"MATERIALS MANAGEMENT SYSTEM"

P-254

PROJECT REPORT

SUBMITTED BY

George Joseph

Under the Guidance of:

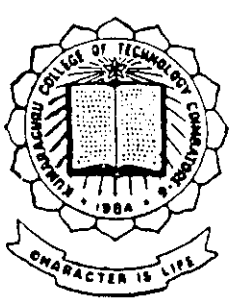
Mr. G. Balasubramanian B.E., M.S.,M.I.S.T.E.

in partial fulfilment of the requirements

for the award of the Degree of

Master of Computer Applications

of the ***Bharathiar University****, Coimbatore.*



Department of Computer Science and Engineering

Kumaraguru College of Technology

Coimbatore - 641 006

1995-96.

Kumaraguru College of Technology

Coimbatore -641 006.

Department of Computer Science and Engineering

Certificate

This is to Certify that the Project Report entitled

"Materials Management System"

has been submitted by

Mr. George Joseph

in partial fulfilment of the requirements for the award of Degree of Master of Computer Application, Bharathiar University, Coimbatore – 641 046 during the academic year 1995–'96.

(Guide) 5/6/96

(Head of Department)

Certified that the Candidate was Examined by us in the Project Work Viva-Voce Examination held on _____ *and the University Register Number is* _____

(Internal Examiner)

(External Examiner)

TO MY LORD, MY FATHER AND

MY MOTHER WHO MADE ME

WHAT I AM.

दि फ़र्टिलाइज़र्स एण्ड केमिकल्स ट्रावनकोर लिमिटेड

FACT

THE FERTILISERS AND CHEMICALS TRAVANCORE LIMITED

(A GOVERNMENT OF INDIA ENTERPRISE)

FACT MANAGEMENT DEVELOPMENT CENTRE

TELEPHONE: COCHIN 540801 TELEX: 0885-5004 / 5007 FACT IN FAX: 0484-532475

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COCHIN, INDIA

31-5-1996

Certified that

Mr./Ms. GEORGE JOSEPH

Student of KUMARAGURU COLLEGE OF TECHNOLOGY, COIMBATORE

has succeesfully completed Project Work*/ [illegible] at our FACT ENGINEERING AND DESIGN ORGANISATION (FEDO)

during the period from 1-1-1996 to 31-5-1996

*Title of Project Work "Materials Management System"

(Office Seal)

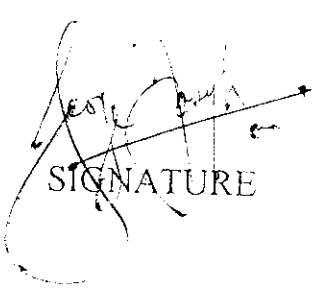
CHIEF ADMINISTRATOR

DECLARATION

I hereby declare that the Project work titled **MATERIALS MANAGEMENT SYSTEM** submitted to the BHARATHIAR UNIVERSITY, COIMBATORE in partial fulfillment of the requirements for the award of **MASTER of COMPUTER APPLICATIONS degree**, is a record of original work done by me under the supervision and guidance of Mr.G.Balasubramanian B.E,M.S,MISTE of Computer Science and Engineering Dept., and that it has not formed the basis for the award of any Degree/Diploma/Associateship/Fellowship or other similar title to any candidate of any University.

NAME : **George Joseph**

Reg.No : **9338M0188**



ACKNOWLEDGEMENT

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SYNOPSIS

This system **MATERIAL MANAGEMENT SYSTEM**, has been developed under UNIX environment, in **INGRES** 4GL RDBMS at FEDO (FACT Engineering and Design Organization). The system is specially developed for the use of Materials Department in FEDO. The Purchase Department produce the Purchase Order based on the requirement of items in different departments. The Purchase orders are mailed to the respective vendors and the vendors are requested to supply the items within the expected date. The items in the store have to be issued to contractors based on requests placed by them. The items have to be issued to contractors considering the availability of that particular item. The vendor may supply the items partially or fully. The stock should be updated when the items are received. There may be more than one item in a receiving receipt. Same as this each purchase order may contain more than one item to a particular vendor. The contractor request item quantity should not be greater than the stock level and the issued quantity should be less than the request quantity. The programs have been tested with sample data. This system can be applied to any organization for monitoring its efficiency, with limited modifications.

This package is similar to the existing system with modification for improving the efficiency and user friendliness of the system. This system is very user friendly and is fully menu driven. Even a person having no knowledge of computers can operate this system with much ease and accuracy.

CONTENTS

Introduction

ORGANIZATION PROFILE

FERTILIZERS AND CHEMICALS TRAVANCORE LTD - FACT, a leader in the fertilizer industry had its origin as early as 1943, ushered a new era in Indian Agriculture.Today FACT is a large multi-product, multi-divisional corporation with a turnover of about Rs.1000 crore.FACT has a number of divisions including

FEDO (FACT Engineering and Design Organization)

FEW (FACT Engineering Works)

CD (Cochin Division)

PD (Petrochemical Division)

UD (Udyogamandal Division) etc.

FEDO was established to meet the emerging need for utilizing indigenous capabilities in the vital areas of Engineering Design and Consultancy for building large, modern fertilizer plants. FEDO was recently accredited with the covetous ISO-9001 Certificate. FEDO is committed to :

- Customer satisfaction through engineering excellence.
- Achievement of the state of total quality management.
- Accomplishment of the corporate objectives.

FEDO is equipped to take up

1. Techno-economic feasibility studies.
2. Market surveys.
3. Process selection and evaluation.
4. Process engineering.
5. Detailed engineering.
6. Architectural design and town planning
7. Equipment procurement, inspection and shipping.
8. Construction.

9. Site management and supervision.

10. Off site design.

11. Start-up and commissioning.

12. Turn-key contracts.

13. After sales service.

14. Refinancing on deferred payment schemes.

15. Operation and maintenance of personnel training.

COMPUTERIZATION OF FACT

The complexity of this Multi-Division Corporation has accelerated automation in Information Technology by introducing computers of adequate capabilities starting with IBM Unit Record equipment in 1965. Today computerization covers a wide range of activities including,

- Production Management
- Material Management
- Maintenance Management
- Marketing Management
- Human Resource Management
- Financial Management and Engineering etc.

Milestones in Data Processing And Computerization :

1965 - Unit Record Machines for accounting applications.

1971 - IBM 1401 second generation computer for meeting additional Data Processing requirements.

1979 - Spectrum 7/31 of DCM data products for FEDO's design and detailed engineering activities.

1981 - IBM 1401 replaced with third generation TDC-316

1986 - Olympia/32, a mini computer was introduced at Udyogamandal.

1987 - Olympia/32 for FEDO's engineering activities. Olympia/32 at Cochin Division for integrated materials and maintenance management.

1988 - Introduction of CAD based PC-ATs at FEDO.

1989 - Commissioning of S-39 ICIM Fourth Generation mainframe computer as the apex data processing support.

1990 - Introduction of FACTNET (Network) in all divisions.

1994 - Introduction of DRS - 6000 Systems in Udyogamandal, Petro Chemical and Cochin Divisions. Introduction of ZeUS - 486 at FEDO and RAP.

WHY DATABASES ?

A database is a collection of related data. A database can be of varying size and complexity. Hence the information must be organized so that the users can append, search, retrieve and update data as required. The tool to achieve this is Data Base Management System.

ADVANTAGES OF DATABASES

1. Reduced Data Redundancy

In file management systems, data redundancy arises due to the fact that the same data has to be stored in physically separate locations. This may lead to Data Inconsistency and Data Insecurity. A DBMS overcomes this problem by allowing the users to share data. It also allows the creation of Views by which the end-user is enabled to see a part of the data and thus enforce security to a large extent.

2. Data Integrity

All DBMS has to enforce some level of data integrity on the database. This is done at the time database structuring is being defined. The user is given the facility to define what data type each cell can hold. Another common way is that data entered and saved in one database is checked against data held in another database.

