ADDIS ABABA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

SCHOOL OF INFORMATION STUDIES FOR AFRICA

INCORPORATION OF MULTIMEDIA FEATURES IN CONVENTIONAL CATALOGUING DATABASE: A CASE STUDY OF THE INSTITUTE OF ETHIOPIAN STUDIES MUSEUM

BY

WOINSHET ABDELLA

May 1997

ADDIS ABABA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

SCHOOL OF INFORMATION STUDIES FOR AFRICA

INCORPORATION OF MULTIMEDIA FEATURES IN CONVENTIONAL CATALOGUING DATABASE: A CASE STUDY OF THE INSTITUTE OF ETHIOPIAN STUDIES MUSEUM

A THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE DEGREE OF MASTER OF SCIENCE IN INFORMATION SCIENCE

BY

WOINSHET ABDELLA
16 May, 1997

ADDIS ABABA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

SCHOOL OF INFORMATION STUDIES FOR AFRICA

INCORPORATION OF MULTIMEDIA FEATURES IN CONVENTIONAL CATALOGUING DATABASES: A CASE STUDY OF THE INSTITUTE OF ETHIOPIAN STUDIES MUSEUM.

By
Woineshet Abdella Mohammod

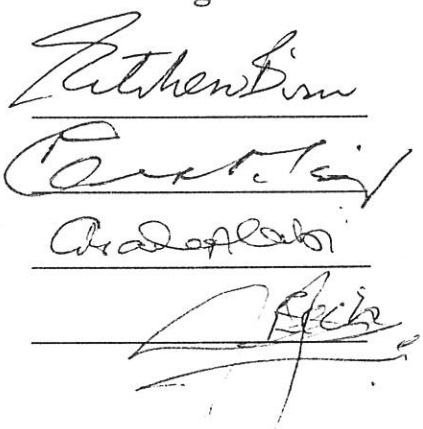
Name and Signature of Members of the Examining Board

Ato Getachew Birru, Chairman, Examining Board

Ato Tesfaye Biru, Advisor

Dr. G.A. Alabi, Internal Examiner

Dr. K. Bechkoum, External Examiner



ACKNOWLEDGEMENT

I would like to thank all those who contributed in one way or another towards the successful completion of this work.

I am heavily indebted to my advisor Ato Tesfaye Biru for his invaluable, timely, continuous, and tireless guidance, advice and contribution throughout the pursuit of the study; Ato Getachew Birru for his encouragement throughout my study; and my instructors. I would also like to thank Ato Sisay Fisseha for his technical assistance and fruitful comments; Ato Worku, Ato Melaku and Ato Kebede for assisting me in editing.

Finally special thanks goes to my beloved husband Belay Tegene, my children Sarem and Illili Belay, my mother Siti Edris, my sisters and brothers, and my friends, and all SISA & IES museum staff.

ABSTRACT

Researchers and curators at museums are increasingly faced with providing meticulous inventories of the objects under their care. They are confronted with a dearth of information about relationships between form, function and use of objects, as well as information about production methods, use and users. The IES museum is not an exception to this. Among the major activities preoccupying the museum is information provision on its holdings: maintenance of accession registers, card catalogues, photograph documentation, treatment records etc.

This study attempted to address the information handling problems existing in the IES museum. Currently manual methods of information management are in place. These methods, however, have created problems in information handling activities because of the size and diversity of the collection as well as varied information requirements of the users.

Previous studies suggested conventional computer-based bibliographic database systems as one means of dealing with such problems. Although the recommendations may work well for IES in general and as a starting point for the museum in particular, the user survey conducted in this regard showed that the recommendations are of limited use to enhance the information handling activity of the museum as records in the museum objects comprise different data types, i.e., structured and unstructured text, still images, sound, and video, and which are difficult to fit into the conventional formats.

To this end, an attempt is made in this work to demonstrate the incorporation of multimedia features in the suggested cataloguing databases in order to enhance systematisation in the organization and accessibility of the museum objects at the Institute.

TABLE OF CONTENTS

CHAPTER FIVE
PROTOTYPE IMPLEMENTATION

CHAPTER SIX
CONCLUSION AND RECOMMENDATION

LIST OF TABLES

LIST OF FIGURES

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE

INTRODUCTION

1.1 STATEMENT OF THE PROBLEM AND JUSTIFICATION

Without the past there is no present and without the present there is no future. The past has its own value, be it good or bad. It is therefore out of necessity that we register and protect the past. One of the possible ways of registering the past is through the cultural and natural heritage of a country. It is an accepted fact that this heritage is our collective identity as well as our image of yesterday. Without recording the cultural wealth, a modern urban society would have been created in a complete vacuum (Girma 1990).

Historically, libraries and museums are among the major repositories of information in this regard. In particular, museums play a vital role in the research and documentation of natural and cultural heritages. They record and provide knowledge regarding the roots of societies and also illustrate the changing way of life. With the passing years, museum collections have become increasingly important. On the other hand, the diversity of materials collected by museums over the years has made their management difficult along classic and traditional lines (Annabi 1996).

Researchers and curators are increasingly faced with providing meticulous inventories of the objects under their care. They are confronted with a dearth of information about relationships between form, function and use of objects, as well as production methods, use and users. It is often difficult to provide correct overview of the state of the museum documentation in Africa. To do so, one would need precise up-to-date information in all aspects of the

museum's collection. Even the most complete museum collection is often hampered by an inadequate documentation system, precluding full appreciation of the objects displayed (Annabi 1996; and Cuypers 1996).

Today, there is no doubt that Information Technology (IT), i.e. computer and telecommunication technologies, has a major role in facilitating recording, processing, storing, retrieving, and disseminating all types of information including text, still image, animation, sound, and video. Use of IT enhances the productivity of information handling and services. Many organizations, in general, and museums, in particular, are benefiting from this technology.

Ethiopia is often considered as a cradle of mankind, a cross-road of civilization, a museum of nationalities, and many local belief systems such as Geda, Zar, etc. It is a country which hosts the three major religions of the world. Its long history has made Ethiopia rich in historical and cultural heritages. To cite but a few, Hadar, the birth place of Lucy, the famous lofty steles of Axum, the great wonder of Lalibella rockhewn churches, the magnificent Gondar Castles, the stone tool archaeological site of Tiya besides exotic natural parks are some that exist in the list of the world heritage of UNESCO (Ahmed 1996). Accordingly, Ethiopia may deserve special attention with regard to preservation and documentation of heritages, not only as part of the country's own culture but also as monuments of the world's cultural heritage (Girma 1990).

The Institute of Ethiopian Studies (IES) at Addis Ababa University (AAU) was established in 1963 as one of the cultural preservation centers in the country. The general objectives of the institute include (Tadesse 1990, 1):

"conducting, promoting and coordinating research and publication on Ethiopia with special emphasis on the humanities and cultural studies. It also carries the responsibility of preservation of the cultural heritage of the country by collecting, cataloguing and displaying artifacts and items of historical value".

The Institute consists of a small administrative unit whose main task is to assist and facilitate the activities and programs of the other more important and larger units: the Research and Publications Department, the Library and the Museum. The specific objectives of the museum, in particular, are:

- to preserve cultural and historical objects for the present and future generations;
- to defend the national culture against undesirable influences;
- to provide continuous assistance to university students, teachers, researchers both from within the country and abroad, and the university at large.

Since the museum's establishment, its holdings has expanded significantly. Specifically the size of the collection has grown from 1,817 items in 1963, to 7,003 and 10,000 by 1974 and 1996, respectively.

Currently among the major activities preoccupying the museum is information provision on its holdings: i.e., maintenance of accession registers, catalogues, photograph documentation, etc. Currently manual methods are in use in this regard. Description of items are stored on card files (catalogues) where the items' photographs are also attached.

According to the staff at the museum, the manual cataloguing system is becoming a hindrance to the provision of prompt information services and has considerably limited the level of use of the museum collections. The following are among the specific problems cited:

- Handling the acquisition and cataloguing transactions manually has been taking a long time for the staff involved.
- The increase in the size and diversity of the collection has also created inventory control problems and difficulty in locating items.
- Users gain limited access to the collections browsing through the brief descriptions provided by the card catalogues. The available retrieval instruments are inadequate and inefficient when it comes to providing complete and up-to-date description of items and multiple access.
- Selecting the physical items or / and photographs browsing through the collections has been wearing them out.

The need for improving the services provided (and thereby alleviate some of the problems within the existing systems) through the use of IT has long been recognized, although little has been made towards its implementation.

A survey conducted by Abebe (1993) has summarized the problems faced by users when using the existing system at IES (both the library and the museum). He has also clearly pointed out that "results of the survey indicate the need for establishing an information system that will meet the expressed needs, overcome the shortcomings of the existing library system, and efficiently serve researchers and students in the field of Ethiopian studies." For the purpose of tackling these problems, he proposed an information retrieval system that

would replace the existing manually operated services within the Institute. The following are some of his recommendations:

1) To maintain computer databases of indexes to the library and museum objects concerning Ethiopia and suggested three separate databases for the purpose.

   a) bibliographic materials, museum objects and non-book materials such as microforms, motion pictures, audiorecords, etc.

   b) profiles of institutions, experts/researchers, information systems, databases and research projects, and

   c) serials;

2 To adopt Common Communication Format (CCF) for standardizing documentation;

3 To render services such as reference; referral; clearinghouse; retrospective search; current awareness; SDI; photocopy; indexing and abstracting; translation services to users; etc.;

Although the recommendations may work well for IES in general and as a starting point for the museum in particular, there was a feeling among workers that neither the study nor the recommendations, were of limited use to enhance the information handling activity of the

museum. According to Neelameghan (1994) conventional bibliographic databases of the recommended type can not serve such institutions because of the following reasons:

1. The objects handled in institutions in general, and IES museum in particular, are non-book materials. Hence the bibliographic format is not appropriate for such institutions;
2. Conventional databases are not appropriate for applications which involve more than one type of objects which is true for IES museum.
3. Some institutions handle or process non-text information which conventional databases can not support.

Records in IES museum objects comprise different data types, i.e., text, still images, moving images, sound, and video. Hence the core database needed by museums, in general, and the IES museum, in particular, are to handle information on objects of different media such as pictures of historical arts, agricultural implements, traditional songs, etc. To some extent this calls for the use of such current technologies as multimedia and object orientation as means of information handling in museums.

Multimedia is effectively an infrastructural technology, characterized by the ability to handle very diverse data types such as structured text, unstructured text, record-based data, numeric data, graphics, image, voice and video. It is used to improve electronic information representation, storage and manipulation in a wide range of applications. And it allows the interactive use of these different types of information. Multimedia systems are potentially of great value to organizations in general and IES museum in particular as it handles multimedia data types. Multimedia is not a standalone technology, but one of a number of significant

developments in computing. The most important of these related technologies is object-orientation. Image, voice and video data can be encapsulated in objects. Object Oriented techniques are used to develop multimedia applications (Jeffcoate 1995). The design and development of specialized object-oriented Databases (OODBs) are becoming increasingly the basis for generating value-added products and services, especially at the institutional level (Neelameghan 1994).

There was a strong feeling by museum workers that the accessibility of the museum items will increase significantly by incorporating full descriptions of the items in the existing catalogue together with their photographs. It is believed that this will greatly enhance the use of the museum by availing valuable reference guide.

To this end investigation of the capabilities of such current technologies as multimedia and object orientation is considered a valuable exercise. Such an undertaking is not only important but also timely and in line with the automation plan at the museum. The staff members of the museum, during a preliminary discussion made for the purpose of gathering background information, have strongly expressed the need for and necessity to look into the previous study recommendations with the purpose of incorporating photographs in the cataloguing (bibliographic) information by taking advantage of the advancement in the technology since the compilation of the previous recommendations.

1.3 SCOPE AND LIMITATIONS OF THE STUDY

Because of time constraints, the current undertaking considered the incorporation of only still picture, unstructured text, and sound aspects of multimedia together with text-based cataloguing records.

1.4. METHODOLOGY

1.4.1. Data Sources and Materials

The following were examined to generate the data required for the research

- records from the IES museum
- visit to the IES museum
- literatures for acquiring the concepts and principles of multimedia features, object oriented techniques and other related technologies, and to examine the experiences of other similar institutions.

1.4.2. Data Collection Techniques

For the purpose of determining information requirements of the users, the user population was classified into different groups depending on their type of use on museum objects. Three user groups were identified : staff - curator, registrar, conservators, guides; researchers; and visitors.

Chapter three presents results of the survey that assessed the IES users information requirements. It also includes the shortcomings and strengths of the existing system. The possible causes of the problems are also indicated.

The fourth chapter describes the prototype of the proposed database solution to deal with problems identified in the previous chapters. Chapter five presents the prototype constructed for the purpose of demonstration for the suggested solutions.

The last chapter relates to the conclusions and recommendations of the study.

CHAPTER TWO

MUSEUMS

2.1 HISTORICAL BACKGROUND AND DEFINITION

Museums are the treasure-houses of the human race. They store the memories of the World's peoples, their cultures, their dreams and their hopes. Museums are by nature institutions which hold the material evidence, objects, and specimens, of the human and natural history of our planet. Museum objects are selected lumps of the physical world to which cultural value are ascribed. These objects form the bulk of museum holdings. Museum objects are created by the act of collecting, for reasons which have to do with its perceived aesthetic, historic or scientific value (Ambros and Paine 1993; Pearce 1992).

The first organized museum was founded at Alexandria, Egypt in 332 B.C. by Ptolemy Soter. It collected books and artifacts, and information about them. It has a cataloguing system. It was an institute of advanced study, supported by the state, with many prominent scholars in residence. Following this early museum that focused on education, there was a long period of museological dormancy. Although objects of various kinds were gathered in many parts of the known world, most were either hoard collections accumulated for the monetary value of the objects or collections of curiosities gathered for their uniqueness. In neither case was the primary motive human enlightenment (Edson and Dean 1994; Mann 1995).

The changes in collecting, beginning in the fourteenth century and continuing through the sixteenth century, paralleled the advancements in the fine arts and science. In the fifteenth century, Florence was the center of intellectual growth that supported the best of the arts and

sciences. According to Thompson (1984), cited in Edson and Dean (1994), it was in this city that the word "museum" was first used to describe the collection of the Medici at the time of Lorenzo the Magnificent. The systematic and scientific methodology to the understanding of humankind and nature had evolved by the sixteenth century, and museums as institutions of enlightenment had re-emerged. Since that time it has continued in a linear development, spreading to the rest of the world (Edson and Dean 1994).

The first use of the term 'museum' in English described the collection of strange, rare and exotic things that the gentleman Elias Ashmole gave to the University of Oxford. The Ashmolean at Oxford in England is considered one of the first public museums of note. It opened in 1683 (Ambrose and Paine 1993; Edson and Dean 1994).

The development of public museums was a gradual process. In the United States, collection growth and public availability tended to go hand-in-hand. In Europe, it is now estimated that for every museum which existed in 1950, there are four today. In other parts of the world, museum development is only just beginning (Ambrose and Paine 1993; Edson and Dean 1994).

Nowadays, museums are known more as non-profit making permanent institutions established to ensure the preservation and conservation of the community's cultural and natural heritage. They serve as a cultural focus and a center of expertise, providing opportunities for community involvement in their work through Friends' Groups, volunteers, project work and in other ways. Museums served an educational purpose which gathered strength and social breadth as the modern period progressed. They give support to educational organisations, and offer a facility for cultural events and activities. Museums

have a key task to play in providing an understanding of identity and a sense of belonging to a place or community. In the face of immense and often painful cultural change in many countries, museums can provide a valuable sense of connection with the past and present, and serve a springboard for the future. They represent a unique resource reflecting a country's achievements and progress, and its historical development (Ambrose and Paine 1993; Pearce 1992).

As the American Association of Museums rightly argued, in Edson and Dean's book (1994, 13),

> "Museums generally derive most of their prominence and importance from their collections, and these holdings constitute the primary difference between museums and other kinds of institutions. The collections, whether works of art, artifacts or specimens from the natural world, are an essential part of the collective cultural fabric, and each museum's obligation to its collections is paramount.
>
> Each object is an integral part of a cultural or scientific composite. That context also includes a body of information about the object which establishes its proper place and importance and without which the value of the object is diminished. The maintenance of this information in an orderly and retrievable form is critical to the collection and is a central obligation to those charged with collection management".

The main wish is to see the genuine object - the "real thing." This is the particular domain in which museums hold undisputed sway, and is their source of uniqueness among all other

public institutions. Whatever the reason, museums are increasingly responsive to their audiences, increasingly visited, and increasingly accountable (Mann 1995; Edson and Dean 1994). According to Pearce (1992), the unique characteristics of museums is that

- they hold the real objects, the actual evidence, the true data
- the ability to display, to demonstrate, to show the nature of the world and of man within it by arranging the collected material in particular patterns which reflect, confirm and project the contemporary world view.

For years, museums have perpetuated the concept of reserve and under-statement when addressing the inner workings of the institution. Few members of the general public have had the opportunity to view the museum from the other side of the exhibition - the working side. Museums must take the initiative in shaping the public perception and perpetuating the image of institutions essential to social and civilized well-being.

They require personnel with different and varied educational and managerial backgrounds and it is the balance of these diverse efforts that result in a properly functioning museum. The modern museum by definition must meet and embrace a number of specialized functions which are discussed in section 2.2.3. It must be an informative, professional, systematic (in its collection care), enjoyable, and socially acceptable institution. To meet these often seemingly contradictory goals, traditional methods and practices of management are becoming unwieldy and increasingly obsolete.

The majority of museums internationally have inadequate staffing and resources to meet their large responsibilities. But despite this they still care for a unique resource, a significant part

of the world's heritage (Ambrose and Paine 1993). The main objective of museums is to provide a wide range of services tailored to users expectations and needs within the limited resources available.

2.2. TYPES OF MUSEUMS

As indicated in the preceding sections, museums were formed around special collections to reflect the interests and beliefs of the communities in which they were founded. Museum collections embody an important part of the discipline-based intellectual inheritance by which we understand the world (Edson and Dean 1994; Pearce 1992).

Museums vary enormously in size. They range from great international museums to the smallest one-room village museum. They vary enormously, too, in their purpose. Some are intended purely to amuse and entertain holiday-makers; others preserve the data on which scientific research is based. They vary in their collections: from insects to historic industrial machinery, from ancient statues to pathological specimens, from modern paintings to revolutionary flags. They vary in who runs them. They vary in the public they seek to serve.

In museums the individual discipline strands are usually identified as Natural History, with Zoology, Botany and Geology as its component parts, Archaeology, Anthropology or Ethnography, Art divided into Fine and Applied, and History (Pearce 1992).

By type of their collections or subjects, museums may be classified as:

- general museums
- archaeology museums
- geology museums
- science museums

- art museums
- ethnography museums
- industrial museums
- natural history museums

The collections of most museums, depending upon their size and length of history, are likely to involve a wide range of material, even if theoretically this is concentrated in a narrow band of disciplines. Associated with all this will be a considerable volume of written, printed, and pictorial record, including letters, manuscript note books, annotated maps, offprints from journals, water-colours, photographs and field notes, all in an enormous range of sizes and formats. Some of these materials will have arrived with the original collection, and some will have accrued down the years as the collection has been worked upon in the museum in a range of ways.

2.3. MUSEUM FUNCTIONS

As reported by many scholars (Ambrose and Paine 1993; Case 1995; Chenhall and Vance 1988, Edson and Dean 1994) museum functions start when an artifact is first acquired. Upon arrival, the object must be accessioned, identified, registered, and possibly, restored, and in some cases, photographed. Once the first surge of activity is over, most museum objects rest in storage until such time as they are needed for a research project or exhibit, either at home or on loan in some other museum, or until a noticeable deterioration in the condition of the object indicates that some conservation effort is needed. Eventually, practically some museum objects are disposed of in one way or another.

None of the forgoing activities can be done without the data / information maintained. Appropriate groups must be readily locatable in order for the ongoing activities to be performed efficiently, and this is possible only if the initial activities are carried out properly.

To facilitate this, most museums are functionally organized to perform such major activities as acquisition, documentation, conservation, research and classification, exhibition and education and marketing and information services. The following subsections provide brief prescription on each of these functions.

2.3.1 Acquisition

Acquisition refers to the process of acquiring objects for the Museum. Objects are normally acquired through donation, fieldwork or research, loan, exchange, purchase, or transfer from another institution. In fact, it is quite common for a large collection to arrive in several lots and by more than one of these acquisition routes.

Collections and associated documentation are owned by, or held-in-trust by, the museum, and shall be accessioned. The documentation includes a signed contract-of-gift form for those objects donated to the museum; proof of ownership for those objects purchased by the museum; a letter from the exchanging institution transferring title of the objects to the museum; or a signed accessions contract form for those objects held-in-trust by the museum; permits, stamps, and verification forms for those assembled by fieldwork.

Usually a management policy is formulated that sets forth the purpose of the museum and its goals, and explains how these goals are interpreted in its collections activity (Edson and Dean 1994).

2.3.2 Documentation

Ideally, every item placed in the care of the museum should be recorded in some predetermined manner within a reasonable time. The registration method should be designed to control the acceptance of such deposits in accordance with the museum's policy and to encourage periodic review of the deposits in order to ensure expeditious handling (Edson and Dean 1994).

Museums maintain a detailed record-keeping system for preservation of data on collection. Museum records have substantial intellectual status and are of inestimable value. Museum data support collections care and all other museum programs and functions. Without records, objects and specimens are virtually meaningless. Without this information, there would be no exhibitions, no catalogues, no tours, no programs, and no care of the collections. The up-keep of these records, their accuracy and accessibility, are central to the museum's mission. In the several thousand years between the clay tablet and the computer, there were many experiments in record keeping. Record keeping provides the basis for communicating information about the objects in the collection. Cataloguing and cross-referencing systems allow the collection to be viewed under differing classifications (Mann 1995; Edson and Dean 1994; Ambrose and Paine 1993).

Collection documentation records may be divided into two general categories. The first includes records which are commonly associated with registration functions. These primarily

Usually a management policy is formulated that sets forth the purpose of the museum and its goals, and explains how these goals are interpreted in its collections activity (Edson and Dean 1994).

2.3.2 Documentation

Ideally, every item placed in the care of the museum should be recorded in some predetermined manner within a reasonable time. The registration method should be designed to control the acceptance of such deposits in accordance with the museum's policy and to encourage periodic review of the deposits in order to ensure expeditious handling (Edson and Dean 1994).

Museums maintain a detailed record-keeping system for preservation of data on collection. Museum records have substantial intellectual status and are of inestimable value. Museum data support collections care and all other museum programs and functions. Without records, objects and specimens are virtually meaningless. Without this information, there would be no exhibitions, no catalogues, no tours, no programs, and no care of the collections. The up-keep of these records, their accuracy and accessibility, are central to the museum's mission. In the several thousand years between the clay tablet and the computer, there were many experiments in record keeping. Record keeping provides the basis for communicating information about the objects in the collection. Cataloguing and cross-referencing systems allow the collection to be viewed under differing classifications (Mann 1995; Edson and Dean 1994; Ambrose and Paine 1993).

Collection documentation records may be divided into two general categories. The first includes records which are commonly associated with registration functions. These primarily

document the legal status of an object within the museum and that object's movement and care (loan, exhibition, restoration, deaccessioning) while under the control of the museum. The second category includes records associated with curatorial functions (academic interpretation). These provide a broad body of information about an object which establishes the object's proper place and importance within its cultural or scientific sphere.

There is nowadays a standard documentation system, increasingly agreed throughout the world. This system has different parts including Entry, Accessioning, Cataloguing, Indexing and Retrieval, and Movement control.

a) Entry

Every object or group of objects coming into a museum - whether as a gift, purchase, loan or enquiry - is recorded on a numbered Entry Form. The purpose of the Entry Form is both to acknowledge receipt of the object(s) and to ensure that information from the donor is not lost before a full record is made. A temporary Label is tied to the object or objects, bearing the number from the Entry Form.

b) Accessioning

Accessioning is the formal acceptance of all acquisitions (except loan items), into the museum collection. Upon accessioning the museum assumes the obligation for the proper management of objects. Each object, or group of objects, to be kept by the museum is entered in the Accessions Register. This Register is the most important part of the documentation system. It has three main functions:

- it assigns a unique number to each object,
- it describes each object,

- it gives the history and provenance of each object.

Each group of objects received at the same time and from the same source is given a permanent accession number. Accession number document museum ownership and are an inventory control device for the registrar. Each object in the group is then numbered separately. The whole is known as the Identity Number and is unique to that particular object. Each object has a Permanent Label attached, bearing the permanent identity number. The permanent accession number is also written on the Entry form. Most museums photograph the object at this stage for recording purposes.

The registrar transfers the accession data to an official accession card that is filed numerically. Accession records include an initial condition report, conservation and fumigation needs, the collection area to which the objects are assigned and the associated catalogue numbers. The frame of the black-and-white photograph or the color slide, or video cassette frame number, which ever the case may be, is also attached to the accession card and the negative or duplicate copy is kept.

Objects accepted for educational uses are accessioned into the museum and assigned to the appropriate collection area. The duplicate accession cards for the objects are kept in the files of the assigned collection area even when the physical locations of the objects are reassigned to the museum's education program. When the objects are no longer useful to or needed by the museum's education program, the objects are returned to the collection or origin.

Books to be placed in the museum's library are not accessioned but are recorded by the registrar with the donor's information. Records for books are kept in a file separate from the

- it gives the history and provenance of each object.

Each group of objects received at the same time and from the same source is given a permanent accession number. Accession number document museum ownership and are an inventory control device for the registrar. Each object in the group is then numbered separately. The whole is known as the Identity Number and is unique to that particular object. Each object has a Permanent Label attached, bearing the permanent identity number. The permanent accession number is also written on the Entry form. Most museums photograph the object at this stage for recording purposes.

The registrar transfers the accession data to an official accession card that is filed numerically. Accession records include an initial condition report, conservation and fumigation needs, the collection area to which the objects are assigned and the associated catalogue numbers. The frame of the black-and-white photograph or the color slide, or video cassette frame number, which ever the case may be, is also attached to the accession card and the negative or duplicate copy is kept.

