trans Type	Trans dt	Trans No	Quantity	Reference
3	r	18/03/96	5438	10.000	p005
3	r	29/02/96	9087	3.000	p002
3	r	28/02/96	1854	3.000	p003
3	r	28/7/95	1090	12.000	p003
3	r	20/6/95	1008	10.000	p001
3	p	15/2/95	p005	10.000	i001
3	p	14/2/95	p004	15.000	i001

Indents-Purchase Details

ce : 5/31/96

de : _____

Description: _____

A/C Unit : _____

R.O.L : _____

M I N : _____

A X : _____

ard Details on Indents and Purchases

o	IND Date	IND No	IND qty	P.O Date	P.O No	P.O Qty

6) Clear(AltF2) ListChoices(AltF10) Help(AltF5) >

Indents-Purchase Details

te :

de : 04161226647Description: pressure gaugeA/C Unit : 1R.O.L : 25.000M I N : 20.000I A X : 60.000

Card Details on Indents and Purchases

no	IND Date	IND No	IND qty	P.O Date	P.O No	P.O Qty
	10/2/95	i001	60.000	15/2/95	p005	10.000
				14/2/95	p004	15.000
				13/2/95	p003	15.000
				12/2/95	p002	10.000
				11/2/95	p001	10.000

: (F6) Help (AltF5) End (F3)

Purchase Receipt Details

: 5/31/96
e : _____

Description : _____
A/C Unit: _____

R.O.L : _____
M I N : _____

I N : _____
Kard details on Purchase and Receipts

no	P.O Date	P.O No	P.O Qty	Rec Date	Rec No	Rec Qty

Dues-In :

) Clear(AltF2) ListChoices(AltF10) Help(AltF5) >

Purchase Receipt Details

Account No: 04161226649

Description : polythene bag
 A/C Unit: 3

R.O.L : 600.000
 M I N : 500.000

M I N : 1200.000

Kard details on Purchase and Receipts

o	P.O Date	P.O No	P.O Qty	Rec Date	Rec No	Rec Qty
	13/5/89	746	100.000	10/6/89	1098	55.000
	12/5/89	765	200.000	10/6/89	1098	55.000

Dues-In : 190.000

THE FERTLIZERS AND CHEMICALS TRAVANORE LTD
COCHIN DIVISION

DATE
5/31/96

MENU OPTIONS IN BOTTOM KARD

BOTKARD ENTRY BINBALANCE Issue-recipepts	Enter data to bottom kard Item wise Binbalance listing Itemwise Issues-Recipepts Listing
--	--

Press MENULINE Key to activate corresponding Action.
Press F1 to scroll MENULINE

RD ENTRY(F11) BINBALANCE(AltF2) Issue-recipepts(AltF3) > :

Entry to Bottom kard

6/3/96

Description: _____

A/C Unit: _____

E O Q : _____

M A X : _____

No	TrDate	Party	Quantity	BinBalance	SheetNo	LineNo

Clear(AltF2) ListChoices(AltF10) Help(AltF5) >

Entry to Bottom kard

Date : 6/3/96

Code : 04161226648

Description: vacuum pump

A/C Unit: 1

L : 8.000

N : 5.000

E O Q : 12.000

M A X : 20.000

Tr No	TrDate	Party	Quantity	BinBalance	SheetNo	Lin
190	22/4/94	ammonia pl	1.000	7.000	1	5
110	22/4/94	caprolactu	1.000	6.000	1	4
1009	21/4/94	engg dept	1.000	7.000	1	3
200	20/4/94	computer s	2.000	8.000	1	2
401	19/4/94	Kirloscar	10.000	10.000	1	1