Generally there are two kinds of data integrity enforced on a database.

1. Entity Integrity

2. Referential Integrity

3. Sharing of Data

A multiuser database must allow users to access the database at the same time. A concurrence control must be included to ensure that when several users are attempting to update the data in a centralized database, it is done in a controlled manner and that updates do not bring chaos or inconsistent data.

4. Restricting Unauthorized Access

The DBMS should be able to enforce security and authorization which has to be decided and administered by the DBA (Data Base Administrator).

5. Provide Multiple Interface

The DBMS must have several types of interfaces to provide access to the data, since there are different types of users.

6 . Complex Relationships Among Data

A DBMS must have the capability to represent a variety of complex relationships among database files as well as to retrieve and update data in such files based on these inter file relationships.

7. Backing Up and Recovery of Data

In case of an hardware or software failure, at the time of a complex update, the DBMS must have a built in recovery system that brings the database back to its original state.

8. Data Independence

The application program must be independent of the data file structure. Data independence is the immunity of applications to changes in storage structure and access strategy.

9. Multiple views of data

Database approach entails various users to view data in multiple formats in accordance with the requirements of the user.

There are three types of data base models :

1. HIERARCHICAL

2. NETWORK

3. RELATIONAL

RELATIONAL DATABASES

The relational model of data was formulated in the early 1970's by Dr. E.J. CODD at the San Jose Research Laboratory . Among the three data models,it has the simplest and the most uniform data structures and is formal in nature. It has been adopted by most database researchers as the best database model available, in spite of its imperfections.

It is based on the mathematical foundation - set theory. All database operations are performed on a set of data rather than on a single datum. The data is represented in the database as a collection of tables. The output of any query is also perceived as tables. It has an efficient and a simple Database Manipulation Language. There is a clear sharp boundary between the physical organization of the database and the user requirements. Hence there are no design-built biases and is easy to alter unlike other models.

The grouping of data items represents a relationship between these data items, so a table is also referred to as a relation. Each column of the table represents an attribute . One column or a combination of some columns are used for assessing the data called primary key column.

Referential integrity means ensuring that a value that appears in one relation for a given set of attributes also appears for a certain set of

attributes in another relation, i.e, limiting of a set of foreign key values to a set of primary key values.

Relational mathematics defines a variety of operators with which relations may be manipulated to achieve any desired tabular representation of the data. There are two types of operators. Unary-operand is a single relation Eg:- select,project. Binary- Two relations as operands. Eg :- union, difference, Cartesian product, join etc. These operations can be easily done using the SQL select statements.

When the integrity and accessibility of any company's data resources are at top priority, INGRES is one of the best Relational DataBase Management Systems available. Acclaimed for its superior technology by major analysts, INGRES has been a RDBMS leader for over ten years introducing pioneering breakthroughs in the SQL based database architecture, application development tools and open connectivity solutions.

System Analysis

THE EXISTING SYSTEM

The first objective of my project was to have a perfect and in-depth understanding of the system which was absolutely necessary . Towards the set objective I had a long and detailed talk with the Chief Materials Manager of the organization. This was followed by talks with employees at various levels of the organization. The system as such dealt with the management of materials within the organization. This was a very critical issue since availability of materials in the store whenever there is a request from projects was a must. The system is completely responsible for efficient and flawless management of materials. It is also responsible for a number of reports and queries to the top management or the respective departments . This was to assist decision making at different levels of the organization.

FEDO has got various departments like Electrical,Civil,Mechanical,Finance,Computer Services etc. and these departments will from time to time handling various projects. Material Requisitions(M.R) will be placed by them to the stores whenever they are in need of materials. If the item is available in the store it will be issued and a Stock Issue Voucher(SIV) is prepared. Otherwise ,the store will reject the Material Requisition and raise indents for those items to be forwarded to the Purchase Department.

The Purchase Department maintains a list of qualified vendors for each item. Enquiries are mailed to the respective vendors for the items. The vendors will submit quotations for the items.The quotations or bids are evaluated and compared for competitive rates and certain other factors. The most suitable vendor or vendors are recommended for approval from the Finance Department . Once approval is obtained Purchase Orders are sent out to vendors which specifies the list of items,expected delivery date etc.

The vendors are expected to supply the items within the due date. Failure to accomplish this will affect their rating in the future. Once the items are delivered , it is inspected based on the respective purchase order and a Receival Report(R.R) is prepared.Copies of the RR are sent to the Purchase and Finance Departments.

PROBLEM DEFINITION

The existing system has a number of drawbacks.The system is responsible for handling purchase orders,receival and issue of items.The number of items ,vendors and contractors involved are quite enormous in the organization .Hence to monitor the above activities in a manually maintained system is both highly error prone and extremely difficult .The efficiency of the system is poor and time consumption is high.

Also, indents are raised for a particular item only when it goes out of stock and it is required for some project.This is not a very healthy situation.If the item is urgently required ,the Purchase Department will be forced to make cash purchases,which is not suited for the organization.Hence there is a need to keep track of the item stock level and indents are to be raised whenever the item level goes below the reorder level.

Time to time ,several reports are to be submitted to the concerned personnel .This is mostly to assist decision making at various levels of the organization.There will also be adhoc queries regarding various subjects .This was almost impossible considering the time required to prepare them.

SYSTEM OBJECTIVES

The objectives of the new system are:

1. Increase the efficiency of the system by effectively managing materials. This includes monitoring purchase,receival and issue of items.

2. Reduce cost of Materials Procurement by periodically raising item indents based on the stock level.

3. Avoid delay of projects due to non-availability of items.

4. Generating quick and accurate reports when required.

System Design

THE PROPOSED SYSTEM

Since the existing system was found to have a number drawbacks ,the proposed system is designed to tackle them in an efficient manner.The first step towards tackling a number of them was to develop a computer based Information System .Such a system would solve the problems of error and time consumption to a great extent.

The system monitors the three activities:

1. Item Purchase

2. Item Receival

3. Item Issue

The effective management of these three key activities in the organization would result in increased efficiency and performance.Another critical issue is the availability of materials in the store .The activities which causes variations in the stock level are Item Receival and Item Issue . By maintaining a reorder level and automatic generation of indents whenever the stock level falls below this level assures availability of materials.

The new system involves a number of validations performed at various sections. The duplication of any record is warned at the time of data entry.Thus data redundancy and data inconsistency are avoided.This results in error free operations and reduce user effort.

The system is also capable of generating a number of detailed and accurate reports to the concerned departments .This is to support decision making at different levels of the organization.There are also a number of strict access control restrictions imposed at various levels to improve the security of the system.

DATA FLOW ANALYSIS

The DATA FLOW DIAGRAM (DFD) is one of the most important tools used by systems analysts.The use of Data Flow Diagram as a modelling tool was first popularised by DeMarco(1978),Gane and Sarson(1979) through their structured systems analysis methodologies.DFD is a tool used to model the system components.These components are :

1. System Processes

2. Data used by these processes

3. External Entities that interact with the system

and 4. Information Flows in the system

Processes show what the systems do. Each process has one or more data inputs and one or more data outputs.They are represented by circles in the DFD.Each high level process may be consisting of more than one lower level processes.Processes will be expanded in subsequent level DFD's.