Objects accepted for educational uses are accessioned into the museum and assigned to the appropriate collection area. The duplicate accession cards for the objects are kept in the files of the assigned collection area even when the physical locations of the objects are reassigned to the museum's education program. When the objects are no longer useful to or needed by the museum's education program, the objects are returned to the collection or origin.

Books to be placed in the museum's library are not accessioned but are recorded by the registrar with the donor's information. Records for books are kept in a file separate from the

accessions file. Books are catalogued using standard library procedures. Rare books and historic manuscripts appropriate to the collections are accessioned and assigned to the appropriate collection area. They are catalogued into the collection. Accessioned books are not placed in the library.

c) Cataloguing

The Catalogue is a complete record of everything that is known about every object in the museum's collections. Catalogue information is used in and generated by research and examination of the object. It can be either held on a card catalogue, or on a computer program. A card catalogue consists of individual cards, usually pre-printed, kept in identity number order in a metal card-drawer, ideally in a fire proof lockable cabinet. CIDOC (International Committee for Documentation, International Council of Museums) proposed a standard to enable data exchange. The minimum is:

- the name and address of the owner,
- the registration number,
- the object name or term,
- its category or classification,
- the mode and date of acquisitions,
- the source and place of acquisitions,
- and a description and history of the object.

Other types of information may be useful as well, but the above are usually considered essential.

Unlike other institutions, museums need to maintain photograph documentation in addition to written documentation because of the nature of their collections. Photography, film, and video are used by museums in three ways: as recording techniques, for fieldwork and collecting, as original records, themselves forming part of the collections, as display techniques, to help interpret and present the museum's collections to the public.

d) Indexing and retrieval

Indexes enable users and museum workers to find information in the catalogue without reading every single card. Both an accession file and a catalogue file are organized in numerical sequence, which does nothing to aid museum workers in the performance of their work. The activities of the museum require the ability to find artifacts by such characteristics as object name, storage location or artist name not by a basically arbitrary number. While a set of cards is maintained for each index in manual systems, computer system permit vastly more sophisticated indexing (Ambrose and Paine 1993; Edson and Dean 1994; Chenhall and Vance 1988).

Although the utility of inverted indexing was recognized in museums early, it could not be realized as it involves a considerable amount of labour and time with manual card catalogues. It is possible to prepare three artifact cards without too much trouble, but when the number of discrete, indexable data categories is, say, ten or more, the clerical task of creating, filing and controlling so many cards very quickly gets out of hand and the system breaks down completely. With computer-based cataloguing systems, the files can be reorganized on demand to fit almost any conceivable data need

e) Movement Control

Movement control means the recording of movements of objects from the collections, both within and in and out of the museum. This is caused by some of the museum activities (e.g. exhibition, loan, and deaccessioning).

The locations of collection objects used in exhibitions must be recorded and updated, whether they move from room to room, or from city to city. The bigger the collections, the more important it is for the museum to have a good movement control system.

Borrowing and lending objects are inherent practices in a museum and require specific procedures to assure object management. Museum collections are maintained for the benefit of the public and objects are loaned to reach a wider audience and facilitate research. Loans do not involve transfer of title but are the temporary reassignment of objects from the museum (outgoing) to another institution or to the museum (incoming). All loans are for a defined period of time and for the stated purposes of exhibition, research, and / or education. Records of incoming and outgoing loans are maintained including condition reports; written loan agreements.

Permanently removal (deaccessioning) of an object from the collections through donation, exchange, sale, loss, or deterioration beyond repair, allows the transfer of unrestricted title to the receiving agency. The only material considered for deaccession will be that to which the museum has clear title. A number of reasons create the need for careful removal of objects from the museum collections. In order for the institution to serve the cultural and educational needs of its various communities, it cannot remain static. Periodic re-evaluations and thoughtful selection are necessary for the growth and proper care of collections. The practice

of deaccessioning under well-defined guidelines provides these opportunities. Deaccessioning is documented in writing and photographs. The accession and catalogue cards are marked "deaccessioned" with the date of transaction.

2.3.3 Conservation

The most difficult part of maintaining a museum is the proper care and use of the collections. Collections come in many forms and may represent the most sacred and profound of a society's cultural heritage or embody the common elements of everyday life. Fine art objects, natural history specimens, aboriginal artifacts, or common use articles require the same special care once placed in the custody of the museum. The level of care for all museum objects must be adequate to ensure their existence in the future.

Conservation is an attempt to prolong the life of objects of historical and artistic value. In such efforts of saving, museums provide proper safeguards for the objects against environmental extremes: such as strong light, humidity and temperature fluctuations; insects, animals, and micro-organisms; and vandalism or burglary. Preventive conservation is the first step in the ongoing process of object care supplemented by conservation treatment and lastly by restoration when warranted and desirable. This is usually achieved through periodical review of the conditions of the collections. The primary objective of all museum conservation is to preserve the object in as stable condition as possible.

The Conservator, on a scientific basis, examines museum objects, works to prevent their deterioration, and treats and repairs them when necessary. A conservator usually has the specialized knowledge to treat a certain class of objects, such as paintings, sculpture, textiles,

furniture and wood-work, books and art on paper, etc. and to refer materials that cannot be treated in the museum laboratory.

Collections are central to museums. If collection objects are destroyed or allowed to be destroyed not only does the museum lose a valuable asset, but humankind loses an element of its cultural or scientific heritage that may be irreplaceable. Protection of objects depends on a long-term commitment to preservation of objects by the museum. It is also imperative that all preservation treatments are competently performed and properly documented. Documenting is done for the conditions and movements of the collections. Efficient maintenance of these records facilitate the conservation effort by allowing concentration on the conserving activity.

For conservation reasons some objects may not be displayed unless they are provided controlled environments in display cases - this may be too costly. This can also happen for objects which occupy large spaces. These problems necessitate the use of replicas of objects to give visitors / researcher opportunities to see or use all museum holdings.

2.3.4 Research and Classification

All museum objects have names, frequently, more than one name reflecting their movement from one context to another. It is the function of the museum to provide objects and specimens with names through the interrelated process of classification and research and to express this process in the formal procedures of documentation.

In museums, scholars conduct research and exchange ideas with reference to tangible objects. Museum collections of all types have a vital role to play in research. Indeed one of the

justifications of collecting material for museum collections is that it forms a permanent body of research material for future generations.

> "'The collections' are an immensely complex body of material evidence, an archive which embraces not only the physical evidence of our human and natural past, but also of how this past has itself been interpreted as decade has succeeded decade, and layers of meaning have been generated through study and research" (Pearce 1992, 134).

It is often the case that in the light of new scientific techniques, new discoveries or new methodologies, researchers can be able to approach and use museum collections in ways which had not previously been considered. Researchers often examining classes of material held in more than one museum. Collections in a museum therefore should not be thought of in isolation from other collections (Ambrose and Paine 1993).

Carrying out research on collections in-house, or making collections available to outside organisations or individuals for research purposes, illustrates the importance of effective documentation in collections management. Without high-quality records the value of collections is substantially reduced. Thus museums are required to assemble as much information about its collections as possible and create filing systems and documentation procedures which allow for information about items / specimens to be systematically kept and maintained.

The creation of knowledge and understanding from which the classification systems spring is, of course, research. The research approaches particularly relevant to museum material are

those which arise from the specific nature of objects as lumps of material world, a nature which generates a need to understand their physical properties, their biographies in time and their locations in space. The creation of meaning for museum items vary depending on the discipline, human or natural (Pearce 1992).

From the very beginning, museums were not only collecting objects, but devising means of classifying these objects and organizing information about them (Mann 1995). Collection classificatory systems differ depending on the disciplines concerned (ICOM 1995; Pearce 1992):

- For ethnography, fine arts and archaeology: thematic classification linked to the function and/or physical aspect of the object (ex. tool, architecture, funerary,...) is employed.
- For natural sciences and palaeontology: objects are categorized based on taxonomical classification.

Most museum areas now posses terminology thesauri which set out lists of names and definitions for use in museum nomenclature and which have received various degrees of acceptance (e.g. for archaeology RCHME 1986, for general Orna 1983, etc.)

2.3.5 Exhibition and Education

The places where people see the real things are the exhibit galleries. Every museum has a responsibility to preserve and disseminate information about the cultural or scientific properties of the community it serves. The public side of a museum is its galleries, and the

outward representation of the whole institution is its public exhibitions. The uniqueness of museum exhibitions rests in their employment of the actual object.

According to verhaar and Meeter, cited by (Edson and Dean 1994, 151):

> "An exhibition is a means of communication aiming at large groups of the public with the purpose of conveying information, ideas and emotions relating to the material evidence of man and his surroundings with the aid of chiefly visual and dimensional methods."

Presentation of public exhibitions and programs has become a museum's primary way of establishing accountability to the support community, and justifying the expectation for continued funding. Exhibitions, then, are an extremely vital part of any museum's activities (Ambrose and Paine 1993, Edson and Dean 1994):

In selecting of objects to be exhibited in the museum, every effort is made to maintain the confidence of the constituents. Exhibit decisions is weighed not just in the view of what the museum perceives to be best for the people, but also with consideration of what the people perceive to be in their best interests. The museum's institutional motivation is to present objects and information in a manner conducive to meeting educational goals. Exhibitions fulfil, in part, the museum's purpose.

Public education is one of the museum objectives - using collections to interpret, tell stories, and communicate. Museum educational programs can enhance the interaction among all segments of the visiting public by forming a connection between the audience and the objects collected, preserved, and interpreted in the museum. In addition to exhibition, museum

outward representation of the whole institution is its public exhibitions. The uniqueness of museum exhibitions rests in their employment of the actual object.

According to verhaar and Meeter, cited by (Edson and Dean 1994, 151):

> "An exhibition is a means of communication aiming at large groups of the public with the purpose of conveying information, ideas and emotions relating to the material evidence of man and his surroundings with the aid of chiefly visual and dimensional methods."

Presentation of public exhibitions and programs has become a museum's primary way of establishing accountability to the support community, and justifying the expectation for continued funding. Exhibitions, then, are an extremely vital part of any museum's activities (Ambrose and Paine 1993, Edson and Dean 1994):

In selecting of objects to be exhibited in the museum, every effort is made to maintain the confidence of the constituents. Exhibit decisions is weighed not just in the view of what the museum perceives to be best for the people, but also with consideration of what the people perceive to be in their best interests. The museum's institutional motivation is to present objects and information in a manner conducive to meeting educational goals. Exhibitions fulfil, in part, the museum's purpose.

Public education is one of the museum objectives - using collections to interpret, tell stories, and communicate. Museum educational programs can enhance the interaction among all segments of the visiting public by forming a connection between the audience and the objects collected, preserved, and interpreted in the museum. In addition to exhibition, museum

education is another justification for the museum's existence. Museums have two missions: to collect objects and to use them to educate. As Edson and Dean (1994, 150) pointed out that

> "Museums are a place of the Muses - that is, a place for study, reflection, and learning. The purpose is mainly educational in scope."

Most museums now recognize that communication can only be accomplished within a more interpretive framework (interpretative dominant) than open storage (presentation dominant). The educational mission of museum exhibitions has become the primary focus. The information behind an object - its provenance - needs to be related to the viewer through planned and structured interpretation.

> "Every museum has an educational responsibility to the public it serves. Museums offer a unique encounter with objects and ideas for people of many ages, interests, capabilities and backgrounds. Museum education strengthens that encounter by building bridges between visitor's experiences and expectations and the experiences and ideas that emanate from a museum's collections" American Association of Museums.

Museum education programs are often developed for specific age or interest groups. In this way the information is presented in the vocabulary, comprehension level, and social manner of the group. Education programs can be designed as self-guided tours (with-out a docent or guide), or guided tours (with a guide and prearranged script) depending on the program objectives. By contrast, general museum programming of exhibits and events is less focused and intended for the casual visitor.

2.3.6 Marketing

When considering the idea of public service, museums have come to acknowledge the fact that the visiting audience has a variety of cultural or leisure time opportunities. They may choose a concert, theatre, cinemas, watch television, etc. There should be a plan to attract people to the museums that had not previously been museum-goers. By involving the public in the general well-being of the museum, visitorship and local support can be increased. There should be efforts to address the perceived needs of the communities in which museums are located in order to secure large audiences. For the most part, this effort should be in the form of audience confirmation and reassurance. The real challenge to museum workers is to have a broad view of global issues and to determine what can be done to make a difference. They must also consider how to make those issues available to the visitor.

As John cotton dana, cited in Edson and Dean (1994), argued that

> "Museums can only be of service if they are used. They will be used only if people know about them, and only if attention is given to the interpretation of the objects in terms that the visitors can understand."

The museum has to develop a product or services to meet the needs and interests of the market. It has to ensure that the way in which that product is made available or priced will generate demand. It has to promote and publicise its services in the market-place. It has to develop a good working relationship or good public relations with its users and patrons in order to maintain and develop interest in the museum's services and to fulfil its mission. When advertising a museum, one has to ensure that the benefits to the user are stated clearly.

A market can be thought of as the social and economic context within which a museum operates. All museums operate within a market. The market will vary from place to place, country to country. For a museum understanding, the nature and composition of its market is of paramount importance for success. Researching the market helps the museum to determine whether it is offering the right type or mix of services to its users, at the right location at the right time and at the right level (Ambrose and Paine 1993).

Market research is necessary when starting up and developing a new museum, or managing an existing one. Further, it should be a continuous exercise to help develop or change services to users in the light of their needs and responses to the museum.

Defining the services on offer and the range of benefits available will help museums to understand the market more accurately. It is unlikely that the museum will have the money or resources to provide for all the needs of all possible users. The museum will have to decide what services it would be best to provide with the resources that it has. Market research will provide the information to make these decisions. Based upon the research documents, interpretive materials such as text and labels are fitted to the audience needs and educational level.

In practice, there is not one huge uniform type of users, but a collection of many smaller groupings. Museum markets can thus be divided into segments, each of which represents a target audience for the museum. There are many ways of dividing or segmenting visitors. These include age, sex, income, education, location, leisure participation, lifestyle, patters of use. Market surveys can help to provide information to help segment users and services (Ambrose and Paine 1993).

The communications and promotional strategies that can be employed for marketing purposes include the broadcasting media, print or audio-visual materials. Word-of-mouth publicity from satisfied users is a very powerful means of advertising. The reception desk is also conceived of as a key 'point of sale' for the museum.

Tactile exhibits, "guided" tours, audio-visual devices, special activities, transportation options, providing exploration activities, docents with sign language capabilities, emphasis on first-hand experience over books and words, and demonstrations all are also among the ways to afford the audiences effective museum exhibit experiences.

2.3.7 Information Services

Museums provide information to their users in a wide variety of ways - through exhibitions; publications; telephone enquiry services; posters and leaflets; reception desks; identification services; lectures and talk programmes; correspondence and many more. Information about any museum is also provided by other people outside the museum - tourist information officers, Trustees or Governors, volunteers and Friends, corporate supporters and visitors. The information provided by the museum are expected to be accurate, clearly presented and communicated, and in accordance with the organisation's communications policy. To this end, museums usually develop a clear communications policy within which the museum's information services have a defined role (Ambrose and Paine 1993).

Publications, based on the museum's collections, produced by the museum form important resources for visitors / users. They are means of presenting information not included in the other communication methods. Such publications can take a wide variety of forms ranging

from scholarly catalogues of collections to popular guidebooks, to articles in specialist journals to children's activity books. They can also include interactive video-discs, audio-tapes and computer systems.

When Exhibitions are prepared, at the time of installations, such information products as: labels, text, and title copy, as well as, writing gallery guides, brochures, and training materials for tour guides and teachers are prepared.

2.4 MUSEUM USERS AND THEIR INFORMATION REQUIREMENTS

The information need of users is of central concern to providers of information service. The ultimate aim of any information service is to supply and deliver the information which can precisely match the information requests from users. Information needs and users are studied with a view to improve the overall system of information transfer. Obviously, the key to the success of information transfer depends largely on the accurate identification of what the user needs (Pao 1988).

Many people make use of museums - registrars, curators, conservators, researchers, educators, exhibit designers, local and tourist visitors, reporters, donors. Different users have different information requirements in terms of content / subject, levels of detail, format, and media depending on the purpose.

Information can be provided orally, as in a reply to a telephone inquiry, or in writing, as in correspondence lists, file cards, and publications. A photograph or slide, a microfiche, a computer printout all constitute forms of information.

The following information on objects are needed by various users depending on the purpose:

I. ***Collection management information*** - records on any activity that affects an object, any transaction related to an object, and any movement of an object. Registrars, curators, administrators and conservators use and generate such information. In particular, information on:

   A. acquisitions, accessioning, inventory, photography, insurance, storage, shipping, and packing information;

   B. object's movement and care (loan, exhibition, restoration, deaccessioning): location, condition, etc.

II. ***Cataloguing information*** - information required by researchers, educators, conservators, curators and registrars, and consists of descriptions on cultural or historic or scientific context; provenance; techniques of manufacture, methods of use, classification, interpretation. These descriptive data allow to answer questions: when was the object made; who made it; when, how, why, where it was collected; who used it and how.

III. ***Research related information*** - exhibition histories, biographies, bibliographies; social and political history; scientific and technological developments; descriptions of artistic media; and others.

IV. ***Publications*** - bibliographic resources; catalogues; indexes; bulletins; etc.

V. ***Statistical data*** - information on visits, etc.

Complete, accurate, and retrievable documentation reflects well on the system and the museum. Users need the following capabilities from the museum systems in order to facilitate their performance:

- retrieve information by different characteristics of the objects such as provenance, object category, name, location, age or period of production etc. promptly. For example, one can ask: "What nineteenth-century paintings does the museum own"; "List of items acquired through donations"; etc.
- produce interpretive materials: texts, labels; retrieval tools: catalogues, indexes, etc.; inventory lists; etc.
- get the information in different media: printed, electronic form, etc.
- get the information through telephone, in person, and telecommunication lines; seminars; workshops; etc.
- information about additions to the collections.

2.5 PRACTICES IN MUSEUM AUTOMATIONS

There is substantial evidence now, Mann (1995), that conventional manual systems, for all their ease and sophistication, are less and less capable of yielding answers to the questions museum professionals and users ask. The mountain of data is simply too big, the information needs too complex.

The development of new methods to manage information are becoming possible by the use of computers. Computers offer solutions to many of the problems that museums normally encounter. They bring order to the mass of information they handle. They organize, replace drawers of catalogue cards, and provide instant answers to questions people ask about collections.

It was in the 1970s that museums began to launch projects to computerize collections records. Some were successful and still exist. According to Sarasan, referred by Schmiegel (Introduction, 1995), many were dumped as failures, or were too costly, or were put on hold.

Internal uses of computer technology fall into three functional areas: office automation, collections management, and environmental control. Office automation tasks in a museum are much the same as in any office. Computerized systems such as electronic mail, calendars, word processing, and interactive teleconferencing are affordable realities. Many museums are also beginning to automate business functions such as personnel, payroll, and accounting. Office automation and automated financial systems accounts for most of the computer usage in museums today. Museums are also looking to computers to help manage mailing lists, membership records, and development efforts (Clifford 1995).

Automation of environmental control in the museum is less common. Among the services supplied or envisioned in this category are: energy systems such as automatic lighting, temperature, and humidity control; fire, smoke, and other hazard detection; etc.

In its unique role as a caretaker, a museum must record basic inventory information about each object in its holdings. There has been much museum interest and activity surrounding the automation of registration and curatorial functions. There are many automated systems in use, Clifford (1995), to support these functions. Some are tailor-made for museums, others are general purpose inventory management systems. The development of the microcomputer, associated mass storage devices, and general - purpose software packages - all at reasonable prices - is bringing automated collections management within the reach of most museums.

For instance, Clifford (1995), in America only 32 percent of American museums use computers at all. Primarily they use computer for administrative purposes, only 16 percent of museums use computers for collections information management and most of this usage is for the simplest collections management tasks.

Six African Museums participating in AFRICOM project, which has the objective of creating adaptable standards for African museums, reported that some computerisation activities on collection inventory systems were already accomplished.

According to Hogenboom (1996), the national Museums of Kenya has responded to the needs of its departments in various areas including collection management systems, research databases etc. by providing IT solutions based on stand alone PC's and LANs. Presently the Museum maintains the bulk of databases (e.g. Biodiversity).

However, automation efforts in the documentation of museum collections have traditionally focused on the creation of comprehensive databases of structured text records, each detailing the salient characteristics of a particular object, specimen or work of art. Now, the ability to capture and store information in formats other than structured text using multimedia features provides new opportunities for the documentation and interpretation of works in museum collections (Starre et al. 1996).

Museums have always been concerned with presenting multimedia experiences to their visitors through their collections and exhibitions. They were also among the first organisations to realise the potential of interactive multimedia computer technology as a way of allowing a greater degree of public participation and involvement in the learning

experience. Long before the terms `interactive' and `multimedia' became 1990s technology buzzwords, museums were presenting multimedia displays and exhibitions to their visitors and encouraging interaction between the visitor and the museum object (Kassay 1995).

Obviously, a museum is a natural client for a catalogue that provides images of exhibits along with hypertext documentation and commentary and perhaps some video and audio. Basic information can be combined with background details about maker, genres, subjects, provenance, and techniques. Such a museum multimedia information system could be used as an inventory, an enhanced exhibition catalogue, electronic docent, aid for training human docents, and as a research tool (Buechner 1992).

Multimedia is used as a communication tool, interpreting museum artifacts and collections, both within the institution (in the exhibition gallery or orientation kiosk) and through distribution mechanisms (such as published CD-ROMs or multimedia databases accessible through the Internet or the World Wide Web). Multimedia is also being used as a documentation tool, building integrated museum databases that record information about collections. They may be used simply as internal collections management or documentation tools, or they may be made accessible to outside researchers.

Thus, multimedia systems are not limited by the linear catalogue format, but exploit associative links to allow full hypertext navigation between artifacts or works of art, published references, people, events, places, and concepts. Such systems are powerful research tools which allow in selection of relevant works when starting research.

Interactive image manipulation capabilities can make it possible for a visitor to compare and contrast objects, and to examine works in detail.

The touch-screen Micro Gallery is an interactive multimedia information facility for visitors to the National Gallery in London. It provides access to the complete catalogue of the National Gallery's Collections using traditional methods as well as through a series of historical maps providing access by time and place. It is based on high quality colour images and many thousands of individual screens, hundreds of thousands of words of text, and dozens of animations. There are approximately 2,200 painting entries and a total of approximately 5,000 pages in the complete system. The detailed contextual and interpretive information and the many different ways of gaining access to that information allow the system to be used as a multimedia encyclopaedia on the history of Western painting -- not just as a catalogue of the Gallery's collection. The system won the British Computer Society award for 1991 (Kassay 1995; Micro Gallery Visitor Survey).

While principally a collection information system, the Micro Gallery also fulfils the role of an orientation guide by showing users the precise location of particular works in the Gallery. At the end of the session a map of the Gallery can be printed, showing where the paintings selected by the visitor are hung.

The Rossetti Project at the Institute for Advanced Technology in the Humanities integrates source material in digital form: images of paintings and drawings, images of published texts, and texts marked up in SGML with description and analysis provided by a specialist. Research-focused multimedia publications, such as Luna Imaging's Frank Lloyd Wright, Presentation make large amounts of quality information easily available to the scholarly

community (Starre et al. 1996).

In art-history-related research, comparison of paintings and drawings is one of the most essential techniques. Vaughan (1995), cited in Starre et al. 1996, reported that Morelli system allows users to retrieve from a database of many images those which bear a close resemblance to one selected. Thus the image itself becomes a search argument (Moline 1991).

Other significant museum multimedia applications, for example in the National Museums of Denmark and the Imperial War Museum, aim to provide visitors with access to material not on display. These applications are a cross between a virtual study collection and an illustrated catalogue of the collection, albeit with more powerful information retrieval capabilities and, possibly, better quality images (Starre et al. 1996).

Multimedia interpretive systems can be used in different approaches. The Classical art videodiscs installed in the Greek galleries of the Louvre include monograph collections of textual and visual information, hierarchically arranged. Other applications include role-playing dramatizations, such as the hunting game in the "Life in the Arctic" videodisc that accompanied the exhibition of the same name in the Museum of Mankind in London, and simulations, such as that of a three species habitat in the Exploratorium in San Francisco. Interactives in the Noorder Dierenpark (Netherlands) use humorous, cartoon-like creatures in order to teach children about evolution. The museum visit can be enhanced by multimedia systems emphasizing narrative content, the Yorvik Viking Center in York is an example of such systems. It has been criticized for diverting the attention of visitors from original artifacts (Starre et al. 1996).

The Natural History Museum in London is an excellent example of a multimedia computerised orientation guide. This is one of the largest museums in the world, with an incredible variety of collections and exhibitions, and it is easy to become overawed by the choice of exhibits on offer. Staff at the Museum realised that this was a problem and the interactive orientation guide is their answer (Kassay 1995).

The J. Paul Getty Museum in Malibu has produced an interactive videodisk of the museum's manuscript collection, which allows visitors to page through five examples of these delicate and beautiful works through a touch-screen computer terminal. Not only does the system allow visitors to look through an entire manuscript they would otherwise be restricted to peering at through a pane of glass, it also includes video sequences that demonstrate medieval techniques of manuscript production such as the preparation of vellum, binding, calligraphy and illumination (Kassay 1995).

Applications functioning as visitor guides may be installed at the entrance of a gallery, as in the case of the Micro Gallery of the National Gallery in Washington; distributed in a number of access points in the exhibition itself, as in the Networked World exhibition of the Boston Computer Museum; or accessible through devices carried around by visitors, as in the portable CD-ROM system by the Isle of Man museum for visitors to the monuments of the island (Starre et al. 1996).

Australian museums that have made extensive use of interactive multimedia computer technology in their exhibitions include the Powerhouse Museum and the National Maritime Museum in Sydney. Among others, they include touch-screens, quizzes, games, etc. The

Maritime Museum is also planning to develop a public-access multimedia catalogue of its collection (Kassay 1995).