(F6) Save (F10) RowInsert (AltF3) ListChoices (AltF10) >

THE FERTILISERS AND CHEMICALS TRAVANCORE LTD
COCHIN DIVISION

DATE
5/31/96

REPORTS MENU

ITEM	DESCRIPTION
TOPKARD REPORT	Report on topkard
BOTKARD REPORT	Report on bottom kard
MINIMUM LEVEL	Materials at minimum level
R O L	Material at R.O.L.
E O Q	E.O.Q of Materials
CONSUMPTION	Report on material consumption
NM5	Non moving items (5 years)
NM10	Non moving items (10 years)
ASL	Annual stock report

Press KEY on MENULINE to activate corresponding function
Press F1 to scroll MENULINE

TOPKARD REPORT (F11) BOTTOMKARD REPORT (Alt+F2) >

THE FERTILIZERS AND CHEMICALS TRAVANCORE LTD

COCHIN DIVISION
KARDEX CONTROL - TOPKARD DETAILS

Code : 04161226647		Desc: pressure gauge					A/C
INDENTDATE	QTY	PONO	PODATE	QTY	GRN NO	DATE	
10/2/95	60.000	p005	15/2/95	10.000	5438	18/	
		p003	13/2/95	15.000	1854	28/	
					1090	28/	
		p002	12/2/95	10.000	8760	08/	
					9087	29/	
		p001	11/2/95	10.000	1008	20/	

LEVEL :-

: 20.000

: 60.000

Bin Balance: 50.000

: 25.000

THE FERTILIZERS AND CHEMICALS TRAVANCORE LIMITED

COCHIN DIVISION

AMBALAMEDU

KARDEX CONTROL - BOTTOMKARD DETAILS

code: 04161226647 Description: pressure gauge A/C unit: 1

GRN/MRIN/SAM	Quantity			Date	Stock Balance
	Receipts	Issues	Returns		
1008	10.000			20/6/94	10.000
1090	12.000			28/7/94	22.000
100		10.000		30/7/94	12.000
290			2.000	8/8/94	14.000
200		4.000		9/8/94	10.000
1854	3.000			28/02/95	13.000
9087	3.000			29/02/95	16.000
8760	7.000			08/03/95	23.000
5438	10.000			18/03/95	33.000

THE FERTILIZERS AND CHEMICALS TRAVANCORE LTD

COCHIN DIVISION

LIST OF DUES_IN ITEMS

Date : 03/06/96

SL CODE	DESCRIPTION	INDENTNO	PONO	DUES_IN QT
6305	PRESSURE GAUGE	1001	p001	20.000
6647	CO2 COMPRESSOR	1001	p004	15.000
6648	WAGON UNLOADING ARMS	1001	p003	21.000
6648	WAGON UNLOADING ARMS	1001	p002	19.000
6649	VACCUM RELIEF VALVE	8976	746	100.000
6649	VACCUM RELIEF VALVE	8076	765	145.000

UTILISERS AND CHEMICALS TRAVANCORE LTD_COCHIN DIVISION

AMBALAMEDU

ANNUAL CONSUMPTION REPORT FOR FOUR CONSECUTIVE YEARS

Date:03/06/96

L	DESCRIPTION	ANNUAL CONSUMPTION (units)			
		C-YR	L-YR	S-YR	T-YR
26659	PRILLING MACHINE	100.000	80.000	40.000	400.000
26647	PRESSURE GUAGES	20.000	10.000	35.000	20.000
34457	CARBON RINGS	100.000	200.000	400.000	50.000
57045	I/P CONVERTER	30.000	80.000	20.000	50.000
44570	ROTARY SCRAPER	1000.000	1300.000	2000.000	1300.000
23001	JVC COMPRESSOR	5.000	10.000	15.000	18.000
24009	OIL COOLER	10.000	45.000	30.000	10.000
70190	BUFFERS SIZE 40	100.000	140.000	75.000	120.000
34029	PARCOL SPARES	100.000	20.000	25.000	50.000
56620	COPPER CABLE	20.000	40.000	70.000	50.000
32004	LOAD CELL	30.000	10.000	20.000	18.000
43005	MUW PUMP + SPAR	45.000	30.000	20.000	18.000
33456	TACHNO GENERATO	30.000	80.000	60.000	30.000
56680	DRYCELL	4554.000	531.000	451.000	466.000
225651	4994 spares	54040.000	49494.000	377373.000	37737.000