The high level processes in the system are:

- Purchase Order Process
- Receival Process
- Stock Issue Process

File or Data Store is a repository of data.They contain data that is retained in the system. Processes can enter data into data store or retrieve data from the data store. The data stores used by each process are as follows:

* Purchase Order Process
  - Vendors
  - Items

* Receival Process
  - Purchase Order
  - Stock

* Item Issue Process

- Items
- Contractors
- Stock

External Entities are outside the system but either supply input data into the system or use the system output.They are entities over which the designer has no control. The external entities in the system are :

- Vendor
- Contractor

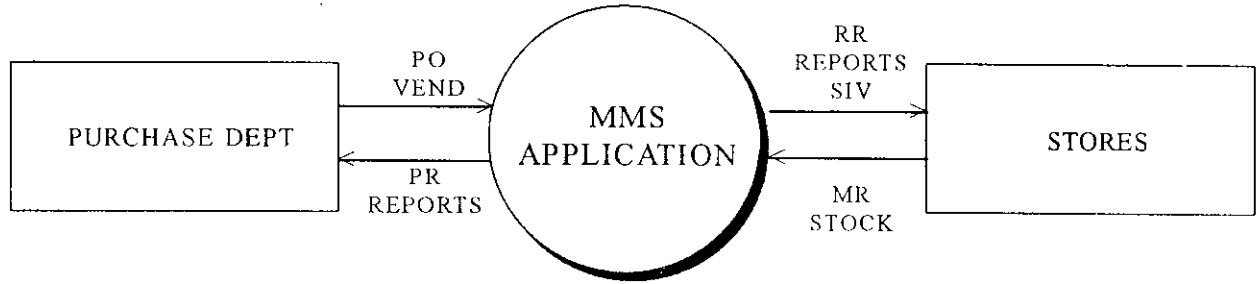
Data flows model the flow of data in the system.Flow of data can take place :

- between two processes
- from data source to process
- from process to data source
- from source to process
- from process to sink

Data Flow Diagrams in different levels are as follows:

DATA FLOW DIAGRAMS :