2.6 TRENDS IN MUSEUM INFORMATION SYSTEMS

As computer and telecommunication technologies become more powerful, sophisticated, and easier to use and digital storage becomes cheaper, museums will have opportunities to use these technologies in new and innovative ways. A brief description of some of the technologies that will contribute to the enhancement of museum collection systems are presented below.

- **Integrated multimedia systems**

Multimedia systems for research mostly concentrate on two media, text and image, often enhanced by specially designed software for manipulation. Similar techniques for moving images and sound will become available, presenting museums with a whole range of tools to be used to fulfil their goals: preserving, documenting, and exhibiting cultural heritage (Starre et al. 1996).

- **Natural language Interface**

Natural language Interface, either typed or spoken, is among the many possibilities that is required for user-machine communication. The most effective one allow virtually unrestricted English communication with database querying systems - exactly the environment appropriate for a dialogue between the public and the museum's information base (Clifford 1995).

- **Object-Oriented systems**

"Multimedia systems - and object-oriented systems - may derive information technology development for the foreseeable future" (Buechner 1992, 1). CIDOC Data standards Workgroup agreed to use object-oriented methods for developing future CIDOC data models in their meeting of March 6 - 8, 1996. They believed this technique will extend and strengthen the existing CIDOC Relational Data Model. They pointed out that "It will offer flexibility and extensibility not possible with a relational approach. Information which is implicit in the relational model will be represented explicitly in the OO model. More specifically the, OO model can provide varying levels of information from a general overview to a targeted search, enabling the display, use, and retrieval of information from multiple points of access simultaneously" (Reed and Crofts).

- **Standardization & Interconnection of Museums**

The convergence of multimedia computing with broad-band digital telecommunications will open up an entirely new range of possibilities. Physical distance and the walls of the museum will cease to be barriers to information about museums and their collections. Already there is talk of the international `virtual museum' accessible by fibre-optic cable (the `information superhighway') through a home computer, allowing users to randomly select works from museums all over the world and display still images, motion video and supporting documentation on their computer screen. Examples of such systems include VAN EYCK (Visual Arts Network for Exchange of Cultural Knowledge), NARCISSE (Network of Art Research Computer Image Systems in Europe), Musée du Louvre in Paris and RAMA (Remote Access to Museum Archives) (Kassay 1995).

As more cultural institutions automate information, it will become easier to beg, borrow, or otherwise acquire some of that knowledge through any of the myriad communication networks that are appearing. The international business community invests heavily in the building of international communication networks, and the technology and the standards needed to support them are finally emerging. Museums will continue efforts towards standardization and cooperation, and increase commitment to imaginative, first-rate information systems (Clifford 1995).

Linked together over networks, museum multimedia databases become a valuable cultural resource. The continent of multimedia information is just now forming in networked information space (Starre et al. 1996). The expanding use of the Internet by museum professionals throughout the world will help to facilitate widespread inter-institutional cooperation and information sharing on an international level, as well as providing online public access to museum collections.

- Other promising applications for furthering visitors' understanding include virtual reality and computer graphic reconstruction, construction, and manipulation games (such as archaeological dig simulations), video-on-demand applications with material relevant to specific galleries, and holographic displays (Starre et al. 1996).

CHAPTER THREE

ANALYSIS OF THE EXISTING IES MUSEUM

For the purpose of documenting the existing system, in addition to review of related documentation, interview and extensive discussions were held with the technical staff at the museum and selected users of the museum. To this end, three separate discussion guides were prepared: one for staff members, one for researchers and one for visitors (see Appendix A for details). Summaries of the discussions and the reviews are presented under the various sections of this chapter.

3.1 HISTORICAL BACKGROUND

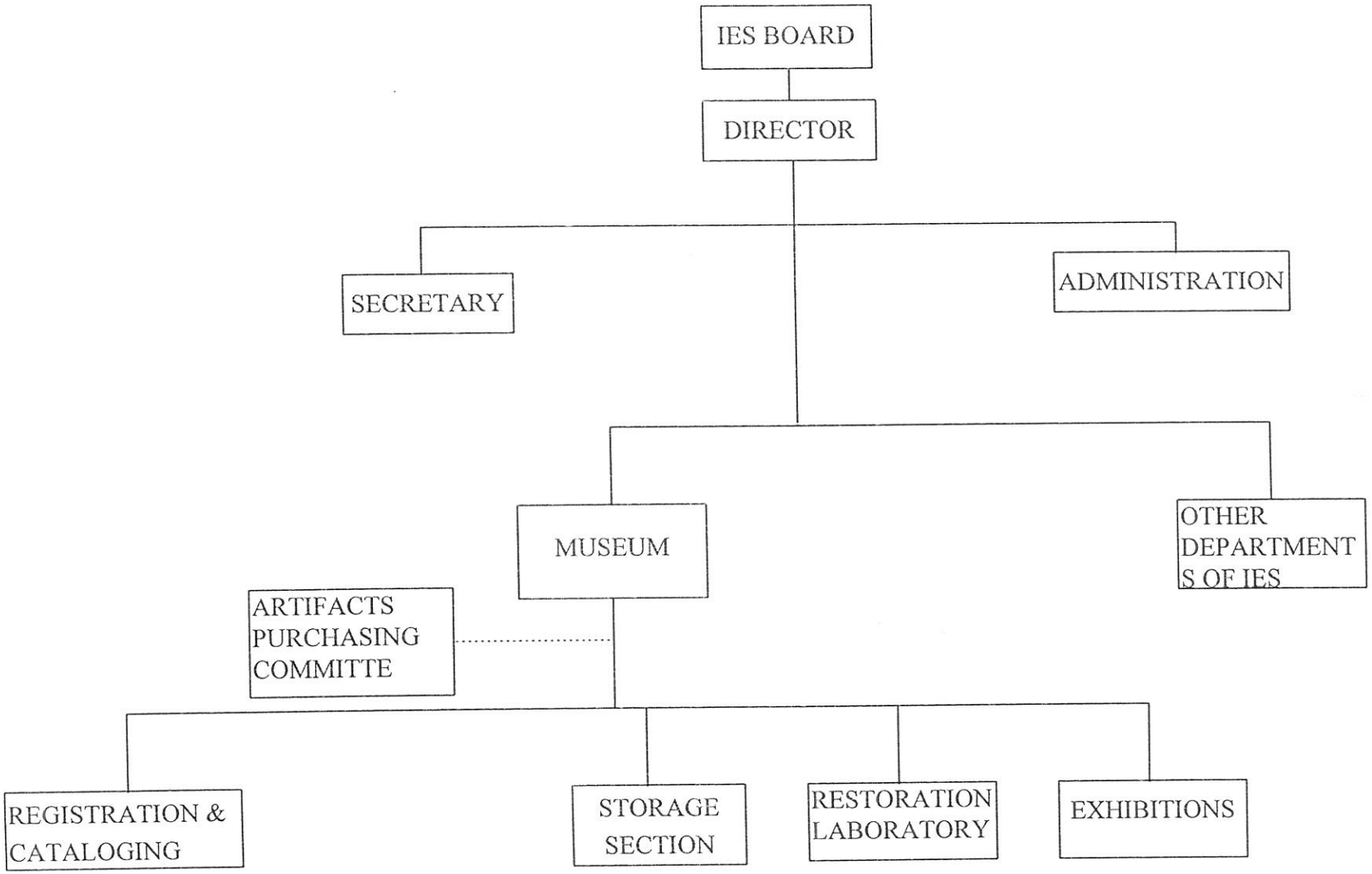
Collection of ethnographic objects at IES was started in 1952 by a Librarian, Stanislaw Chojnacki, of the then University College of Addis Ababa (UCAA). At about the same time, an ethnological society was established, consisting of mainly university students, to raise funds and to collect items from their origins when they return home on their vacation. In addition, the ethnographic objects and zoological specimens, collected by Italians (1936-41), were transferred from Ministry of Agriculture compound then situated in Akaki (a village near Addis Ababa) to Arat Kilo Campus that housed UCAA. After the founding of the IES in

1963, the ethnographic collection was transferred from the Arat Kilo Campus to the new seat of the IES, in the former Imperial Palace (Chojnacki 1996; Pankhurst 1990), and now the main campus of Addis Ababa University.

As in the forgoing, historically the IES museum was meant to be an ethnographic collection. However, because of the arrival at the Addis Ababa market of increasing number of old Ethiopian paintings, valuable crosses and other church paraphernalia, the museum decided to move into its present status in about 1965 in order to save them and start an art gallery. By 1975 the Museum had become the seat of the largest and most representative collection of Ethiopia's sacred art in public hands. Currently, the IES museum houses two distinct types of collections conveniently in one building: the Ethnographic Collection (part of which is on display in the second floor of the IES building), and the traditional art collection (part of which is on display on the third floor). Although the collections have had to be separated for convenience, they are, nevertheless, complementary and offer a fairly representative view of the material, cultural and spiritual life of the inhabitants of Ethiopia (Chojnacki 1996; Pankhurst 1990). Chojnacki (1996, 4) "There is much room for improvement and innovation, especially in the areas of collecting, recording, interpretative display, and the concomitant responsibilities for collection management and preservation, as well as records management."

The present organisational structure of the museum is shown in Figure 3.1.

Fig. 3.1 Organizational structure of the IES museum (proposed)



The museum consists of an ethnographic hall and an art gallery having sections for the storage of artifacts; registration & cataloguing; photographic laboratory as well as restoration. The ethnographic exhibition hall is devoted to the material culture of different ethnic groups. It has two parts: where in the first part, objects are arranged by purpose, the display is grouped by administrative regions in the second part. The bed room of the late Emperor and his things are also displayed in this hall.

The Art Gallery is devoted to folk art, traditional paintings, religious objects, old manuscripts, etc. and is organised thematically.

3.2 COLLECTION TYPES AND SIZE

The types of collection at the IES museum include:

Material culture:- devoted to the material cultures of the peoples of Ethiopia, i.e. agricultural implements, household objects, traditional clothing, etc. Included in the collection is the crown of the King of Kaffa dating from the 15th century.

Religious and medieval art:- contains old and beautiful objects including crosses, paintings, and icons. The collection includes Lalibela crosses, dating from the 12th century, and Emperor Zara Ya'eqob's cross from the 15th century, as well as painting of the Madonna, also from the 15th century

Ethno-Musicological:- containing musical instruments and recordings of traditional songs from many parts of the country, which include the Begenna, Kerar, Massanko, Washint, Embilta, Malaket, Kabaro, etc.

Coins and Philatelic:- collects Ethiopian postage stamps and coins. There are coins from Axum, coins from Harar, and pieces of salt, iron, and bullets, used instead of money as well as twentieth century bank notes and coins. A fine collection of Ethiopian postage stamps dating from 1894 to 1969 was generously donated by Ivan adler from Sweden, and to bring the collection up to date the Ethiopian Ministry of Posts kindly presented later stamps, including the most recent issues.

While, restoration and exhibitions of these items are taken care of by the museum, the photographic collection and manuscripts are handled by a different section of the Institute. The photographic archive includes photos of historical and social events such as photographs of the Addis Ababa railway station in 1917, Addis Ababa and Dire Dawa dated 1924 and later; the arrival of the first aeroplane in Ethiopia in 1928, and so on. There are about 30,000 photographs in the collection. The collections of the museum by media type are as shown in Table 3.1. According to the survey, the size of the collection is expected to increase 5 per month.

MEDIA	TOTAL
Ethnographic and traditional art objects	10,000
Photographs	2,000
Slides	1,500
Sound	425
Video	110
Stamps/ Coins	300 /unknown

Table 3.1 Collection of the museum by media type

3.3 FUNCTIONS AND SERVICES

The main functions of IES museum follow those identified in the previous chapter and are briefly presented as under.

3.3.1 Acquisition

The museum objects are acquired through various modes including purchase, donation and/or research. The major sources of items, so far identified, are researchers and other individual donors. At IES museum, donations usually are not rejected even if the objects are not within the framework of the museum's collection. Several of the visiting scholars at IES are said to have generously assisted in acquiring articles for the Museum in their areas of respective research. It was learnt that this enabled the Institute to acquire objects from many remote areas which would otherwise have been far beyond its reach. The Society of Friends of the IES was also established in 1968 to raise funds and enable the museum to its acquisition (Girma 1990).

3.3.2 Documentation

Documentation is a continuos activity of the museum. Currently, manual methods are in use for this purpose. Records of collection are of two types: collections management information - records associated with movement and care of collections; and cataloguing information.

a) Collections Management Information

The IES museum collections management information embraces a wide range of its operations, including exhibition, accessioning, conservation, loans, and photography. (So far, deaccessioning is not practised at IES. However, there are objects which are beyond repair and are lost - some records are available where the accession records of lost items are marked.)

Accessioning: Unlike other museum practices (from the literature), all items coming into the museum are not registered, only accessioned objects are registered. Upon accessioning, the items are assigned a one-part unique number in the order of their arrival and registered accession registers with all available accession data and object descriptions. These numbers are used as identifications of the items.

Photography: Photograph documentation, which is one of the museum's initial activities, is the major aspects of its documentation. Photographs are taken for all items accessioned. The contact prints, where the object's accession and negative numbers are also contained, are attached with the corresponding catalogue cards (see Fig 3.2). The negatives, which contain the accession number, are also attached with other sets of cards which embrace information related to photography activities (date of photography, photographer, etc.). These cards are arranged by negative numbers and kept in the Registrar's office.

Conservation/restoration: Objects, displayed or from store, are routinely examined by the museum's conservators or other staff members and will be transferred for restoration if any noticeable deterioration is observed. In case of transfer for restoration, treatment information generated by such activity is maintained by the conservators. Some of the information

maintained include condition report before and after restoration, techniques used and treatment methods of restoration, beginning and end dates of the work. Photographs are also taken before and after the restoration activities and are attached with the respective conservation sheets. But movement related information such as date, location, etc. are very important for tracing objects, as well as records of negatives are not maintained in the existing system.

Ethnographic Museum-Institute of Ethiopian Studies
Addis Ababa University

<table>
<tr><td colspan="2">Name of Object: .....
Local Name: .....
Function: .....</td><td>Accession No.

Other No.</td></tr>
<tr><td>File No.</td><td>Negative No.</td><td rowspan="5">Contact print</td></tr>
<tr><td colspan="2">Source or donor:</td></tr>
<tr><td colspan="2">Provenance:
Ethnic group:</td></tr>
<tr><td>Date:</td><td>Date of Entry:</td></tr>
<tr><td>Material:</td><td>Condition:</td></tr>
<tr><td>Measurements

H. W.
L. D.</td><td colspan="2">Actual Location

Storage ☐ Room No. Shelf No.
Exhibition ☐ Room No. Show Case No.</td></tr>
<tr><td colspan="3">Description:</td></tr>
</table>

Fig. 3.2 IES museum Card Catalogue Format

At IES museum, conservation efforts are usually necessary for newly acquired objects. Such objects are fumigated, and further examined and restored as necessary.

Exhibitions: For ***internal exhibitions*** (permanent or special), from time to time, items are transferred from the store to the display area. As this is done related information is recorded on the museum's movement form. Information recorded include location information, date of movement, issuer and receivers' name and signature. For ***Exhibitions outside the museum,*** the store man keeps letters that contain list of loaned items and signed by the Director of IES. Items identified for such exhibitions are listed and checked out with the necessary arrangement for protection of physical and other damages. When the items are returned the letters are marked by the store man accordingly. However, the museum does not maintain other important records of outgoing loans including condition reports before and after movement, dates etc. in an organised manner.

Loan: As researches for the interpretation of the museum's collection are carried out, researchers locate the items of their interest first by using the catalogue cards through the help of the Registrar. Then the selected items are checked out from the stores, and authorised researchers use the objects in a different room near the storage area. The store man checks-out and checks-in the items as necessary. However, no movement information is maintained to represent such activities.

b) Cataloguing Information

The catalogue information is systematised and recorded in accession registers and card catalogues. Both the registers and card files contain accession and description data including name of object, local name, etc. As indicated earlier, photographs of objects are also part of the catalogue records. In addition to this, the card files comprise contextual information including ethnological, historical, and spiritual context. However, most of the items lack ethnological information because donors (or non-professional collectors) usually acquire the

objects without further investigation of the object's history at the time of acquisition. Only objects collected by field work have this type of information.

The card catalogues are arranged by accession numbers. No indexes are maintained. Therefore, access to information can only be achieved by browsing through the entire accession or card records. According to the staff, in the existing system, retrieval of information on a certain object requires half a day on the average. According to our survey, a standard input format, which is vital for exchanging information, is not yet adopted for the catalogue information,. Also no standard terminology lists are used to facilitate recording and retrieving of information. Negative numbers are the only cross-reference available in the catalogue cards to refer to photography related information. It was reported, during the survey, that unavailability of such cross-references to related objects seriously hinders thematic research.

At the museum, a standard classification scheme is already adopted for ethno-musicology collections, classification of musical instruments using this scheme is currently under processing.

According to the finding following the survey, the documentation system in place does not allow the maintenance of locational information easily. The cards maintained do not contain complete and up-to-date locational information. Because of limited resources including manpower, facilities and funds, shelf numbering for ethnographic storage section which was started long ago could not be finalised, hence, at present many items are not assigned unique shelf numbers. Nevertheless, this is not the case with the exhibition area and the treasury storage section. In the existing system updating of location information on the cards when

items move from one area to another is costly and thus not practised . Such information is not recorded in other forms neither.

What is more, because of lack of spatial information, specific items can not be located efficiently in the existing system. Items are located by matching the accession numbers (retrieved from the cards) with labels marked on the items from the stores or exhibitions by browsing through the physical items, one by one manually. Thus, while locating an item in the stores may take half a day on the average as indicated earlier, taking inventory on the average takes two months.

3.3.3 Services & Publications

a) **Exhibitions:** The two permanent exhibitions - ethnographic and art - serve visitors (local and tourist), school-children, university students and researchers. To supplement the display at these exhibitions, the museum uses various presentation techniques including photographs and human guides. Individual text labels, titles or maps are attached on show cases that contain similar objects or ethnic collection respectively. The IES tour guides provide users introductory statements such as what types of objects are on display, how they are organised, and answers for inquiries from the visitors. The exhibitions are usually visited over the years by Heads of states and other official visitors, as well as by a ceaseless flow of tourists, besides scholars and students involved in the study of Ethiopia's material culture and art.

In addition to these two permanent exhibitions, the museum organises special exhibitions once a year on the average. Over the years the museum has collaborated with the National

Museum of Ethiopia in organizing exhibitions of Ethiopian art and culture in various parts of the world: Dakar, Lagos and Montreal, Germany, Austria and Switzerland. These exhibitions led to the compilation of two illustrated catalogues: Religious Art in Ethiopia and Ethiopien (Pankhurst 1990). Another joint touring exhibition with National Museum was organized for various parts of American states that lasted three years. It was a comprehensive exhibition of Christians art from the Orthodox Church of Ethiopia. As a result of this exhibition, 'African Zion' was published in Texas, 1993. It included exhibition catalogues and scientific articles on Ethiopian history.

b) **Publications:** The IES Museum has its own publications. These comprise illustrated catalogues, albums, as well as a series of photographic post-cards. The catalogues, which first appeared in 1969, were Ethiopian Processional Crosses, prepared by a Finish woman, Eine Moore, and The Pottery collection by the Institute's German ethnographer Elisabeth-Dorothea Hecht. Another catalogue was The Hand Crosses of the IES Collection By Dorothea Hecht, Brigitta Benzing and Girma Kidane, IES, AAU, 1990. The albums, which were much admired, comprised a collection of twelve large drawings by Eine Moore of Ethiopian processional crosses. The other important publications relate to the permanent exhibitions and include the museum manual, 1988; the museum catalogue guide, 1989; and Text Title, labels and some photographs for displayed objects;

c) **Other:** Other services and publications provided by the museum include the following.

- Provision of short term training programmes on museum and related areas to interested organisations and on-the-job training to its non-professional staff;
- Provision of consultancy services on matters related to ethnological and other museum activities;

- Provision of collection items and their photographs to researchers for further study; and
- Provision of telephone enquiry services on any aspect of the museum activities

3.4 MANPOWER

The museum has 14 staff members working in its various sections: a curator, a restoration head, 3 restorers, a registrar, a store keeper, a photographer, two guides, a guard and three cleaners. The breakdown of the workforce by academic qualification is shown in Table 2.

Skill	Qualification	No.
Curator	MST in Museuology	1
Restorer	MSc. in Art Restoration	1
Restorer	MSc in Chemistry	1
Restorer	Diploma in Fine Art	1
Restorer	High School graduate	1
Registrar	12+2 years in statistics	1
Guides	High School graduate	2
Store keeper	High School graduate	1
Photographer	12+4	1

Table 3.2 Staff of the museum by qualification.

3.5 BUDGET

While salaries and other administrative costs of the museum are covered from annual budget provision from the Federal Government for the purpose of acquisition and other activities, in addition to the minimal budget provided by the Government, funds are obtained from the Society of Friends of the IES, various donations, public and private, as well as organized social events. The Institute obtains financial assistance, both from locally and international organizations, to run the Museum. A small amount of income is also generated from the entrance fee at the museum.

3.6 COMPUTING AND RELATED FACILITIES

There are three 386 microcomputers, one 486 microcomputer, one printer; four analog video camera, sound recorder, one editing machine, four photo cameras, five slide projectors and one slide copier; and word processors and communication software. Plan is also underway for buying the state-of-the-art computer system.

The existing computers are used for such routine clerical functions as word-processing and electronic mail. There are no application programs to support any of the museum functions.

3.7 USERS' VIEWS

The major users of the IES museum include staff of the museum, researchers, visitors - local and tourist, donors, administrators and exhibition organisers. Unfortunately, during the actual

conduct of the survey, there were no active researchers, except the curator and the founder of the museum Prof. Chognacki. Furthermore, although efforts were made to arrange discussion with Prof. Chognacki, he was not willing to discuss on the subject under investigation. He tried to argue that there are more important issues which should receive greater attention if there is any capacity instead of automation. According to the professor much effort is needed to preserve the Ethiopian heritages that are currently being destroyed by people.

With regard to visitors, the guest book at IES museum was consulted to examine some of the comments made by them. To supplement this, discussions were also made with visitors (mostly from overseas) who came to the museum on weekends. The discussion guide prepared for the purpose was employed during the discussion with the visitors. While some are required to respond in writing to the questions asked in the guide, the worker attempted to complete the discussion guides through interviewing the visitors since most of them were tourists visitors, hence did not have time to answer more than a couple of the questions and since a good proportion of them were not very conversant with English.

Summary information of the survey is presented in Appendix A. As can be seen from the visitors surveyed 45% of the visitors were informed of the exhibition at IES by a 'Spectrum Guide to Ethiopia' prepared by the Ethiopian Tourism Commission and 20 % by friends. About 55% of the visitors were helped with external tour guides or friends and 60% of the respondents indicated that the current level of information provision is not fully adequate to help them understand the display.

Sixty percent of the surveyed visitors demonstrated that the use of photographs for various purposes: descriptions of production / use processes when the originals can not be shown; etc.

provision does not help them to get enough information to understand the display and criticised the display techniques / materials used such as human guides as backward.

3.8 SUMMARY OFTHE PROBLEMS

3.8.1 Problems

Based on the assessments made following the survey and discussions with selected members of the museum staff and users, the following major problems are identified in the existing information handling system.

- The card catalogue in use contains incomplete information and lacks cross-references;
- Accessing information is inefficient;
- Taking inventory and identification of lost / deteriorated object is difficult and time consuming;
- There is no adequate search/retrieval tools such as indexes, terminology lists, catalogues by type, etc.;
- The production of such publications as catalogues, exhibition interpretative materials, indexes, etc. in adequate quantity is difficult;
- There is a lot of repetition/duplication of data here and there.

At the museum, there is a growing awareness that automation of the major functions would help overcome, most of the problems identified in the forgoing. To this end, measures were taken to acquire some microcomputers per recommendations of earlier studies. However, the

previous studies recommended a conventional automated system that handles only textual information and incorporates additional features such as the ability of the creation and use of indexes and other retrieval tools. Such system would very much limit the application of modern computers and would not also do much in terms of tackling the information handling problem at the museum, as the type and format of information in need consist of all types including text, picture, sound, and video.

CHAPTER FOUR

PROTOTYPE DESIGN

In the previous chapter, an attempt was made to document the existing information handling situation at IES museum including the problems on the basis of the discussion made with users and own observation. This chapter seeks to provide one proposed alternative solution (particularly, a prototype integrated database system) for consideration. As a starting point, requirements (in terms of data management and processing) is presented. This is followed by a brief description of the approach suggested for use in the design of the proposed database solution. The last part of the chapter, presents the prototype of the solution proposed. The implementation of the prototype designed is the subject of the next chapter.

4.1 SYSTEM REQUIREMENT

4.1.1 Collection Related

- database that facilitate the maintenance of collection cataloging information for all media including text, pictures, sound and video to support all collection types;
- database that facilitate the maintenance of collection management information: accessioning, loan, exhibit, photography, disposition;
- database that facilitate the maintenance of conservation related information: records of conservation and treatment efforts, treatment method and techniques, production efforts;

using the low cost technologies affordable to the museum, it was considered for experimentation. This type of system allows a good management and care of the collection as it allows to have a full overview of the content of a collection and its condition. This effort is considered to be an important endeavor to approximate the first option (ideal system) instead of doing nothing.

Why Object-Oriented Approach?

System development techniques can be used to help in the process of analysis and design and to verify that all the steps in the methodology have been carried out. One of the generally acknowledged advances in information systems development is the improvement that has resulted from the use of these techniques. Most methodologies take either a **function-oriented top-down** or a **data-oriented** approach for developing information systems. Object orientation approaches that address both data and process aspects of the system are emerging. In this undertaking, i.e., to design a prototype for IES museum collection database systems, object-oriented methods are used.

As it has been noted by many authors object orientation techniques offer adequate modelling power, and more importantly, performance to handle such complexity. Rumbaugh, referred in Buechner (1992), argued that the object abstraction in object-oriented database systems inherently allows for the heterogeneous data (text, image, graphics, video, audio) of a multimedia system to be treated in a consistent fashion, conceptually freeing the user to refer to the diverse data types in an intuitive fashion. Moreover, according to Hurson and Pakzad (1993), applications that involve complex data and operations are not served well by conventional data models and DBMSs. These applications include design databases,

museum object, a book, a person, etc. A set of operations / methods can be defined for an object to affect or examine the saved information of the object.