is the list of annual consumption of materials for four consecutive

FERTILISERS AND CHEMICALS TRAVANCORE LTD_COCHIN DIVISION
 AMBALAMEDU

MINIMUM LEVEL REACHED ITEM'S LIST

Date:03/06/96

CODE	DESCRIPTION	QTY ON HAND	MINIMUM QTY	CONSUMPTION(C...
559	PRILLING MACHINE	220.000	250.000	100.000
570	ROTARY SCRAPER RCC	800.000	1000.000	1000.000
520	COPPER CABLE	20.000	40.000	20.000
680	DRYCELL	1500.000	1064.000	1554.000
551	4994 spares	51420.000	53333.000	54040.000

These are the list of items that has reached MINIMUM LEVEL

THE FERTILIZERS AND CHEMICALS TRAVANCORE LIMITED
COCHIN DIVISION
AMBALAMEDU

LIST OF NON-MOVING ITEMS FOR 5 yrs

Date: 03/06/96

L CODE	DESCRIPTION	QTY ON HAND	ISSUE DATE
226690	TACHO METER	13.000	10/7/89
323001	JVC COMPRESSOR	3.000	02/03/89
324009	OIL COOLER	7.000	12/08/89
667045	I/P CONVERTER	13.000	23/03/90
323651	4767 spares	103.000	30/03/91

FERTILISERS AND CHEMICALS TRAVANCORE LTD_COCHIN DIVISION

AMBALAMEDU

ANNUAL STOCK LEVEL REPORT

Date:03/06/9

AL CODE	DESCRIPTION	QTY ON HAND	MIN QTY	MAX QTY
226659	PRILLING MACHINE	220.000	250.000	500.
226647	PRESSURE GUAGES	10.000	10.000	50.
334457	CARBON RINGS	1000.000	100.000	500.
667045	I/P CONVERTER	50.000	50.000	100.
344570	ROTARY SCRAPER RCC	800.000	1000.000	2500.
323001	JVC COMPRESSOR	30.000	8.000	20.
324009	OIL COOLER	20.000	35.000	50.
670190	BUFFERS SIZE 40	100.000	50.000	200.
634029	PARCOL SPARES	200.000	20.000	100.
556620	COPPER CABLE	20.000	40.000	75.
232004	LOAD CELL	15.000	10.000	30.
543005	MUW PUMP + SPARES	30.000	20.000	50.
133456	TACHNO GENERATOR	50.000	20.000	100.
456680	DRYCELL	0.000	64.000	6774.
225651	4994 spares	0.000	3333.000	37377.

This is the current year STOCK LEVEL of materials

5 CONCLUSION

The entire Kardex Control System is computerised. The details pertaining to Indents, Purchase Orders, Receipts, Issues and Returns are recorded. This work is performed in such a manner that even an end user can use it. The necessary menu items and messages are displayed wherever necessary. This work can be future extended for the disposal of scrap materials also.

 Application Information -----

Application Name: kard2
 Application Owner: train
 Creation Date: Mar 29, 1996 10:43 a.m.
 Last Modify Date: Mar 29, 1996 12:49 p.m.
 Short Remark: 'kardex system'
 Source Directory: /home/train/kard/den
 Query Language: SQL
 Default Start: kard2 (Frame)