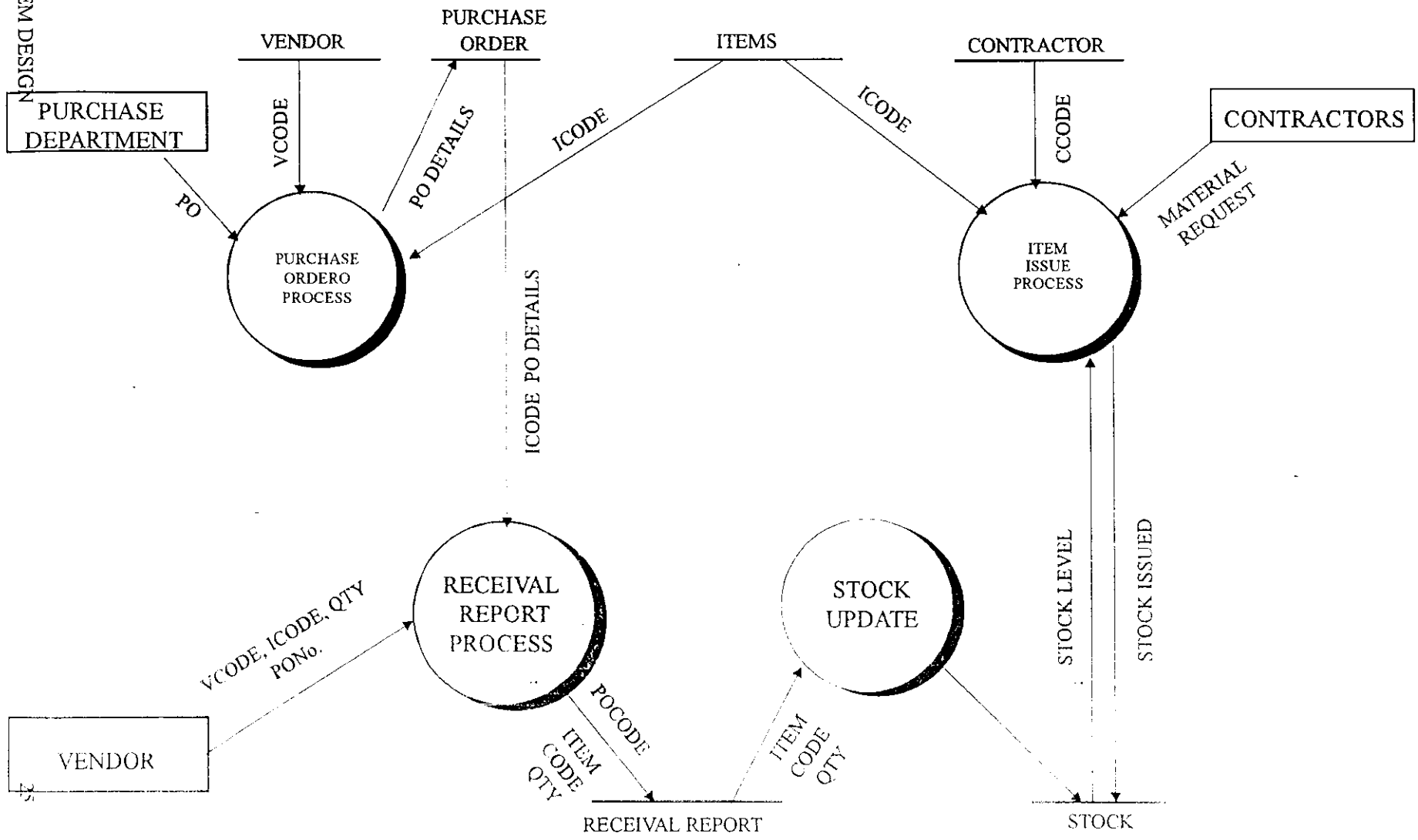
LEVEL 0



DATA FLOW DIAGRAMS

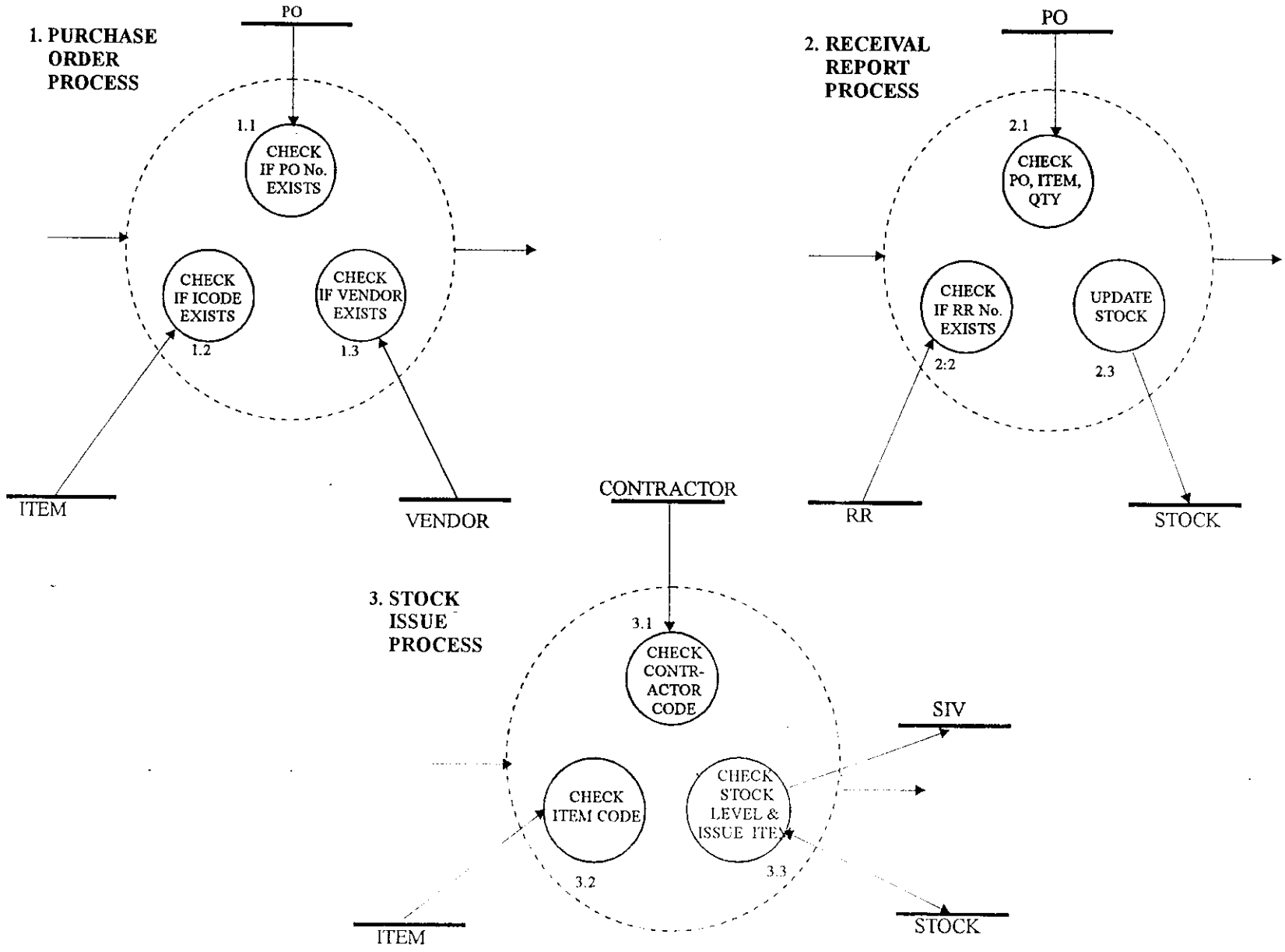
SYSTEM DESIGN

LEVEL 1



DATA FLOW DIAGRAMS

LEVEL 2



DATA BASE DESIGN

ENTITY RELATIONSHIP ANALYSIS:

In the first level of data modelling, a conceptual model of the data is developed.This model represents the major data object or entities in the system and the relationships between them.The next step is to find out what data about each of these entities are of interest to the system.The next step is to remove redundancies,by a process called normalization.The normalized model is now converted into the physical database.

Entity - relationship analysis uses three major abstractions to describe data.They are:

- ENTITIES - distinct data objects associated with the system
- RELATIONSHIPS - interactions between the entities
- ATTRIBUTES - properties of the entities and relationships

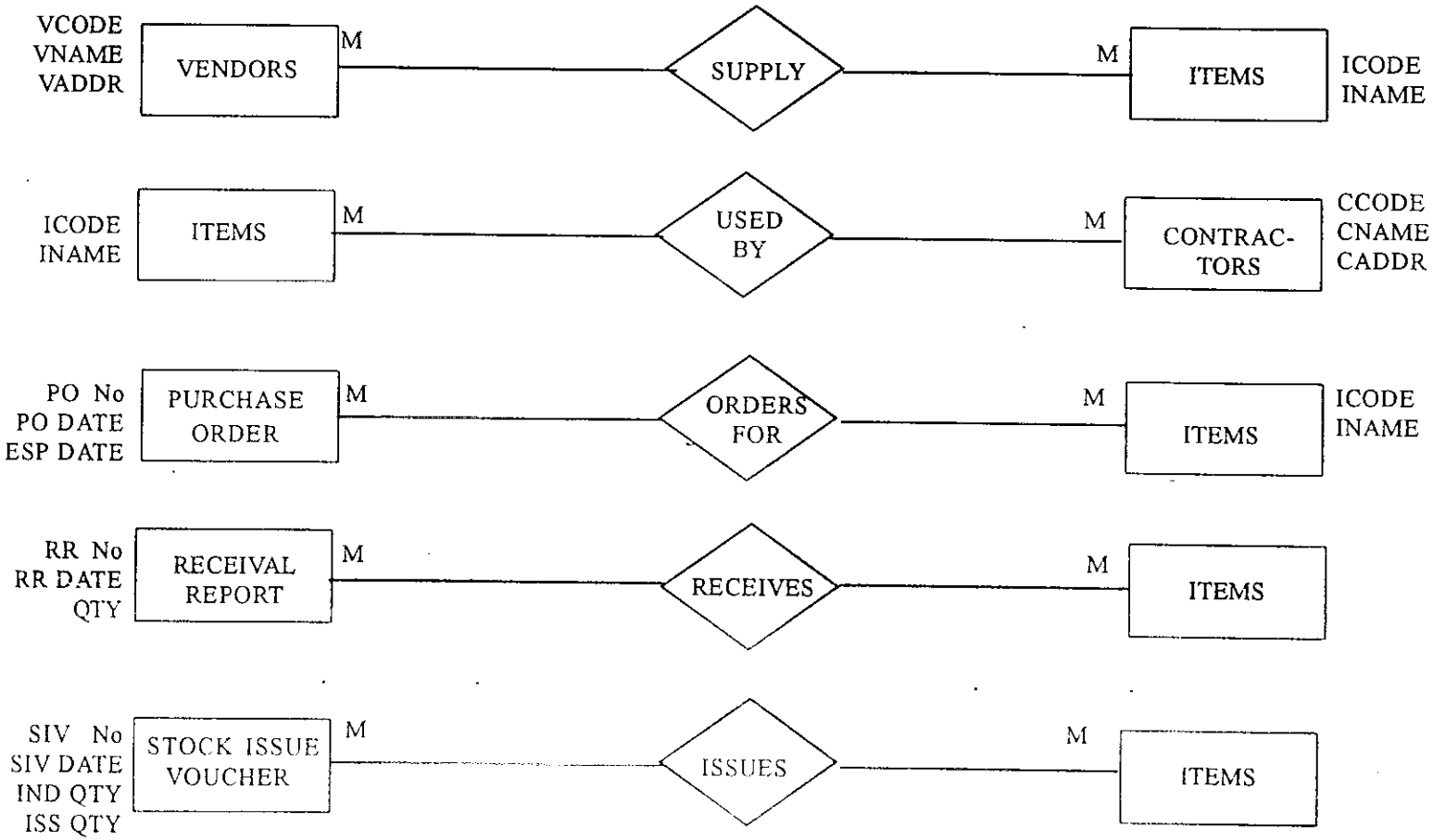
The entities in the system are:

- ✓ Vendor
- ✓ Item
- ✓ Contractor
- ✓ Purchase Order
- ✓ Receival Report
- ✓ Stock Isuue Voucher