Objects are related to one another and there are two types of relations: **static and dynamic**. Static relations, namely relations existing over a longer period, which mean that two objects know about each other's existence; in dynamic relations, two objects actually communicate with each other. These relations are specified within the object's information structure. The dynamics in an object-oriented model are created through the dynamic relations, by means of objects sending **messages** to other objects. Here a 'message' means the event of one object communicating with another. It causes an operation to be performed in the receiving object. The only way to affect the object is to perform operations on it. Every one of the object's operations performs part of the object's behavior, and can modify information in the object. There are different types of static relationships in different OO methods inheritance association ('is a' relationship); aggregation / whole-part; instance association; attribute relationship. **Cardinality** is assigned to each instance association to express how many instances can be associated. Instance association is the traditional relationship of the entity-relationship approach (Eckert et al., 1994).

4.3.2 Object identity

Unlike entities in the E-R model, each object has its own unique identity independent of the values it contains (Korth et al. 1991). The identification of objects is based on nothing but their existence and this therefore frees the analyst from the bothersome task of defining artificial identifier attributes (keys).

4.3.3. Classes and Instances

According to Jacobson et al. (1992):

> "A class is an abstraction that represents a template for several objects and describes how these objects are structured internally. Objects of the same class have the same definition both for their operations and for their information structures." An object that belongs to a certain class is called an instance of that class. The behavior and information structure of the instance are defined by its class.

4.3.4 Encapsulation

Booch (1994) defined encapsulation as "the process of compartmentalizing the elements of an abstraction that constitute its structure and behavior; encapsulation serves to separate the contractual interface of an abstraction and its implementation".

Encapsulation provides explicit barriers among different abstractions. It is fundamental because it conveys the very notion of objects, but nevertheless large variations are possible according to the possible properties which are grouped together (attributes, operations, constraints, messages, algorithms, etc.) Encapsulation is most often achieved through **information hiding**, which is the process of hiding all the secrets of an object that do not contribute to its essential characteristics; typically, the interface is visible while the structure of an object is hidden, as well as the implementation of its methods. In practice each class must have two parts: an interface and an implementation. Access to an object is restricted by its interface. However, this principle is broken by inheritance which causes a subclass to depend on the internal representation and algorithms of its superclass.

to avoid redundancy thereby leading to smaller models that are easier to understand. This is possible since adding new classes can easily be done by just describing changes to existing classes. However, adding new classes my sometimes involve restructuring the inheritance hierarchy.

4.3.6 Polymorphism

Polymorphism means that the sender of a message does not need to know the receiving instance's class. The receiving instance can belong to an arbitrary class and it determines how a message will be interpreted. The consequence of polymorphism is that one method can be implemented in different ways in different classes (Jacobson et al., 1992). These methods are known us polymorphic methods. It is perhaps the most powerful feature of object orientation next to their support for abstraction. It allows us to develop flexible and modification-resistant systems.

On the whole, it has been argued that OO improves:

- problem domain understanding as it organizes information in the same way people have been organizing their thinking: objects and attributes etc.;
- effective communication as real-world concepts are used;
- the explicit representation of commonality;
- the building of specifications resilient to change;
- tackling more challenging problem domains: new and emerging database applications such as CAD/CAM/CASE, **Multimedia databases**, Knowledge bases require the representation of complex data elements as well as complex relationships among them;

- greater reuse potential. More effective analysis requires the use of problem domain constructs, both for present reuse and for future reuse. Reusable analysis results and components carry the greatest potential for improvement system development;
- the provision of a consistent underlying representation throughout the development process. Traditional analysis and design techniques imply constant paradigm shifts, since they manipulate different concepts at each different phase of software development. The same ideas and concepts are manipulated from requirements phase down to the implementation phase in OO approaches.
- OO approaches attempt to bridge the gap between structured process analysis and data analysis thereby avoiding the over-reliance on either the functional side or the database side that is inherent in these approaches. Thus OO ensures proper integration of data and processes.

4.4 THE DESIGN OF IES MUSEUM COLLECTION DATABASE SYSTEM (IESMCDS)

4.4.1 IES Museum Collection Database System (IESMCDS) Requirements

The requirements of a prototype database proposed for consideration in this connection is described as under.

1. Maintenance of accession and disposition data for its objects
2. Maintenance of object catalogue records and their locations including structured and unstructured text, image, sound, and video.
3. Maintenance of photograph records of objects including photography information

- greater reuse potential. More effective analysis requires the use of problem domain constructs, both for present reuse and for future reuse. Reusable analysis results and components carry the greatest potential for improvement system development;
- the provision of a consistent underlying representation throughout the development process. Traditional analysis and design techniques imply constant paradigm shifts, since they manipulate different concepts at each different phase of software development. The same ideas and concepts are manipulated from requirements phase down to the implementation phase in OO approaches.
- OO approaches attempt to bridge the gap between structured process analysis and data analysis thereby avoiding the over-reliance on either the functional side or the database side that is inherent in these approaches. Thus OO ensures proper integration of data and processes.

4.4 THE DESIGN OF IES MUSEUM COLLECTION DATABASE SYSTEM (IESMCDS)

4.4.1 IES Museum Collection Database System (IESMCDS) Requirements

The requirements of a prototype database proposed for consideration in this connection is described as under.

1. Maintenance of accession and disposition data for its objects
2. Maintenance of object catalogue records and their locations including structured and unstructured text, image, sound, and video.
3. Maintenance of photograph records of objects including photography information

4. Recording of object's movement such as from store to display area; display-to-conservation, store-to-exhibition, changing permanent location, etc.

5. Maintenance of treatment, exhibition, and bibliographic records.

6. Display / list items on treatment, exhibition, research, display, in store; objects by type or some other characteristics; or produce catalogues, indexes.

8. Security of information from invalid access

On the basis of familiarity, the approach proposed by Lorenz (1993) is employed in the design of the database. The recommended steps by the methodology are:

a) Write Use cases.:

- Use cases are mini-scenarios for the system.

b) Develop message flow diagrams for use cases (optional).

c) Develop collaboration diagrams.

- Collaboration diagrams graphically depict classes and subsystems, along with indications of other classes and subsystems they collaborate with.

Identify classes.

Identify class attributes.

Identify responsibilities (methods)

Identify Subsystems

Identify Contracts

Contracts are key, high-level responsibilities for a class or subsystem

d) Place classes in the inheritance hierarchy

e) Develop message flow diagrams for methods (optional).

f) Implement methods.

g) Test methods

h) Develop function tests

4.4.2 Use Cases of IESMCDS

From the requirement list the following use cases of the IESMCDS were derived to incorporate in the design:

- IESMCDS access control
- Maintenance of object catalogue records and their locations
  - Create a record for a newly arrived object
  - Update the record details except its location
  - Delete the record
  - Retrieve the catalogue record (and its associated records)
- Recording of object's movement within and in and out of the museum
- Display / list objects by object name

Details of each use case is presented below:

USE CASE - ACCESS CONTROL

(REUSED FOR OTHER USE CASES)

A machine is available at different sections of the museum to perform record maintenance and inquiry functions. The user is prompted for his identification number and password. If it matches with his password in the database, a menu choice of actions on the screen appears. If the password does not match, the user is shown a message on the screen.

USE CASE - DELETE CATALOGUE RECORD

<USE CASE - ACCESS CONTROL is prerequisite> If delete button is pressed, the user is asked accession no. If the record exists, a message is displayed for confirmation. if yes button is pressed, the record is deleted . The user is allowed to then request another action, or to exit.

USE CASE - CREATE CATALOGUE RECORD

<USE CASE - ACCESS CONTROL is prerequisite> If Create button is pressed, the user is allowed to enter the details. If the record exists a message appears on the screen, the new details will not be recorded. The user is allowed to then request another action, or to exit.

USE CASE - RETRIEVE CATALOGUE RECORD

<USE CASE - ACCESS CONTROL if> If retrieve button is pressed, the user is asked accession no. If the record exists, the details of the record is displayed - otherwise a message appears. The user is allowed to then request another action, or to exit.

USE CASE - UPDATE CATALOGUE RECORD

<USE CASE - ACCESS CONTROL is prerequisite> If update button is pressed, the user is asked accession no. If the record exists, it is displayed and the user is allowed to change the details - otherwise a message appears on the screen. The user is allowed to then request another action, or to exit.

USE CASE - MOVE OBJECT

<USE CASE - ACCESS CONTROL is prerequisite> If move object button is pressed, the user is asked accession no. If the record does not exist a message appears - the user is asked the date, transaction no., issuer's name, receiver's name, remarks and the sites (destinations) are displayed to allow him select. If he selects <display> or <change permanent storage location> a menu appears to select from the available locations. The user is allowed to then request another action, or to exit.

USE CASE - OBJECT NAME SEARCHING

<USE CASE - ACCESS CONTROL is prerequisite> If Objectname button is pressed, a user is asked to enter the object name, and then all objects matching the search argument are displayed. The user is allowed to then request another action, or to exit.

In the design, it is attempted to address the data aspects of the system for the types of records mentioned in the requirement but the process requirements of the system are done partially. The data definitions of the system are not exhaustive.

It is attempted to identify all the classes that can model the application area in order to meet the system requirements. The major subsystems are presented in section 4.4.3. (Figure 4.1, 4.2 and 4.3) including their descriptions. The major services / contracts provided by the classes are described in section 4.4.3.2. The class inheritance structure and Cardinality relationships of classes are shown in figure 4.4 and 4.5 respectively.

Descriptions of classes and data elements are documented in section 4.4.6. The class definitions include only for domain objects the interface objects are not defined here. This is done for brevity purpose. However their definitions are not complete, especially method definitions. The methods for retrieving and changing instance variables for classes such as Ethnographic&Art, Stamp, Coin, Denomination, Exhibition, Accession, disposition, Treatment, and Bibliography can be similarly defined as shown in MuseumObject and other class definitions. Other specialized methods are defined in the appropriate classes. For example, for checking whether a user is valid or not the IESMuseum Class defines a method, i.e. **ValidateUser,** to handle this. Then the ***User*** Class has a method, i.e. **ValidPassword**, to check whether the user has a correct password or not.

4.4.3 IESMCDS Collaboration Diagrams

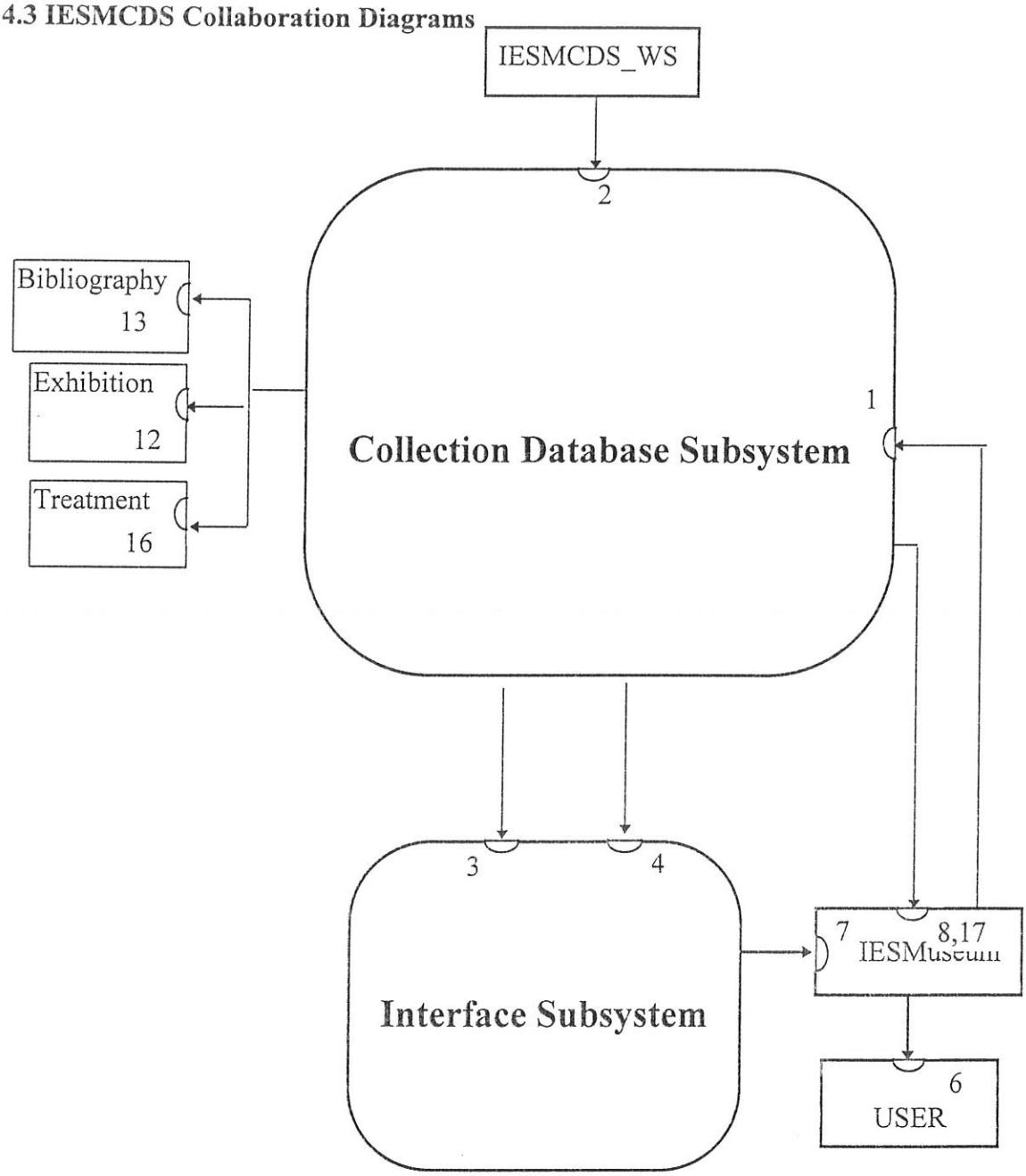
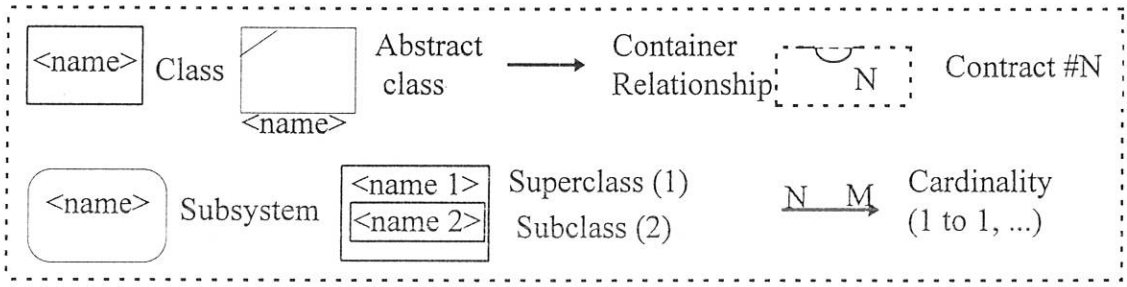


Fig. 4.1 IESMCDS Collaboration Diagram

Notations used in the diagrams



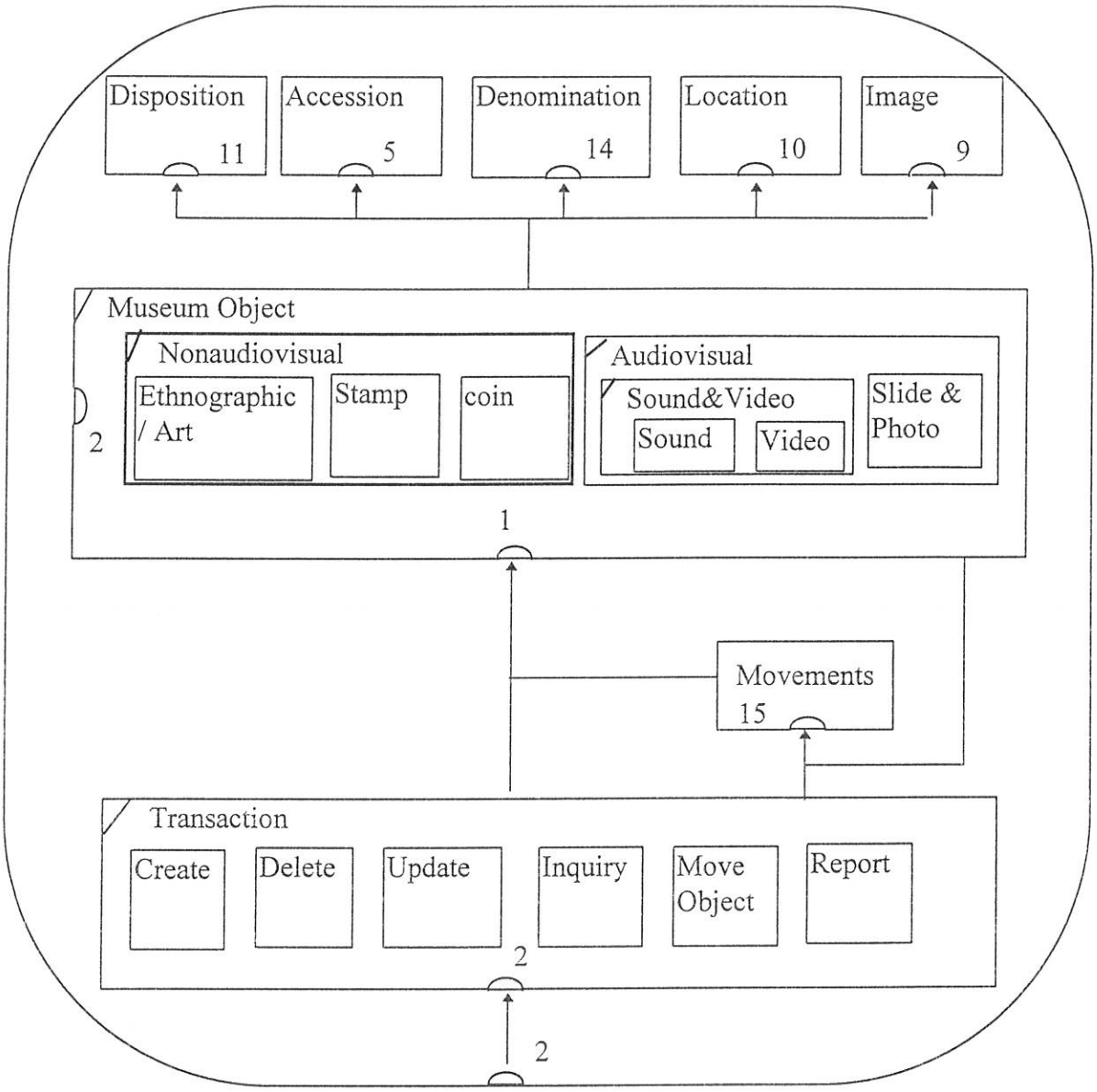


Fig. 4.2 Collection Database Subsystem

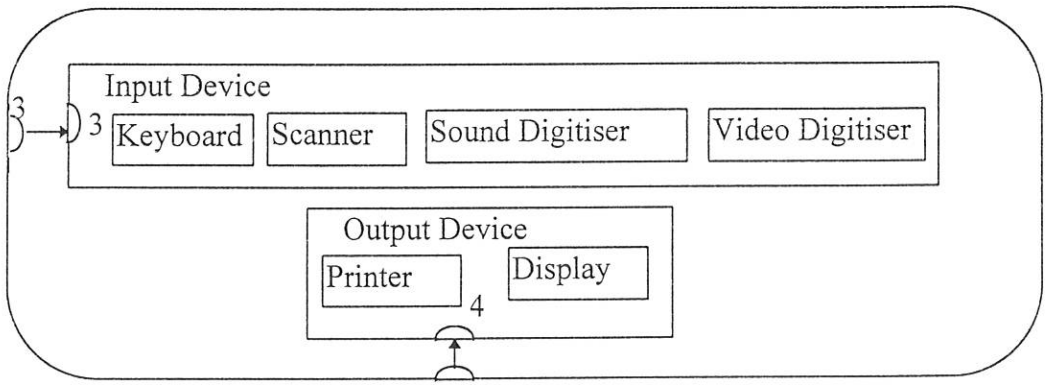


Fig. 4.3 Interface Subsystem

4.4.3.1 IESMCDS Subsystems

Collection Database Subsystem

Description:- Coordinate the activities relating to the maintenance of the object's catalogue record and report generation

CONTRACT	RESPONSIBLE CLASS
[2] Process Transaction	Transaction
[1] Maintain Catalogue Record	MuseumObject

Interface Subsystem

Description:- Coordinate the Devices used by the workstation to transfer information to and from the bank's customers.

CONTRACT	RESPONSIBLE CLASS
[3] Get user input	InputDevice
[4] Put output to the user	OutputDevice

4.4.3.2 IESCDS Contracts

CONTRACT 1 - MAINTAIN CATALOGUE RECORD

Description:- Provide basic catalogue record maintenance functions including create, update, delete and inquiry.

Server - MuseumObject

Clients - Create, Update, Delete, Inquiry, MoveObject, IESMuseum, Movements

CONTRACT 2 - PROCESS TRANSACTION

Description:- Process the catalogue record maintenance and report generation services available at the IESMCMS workstation including create, update, delete inquiry, and report generation.

Server - Transaction

Clients - IESMCDSWorkstation

CONTRACT 3 - GET USER INPUT

Description:- Handle inputs from the user, including keyboard, Scanner.

Server - InputDevice

Clients - IESMCDS_WS

CONTRACT 4 - PUT OUTPUT TO THE USER

Description:- Handle outputs to the user including object information, display messages, lists.

Server - OutputDevice

Clients - Transaction

CONTRACT 5 - MAINTAIN ACCESSION RECORD

Description :- Provide basic accession record maintenance functions.

Server - Accession

Clients - MuseumObject

CONTRACT 6 - VERIFY PASSWORD

Description:- Make sure that this user has a valid access password.

Server - User

Clients - IESMUSEUM

CONTRACT 7 - VERIFY USER

Description:- Make sure that this user is yours.

Server - IESMUSEUM

Clients - InputDevice

CONTRACT 8 - LIST OBJECTS' DETAIL

Description:- Retrieve all your objects that have a given object name.

Server - IESMUSEUM

Clients - Report

CONTRACT 9 - MAINTAIN PHOTOGRAPH RECORD

Description:- Provide basic photograph record maintenance functions.

Server - Image

Clients - Nonaudiovisual, Treatment, Slide&Photo

CONTRACT 10 - MAINTAIN LOCATION RECORD

Description:- Provide basic location record maintenance functions.

Server - Location

Clients - MuseumObject, Movement

CONTRACT 11 - MAINTAIN DISPOSITION RECORD

Description:- Provide basic disposition record maintenance functions.

Server - Disposition

Clients - MuseumObject, Movement

CONTRACT 12 - MAINTAIN EXHIBITION RECORD

Description:- Provide basic Exhibition record maintenance functions.

Server - Exhibition

Clients - MuseumObject, Movement

CONTRACT 13 - MAINTAIN BIBLIOGRAPHY RECORD

Description:- Provide basic Bibliographic record maintenance functions.

Server - Bibliography

Clients - MuseumObject

CONTRACT 14 - MAINTAIN DENOMINATION RECORD

Description:- Provide basic Denomination record maintenance functions.

Server - Denomination.

Clients - Stamp.

CONTRACT 15 - MAINTAIN MOVEMENT RECORD

Description:- Provide basic Movement record maintenance functions.

Server - Movement.

Clients - MuseumObject, MoveObject.

CONTRACT 16 - MAINTAIN TREATMENT RECORD

Description:- Provide basic Treatment record maintenance functions.

Server - Treatment.

Clients - NonAudiovisual.

CONTRACT 17 - VERIFY OBJECT'S EXISTENCE

Description:- Make sure that you have this object.

Server - IESMuseum.

Clients - Transaction, Inquiry, Delete, Update, MoveObject.