 Application Flow Diagram -----

-- TOP --] -> Menu Frame: kard2
 [TOPKARD MENU] -> Menu Frame: topkard
 [TOPKARD ENTRY] -> Update Frame: topkentry
 [CONSUMPTION LIST] -> Browse Frame: itemlist
 [IND-PURCH DETAILS] -> Browse Frame: indpurdetails
 [PURCH-REC DETAILS] -> Browse Frame: purrecdetails
 [BOTKARD MENU] -> Menu Frame: botkardmenu
 [BOTKARD ENTRY] -> Update Frame: botkardentry
 [BINBALANCE] -> Browse Frame: binbalance
 [Issue-receipts] -> Browse Frame: issuereceipts
 [REPORT MENU] -> Menu Frame: reportmenu
 [TOPKARD REPORT] -> Procedure: tpk
 [BOTTOMKARD REPORT] -> Report Frame: btkardreport
 [DUES-IN REPORT] -> Procedure: duesin
 [MINIMUM LEVEL] -> Report Frame: mini
 [R O L] -> Report Frame: rol
 [E O Q] -> Report Frame: eoq
 [ANNUAL CONSUMPTION] -> Report Frame: cons
 [NM5] -> Report Frame: nmv5
 [NM10] -> Report Frame: nmv10
 [ASL] -> Report Frame: sk

 Frame Details -----

Frame Name: binbalance
 Type: Browse Frame
 Owner: train
 Creation Date: May 30, 1996 09:48 a.m.
 Last Modify Date: May 30, 1996 09:49 a.m.
 Short Remark: 'Item wise Binbalance listing'

Owner: train
Creation Date: May 30, 1996 04:08 p.m.
Last Modify Date: May 30, 1996 04:12 p.m.
Short Remark: 'Enter data to bottom kard'

Frame Name: botkardmenu
Type: Menu Frame
Owner: train
Creation Date: Apr 3, 1996 11:31 a.m.
Last Modify Date: Apr 3, 1996 11:31 a.m.
Short Remark: 'menu to Botomkard'

Frame Name: btkardreport
Type: Report Frame
Owner: train
Creation Date: May 23, 1996 10:11 a.m.
Last Modify Date: May 23, 1996 10:21 a.m.
Short Remark: 'Report on bottom kard'

Frame Name: cons
Type: Report Frame
Owner: train
Creation Date: May 15, 1996 09:34 a.m.
Last Modify Date: May 15, 1996 10:44 a.m.
Short Remark: 'Report on material consumption'

Frame Name: duesin
Type: Procedure
Owner: train
Creation Date: May 23, 1996 10:15 a.m.
Last Modify Date: May 23, 1996 10:15 a.m.
Short Remark: 'Report on items due'

Frame Name: eoq
Type: Report Frame
Owner: train
Creation Date: May 15, 1996 09:39 a.m.
Last Modify Date: May 15, 1996 10:46 a.m.
Short Remark: 'E.O.Q of Materials'

Frame Name: indpurdetails
Type: Browse Frame
Owner: train
Creation Date: May 29, 1996 11:23 a.m.
Last Modify Date: May 30, 1996 10:30 a.m.
Short Remark: 'Indent to Purchase order listing'

Owner: train
Creation Date: may 3, 1996 09:50 a.m.
Last Modify Date: may 3, 1996 09:51 a.m.
Short Remark: 'Itemwise Issues-Reciepts Listing'

Frame Name: itemlist
Type: Browse Frame
Owner: train
Creation Date: Apr 26, 1996 02:32 p.m.
Last Modify Date: May 31, 1996 12:51 p.m.
Short Remark: 'List of Items and Consumption rate'

Frame Name: kard2
Type: Menu Frame
Owner: train
Creation Date: Mar 29, 1996 10:43 a.m.
Last Modify Date: Mar 29, 1996 10:43 a.m.
Short Remark: 'kardex system'

Frame Name: mini
Type: Report Frame
Owner: train
Creation Date: May 15, 1996 11:19 a.m.
Last Modify Date: May 15, 1996 11:23 a.m.
Short Remark: 'Materials at minimum level'