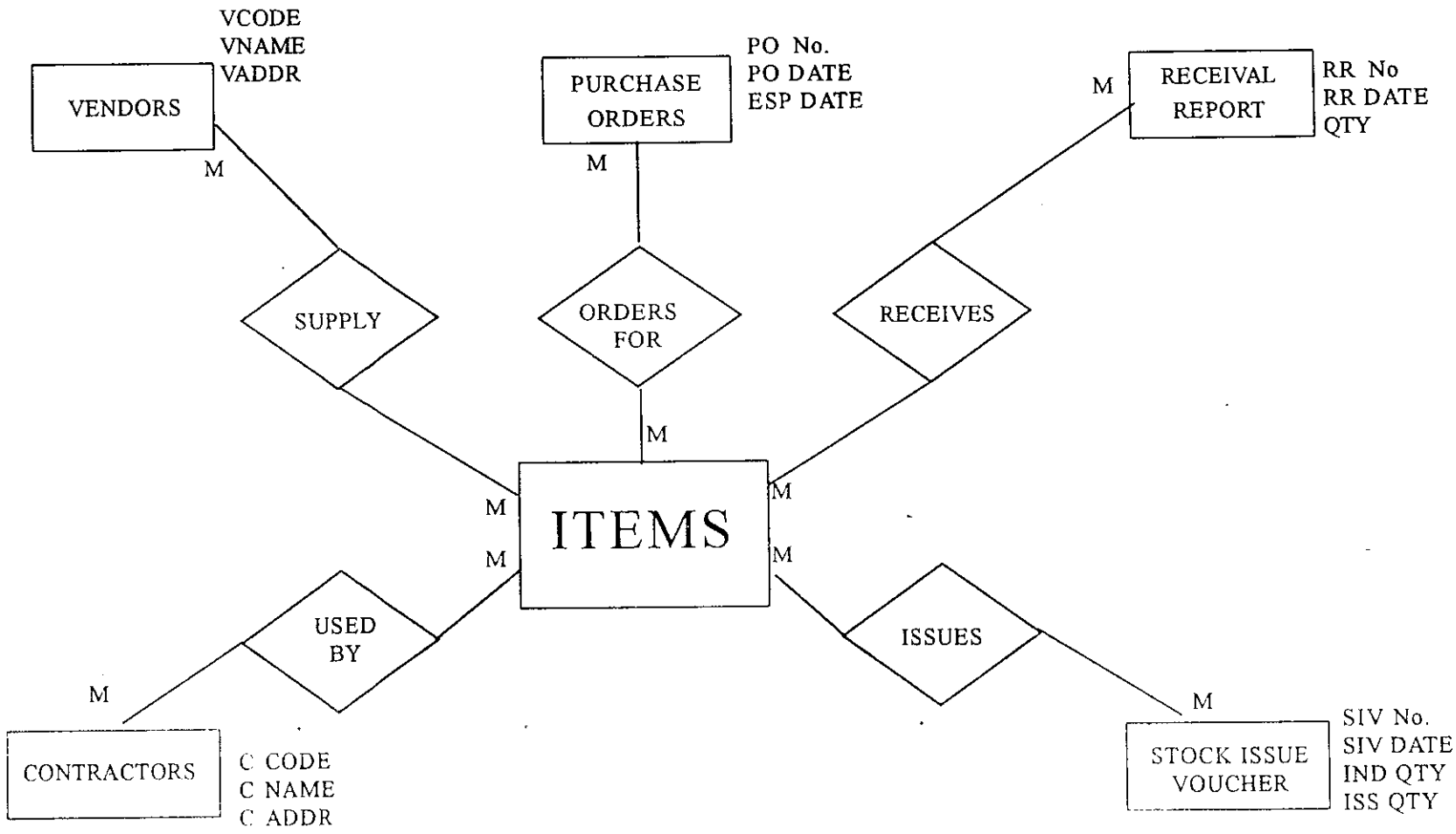
The relationships between these entities and the attributes associated with each entity are represented in the Entity-Relationship diagrams.

The Entity - Relationship diagrams of the system are as follows:

ENTITY RELATIONSHIP DIAGRAMS :



ENTITY - RELATIONSHIP DIAGRAMS :



Now the final steps are:

1. Each entity is translated into a table.

2. The attributes associated with a table is translated into the columns of that table.

3. Unique identifier of the entity is the primary key of the table.This enforces entity integrity.

4. The tables are normalized to avoid data redundancy.

5. Foreign key are defined to enforce referential integrity.

The normalized tables used by the system are listed in the Appendix.

System Development

HARDWARE SETUP PROFILE

SYSTEM : ICIM KRYPTON DRS 6000

PROCESSOR : SPARC RISC CPU @ 40 MHz.

128 KB CACHE

FLOATING POINT CO-PROCESSOR

MEMORY : 64 MB ECC MEMORY

HARD DISK CAPACITY : 3.6 GB

AUXILIARY STORAGE :

: CARTRIDGE DRIVE

: FLOPPY DISK

: OPTICAL DISK DRIVE

TERMINALS : VT 220 COMPATIBLE DIRECT TERMINALS

: PC-386SX TERMINALS

SELECTION OF SOFTWARE

WHY INGRES ?

INGRES RDBMS SOFTWARE V 6.4

OPERATING SYSTEM : UNIX SVR4 with unlimited user license.

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 **IN**teractive **G**raphics and **RE**trieval **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 mare tables stored in the database, normally the tables in the database is 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,QBF 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 is 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 user of an Ingres table can actually see. Views can also be used for selecting the data that can be had in the report.

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 interface to use . 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 crate 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

The query language is the medium of instruction that the user has to adopt, to communicate with the INGRES data manager so as to be able to manipulate date held in an INGRES database. All communications with the DBA is via. the INGRES query language called SQL.

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.

INGRES NET:

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

INGRES GATEWAYS:

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

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 High Resource Utilization
- Full Multi-processor support
- No architectural bottle necks
- Reduced Network traffic

INGRES APPLICATION DEVELOPMENT TOOLS :

- Embedded Query Language
- VIFRED (Visual Forms Editor)
- Vision
- Application-By-Forms (ABF)
- Report Writer

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(Usually VI 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 using INGRES report-writer syntax. Any ASCII editor can be used to create a report specification file. A report frame usually consists of a report and a menu for running it. The frame may also include a form,created using 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 standalone 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 deleted since the table was last modified.

Rows never span pages, limiting the maximum row width to 2048 bytes. This limitation exists because of the 2048 pages in Ingress' unit of I/O, a write to disk involves a write to page. This is because Ingres access records at page level which means for every query fired, there is a swapping of at least one page in and out of the disk.

A storage structure is a file management providing a way to access data in a table. Keyed storage structure provides a way to get a particular row or a set of rows from database tables faster than would be possible if the table had no key.

The default storage structure for Ingres is HEAP

*It is the simplest storage structure

*No key, just a heap of data

*Storage and data access is sequential

*New data is added to the last page

INGRES 4GL:

An Ingres/4GL operation can be

1. **Initialization:**

This is the first block to be executed in a 4GL program. It is in this block the hidden variables are declared.

2. **Field Activation:**

Field activation can be

a. Simple fields

b. Table fields

A field activation causes a specific action to occur when a user enters or leaves a specific field.

3. Menu Activation:

Menu activation block gets triggered when the user selects the particular menu item.

4. Key Activation:

This is used along with the menu item in order to specify a key from the keyboard for that menu item. The operation is specified for an FRS (Forms Run-time Systems) key.

5. Time out Activation:

This feature enables to control how long the application should wait for requested input from the user. If the user fails to make a menu choice or respond to a message within the specified time, then a time-out occurs.

INPUT DESIGN

The input device used in the system is the keyboard. The input data entry is necessary for each module of the system. Data is entered to the system through the data entry screens. The major data inputs are carried out at the following stages.

1. Vendor ,Contractor and Item data entry.

2. Initial stock entry.

3. While generating the Purchase Order(PO).

4. While generating the Stores Issue Voucher(SIV).

5. While generating Receival Report (RR).

Data validation and error handling through Forms

INGRES VIFRED has a sub-set of tools that allows the user to declare complex validations to be fired on data being keyed in. These validations are fired prior to the placing of such data in the table structure. If the validations are satisfied, the data is placed in the table structure.If not a message is displayed to the user ,the data is prevented from being loaded into the

table,and the user is required to reenter the data on the form . Thus INGRES helps to ensure both entity and referential integrity of the data being saved in the table.

Data validation and error handling through INGRES 4GL

INGRES 4GL provides facilities to ensure data validation before entering and after leaving the field, on selecting a menu option or a key, to show error messages with popup screens and reenter the data if required. List choices menu option will be given for fields wherever possible so that the user will be able to choose from the options and thus reduce the effort.

OUTPUT DESIGN

The output devices used in the system are printer and visual display unit. So the output can be both hard copy and display outputs.

The hard copy outputs generated by the system is :

1. Vendor details.

2. Item details.

3. Contractor details.

4. Stock level reports.

5. Purchase order Report.

6. Receiving Report Register.

7. Stores Issue Register.

The INGRES REPORT WRITER provides a high level report language that allows you to quickly create sophisticated reports without having to write an application program.

The outputs are for monochrome monitors only. The screen will be similar to those used for data entry,i.e.the output screens. At the top of the report there will be the name of the firm and the name of the system. The forms will be created using the INGRES VIFRED.

APPLICATION STRUCTURE

MMS is divided into 5 modules :

(1). MASTER FILE MAINTENANCE

(2). PURCHASE ORDER

(3). RECEIVING REPORT

(4). STORES ISSUE VOUCHER

(5). REPORTS

(1). MASTER FILE MAINTENANCE :

This module is used to maintain the master files used in this system, viz. VEND,ITEMS,CONTRACT.There is a sub-menu of options a here.They are :

1.Append, 2. Delete ,3.Update.