4.4.4. IESMCDS Inheritance Hierarchies

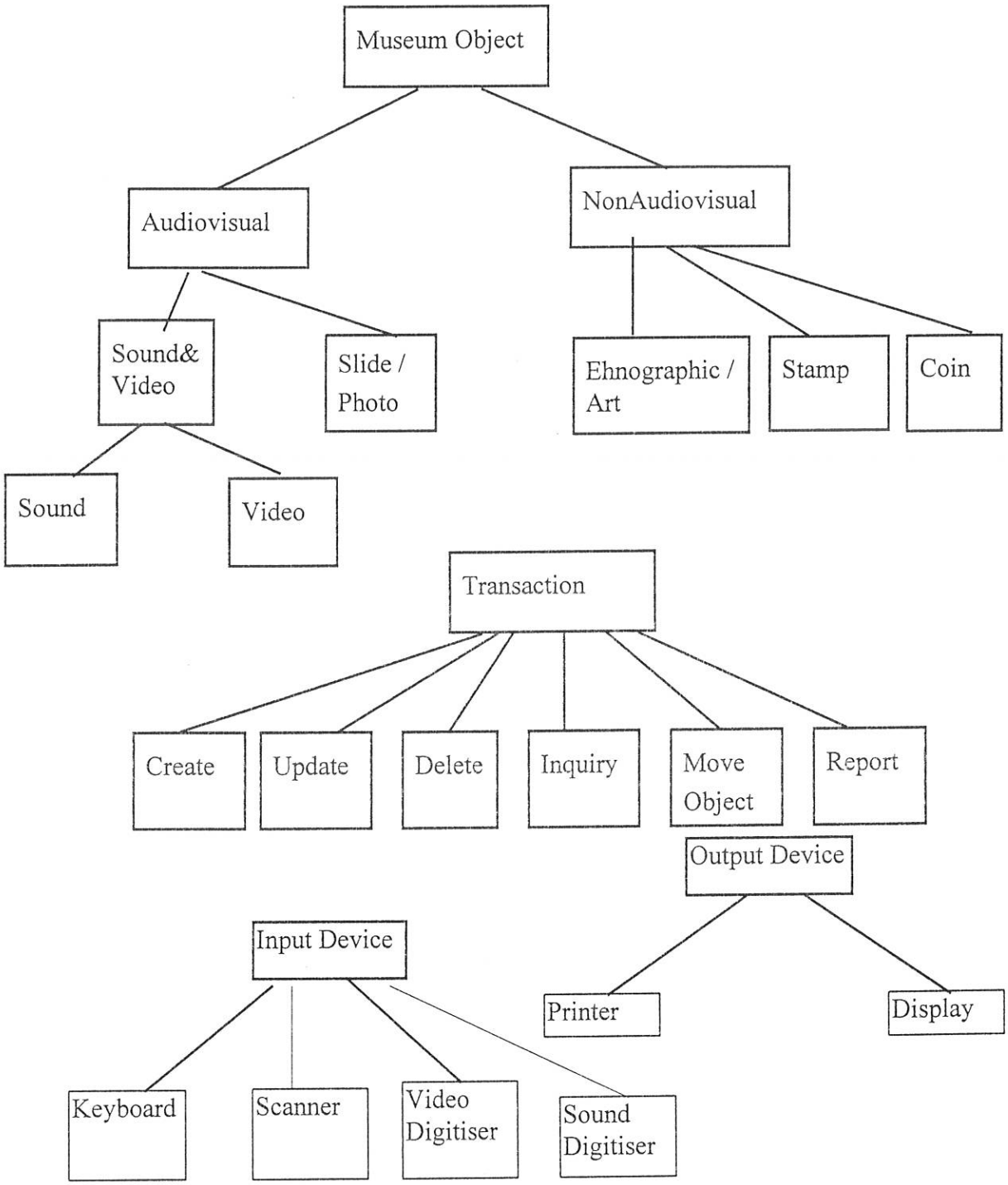


Fig. 4.4 IESMCDS Inheritance Hierarchies

4.4.5. IESMCDS Cardinality Relationship

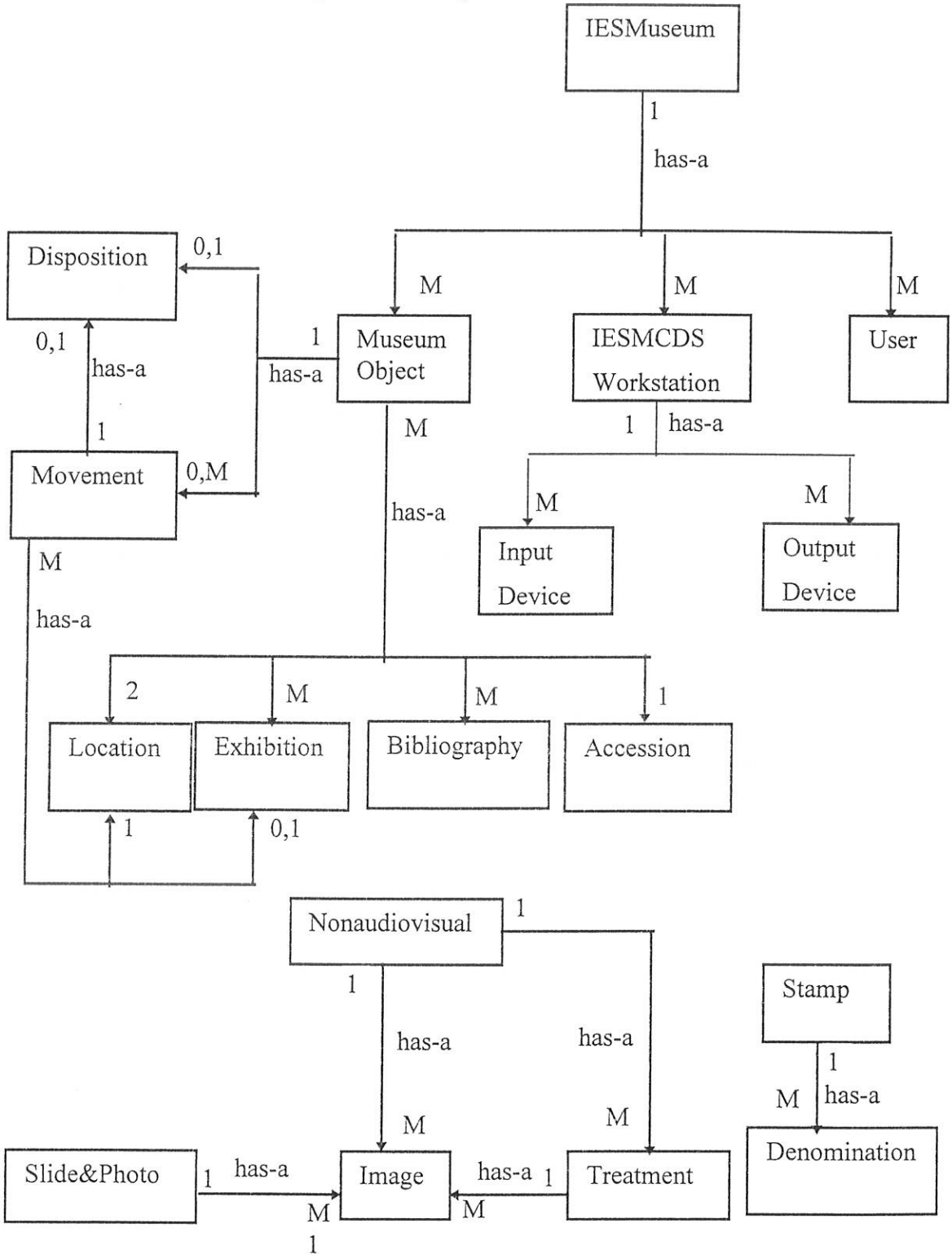


Fig. 4.5 IESMCDS Cardinality Relationship

4.4.6 IESMCDS CLASS DEFINITIONS

ACCESSION CLASS

Description - The Accession class is a data repository, maintaining accession information of the IES museum. There is one instance of this class for each accession. Many objects accessioned in a lot have one common accession data.
Superclasses - PersistenetObject.
Subclasses - None.

CONTRACTS

[5] **Maintain Accession Record** is implemented by this class.

DATA	DESCRIPTION
EntryNo	The accession number
AccessionDate	My accession date.
Source	The name of the donor or vendor.
MethodofAcquisition	The method of acquisition (donation, etc.)
SourceofFunds	The source of the fund for purchased objects.
legaldocument	The receipt of purchase or acknowledgment letter
NumberObjInLot	Number of objects in the Lot

AUDIOVIDUSAL CLASS

Description - The Audiovisual class is an abstract class that provides common services for all types of audiovisual museu objects. The more generalized functions are inherited from the MuseumObject class.
Superclasses - MuseumObject
Subclasses - Sound&Video, Slide&Photo

CONTRACTS

[1] **Maintain Catalogue record** is implemented by the following public methods:
(all the method are listed below under **RESPONSIBILITY**)

RESPONSIBILITY	DESCRIPTION
medium	Return my medium
placeOfRecording	Return my place of recording
color	Return my color
TotalPhysicalMedia	Return my the total no. of physical media I am recorded
medium: aMedium	Set The physical media I am recorded on
placeOfRecording: aPlaceOfRecording	Set my place of recording to aPlaceOfRecording
color: aColor	Set my color to aColor
TotalPhysicalMedia: aTotalPhysicalMedia	Set the total no. of physical media to aTotalPhysicalMedia

DATA	DESCRIPTION
medium	The physical media I am recorded on
placeOfRecording	Place where I am taken
color	My color
TotalPhysicalMedia	The total no. of physical media I am recorded

BIBLIOGRAPHY CLASS

Description - The Bibliography class is a data repository, maintaining bibliographic information that are related to the museum's object. There is one instance of this class for each bibliographic material.
Superclasses - PersistenetObject.
Subclasses - None.

CONTRACTS

[13] **Maintain bibliographic record** is implemented by this class.

DATA	DESCRIPTION
callNo	Call number of the document.
title	Title of the document
Subject	Subject of the document
Author	Author(s) of the document.
Imprint	Imprint information
ISBN	The International Standard Book Number
musuemobjects	list of museum objects' addressed in this document

COIN CLASS

Description - The Coin class provides services for all types of Coin collections of the museum. The more generalized functions are inherited from the NonAudiovisual class. There is one instance of this class for each Coin collection.
Superclasses -Nonaudiovisual
Subclasses - None

CONTRACTS

[1] **Maintain Catalogue record** is implemented by this class.

DATA	DESCRIPTION
obverse	my description of the front side
obverseLedgend	the inscription value I currently hold on the front side
reverse	my description of the back side
reverseLedgend	the inscription value I currently hold on the back side
diameter	the diameter of the coin

CREATE CLASS

Description - The Update class services the editing of object's information. This transaction is created by the transaction class. This transaction is a transient object.
Superclasses - Transaction.
Subclasses - None.

CONTRACTS

[2] **Process Transaction** is implemented by the following public methods:
a) CreateMuseumObject:
b) WriteObjectDetail:

RESPONSIBILITY	DESCRIPTION
CreateMuseumObject: anaccesionNo	Create a museum object with an accessionNo.
WriteObjectDetail: anaccesionNo	Write its detail for this object.

DELETE CLASS

Description - The Delete class services the deleting of the museum object's record. This transaction is created by the transaction class. This transaction is a transient object.
Superclasses - Transaction.
Subclasses - None.

CONTRACTS

[2] **Process Transaction** is implemented by the following public methods:
a) DeleteObject:

RESPONSIBILITY	DESCRIPTION
ConfirmDelete:	Ask the user for confirmation to delete.
DeleteObject: anAccesionNo	Delete an object with identification: anAccessionNo

DENOMINATION CLASS

Description - The Denomination class is a data repository, maintaining denomination information for all stamps in the IES museum. There is one instance of this class for each denomination for a particular issue.
Superclasses -PersistentObject
Subclasses - None

CONTRACTS

[1] **Maintain Catalogue record** is implemented by this class.

DATA	DESCRIPTION
denomination	the denomination
frameColuor	the frame colour
centerColour	the colour of the center
description	the description of the stamp
quantity	the quantity
lengthWithoutPerf	the length of the stamp without perforation
widthWithoutPerf	the width of the stamp without perforation
lengthWithoutPerf	the length of the stamp without perforation
widthWithoutPerf	the width of the stamp without perforation
sRemark	any remark

DISPOSITION CLASS

Description - The Disposition class is a data repository, maintaining deaccessioning information of all types of objects in the IES museum. There is one instance of this class for each deaccessioned object.
Superclasses - PersistenetObject.
Subclasses - None.

CONTRACTS

[11] **Maintain Disposition Record** is implemented by this class.

DATA	DESCRIPTION
dispositionNo	The disposition number
DispositionDate	My disposition date.
ReceivingInst	The receiving institution.
Methodofdisposition	The method of disposition
dispRemark	The disposition remarks.
legaldocument	legal documents

ETHNOGRAPHIC&ART CLASS

Description - The Ethnographic&Art class provides services for all types of Ethnographic & Art collections of the museum. The more generalized functions are inherited from the NonAudiovisual class. There is one instance of this class for each Ethnographic & Art collection.
Superclasses -Nonaudiovisual
Subclasses - None

CONTRACTS

[1] **Maintain Catalogue record** is implemented by this class.

DATA	DESCRIPTION
LocalName	My local name.
Material	the material the object's made of.
Height	the height of the object
Length	the length of the object
Width	the width of the object
Diameter	the diameter of the object
technique	the techniques used to create the object
Inscription	the inscription
condition	the condition
physicalDescription	the physical description
productionNotes	any remark concerning its production
GroupOfProduction	ethnic group to which the creator belongs
function	My function
use	My use
placeofUse	place of use
GroupofUse	ethnic groups who use the object
DateofUse	date of use
UseNotes	any remark about its use

EXHIBITION CLASS

Description - The Exhibition class is a data repository, maintaining information about exhibitions the IES museum participates. There is one instance of this class for each exhibition.
Superclasses - PersistenetObject.
Subclasses - None.

CONTRACTS

[12] **Maintain Exhibition record** is implemented by this class.

DATA	DESCRIPTION
exhibitionId	My exhibition number
exTitle	My Exhibition Title
receivingInstitution	The name of the receiving institution.
place	The location of the receiving institution.
exStartDate	The starting date of the exhibition.
exEndDate	The end date of the exhibition.
museumobjects	List of objects involved in the exhibition.

IESMCDSWORKSTATION CLASS

Description - The IESMCMSWorkstation class is responsible for providing collection management services available for the museum users, creating the appropriate Transactions. There is one instance of this class for each workstation.
Superclasses - Object.
Subclasses - None.
Contracts - None.

RESPONSIBILITY	DESCRIPTION
aCreateTransaction:	Initiate the appropriate transaction
anAccessionNumber:	Get the accession number the user wants to take action.
anObjectInformation:	Get the object's information the user wants to update orcreate a new one.
anObjectName:	Get the object name to list all objects with the same name.
Iterate:	Allow user to request another action.

IESMUSEUM CLASS

Description - The IESMuseum class provides handles requests about its objects and users. There is only one instance of this class.
Superclasses - PersistenetObject.
Subclasses - None.

CONTRACTS

[7] **Verify User** is implemented by the following public methods:

a. ValidateUser:

[8] **List objects' details** is implemented by the following public methods:

a. ListObjectsDetail:

[17] **Verify object's existence** is implremented by the following public methods:

a. ValidateObjectId:

RESPONSIBILITY	DESCRIPTION
ValidateUser: anInteger	Compare aninteger to my users. Return true if it is a valid user, false otherwise.
ValidatePassword: aPassword forUser: aUser	Compare aPassword to the aUser's password. Return true if it is equal, false otherwise.
ValidateObjectId: anAccessionNo	Compare anAccessionNo to my objects. Return true if it is the museum's object, false otherwise
ListObjectDetail: anObjectname	Compare anObjectName to users' objectName. For matching instances, return their details.

DATA	DESCRIPTION
museumobjects	list of the IES museum objects.
users	list of valid users of the system.
IESMuseumWorkstations	list of available workstations

IMAGE CLASS

Description - The Image class is a data repository, maintaining information about all photographs and photography information. There is one instance of this class for each photograph taken.
Superclasses - PersistentObject
Subclasses - None.

CONTRACTS

[9] **Maintain image record** is implemented by the following public methods:
(all the method are listed below under **RESPONSIBILITY**)

RESPONSIBILITY	DESCRIPTION
image:	Return my image.
image: anImage	Set my current image to anImage
imagId:	Return my imaged.
imaged: anImageId	Set my current imageId to anImageId
DateofPhoto: aDateofPhoto	Set my date of photo to aDateofPhoto
aDateofPhoto:	My date of photo
photographer:	Return my photographer's name
photographer: aPhotographerName	Set my photographer name to aphotgrapherName

DATA	DESCRIPTION
imageId	my identification number
image	my image
DateofPhotograph	my date of photography
photographer	my photographer

INQUIRY CLASS

Description - The Inquiry class services object's retrieval requests. This transaction is created by the transaction class. This transaction is a transient object, ceasing to exist after the request is serviced.
Superclasses - Transaction.
Subclasses - None.

CONTRACTS

[2] **Process Transaction** is implemented by the following public methods:
a) ObjectDetail:

RESPONSIBILITY	DESCRIPTION
ObjectDetail: anaccesionNo	Tell the user anObject's detail.

LOCATION CLASS

Description - The Location class is a data repository, maintaining location information available in the museum. There is one instance of this class for each specific location.
Superclasses -PersistentObject
Subclasses - None

CONTRACTS

[10] **Maintain Location Record** is implemented by the following public methods:
(all the method are listed below under **RESPONSIBILITY**)

RESPONSIBILITY	DESCRIPTION
site	Return my site.
roomNo	Return my room number.
shelfNo	Return shelf or showcase number
LayerNo	Return layer or drawer no
site	Set my site to aSite.
roomNo	Set my room number to aRoomNumber
shelfNo	Set my shelf or showcase number to aShelfNumber
LayerNo	Set my layer or drawer no to aLayerNumber

DATA	DESCRIPTION
site	The place where I am located.
roomNo	My room number.
shelfNo	My shelf or showcase number
LayerNo	My layer or drawer no

MOVEMENT CLASS

Description - The Movement class is a data repository, maintaining movement information for all objects of the IES museum. There is one instance of this class for a particular movement.
Superclasses - PersistenetObject.
Subclasses - None.

CONTRACTS

[15] **Maintain movement record** is implemented by the following public methods:

(all the method are listed below under **RESPONSIBILITY**)

RESPONSIBILITY	DESCRIPTION
dateOfMovement:	Return the date of movement.
movementNo:	Return the movement number in a day.
issuerName:	Return the name of issuer.
ReceiverName:	Return the receiver's name.
location:	Return the destination of the object.
exhibition:	Return the exhibition number
remark:	Return the remark.
dateOfMovement: adateOfMovment	Set the dateOfMovement to adateOfMovment.
movementNo: a movementNo	Set the movementNo to amovementNo.
issuerName: anissuerName	Set the issuerName to anissuerName.
ReceiverName: aReceiverName	Set the ReceiverName to aReceiverName.
exhibitionNo: anExhibitionNo	Set the exhibition number to anExhibitionNo.
movRemark: aMovremark	Set the remark to aMovRemark.
Location: aLocation	Set my location detail to aLocation.
ChangeObjLoc: aLocation	Change anObject's current location with aLocation and dateOfPerLocation to adateOfMovement. If aSite equals 'permanentLoc' change anObject's permanent location to aLocation and dateOfCurLocation to aDateOfMovement.

DATA	DESCRIPTION
dateOfMovement	The date of an object's movement.
movementNo	The movement number in a day.
issuerName	Name of issuer.
ReceiverName	Reciever's name.
location	destination of the object.
exhibitionNo	The exhibition number if 'site' is exhibition.
dispositionNo	The disposition number if site' is disposition.

MOVEOBJECT CLASS

Description - The MoveObject class services the recording of the msueum object's movement. This transaction is created b the transaction class. This transaction is a transient object.
Superclasses - Transaction.
Subclasses - None.

CONTRACTS

[2] **Process Transaction** is implemented by the following public methods:

a) GetMovementDetail:

RESPONSIBILITY	DESCRIPTION
GetMovementDetails:anAccessionNo	Ask the user movement details for this object.
CreateMovementRecord: aMovementNo	Create movement record with movement number: aMovementNo
WriteMovementDetail: MovementNo	Write its detail for this movement.

NONAUDIOVISUAL CLASS

Description - The NonAudiovisual class is an abstract class that provides common services for all types of non audiovissual collection of the museum.
Superclasses - MuseumObject
Subclasses - EthnographicArt, Stamp, Coin

CONTRACTS

[1] **Maintain Catalogue record** is implemented by the following public methods:

Weight:, weight: aweight,
DeleteNonAudioVImageNo: anImageNo,
AddNonAudioVImageNo: anImageNo,
ChangeNonAudioVImageNo: anExistingImageNo To aNewImageNo,
DeleteNonAudioVTreatmentNo: anTreatmentNo,
AddNonAudioVTreatmentNo: anImageNo,
ChangeNonAudioVTreatmentImageNo: anExistingImageNo To aNewImageNo,

DATA	DESCRIPTION
weight	My weight
treatments	My treatment list
images	My image list

REPORT CLASS

Description - The Report class services the objects' retrieval using a certain characteristic. This transaction is created by the transaction class. This transaction is a transient object.
Superclasses - Transaction.
Subclasses - None.

CONTRACTS

[2] **Process Transaction** is implemented by the following public methods:
a) SimilarObjectsDetail:

RESPONSIBILITY	DESCRIPTION
similarObjectDetail: anobjectname	List for the user all object's with name: anobjectname.

SLIDE&PHOTO CLASS

Description - The Slide&Photo class provides services for all types of slide and photograph collections of the museum. The more generalized functions are inherited from the AudioVisual class. There is one instance of this class for each slide and photo collection. (the same topic/title can have more than one photograph/slide the 'images' instance variable represent this situation).
Superclasses -AudioVisual
Subclasses - None

CONTRACTS

[1] **Maintain Catalogue record** is implemented by the following public methods:
(all the method are listed below under **RESPONSIBILITY**)

RESPONSIBILITY	DESCRIPTION
images:	Return all my images
AddImageNo: anImageNo	Add anImageNo to the image list.
ChangeImageNo: anExisting ImageNo To aNewImageNo	Compare anExistingImageNo with my image list. If found set anExistingImageNo to aNewImageNo, otherwise return false.
DeleteImageNo: anImageNo	Compare anExistingImageNo with my image list. If found delete it, otherwise return false.

SOUND CLASS

Description - The Sound class provides services for all types of sound collections of the museum. The more generalize functions are inherited from the Sound&Video class. There is one instance of this class for each sound collection.
Superclasses - Sound&Video.
Subclasses - None.

CONTRACTS

[1] **Maintain Catalogue record** is implemented by the following public methods:
(all the method are listed below under **RESPONSIBILITY**)

RESPONSIBILITY	DESCRIPTION
sound:	Return my sound
sound: aSound	Set my current sound to aSound

DATA	DESCRIPTION
sound	my sound

SOUND&VIDEO CLASS

Description - The Sound&Video class is an abstract class that provides common services for all types of sound and video collection of the museum. The more generalized functions are inherited from the AudioVisual class.
Superclasses -AudioVisual
Subclasses - Video, Sound

CONTRACTS

[1] **Maintain Catalogue record** is implemented by the following public methods:
(all the method are listed below under **RESPONSIBILITY)**

RESPONSIBILITY	DESCRIPTION
duration	Return the time I take to play
dateofRecord	Return my date of recording
recorder	Return the name of the person who recorded me
duration: aDuration	Set the time I take to play to aDuration
dateOfRecord: aDateOfRecord	Set my date of recording to aDateofRecord
recorder: aRecorder	Set the name of the person who recorded me to

DATA	DESCRIPTION
duration	The time I take to play
dateofRecord	My date of recording
recorder	The name of the person who recorded me

STAMP CLASS

Description - The MuseumObject class is an abstract class that provides common services for all types of museum objects
Superclasses - NonaudioVisual.
Subclasses - None.

CONTRACTS

[1] **Maintain Catalogue record** is implemented by this class.

DATA	DESCRIPTION
design	the type of design
engravers	name of engravers
printers	name of printers
denominations	my denomination list

TRANSACTION CLASS

Description - The Transaction class is an abstract class that povides common services for all transactions.
Superclasses - Object.
Subclases - Create, Update, Delete, Inquiry, MoveObject, Report.

CONTRACTS

[2] **Process Transaction** is a subclass responsibility.

RESPONSIBILITY	DESCRIPTION
VerifyObjectExis	Verify the object's existence before any action is taken place

DATA	DESCRIPTION
accessionNumber:	The accession number associated with the transaction.

TREATMENT CLASS

Description - The Treatment class is a data repository, maintaining treatment information of all types of non audiovisual bjects in the IES museum. There is one instance of this class for each treatment. Each treatment examines one object.
Superclasses - PersistenetObject.
Subclasses - None.

CONTRACTS

[1] Maintain Catalogue record is implemented by this class.

DATA	DESCRIPTION
treatmentNo	The treatment number
trStartDate	Starting date of the treatment.
trEndDate	Finishing date of the treatment.
conditionBefore	The condition of the object before treatment
imagesBefore	Images of the object before treatment.
treatmentNeeded	Treatment Needed.
trTechnique	Techniques used.
TreatmentAplied	Treatments applied.
ImagesAfter	Images of the object after treatment.
ConditionAfter	The condition of the object after treatment.
TrRemark	Treatment notes.
NameofResp	Name of the responsible person for the work

UPDATE CLASS

Description - The Update class services the editing of object's information. This transaction is created by the transaction class This transaction is a transient object.
Superclasses - Transaction.
Subclasses - None.

CONTRACTS

[2] **Process Transaction** is implemented by the following public methods:
a) ChangeObjectDetail:

RESPONSIBILITY	DESCRIPTION
ConfirmChange:	Ask the user for confirmation to update.
ChangeObjectDetail: anAccesionNo	Change the details for an object with identification: anAccessionNo

USER CLASS

Description - The User class is a data repository, maintaining the museum users information. There is one instance of this class for each user of the system.
Superclasses - PersistenetObject.
Subclasses - None.

CONTRACTS

[6] **Verify User** is implemented by the following public methods:

a. ValidatePassword:

RESPONSIBILITY	DESCRIPTION
ValidPassword: aPassword	Return true if aPassword equals my password, false otherwise.

DATA	DESCRIPTION
userId	My identification number.
password	My password.

VIDEO CLASS

Description - The Video class provides services for all types of video collections of the museum. The more generalized functions are inherited from the Sound&Video class. There is one instance of this class for each video collection.
Superclasses - Sound&Video.
Subclasses - None.

CONTRACTS

[1] **Maintain Catalogue record** is implemented by the following public methods:
(all the method are listed below under **RESPONSIBILITY**)

RESPONSIBILITY	DESCRIPTION
video: aVideo	set the video to aVideo
video:	play back

DATA	DESCRIPTION
video	The video record
playingSpeed	My playing speed

CHAPTER FIVE
PROTOTYPE IMPLEMENTATION

5.1 IMPLEMENTATION

Prototyping is used in the implementation to clarify some of the features of the proposed database system. As such it may not have full versions of all datafiles or support all the procedures, and functionality of the proposed system. It is, however, constructed in a way which demonstrates the most pertinent characteristics of the proposed system. An attempt is made to show the users inputs, intermediary stages, and outputs from the system.

The prototype is developed using dBase V for windows. In addition to its structured programming support, dBase V for Windows also provides some features for creating and using objects and classes, and declare subclasses from supper class thereby enabling object oriented design and development. Most of the classes identified in the design stage are implemented using forms. A form is one of the standard classes provided by dBase V and used to build the user interface of an application.

The highest level classes defined in the design stage were implemented by declaring them as subclasses of the Base Form class, whereas subclasses which are in the lower levels of the hierarchy structure are derived from these classes accordingly.