Frame Name: nmv10
Type: Report Frame
Owner: train
Creation Date: Apr 24, 1996 03:17 p.m.
Last Modify Date: May 15, 1996 10:52 a.m.
Short Remark: 'non moving items (10 years)'

Frame Name: nmv5
Type: Report Frame
Owner: train
Creation Date: Apr 24, 1996 03:15 p.m.
Last Modify Date: May 15, 1996 10:49 a.m.
Short Remark: 'non moving items (5 years)'

Frame Name: purrecdetails
Type: Browse Frame
Owner: train
Creation Date: May 29, 1996 03:38 p.m.
Last Modify Date: May 30, 1996 10:11 a.m.
Short Remark: 'Purchase Reciept Details'

Owner: train
Creation Date: Apr 24, 1996 03:06 p.m.
Last Modify Date: Apr 24, 1996 03:06 p.m.
Short Remark: 'menu for reports'

Frame Name: rol
Type: Report Frame
Owner: train
Creation Date: May 15, 1996 09:52 a.m.
Last Modify Date: May 15, 1996 11:38 a.m.
Short Remark: 'Material at R.O.L.'

Frame Name: sk
Type: Report Frame
Owner: train
Creation Date: May 15, 1996 09:59 a.m.
Last Modify Date: May 15, 1996 10:48 a.m.
Short Remark: 'Annual stock report'

Frame Name: topkard
Type: Menu Frame
Owner: train
Creation Date: Mar 29, 1996 10:55 a.m.
Last Modify Date: Mar 29, 1996 10:55 a.m.
Short Remark: 'menu options for top kard'

Frame Name: topkentry
Type: Update Frame
Owner: train
Creation Date: May 28, 1996 11:07 a.m.
Last Modify Date: May 30, 1996 10:18 a.m.
Short Remark: 'Data entry to top kard'

Frame Name: tpk
Type: Procedure
Owner: train
Creation Date: May 23, 1996 10:06 a.m.
Last Modify Date: May 23, 1996 10:06 a.m.
Short Remark: 'Report on topkard'

SOFTWARE : INGRES RDBMS Ver 6.4
 OPERATING SYSTEM : UNIX SVR 4 with unlimited user licence.

INGRES is an RDBMS and has the advantages like sharing of data, restricting unauthorized access, providing multiple interface, complex relationship among data, backing up and recovery of data, data redundancy etc. INGRES is an acronym for **I**nteractive **G**raphics and **R**etrieval **S**ystem. It allows both end-users and programmers to store and retrieve data from database that are perceived as a collection of relations or tables. Data is the basic building block of a database. The data types supported by INGRES includes,

1. character (fixed size or variable size)
2. integer (1 byte, 2 bytes or 4 bytes)
3. float (4 bytes or 8 bytes)
4. date (12 bytes)
5. money (6 bytes).

An INGRES database is a collection of tables. In INGRES you work with one database at a time. You can have one or more tables stored in the database, normally the tables in the database are related. Whenever you need to perform a task on the data within the database, data is stored together in the database and then there are view definitions, reports, forms, indexes, OBF objects, graphs etc. to operate on it.

1. TABLES:

Data are stored in tables or relations, a two dimensional matrix having rows and columns, where the horizontal dimension is user definable and hence column width is adjustable to take in whatever size of data that user requires. The intersection of a row and a column contain a data value. Ingres allows a maximum of 127 columns in a table.

Each column has a name that uniquely identifies the column in the table. Each column is assigned a data type to indicate the data to be stored and the length of the data. Each column can also be specified whether it can take null value or not.

A null value is a special value that represents unknown or unavailable data. A null value is treated differently with a blank or a zero. If the null value is zero, then we can specify whether the column should take default values when is not entered. The value 0 is taken in case of numeric field and blanks in the case of character fields. If the null value is 'No' and the default value is 'No' then the column becomes a mandatory column which means that the user has to enter data in the column.