These three operations can be done on any one of the master files.There is another option available in this module which can be used to initialize the stock level of each item at the time of implementation of the system.

Validations are performed at various levels . The use of the Master File Maintenance module of MMS is restricted to Authorized Personnel only to enhance the security of the system .

(2). PURCHASE ORDER :

The Purchase Order (PO) module is used to process the purchase orders which are produced by the Purchase Department .They are placed according to the requirement for each item in various departments. A particular Purchase Order may contain several items directed to a particular vendor.The vendor name and quantity to be ordered will be specified by the purchase department. The vendor is expected to supply the ordered items within a reasonable span of time. A particular item cannot be ordered more than once in a single Purchase Order. A number of validations are performed while data entry is done.

(3). RECEIVING REPORT :

Once the Purchase Orders are placed and mailed to the respective vendors, items will start arriving at the store. This is handled by the module named Receiving Report. A vendor may also fulfill the orders

partially,ie the receiving quantity may be lesser than the ordered quantity.The items arriving at one time have to be entered in the data entry form of this module .

Validations are performed at different levels.The quantity of an item received must not be greater than the ordered level.It is also checked whether the item has been ordered in the particular PO or not.The received items are updated in the stock.The partial fulfillment of orders will result in later arrival of those items .At this stage again it has to be checked whether the total quantity is not greater than the ordered quantity. Corresponding entries are made in the respective tables.

(4). STORES ISSUE VOUCHER :

There are several contractors associated with the projects undertaken by FEDO. The items in the store have to be issued to them based on requests placed by them.This process is being handled by the Stores Issue Voucher module. A contractor may request for a number of items based on his requirements.The items have to be issued to him considering the availability or stock level of that particular item. The quantity intended must not be greater than the stock level of the item. Also the issued quantity must not be greater than the intended quantity.If after the issue of a

particular item,its stock level falls below the reorder level ,indents are generated for that item.

(5). REPORTS :

A number of reports have to be generated by this system based on requests from various departments and offices. The reports have been designed in the format specified by the respective departments. The main reports are:

1. Stock Level Report

2. Master File Reports

3. Purchase Order Register

4. Receiving Receipt Register

5. Stock Issue Register

SCREENS

The system provides numerous highly controlled user interfaces built with the help of the powerful tool VIFRED (VIsual FoRms EDitor) The various user interfaces and their functions are listed below.

1 Mainframe: Main Menu for the application.

2. Mflpword : Password frame.

3. Data_entry: Data entry sub menu frame.

4. Data_hand : Master file data entry frame.

5. Tableselect : Sub menu frame for selecting the master file.

6. Edit_menu: Edit sub option frame.

7. Condata: Contractor data entry frame.

8 Itdata : Item data entry frame.

9. Vend : Vendor data entry.

10. Delcon_frame : Contractor details are deleted using this frame.

11. Delven_frame : Used to delete vendor details.

12. Delitem_frame : Used to delete item details.

13. Upcon_frame: Contractor details can be updated using this frame.

14. Upven_frame : Used to update vendor details.

15. Upitem_frame: Used to update item details.

16. Po_frame : This frame is used to enter the purchase order details.

17. Rr-frame: Used to enter the Receiving report details.

18. Rritem_frame : Here receiving item details are entered.

19. Siv_frame : This frame is used to enter the issuing items details.

20. Stock_frame : Used to initialize the stock during the item entry.

21. Repmenu_frame: Menu frame for reports.

REPORTS

1. Rep_con : Contractor reports .

2. Rep_ven : Vendor reports .

3. Rep_stock: Stock level reports.

4. Rep_rr : Receiving Item reports.

5. Rep_siv: Issuing items reports.

6. Rep_po : Purchase order reports.

THE HELP SYSTEM

An extensive an elaborate On-line Help System has been developed for the system.It provides context sensitive help at various levels of the system .It has been designed in such a way that the user at any level of the organization can clear any of his doubts regarding the usage of the system with consumate ease.

ACCESS CONTROL WITHIN THE SYSTEM

This system imposes some strict restrictions on access to certain modules. Modules like File Maintenance should be used only by authorized personnel. This has been implemented by passwords made known only to persons in such capacity.

System Implementation

SYSTEM IMPLEMENTATION

Implementation is the stage of the project when the user is actually provided with a working model of the system. The stage consists of:

1. **Testing the developed application with the sample data.**
2. **Correcting of errors.**
3. **Imparting training to users of the system**
4. **Getting the users to actually work with the system.**
5. **Making necessary changes as desired by the user.**

This system has been tested with sample data and adequate corrections to the system were made as per the user requirements. The user has a very little chance of committing data entry errors since the program has been provided with validation checks. The end user, even with minimum knowledge of computers will find it easy to use the system. System release 6.4 , ICIM Manual.

CONCLUSION AND FUTURE SCOPE

A lot of effort has gone into this project to clear out the disadvantages that the existing system holds. Using INGRES 6.4 and UNIX the system was developed and implemented with high degree of accuracy and user friendliness. The system was tested with all possible samples of data.

The performance of the system proved to be efficient. Also the generated reports help the management in decision making as accurate information is available when demanded.

Currently the vendor maintenance is performed by a separate system . As a part of future enhancements , it can be integrated with the Materials Management System.

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Appendix

Data Base Structure

TABLES

1. Contract.
2. Items
3. Vendor
4. PO
5. PO_Item
6. RR
7. RR_Item
8. Stock
9. Department
10. Siv
11. Siv_Item
12. Vend_Item
13. Con_Item

1. Table Name : **CONTRACT**
   Index Tag : *CC* on **Ccode**

Slno:	Field Name	Type	Key	Allow null	Validation
1.	Ccode	int(8)	Y	N	Y
2.	Cname	char(25)	N	N	N
3.	Caddr	char(40)	N	N	N

2. Table Name: **ITEMS**
   Index Tag : *IT* on **Icode**

Sl no:	Field Name	Type	Key	Allow null	Validation
1.	Icode	char(17)	y	N	Y
2.	Iname	char(85)	N	N	Y
3.	Igroup	char(25)	N	N	N
4.	Is1	int(4)	N	Y	N
5.	Is2	int(4)	N	Y	N
6.	Isthick	char(10)	N	Y	N
7.	Iunit	char(10)	N	Y	N

3. Table Name: **VENDOR**
   Index Tag : *VC* on **Vcode**

Sl no:	Field Name	Type	Key	Allow null	Validation
1.	Vcode	int(8)	Y	N	Y
2.	Vname	char(25)	N	N	N
3.	Vaddr1	char(40)	N	N	N
4.	Vaddr2	char(40)	N	N	N
5.	Vaddr3	char(40)	N	N	N

4. Table Name : **PO**
   Index Tag : *PO* on **Pono**

Sl no:	Field Name	Type	Key	Allow null	Validation
1.	Pono	char(25)	Y	N	Y
2.	Podte	date	N	N	N
3.	Vcode	int(8)	N	N	Y
4.	Poespdte	date	N	N	Y

5. Table Name : **PO_ITEM**
Index Tag : *PI* on **Pono + Po_itemno**

Sl no:	Field Name	Type	Key	Allow null	Validation
1	Pono	char(25)	Y	N	Y
2	Icode	char(17)	N	N	Y
3	Iqty	int(8)	N	N	N
4	Po_Itemno	int(4)	Y	N	Y

6. Table Name: **RR**
Index Tag : *RR* on **Rrno**

Sl no:	Field Name	Type	Key	Allow null	Validation
1	Rrno	char(10)	Y	N	Y
2	Rrdte	date	N	N	N
3	Pono	char(25)	N	N	Y

7. Table Name: **RR_Item**
   Index Tag : *RI* on **RRno**

Sl no:	Field Name	Type	Key	Allow null	Validation
1	Pono	char(25)	N	N	Y
2	Rrno	char(10)	Y	N	Y
3	Ricode	char(17)	N	N	Y
4	Riqty	int(8)	N	N	Y