The Museum Object, NonAudiovisual, and Ethnographic&Art classes were implemented including other related classes such as Image, Location, Accession, and Sound. The Museum Object class is the super class to most of other classes. Hence, the MuseumObject class is derived from the standard FORM Class. The following source code, which is

extracted from the program (see APPENDIX B for the full program), shows the declaration of the MuseumObject Class.

```
CLASS MOBJECTFORM OF FORM
  Set Procedure To BUTTONS.CC additive
  this.Left =        1
  this.ColorNormal = "0X408080/0X408080"
  this.Top =         0.0586
  this.Text = ""
  this.HelpId = ""
  this.HelpFile = ""
  this.Width =       101.5
  this.Height =       20.8232  ....

.....

ENDCLASS
```

Other classes such as NonAudiovisual and Ethnographic&Art are successively derived from the MObject Class. The Museum object class contains Entryfields for entering and displaying values for the fields, AccessionNo, ObjectName, etc., which are common to all the subclasses in the hierarchy. Other attributes, such as Location and Accession, are implemented using Buttons to refer to the instances of Class Location and Accession respectively. It also sets some of the properties of the form, including color, size etc., which are also common to the subclasses down in the Inheritance hierarchy structure, e.g. Ethnographic&Art.

Just below the Museum Object class in the Inheritance hierarchy comes two subclasses of which the Non Audio Visual class is one. This subclass is implemented by deriving it from the Museum Object class inheriting all the attributes and the methods of the superclass as shown in the source code given below. It defines Entryfield for the attribute, Weight, which is specific to this class.

```
CLASS NONAVFORM OF MOBJECTFORM
  this.OnGotFocus = CLASS::OnGotFocus
```

The attribute Image, which refers to the instances of Image class, is implemented by using Button which enable the user to access photographs and photography related information.

One of the classes in the last level of the hierarchy structure is the Ethnographic&Art, which is derived from Nonaudiovisual class.

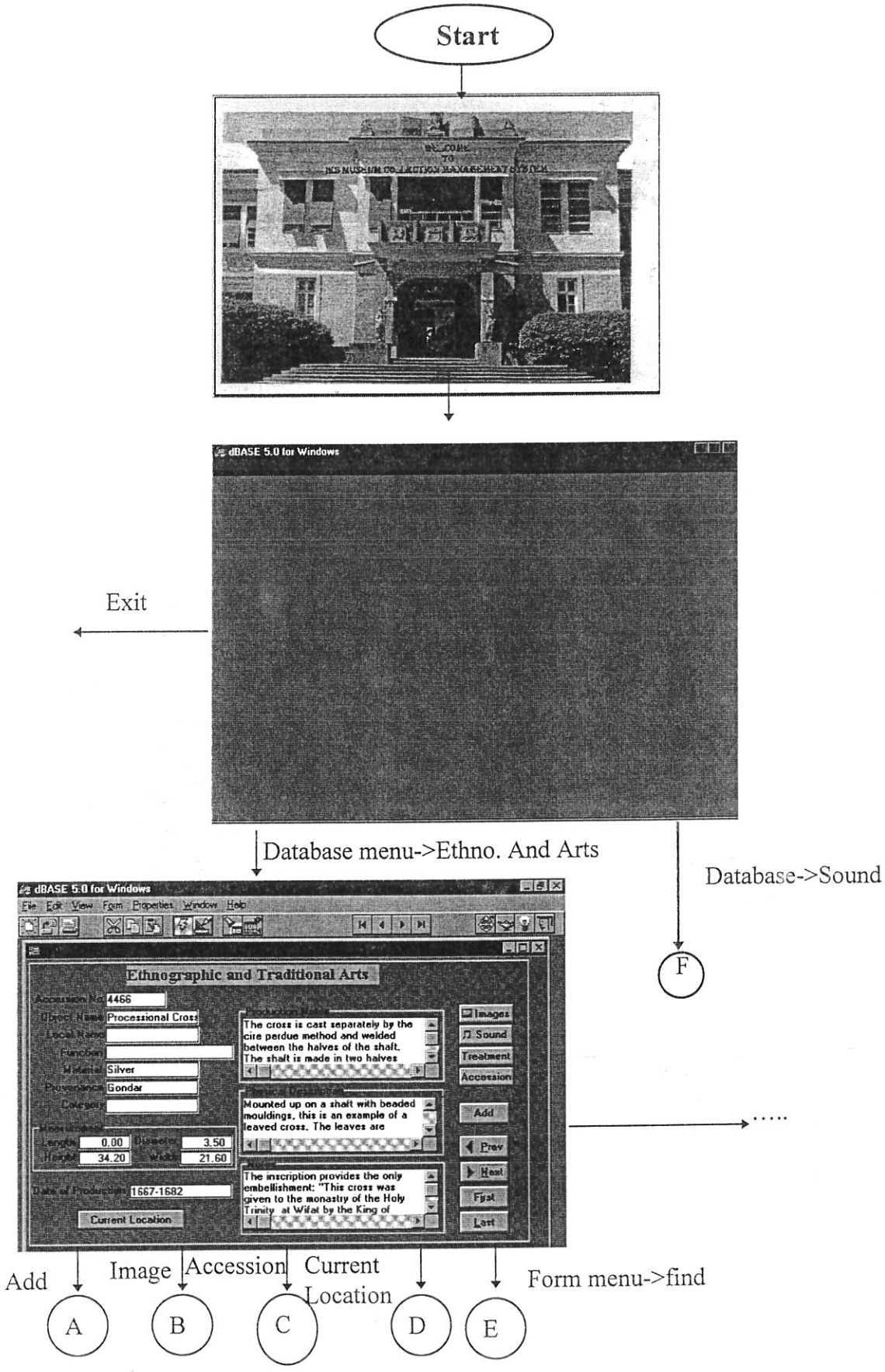
```
CLASS ETHNOFORM OF NONAVFORM
  this.view = "Museum.Qbe"
  form.ACCNOENTRY.DATALINK = "Mobject->AccNo"
  form.OBJNAMEENTRY.DATALINK = "Mobject->objname"
  form.CATEGORYENTRY.DATALINK="Mobject->category"
  form.DATEOFPRODENTRY.DATALINK = "Mobject->dateofprod"
```

The Ethnographic and Arts Class inherits the attributes of the super classes, and sets the view property of the Class to Museum.Qbe. It also sets the datalink properties of most of the Entryfields defined in the supper classes to the appropriate fields.

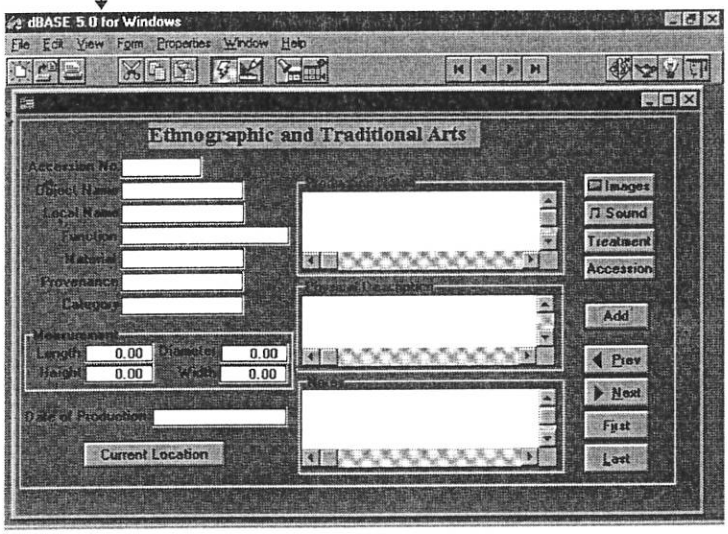
Although the classes are implemented as described in the above paragraph, the actual data is stored in relational tables. Because, dBase is basically a relational database management system, it has been necessary to separate the data from the object and store them in tables.

For the prototype, the following tables have been created, Mobject, NonAV, Ethno, Image, Location , Accession, and Sound. These tables are used to supply and store data from Entry fields defined in the corresponding forms. Since the Accession and Location are reference attributes of the MuseumObject class, an identification field is introduced in the Mobject table in order to provide a link to the tables containing accession and location information. The last class in the hierarchy which is the Ethnographic&Art class inherits all the

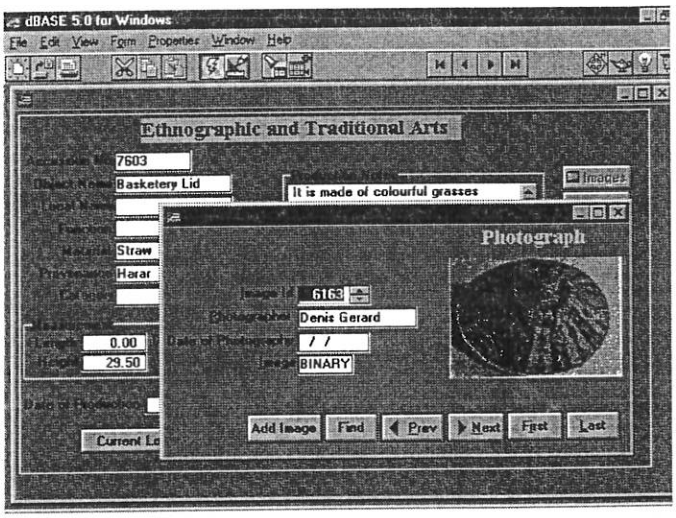
5.2 OVERALL SCREEN FLOW OF THE PROTOTYPE



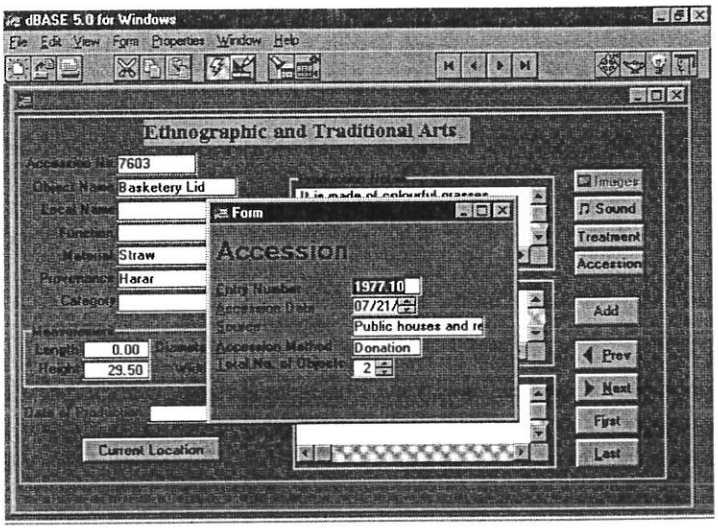
A


dBASE 5.0 for Windows
File Edit View Form Properties Window Help
Ethnographic and Traditional Arts
Images
Sound
Treatment
Accession
Add
Prev
Next
First
Last
Current Location

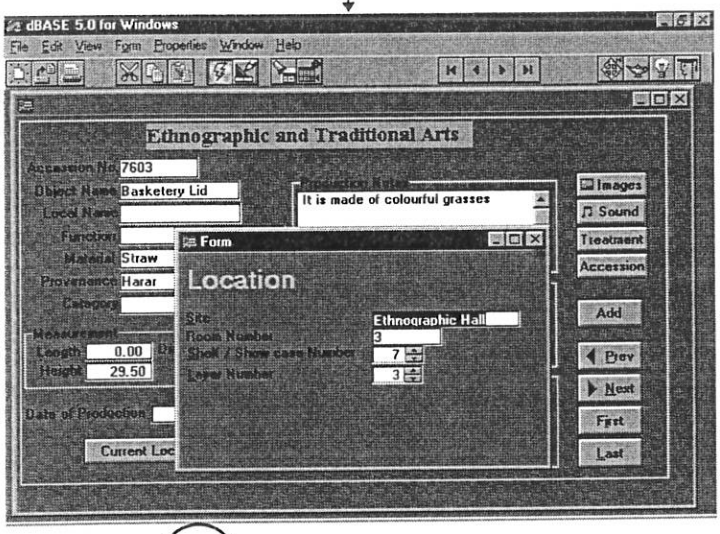
B


dBASE 5.0 for Windows
File Edit View Form Properties Window Help
Ethnographic and Traditional Arts
7603
Basketery Lid
It is made of colourful grasses
Images
Straw
Harar
Photograph
6163
Denis Gerard
BINARY
Add Image
Find
Prev
Next
First
Last

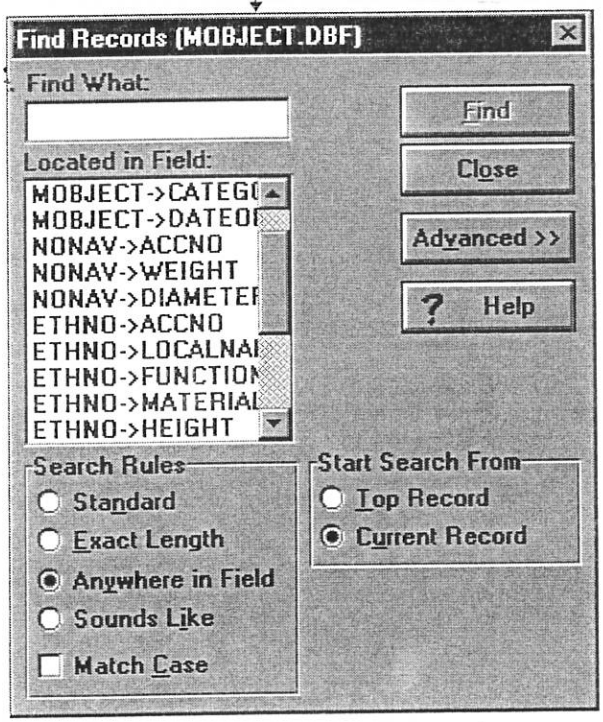
C


dBASE 5.0 for Windows
File Edit View Form Properties Window Help
Ethnographic and Traditional Arts
7603
Basketery Lid
Straw
Harar
Form
Accession
1977.10
07/21
Public houses and re
Donation
2
Images
Sound
Treatment
Accession
Add
Prev
Next
First
Last
Current Location

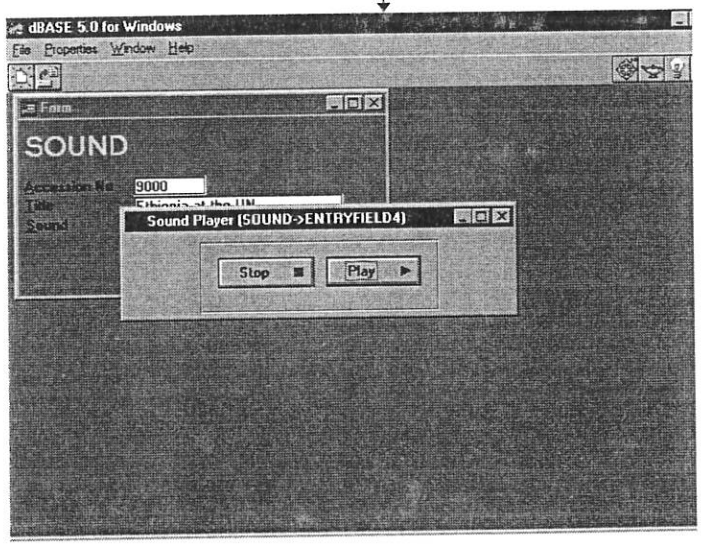
D


dBASE 5.0 for Windows
File Edit View Form Properties Window Help
Ethnographic and Traditional Arts
Accession No 7603
Object Name Basketery Lid
Local Name
Function
Material Straw
Provenance Harar
Category
Measurements
Length 0.00
Height 29.50
Date of Production
Current Loc
It is made of colourful grasses
Images
Sound
Treatment
Accession
Add
Prev
Next
First
Last
Form
Location
Site Ethnographic Hall
Room Number 3
Shelf / Show case Number 7
Layer Number 3

E


Find Records (MOBJECT.DBF)
Find What:
Located in Field:
MOBJECT->CATEGO
MOBJECT->DATEOF
NONAV->ACCNO
NONAV->WEIGHT
NONAV->DIAMETER
ETHNO->ACCNO
ETHNO->LOCALNAM
ETHNO->FUNCTION
ETHNO->MATERIAL
ETHNO->HEIGHT
Find
Close
Advanced >>
Help
Search Rules
Standard
Exact Length
Anywhere in Field
Sounds Like
Match Case
Start Search From
Top Record
Current Record

F


dBASE 5.0 for Windows
File Properties Window Help
Form
SOUND
Accession No 9000
Title
Sound
Sound Player (SOUND->ENTRYFIELD4)
Stop
Play

5.3 DEMONSTRATION OF THE PROTOTYPE

To start the prototype program, assuming that Windows 95 is being used , one has to:

- Click on the Start button from the Task Bar of Windows 95
- Select the Program submenu from Start menu
- Click on the Icon labeled IESMCMS

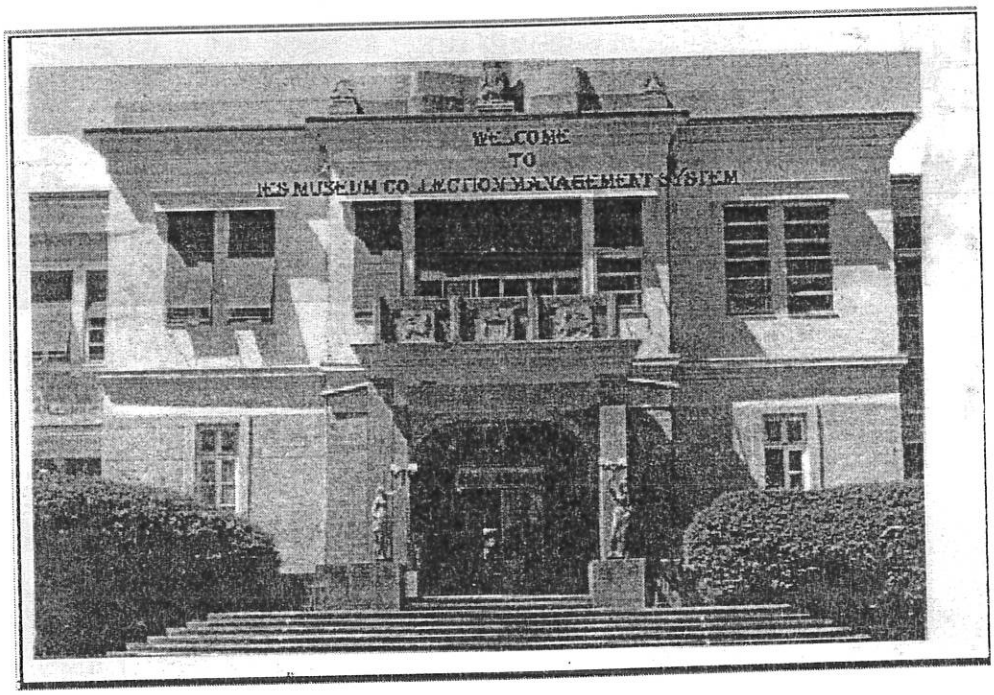


Fig. 5.1 The Welcome Screen of IESMCDS

The program will automatically load dBase V and starts the application. The welcome screen appears displaying the building in which IES museum is housed (Fig 5.1). The users can close the welcome window by clicking anywhere outside the window. At the beginning, only three menus will be displayed in the Menu Bar, File, Database, and Help. Among which options 'Ethno. and Art', and 'Sound' of the Database Menu, and 'Exit' from the File Menu can be selected, the other modules are not fully developed in this version. When the 'Ethno. and Art' menu is clicked the following data entry form appears:

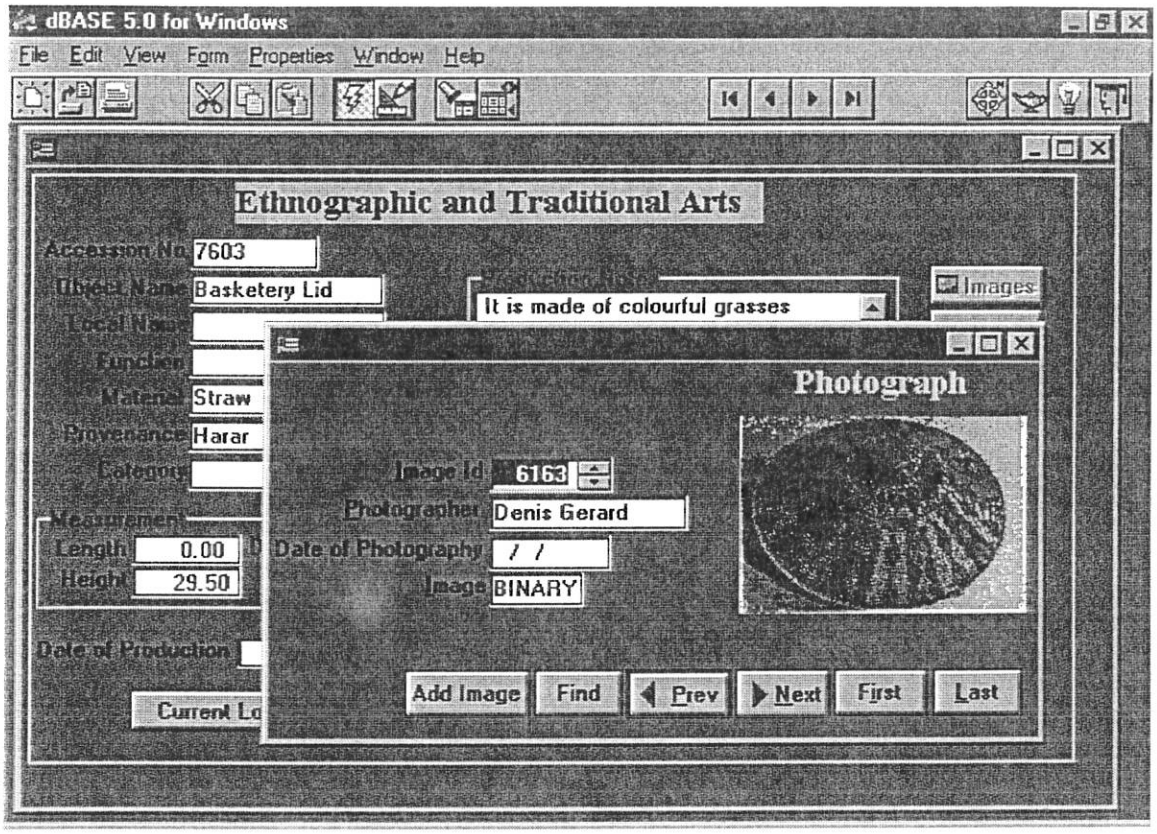


Fig. 5.4 Image Form

Similarly, accession and location information from other classes such as Accession and Location can be accessed by clicking the corresponding buttons (figures 5.5 and 5.6).

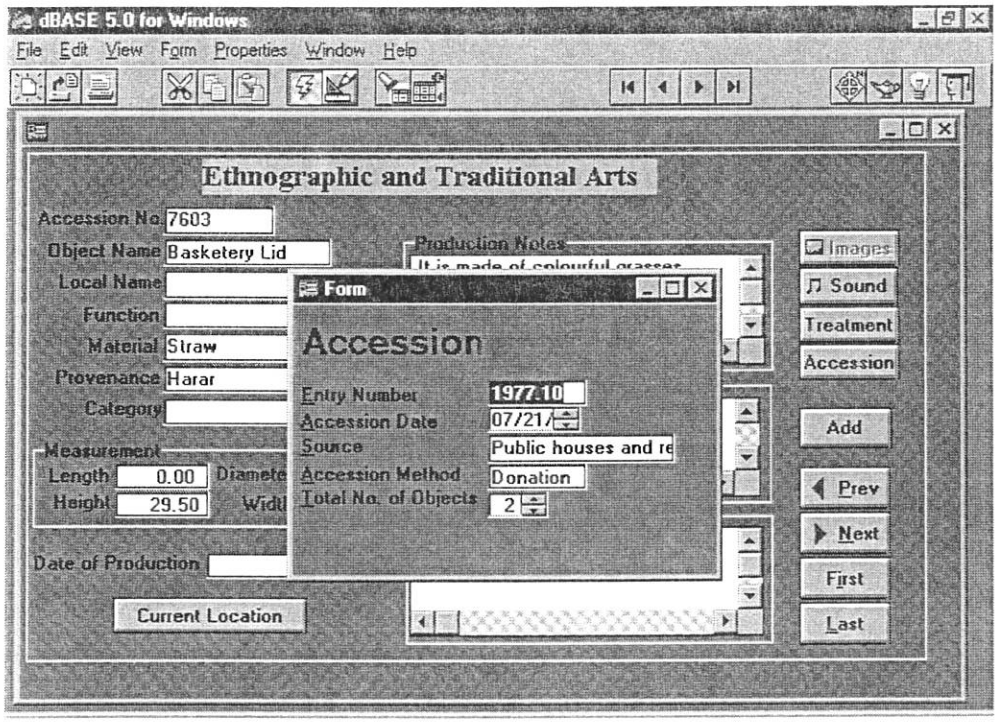


Fig. 5.5 Accession Form

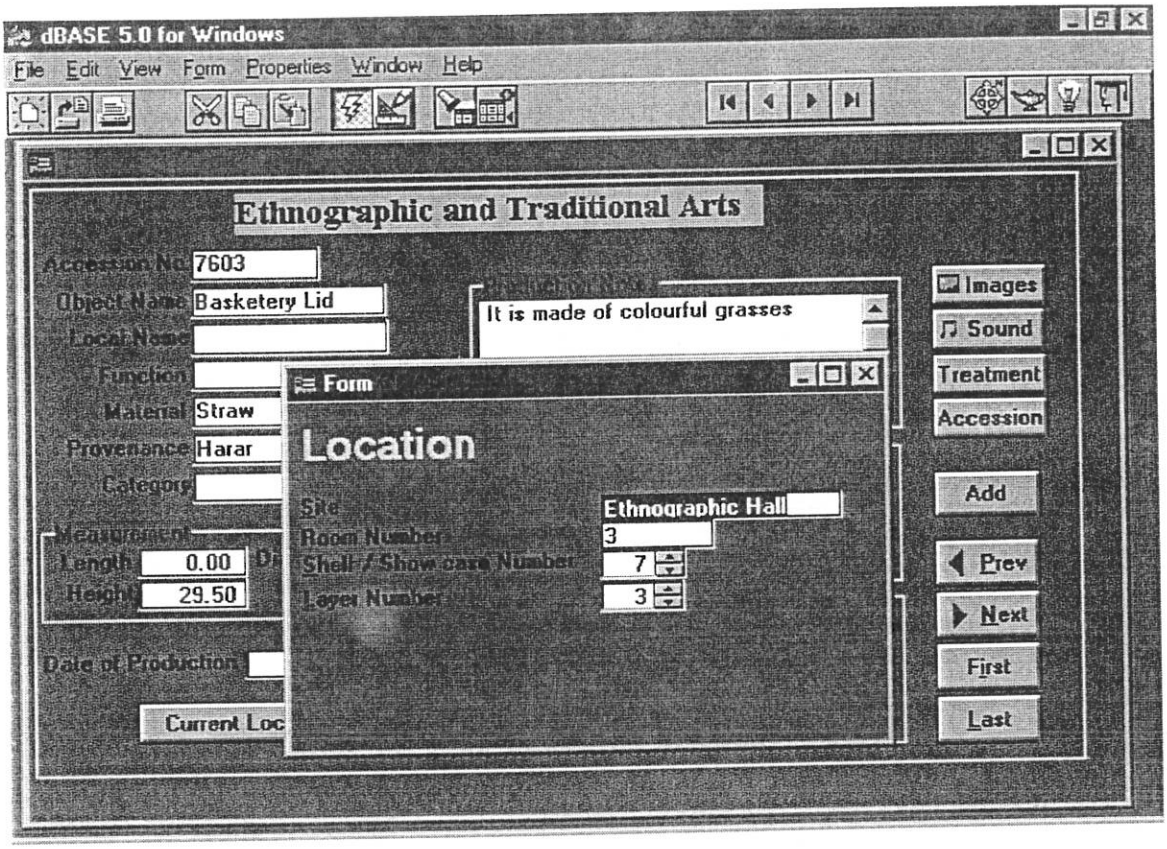


Fig. 5.6 Location Form

The user can open all these forms thereby enabling him / her to access an integrated information, which are in various forms including structured text, unstructured text, and still image, about a specific museum object (Fig. 5.7).