2. INDEXES:

Data can be accessed at a much faster rate if the search of a record is done on the basis of a particular field. This field may be unique or non_unique and this field is specified as the key field. An index is created on this key field and each key field points to the record in the data page containing the value. INGRES use the index to go directly to the page within the table where the row with the key resides.

When one table needs more than one key, secondary indexes provide a secondary key which are actually tables, automatically tied to the base table and updated when the base table is changed. There is a row in the secondary index for every row in the base table. There is also a column called tids. This is the tuple identifier of the row in the base table. There are two limits to number of secondary indexes that can be created on the table.

3. VIEW DEFINITIONS:

A view definition is a user defined choice of seeing data held within a table. A table may store data quite differently from the way in which the user may want to see it, a view definition is therefore a INGRES tool which enables users to define the manner in which they wish to see the data stored in the table.

Views are database objects, especially helpful when the DBA wants to restrict the data that the

4. REPORTS:

A report is a database object that displays the data from a table or a view in a user defined format. You can produce an Ingres report on the monitor or in a file or on a printer.

5. FORMS:

A form is the ingres method of giving the user of the system a familiar medium to use i.e. a paper form. Some forms are created automatically and others are user defined to fit the columns of an INGRES table.

INGRES FRONT ENDS

1. VIFRED

A forms-based system that allows developers to create forms for use in a customized forms-based system.

2. QBF

A forms-based system that enabled the user to append, retrieve and update data onto one or more tables. It also helps you create join definitions.

3. TERMINAL MONITOR

A forms-based system that allows users to specify query language statements, execute the query statements and view the results.

4. VIGRAPH

A forms-based system to create, display and print graphs.

5. REPORT WRITER

A language that allows the developer to define custom reports.

6. RBF

A forms-based system that allows users to create default report specifications.

7. ABF

A forms-based application development system that allows developers to use INGRES/4GL to write, compile, and execute programs.

8. VISION

A forms-based application code generator that allows user to build and test an application quickly by responding to prompts and choosing menu operations. The 4GL code is generated automatically and can be customized using other INGRES tools.

BASIC INGRES ARCHITECTURE

INGRES is divided into the following sections:

1. INGRES DATABASE

2. USER INTERFACE

The Terminal Monitor

INGRES tool set

Customized Application Program

The interface accepts instructions from users, converts these instructions to SQL statements and forward them to the Data Manager. After the operations required by the SQL statements are performed on the table user interface displays the results to the end user.

3. THE DATA MANAGER

The data manager accepts query language instructions and performs the specified operations on the data within the database. All the basic tasks such as data updates, retrievals etc. are performed directly by the data manager. The user never communicates directly with the data manager but must give instructions to the INGRES data manager via one of the INGRES tools.

4. THE QUERY LANGUAGE - 4GL & SQL

with the DBA is via the INGRES query language called SQL

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INGRES AS A DISTRIBUTED DATABASE

The greatest advantage of INGRES is that it allows a system to be distributed across a network.

Distributed Access

This means any user at any site can obtain access to data from an Ingres Table as if it were on their computer.

Distributed Storage

Data stored at different network sites can be shared rather than duplicated at each site.

Distributed Processing

Data from any site can be processed anywhere in a network and can be stored at any required site.

Interoperability

To create a true distributed database environment, the tools available in Ingres are INGRES/NET, INGRES Gateway and INGRES/STAR.

1. INGRES NET:

Connects any number of sites using Ingres database including mainframes, minis and micro work stations & PCs. Users anywhere in the world using different computers can share the same database and the data held in its tables.

2. INGRES GATEWAYS:

This tool helps in access of non-Ingres data as if it were stored in an Ingres database.

3. INGRES STAR:

This tool enables the user to combine data held in different databases stored at different sites to a single database. Thus data is always available to those who require it, and data duplication is avoided.