8. Table Name: **STOCK**
   Index Tag : *SI* on **Icode**

Sl no:	Field Name	Type	Key	Allow null	Validation
1	Icode	char(17)	Y	N	Y
2	Stock	int(10)	N	N	N
3	Rlev	int(10)	N	Y	N
4	OQ	int(10)	N	Y	N

9. Table Name: **DEPARTME**
   Index Tag : *DC* on **Deptcode**

Sl no:	Field Name	Type	Key	Allow null	Validation
1	Deptcode	int(1)	Y	N	Y
2	Deptname	char(15)	N	N	Y

10. Table Name: **SIV**
Index Tag : *SIV* on **Sivno**

Sl no:	Field Name	Type	Key	Allow null	Validation
1.	Sivno	char(10)	Y	N	Y
2.	Sivdte	date	N	N	N
3.	Wslipno	char(10)	N	N	N
4.	wslipdte	date	N	N	N
5.	Ccode	char(8)	N	N	Y

11. Table Name: **SIV_ITEM**
Index Tag : *SIV_IT* on **Sivno + Icode**

Sl no:	Field Name	Type	Key	Allow null	Validation
1.	Sivno	char(10)	Y	N	y
2.	Icode	char(17)	Y	N	Y
3.	Rrno	char(10)	N	N	y
4.	Intdqty	int(8)	N	N	Y
5.	Issdqty	int(8)	N	N	Y

12. Table Name: **Vend -Item**
Index Tag : Vcode+Icode

Sl no:	Field Name	Type	Key	Allow null	Validation
1	Vcode	int(8)	Y	N	Y
2	Icode	char(17)	Y	N	Y

13. Table Name: **Con_Item**
Index Tag : **CCode+Icode**

Sl no:	Field Name	Type	Key	Allow null	Validation
1	CCode	int(8)	Y	N	Y
2	Icode	char(17)	Y	N	Y

DATA DEPENDENCIES

Field Name	Table in which Primary Key	Related Tables
1.Icode	Items	PO_Item RR_Item SIV_Item Stock
2.Pono	Porders	PO_Item RR RR_Item
3.Rrno	RR	RR_Item SIV_Item
4.Vcode	Vendor	RR
5.Ccode	Contract	SIV
6.Sivno	Siv	SIV_Item

System Output

M A T E R I A L S M A N A G E M E N T S Y S T E M

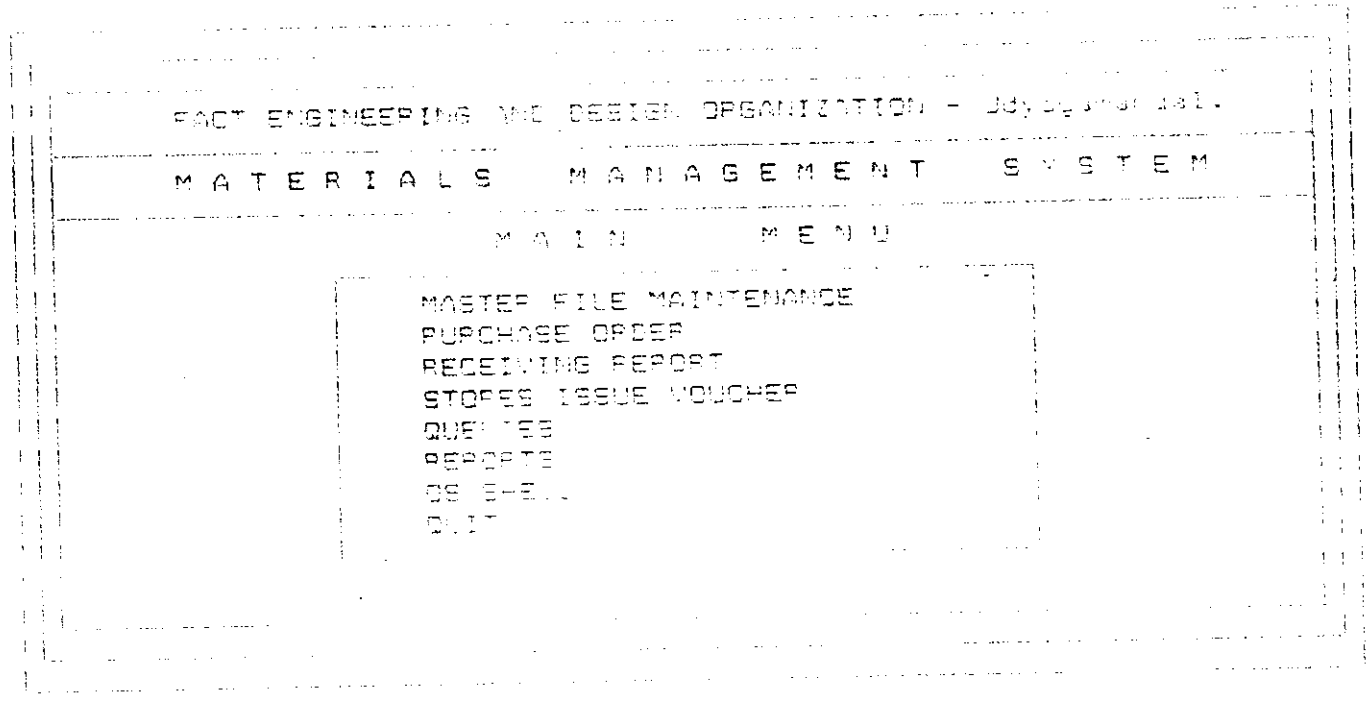
FACT ENGINEERING AND DESIGN ORGANIZATION

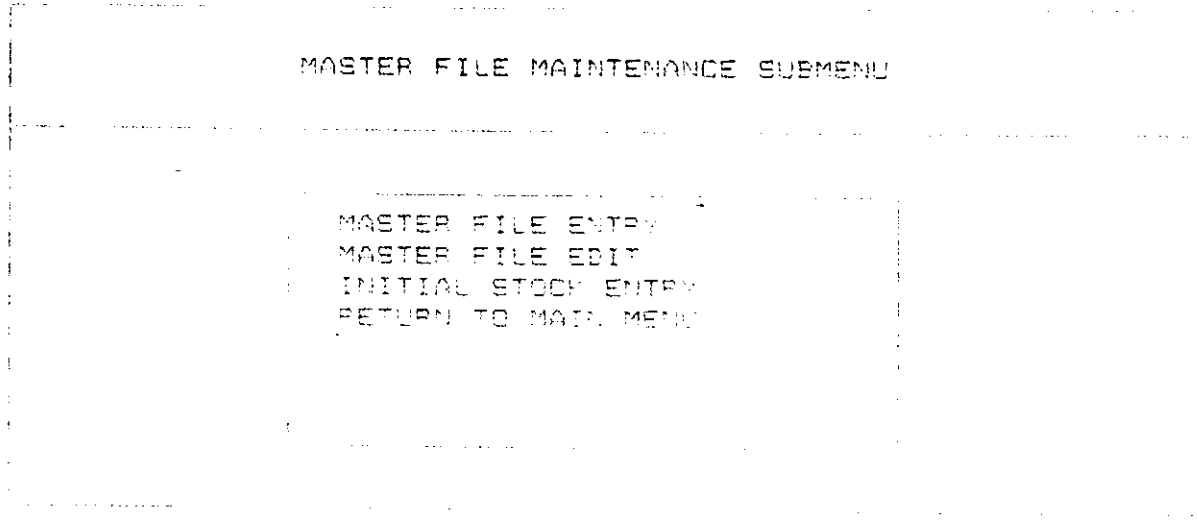
UDYOGAMANDAL - COCHIN

Project Done By George Tobias

Jan - June 1996.