Other than Ethnographic&Art class, the Sound class is also partially implemented. Although not fully developed, the Sound option of the Database menu opens up a Sound form (Fig. 5.8) which allows to record and play sound. This in turn demonstrates how information relating to sound collections can also be maintained like other museum objects.

includes various types of records such as cataloguing information, other collection management information and some research related information.

dBase V for Windows was used to prototype / implement an aspect of the proposed database solution. In the prototype, in addition to structured and unstructured text, incorporation of still image, and sound were achieved. The prototype also integrated catalogue and other related information thereby providing a comprehensive view about a specific museum object.

The prototype was also demonstrated to the IES Museum staff in order to consider their comments and suggestions for improving the prototype. They suggested that they would like to have some features, like navigating through records and adding records, within the Ethnographic form as these are frequently required functions. Then the working model was revised accordingly. Before the improvement, it was possible to use these features through the Form menu of the Menu bar.

The prototype developed may contribute to alleviate some of the problems identified in this study, as it offers the following capabilities:

- efficient and easier management and cataloguing transactions handling,
- provision of prompt locational information,
- provision of multiple access points,
- provision of indexes which allow prompt searching by different characteristics of an object,
- provision of object's full descriptions and cross-references,
- initial selectiion of items can be achieved using the system.

BIBLIOGRAPHY

_____. 1996. Micro Gallery Visitor survey. Cognitive Applications Limited. http://www.cogapp.com/home/VisitorSurvey.html.

Abebe Rorrisa. 1993. An Ethiopian Studies Resource Centre: A Feasibility Study. M.Sc.I.S. Thesis. Addis Ababa: SISA, Addis Ababa University.

Ahmed Zekaria, 1996. "Illicit trafficking: an ugly transaction." International Committee for documentation, International council of Museums (CIDOC) Newsletter, vol. 7: 49-53.

Ambrose, T. and Paine, C. 1993. Museum Basics. New York: Routledge.

Annabi, C. 1996. "Standardization and computerization of the inventories of the African museums." International Committee for documentation, International council of Museums (CIDOC) Newsletter, vol. 7: 41-47.

Avison, D. E. and Fitzgerald, G. 1993. Information Systems Development: Methodologies, Techniques and Tools. Oxford: Alfered Walter Ltd. Publishers.

Booch, G. 1994. Object-Oriented Analysis and Design with Applications. California: the Benjamin/Cummings Publishing company, Inc.

Borland International. 1994. Programmer's guide: Borland dBASE for Windows. U.S.A.: Borland International, Inc.

Buechner, R. 1992. Multimedia. California. http://apiitg30.apiit.edu.my/~ziad/cnds/MM/multimedia.html.

Case, M. 1995. "What Registrars Do All Day." Registrars on Record: Essays on Museum Collections Management. Washington, D.C.: the American Associations of Museums.

Chenhall, Robert G. and Vance, David. 1988. Museum collections and today's computers. New York: GreenWood.

Moline, J. 1991. "designing Multimedia systems for Museum Objects and Their Documentation." Microcomputer for Information Management 8(2): 69-86.

Munro-Hay, S. C. H. 1986. The Munro-Hay colllection of Aksumite coins. Napoli: Istituto Universitario Orientale.

Neelameghan, A. 1994. Design and Development of Object-Oriented Databases: Application of the Principles and Postulates of the general theory of Knowledge classification. Addis Ababa: SISA, Addis Ababa University.

Pankhurst, Richard. 1990. "IES Foundation and the First Decade: A personal view." Silver jubilee anniversary of the Institute of Ethiopian Studies. Proceedings of the symposium. (ed. by) Richard Pankhurst and Tadesse Beyene: Addis Ababa: Institute of Ethiopian Studies. Addis Ababa University. pp. 11-26.

Pao, M. L. 1988. Concepts of Information Retrieval. Englewood: Libraries Unlimited, Inc.

Pearce, S. M. 1992. Museums, Objects, and Collections: A Cultural Study. Washington, D.C.: Smithsonian Institution Press.

Schmiegel, K. A. 1995. "Introduction to Automation." Registrars on Record: Essays on Museum Collections Management. Washington, D.C.: the American Associations of Museums.

Schmiegel, K. A. 1995. "Managing collections Information." Registrars on Record: Essays on Museum Collections Management. Washington, D.C.: the American Associations of Museums.

Smith, M. F. 1991. Software prototyping: adoption, practice and management. London: McGraw-Hill Book Company.

Starre, J.V.D. and Davis, B. and Trant J. Eds. 1996. Introduction to Multimedia in Museums. Getty Information Institute International Council of Museums (ICOM).

Tadesse Beyene. 1990. "Opening statement by Dr. Tadesse Beyene." Silver Jubilee Anniversary of the Institute of Ethiopian Studies. (ed. by) Richard Pankhurst and Tadesse Beyene: Addis Ababa: IES. pp.1-7.

Wilkinson, T. S. and Bhandarkar, P. L. 1984. Methodology and Techniques of Social Research. Bombay: Himalaya Publishing.

APENDIX A

DISCUSSION GUIDES

DISCUSSION GUIDE FOR CURATORS, REGISTRARS, AND CONSERVATORS OF IES MUSEUM

The discussion guide is aimed at determining the strengths and weaknesses of the information handling activities of the IES museum. This study is being undertaken for a thesis work by a graduate student of School of Information Studies for Africa, Addis Ababa University for fulfilling the requirements of the M.Sc.I.S program. I believe that looking at the following items before the actual discussion will make our discussion fruitful. Based on the responses a study will be made to improve the information handling activities of the museum thereby improving other activities of the museum and contributing towards the achievement of the museum's objectives.

I. IDENTIFICATION

What is

your responsibility in the museum ? _____
your educational background ? _____
your work experience ? _____

II. ORGANIZATION

1. What is the objective of the museum?
2. What are the information related activities and services of the museum?
3. What types of collections do you have or what type of museum is it?
4. How is the museum structured (organizationally), managed and financed?

III. USERS

5. Who are the major users of the museum?
   Researchers, _____ Donors, _____ Administrators, _____
   Visitors - local visitors, tourist visitors _____
   Others _____

IV. COLLECTION TYPE AND SIZE

6. What media (and in what average size) are included in your collection?
   Photograph ____ Video _____
   Manuscripts ____ Sound _____
   historical and cultural objects _____

7. On the average what is the monthly addition of each type?
   Photograph ____ Video _____
   Manuscripts ____ Sound _____
   historical and cultural objects _____

V. DOCUMENTATION SYSTEM

8. What type of collection documentation system do you use?
   [ ] Leather-bound ledgers
   [ ] manual catalogue cards
   [ ] computerized registration system
   Others _____

9. In the existing manual system, how are the catalogue cards organized?
   [ ] by accession no.
   [ ] by other characteristics of the object such as object name, origin, etc.

10. Do you maintain indexes ?

11. Do the Catalogue cards contain complete and up-to-date information?

12. How much does it take to select an object information from the catalogue cards for some purposes such as record updating, retrieving item's location, etc.?
    [ ] less than one hour [ ] half a day [ ] one hour
    [ ] or more [ ] two hours

13. How do other users, say researchers, use the cards?
    [ ] by their own (open access)
    [ ] through the help of the registrar

14. How are the physical objects organized in store or exhibition?
    [ ] accession no. [ ] material type
    [ ] others. _____

15. Is it possible for you to take inventories of your articles at the required frequency and with an acceptable time?

16. How easy is the identification of lost items and deteriorated objects?

17. Do you keep photograph documentation other than written?

18 Does the existing documentation system facilitate the selection of items (for exhibitions, conservation, research purposes) without browsing through the physical items?

19 Do you use any standard input format (regional, or international) for cataloguing information?

20. Do you have any classification scheme for categorizing your objects?

21. Do you have terminology lists for different categories of information that can help you describing the items consistently or aid at the time of searching (e.g origin names, category, etc.)?

22. Does the card system provide sufficient cross-references to related information: other object, maker / artist, etc. ?

23. Does the documentation system facilitate in retrieving an integrated information about an object including text, picture, sound, etc. timely? if no, does it affect your work:
[ ] very much [ ] little [ ] not at all

24. How do users (researchers, visitors, etc.) get their information?
[ ] exhibitions [ ] publications [ ] in person
[ ] telephone [ ] seminars; workshops

25. What publications you are usually required to produce from your collection information? Can you do it at the required frequency and quickly?

26. How often do you prepare special exhibitions and programs?

[ ] once a year [ ] twice a year [ ] three times a year
Others _____

27. Can you easily prepare supplementary interpretive materials (object labels, museum catalogues, guides, etc.) for special / permanent exhibitions or programs?

28. What types of information do you need or already maintained other than cataloguing information to facilitate your work:

Collections management information
[ ] Accessioning [ ] Source (e.g. donor)
[ ] Provenance [ ] Loan/Exhibit
[ ] Photography [ ] Disposition

Conservation related information
[ ] treatment information
[ ] production techniques
[ ] treatment methods / techniques
[ ] records of conservation information

Research related information
[ ] Bibliographic information
[ ] Biographic data: artist or maker, art historians, etc. [ ] Descriptions of artistic media
[ ] other institutions and museums
[ ] other museum collections
Others,_____

29. How quickly do visitors able to locate information using the museum guide, if any?
[ ] less than half an hour [ ] two hours [ ] one hour [ ] half a day
Others _____

30. What type of presentation techniques do you use? Either to supplement the display for facilitating the understanding of visitors or give them better opportunities to look at or touch them?
[ ] tour guides [ ] models
audio-visuals
[ ] slide tapes
[ ] audio systems
[ ] videos
[ ] computer systems

31. Do you think the use of automated systems that provide all types of information (e.g. what an exhibition is about, how it is organized, full object description, image, etc.) improve the exhibition service?

32. Is there any information flow between you and other units of the institute or outside the institute?

33. Is there any collaboration programs for sharing objects and their information from similar institution for research or other purpose?

VI. GENERAL

1. Is the current system efficient?

2. To what extent were the aims of the museum met?

3. What should be put in place in order to solve fully or partially the current problems and raising the overall levels of your performance?

VII. OTHERS

1. Is there any plan to automate the system?

2. If there is, what type is it?
   A conventional automated system:
   [ ] a replacement of the manual system
   [ ] with additional features such as the ability of the creation and use of indexes and other retrieval tools
   A multimedia system that:
   [ ] integrates all types of information: text, picture, sound, etc.

3. What main features / facilities do you expect an automated system should provide you with?
   Databases, Database searching, ...

4. What will be the benefit for your museum to automate?

5. Internet is just introduced in our country, do you think that connecting your system to the internet helps in some way or another in facilitating your activities? If yes for what purpose:
   [ ] for collaborative research
   [ ] access practices of similar institutions
   [ ] for advertising your collections
   [ ] others

III. RESOURCE & FACILITY

1. What type of IT facilities do you have at the museum?

[ ] Computers	[ ] softwares	[ ] application programs
[ ] Printers	[ ] Scanners	[ ] digital camera
[ ] CD-ROM	Others _____	

2. If you have, for what purpose do you use them?
   [ ] Office and business functions (word processing, electronic mail, payroll, etc.)
   [ ] collections management [ ] statistics
   Others _____

3. Do you have any employee who has some qualifications in the field of information science/library science or related fields

If yes,

Total. No.	field of study	qualification	position
_____	_____	____	
_____	_____	____	

4. How do you plan to financing of the automation?
   [ ] own fund
   [ ] government funds
   [ ] funds from other organizations

5. Other relevant information:

ASSESSMENT OF VISITORS INFORMATION REQUIREMENTS

Qan. N0		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	T.	%
1	museum guides																					0	0
	external tour guide / a friend	x			x	x		x	x	x	x			x		x			x	x		11	55
	assistance of museum staff	x														x						2	10
	self-guided		x	x			x		x			x	x		x							7	35
	others																x	x				2	10
2	Guide book of ETC			x	x	x	x	x								x	x		x	x		9	45
	newspaper			x																		1	5
	a friend									x		x		x		x						4	20
	from school														x			x				2	10
3	what the exhibition is all about		x	x	x		x			x			x		x	x						8	40
	major aspects of the subject	x	x	x	x		x					x	x		x							8	40
	floor plan & how the exhibition is organized and its plan	x	x	x		x	x	x		x		x	x			x			x	x		12	60
	narrated commentary		x	x			x	x			x	x					x	x				8	40
	detail object description - cultural / historical context for selected objects		x	x		x	x	x		x		x	x	x		x						10	50
	dates	x			x	x						x	x					x			x	7	35
	use / purpose	x										x				x		x				4	20
	provenance					x						x										2	10
	whether in use or not / life objects				x																x	2	10
	biographic										x							x				2	10
	location at the exhibition																	x				1	5
	short explanation for each region																		x			1	5
	bibliographic												x									1	5
4	yes		x		x	x		x	x	x		x	x		x	x	x	x				12	60
	No																			x		1	5
	Partially	x		x							x											3	15
5	yes																					0	0
	No- difficult without a friend											x				x						2	10
	partially	x	x		x	x				x				x	x		x	x	x			10	50
6	Catalogues by type / indexes / leaflets / brochures / guide book			x				x	x			x	x		x	x			x			8	40
	personal guide															x						1	5
	individual labels		x													x						2	10
	more pictures		x	x	x				x	x		x	x		x		x		x			10	50
	photographs when originals can not be seen						x															1	5

Qan. N0		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	T.	%
	sound (sometimes)		x						x													2	10
	audio tour	x						x														2	10
	video			x																		1	5
	films that show use, manufacture, etc.			x																		1	5
	printed materials with different languages	x			x			x				x		x			x					6	30
	computer systems	x					x	x				x										4	20
	CD-ROM&Internet						x															1	5
	no explanations in some showcases, for non-amharic speakers: for the king's bedroom							x	x													2	10
	multimedia systems		x																			1	5
	maps														x							1	5
	loan service														x							1	5
	more information by subject												x	x								2	10
7	yes	x	x	x	x		x	x		x	x	x	x	x	x		x	x	x	x	x	17	85
	no																					0	0