Benefits of Using Ingres :

INGRES provides a multiple, multi-threaded Client/Server architecture, which is type of architecture that provides the following benefits :

- * Very Low Resource Utilization
- * Full Multiprocessor support
- * No architectural bottle necks

INGRES APPLICATION DEVELOPMENT TOOLS:

- * VIFRED (Visual Forms Editor)
- * Vision
- * Application-By-Forms (ABF)
- * Report Writer.

INGRES USER INTERFACE TOOLS:

- * Ingres/Menu
- * Query-By-Forms (QBF)
- * Report-By-Forms (RBF)
- * Tables Utility
- * Vision
- * Interactive SQL or QUEL

INGRES / 4GL

INGRES/4GL is a fourth generation language. With 4GL you can specify what you want to be done, not how to do it. 4GL is generally non-procedural, allowing the application developers and the end user flexibility in choosing which operations takes place in a session.

INGRES / 4GL provides 3 major functions:

- Accessing databases in a number of ways.
- Provides control over screen management through FRS(Forms Runtime System)
- Provides control over how commands are executed.

INGRES / 4GL supports the standard SQL and INGRES proprietary QUEL. The INGRES 4GL source file is edited using an ASCII editor.

ABF, the INGRES application development tool, allows you to define, test and run fully developed applications without having to use a conventional programming language. Using ABF you can put together an entire application consisting of data entry, processing and report program. An ABF application uses standard INGRES forms and menus to access a database table and perform a series of operations like queries, updation and reports.

The highest object that ABF manipulates is an application. An ABF application is restricted to operations in a single database, since the important components of the application resides in the database itself. An ABF application may include these components :

1. FRAMES

The basic operational unit of application. A frame has two components attached to it i.e. a form and an INGRES 4GL source code containing a set of menu items that lead to specific INGRES operations. Each of these menu items have blocks of statements performing a specific action. INGRES supports three types of Frames :

a. User-defined frame :

One that is defined by the developer of an application, i.e. the has to specify the operations to be performed by each of the menu items on the menu of that frame and create a form using VIFRED.

b. QBF Frame :

The application uses Query- By- Forms to access the database. The user has to create a form using .VIFRED, specify a table or a joindef and the command flags to be used by QBF when the frame is activated.

c. Report Frame :

A report in an application can be a default report created by RBF or an INGRES report

VIFRED on which the user can enter one or more values in the report at run time.

2. PROCEDURES

Separate modules of INGRES/4GL or a host language code that perform specific operations.

Procedures can be :

a. 4GL Procedure.

A 4GL procedure is written using 4GL code. It can be a stand-alone procedure (global) or embedded in a 4GL frame (local)

b. SQL/ Database Procedures.

A database procedure is a series of SQL statements and is stored as an object in the database.

c. Embedded SQL Procedures.

A ESQL procedure is written using SQL and a 3GL . These procedures allow you to connect to multiple databases.

d. 3GL Procedures.

A 3GL Procedure is written in 3GL only.

3. TABLES

Database Tables containing data on which the application operates.

4. REPORTS

Data formatted for display or printing.

5. FORMS

User's interface for performing operations on a database.

6. GLOBAL VARIABLES

Variables global to the scope of an application.

7. CONSTANTS

Names values global to the scope of an application.

8. RECORD TYPES

Named grouping of data types which can be treated as a single component.

Steps in Developing an Application

1. Create the application.
2. Create the database tables.
3. Define the forms in the application.
4. Define the global components and procedures.
5. Test the application during the definition
postage.
6. Create an executable image of the application when testing is complete.
7. Run the executable image from the operating system.

STORAGE STRUCTURE

The data for each Ingres table is stored in a file on the disk. Tables are broken into 2048 byte pages, with approximately 2000 bytes available to store user data and 48 bytes reserved for use by Ingres. Each page stores a certain number of rows. The number of rows per page varies according to the row width, the storage structure of the table, whether or not the table is compressed and how much data has been added or

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