Start(F2) End(F3) :


FACT ENGINEERING AND DESIGN ORGANIZATION - [illegible]
MATERIALS MANAGEMENT SYSTEM
MAIN MENU
MASTER FILE MAINTENANCE
PURCHASE ORDER
RECEIVING REPORT
STORES ISSUE VOUCHER
QUERIES
REPORTS
OS SHELL
EXIT
SELECT(F6) HELP(F2) END(F3)


MASTER FILE MAINTENANCE SUBMENU
MASTER FILE ENTRY
MASTER FILE EDIT
INITIAL STOCK ENTRY
RETURN TO MAIN MENU

ITEM DATA ENTRY SCREEN

Item Code : 11I0000111

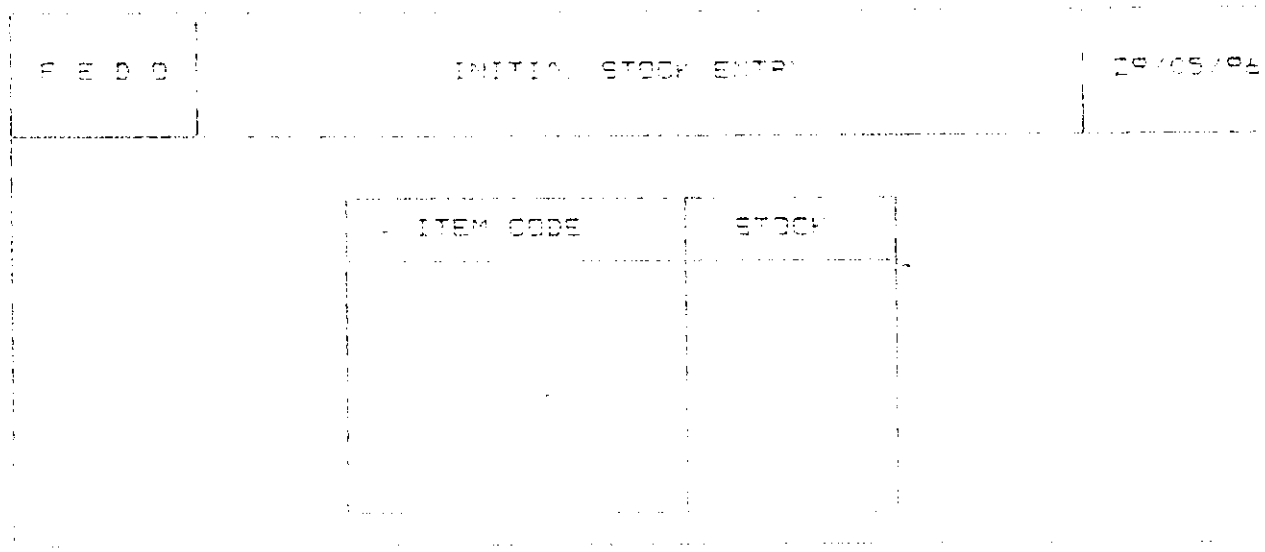
Item Name : GI PIPES

Item Group: 1

Size 1 : 12 Thickness : 10

Size 2 : 16 Item Unit : MT

Append(F4) End(F3) Clear(F2)


ITEM CODE
STOCK

F E D O
M M S

P U R C H A S E O R D E R F O R M

P O No : 121

P O Date: 01/01 96

Vender Code : 10002348

Expected Date : 02/02 96

ITEM LIST

PO ITEMNO	ITEM CODE	ITEM QT
111	123	1
112	124	10
113	125	1

Save(F10) Update(F9) Vender List(F8) Item List(F6)

F E D O
M M S

S T O R E S I S S U E V O U C H E R

29 02 96

SIV No : 11221

SIV Date : 22/02/96

Walio No : 1

Walio Date : 01/01/96

Contractor Code : 100

ITEM CODE	PR NUMBER	INDENT QTY	ISSUED QTY
101	1313	100	100
102	1314	50	35
103	1315	100	80

Save(F9) Select PRNo:(F4) End(F3)

FACT ENGINEERING AND DESIGN [illegible]

M A T E R I A L S M A N A G E M E N T S Y S T E M

HELP SYSTEM:

This is an Integrated Materials Management System developed for the use of FEDD-Materials Department. The opening screen will present a menu driven user interface with the following options:

1. Master Files Maintenance
2. Purchase Order
3. Receiving Receipt
4. Stores Issue Voucher
5. Queries
6. Reports
7. OS Shell
8. Quit

1. Master Files Maintenance:

Select this option to [illegible] files which includes ITEMS,VENDORS & CONTRACTORS. The different options available are Add , Update & Delete. There is also an option to [illegible] initial stock level. This module can be accessed only by authorised persons. Access control is implemented by a password.

2. Purchase Order :

Select this option to process the Purchase Orders.

3. Receiving Receipt:

Select this option to process the receipt of items.

4. Stores Issue Vouchers:

Select this option to process the issue of items.

5. Queries :

Selecting this option will present you the Ingres Terminal Monitor.

This online interface can be used to execute SQL statements on the tables.

6. Reports :

This option has a sub menu using which you can select from a

number of pre-designed reports which will be generated by the system.

7. OS Shell :

Use this option to temporarily exit to the UNIX prompt. To return

to the system type EXIT or press Ctrl-D.

8. Quit :

Select this option to quit the system.

PURCHASE ORDER MODULE:

This is the Purchase Order Entry Screen. You can use this to enter and process the Purchase Orders. There is also a facility using which you can edit and update existing PO's. You can browse the item list and select the necessary Item Code . The various menu keys and their functionalities are as below:

MENU COMMANDS		SYNOPSIS
* Save	:	Saves the records entered in the items table.
* Update	:	This key is ACTIVE only when you are updating an existing Purchase Order.
* Vendor List	:	This option can be used to list all the Vendors and select the required Vendor Code.
* Item List	:	This option can be used to browse the item list and select the Item Code. To select from the list move the cursor to that item and press Enter.
* Clear Table	:	Use this to clear the values entered in the table.
* End	:	To return to the MAIN MENU.

29/05/96 12:02:36

FACT ENGINEERING AND DESIGN ORGANIZATION

STOCK LEVEL REPORT

ITEM CODE	ITEM NAME	STOCK LEVEL
II01001001	PRIMARY HDS PREHEATER	25
II01001002	PARTIAL CONDENSER	30
II01001003	STRIPPER OVERHEAD CONDENSER	10
II01001004	AIR COOLER	5
AA00101002	ADDITIONAL RAW NAPHTHA PUMP	15
AA00101003	MOTOR FOR J 110 C	10
AA00101004	FAN FOR E 116C	30
BB01001010	HDS PREHEATER	25
BB01001001	PRIMARY REFORMER	20
BB10100001	NAPHTHA FUEL PREHEATER	17
BB12201010	HP STEAM SUPER HEATING COIL	22
EE01001111	PROCESS FEED PREHEATING COILS	107
EE01001122	PROCESS AIR PREHEATING COILS	122

29/05/96 12:02:36

FACT ENGINEERING AND DESIGN ORGANIZATION

RECEIVING REPORT REGISTER

RRNO	RRDATE	ITEM CODE	ITEM QTY	PONO
101	01/01/96	AA0011010101	100	100
101	01/01/96	CC0011010101	100	100
101	01/01/96	AA0011010101	100	100
102	02/12/95	AA0012010104	200	120
102	02/12/95	BB0012010105	100	150
103	01/03/96	CC0100050505	200	150

29/05/96 12:02:36

FACT ENGINEERING AND DESIGN ORGANIZATION

ITEM ISSUE REGISTER

SI/NO	SIVDATE	ITEM CODE	INTD QTY	ISSD QTY	CODDE
101	01/01/96	AA00110101	100	75	111
101	01/01/96	AA00110102	150	150	411
101	01/01/96	CC00110103	100	100	B12
102	02/12/95	AA00120104	200	175	412
102	02/12/95	BB00120105	100	100	CCC
107	01/03/96	II0109P199	200	200	C12