APPENDIX B

Source Code of the Program

```
shell(.f.,.t.)
create session

** END HEADER -- do not remove this line*
* Generated on 05/28/97
*

set procedure to iesstart.wfm
LOCAL f
f = NEW IESMCDSFORM()
f.Open()

CLASS IESMCDSFORM OF FORM
  Set Procedure To BUTTONS.CC additive
  this.OnOpen = Class::OnOpen
  this.OnClose = Class::OnClose
  this.Height =       18
  this.MenuFile = "IESMCDS.MNU"
  this.Text = "Form"
  this.Left =       170
  this.Top =        0
  this.HelpId = ""
  this.HelpFile = ""
  this.Width =       63


Procedure OnOpen
 do iesstart.wfm
 _app.FrameWin.Text=space(25)+"IES MUSEUM
COLLECTION DATABASE SYSTEM"

return
procedure OnClose
 _app.FrameWin.Text="dBASE 5.0 for Windows"
RETURN

ENDCLASS


#include <Messdlg.h>

** END HEADER -- do not remove this line*
* Generated on 05/28/97
*
Parameter FormObj
NEW IESMUSEMMENU(FormObj,"Root")
CLASS IESMUSEMMENU(FormObj,Name) OF
MENU(FormObj,Name)
  this.Text = ""
  this.OnOpen = CLASS::OnOpen

  DEFINE MENU FILE OF THIS;
    PROPERTY;
     Text "&File"

     DEFINE MENU EXIT OF THIS.FILE;
       PROPERTY;
        OnClick {;FORM.CLOSE()},;
        Text "Exit",;
        StatusMessage "cLOSE THE FORM"

  DEFINE MENU DATABASE OF THIS;
    PROPERTY;
     Text "&Database"

     DEFINE MENU ETHNO_AND__ARTS_ OF
THIS.DATABASE;
       PROPERTY;
        OnClick
CLASS::ETHNO_AND__ARTS__ONCLICK,;
        Text "Ethno. and  Arts "

     DEFINE MENU STAMP OF THIS.DATABASE;
       PROPERTY;
        Text "Stamp"

     DEFINE MENU COINS OF THIS.DATABASE;
       PROPERTY;
        Text "Coins"

     DEFINE MENU SOUND OF THIS.DATABASE;
       PROPERTY;
        OnClick CLASS::SOUND_ONCLICK,;
        Text "Sound"

     DEFINE MENU VIDEO OF THIS.DATABASE;
       PROPERTY;
        Text "Video"

     DEFINE MENU SLIDES OF THIS.DATABASE;
       PROPERTY;
        Text "Slides"

  DEFINE MENU HELP OF THIS;
    PROPERTY;
     Text "&Help"

     DEFINE MENU CONTENT OF THIS.HELP;
       PROPERTY;
        Text "&Content"

     DEFINE MENU ABOUT OF THIS.HELP;
       PROPERTY;
        Text "&About"


  Procedure ETHNO_AND__ARTS__OnClick
   do test6.prg
  return

  Procedure SOUND_OnClick
   do  soundfrm.wfm
  return
  Procedure OnOpen
   _app.FrameWin.Text = SPACE(10)+"IES MUSEUM
COLLECTION DATABASE SYSTEM"
  return

ENDCLASS


create session
shell(.f.)

set talk off
set ldcheck off

** END HEADER -- do not remove this line*
* Generated on 05/20/97
*
LOCAL f
f = NEW IESSTARTFORM()
f.Open()

CLASS IESSTARTFORM OF FORM
  Set Procedure To
C:\DBASEWIN\SAMPLES\BUTTONS.CC additive
  this.OnLostFocus = {;this.Close()}
  this.SysMenu = .F.
  this.Left =       7.333
```

```
  this.Maximize = .F.
  this.Top =        3
  this.Minimize = .F.
  this.HelpId = "Contents"
  this.Text = ""
  this.Enabled = .F.
  this.HelpFile = ""
  this.Width =       81.166
  this.Height =      19.2939
  this.MDI = .F.
  this.Sizeable = .F.
  this.Moveable = .F.

  DEFINE RECTANGLE RECTANGLE1 OF THIS;
    PROPERTY;
     Left       0.165,;
     Top        0.1172,;
     Text "Rectangle1",;
     Width      81.168,;
     Border .T.,;
     BorderStyle        1,;
     ColorNormal "N/N",;
     Height     19.1768

  DEFINE IMAGE MUSICIMAGE OF THIS;
    PROPERTY;
     Left       0.665,;
     Top        0.2344,;
     Width      80.335,;
     Height     18.8242,;
     DataSource "FILENAME
C:\DBASEWIN\SAMPLES\IES.BMP"

ENDCLASS

create session

** END HEADER -- do not remove this line*
* Generated on 05/20/97
*
LOCAL f
f = NEW ACCESSNFORM()
f.Open()

CLASS ACCESSNFORM OF FORM
  Set Procedure To BUTTONS.CC additive
  this.ScrollBar =       2
  this.View = "accessn.qbe"
  this.Left =        1
  this.Text = "Form"
  this.ColorNormal = "N/N+"
  this.Top =         0
  this.HelpId = ""
  this.HelpFile = ""
  this.Width =       45.833
  this.Height =      10.2344

  DEFINE TEXT TEXT1 OF THIS;
    PROPERTY;
     Left       1,;
     FontSize       18,;
     Border .F.,;
     Text "Accession",;
     ColorNormal "N/N+",;
     Top        0.5,;
     Width      21,;
     Height     2.0293

  DEFINE TEXT TEXT2 OF THIS;
    PROPERTY;
     Left       0.833,;
     Border .F.,;
     Text "&Entry Number",;
     OldStyle .T.,;
     ColorNormal "B/N+",;
     Top        3,;
     Width      15.167,;
     Height     1

  DEFINE ENTRYFIELD ENTRYFIELD1 OF THIS;
    PROPERTY;
     Left       21.166,;
     Border .T.,;
     DataLink "ACCESSN->:ENTRYNO:",;
     ColorNormal "N/W+",;
     Top        2.8232,;
     Width      10.667,;
     Height     1

  DEFINE TEXT TEXT3 OF THIS;
    PROPERTY;
     Left       0.833,;
     Border .F.,;
     Text "&Accession Date",;
     OldStyle .T.,;
     ColorNormal "B/N+",;
     Top        4,;
     Width      15.167,;
     Height     1

  DEFINE SPINBOX SPINBOX1 OF THIS;
    PROPERTY;
     Left       21.166,;
     Border .T.,;
     DataLink "ACCESSN->:ACCESSIOND:",;

     ColorNormal "N/W+",;
     Top        3.8232,;
     Rangemax {10/29/77},;
     Rangemin {07/21/77},;
     Width      10,;
     Height     1

  DEFINE TEXT TEXT4 OF THIS;
    PROPERTY;
     Left       0.833,;
     Border .F.,;
     Text "&Source",;
     OldStyle .T.,;
     ColorNormal "B/N+",;
     Top        4.9404,;
     Width      15,;
     Height     1

  DEFINE ENTRYFIELD ENTRYFIELD2 OF THIS;
    PROPERTY;
     Left       21.166,;
     Border .T.,;
     DataLink "ACCESSN->:SOURCE:",;
     ColorNormal "N/W+",;
     Top        4.8818,;
     Width      20.167,;
     Height     1.1182

  DEFINE TEXT TEXT5 OF THIS;
    PROPERTY;
     Left       0.833,;
     Border .F.,;
     Text "&Accession Method",;
     OldStyle .T.,;
     ColorNormal "B/N+",;
     Top        6,;
     Width      19.167,;
     Height     1.1172

  DEFINE ENTRYFIELD ENTRYFIELD3 OF THIS;
    PROPERTY;
     Left       21.166,;
     Border .T.,;
     DataLink "ACCESSN->:METHODOFAC:",;
```

```
      ColorNormal "N/W+",;
      Top       6,;
      Width     10.667,;
      Height    1

  DEFINE TEXT TEXT6 OF THIS;
    PROPERTY;
      Left      0.833,;
      Border .F.,;
      Text "&Total No. of Objects",;
      OldStyle .T.,;
      ColorNormal "B/N+",;
      Top       6.8818,;
      Width     19.5,;
      Height    0.9414

  DEFINE SPINBOX SPINBOX2 OF THIS;
    PROPERTY;
      Left      21.166,;
      Border .T.,;
      DataLink "ACCESSN->:NUMBEROBJ:",;
      ColorNormal "N/W+",;
      Top       7.0586,;
      Rangemax  100,;
      Rangemin  1,;
      Width     6.5,;
      Height    1
Procedure ShowAcc(entryno1)
    go top
    seek entryno1
    if .not. found()
     form.close()
     msgbox("Not found","Alert message",48)
    endif
  return
ENDCLASS


create session
** END HEADER -- do not remove this line*
* Generated on 05/18/97
*
LOCAL f
f = NEW IMAGEFORM()
f.open()

CLASS IMAGEFORM OF FORM
  Set Procedure To BUTTONS.CC additive
  this.HelpFile = ""
  this.Width =      71.666
  this.Height =     12.2344
  this.View = "Image3.qbe"
  this.Left =       6.5
  this.Top =        6
  this.Text = ""
  this.ColorNormal = "N/N+"
  this.ScrollBar =  2
  this.HelpId = ""


  DEFINE TEXT TEXT1 OF THIS;
    PROPERTY;
      Width     16.168,;
      Height    1.4697,;
      FontName "Times New Roman",;
      Left      48.832,;
      FontSize  14,;
      Top       0,;
      Text "Photograph",;
      Border .F.,;
      ColorNormal "RG+/N+"

  DEFINE TEXT TEXT2 OF THIS;
    PROPERTY;
      Width     8.668,;
      OldStyle .T.,;
      Height    1.2354,;
      Left      11.832,;
      Top       3.1172,;
      Text "&Image Id",;
      Border .F.,;
      ColorNormal "N/N+"

  DEFINE SPINBOX SPINBOX1 OF THIS;
    PROPERTY;
      Width     11.335,;
      Height    1.1172,;
      Left      20.665,;
      Rangemax  100,;
      DataLink "IMAGE->:IMAGEID:",;
      Top       3.1172,;
      Rangemin  1,;
      Border .T.,;
      ColorNormal "N/W+"

  DEFINE TEXT TEXT3 OF THIS;
    PROPERTY;
      Width     5.835,;
      OldStyle .T.,;
      Height    1.2949,;
      Left      14.665,;
      Top       6.8223,;
      Text "&Image",;
      Border .F.,;
      ColorNormal "N/N+"

  DEFINE TEXT TEXT4 OF THIS;
    PROPERTY;
      Width     13.5,;
      OldStyle .T.,;
      Height    1.2363,;
      Left      7,;
      Top       4.3516,;
      Text "&Photographer",;
      Border .F.,;
      ColorNormal "N/N+"

  DEFINE ENTRYFIELD ENTRYFIELD2 OF THIS;
    PROPERTY;
      Width     18.335,;
      Height    1.1182,;
      Left      20.665,;
      DataLink "IMAGE->:PHGRAPHER:",;
      Top       4.3516,;
      Border .T.,;
      ColorNormal "N/W+"
  DEFINE ENTRYFIELD ENTRYFIELD3 OF THIS;
    PROPERTY;
      Width     11.168,;
      Height    1.1182,;
      Left      20.665,;
      DataLink "IMAGE->DATAOFPHOT",;
      Top       5.6465,;
      Border .T.
  DEFINE ENTRYFIELD ENTRYFIELD1 OF THIS;
    PROPERTY;
      Width     8.668,;
      Height    1.1182,;
      Left      20.665,;
      DataLink "IMAGE->IMAGE",;
      Top       6.8223,;
      Border .T.

  DEFINE IMAGE IMAGE1 OF THIS;
    PROPERTY;
      Width     26.668,;
      Height    6.4121,;
      Left      43.832,;
      Top       1.7637,;
      DataSource "BINARY IMAGE->IMAGE"
```

```
DEFINE PUSHBUTTON PUSHBUTTON1 OF THIS;
  PROPERTY;
   Width       11.668,;
   Height       1.5293,;
   Left       12.832,;
   OnClick CLASS::PUSHBUTTON1_ONCLICK1,;
   Top       10,;
   Text "Add Image",;
   Group .T.,;
   ColorNormal "N/W"

DEFINE PREVBUTTON PREVCUSTBUTTON OF THIS;
  PROPERTY;
   Width       9.834,;
   Height       1.5879,;
   Left       33.332,;
   OnClick CLASS::PREVIOUS,;
   Top       10,;
   Text "&Prev",;
   Group .T.,;
   Default .T.

DEFINE NEXTBUTTON NEXTCUSTBUTTON OF THIS;
  PROPERTY;
   Width       8.833,;
   Height       1.5879,;
   Left       43.5,;
   OnClick CLASS::NEXT,;
   Top       10,;
   Group .F.

DEFINE PUSHBUTTON FIRSTCUSTBUTTON OF THIS;
  PROPERTY;
   Width       8.668,;
   Height       1.5293,;
   Left       52.665,;
   OnClick {;go top in 2},;
   Top       10,;
   Text "F&irst",;
   Group .F.,;
   ColorNormal "N/W",;
   StatusMessage "Go to the first photograph"

DEFINE PUSHBUTTON LASTCUSTBUTTON OF THIS;
  PROPERTY;
   Width       8.334,;
   Height       1.5293,;
   Left       61.832,;
   OnClick {;go bottom in 2},;
   Top       10,;
   Text "&Last",;
   Group .F.,;
   ColorNormal "N/W",;
   StatusMessage "Go to the last photograph"

DEFINE TEXT TEXT5 OF THIS;
  PROPERTY;
   Width       20,;
   Height       1.1768,;
   Left       0.5,;
   Top       5.6465,;
   Text "Date of Photography",;
   Border .F.,;
   ColorNormal "N/N+"


DEFINE PUSHBUTTON PUSHBUTTON2 OF THIS;
  PROPERTY;
   Width       8.168,;
   Height       1.5293,;
   Left       24.832,;
   Top       10,;
   Text "Find",;
   Group .T.,;
      ColorNormal "N/W"

Procedure ShowImage2(accno1)
  go top
  seek accno1
  if .not. found()
     form.close()
     msgbox("Not found","Alert message",48)
  endif
return

procedure Next
if .not. eof(2)
  skip in 2
endif
if eof(2)
   skip -1 in 2
   msgbox("At the last photograph","Alert message",48)
endif
RETURN

procedure Previous
if .not. bof(2)
  skip -1 in 2
endif
if bof(2)
   msgbox("At the first photograph","Alert message",48)
endif
RETURN

Procedure PUSHBUTTON1_OnClick1
  select image
  append blank
  form.spinbox1.setFocus()
  select ethno
return

ENDCLASS
** END HEADER -- do not remove this line*
* Generated on 05/20/97
*
LOCAL f
f = NEW LOCATIONFORM()
f.Open()

CLASS LOCATIONFORM OF FORM
  Set Procedure To BUTTONS.CC additive
  this.ScrollBar =       2
  this.View = "location.qbe"
  this.Left =       15
  this.Text = "Form"
  this.ColorNormal = "N/N+"
  this.Top =       8
  this.HelpId = ""
  this.HelpFile = ""
  this.Width =       55.5
  this.Height =       11.3525

  DEFINE TEXT TEXT1 OF THIS;
    PROPERTY;
     Left       1.166,;
     FontSize       18,;
     Border .F.,;
     Text "Location",;
     ColorNormal "RG+/N+",;
     Top       0.5,;
     Width       24,;
     Height       2.0293

  DEFINE TEXT TEXT2 OF THIS;
    PROPERTY;
     Left       1,;
     Border .F.,;
     Text "&Site",;
     OldStyle .T.,;
```

```
    ColorNormal "B/N+",;
    Top       3,;
    Width     15,;
    Height    1

DEFINE ENTRYFIELD ENTRYFIELD1 OF THIS;
  PROPERTY;
    Left      29.166,;
    Border .T.,;
    DataLink "LOCATION->:SITE:",;
    ColorNormal "N/W+",;
    Top       3,;
    Width     22.5,;
    Height    0.9404

DEFINE TEXT TEXT3 OF THIS;
  PROPERTY;
    Left      1,;
    Border .F.,;
    Text "Room Number",;
    OldStyle .T.,;
    ColorNormal "B/N+",;
    Top       4,;
    Width     15,;
    Height    1

DEFINE ENTRYFIELD ENTRYFIELD2 OF THIS;
  PROPERTY;
    Left      29.333,;
    Border .T.,;
    DataLink "LOCATION->:ROOMNO:",;
    ColorNormal "N/W+",;
    Top       3.9404,;
    Width     10.667,;
    Height    1

DEFINE TEXT TEXT4 OF THIS;
  PROPERTY;
    Left      1.166,;
    Border .F.,;
    Text "&Shelf / Show case Number",;
    OldStyle .T.,;
    ColorNormal "B/N+",;
    Top       4.8818,;
    Width     25.5,;
    Height    0.9414

DEFINE SPINBOX SPINBOX1 OF THIS;
  PROPERTY;
    Left      29.166,;
    Border .T.,;
    DataLink "LOCATION->:SHELFNO:",;
    ColorNormal "N/W+",;
    Top       4.9404,;
    Rangemax  100,;
    Rangemin  1,;
    Width     7.834,;
    Height    1

DEFINE TEXT TEXT5 OF THIS;
  PROPERTY;
    Left      1.166,;
    Border .F.,;
    Text "&Layer Number",;
    OldStyle .T.,;
    ColorNormal "B/N+",;
    Top       6,;
    Width     15,;
    Height    1

DEFINE SPINBOX SPINBOX2 OF THIS;
  PROPERTY;
    Left      29,;
    Border .T.,;
    DataLink "LOCATION->:LAYERNO:",;
    ColorNormal "N/W+",;
    Top       6,;
    Rangemax  100,;
    Rangemin  1,;
    Width     7.833,;
    Height    1

  Procedure ShowLoc(locid1)
    go top
    seek locid1
    if .not. found()
     form.close()
     msgbox("Not found","Alert message",48)
    endif
   return


ENDCLASS


** END HEADER -- do not remove this line*
* Generated on 05/20/97
*
LOCAL f
f = NEW SOUNDFRMFORM()
f.Open()

CLASS SOUNDFRMFORM OF FORM
  Set Procedure To
C:\DBASEWIN\SAMPLES\BUTTONS.CC additive
  this.View = "C:\DBASEWIN\SAMPLES\WSOUND.QBE"
  this.ScrollBar =      2
  this.Left =       1
  this.Text = "Form"
  this.Top =        0
  this.HelpId = ""
  this.HelpFile = ""
  this.Width =      54
  this.ColorNormal = "N/N+"
  this.Height =     9

  DEFINE TEXT TEXT1 OF THIS;
    PROPERTY;
     FontSize     18,;
     Left      1,;
     Text "SOUND",;
     Top       0.5,;
     Border .F.,;
     Width     16.5,;
     ColorNormal "RG+/N+",;
     Height    2.0293

  DEFINE TEXT TEXT2 OF THIS;
    PROPERTY;
     Left      1,;
     Text "&Accession No",;
     Top       3.0586,;
     Border .F.,;
     Width     15,;
     ColorNormal "B/N+",;
     Height    1,;
     OldStyle .T.

  DEFINE ENTRYFIELD ENTRYFIELD1 OF THIS;
    PROPERTY;
     DataLink "MOBJECT->:ACCNO:",;
     Left      17,;
     Top       3,;
     Border .T.,;
     Width     10.666,;
     ColorNormal "N/W+",;
     Height    1

  DEFINE TEXT TEXT3 OF THIS;
    PROPERTY;
```

```
      Left        1,;
      Text "&Title",;
      Top         4,;
      Border .F.,;
      Width       15,;
      ColorNormal "B/N+",;
      Height      1,;
      OldStyle .T.

  DEFINE ENTRYFIELD ENTRYFIELD2 OF THIS;
    PROPERTY;
      DataLink "MOBJECT->:OBJNAME:",;
      Left        17,;
      Top         4,;
      Border .T.,;
      Width       30.666,;
      ColorNormal "N/W+",;
      Height      1

  DEFINE TEXT TEXT5 OF THIS;
    PROPERTY;
      Left        1.165,;
      Text "&Sound",;
      Top         5,;
      Border .F.,;
      Width       15.001,;
      ColorNormal "B/N+",;
      Height      1,;
      OldStyle .T.

  DEFINE ENTRYFIELD ENTRYFIELD4 OF THIS;
    PROPERTY;
      DataLink "WSOUND->:SOUND:",;
      Left        17,;
      Top         5,;
      Border .T.,;
      Width       8.666,;
      ColorNormal "N/W+",;
      Height      1

ENDCLASS
newrecchange = .f.

create session
** END HEADER -- do not remove this line*
* Generated on 05/12/97
*
Set Procedure To Image.WFM additive
Set Procedure To Accessn.WFM additive
Set Procedure To Location.WFM additive

LOCAL im, f
f = NEW ETHNOFORM()
f.Open()

CLASS MOBJECTFORM OF FORM
  Set Procedure To BUTTONS.CC additive
  this.Left =         1
  this.ColorNormal = "0X408080/0X408080"
  this.Top =          0.0586
  this.Text = ""
  this.HelpId = ""
  this.HelpFile = ""
  this.Width =        101.5
  this.Height =       20.8232

 DEFINE RECTANGLE RECTANGLE7 OF THIS;
    PROPERTY;
      Left        0.5,;
      ColorNormal "0x408080/0x408080",;
      Top         0.1758,;
      Text "",;
      Border .T.,;
      Width       97.333,;
      Height      19.2354

 DEFINE ENTRYFIELD ACCNOENTRY OF THIS;
   PROPERTY;
     Left        15.3311,;
     Top         2.2344,;
     Value "",;
     Border .T.,;
     Width       12.002,;
     Height      1.1182

 DEFINE TEXT CATEGORYTEXT OF THIS;
   PROPERTY;
     Left        6.8311,;
     ColorNormal "/0x408080",;
     Top         9.4688,;
     Text "Category",;
     Border .F.,;
     Width       8.502,;
     Height      1.0605

 DEFINE ENTRYFIELD CATEGORYENTRY OF THIS;
   PROPERTY;
     Left        15.3311,;
     Top         9.4688,;
     Value "",;
     Border .T.,;
     Width       18.1689,;
     Height      1.0605

 DEFINE TEXT DATEOFPRODTEXT OF THIS;
   PROPERTY;
     Left        1.332,;
     ColorNormal "/0x408080",;
     Alignment   2,;
     Top         15.293,;
     Text "Date of Production",;
     Border .F.,;
     Width       18,;
     Height      1.0596


  DEFINE ENTRYFIELD DATEOFPRODENTRY OF
THIS;
    PROPERTY;
      Left        20,;
      Top         15.293,;
      Value "",;
      Border .T.,;
      Width       20,;
      Height      1

 DEFINE PUSHBUTTON LOCATION OF THIS;
   PROPERTY;
     Left        10,;
     ColorNormal "N/W",;
     Top         17,;
     Text "Current Location",;
     Width       20.8359,;
     Height      1.3535,;
     OnClick CLASS::Location_OnClick

 DEFINE TEXT TACCNO OF THIS;
   PROPERTY;
     Left        1.8311,;
     ColorNormal "/0x408080",;
     Top         2.293,;
     Text "Accession No.",;
     Border .F.,;
     Width       13.502,;
     Height      1.1768

 DEFINE TEXT TOBJNAME OF THIS;
   PROPERTY;
     Left        2.8311,;
     ColorNormal "/0x408080",;
```

```
      Top        3.5293,;
      Text "Object Name",;
      Border .F.,;
      Width      12.502,;
      Height      1.1172


  DEFINE ENTRYFIELD OBJNAMEENTRY OF THIS;
    PROPERTY;
     Left       15.3311,;
     Top        3.4688,;
     Value "",;
     Border .T.,;
     Width      18.1689,;
     Height      1.0605
  DEFINE PUSHBUTTON ACCESSIONBUTTON OF
THIS;
    PROPERTY;
     Left       84.1641,;
     ColorNormal "N/W",;
     Top        7.4688,;
     Text "Accession",;
     Group .T.,;
     Width      10.8359,;
     Height      1.3545,;
     OnClick CLASS::AccessionButton_OnClick


  Procedure Location_OnClick

    local templocid
    templocid= mobject->locationid
    create session
    form.childlocform = new locationFORM()
    form.childlocform.open()
    form.location.enabled = .f.
    opnl = .t.
    form.childLocform.showLoc(templocid)
  return
 Procedure AccessionButton_OnClick

    local tempentryno
    tempentryno= mobject->entryno
    create session
    form.childaccform = new accessnFORM()
    form.childaccform.open()
    form.accessionButton.enabled = .f.
    form.childaccform.showacc(tempentryno)
  return

ENDCLASS

CLASS NONAVFORM OF MOBJECTFORM

  DEFINE PUSHBUTTON IMAGES OF THIS;
    PROPERTY;
     Left       84.1641,;
     ColorNormal "N/W",;
     OnClick CLASS::IMAGES_ONCLICK,;
     Top        3.1758,;
     Text "Images",;
     UpBitmap "RESOURCE #617",;
     Group .T.,;
     Width      10.8359,;
     Height      1.3535

  DEFINE PUSHBUTTON TREATMENT OF THIS;
    PROPERTY;
     Left       84.1641,;
     ColorNormal "N/W",;
     Top        6.0586,;
     Text "Treatment",;
     Group .T.,;
     Width      10.8359,;
     Height      1.3525
 DEFINE PREVBUTTON PREVCUSTBUTTON OF THIS;
    PROPERTY;
     Left       84.1641,;
     OnClick CLASS::PREVIOUS,;
     Default .F.,;
     Top        12.1172,;
     Text "&Prev",;
     Group .T.,;
     Width      9.8359,;
     Height      1.5879

 DEFINE NEXTBUTTON NEXTCUSTBUTTON OF THIS;
    PROPERTY;
     Left       84.1641,;
     OnClick CLASS::NEXT,;
     Top        13.8223,;
     Group .F.,;
     Width      9.8359,;
     Height      1.5889

 DEFINE PUSHBUTTON FIRSTCUSTBUTTON OF THIS;
    PROPERTY;
     Left       84.1641,;
     ColorNormal "N/W",;
     OnClick {;go top},;
     Top        15.5293,;
     Text "F&irst",;
     StatusMessage "Go to the first record.",;
     Group .F.,;
     Width      9.8359,;
     Height      1.5879

 DEFINE PUSHBUTTON LASTCUSTBUTTON OF THIS;
    PROPERTY;
     Left       84.1641,;
     ColorNormal "N/W",;
     OnClick {;go bottom;},;
     Top        17.2344,;
     Text "&Last",;
     StatusMessage "Go to the last customer.",;
     Group .F.,;
     Width      9.8359,;
     Height      1.5889


procedure Next
 if .not. eof()
   NEXTBUTTON::OnClick()
  endif
RETURN

procedure Previous
  PREVBUTTON::OnClick()
RETURN

Procedure Images_OnClick
   local acc_no
   acc_no = ethno->accno
   create session
   form.childimageform = new IMAGEFORM()
   form.childimageform.open()
   form.images.enabled = .f.
   opn = .t.
   form.childimageform.showimage2(acc_no)
return


Procedure weightEntry_OnGotFocus
    if nonav->accno = ""
      select nonav
      append blank
      select mobject
    endif
```

```
  Procedure DiameterEntry_OnGotFocus
      if nonav->accno = ""
        select nonav
        append blank
        select mobject
      endif
return


ENDCLASS

CLASS ETHNOFORM OF NONAVFORM
  this.view = "wmuseum.Qbe"
  form.ACCNOENTRY.DATALINK = "Mobject->AccNo"
  form.OBJNAMEENTRY.DATALINK = "Mobject-
>objname"
  form.CATEGORYENTRY.DATALINK="Mobject-
>category"
  form.DATEOFPRODENTRY.DATALINK = "Mobject-
>dateofprod"
  this.OnGotFocus= CLASS::OnGotFocus

  DEFINE RECTANGLE RECTANGLE2 OF THIS;
    PROPERTY;
     Left       41.1641,;
     ColorNormal "0x408080/0x408080",;
     Top        8.6465,;
     Text "Physical Description",;
     Border .T.,;
     Width      40.002,;
     Height     4.8232

  DEFINE RECTANGLE RECTANGLE3 OF THIS;
    PROPERTY;
     Left       41.5,;
     ColorNormal "0x408080/0x408080",;
     Top        13.5879,;
     Text "Notes",;
     Border .T.,;
     Width      39.833,;
     Height     5.1768


  DEFINE RECTANGLE RECTANGLE4 OF THIS;
    PROPERTY;
     Left       1.1641,;
     ColorNormal "0x408080/0x408080",;
     Top        11.0586,;
     Text "Measurement",;
     Border .T.,;
     Width      39.6689,;
     Height     3.2939


  DEFINE RECTANGLE RECTANGLE5 OF THIS;
    PROPERTY;
     Left       41.1641,;
     ColorNormal "0x408080/0x408080",;
     Top        3.2344,;
     Text "Production Notes",;
     Border .T.,;
     Width      40.1689,;
     Height     5.2354


 DEFINE TEXT TLOCALNAME OF THIS;
    PROPERTY;
     Left       4,;
     ColorNormal "/0x408080",;
     Top        4.7051,;
     Text "Local Name",;
     Border .F.,;
     Width      11.333,;
     Height     0.9414

  DEFINE ENTRYFIELD LOCALNAMEENTRY OF THIS;
     PROPERTY;
      Left       15.3311,;
      Top        4.6465,;
      Value "",;
      Border .T.,;
      Width      18.335,;
      Height     1.1182,;
      DataLink "ETHNO->LOCALNAME"
      OnGotFocus
 CLASS::LOCALNAMEENTRY_ONGOTFOCUS,;


  DEFINE TEXT TMATERIAL OF THIS;
     PROPERTY;
      Left       7.1641,;
      ColorNormal "/0x408080",;
      Top        7.1172,;
      Text "Material",;
      Border .F.,;
      Width      8.3359,;
      Height     1

  DEFINE ENTRYFIELD MATERIALENTRY OF THIS;
     PROPERTY;
      Left       15.3311,;
      Top        7,;
      Value "EntryField",;
      Border .T.,;
      Width      18.335,;
      Height     1.1172,;
      OnGotFocus
 CLASS::MATERIALENTRY_ONGOTFOCUS,;
      DataLink "ETHNO->MATERIAL"


  DEFINE PUSHBUTTON ADDBUTTON OF THIS;
     PROPERTY;
      Left       84.1641,;
      ColorNormal "N/W",;
      Top        9.8809,;
      Text "Add",;
      Group .T.,;
      Width      10.002,;
      Height     1.5303,;
      OnClick CLASS::ADD


  DEFINE ENTRYFIELD ENTRYFIELD5 OF THIS;
     PROPERTY;
      Left       15.3311,;
      Top        5.8223,;
      Value "",;
      Border .T.,;
      Width      25.002,;
      Height     1.0596,;
      datalink "ethno->function"

  DEFINE ENTRYFIELD LENGTHENTRY OF THIS;
     PROPERTY;
      Left       10.1641,;
      Top        11.9395,;
      Value "",;
      Border .T.,;
      Width      10.1689,;
      Height     1.001,;
      datalink "ethno->length"

  DEFINE ENTRYFIELD DIAMETERENTRY OF THIS;
     PROPERTY;
      Left       30,;
      Top        12,;
      Value "",;
      Border .T.,;
      Width      10.166,;
```

```
    Height      1,;
    datalink "ethno->diameter"

  DEFINE ENTRYFIELD HEIGHTENTRY OF THIS;
    PROPERTY;
     Left      10.1641,;
     Top       13,;
     Value " ",;
     Border .T.,;
     Width     10.1689,;
     Height    1,;
     Datalink "ethno->height"

  DEFINE ENTRYFIELD WIDTHENTRY OF THIS;
    PROPERTY;
     Left      29.8311,;
     Top       13.0586,;
     Value "",;
     Border .T.,;
     Width     10.1689,;
     Height    1,;
     datalink "ethno->width"

  DEFINE EDITOR EDITOR3 OF THIS;
    PROPERTY;
     Left      42,;
     ColorNormal "N/W*",;
     Top       4.0586,;
     Border .T.,;
     Width     38.5,;
     Height    4.1758,;
     datalink "ethno->prodnote",;
     wrap .t.

  DEFINE EDITOR EDITOR1 OF THIS;
    PROPERTY;
     Left      42,;
     ColorNormal "N/W*",;
     Top       9.4688,;
     Border .T.,;
     Width     38,;
     Height    3.7656,;
     datalink "ethno->condition",;
     wrap .t.

  DEFINE EDITOR EDITOR2 OF THIS;
    PROPERTY;
     Left      42,;
     ColorNormal "N/W*",;
     Top       14.3516,;
     Border .T.,;
     Width     38.333,;
     Height    4.1182,;
     datalink "ethno->usenotes",;
     wrap .t.

 DEFINE TEXT TEXT1 OF THIS;
    PROPERTY;
     Left      20.6641,;
     ColorNormal "/0x408080",;
     Alignment 2,;
     Top       11.9395,;
     Text "Diameter",;
     Border .F.,;
     Width     8.8359,;
     Height    1.1191

  DEFINE TEXT TEXT2 OF THIS;
    PROPERTY;
     Left      22.3311,;
     ColorNormal "/0x408080",;
     Alignment 2,;
     Top       13.0586,;
     Text "Width",;
     Border .F.,;
     Width     7.1689,;
     Height    1.1172

  DEFINE TEXT TEXT3 OF THIS;
    PROPERTY;
     Left      2.5,;
     ColorNormal "/0x408080",;
     Alignment 2,;
     Top       12,;
     Text "Length",;
     Border .F.,;
     Width     7.166,;
     Height    1.1172

  DEFINE TEXT TEXT4 OF THIS;
    PROPERTY;
     Left      2.6641,;
     ColorNormal "/0x408080",;
     Alignment 2,;
     Top       13,;
     Text "Height",;
     Border .F.,;
     Width     7.1689,;
     Height    1.1172

  DEFINE TEXT TEXT5 OF THIS;
    PROPERTY;
     Left      6.6641,;
     ColorNormal "/0x408080",;
     Top       5.9395,;
     Text "Function",;
     Border .F.,;
     Width     8.8359,;
     Height    0.8838

  DEFINE TEXT TEXT6 OF THIS;
    PROPERTY;
     Left      19.5,;
     ColorNormal "N/W",;
     Top       0.4688,;
     Text "Ethnographic and Traditional Arts",;
     FontSize  14,;
     Border .F.,;
     FontName "Times New Roman",;
     Width     49.166,;
     Height    1.3545

 DEFINE TEXT PROVENANCETEXT OF THIS;
    PROPERTY;
     Left      3.6641,;
     ColorNormal "/0x408080",;
     Top       8.293,;
     Text "Provenance",;
     Border .F.,;
     Width     11.8359,;
     Height    1.0596

 DEFINE ENTRYFIELD PROVENANCEENTRY OF THIS;
    PROPERTY;
     Left      15.3311,;
     Top       8.2344,;
     Value "",;
     Border .T.,;
     Width     18.1689,;
     Height    1.0596,;
     datalink "ethno->provenance"

 Procedure ADD
    select mobject
    append blank
    form.accnoEntry.setFocus()
 return

 Procedure Localnameentry_OnGotFocus
   if ethno->accno = ""
```

```
        select ethno
        append blank
        select mobject
      endif

  Procedure materialentry_OnGotFocus
      if ethno->accno = ""
        select NonAv
        append blank
        select ethno
       append blank
        select mobject
      endif
  Procedure OnGotFocus
     if Ethno->accno=""
    select Ethno
    append blank
    select mobject
    endif
    form.accessionButton.enabled=.t.
    form.location.enabled=.t.
    form.images.enabled=.t.
  return

ENDCLASS
```

DECLARATION

This thesis is my original work and has not been submitted for a degree in any other university.

Woinshet Abdella

16 May,1997

The thesis has been submitted for examination with my approval as university advisor.

Ato Tesfaye Biru

16 May,1997